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UNITED STATES NUCLEAR REGULATORY COMMISSION'S

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

December 7, 2006

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

538th MEETING

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THURSDAY,

DECEMBER 7, 2006

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ROCKVILLE, MARYLAND

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The meeting was convened in Room T-2B3 of Two White Flint North, 11545 Rockville Pike, Rockville, Maryland, at 8:30 a.m., Graham B. Wallis, Chairman, presiding.

MEMBERS PRESENT:

GRAHAM B. WALLIS	Chairman
WILLIAM J. SHACK	Vice Chairman
SAID ABDEL-KHALIK	Member
GEORGE E. APOSTOLAKIS	Member
J. SAM ARMIJO	Member
MARIO V. BONACA	Member
MICHAEL CORRADINI	Member
THOMAS S. KRESS	Member

MEMBERS PRESENT: (cont'd)

OTTO L. MAYNARD	Member
DANA A. POWERS	Member
JOHN D. SIEBER	Member-At-Large

ACRS STAFF PRESENT:

ERIC OESTERLE

JERRY WILSON

DONNIE HARRISON

MARK RUBIN

JOE COLACCINO

DAVID FISCHER

NICK SALTOS

JENNIFER ULE

HIPOLYTO GONZALEZ

TIM COLLINS

JOHN FERRER

KAMAL MANOLY

MIKE MAYFIELD

BILL CULLEN

DAN BARASS

BRUCE MUSICO

JIMI YEROKUN

JOHN MONNINGER

JOCELYN MITCHELL

ALSO PRESENT:

ROBERT GURDAL

BRYAN ERLER

ALAN NELSON

MARTIN HUG

ROBERT PRATO

CHARLES TINKLER

CHRIS HUNTER

RANDY SULLIVAN

BIFF BRADLEY

I-N-D-E-X

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

(8:32 a.m.)

CHAIRMAN WALLIS: Good morning. The meeting will now come to order.

This is the first day of the 538th meeting of the Advisory Committee on Reactor Safeguards. We say all this so that the members know where they are and what they're doing.

During today's meeting the Committee will consider the following: Draft Final Regulatory Guide DG-1145, "Combined License Applications for Nuclear Power Plants"; Draft Final Regulatory Guide DG-1144, "Guidelines for Evaluating Fatigue Analyses Incorporating the Life Reduction of Metal Components Due to the Effects of the Lightwater Reactor Environment for New Reactors"; Proposed Revisions to Standard Review Plan Section 13.3, "Emergency Planning"; State-of-the-Art Reactor Consequence Analysis Project; and the Preparation of ACRS Reports.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Dr. John T. Larkins 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. A transcript of portions of the meeting is being kept, and it is 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.

I will begin with some items of current interest. Dr. John Larkins, our Executive Director, is retiring on January 4, 2007. As the Director -- Executive Director for the past 13 years, he has been very devoted to the Committee, and has provided outstanding management support to the members.

He has continually ensured a high level of technical and administrative support to the Committee in performing its statutory obligations effectively and efficiently. His many contributions include the selection of new members and consultants to the Committee, reappointment of members, formulation and execution of the Committee's operating budget, resolution of conflict of interest issues, and quality assurance of ACRS office activities.

Increasing the number of ACRS members to the statutory maximum of 15 is one of his recent achievements. Additionally, Dr. Larkins was instrumental in improving communications and cooperation between the ACRS, the NRC staff, and the Commission. His devotion, enthusiasm, and unrelenting effort to support the Committee are second to none and are very much appreciated by all of us and particularly by me personally.

On behalf of the Committee, I would like to thank Dr. Larkins for his dedication to the Committee, wish him happy retirement, and good luck in his future endeavors. Where is John? He's hiding behind --

(Applause.)

Now I turn to Frank Gillespie. You all know he started his career with the NRC in 1975 as an Inspector in Region I. From 1978 to 1980, he served as a Section Chief in Region II. Mr. Gillespie was in the Office of Nuclear Regulatory Research from 1980 to 1986, first as the Safeguards Branch Chief and subsequently as the Director of the Division of Accident Evaluation and the Division of Risk Analysis and Operations.

In 1986, he worked at Batelle Memorial Institute, returning to the Office of Nuclear Reactor Regulation in 1987. From 1987 until the present, he has held various Division Director and Deputy Division

Director positions, the most recent being Director of the Division of License Renewal.

I'm happy to report that effective November 27, 2006, Mr. Gillespie started his transition into the new position of Executive Director, ACRS and ACNW,and will assume the full range of responsibilities effective January 4, 2007. So please congratulate Frank on his appointment.

(Applause.)

Also, Mike Snodderly, who has been with the ACRS since October 2002, is leaving to join the Office of New Reactors as the Branch Chief for the Containment Systems Branch for the ESBWR and ABWR in January 2007.

As a Senior Staff Engineer for two years, Mr. Snodderly provided outstanding technical support to the Committee in reviewing several complex technical issues, including risk-informed and performance-based regulatory approaches, use of PRA in the regulatory decision-making process, implementation of the Commission's phased approach for PRA quality, and risk-informed revisions to 10 CFR 50.44.

As a Branch Chief for both ACRS and ACNW staff, he provided leadership to the technical staff and ensured high-quality technical support to the

Committee in reviewing various regulatory issues, including license renewal, core power uprate applications, and PWR sump performance issues.

He was an outstanding Senior Staff Engineer and an exceptional Branch Chief. And on behalf of the Committee, I would like to thank him for his numerous contributions and wish him good luck in his new job.

Thank you very much, Mike.

(Applause.)

There are some other items of interest that have been handed out, this pink-covered collection here. You'll note there are some presentations by Commissioners. And for those of you who missed The Washington Post yesterday, the article on Commissioner McGaffigan has been reprinted on page 50.

I'd now like to move to our business. The first item on the agenda is the Draft Final Reg. Guide DG-1145. I turn to my colleague Tom Kress to lead us through this one.

MEMBER KRESS: Thank you, Mr. Chairman.

We had a spirited subcommittee meeting. And, as you know, DG-1145 is a substantial document, and it was difficult to decide which parts of a full day meeting which was also too short we could cover in just a couple of hours here.

So you have the agenda in front of you, and those are the items we thought might be of both interest and might be of some controversy to the Committee. So without any further introduction, I'll turn it over to the staff and let them give you the right introduction.

MR. OESTERLE: Thank you, and good morning, everyone. My name is Eric Oesterle. I'm the Lead Project Manager on Draft Regulatory Guide DG-1145. I'm in the Guidance Infrastructure and Financial Review Branch with the Division of New Reactor Licensing in the Office of New Reactors.

I want to thank the full Committee for allowing the staff this opportunity to provide this informational briefing on DG-1145.

This morning I would like to provide the full Committee with an overview of DG-1145. As Dr. Kress indicated, we had a subcommittee meeting last week on Thursday, November 30th, and the staff came before the subcommittee on future plant designs and provided presentations on some specific areas of interest on DG-1145.

Based on the requests of that

subcommittee, we are here today to provide selected presentations to the full Committee. Following this overview, you will hear a presentation on probabilistic risk analysis, public workshop issues and public comments, and then, finally, a discussion on conformance, completeness, and consistency of DG-1145.

With the increasing interest and attention focused on new reactor -- potential new reactor licenses, development of DG-1145 became a tremendous undertaking and a very important one. In recognizing that importance, and the importance of this guidance document for potential COL applicants, the ACRS requested that the staff provide it with an informational briefing and the status on its development, and that is our purpose here today.

This guidance document was developed in response to external stakeholder requests for timely guidance based on intended submittals of COL applications in 2007. This effort was very intensive, it was expedited, and it was a committed effort on the part of the staff, with a high level of external stakeholder participation during its development.

This guidance document has had a high level of NRO and NRR management attention, and certainly has the interest of the Commission.

This guidance document follows the Part 52 rulemaking that was issued in March of this year. It does not impose any new requirements. And as someone eloquently put it in the subcommittee meeting last week, that the rule rules, so the guidance document cannot impose any new requirements. It must defer to the Part 52 rulemaking.

This guidance document is consistent and has been developed consistent with the SRP format and content, such that the sections correspond with each of the SRP sections. In addition, this guidance document provides a roadmap to other technical guides, technical regulatory guides, and industry standards.

One last thing before we get started into this presentation. This draft guide, which the ACRS members reviewed, was based on the proposed Part 50 rule that was issued in March of this year. As you may know, the Part 52 rule has been revised and submitted to the Commission last month.

There were changes made to that rule, and as a result of those changes that were sent to the Commission, some of the presentations today will reflect or acknowledge changes that must be made to the guidance to conform with the rule that was sent to the Commission. And we recognize that additional changes may be necessary to this guidance document to conform with any changes that the Commission decides are necessary when they disposition that rule.

The purpose for DG-1145 was to provide guidance to potential applicants on the format and content for a combined license application pursuant to 10 CFR Part 52. This guidance document recognized that several scenarios were possible for a COL applicant, so this guidance document provides guidance for a COL applicant referencing neither a certified design nor an early site permit, and you may hear this referred to as a custom design.

It also provides guidance for a COL applicant referencing a certified design, but not an early site permit, and it also provides guidance for a COL applicant referencing both a certified design and an early site permit.

For several years prior to the development of these --

MEMBER APOSTOLAKIS: Just --

MR. OESTERLE: Yes, sir.

MEMBER APOSTOLAKIS: -- for my own benefit here, so when is this application submitted? Before they do anything on the site, right? Do they say, "We intend to build a reactor, and here is our application," is that correct?

MR. OESTERLE: There are several scenarios, and I'll defer to Jerry Wilson to help me out with this question.

MR. WILSON: Jerry Wilson, Office of New Reactors. I call Dr. Apostolakis' attention to 10 CFR 50.10. Applicants are allowed to do certain activities on the site without getting approval from the NRC, so there are site investigations.

We are currently doing a rulemaking on that provision in which the Commission is considering whether we should increase the amount of -- let me call them pre-construction activities on the site without any approval from the NRC, and even before submittal of an application.

So I can't give you an exact answer to that question at the moment, because it's before the Commission.

MEMBER APOSTOLAKIS: I guess, you know, I was reading selected chapters, and the thing is that this application -- wow --

(Laughter.)

There are certain things such as, you know, goals for core damage frequency and large release frequency, and the reason why I'm asking is because depending on when the application is submitted a PRA may or may not be complete.

So when you say that, you know, here is a goal, and I haven't done anything yet, and all I have a certified design and maybe the early site permit, how do I demonstrate that I am complying with the goals? Or is this a continuing process, and you are updating the PRA as, you know, the testing strategies are defined and all that?

I mean, there are certain not quite requirements, but I don't know what to call them -- goals. When is the final time when you say, "Now, if you don't demonstrate to me that you are meeting these goals, I'm sorry, but I have to refuse doing A, B, C"?

MR. OESTERLE: The changes to the Part 50 rule that went to the Commission did make some changes with respect to the requirements for submitting a PRA. And I'm going to defer to Donnie Harrison, who is --

MEMBER APOSTOLAKIS: Okay.

MR. OESTERLE: -- providing the next presentation this morning specifically on PRA to try to address your question.

MEMBER APOSTOLAKIS: Yes. The question is not really specifically on PRA. It's the timing of things. I mean, when you ask for something --

MR. HARRISON: Yes, and I -- this is Donnie Harrison from the Division of Risk Assessment of NRR. To answer the question is is if you have a design certification, that means you addressed, at least at the design stage, the PRA -- a design-specific PRA that carries assumptions. Many of those end up with, if you will, ITAAC requirements or commitments to do walkdowns.

Obviously, even at a plant licensing stage, you haven't built a plant yet, so you still can't perform a walkdown. So what will happen is you will do a plant-specific update of that design-specific PRA, make it plant-specific, fill in the details that you've got. That will be what's used in the COL review, but you will still have assumptions result -- for confirming, if you will, what was actually built to make sure it represents.

That would occur prior to operation. You'll have the seismic walkdown, the fire walkdowns. All those things will occur there to, if you will, confirm or to meet the commitments that are made as part of the COL phase.

MEMBER APOSTOLAKIS: And is that kind of common knowledge? Because I didn't get that impression from the document. Everybody knows that? I mean, maybe that's the case.

MR. RUBIN: Well, this is Mark Rubin, also from the staff. A couple of the specific items you mentioned, such as large release frequency, kind of the Level 2 interface items, the NSSS vendor will do some envelope calculations to characterize a typical site and show that those can -- those metrics can typically be met by that design at a "typical" site.

When a COL vendor -- excuse me, when a COL applicant comes in, they will show that their site characteristics -- population density, meteorology, all those factors -- is well scoped or bounded by what was used, or they will do site-specific calculations to show that the metrics are met. So either way the specific requirements will be demonstrated for that site, either through bounding analysis or site-specific calculations at the COL stage.

MR. COLACCINO: This is Joe Colaccino, also from the Office of New Reactors. And Dr. Apostolakis has hit on one of the issues that was predominant during the workshop meetings between the NRC and the industry -- is the timing of when this information needed to come in.

Now, remember, under Part 52 we're

resolving all safety issues before the issuance of the license. And the staff needs information sufficient to resolve all its safety issues before that. Now, some of the industry has told us in certain areas that this information may not necessarily be available, but there's still -- I mean, in some areas I think they're looking at this from a Part 50 type strategy.

And I will just tier off of what Mr. Rubin said, just that when you discuss bounding analyses or bounding things, the staff is going to need, in those areas where that information is not available, like for instance that particular piece of equipment has not been procured yet, the licensee -- the applicant is going to have to make -- providing bounding information such that the staff will be able -- at the time of the license be able to resolve all safety issues.

So, and that has been a fundamental discussion that we've been having.

MEMBER APOSTOLAKIS: So the time of the license is when? I suspect when it is, but when is it?

MR. COLACCINO: Well, the timing of the license will be before -- you know, we think -- the way that we hear -- the industry discusses it will be before the vast majority of the construction has been started. I mean, Part 52 does tell them that they can proceed at their risk, and the information that the industry has been telling us is that they are very cognizant of this risk.

MEMBER APOSTOLAKIS: So at that point, you should have either specific information or some sort of bounding information that after they build it what they promise will, in fact, be met.

MR. COLACCINO: And that's what's embodied -- what should be embodied at the staff -- you know, if we've done it correctly, it should be embodied in the ITAAC, the verification process.

MEMBER APOSTOLAKIS: It's just that I didn't get that feeling of the time sequence of events by anything in the document.

MR. COLACCINO: And -- you know, and when the document was developed, you know, quite frankly we looked at this from a very generic basis. And I'll just take one of the timing -- I think it's the classical one -- is the meteorology example is that we have given a document that they needed two years of met data, but the COL applicants have told us they won't have that in time, but they want it at a later point.

So, I mean, this is -- I just wanted to say that this is one of the predominant discussions we had in the workshops.

Thank you.

MEMBER APOSTOLAKIS: Thank you very much.

MEMBER CORRADINI: Since George raised it now, but I expect -- if you're going to get to this, I'll defer -- is that Said actually at the subcommittee last time said it best, which is in some sense DG-1145 is a checklist of all the things that the licensee has to remember to have ready either by substantive information, bounding information, or an ITAAC to show the process to resolve it, and then pass all this information on to you all, and then you will then look at that information and say, "Okay. We have enough to proceed, or we don't have enough to proceed."

So the timing in some sense is they think they know the right time. They send it over the fence to you. You look at what's given, compare it to 1145 saying you've got to have this, you've got to have that, you've got to have this, you've got to have that. And then you say, well, we're missing something here. What about this?

So in a sense it's a checklist to minimize the communication back and forth. Do I have it approximately right?

MR. OESTERLE: I would say very, very approximately. It's much, much more --

(Laughter.)

-- much, much more than a checklist. It provides applicants with the -- with guidance on the entire set of information --

MEMBER CORRADINI: Right. But it's --

MR. OESTERLE: -- that's needed, and it also contains a checklist.

MEMBER CORRADINI: But it's a guide that tells -- as we went through it last time, it's a guide that tells them for this particular thing, take Chapter 6, go look at this rule, this guidance. For PRA, go look at this rule, this guidance. Am I --

MR. OESTERLE: It includes that. It's more of a roadmap than a checklist. If you want to give --

MEMBER CORRADINI: Excuse me. That's a much better characterization. I apologize.

MR. OESTERLE: If you want to give some specific technical guidance, this DG-1145 document does point you to specific technical regulatory guides and industry standards for that technical guidance.

This is the roadmap for how to put together your application and what information it needs to contain.

MEMBER CORRADINI: But then, as a roadmap, the timing of when this roadmap -- the timing at which you then submit down the road is not given. So in some sense it -- following the roadmap gives you enough information to say this is an appropriate time that we can actually understand where you're going and the timing is right, or generates questions.

MR. OESTERLE: I would say that the guidance document assumes that the large majority of information is required at the time of submittal.

MEMBER CORRADINI: Right.

MR. OESTERLE: There are specific areas where information is not available at that time, and the guidance document will reflect, I would say, options that the applicant has, which we'll discuss also a little bit later this morning, on either providing that information, updating that information, or verifying that the as-built or as-procured information conforms with the design as licensed.

MEMBER APOSTOLAKIS: How long is the process expected to take?

MR. OESTERLE: I'm not in a good position to answer that question. This is guidance for the applicant to provide us with the information. If you're asking me, how long does it take the staff to review that application and issue the license, I'm not knowledgeable enough to answer that question.

MEMBER APOSTOLAKIS: Do you --

MR. OESTERLE: Perhaps another member of the staff could.

MR. WILSON: Jerry Wilson, Office of New Reactors. We have planning assumptions. The specific answer, of course, is very case-dependent. Just recalling off the top of my head, why don't you assume three years. You know, it depends on what they're referencing or not referencing, and a variety of other factors.

MEMBER APOSTOLAKIS: But from the time of submission.

MR. WILSON: Yes.

MEMBER APOSTOLAKIS: Okay. To the license. Okay. Thank you very much.

MR. OESTERLE: Okay. Moving on, for several years prior to the development of DG-1145, the staff was engaged with the industry, in particular Nuclear Energy Institute, otherwise known as NEI, in their effort to develop guidance for COL applicants. And that document was NEI 04-01.

The guidance developed in NEI 04-01 was considerable. However, it considered what we call the base case. That is, the base case is a COL application that referenced a certified design and an early site permit. In addition, although this guidance document had a very substantial amount of usable information and guidance, it was focused predominantly on one standard design, the AP1000, which had yet to be certified.

During staff reviews of NEI 04-01, consistent questions came up about a roadmap -- how do we use this document to get us to where we need to be in terms of issuing a license? And the guidance in DG-1145 attempted to provide that roadmap.

During the last quarter of 2005, following approval of the Energy Policy Act, the NRC engaged in interactions with a growing number of external stakeholders who expressed serious interest in applying for a COL.

The increase in the number of potential COL applicants resulted in the possibility for several different COL application scenarios. That is, the staff heard about potential plans for COL applications referencing a certified design, COL applications referencing design certifications in progress, COL applications referencing an early site permit and a design certification in progress, etcetera.

So it became clear to the staff as a result of these interactions that a more comprehensive guidance document for COL applicants was needed. And at that time, the staff did not hear from any particular applicant that would meet the base case. That is, no COL applicant was talking about referencing a certified design and an early site permit. In response to those discussions with external stakeholders, the staff began development of DG-1145.

To develop DG-1145, the staff went back to Reg. Guide 1.70, which was the standard format and content of safety analysis reports for nuclear powerplants, lightwater reactors. And with that being said, DG-1145, using Reg. Guide 1.70 as its basis, also provides guidance to that limited set of reactors, lightwater reactors. It does not provide guidance to high-temperature, gas-cooled reactors or other non-LWR reactors.

Project managers were assigned the heavy lifting, if you will, during the drafting of the initial sections of DG-1145 using Reg. Guide 1.70 as the basis and updating it to include information from updated SRPs including the draft '96 updates of the standard review plan, guidance contained in the draft NEI 04-01 document, and experience from NRC certification of standard designs, experience from NRC reviews of ESP applications, and numerous SECY papers and their associated SRMs that were related to new reactor licensing.

These draft sections of DG-1145 were provided to staff technical reviewers to update, refine, and include any additional applicable guidance.

The format and content requirements for DG-1145 was also based on the proposed Part 50 rule that was issued in March of this year. Planning for the development of DG-1145 took place during the latter part of 2005, and in January of this year is when we started developing DG-1145 in earnest.

Upon completion of the draft work in progress sections of DG-1145, they were placed on the NRC's public website. Monthly public workshops were held beginning in March 2006 to discuss these draft work in progress sections that had been completed, and public comments and feedback were solicited on these sections.

The public workshops continued through

September of 2006, even though all draft work-in-progress sections were posted on the NRC's public website by June 30, 2006.

This was an extraordinarily intense and focused effort over six months, and took place in the public domain. External stakeholder participation and involvement was consistently high and very constructive.

The public workshops resulted in over 500 comments, which the staff reviewed, resolved, and discussed with external stakeholders, and included in an appendix to DG-1145 when it was issued as a draft for public comment. Incorporation of these public workshop comments took place during July and August -- a challenging time for any major work activity.

The draft was issued for a 45-day public comment period on September 7, 2006. But prior to that, on September 1st, the draft DG-1145 document was made available to external stakeholders on the NRC's public website.

The format and structure of DG-1145 is consistent with the structure of other NRC regulatory guides. Part C, which provides the regulatory basis and the real heart of this regulatory guide, is divided up into four different sections. Part C.1

provides guidance for a COL applicant that references neither a certified design nor an early site permit, and it is often referred to as a custom design.

It reflects the requirements and it's consistent with the information content requirements of 10 CFR Part 52.79, again, as it was proposed in March of 2006.

In Section C.1, although it was not intended to be guidance for a design certification applicant, much guidance can be gleaned from this section by such an applicant, and we have been told of that effect by General Electric as they were developing their ESBWR certification.

It was also anticipated that Section C.1 could provide some benefit for guidance to a COL applicant referencing a certified design in progress.

Section C.2 provides guidance on the requirements for additional technical information and is consistent with the proposed requirements of Part 52.80.

Section C.3 developed guidance for COL applicants referencing certified designs and early site permits and provides guidance associated with topics unique to these scenarios.

Part C.4 provided guidance on

miscellaneous topics associated with the COL applications and new reactor licensing.

Now, to help clarify the differentiation between these sections, I've provided a little viewgraph that hopefully puts things in better context.

This large gray stack you may want to consider as the entire stack of information that a COL applicant needs to submit, whether they reference a certified design and early site permit or not.

Sections C.1 and C.2 of DG-1145 provide information for the entire stack needed by a COL applicant.

In Section C.3, C.3.1 provides guidance for a COL applicant that references a certified design. So you can see, although this stack is not to scale, you can see that there is a large portion of information that has already been resolved by the certified design, and that -- the portion on early site permit information and remaining information is what that type of applicant would need to submit, remaining information being information on site-specific design features, like cooling towers or intake cooling structures or that sort of thing.

CHAIRMAN WALLIS: Now, is the size of

these boxes supposed to represent the amount of effort or content or something? Because it looks as if there's a real advantage to having an ESP, and the remaining information looks pretty small. Is that realistic, what you have up there?

MR. OESTERLE: In general, yes. Although it's not to scale, the way this has been represented is designed to show that there are some advantages to resolving safety issues early on in the process by referencing a certified design and an early site permit, and that was fundamentally the intent of the Part 52 process -- early resolution of safety issues.

CHAIRMAN WALLIS: And there are people who have an ESP without a certified design, where one is underneath the other.

MR. OESTERLE: Right.

CHAIRMAN WALLIS: Is that permutation covered by this picture or --

MR. OESTERLE: No, it's not.

MEMBER CORRADINI: Does that exist -- does what Graham just said really occur? I wasn't aware of that.

MR. COLACCINO: This is Joe Colaccino from the staff. All the COL applicants are referencing designs that are either certified or under review. So ultimately everyone will reference a design that is certified.

MEMBER POWERS: I guess it a little bit depends on what you mean by "under review." I mean --

MR. COLACCINO: I'm sorry. Actually, thank you very much. Either -- there is a third permutation for that, because with the EPR we actually do not have that design certification application. Thank you for pointing that out.

MR. OESTERLE: So Sections C.3.1 and C.3.2 were intended to provide guidance for COL applicants referencing a certified design and an early site permit. C.3.2 really identifies guidance for what we previously referred to as the base case, a COL applicant referencing both a certified design and an early site permit.

CHAIRMAN WALLIS: So in terms of the ACRS work on this, the bottom box is by far the biggest. What do we have to do with the remaining information, if anything? How much work is involved for us with what you call "remaining information"?

MR. WILSON: This is Jerry Wilson, Office of New Reactors. I'd first like to emphasize the point Mr. Oesterle made that that diagram is not to scale. So let's not try and draw too many conclusions from it.

Now, focusing on the remaining information, a key facet there are the operational programs that the licensee is going to use to operate their plant. Those clearly have safety significance, and I would envision that the Committee would want to review those programs.

MEMBER MAYNARD: There would also, I would assume, be some site-specific issues with cooling, whether it's cooling towers, your essential surface water system. They are some site-specific things that also are going to get into some of the safety systems, too.

MR. WILSON: That's correct.

MEMBER APOSTOLAKIS: But we will have to write a letter on the license itself, right? So whatever it takes to help us write that letter we will do.

MR. OESTERLE: The remaining set of information also depends on the specific reactor technology that is referenced in the certified design. For example, we have reactor designs that incorporate passive safety systems that have already been certified or are under certification review, and we have reactor designs that are in pre-application process that incorporate the traditional active safety systems.

So for the COL applicant it really depends on which one of those reactor technologies they choose.

CHAIRMAN WALLIS: I'm just trying to look at sort of our workload. I know that certifying the design takes many subcommittee meetings and a lot of technical work. Early site permits we have some experience with. We have some idea how big that workload is. And it may be that the remaining information is about the same effort as the early site permit or could in some cases be more, couldn't it?

MR. COLACCINO: It could -- this is Joe Colaccino. It could certainly be more. And I'll just point out that of the 19 COLs -- I don't know what the number is today. I haven't checked. I haven't checked this morning. But only three of them reference an early site permit, so 16 of them do not. And that's very important. So that there will be a number -- you know, the COL referencing an ESP and a design certification is really more the exception than the rule.

MEMBER MAYNARD: Well, even those with an early site permit, not all the early site permits are a complete, everything included type permit. There are still out issues or questions to still be submitted and resolved as part of the COL application, too.

MR. OESTERLE: Right.

MEMBER POWERS: How many of the COL applications that you've looked at up 'til this morning have greenfield sites?

MR. COLACCINO: Well, we haven't gotten -- this is Joe Colaccino again. We haven't -- obviously, we haven't gotten any COL applications. But of the 19 that are in, I don't know if there are any. I don't think there are any that are in the first wave, or at least in the -- like I said, I haven't checked. But I'm not going to say that 100 percent sure, because I don't have the list in front of me.

MEMBER POWERS: Sure.

MR. COLACCINO: One comes to mind, but I don't know if that -- I think the vast majority -- I think I'd be safe to say that the vast majority are at a -- have operating reactors adjoining the site.

MR. OESTERLE: All right. Moving on, I just want to show the makeup of Section C.1. It includes all of the traditional FSAR chapters with some additions. Chapter 19 is a new chapter, and that will include the results of the PRA. Chapter 1 has an asterisk by it as well. The reason being is that that chapter is expanded, based on the information that is provided in the certified designs.

MEMBER APOSTOLAKIS: You said Chapter 19 will be the results of the PRA, but not the PRA itself.

MR. OESTERLE: That's correct.

MEMBER APOSTOLAKIS: And why is that?

MR. OESTERLE: The reason for that is the Part 52 rule, as I mentioned this morning --

MEMBER APOSTOLAKIS: Yes.

MR. OESTERLE: -- DG-1145 provides guidance, and the rule rules. The current Part 52 rule does not require submittal of a PRA. However, it does require that the results of the PRA are included in the FSAR portion of the application.

MEMBER APOSTOLAKIS: But you cannot take them at face value. I mean, the moment you look at some results you will ask questions, how did you get this, how did you get that. So, I mean, how do you convince yourselves that the PRA results are valid?

MR. OESTERLE: On that point, I'm going to defer to Donnie Harrison.

MR. HARRISON: This is Donnie Harrison

again with the Division of Risk Assessment. If we can maybe defer for another 15 minutes, we'll get to some slides that talk explicitly about that.

MEMBER APOSTOLAKIS: Fine.

MR. HARRISON: So, but you're right.

MEMBER APOSTOLAKIS: I am right. So we did defer it, then. Why did you want to defer it? You said I'm right.

(Laughter.)

CHAIRMAN WALLIS: George, this is a question raised by the subcommittee. We had quite a discussion about it, and I would very much appreciate your discussion of it as well, you know, when we get to it. We spent some time on this in the subcommittee.

MEMBER SIEBER: On the other hand, the Commissioners told him to do it this way.

MR. HARRISON: That's correct.

MEMBER APOSTOLAKIS: But from the practical point of view, I'm trying to understand what will happen.

MEMBER SIEBER: Well, you can ask all the questions you want.

MEMBER KRESS: Well, the short answer is that the PRA will be available for audit by the staff.

That's the short answer.

MEMBER APOSTOLAKIS: How about -- I mean, are there going to be 365 RAIs flying all over the place? I mean, you get the PRA eventually piecemeal, is that really -- well, I'll -- we'll wait until Donnie --

MR. HARRISON: Yes, we'll get there.

MEMBER APOSTOLAKIS: -- gets to the hot seat.

MR. HARRISON: Okay. Thank you.

MR. OESTERLE: Moving on to Part C.2, the format of Part C.2 also was based on the proposed Part 52 rule issued in March of this year. And that included requirements -- or this included guidance on the PRA, ITAAC, and the environmental report. The latest Part 52 rule that was sent to the Commission will require a change in these topics.

For example, just like I mentioned, the Part -- the current Part 52 rule with the Commission now does not require submittal of the PRA, so much of the guidance from C.2.1 will be relocated to Chapter 19.

Part C.3 includes guidance for COL applicants referencing certified design and an ESP. Those -- that guidance is provided in Section C.3.1

and C.3.2. The additional sections under C.3 provide guidance for topics associated with COL applicants that reference a certified design and an ESP, like the finality of an environmental impact statement associated with an early site permit, COL action items that are included in certified designs and early site permits, design acceptance criteria that are included in certified designs, COL application timing, which addresses the scenario where a COL applicant references a design certification in progress, for example, and then ITAAC for COL applications referencing a certified design and/or an early site permit. Part C.4 also includes guidance on miscellaneous topics related to COL application.

And to wrap this up, I'll go over the status of DG-1145. The comment period for DG-1145 closed on October 23, 2006.

CHAIRMAN WALLIS: I'm curious about this certified design in progress. Does that mean that the design itself is in progress, or that the certification is the only thing which is in progress?

MR. OESTERLE: The certification is --

CHAIRMAN WALLIS: The design would have to be complete?

MR. OESTERLE: As complete as required by the design certification guidance.

CHAIRMAN WALLIS: Thank you.

MEMBER APOSTOLAKIS: Now, when you say 700 total comments received, I mean, we have a long list of NEI comments.

MR. OESTERLE: Yes.

MEMBER APOSTOLAKIS: These are counted here. I mean, they don't count as one.

MR. OESTERLE: Yes. All those -- that entire list of NEI comments, plus a few additional comments, comprise that 700 number. Right. They include typos and editorials and some larger issues.

Staff is currently working on resolving these public comments and revising DG-1145 as appropriate, and also revising DG-1145 to conform with the final proposed Part 52 rule that went to the Commission.

CHAIRMAN WALLIS: Now, are these going to result in any substantial changes? Say, because, you know, we have seen the version, and we think -- do you anticipate any significant change as a result of the public comments?

MR. OESTERLE: In some areas, the comments are consistent with the changes in the Part 52 rule. So with respect to those changes, yes, there will be some significant changes, although minimal.

CHAIRMAN WALLIS: Significant, although minimal. That's --

MR. OESTERLE: The number of --

(Laughter.)

The number of significant changes will be small.

(Laughter.)

MEMBER APOSTOLAKIS: One would expect that. I mean --

MR. OESTERLE: We have a process in place to ensure consistency between DG-1145 and the updates to the standard review plan and the updates to regulatory guides. We have project managers assigned to DG-1145 sections for coordination and resolution of public comments with tech staff, and they are also assigned the same sections for the SRP updates for -- to ensure the coordination and consistency.

The plan is to publish DG-1145 final as Reg. Guide 1.206 after incorporation of these public comments and final issuance of the Part 52 rule.

The staff is considering additional public forums to update external stakeholders on Reg. Guide 1.206 prior to publication. And we are looking at such things as putting the completed sections of

Reg. Guide 1.206 up on the NRC's external website, and we're also looking at holding a public workshop, board workshops.

MEMBER MAYNARD: I don't know if you're going to cover this later or not, but on the standard review plan, consistent with the reg. guide standard review plan, one of the comments that I had on 1145 is that it referenced a whole lot of generic letters, branch technical positions, and the staff is going through reg. guides and updating them to new rules.

I didn't understand the need for referencing a lot of old correspondence. I'm not sure why the SRPs and reg. guides can't be brought up to date.

MR. OESTERLE: In fact, one of the changes that we need to make to the guidance document to conform with the final proposed Part 52 rule is to update the requirement associated with looking at incorporation of operational experience contained in those old generic letters and bulletins.

There is a new requirement that doesn't go all the way back to, say, 1980. It just makes you look at more recent examples.

MEMBER MAYNARD: It just seems like it's -- it would be a lot cleaner for everyone if we could clean all that up maybe.

MEMBER SIEBER: Well, this whole effort is schedule-driven, I think.

MR. OESTERLE: Yes.

MEMBER SIEBER: And that's why some of the intermediate documents are not being consolidated and updated. They're just referenced to carry them along as a package, and it's more complicated this way. Otherwise, we would be two years getting all this done, I think, if you had to go back and do that work for each one of the sub-level reg. guides that are involved, and standards.

MR. OESTERLE: And that's a good segue into the next slide.

MEMBER APOSTOLAKIS: This Committee will have a chance to review the final version of the regulatory guide.

MR. OESTERLE: The final version of Reg. Guide 1.206?

MEMBER APOSTOLAKIS: Yes. Sorry? This is it?

MR. OESTERLE: I understand this is --

MEMBER APOSTOLAKIS: But you are going to change things.

MR. OESTERLE: We were requested to

provide an informational briefing, and that's what we're doing today.

MEMBER APOSTOLAKIS: No. I understand what you are doing today. But even if we issue a letter this time around, when do we issue --

MEMBER SIEBER: If they issue it again, we have an opportunity to review it again.

CHAIRMAN WALLIS: If the changes turn out to be significant and not minimal --

MEMBER APOSTOLAKIS: Who will judge that?

CHAIRMAN WALLIS: -- then I think you might want to let us know. And we have, then, a choice of saying whether or not we want to comment on those changes.

MEMBER APOSTOLAKIS: David?

MR. FISCHER: I was going to say the same thing. If we want, in our letter we could ask them to report on significant changes that are made to DG-1145.

MEMBER APOSTOLAKIS: It seems to me this is important enough for the Committee to plan on writing a letter when 1.06 is in its final draft form. The letter may be, "It's very good. Thank you." But I think we should plan on writing a letter, not rely on somebody's judgment that these changes are significant. We should make that judgment.

MR. OESTERLE: To put this all into schedule context, we are schedule-driven, and this shows the reason for the schedule. If you look all the way over on the right, we anticipate the first new COL applications coming in around September of '07. And with the -- at least one requirement of Part 52 for applicants to evaluate the standard review plan in effect six months prior to docketing.

So if we go back six months, that brings us to March. So that is one of the drivers for the schedule on Reg. Guide 1.206.

And with that, that concludes my prepared remarks on DG-1145 overview. Next is a presentation on probabilistic risk assessment.

MEMBER APOSTOLAKIS: Did you make -- did members make detailed comments on the PRA at the subcommittee meeting?

MEMBER KRESS: We had a significant discussion on it, yes.

VICE CHAIRMAN SHACK: I think we addressed all the comments that you made in your e-mails to us.

MEMBER CORRADINI: Yes, I think they overlap to some extent, too.

MEMBER APOSTOLAKIS: Okay. So I shouldn't raise them again, then?

VICE CHAIRMAN SHACK: You can raise them again, so you get your answers, but we did discuss them.

MEMBER APOSTOLAKIS: Okay. Do we get the same answer today?

(Laughter.)

MEMBER KRESS: One reason we put this on the agenda is because we knew you'd be here --

MEMBER APOSTOLAKIS: Okay.

MEMBER KRESS: -- and could take advantage of this opportunity.

MR. HARRISON: My name is Donnie Harrison. I'm with the Division of Risk Assessment. And for the members that were here at the subcommittee meeting, this is going to look very familiar. We're basically going to present the same information and --

CHAIRMAN WALLIS: So we didn't change your mind in any way at all.

(Laughter.)

MR. HARRISON: We had lots of discussion, but we didn't have any resolutions I guess.

What we're going to talk about is -- the first thing will be the recent change that was made to Part 52, and its impact on the staff's review, and the guidance document. We'll then briefly talk about the bases for the regulatory guidance, where the PRA bases come from, the grouping of the objectives of the PRA and severe accident evaluations, and then just an outline of what the Chapter 19 of the FSAR regulatory guidance is.

As hopefully as you're aware of by now is -- in the proposed rulemaking there was a requirement under 52.80(a) that the PRA be submitted as additional technical information. So it was addition to the Chapter 19 of the FSAR by the applicant.

We got public comments on that. After completion of the draft guide, our original approach was to reject the public comment and to maintain the requirement for the submission of the PRA. After we drafted the DG-1145, that NRC position was changed, and we accepted the public comment, that the PRA did not need to be submitted but needed to be maintained available for staff audit at the vendor or plant site location.

MEMBER CORRADINI: Just -- you probably did this, and I just don't -- I didn't write it down, so it's my memory. What was the rationale for the public comment that didn't -- that suggested that it not be submitted? Can you --

MR. HARRISON: It's basically this basis. It's that it wasn't necessary to submit it because it would be available for review to the staff at an offsite location. So the submission was --

MEMBER CORRADINI: And, logistically, that -- from the comment that was better, you know, and no worse, not a burden? The logistics of it are kind of still throwing me.

MR. HARRISON: Well --

MEMBER CORRADINI: But is that -- what that discussed at all?

CHAIRMAN WALLIS: That seems to -- we said this at the subcommittee. This seems extraordinary. I mean, with modern electronics, it's no different to send it than to have it available at your site.

MEMBER APOSTOLAKIS: It's just a CD.

MEMBER SIEBER: It's not uncommon to have documents like this available only at the plant site, you know, not only PRAs but other kinds of documents. This is not unusual.

MEMBER CORRADINI: You gave some examples. What were a couple of those that you mentioned that were --

MEMBER APOSTOLAKIS: You have to speak into the microphone.

MEMBER CORRADINI: Sorry.

MEMBER SIEBER: There aren't submitted -- a lot of tech spec bases aren't submitted. They are submitted in summary form, but the real basis or the technical basis is at the plant. Perhaps the staff can come up with a couple of others like that.

MR. HARRISON: The details of the Chapter 15 analyses, the thermal hydraulic codes, those are not -- those aren't submitted.

MEMBER SIEBER: The reload safety analysis is --

MR. HARRISON: The detailed analysis --

MEMBER SIEBER: -- just a letter? But it does not have the analysis connected to it and is not submitted?

MEMBER APOSTOLAKIS: But maybe that was appropriate at the time when everything was on paper. I mean, this is a matter of submitting a CD.

MEMBER SIEBER: Well, it's appropriate now. That's the way it is now, today.

MEMBER APOSTOLAKIS: Yes. But, I mean, because of the tradition. But now, you know, a CD is -- you know, a PRA can be there.

CHAIRMAN WALLIS: There has to be another rationale. I think in the subcommittee we talked about the business of it -- there being some reason, legal reason or something that this should not be officially part of the application.

MEMBER MAYNARD: Well, there are --

CHAIRMAN WALLIS: But it still should be available.

MEMBER MAYNARD: -- number of reasons other than just, I mean, you can submit anything quite easily on a CD. But whenever you start submitting things on the docket, there are -- you do incur -- there's more legal issues, there's more complications as to what has to be done, the reviews of that. You have other regulations that start coming into play that makes it far more complicated than if you can just have the document available for review at the site. So there are a lot of good reasons for that.

MEMBER BONACA: And one example is, by the way, you know, now you have this information in great detail in the hands of another analyst who may raise questions on a daily basis about things which are in the PRA. And that's some of the reasons for them -- for concern about submitting a PRA.

The other one is the PRA will change all the time. There will be modifications, and so on and so forth. So there is -- I think the applicant will submit a PRA.

I'm just telling you what I've seen in the past. The applicant submits a PRA. He will have to commit practically to submitting every modification he makes to the PRA, because he has a document submitted on the docket that now has changed. So there has to be some change process that is -- goes together with that. So there are a number of issues which I'm not -- which have to be dealt with when you submit that kind of information.

MEMBER CORRADINI: If I might just -- if this is appropriate, I just wanted to ask, though, Mario -- the second part of that -- I thought last week, now I may have misheard again, that there is no requirement that the PRA be updated. So this is -- even if it was a static document, having it reside at the locale versus somehow here is in some sense a filter for -- now I'm going to say this, and maybe this is an inappropriate -- a filter for unwanted, just I want to call it useless interchange, whereas if it were here you could get a lot of people asking questions that would just not be -- it would be appropriate for the licensee and the staff to deal with.

MEMBER BONACA: I think the issue --

mentioned the changes, because the PRA will change all the time.

MEMBER CORRADINI: But it's not required, though.

MEMBER BONACA: It's a critical issue. That's a central issue. If, in fact, you perform a PRA and put it on a shelf, I would say that any licensee wouldn't care. I mean, that's fine. Put it on the shelf, put it on --

MEMBER CORRADINI: And I would say --

MEMBER BONACA: -- it stays there, and that's it. It becomes an obsolete document very quickly.

MEMBER SIEBER: If you submit it to the agency, it becomes a public document.

MR. HARRISON: Well, no, not in this situation. It would have been under -- Part 52.80(a) would have been additional information. It would not be part of the FSAR. So it would have been -- it would be docketed but not available, if you will.

MEMBER MAYNARD: Well, it's still available. I think anything admitted is available, unless you are able to get it withdrawn.

MR. COLACCINO: Yes. This is Joe Colaccino. Just a clarification on a point Donnie just made. If it was submitted on the docket, then it would be available to the public.

MEMBER MAYNARD: That's right.

MR. COLACCINO: So in this scenario, the way it's now proposed in Part 52, it would be available at the site for staff audit.

MEMBER MAYNARD: Right.

MEMBER APOSTOLAKIS: But it could be submitted according to Donnie and not be available to the public.

MR. COLACCINO: And this came up -- Joe Colaccino again. That came up last week, is that we're -- certainly, there isn't anything in Part 52 right now that would preclude an applicant from submitting their PRA.

MR. RUBIN: And also, there are procedures in place to submit information and withhold it from public disclosure, such as proprietary withholdings, which many PRAs have come in with, or safeguards material.

MEMBER SIEBER: On the other hand, that's just not a rubber stamp. You actually have -- there actually has to be proprietary stuff in there.

MR. HARRISON: page by page verification.

MEMBER SIEBER: Yes.

MEMBER CORRADINI: So just to drive the point home, if -- let's take the path that Eric had mentioned, which is -- or somebody had mentioned, there is 19 out there and they all had design certifications, either on the docket or being reviewed. All of those design certifications have a PRA attached to them, correct?

MR. HARRISON: Correct.

MEMBER CORRADINI: And those are part of the record already, public record?

MR. HARRISON: Correct. Yes.

MEMBER CORRADINI: So the --

VICE CHAIRMAN SHACK: But the EPR one won't be submitted, as I understand it.

MEMBER CORRADINI: Well, I thought I heard the opposite last week.

MR. WILSON: This is Jerry Wilson. Let me give a little bit of background from a rulemaking perspective.

MEMBER CORRADINI: Let me finish my question, and you can see why I'm asking it, because then what I'm kind of thinking from my head is if Mario's point about certain things are reasonable because they'd be there, then it would be things related to the site -- to site-specific issues. But the base, full scope, whatever the right terminology is of the PRA via design certification, is already publicly available.

So I know a good deal of where one is going with the plant already, I thought, if I understand this, except now for the one thing that Bill has mentioned, that the EPR may not be in this mode.

MR. WILSON: Jerry Wilson. I want to remind the Committee that I and my colleagues on the Part 52 rulemaking working group were here before the Committee with the proposed Part 52 rule, and this was part of what we were discussing at that time. And this Committee wrote a letter on that subject, and I'll call your attention to the fact in the letter, you know, they said that you don't have to submit the PRA.

Now, with that in mind, and a couple of other factors that we considered while we were deciding how to put the rule together that we submitted to the Commission, one is that my colleagues in the PRA Branch are working with industry to develop guidance on performing PRAs.

It's the expectation of NRO management in the future applicants and licensees will have PRAs performed in accordance with that guidance, and in their view would reduce the need for the staff to be reviewing these PRAs to the level of review that we have done in the past.

And that factored into this decision as well, and so -- and also, you know, it's a forward-looking rule. We're looking to the future on this. But the other factor is the point that Mr. Harrison mentioned. We have the vision that it's like analyses done for Chapter 15.

The applicant summarizes their Chapter 15 analysis in their FSAR. But if the details in the analysis aren't submitted, and if the staff feels the need to look at that, they can do it. And so looking forward in the future, NRO management felt that the PRAs could be handled in a similar manner. And that's why the rule is as it is today, that you have to have a PRA. If you reference a certified design, you have to update that PRA to take into account those additional site-specific design features.

But you have to submit, as Mr. Harrison is going to point out, the results and summary of the PRA. But the detailed PRA you don't have to submit. That's the staff's view at this point in time.

MEMBER APOSTOLAKIS: If the staff has a

question about a particular number or result, they would have to go to the site to find out why this is so, or they can request information that will be submitted?

MR. WILSON: Both options are available. As in anything else, it's like thermal hydraulic analyses that this Committee looks at. They don't necessarily submit the details of that, but the staff either goes out and does an audit at the vendor's place or asks questions and has additional information provided.

MR. HARRISON: And, George, just -- the jump forward, on the next slide we talk about the impact of that change, and one of the impacts is for us to be able to understand and confirm the PRA results and insights. It's expected that we'll need to do audits, and fairly long-term audits, at the site location, so that we can fully understand the PRA and its bases and developing the RAIs even. So we're going to --

MEMBER MAYNARD: Yes. But I would contend that you would probably save time in the long run by doing it that way, because otherwise you're going to be going back and forth with requests for information. It's going to be handled, and it's going to take a long time and a lot of time on both the licensee and the NRC staff in just reviewing and submitting questions.

And you're a lot better off being right there where the information is available. You'll get a lot more resolved in a shorter period of time.

MR. HARRISON: Right. And that's the staff -- in response, that's how the staff sees going forward is that that will need to be done.

MEMBER BONACA: I would expect that also the staff would develop a SPAR model at some point to these plants, and, you know, to develop that you go to the plant, you sit down with the analysts, and you review the PRA.

PRA without the analysts that work on it really it's not very understandable, because there are so many assumptions you have to communicate back and forth what is represented there.

MEMBER APOSTOLAKIS: So when this Committee, then, writes a final letter, say approving the license of a particular reactor, we will have to go to the site to review the PRA, to look at the PRA if we want to look at it?

MEMBER SIEBER: Yes.

MEMBER APOSTOLAKIS: We will have to do

that?

MEMBER SIEBER: Sure.

MEMBER APOSTOLAKIS: Why can't we get it on a CD? It's not part of the docket if they give it to us.

MEMBER SIEBER: If it's sent to us, it is.

CHAIRMAN WALLIS: No, I don't think that's exactly true. I think the subcommittee went through this.

MEMBER APOSTOLAKIS: Oh, come on.

CHAIRMAN WALLIS: And I thought you said there was nothing that prevented the licensee from sending supplementary information, which could be a CD of the PRA.

MEMBER SIEBER: But once it gets into the agency's paper system, it's a public document.

CHAIRMAN WALLIS: It's labeled proprietary. It doesn't have to --

MEMBER SIEBER: Because it's proprietary or one of these other --

MEMBER APOSTOLAKIS: No. But the PRA we have now for the ESBWR, we are not allowed to give it to the public. It says don't do that.

(Laughter.)

It's a control document, whatever they

call it, a control document.

MEMBER APOSTOLAKIS: It is proprietary information.

MR. RUBIN: Right. This is Mark Rubin. An ESBWR PRA was submitted to the staff, but not as part of the safety analysis report.

MEMBER APOSTOLAKIS: So it can be done.

MR. RUBIN: It was, but Part 52 says it doesn't need to be submitted.

MR. HARRISON: And you need to -- actually, take me back to the slide before the last bullet. Under Part 52, under design certification, which an ESBWR was submitted under that guidance, I think that's 5247, they had a requirement that the PRA be submitted.

Okay. When the change was made to Part 52 to eliminate the requirement in 52.80(a), they made conforming changes. So they also deleted the requirement going forward for plants that make submissions under design certification will also not have to submit a design-specific PRA. Those would be maintained at the design vendor's site for review and audit.

MEMBER BONACA: I don't see --

MEMBER APOSTOLAKIS: The question is

really simple.

MEMBER BONACA: Yes.

MEMBER APOSTOLAKIS: Is this Committee going to have access to it? Or we will be told no, you travel to Texas to see it?

MEMBER SIEBER: Well, it's the rule that governs what gets submitted and what doesn't. And the rule says the licensee doesn't have to submit it.

MEMBER BONACA: But the question is --

MEMBER APOSTOLAKIS: The statutes also say that this Committee has to write a letter.

CHAIRMAN WALLIS: What George is saying is, how does this Committee make a decision?

MEMBER APOSTOLAKIS: Yes.

CHAIRMAN WALLIS: This Committee may say, without the PRA, we would refuse to make a decision.

MEMBER MAYNARD: Well, I believe we would be able to get the information that we needed. And I personally don't see a problem if some of this required or would call for us going to the site. I don't think there's -- I think it would be even a good idea for the ACRS to --

CHAIRMAN WALLIS: No, that's a tremendous -- the 19 applications this Committee has to travel to sites. That's ridiculous.

MEMBER SIEBER: Let's face it, none of these applications are risk-informed.

MEMBER BONACA: The Thermal Hydraulic Committee makes decisions regarding the adequacy of a LOCA analysis.

MEMBER SIEBER: But why do you need to look at it?

MEMBER BONACA: Without having the analysis in front, right? I mean, you get the vendor coming in describing to you the analysis, the assumptions. You ask specific questions. You don't have the analysis in front of you. You don't have a computer code with the actual results of everything. You can ask for that, but --

CHAIRMAN WALLIS: Sometimes we do get the analysis.

MEMBER BONACA: Get information.

CHAIRMAN WALLIS: In the case of AP600, I got several boxloads of --

MEMBER BONACA: And, in fact, I believe it was for the PRA we are getting the PRA to do the design phase. I think there is a distinction to be made for the reluctance of the licensee at the moment in which you have an operating plant, and you have a docket there. And you now have a commitment -- a moot commitment to so many things in the PRA, including training, operating crews, the assumptions you made in human factors inside the -- they're all inside the PRA.

I mean, PRA reaches so far, and as far as I know from the years I was in the industry that was one of the reasons for the reluctance to give the information, because you have a changing model all the time. You are making decisions there regarding --

CHAIRMAN WALLIS: I don't think you're right about thermal hydraulics. I have a whole stack of stuff in my -- at home which is to track the GE code that's used for thermal hydraulic analysis. Everything is there, supposedly, all the assumptions and equations and coefficients and everything are there. I can see it.

MEMBER CORRADINI: So can I ask an analogy question? Since you had a very good analogy, one of you three back here, which was it's just like a Chapter 15 analysis. You don't want to send all that junk over the wall. It's going to be at the plant. So how is that handled if this Committee was reviewing an old-fashioned reactor with a Chapter 15 analysis in great detail? How is that information properly transferred, so that one could make a decision?

MEMBER KRESS: In the FSAR.

MEMBER CORRADINI: And it seems to me -- no, no, the results were in the FSAR, the way I understood Jack's point, and all the rest of the stuff was sitting back at the utility or the --

MEMBER SIEBER: The vendor.

MEMBER CORRADINI: -- at the vendor, excuse me, or whatever.

MEMBER SIEBER: They reviewed AP1000, and that's where we went. We went to the vendor's shop in Pittsburgh.

MEMBER CORRADINI: Okay.

MEMBER SIEBER: That's the way you do it.

MEMBER CORRADINI: Okay.

MEMBER APOSTOLAKIS: No, but we had the PRA.

CHAIRMAN WALLIS: But it's not true that they didn't submit -- as I say, with AP600, which is very much like AP1000, I had several boxloads of stuff sent by Westinghouse, which contained all of the assumptions in their --

MEMBER SIEBER: Well, they like to give it to you. On the other hand, under the rule they don't have to give it to you.

CHAIRMAN WALLIS: They don't have to, but

I just don't think --

MEMBER SIEBER: And if you ask them for it, they can say, "Go away."

MEMBER CORRADINI: But just from an analogy standpoint, it seems to me, to answer George's question, we would have to follow a similar thing as a Chapter 15 analysis, which is when there's detail there is some protocol that we have to go through.

MEMBER SIEBER: And we don't need the PRA to make our decision, because this is not a risk-informed application.

MR. SALTOS: Excuse me. This is Nick Saltos. If I can add a clarification between the analogy between Chapter 15 and Chapter 19. Chapter 15 requires that they submit their input to the codes to the staff. The analogy in the PRA, the input is the fault trees, event trees, DARTA, all that stuff are input, are not codes. We never ask for codes in a PRA. We never ask for thermal hydraulic codes. We never asked for CAFTA or codes used for quantification for uncertainty analysis. But we always asked for input like fault trees, the logic model.

MEMBER BONACA: Well, that's because you already approved the code --

MEMBER APOSTOLAKIS: We have that.

MEMBER BONACA: -- the topical, right? We had a topical for --

MR. SALTOS: We have that in the certifications that we've had so far. But the proposed rule, I don't know what -- how it is going to be implemented. It talks about a summary description of the PRA. Whatever does that mean? It means that we are not going to have the event trees and the fault trees and the fire analysis. I don't know.

CHAIRMAN WALLIS: I might disagree with you, but you never asked the codes. We went through this many times. You did ask for codes, and the ACRS recommended that you were able to run the vendor's thermal hydraulic codes. And some vendors actually gave you their codes.

MR. SALTOS: Are you talking about PRA?

CHAIRMAN WALLIS: One particular one that refused to give you --

MR. SALTOS: I'm talking about the PRA.

CHAIRMAN WALLIS: Yes. I'm talking about thermal hydraulic.

MR. SALTOS: Yes.

CHAIRMAN WALLIS: You put that in the same box with PRA.

MR. SALTOS: Well, we do not ask -- it's

my understanding, never asked in the past anybody who applied to certify the design to submit any thermal hydraulic code to us.

MEMBER BONACA: Well, because they are already submitted and reviewed as part of the topical report. I mean, the NRC makes a separate determination for the computer code. Licensing the code -- I mean, approve it, and then --

MEMBER APOSTOLAKIS: But not for the PRA codes, that's his point, which is true.

MR. HARRISON: Yes. Nick's point is that for the Chapter 15 analyses all the methodologies and codes, they use approved NRC-endorsed codes.

MEMBER APOSTOLAKIS: Right.

MR. HARRISON: For the PRA, that is not the case. It has not -- we have not done reviews and approved the code for --

MEMBER APOSTOLAKIS: Again, I'm trying to envision the process here. Let's say there is a particular COL that's submitted next September or October. This Committee will start reviewing it, right? Because eventually we'll have to write a letter. Is there going to be a PRA subcommittee meeting?

MR. HARRISON: I would be surprised if

there wasn't at least a discussion on PRA during a subcommittee meeting. I don't know which --

MEMBER APOSTOLAKIS: Okay.

MR. HARRISON: -- subcommittee would --

MEMBER APOSTOLAKIS: So that subcommittee -- now, the members preparing for the subcommittee, I hope they will not have to go to the site to read the PRA.

MR. HARRISON: From the submission, what you will have is the --

MEMBER APOSTOLAKIS: The results.

MR. HARRISON: -- the description of the PRA and its results and the severe accident evaluation description.

MEMBER APOSTOLAKIS: But we will not know what kind of data they used? I mean, Nick said that they will be -- these are inputs.

MR. RUBIN: Let me supplement a little bit. This is Mark Rubin again from DRA. Under the current guidance in 1145 and the expectations from our industry stakeholders, the information in SRP 19 -- with respect to the PRA would be relatively brief, high-level, qualitative information.

Now, with the change in Part 52, we're thinking of revisiting that to see if we can get more detailed results information. But it will be a function of whether we can get agreement from OGC that it's not part of the plant's design basis, because as many of the members have indicated PRA conceptually changes and it's to reflect plant changes. And you don't want to really hold a plant to PRA changes. It's the opposite you want to do -- reflect changes in the plant.

So senior NRO management has indicated its desire that severe accident and PRA information not be part of the plant's licensing basis. Industry stakeholders have also indicated that. From the working level of the staff, it seems reasonable that that be the case, because we use it as a licensing evaluation tool in severe accident space.

What we need to do is get a consensus view from OGC along those lines, and then we could perhaps beef up the SRP 19 submittal to include more detailed quantitative PRA information. But currently it's restricted to qualitative very brief summary information.

MEMBER APOSTOLAKIS: But some --

MEMBER SIEBER: But you haven't crossed that bridge yet?

MR. RUBIN: Excuse me, sir.

MEMBER SIEBER: You have not crossed that bridge yet. OGC hasn't agreed to that, right?

MR. RUBIN: We're working with senior members of OGC, and we're laying the planks for the bridge.

MEMBER APOSTOLAKIS: Is information submitted to the ACRS for evaluation -- does it become part of the licensing basis?

MR. RUBIN: No.

MEMBER APOSTOLAKIS: So I can see, you know, the legal problem resolved. No, it's not part of the licensing basis for the reasons you have --

MEMBER SIEBER: If it's in the application it is.

MEMBER APOSTOLAKIS: But every single piece of information we get becomes part of the licensing basis. I don't believe that. I mean, that's incredible. So --

MEMBER SIEBER: Okay. I stand corrected.

MEMBER CORRADINI: He said public information, not licensing --

MEMBER APOSTOLAKIS: Well, it can be controlled. It can be controlled.

MR. RUBIN: Dr. Apostolakis, I believe you are absolutely correct. It certainly does not become part of the licensing basis, but my linted understanding is that it becomes public if it's part of an ACRS meeting and deliberations. But your staff can advise you, certainly, much better than I.

MEMBER APOSTOLAKIS: It becomes -- the public part is what is discussed here.

CHAIRMAN WALLIS: Right.

MEMBER APOSTOLAKIS: But not all details are --

CHAIRMAN WALLIS: But what we get as members, I often get stuff which is stamped proprietary information.

MEMBER APOSTOLAKIS: Yes, sure. Even the documents we have now for --

CHAIRMAN WALLIS: And I don't give it to the public.

MEMBER KRESS: We quite often have closed meetings.

CHAIRMAN WALLIS: Right.

MEMBER APOSTOLAKIS: Another thing that the members should remember --

MEMBER SIEBER: The e-mails among us are public documents.

MEMBER APOSTOLAKIS: It's one thing to say it's available on the site for audit. That's not a day's work. I mean, the staff can afford to go there for maybe two weeks to review it, but the members cannot. So to say that we will go there and spend a day, day and a half, that's not really a review. That's not really very informative, because, really, you have to have it at home and sit down and study it.

So I think there's going to be a problem there, and the language has to be such that there will be a lot of flexibility, because I do appreciate all the issues about making it part of the licensing basis. And that's not my problem. I don't want to -- I mean, if that's a problem, don't do it.

But to say that, if you want to see what happened, you have to travel there, it just seems unreasonable to me, because I have to write a letter at the end that says, yes, go ahead and operate.

MR. WILSON: This is Jerry Wilson. If I could remind the Committee that the regulations we're discussing are regulations applying to the applicants who are submitting applications to NRC staff. The ACRS is an independent statutory committee, and you're not constrained by the staff's rules. And you can ask for whatever you want to ask for.

MEMBER APOSTOLAKIS: We are constrained by the Commission's rules, though, aren't we?

VICE CHAIRMAN SHACK: Well, you can ask, George. They don't have to supply.

MEMBER KRESS: And we don't have to agree.

MEMBER BONACA: No, I don't think that there will be a reluctance, I think, from the plant to supply until they start the plant. I think that the problem becomes when you start a plant and you have --

MEMBER APOSTOLAKIS: Yes, that's when you start changing things.

MEMBER BONACA: And that's really where you would want to have --

MEMBER APOSTOLAKIS: Yes. I don't really care about that.

MEMBER BONACA: But up to that point, I don't see that there should be any reluctance. I mean, this is, you know, information to do with a decision and --

CHAIRMAN WALLIS: I think, George, what we need to do is just put a couple of sentences in our letter.

MEMBER APOSTOLAKIS: We should, yes.

CHAIRMAN WALLIS: Which we can then appeal to later on, and then that will help us to --

MEMBER ABDEL-KHALIK: Can I ask a question?

MEMBER APOSTOLAKIS: Of course.

MEMBER ABDEL-KHALIK: Would the staff expect to approve any COL without doing an onsite audit?

MEMBER APOSTOLAKIS: That's a good question.

MEMBER ABDEL-KHALIK: Do you foresee a situation where you would approve a COL application without an onsite audit?

MR. RUBIN: This is Mark Rubin again. Boy, it's hard to answer absolute. Let me characterize --

MEMBER ABDEL-KHALIK: Can you make a judgment?

MR. RUBIN: Sure. I'll be glad to give you a judgment. Under the conditions that the majority of the PRA analysis is done during the final design approval and the design certification, because that's where we look at the NSSS, and the majority of the plant PRA parameters, and all that a COL has to do is changes in that design which very likely will be nothing, plus site-specific parameters that were probably scoped by bounding calculations.

I could conceive it's possible that a COL could submit sufficient information through RAIs to alleviate the need for a site-specific audit. But I would characterize it as doubtful. I would characterize the need for a site-specific audit for the FDA part of a PRA review as essential, and I could see no way that we would get through a PRA review for that state of the PRA assessment without a site-specific audit to look at the actual PRA.

MEMBER ABDEL-KHALIK: So in the majority of cases, you would expect that, you know, you receive this information as specified in 1145, but inherent in this process the staff will have to do an onsite audit to check the details of the PRA.

MR. RUBIN: Yes. We do onsite audits of PRAs for much less significant PRA scope issues than this. We do it for risk-informed applications now where we think there may be some questionable modeling or scope issues. This is much more broad, and I'll defer to Nick Saltos here who does a number of these evaluations.

Nick, could you conceive of us not doing an audit?

MR. SALTOS: Well, we are talking about here a COL with a -- that references a certified design or an application for a certification of a design. Those things are different. If you have a certified design, you have a PRA, you have reviewed the PRA, you have applied the PRA to identify design and operational requirements like what systems are going to be safety-related versus non-safety-related, regulatory treatment of non-safety systems, tech specs, ITAACs.

The PRA provides input to the licensing basis. I heard here people saying that the PRA is not part of the licensing basis. That's true. But the PRA is used -- is applied, is an application of the PRA to provide input to the licensing basis. The PRA has identified that these are not ITAACs, that they are not identified by the deterministic reviewers, has modified ITAACs, has contributed to a change -- non-safety-related systems to safety-related systems, has identified tech specs --

CHAIRMAN WALLIS: Well, I --

MR. SALTOS: -- requirements of non-safety systems, we know all that stuff.

CHAIRMAN WALLIS: I'm going to ask Tom Kress if it isn't time to move on. We could spend a lot of time on this.

MEMBER KRESS: It is time to move on. I'd like to make one more statement about the PRA. I think our problem stems from the fact that we dance around the issue of whether the PRA is part of the licensing basis. I personally think it ought to be, and that would solve our problems. We could deal with -- we could deal with how the -- get to it and look at it, and everything.

You know, we just heard that it's part of determining RTSS, it's part of determining safety systems, it's used for the site EIS. I think it ought to be part of the licensing basis, and then we'd quit dancing around this issue. But that's a personal opinion.

MEMBER SIEBER: Well, that's also a subject -- policy subject --

MEMBER KRESS: Oh, sure. It's a policy --

MEMBER SIEBER: -- for the Commissioners to --

MEMBER KRESS: -- issue.

MEMBER APOSTOLAKIS: But also, I think it's important to come back to something that Mr. Wilson said, that in our letter of May 22, 2006, we agreed that the PRA should not be submitted. It's not really clear that that's what we're saying. We are saying updates to the PRA need not be submitted to the NRC. There is a slight difference there. Big difference.

MEMBER KRESS: There's a way to handle that with the thermal hydraulic codes that have been blessed that changes the rules.

MEMBER APOSTOLAKIS: Well, I'm glad it was --

CHAIRMAN WALLIS: We were quoted out of context. We were -- we're missing a key word "updates," right?

MEMBER APOSTOLAKIS: Well, if you read it, it's not very clear what it means, but I think the intent was that the updates should not --

CHAIRMAN WALLIS: Our letter is not clear, George?

MEMBER APOSTOLAKIS: -- be submitted. But some original PRA should be. Anyway, I mean, it will be a major problem for me if we have to write a letter -- well, we will have to write a letter at the end saying, yes, go ahead, operate, or not, and, you know, to have had meetings where I don't have the information.

MEMBER KRESS: Let's move on, please.

MR. HARRISON: Okay.

CHAIRMAN WALLIS: I think eventually you would get that information, George.

MEMBER APOSTOLAKIS: I believe I -- we

will, too. Yes.

CHAIRMAN WALLIS: So let's move on.

MR. HARRISON: Okay. And I'll try to move quickly to catch us up a little bit here.

MEMBER APOSTOLAKIS: Well, Donnie, let me ask you a question, because we are running out of time here.

(Laughter.)

You don't have to -- I'm sorry. I notice that a lot of this presentation is we did this, we did that, we were told this, and we were told that. And there isn't really any technical content, and there is only half an hour left. So I'm proposing to the Committee that we discuss some of the technical issues and forget about who said what, unless there is something very important, you know, okay, we got 700 comments, yes, all right, what do you think?

MR. HARRISON: No, that's fine. If you've got --

MEMBER APOSTOLAKIS: Does the Committee agree?

CHAIRMAN WALLIS: Well, we had the same problem with the subcommittee. I thought we were meeting to receive comments from the subcommittee that would help the staff, and we spent a lot of time on other things. I'm not quite sure, Tom, how are you going to fit that in today? Are you going to fit in some technical matters or not?

MEMBER APOSTOLAKIS: I mean, this issue of large release frequency, Donnie, maybe I'm missing something, but have we defined it anywhere? And where is this 10^{-6} per year coming from?

MR. HARRISON: Okay. And that one I can actually give you an answer.

MEMBER APOSTOLAKIS: Well, I'm sure you can, but --

(Laughter.)

But this is the kind of question I want to ask, not we have experience with design certification. I know you are very experienced, very experienced.

MR. HARRISON: This fits into this slide.

MEMBER APOSTOLAKIS: Tom, what --

MEMBER KRESS: I think it's a good idea. We shouldn't be a slave to --

MEMBER APOSTOLAKIS: Okay. So if we look at the PRA section -- as a side remark first, it seems to me the statements like "applicants should not artificially increase PRA results" don't belong here. I mean, you are -- you should delete that kind of thing.

MR. HARRISON: Okay. That was a comment, because in addressing the multiple different goals you don't want to be in a situation where an applicant is slightly not meeting a goal. And to meet it they --

MEMBER APOSTOLAKIS: But that's understood.

MR. HARRISON: -- finagle their results.

MEMBER APOSTOLAKIS: The issue of bright lines has been discussed, and I don't think it -- but there are two questions on this particular point. First of all, when did the agency decide to use the large release frequency as opposed to the large early release frequency as a metric? And the 10^{-6}, and then a probabilistic goal for the condition or containment failure probability of .1, is that consistent or inconsistent with a 10^{-6}?

MR. RUBIN: It was -- Mark Rubin. It was in 1990, and Donnie will give you the specific references. All these came from direct Commission guidance when we started the evolutionary and advanced reviews, starting from the EPRI requirements document. And I'll remind those Committee members who weren't here then that these were the first times that the PRAs were actually used an integral part of the staff's safety review process.

And Donnie will give you the actual policy guidance, because the staff sent up --

MEMBER APOSTOLAKIS: Okay.

MR. RUBIN: -- some position and technical resolution and criteria papers, and the staff -- excuse me, and the Commission modified them significantly for our review process.

MEMBER APOSTOLAKIS: When was this?

MR. RUBIN: It started in 1990, and we continued to get guidance for about three or four years as we continued with ABWR and AP600.

MEMBER APOSTOLAKIS: So the concept of large release frequency has been in the book since 1990?

MR. RUBIN: Yes, sir.

MR. HARRISON: For advanced reactors. For evolution in --

MEMBER APOSTOLAKIS: And then, in 1990 -- oh, for advanced --

MR. HARRISON: Yes. It was -- this is related to SECYs and SR --

MEMBER APOSTOLAKIS: And the 10^{-6}, too?

MR. HARRISON: The 10^{-6} was actually brought up in I think the '90 timeframe. It was actually explicitly reconfirmed in a later SECY SRM to --

MR. RUBIN: This is the only place that the staff applies the decision that -- the severe accident decision metric of 10^{-6} for large release frequency, and it's only applied for new reactor licensing. And that's Commission-specific direction.

MEMBER APOSTOLAKIS: So if those guys, then, later want to invoke Regulatory Guide 1.174 to make a risk-informed change, then they will have to live with this new goal.

MR. RUBIN: That gets to the heart of the issue of whether severe accident and PRA evaluations that are part of the initial Part 52 licensing is part of the plant's licensing basis or not. If we go under the assumption that it is not, then we do the assessment one time for the design certification evaluation, and then they will be covered by the same Reg. Guide 1.174 delta assessment that everyone else is.

If we assume that it's a living requirement, then your postulate is correct. And that's why we're seeking OGC guidance.

MEMBER CORRADINI: He understood that. Can you do that one more time?

(Laughter.)

Slower.

MR. RUBIN: I would say it would be my pleasure, but I'm confusing myself. But, sure, I'd be glad to. Here's the issue. This is the only place that we have a large release versus a large early release frequency, and it's a baseline rather than a delta change criteria. And when the staff sent up a policy Commission paper proposing a CDF and a large early release criteria, the Commission responded with essentially, "No, we believe there are other metrics and other values that are more appropriate to the advanced reactors."

They proposed a different baseline CDF value than the staff had proposed, and they proposed large release frequency in combination with a conditional containment --

CHAIRMAN WALLIS: You said there were other metrics. That really mystified me. You meant there were other values of the conventional metrics.

MR. RUBIN: No. There were other metrics.

CHAIRMAN WALLIS: What are those mysterious metrics which are superior?

MR. RUBIN: Conditional containment failure probability.

CHAIRMAN WALLIS: Okay. So it --

MR. RUBIN: And there are values to those other metrics, but they were different. And the large release frequency they proposed as one in a million chance of having a large release.

And if we look at it as a one-time review checkoff, then we will look at the Level 2 PRA analysis, and we have Mr. Paola here to explain in detail how that's done, and so we won't look at just the early releases, which have the potential for early fatalities and consider timing and evacuation. We'll look at all of the releases that could be considered roughly large and independent of timing.

And then, we'll see if it meets the one in a million probability that the Commission mandated, but we would only do it through -- for the final design approval and design certification review. If the severe accident and PRA acceptance guidelines that the Commission policy SECYs -- and there were about three or four of them -- is considered part of the plant's licensing basis, then those guidelines would have to be considered through the life of the plant, and continuously reevaluated as the plant changes, data changes, model changes, and your state of knowledge changes.

And that seems perhaps overly burdensome and perhaps unnecessary, because we already have in place risk change control metrics that both the staff, the Commission, and at the time the Advisory Committee thought were adequate to control changes in plant risk.

So we're working on it with OGC and senior management, but right now we think doing it just during licensing -- and it's the only place that metric exists right now from Commission guidance -- is probably enough and --

CHAIRMAN WALLIS: I'm really puzzled, Mark. You seem to be using OGC to interpret what the Commission meant. Why don't you just ask the Commission?

MEMBER SIEBER: That's why they're using OGC.

MR. RUBIN: The Commission sent guidance down for the review of the advanced reactors.

MEMBER APOSTOLAKIS: It was a different Commission.

CHAIRMAN WALLIS: Yes.

MEMBER CORRADINI: So since I started this by asking you to do it again, so let me just try to translate back so I get it in less words. And I'll probably get it wrong, but just let me try to say it.

CHAIRMAN WALLIS: And less time maybe?

MEMBER CORRADINI: Well, that's all right. Probably not. So, but the other piece -- so what you said was there is going to be, I'll call it, measure 1 at the time of licensing, and there will be measure 2 which, if I use measure 1, would be -- have been included in it, because the LERF is essentially a subset of the LRF.

But let's just say I've got measure 1 during licensing, and I've got a different measure as life proceeds down a path. The other thing that you -- that somewhere in there you've said, and then you pointed to the young man behind you, was that I've got a third measure which is the containment failure probability, which would only be applied at licensing, and then, from then on, not at all.

MR. RUBIN: It would --

MEMBER CORRADINI: Have I got it right?

MR. RUBIN: Not quite. Sorry I didn't go into those areas. The quantitative containment performance conditional failure probability was imposed by the Commission for licensing. The staff --

MEMBER CORRADINI: But only for licensing.

MR. RUBIN: Only for licensing. However, the staff doesn't have a quantitative containment performance goal in Reg. Guide 174. It uses a qualitative defense-in-depth concept to roughly achieve the same thing. High confidence that you have containment integrity long term if at all possible. And so we look for -- we look for challenges to the containment that will give containment failure, and we try to find ways to prevent that from occurring. But we don't have an actual numerical metric like the Commission gave us for licensing.

MEMBER CORRADINI: But what I said, though, to begin with is that's the containment failure probability of 0.1.

MR. RUBIN: Only used once.

MEMBER CORRADINI: It was only used once, just as the LRF is only used once.

MR. RUBIN: Yes, sir.

MEMBER CORRADINI: Okay. Thank you.

MR. HARRISON: Yes, and just -- that's assuming that OGC provides the guidance that Chapter 19 input is not part of the licensing bases.

MEMBER CORRADINI: Okay. Thank you.

MEMBER KRESS: I think specifying both in LRF and a conditional containment failure probability is an overspecification. One can be derived from the other.

MEMBER APOSTOLAKIS: In fact, I'm not sure they are consistent here.

MEMBER KRESS: They have to be made consistent in my mind. And not only that, you are very correct in saying that LERF, L-E-R-F, is a subset of LRF. Not only is it a subset, it's more than likely about 95 percent of it. So specifying one or the other doesn't make much difference in PRA space.

MR. RUBIN: Dr. Kress, the one thing I would just amplify your point on -- and you're absolutely correct -- is that other than the baseline initial licensing, the Commission has given us no goals for baseline plant risk. All the other guidance we have from the Commission is risk changes after licensing. There are no baseline plant risk goals. Only for initial licensing on new reactors.

MEMBER KRESS: That ought to be part of the site approval, the risk criteria. But we don't really have them. We have site characteristics and site population densities and other things, but we don't have any risk goals -- risk rules. We have goals, we have the QHOs, but so far they are not individual plant risk metrics that have to be met. But, you know, if I had my way, I'd change all of that.

CHAIRMAN WALLIS: Tom?

MEMBER KRESS: Yes.

CHAIRMAN WALLIS: I want to ask you something. We have this agenda here. We're way behind. Is there any time we're ever going to get comments on anything other than PRA?

MEMBER KRESS: Well, I'll tell you how I suggest we proceed. Let's dispense with the agenda and say, does anybody have any questions in these areas --

MEMBER APOSTOLAKIS: Well, some people have left now, so --

MEMBER KRESS: Yes.

MEMBER SIEBER: I think there's one thing that we can say is there is no new ground being formed in the preparation of DG-1145. All this does is endorse a lot of existing regulatory guides, codes and standards, rules and other documents, and then it specifies what has to be in the application. And so from that standpoint, there is nothing new here.

And in our review, we all reviewed and found a few little things that we wondered about. For example, in my own case, I've wondered where some things I expected to find were, but the document is very big, and I didn't read the entire document. And it turned out they're in there.

And so from the standpoint of looking at the details of what these regulatory guides, rules, Appendix A criteria, and all these other documents say, nothing is new.

MR. HARRISON: That's correct. If you look at it from like the design cert experience, the SECYs and SRMs, the draft guide, at least in the PRA area, is trying to bring that all into one place and provide a concise --

MR. COLACCINO: This is Joe Colaccino from the staff. I just want to change one word. Instead of "endorse" I would say "roadmap," because the endorsements would be contained without the regulatory guides themselves. But what the document does is provide a roadmap to that information.

MEMBER SIEBER: And an analogy that turned up in the subcommittee meeting is that with DG-1145 in the current rules that are there, we could submit an application and build a perfect 1980s-type plant.

(Laughter.)

MR. HARRISON: Yes, I think that was your comment the last --

MEMBER APOSTOLAKIS: Is the .1 CCFP consistent with a 10^{-6} for LRF?

MR. HARRISON: Yes, that I would clarify. I think they are different, because no matter how low you get the CDF -- you could have a plant come in with a design that says their core damage frequency is less than 10^{-8}, therefore, their large release frequency is going to be less than 10^{-8}. So they automatically meet the large release frequency.

However, they still have to meet the goal of .1 for the containment, so you have that -- so that would mean that they would --

MEMBER KRESS: But that .1 --

MR. HARRISON: -- it acts as a defense-in-depth --

MEMBER KRESS: -- that .1 is weighted by the CDF, and that sort of takes care of that problem. The .1 is not just multiplied by the CDF. It's weighted by the -- each sequence has a CDF and a conditional containment failure --

MEMBER APOSTOLAKIS: Okay.

MEMBER KRESS: -- but the one we're talking about has that sequence's contribution to that weighted by the CDF. It's divided into it. So it's a percent.

MR. RUBIN: Yes, sir. It's weighted, but --

MEMBER KRESS: That takes care of that problem.

MR. RUBIN: It's weighted, but it doesn't eliminate the fact that as you reduce CDF lower and lower and lower, the remaining very severe sequences have very high conditional containment failure probability. So as you make the plants safer and safer, you drive up the conditional failure probability higher and higher. And so that gives a -- it seems to give an incentive to a designer to run the CDF higher, so they can come closer to achieving the .1 value. And that's not our objective.

MEMBER KRESS: Yes.

MR. RUBIN: And we wanted to make that clear as Dr. Apostolakis pointed out. That's foolish.

MR. HARRISON: And, again, if you think of it, if you're dominated by -- because you get the risk low enough at your plant, you get the CDF low enough, you may be dominated by very high CCFPs for the sequences that are left. I mean, it's proportional. So you could end up with a plant with a very high containment failure probability for its CDF, because you've gotten rid of everything that's successful containment, so --

MEMBER APOSTOLAKIS: Okay. Changing the

subject, in the RTN assessed discussion chapter, it says that this process started with a comprehensive Level 3 baseline PRA.

MR. HARRISON: And that's incorrect.

MEMBER APOSTOLAKIS: Okay.

MR. HARRISON: We need to revise that section.

MEMBER APOSTOLAKIS: Okay.

MR. HARRISON: The metrics are LRF, CDF, CTFP. Those are all taking you up to -- they take you up to a Level 2 PRA, if you will, but they don't take you to Level 3. So that's a -- that was something that --

MEMBER APOSTOLAKIS: So that will be fixed.

MR. HARRISON: Yes.

MEMBER APOSTOLAKIS: And the final conclusion, LRF will be used one time for the approval or --

MR. HARRISON: That's an open question. That's the question with OGC.

MEMBER APOSTOLAKIS: But that's --

MR. HARRISON: That's the current understanding.

MEMBER APOSTOLAKIS: And then, from then

on, risk-informed changes will go back to 1.174.

MR. RUBIN: That is --

MEMBER APOSTOLAKIS: Could be.

MR. RUBIN: Right. That's one path forward. Yes. The other path --

MEMBER APOSTOLAKIS: I don't know. The issue of making sense has to be --

MR. HARRISON: Well, the issue becomes if OGC rejects that path, then you would have to maintain the metrics that are in the LRF, the CDF, the CCFP. Even under a Reg. Guide 1.174 submittal later, you would have to -- you would have to maintain those bases. So --

MEMBER APOSTOLAKIS: Of course, this is a technical question more than a legal question. But --

MR. HARRISON: Because it would become part of the licensing basis, yes.

MEMBER APOSTOLAKIS: Oh.

MR. HARRISON: So that's the ultimate question to the lawyers.

MR. RUBIN: None of these plants would -- this is Mark Rubin again. None of these plants will have problems meeting the CDF goal. They're much safer than that.

MR. HARRISON: It's just that the LRF is

more restrictive than the LERF. And so you may not have as much flexibility for mods down the road.

CHAIRMAN WALLIS: Well, I hear a silence. Maybe we can move on?

MEMBER KRESS: I think so. Or let --

MEMBER APOSTOLAKIS: The uncertainty analysis should identify major contributors to the uncertainty. We don't do that now, do we?

MR. HARRISON: As part of your design certs, I believe -- Nick, correct me if I'm wrong here -- but they have done fairly extensive both uncertainty sensitivity analyses to get an idea of the magnitude of the uncertainty in the calculations and --

MEMBER POWERS: Well, the common practice -- I mean, the practice that the staff is using in some of its phenomenological models is to come back and have a ranking of the uncertainties, and bounds to a linear correlation coefficient between the uncertainty and the calculated output with a probability and, in fact, an uncertainty range on that ranking.

MEMBER APOSTOLAKIS: I think they are identifying the major contributors to risk, but not the contributors to uncertainty.

MEMBER POWERS: These are specifically contributors to uncertainty.

MR. SALTOS: If I can answer what we did so far in the design certifications. We identify the areas of uncertainty. For example, squib valves, we don't have a lot of information about squib valves, especially the size that are used in advanced reactors.

Software common cause failures, we don't have a lot of experience about these. So we identify these kind of areas of uncertainty, and then we perform sensitivity studies to see how it will impact the results, and then go from there, take that into account in the decisionmaking -- you know, identify requirements for the design changes or operational requirements.

MR. HARRISON: And I think one of the insights on like the AP600 or AP1000 was the uncertainty in the thermal hydraulics for the passive features, right? That was another area where --

MR. RUBIN: Low delta P for injection.

MR. HARRISON: -- low delta P.

I'll go through this very quickly, then. And if there's nay technical questions, ask. But the basis for the reg. guide for the PRA section comes out of the SECYs that -- much as Dr. Sieber mentioned, the policy statements, experience with design certification reviews, and then just the requirements that are in 10 CFR 52.79 specifically requiring a description of the PRA and its results, the severe accident evaluations that have to be performed.

The objectives that are derived from those policy statements and SECYs with -- endorsing SRMs can be grouped -- I think we had nine objectives identified of the PRA and severe accidents. You can lump them into two groups.

The first group, which includes the goals, the quantitative goals, are to assess the balance of preventive and mitigated features, and to show that there's a risk reduction from the current plants. And that dates to the severe accident policy statement in 1985. So you're comparing it to plants of that vintage.

The other group is how the PRA is being used and applied. It's being used to support RITNESS. It's being used to support the RATH program. You'll develop ITAACs, other commitments and interface requirements. So those are the uses and applications of the PRA, so you can lump them into those two groups.

This is just an outline of what the Chapter 19 regulatory guidance is. This would be the topics that you would cover in the FSAR. So there would be an introduction. The applicant would -- you would expect him to describe the objectives, the nine objectives, any others that they're applying for the PRA.

19.2 would be the PRA results and insights. This would include how they're using the PRA. And if they're making an application in parallel with a COL, or even a design certification, but if they're making, for example, a risk-informed ISI application to go along with their COL application, they would need to describe that and how the PRA is being used in that application.

You have the severe accident evaluations, which is the more traditional deterministic severe accident topics that are split into preventive and mitigative categories. There is a section on PRA maintenance. And, again, this is PRA maintenance for the applications. So how you're using the PRA, what's the PRA quality, level of detail, scope that you need for those applications, and how do you maintain that going forward.

Section 19.5 is -- it becomes a commitment section or the ITAAC, the COL action items. What things are you going to have to confirm or verify after you get your license and establish those at this stage, so that you know I've done a PRA-based seismic analysis, or I've done a fire analysis. When I build a plant, if I move cables or I change something, I need to come back and make sure my results haven't changed, my overall results and insights haven't changed.

And then, the last section is a conclusion section where we're asking that the applicant explicitly address the nine objectives and state at that point how they believe they've met those objectives.

CHAIRMAN WALLIS: Have you finished?

MR. HARRISON: Yes.

CHAIRMAN WALLIS: Thank you very much.

Tom, we do have another item I'd like to finish this morning, if we can get to it. And then we have -- not your business, but we have another item on the agenda after the break. I would hope we could finish up before lunch.

MEMBER KRESS: We have until 10:45.

CHAIRMAN WALLIS: We have until 10:30. You've got five minutes now.

MEMBER KRESS: My agenda says --

CHAIRMAN WALLIS: Well, it's okay. But I'm just wondering what you're -- how you're going to get us through --

MEMBER APOSTOLAKIS: No, that's a break, Tom.

MEMBER KRESS: Well, I suggest -- yes, I see. I suggest that, since there's only one slide basically on the conformance, completeness, and consistency -- and we can read that -- why don't we get a -- spend five to ten minutes on the industry concerns and public comments, and maybe skip to slides -- in that area I have slides 4, 5, and 6. Maybe present those three slides, and we can --

MEMBER APOSTOLAKIS: What is the industry concern?

MEMBER KRESS: And take no more than 10 minutes.

MR. OESTERLE: This is Eric Oesterle again from Division of New Reactor Licensing. We held a number of public workshops on development of DG-1145. We had a lot of participation from industry. Some of those workshops identified comments that did carry over through into the public comment period, and I summarize some of these issues and comments in these next three slides.

They are certainly not in order of priority, but they are issues that still need to be worked through by the staff and industry. The first bullet is on COL information availability. That was a consistent item throughout the workshops and comments.

Due to the use of Reg. Guide 1.70 as the basis for DG-1145, and the staff's predominant experience in licensing plants using the Part 50 process, workshop discussions focused on areas of the guidance document in which information was requested that would not be available at the time of the COL application submittal, or even after the COL issuance.

This is one of the most challenging areas for the staff in terms of being able to negotiate the paradigm shift from the Part 50 licensing process to the Part 52 licensing process. Comments on COL information availability were made in several areas where the guidance document requested information that would not be available at the time the COL application was submitted.

I'll give you an example. Section C.I.8.3.2 for onsite DC power systems requested battery characteristic curves. These battery characteristic curves will not be available until batteries have been procured, which will be after the submittal of the COL application and could likely be even after the issuance of the COL license.

As another example, the guidance in Section C.I.3.6.2 for determination of pipe rupture locations and dynamic effects associated with postulated rupture of piping requested that applicants provide information in addition to their design criteria on detailed information on containment penetrations and protective assemblies or guard pipes to be used for piping penetrations of containment areas. This detailed information is not expected to be available at the time the COL application is submitted.

The staff is currently reviewing the available methods by which verification can be performed to ensure that the information, once provided by the COL applicant or licensee, conforms with the licensing design, and those verification methods include ITAAC, they include engineering design verification, and also include construction inspections by the staff.

Another area that incurred some discussion during the workshops were the verification activities themselves. Do we do inspections, or do we impose ITAAC? In areas where the guidance document requested that information, that would not be available at the time the application was submitted. There were certain places where the guidance requested the applicant to identify the ITAAC that had been proposed to verify that information.

Commenters suggested that instead of ITAAC that construction inspections rather than ITAAC were more -- the more appropriate verification method. We are still looking at that.

There were some discussions on first-of-a-kind engineering inspections. Those areas are very limited to the first time that the vendors actually translate the high-level design information contained in the certified design documents to documents that you can take and go build a plant with -- construction drawings, procurement specs, and things like that.

Right now, you could not take the design certification document and hand it to an AE and say, "Hey, here, go build this." There needs to be some translation of these high-level design documents.

So the FOAKE inspections were designed to ensure that this translation was adequate, and those would be limited. There was also discussions on engineering design verifications, and that's more or less once -- once the procurement specs had been developed, it was kind of like a QA/QC check to ensure that the applicant's or the licensee's process now ensures that the equipment that they asked for is what they got.

CHAIRMAN WALLIS: Are there any of these public comments that are substantial or make substantial changes in the -- well, I asked you that before, and you said they were minimal. Which ones of these are significant?

MR. OESTERLE: The one on COL information availability is --

CHAIRMAN WALLIS: That's important.

MR. OESTERLE: Right. It won't make a significant or substantial change to the document, but it will be a -- we're intending more of a generic change, and we're considering having applicants identify those areas where information will be provided later or will be updated, and to propose methods for doing so, including identifying what section of the application those items are included in.

One area that -- another area that's going to change in a more generic nature is providing guidance for plants that incorporate passive safety system designs. Originally, we intended this document to be a very generic document, and not focus specification on particular reactor vendor designs. But in some areas, we acknowledge that providing another level of generic guidance for areas for passive plants, if you will, would be beneficial.

And examples include guidance in Chapter 8 for applicants to identify or provide guidance for applicants that do not rely upon safety-related Class 1E emergency diesel generators, because they have 72-hour capacity batteries.

Likewise, we looked at providing guidance for those applicants in Chapter 9 in the areas that included guidance on diesel generator support systems. There's intake air, combustion air, lubrication systems, starting air systems, cooling water systems. If you don't have Class 1E safety-related diesel generators, the pedigree of those supporting systems also changes.

I think we talked quite a bit about plant-specific PRA, and I'll just move on.

One area that we had some good success on was on the maintenance rule discussions. In fact, we have a separate breakout session on that from the workshops. And the initial guidance that was provided in DG-1145 was -- provided comprehensive guidance on the maintenance rule and practically gave everything that the agency knew about in terms of maintenance rule and how plants are to maintain their program, even after they've begun operating.

We have scaled that back somewhat based on workshop comments and discussions to -- for applicants, just to provide the information necessary to get their license.

Digital I&C continues to be an area where there are discussions between staff and industry. I will point out that most, if not all, of the digital I&C areas are covered by DAC, the design acceptance criteria. And those contain elements of design completion and design implementation, so the staff and industry are continuing discussions on those in order to reach resolutions on design issues. In fact, there have been some -- one of the brings to the Commission on new reactor licensing included digital I&C as one of the specific topics.

MEMBER SIEBER: And some of the fundamental issues in I&C are not yet codified.

MR. OESTERLE: I think that's correct.

MEMBER SIEBER: Yes. There's got to be

more work.

MR. OESTERLE: There were some --

MEMBER SIEBER: We'll be revising this document once that work is complete.

MR. OESTERLE: There were some discussions on ITAAC, the guidance that was provided on ITAAC, and certain areas seemed to be much more detailed than necessary, and it was not consistent with the idea that ITAAC was intended to verify top-level performance requirements or design requirements for the plant.

Other areas of workshop discussion and comments included the format and content for an environmental report. Also, the finality of an environmental impact statement associated with an early site permit. The Part 52 rule that went up to the Commission largely clarified the issues with respect to finality of an environmental impact statement associated with an ESP that a COL applicant references. And we will revise DG-1145 to conform with that rule.

There were also some discussions on human factors engineering which are also covered by design acceptance criteria, rad waste treatment systems with a focus there on temporary or mobile skid-mounted rad waste treatment systems, and then what I call varied guidance.

When we resolved comments that came up during the workshops, we included the responses to those comments in an appendix to DG-1145. And in some areas where we acknowledged or accepted the comments, we failed to move the basis for acceptance into the guidance document, and we want to make sure that -- and we are making sure that the basis for accepting that guidance does not stay in the appendix and gets moved forward into the guidance document.

Does that get us back on track?

MEMBER KRESS: I think that does it. Why don't we turn the meeting back to you now.

CHAIRMAN WALLIS: Well, how about the other members who haven't spoken yet. Do they have comments on this guide?

MEMBER KRESS: Well, we could ask for those, yes.

CHAIRMAN WALLIS: Nothing wishing to speak?

MEMBER MAYNARD: I've got just a couple. I don't know if they got discussed in the subcommittee meeting or not. I'll keep it real brief.

In Chapter 9, the auxiliary systems, to me there appear to be some discrepancies as to what's being asked for some of the things. Up towards the front of it, it's pretty methodical. You wanted this, this, this, and this, and then toward the end of Chapter 9 sometimes the safety analysis or safety evaluation wasn't asked for, sometimes an inspection wasn't, and it wasn't clear that there was logic or rationale for that. So just kind of consistency through that.

Another comment -- I think it's Chapter 13, Operations, a lot of things that need to be submitted, including like organization charts and things and resumes. I think you need to take a look at how much of that do you really need to have and continue to get updated? What gets done with that when it's here? And how timely is that anyway when that's known ahead of time?

Take a look at that and see -- I believe some of those things become a burden not only on the licensee but also on the staff, and doesn't necessarily add any safety benefit whatsoever. So those are kind of -- I've already covered my other generic comments on reg. guides and references to generic letters and just a hodge-podge of a lot of things here.

MR. OESTERLE: We received similar or identical comments to those which you just mentioned from NEI, and we are looking at those to resolve.

CHAIRMAN WALLIS: Anything else?

SB*: I just have a couple of comments on Chapter 15. You -- in particular for new designs, and that -- I know that it doesn't apply to certified designs, right? These are custom plants that you're talking about. But quite often the word "limiting," and things like this are used. And it's not very clear what you mean by these things exactly.

And also, with regard to new designs, how these scenarios can be found, because I think there is mention there that analysis doesn't have to be done, but somehow you're going to pull these cases out of the air or wherever. So I think the guidance is rather unclear with regard to what should be done, in particular for cases where there isn't a lot of experience.

And in that chapter also there doesn't seem to be that much guidance for what happens with designs which are, for example, passively cooled, you know, so there needs to be a little bit more clarity. In any case, I've given my detailed comments, which hopefully will be passed on to you regarding that.

MR. OESTERLE: Yes, we have those comments, and we'll be considering them.

SB*: Let's clear it up a little bit.

CHAIRMAN WALLIS: Thank you very much.

Are we now through with other member comments?

MEMBER KRESS: I was wondering if this is the right time, or maybe later, to ask members if they have specific comments about what should go in the letter, or should we wait until --

CHAIRMAN WALLIS: Well, we have time when we're writing the letter to do that probably --

MEMBER KRESS: Okay. Well, we'll --

CHAIRMAN WALLIS: -- rather than now.

MEMBER KRESS: Why don't we wait and do it then.

CHAIRMAN WALLIS: Yes. When we actually pull things together for the letter, we'll do that.

NEI is on the program. I told -- they're not going to have anything to say.

MEMBER KRESS: No, they're not --

CHAIRMAN WALLIS: So let's move on to the break, and we will take a break for 15 minutes until five minutes before 11:00. Then, we will take up the next item at that time.

(Whereupon, the proceedings in the foregoing matter went off the record at 10:41 a.m. and went back on the record at 10:57 a.m.)

CHAIRMAN WALLIS: Please come back into session and we'll move on to the next item on the agenda which is the Draft Final Regulatory Guide DG-1144, "Guidelines for Evaluating Fatigue Analyses" etcetera.

Before I hand over to my colleague, Dr. Armijo, I'd like to note that the presentation that I've been given here contains too many slides and I hope that we can somehow get through them expeditiously.

MEMBER APOSTOLAKIS: It's not PRA, Mr. Chairman. It will be very quick.

(Laughter.)

CHAIRMAN WALLIS: I was tempted to say that myself. Thank you. Okay, so let's get started.

MEMBER ARMIJO: Mr. Chairman, we reviewed this topic at the Metallurgy Material from Reactor Fuel Subcommittee yesterday. We had very detailed discussions and presentations from the staff from Argonne National Laboratory, as well as presentations from ARIVA and the ASME Code people.

There was a lot of discussion. I think it was a very valuable discussion and the really addressed is focused on the appropriate way to design for the effects of coolant environment on structural materials.

We have a lot of data and fortunately we now have a lot of data and so the issue is how to use that data instead of arbitrary margins to do your design.

This morning the presentations will be made by the staff, by Mr. Gonzalez. He will be introduced by Jennifer Ule of the Office of Research. In addition, we've had requests for five-minute presentations each by Mr. Gurdal of ARIVA and Mr. Erler of the ASME.

So with that, I'd like to turn it over to Jennifer Ule.

MS. ULE: Hi, thank you. Good morning. I'd just like to represent the Office of Research Management. My name is Jennifer Ule. I'm a Deputy Division Director for Materials Engineering in the Division of Fuels, Engineering and Radiological Research.

Yesterday, you heard a very detailed technical presentation from the staff regarding incorporating the effects of the environment on fatigue life and we're hoping today we'll have a brief summary of that and continue to defend the position that the staff is looking for your support for going out with a reg. guide to deal with the situation about the environmental effects of fatigue life. The purpose for that is support new designs which we feel is something that is of vital importance to do so.

Thanks for that and Hipolito Gonzalez will start the presentation.

MEMBER POWERS: I don't want you to get away that easily, Jennifer.

(Laughter.)

MS. ULE: Okay, this isn't thermal hydraulics.

(Laughter.)

MEMBER POWERS: This is an important issue as opposed to thermal hydraulics.

(Laughter.)

MEMBER POWERS: Looking back through the document and I'm sure the presentation of the subcommittee last, although I didn't attend, you know, this is an exposition in empiricism that's quite impressive. But I see little in this exposition that would reflect what I would call fundamental understanding of the fatigue phenomenon. And recognizing that that's a fairly challenging area to undertake, I pose this question to the Office of Research. Is there anything going on within research or should there be anything going on to develop what I would call a fundamental, mechanistic understanding of fatigue?

MS. ULE: I could say and certainly the technical staff can support me on this, our goal here was to get a reg. guide that supports new designs because we have concerns with the situation that the current fatigue rules would not have an environmental effect. And with that we had a certain amount of time to get something in place and we did so.

We always with any modeling you have to understand a certain amount of the mechanisms, but with regard to -- and rightly said, it is an empirical argument.

We have a certain amount of activities associated with moving forward into a more proactive arena for materials management and we have budget set aside to do exactly what you're saying, not only to look into more of the mechanistic understanding of some of the degradation mechanisms associated with the materials arena.

So with that we are heading in that direction, but at the same time when we have a safety issue at hand, we do have to get something in place that we're comfortable, is acceptably accurate and conservative.

MEMBER POWERS: Could you provide the Committee, actually, I don't care if you provide the Committee or not, but provide me with a list of those programs that you think fall within this development of fundamental understanding of the materials degradation?

MS. ULE: Sure, we can get that very quickly back to you.

MEMBER POWERS: Thank you.

MS. ULE: Does the tech staff want to have any other comment about any other modeling area of the mechanistic or fatigue? So we agree there is a need to have that. It's a matter of balancing priorities with regard to a finite --

MEMBER POWERS: Well, I understand that I did not take the position that there's a need. I asked if you thought there was a need and you said that there is.

MS. ULE: I didn't say it quite that strongly.

MEMBER POWERS: I understand.

MS. ULE: Don't get me wrong.

MEMBER POWERS: I've got your exact words.

(Laughter.)

MS. ULE: In a perfect world, we would understand mechanistically everything. And certainly the more you understand something mechanistically, the more confident you are, but at the same time, there are finite resources and in providing we can demonstrate through empiricism and appropriate test conditions that are considered prototypic, then we can establish the safety.

MEMBER POWERS: The challenge I see, of course, is that you reveal in your empiricism a substantial environmental effect and, of course, you characterize that environment as best you can at the time. You're very likely to find something new and exciting, especially as we move to designs where you haven't an experiential data base as rich as we have for the existing reactors.

MS. ULE: Right. And note that we do have in-service inspection programs to try to monitor things as they --

MEMBER POWERS: Which I would be prepared to take the position that they've largely been unsuccessful.

MS. ULE: ISI programs. That's a whole different argument.

MEMBER POWERS: That's a whole different argument, but I would be prepared to defend that point of view.

MS. ULE: ISI has been proven effective in a variety of situations. We do recognize that in certain particular areas, certain geometries, certain specific materials that some ISI techniques are not as effective as we'd like.

MEMBER POWERS: Or you're telling me that the technique is successful except where it isn't. And that's --

MS. ULE: Yes.

(Laughter.)

MS. ULE: Certain specific situations. We do have inspections going on in the Office of Research to demonstrate and determine the effectiveness of ISI programs and we can come back to the Committee on it if you --

MEMBER POWERS: I think about every three years, we augment those lists of special situations where it's not effective.

MEMBER ARMIJO: I think that's the issue

of mechanistic understanding is very important because when changes occur, you don't know whether those changes are going to increase the degradation effect of the environment or decrease it and we've seen the effects of, funny effects of the oxygen content, different for ferritic materials versus austenitic materials. So I think that's work that's valuable. It's a little off the subject at this point and I think we have limited time, so I would like to just proceed with the presentations and keep it as brief as you can.

MR. GONZALEZ: Thank you, Jennifer. First of all, I would like to acknowledge William Collins from the Office of Research and John Ferrer for NRR for their help and comments on this project.

So basic agenda is first we're going to talk about the motivation to perform this work, to have an overview of the Regulatory Guide 1.207, have an overview of the technical basis report and present a summary of the regulatory positions and show their resolution of the public comments for both draft NUREG and draft reg. guide.

NRR requested RES to develop guidance for determining acceptable fatigue life of ASME pressure boundary components with a consideration of light-water reactor environment. This guidance is going to be used for supporting reviews, application that the Agency expects to receive for new reactors.

The industry was notified of the initiation of this work. And in addition, this is one of the high priority reg. guides, has to be completed by March 2007.

Here is an overview of how the reg. guide relates to the regulatory requirements. General Design Criterion 1 and General Design Criterion 13 states that safety-related structural system and component must be designed, fabricated, tested and erected to a quality standard commensurate with the report of the safety function performed and to the highest quality, practical quality standards.

10 CFR 50.55(a) endorses the ASME boiler and pressure vessel code for the design of safety-related system and components. That's Class 1 components and the ASME Code Section includes the design fatigue curves.

This ASME fatigue curves, design curves do not address the impact of the reactor and coolant system environment.

So the objective of the reg. guide is for providing guidance for determining an acceptable fatigue life of the pressure boundary component with consideration of the light-water reactor environment and for the major structural materials. That would be carbon steel, low-alloy steels and austenitic stainless steels and nickel-based alloys, for example, Alloy 600 and 690.

And so doing I will describe the approach that the NRC staff considers acceptable to support reviews of application for new reactors.

Limitations, it's only going to apply to new plants and this means there's no backfit intended.

So now I'm going to -- Omesh is the contractor that came from Argonne National Lab that developed the technical basis report.

CHAIRMAN WALLIS: Just looking at this, "compliance regulatory guides is not required." But it is required that they analyze fatigue and they must use some kind of a curve or something. Is there anything else available?

I don't see what else they could do but -- they use either the ASME Code or they use your guide, that's it.

MEMBER POWERS: Or they can submit another --

CHAIRMAN WALLIS: Are there other things

out there?

MEMBER APOSTOLAKIS: These are the legalities of the issue.

CHAIRMAN WALLIS: No, but --

MEMBER APOSTOLAKIS: You have a regulatory guide.

CHAIRMAN WALLIS: Essentially, these are the choices, aren't they? They don't have a choice of doing something else, do they? Just from the point of view of what's there technically that's available? Is there some other guidance that they could use?

MEMBER APOSTOLAKIS: There's --

MR. FERRER: This is John Ferrer from NRR. I think as we discussed yesterday there are several proposals within the ASME code that were made either by the --

CHAIRMAN WALLIS: Yes, they're within the ASME code, yes.

MR. FERRER: But they could be used as a basis for submitting an alternative proposal.

CHAIRMAN WALLIS: Well, that's where the alternative might lie then.

MR. FERRER: Yes.

CHAIRMAN WALLIS: Okay. Thank you.

MR. GONZALEZ: I will, I'll make sure --

we probably will do the technical basis report presentation.

MEMBER POWERS: I hope you have reduced the number of sentences.

MEMBER ARMIJO: Yes. Give me just about 15 or 20 minutes.

MEMBER POWERS: Okay.

MR. COLLINS: What we're discussing is the effect of light-water reactor cooling environments on the fatigue life of structural steel. And there's a large amount of data developed during the last 20 to 30 years which shows that there's a significant effect of coolant environment on the fatigue live of these steels. And this data is very consistent irrespective of where it was generated, which lab. It shows similar traits without any exception. And it's also consistent with the larger data base which we have on crack growth rates.

Environmental effect on crack growth rates are quite well established. The mechanism is quite well established, at least in several of these alloys, and the mechanism of environmental effects on crack initiation also appear to be similar. And this data has been evaluated to identify the key parameters which influence fatigue life. And these parameters are very similar to what effects we see on crack growth rate. And the analysis has also defined the range of these parameters over which environmental effects are significant. So we know exactly the conditions under which there will be environmental effects.

The question is if these conditions exist in the field, then we will see similar effects and they have to be addressed. As we know, subsection NB-3121 recognizes that the current fatigue design curves do not include the effect of aggressive environment which may accelerate fatigue failure.

So the burden in a way is on the designer to better define the design transience so that we understand what possible effects of environment --

CHAIRMAN WALLIS: So this figure, this number of 20 was just introduced out of the air? It wasn't used to cover other environments at all?

MR. COLLINS: No.

MEMBER ARMIJO: It happened to do that.

CHAIRMAN WALLIS: It happened to do that, but it wasn't because they had tested in other environments?

MEMBER ARMIJO: Correct.

CHAIRMAN WALLIS: And that was

appropriate, okay.

MEMBER ARMIJO: That was good judgment by people a long time ago.

MR. COLLINS: A little background information. We are talking about fatigue life. What do we mean by fatigue life?

The data which was used to generate current core design codes, the specimens were tested to failure. So quite often these curves are termed as cycles to failure, but the attempt was to define conditions to avoid crack initiation.

All the data which we have obtained in the last 20 to 30 years in this fatigue life is defined as the decrease of the peak load by 25 percent. For the size of specimens, this would correspond to about 3 millimeter crack.

CHAIRMAN WALLIS: Is it dependent on how thick the steel is?

MR. COLLINS: All this happens about quarter to three-eighth inch --

CHAIRMAN WALLIS: In the samples.

MR. COLLINS: In the samples. So what the data is showing is initiation of 3 millimeter cracks. The number of cycles needed.

MEMBER APOSTOLAKIS: What does 25 percent load drop mean?

MR. COLLINS: After crack advances, the total load on the sample will decrease because the cross section is depleted.

MEMBER APOSTOLAKIS: I see.

MR. COLLINS: So you can relate how deep the crack is.

And we know on the cyclic loading --

CHAIRMAN WALLIS: So this is the same thing when you have a pipe which has a thick wall?

MR. COLLINS: It will start as a small crack and it will propagate.

CHAIRMAN WALLIS: But the life is the same, independent of how thick it is?

MR. COLLINS: No. For complete failure, it would be different, but to initiate a crack depends on the loading initiatives are there and so on.

CHAIRMAN WALLIS: How do you define life for a big pipe compared with life for your little sample?

MR. COLLINS: Life would be only to initiate a crack and beyond that we use crack growth rate correlations or expressions to see how it will --

CHAIRMAN WALLIS: There's still a lot of life left in this thing after it's had its fatigue life?

MR. COLLINS: Fatigue life is initiation, number of cycles to initiate a crack, which we can defect.

CHAIRMAN WALLIS: So it doesn't fail. It still has got a lot of life left in it after that.

MEMBER POWERS: After the cracks form, then they use this probabilistic fracture mechanics and come up with 10^{45} years.

CHAIRMAN WALLIS: Are you not talking about complete failure, once they reach this life.

MR. COLLINS: So fatigue life can be said to be associated with more of these cracks from some 10 micron size to 3 millimeter size and fatigue life is divided into two stages, initiation stage and a propagation stage.

Initiation is growth of about 300 micron and beyond that --

CHAIRMAN WALLIS: Could you tell me, I'm sorry, I have to pursue my question a bit more. When we look at your curves and you've got a syllabus, a cycle life and all that, that's related to the life of the plant, 40 years, 60 years and so on. But because you're only going to 3 millimeters doesn't that mean that there's still something like a 100 years of life left in this pipe?

MR. COLLINS: That's where flow evaluation analysis --

CHAIRMAN WALLIS: Is that true or am I wrong? Is that true that you've still got decades of life left in the pipe?

MR. FERRER: It's totally dependent on the type of loading. We do have an evaluation of that issue and when we resolved GSI-190 we had a risk assessment performed where they took the Argonne correlations to determine how long it took for crack initiation. Then they went through crack growth evaluation to determine how long it took to go through a wall.

In some cases, under some loading conditions, it goes through very quickly and under other loading conditions --

CHAIRMAN WALLIS: Tomorrow?

MR. FERRER: Not tomorrow, but very quickly in terms of multiples of the time it takes to initiate the crack.

CHAIRMAN WALLIS: But it takes maybe 30 years to initiate the crack to get to 3 millimeters. Is it another 30 years before anything happens?

MR. FERRER: Well, the intent is to go to the design life before you initiate the crack and then there should take -- again, it's a variable, depending on the loading conditions how long it would take for the crack to grow through a wall and cause a leak.

CHAIRMAN WALLIS: So are you answering my question? I'm trying to put this in perspective. Does it really matter that we get this precisely if there's a whole lot of life anyway?

MR. FERRER: I think if we go on to the basis that we discussed yesterday for the fatigue initiation was a 95/5 basis, so you have a 95 percent confidence, fewer than 5 percent fatigue initiation. The only reason that that's acceptable is because you have some remaining life after you initiate the crack.

MEMBER SIEBER: I suspect the uncertainty of crack growth rate is substantially more than the initiation rate and so it's much more difficult to say how much longer will it last once a crack initiates than it is to predict when the crack --

CHAIRMAN WALLIS: It's reasonably conservative to assume that the fatigue life is the life of the pipe?

MEMBER SIEBER: I wouldn't want to run it up to the last minute.

MR. FERRER: I wouldn't.

CHAIRMAN WALLIS: Okay, I'm just trying to put it in perspective. Three millimeters seems very small in a very thick wall.

MR. FERRER: Let me add one thing to this. The piping system has to be able to sustain the design loads, so if you were to get a situation where you would say it's acceptable to run the crack through the wall, you might not have enough section thickness to take something --

CHAIRMAN WALLIS: We have examples of pipes which have had long, big cracks. We have them now.

MR. FERRER: Yes, you have examples, but they may not have been loaded up to their design loading.

CHAIRMAN WALLIS: You still haven't answered my question, really. Maybe you won't. I still don't have an idea. Is this important in the life of the pipe?

MR. FERRER: Yes.

CHAIRMAN WALLIS: How important is it?

MEMBER POWERS: Depends on the pipe.

CHAIRMAN WALLIS: Depends on the pipe. Okay, so there is no answer to my question.

These are big pipes. It must make a

difference.

MEMBER POWERS: What he's telling you is -- I think what you're telling him is it depends on what service the pipe is receiving.

CHAIRMAN WALLIS: You know the service the pipe is receiving, so you should be able to answer that question.

MEMBER APOSTOLAKIS: But is it a matter of years? That was your original question?

CHAIRMAN WALLIS: How many years is it? If it's 30 years to get a 3 millimeter crack, does that mean I've got another something like 30 years left in the pipe? That's the question I'm trying to ask.

MR. MANOLY: May I respond to that? My name is Kamal Manoly and I'm the Branch Chief of the General Mechanics Branch, NRR.

In response to your question, the pipe during operation does not see the design load. The design load is much higher than what you see during operation. So if you have a crack and then you see a design load like seismic event, with a cracked pipe, it's not the cross section that you need. It's a lot less than you need.

CHAIRMAN WALLIS: Can the ASME answer my

question?

Are you from ASME?

MR. MAYFIELD: No, they disowned me years ago. This is Mike Mayfield. I'm the Director of the Division of Engineering in the Office of New Reactors.

Professor Wallis, you're talking about great, thick pipes which is true for the primary coolant loop. They'll run 2.5 to 3 inches or more. That's not necessarily the biggest concern.

As you start getting to smaller diameter pipes, the thickness comes down. Surge lines will run a bit over an inch --

CHAIRMAN WALLIS: All those are true statements.

MR. MAYFIELD: Sir?

CHAIRMAN WALLIS: All those are true statements. What's the answer to my question?

MR. MAYFIELD: Let me go back to the relative importance of three millimeters. Three millimeters is a nice size that we typically see in well-controlled laboratory samples. If you impose the same number of cycles on a pipe specimen and you get to that initiated size, three millimeters may not be the appropriate size. It's the nice size we can detect at the 25 percent load drop in a well-controlled, polished laboratory sample.

So I think there are two things I would challenge in the proposition you put forward. First of all, all the pipes aren't great thick things. And secondly, three millimeters isn't necessarily the initiation size you would see in a pipe.

CHAIRMAN WALLIS: You see the question is what does a test in these little samples with a three millimeter crack have to do with what happens in a pipe in a plant. That's a very simple question. I'd like to have an answer.

MR. MAYFIELD: And the answer is just as one of the Members suggested, it depends. And it depends --

CHAIRMAN WALLIS: That's no use at all.

MR. MAYFIELD: I disagree. I think it's very useful and it depends on is the pipe, has the pipe been counterbored? How thick is it actually? What are the cyclic loads imposed? And it varies where you are --

CHAIRMAN WALLIS: You're acting like a professor. I just want a simple, straightforward answer.

The designer must know.

MR. MAYFIELD: The answer is yes and the

reason is depending, as John pointed out, when we looked at GSI-190, what we found is that you can drive a crack, an initiated crack through wall in much less than the design life of the pipe of the plant in some cases.

In other cases, it's multiples of the design life of the plant. There isn't a simple yes or no answer to your question.

VICE CHAIRMAN SHACK: This is Bill Shack. Let me try another shot at it just to -- the design basis for the pipe says there are no cracks in it. Now that you've got a crack, you have to address the fact that you've got a cracked pipe. You go through a crack disposition analysis.

What you find from that crack disposition analysis will vary from case to case, depending on the loads that you have, but you now have to address the situation that you've initiated a crack.

CHAIRMAN WALLIS: But what I'd like to get is an answer. Let's same the main circuit pipes won't fail for another 100 years, but there are certain pipes which we've analyzed when they get cracks like this which would fail in 10 years. Some answer, which is --

VICE CHAIRMAN SHACK: Failure is a

relative thing. Do you mean growth through the wall? Do you mean --

CHAIRMAN WALLIS: You don't know. You don't know.

VICE CHAIRMAN SHACK: It varies in situation. As John has said, you do the analysis, you get relatively --

CHAIRMAN WALLIS: People must have done the analysis. Okay, I won't ask any more. I'm very disappointed.

MEMBER ARMIJO: Graham, I mean we have detected fatigue cracks in components, reactor components. They're not through wall. They probably would not grow for a long time, but yet we've repaired or replaced them because we just don't want to operate with those kinds of defects for reasons. Good reasons.

And so I think the issue here is try to design a plant so that you don't create a lot of small cracks. And these are relatively small, but if it's a thin-walled pipe, it could be significant. It might not last very long.

MEMBER MAYNARD: The purpose of all this seems to be two-fold. One is to identify the types of conditions and situations that cause fatigue so that you can help in the design phase to design as much of that out as possible. The other is identifying those characteristics, those things that will cause, shorten the fatigue life or have a crack initiation earlier so you know what places to monitor and where to help with the inspection process.

Is that --

MEMBER ARMIJO: Yes. It's just a --

MEMBER MAYNARD: It's a tool to be used to identify vulnerabilities.

MEMBER ARMIJO: And to eliminate them, if we can.

MEMBER POWERS: Because the Committee has so much interest in cracks, I'll help to continue the discussion.

In the exposition in the document, there is really a quite nice discussion of these, I believe you call them microstructural cracks and then you have mechanical engineering cracks.

What was -- and they had different characteristics. One will propagate and the other does not at given stress levels. But you get high enough from stress level and they all propagate.

What I wondered and came away from the document wondering is that there is some understanding of what is qualitatively different about these cracks, other than the fact that they are shorter and longer? Or do we not know? Probably what I'm asking is, is there something very different about the cracked tips on these two classes of cracks that you identify?

MR. COLLINS: Very small cracks, less than 200 microns. The growth is sheer crack growth. It is typically 45 degree to the stress action, along strip lines. And that extends about a couple of grains. Typically grain sizes would be 25 to 50 microns. So it extends beyond that. It switches to a densely cracked growth, which is perpendicular to the stress cracks.

What we typically see in a fracture surface for fatigue is that densely cracked growth, which is very well marked with striations. You can see inside them.

MEMBER POWERS: Yes, looks like fatigue striations.

MR. COLLINS: The effect of alignment on densely cracked growth is very well known. The reason we added that part in our document was to see does environment affect even the small cracked growth? And that's what we have done to mark these samples, fatigue samples, to see how much of an effect environment does. And we see that in fact the effect of environment may be even larger than what we see in crack growth rates.

CHAIRMAN WALLIS: N is the number of cycles to get a 3 millimeter crack in your sample? What does the same number of cycles do to a major pipe in a reactor loop? Would it create a 3 millimeter crack or does it create a 30 millimeter crack? What does it do? What does the same N do in a real situation?

MR. COLLINS: There are three parameters which we have defined now in this fatigue life. At certain stress levels, how much number of cycles would be needed to create a 3 millimeter crack. Now if the same conditions are known in a pipe, if the same stress condition is there, the same number of cycles, would create -- this will give you a probability -- if you follow the design curve, it defines certain problems.

CHAIRMAN WALLIS: Does it give you a three millimeter crack or does it give you a 25 percent load drop? What does it give you? What does it give you in the real --

MR. COLLINS: The way we define in the lab, because all we want to know is measure a crack size.

CHAIRMAN WALLIS: What does it give you in a real pipe?

MR. COLLINS: It would give me a crack which I can detect, a crack of a size that I can detect.

CHAIRMAN WALLIS: Three millimeter?

MR. COLLINS: About three millimeter. That's an approximate number. It depends on the shape of the crack --

CHAIRMAN WALLIS: That's all right. Thank you. That's all.

VICE CHAIRMAN SHACK: This is Bill Shack. It gives you a crack that now grows by fracture mechanics. You know, one of the difference between the microstructural crack is that you have a very localized plastic zone. It's a grain by grain thing, because it's not a continuum. When the crack gets to be three millimeters or so, this material no longer looks like individual grains. It's a continual --

MEMBER POWERS: You're only clear about one question because whenever they try to answer it, you say well, that's not answering my question.

CHAIRMAN WALLIS: We never get to the end of the answer. That's okay.

MEMBER POWERS: Because you interrupt them every time they try to answer.

MR. COLLINS: Just to briefly mention, the Code design curves. The data that we have is obtained on the small specimens, which are very smooth and tested at room temperature under constant loading. In the real situation, to apply this data to a real reactor component, which is much larger in size, surface roughness is there, there may be residual mean stresses and all, to account for all these other effects of variables which do it in fatigue life but were not included in this data.

To account for that, what the code procedure -- what the procedure Code uses now, is to take the best fit of the data and then adjust this mean curve for mean stress corrections and to account for this using this factor of 2 and 20. These are factors to account for variables which were not included in the data, not investigated in the data. And that's how we get the design curves.

Now the current design curve for austenitic stainless steels is not consistent with the current data. I plotted the ASME code mean curve for austenitic stainless steels. This was the curve which was used to draw up the current design curve. And the data which we have for type 316, 304, all of the data, most of the data at low strain levels is to the left of the curve. So the code curve is predicting longer lives. So in this reg guide, a new design curve which is consistent with the data is being proposed.

Now the affect of environments. For carbon and low alloy steels, there are several parameters which influence fatigue life. It doesn't matter which steel type, a grade of steel, greatest carbon steels or low alloy steels, effect is similar. But there is strain threshold, below which effect of environment is insignificant, or it does not occur. And that is closer to the fatigue limit of the steel.

Other three parameters are very important, strain rate, lower the strain rate, higher the effect. And there is a threshold below which effects are significant. Above that, more great effects. Maximum factor of two. Temperature effect, again of threshold, higher temperatures, larger effect. Same dissolved oxygen, there is a threshold of low .04 ppm. Higher oxygen, larger effect. And these are -- although you can say these are empirical, but they are really consistent with the mechanisms that we know on cracked growth rate. How dissolved oxygen would affect and environmental effects.

Same thing in carbon, low-alloy steel. Sulphur content of the steel is very important. And the higher the sulfur content, the higher effect. Surface roughness we know rough samples have lower life in air, because they provide sites for crack initiation, any scratch. And water, high dissolved oxygen water, for carbon and low alloy steels, the surface effect was not observed in some tests done in the lab. Both smooth and rough samples gave similar life.

Flow rate, all the tests which have done in the lab, very slow flow rates, very low flow rates. Whereas in the real systems they are higher flow rates. Tests done to study the effect of flow rates suggests that higher flow rates effect is less. And this is again consistent with the understanding of the mechanisms. It seems to flush the sulfide content away --

CHAIRMAN WALLIS: Does the effect go away in a main pipe in a reactor because the flow rate is so big?

MR. COLLINS: If the flows are higher, it would show a lower effect.

CHAIRMAN WALLIS: So why isn't that accounted for in your predictions here? It seems to be part of the reactor?

MR. COLLINS: Cracking may occur in a stagnant region, so you know you have to consider the locations and so on. If it can be demonstrated that certain location flow is higher, on a case by case basis this could be evaluated.

Similar effects on austenitic stainless steels, there are certain parameters which affect -- steel type is not important. Radius grades have similar effect. Gas stainless steels also have similar effect. Same strain threshold, effects of strain rate temperature are similar. There is a threshold. Lower strain rate, higher effect. Higher temperatures, greater effect.

Dissolved oxygen surface, roughness and flow rate seem to have different effects on austenitic stainless steels compared to carbon steel.

In this case, low oxygen has large effect irrespective of the type of steel or what heat treatment, whether it is sensitized steel or solution, all have the same effects. High oxygen, some of the nonsensitized steels have longer lives. Low carbon grades, 316 ND and so on have longer lives.

Surface roughness in this case both rough and smooth, we did see the effect of roughness in water and in air. Typically, life can be a factor of up to three shorter for rough samples.

Flow rate, there was no effect of flow rate on fatigue life of austenitic stainless steel.

MEMBER POWERS: In your document, you report taking specimens, I presume on a lathe and taking some emery paper to rough them up. And you report here what your observations were on those.

I came away and said gee, you know, when I think about large components being installed, yes, they're certainly not mirror polished like typical specimens, but they also seem to accumulate dents and dings and scratches of macroscopic character and I said is surface roughness correlation applicable to those or is there something else that should be applied to what I call macroscopic flaw.

MR. COLLINS: I think the next slide may give you -- two slides down.

MEMBER POWERS: Sure, I'm patient.

MR. COLLINS: Based on these data which we have, we can have correlations which would predict fatigue life in air and in environment. Environmental effects are lumped here, depending on the strain rate, dissolved oxygen temperatures, sulphur content. Expressed by these, we can determine the effect of fatigue life in these environments, air or light water reactor environments.

Now these expressions represent average fatigue of the material for the median material. Same correlations are for austenitic stainless steels and can be used to predict life.

These correlations were determined from distribution of heat to heat distribution, so that's why these correlations represent the median material.

Now quite often it's suggested that lab data may not apply to a real reactor condition. There is one component test recently, this was sponsored by EPRI. A stainless steel, U-bend tubes were tested in PWR water at 240, and I plotted as the given strain amplitude for the test what is the life they observed for a leak through the pipe.

CHAIRMAN WALLIS: A leak, that's --

MR. COLLINS: Because you have relatively thin walls --

CHAIRMAN WALLIS: Thin walls.

MR. COLLINS: So we define by leak. The diamonds are very low strain rate. Circles are the highest strain rate. And we know their lives. If I know the number for base number in air, I can determine what is the reduction. There are two methods I've used to determine life in air. An average of about 10,000. So I get a reduction factor of 5.8 at the low strain rate, 2.8 at the high strain rate. And those correlations that I showed predict reductions of 5.5 and 3.6.

CHAIRMAN WALLIS: What's the velocity of the water?

MR. COLLINS: They use flow, regular flow. It's in the paper. I can give you that number.

MR. GURDAL: They used different flow rates.

MR. COLLINS: And actually, they did not see the effect of flow rates, so they confirmed what we see in the lab. That's another thing.

CHAIRMAN WALLIS: No effect of flow rates?

MR. COLLINS: Right.

MR. GURDAL: No. Wait a minute. This is for stainless steel. For carbon steel, there is --

MR. COLLINS: Right. I'm just talking about --

MEMBER MAYNARD: You've got to get to a microphone.

MR. GURDAL: Sorry about that. My name is Robert Gurdal from ARIVA. The goal, and I say it was the only purpose to start with of these tests was to find if, for stainless steel you have the same flow rate effect as you have for carbon steel and LAS. What LAS means is low alloy steel. And they found exactly like Omesh said that for stainless steel the effect of flow rate is maybe something like 10 percent maximum. In other words, negligible or you would say none.

But for carbon steel, it's very important for carbon steel and LAS, there is an effect of high flow rate which is not in the methodology.

MEMBER POWERS: Excuse me, I'm confused. We have two strain rates here. I see no measure of flow rate on these plots.

MR. COLLINS: Irrespective of flow rate, they got similar numbers, so these tests that you see here, one is at a low strain rate, flow rate and another at a higher flow rate and they gave similar answers.

So the flow rate, I have not given that information.

MR. GURDAL: The red ones, do you see the red ones in the middle of the picture there, the picture on the left?

MEMBER POWERS: I don't see any red ones.

MR. GURDAL: Sorry, that's four points and these four have two high flow rate tests and two low flow rate tests and they are together.

MEMBER POWERS: I'm just really confused. The plot seems to have nothing to do with flow rate.

MEMBER ARMIJO: Right, it has nothing to do with flow rate because there is no flow rate --

MEMBER POWERS: I am wondering why they're bringing this point up.

MEMBER ARMIJO: I don't know. I agree with you. I don't know why that's a discussion. The issue here is would a small sample test predict behavior of a real component, albeit a small U-bend tube. That's all --

CHAIRMAN WALLIS: The reason flow rate comes up is we were told that the higher flowers there is less effect of this fatigue on some circumstances. That's why the question is --

MEMBER ARMIJO: In carbon steel, it is.

MEMBER POWERS: Again, flow rate has nothing to do with this. It's a stainless steel and it seems not to have a flow rate effect.

CHAIRMAN WALLIS: That's very useful information.

MEMBER POWERS: I'm still trying to understand a little bit about your comparison there, is when you compared, did that come from the normal installation flaws and dings and things like that?

MR. COLLINS: It was normal fabricated tube, what you would use in a real system. So the idea is to show that what we observed, the only purpose of this slide would be to show what we predict in the lab on a small specimen.

Actually, it shows good agreement with what they observed in real material which was a normal tube, not polished. In fact, they used different surface finishes and so on.

Now getting back to how do we determine the design curves. We get data on smooth specimens and I mention just this specimen data to apply to a real component, there are these adjustment factors of 2 and 20. Let's look at this 20. The current code, this 20 is made up of three sub-factors, material variability, tube size 2.5 surface finish, loading is fitted in, taking into account. Total 20.

From our analysis of the current data we get a number of materialability anywhere between 2.1 to 2.8. Size, minimum. This is from the literature survey. We have looked at the studies which have been conducted, the effects of these things and we get minimum and maximum numbers.

Surface finish, we get a number of 2 to 3.5. To answer your question, there is a good correlation which has been developed based on the experimental data correlating the surface finish, RMS value of the surface finish on reduction in fatigue life.

So when we used our samples to grind, we measured the surface finish and used that correlation to see what it would predict and that's what we saw. And these numbers, 2 to 3.5 are based on typical milling, machining, grinding, what surface roughness we get from various fabrication and machining processes, what range we would get and that's how we established this.

So based on these, we see a minimum adjust of 6, maximum of 27. If we use 20, then we are suggesting that I have a very poor material. I have rough surfaces and the worse loading history. That would be somewhat conservative. So we used these four sub-factors, used Monte Carlo simulations, as you allow normal distribution for this, to come up with the best adjustment needed to define the constant A for the component.

And here, we see this is a distribution of A, the constant A for a specimen and solid is for the component. The median value has shifted by about 5.3 and 95th percentile number is an adjustment of about 12. So at least this analysis with what we have done suggests that the 20 adjustment which is currently used may be somewhat conservative.

CHAIRMAN WALLIS: Now would you say that again? This business of the component, what do you mean by the curve to the component?

MR. COLLINS: Our specimens were very small and smooth. We make sure that there are no scratches left. In a real component, surface finishes are there and we know that surface finish would create sites where cracks can form.

CHAIRMAN WALLIS: This isn't based on tests of components?

MR. COLLINS: No. This is based on -- yes, correlating a surface finish.

CHAIRMAN WALLIS: Yes.

MR. COLLINS: So there is a conservatism in the adjustment of 20.

To include environmental effects in fatigue evaluations, two approaches have been proposed. Either we come up with new design curves which are applicable to light-water reactor environments or we use some adjustment, correction factor, F_{en}.

Because life in environment depends on several parameters, we would need several design curves to cover the range of conditions which occur in actual reactor operation. If we come up with a bounding curve, it would be very conservative, whereas this correction factor, F_{en} approach is simple. It's flexible. It can -- it allows you to calculate the correction factor for any specific condition. The only burden is we need to know what those conditions are in the plant.

And these are the expressions, the correction type is nothing but a ratio of life and air, was there life in water.

CHAIRMAN WALLIS: Can I ask you about the roughness of these pipes? Is this roughness independent of age?

MR. COLLINS: Yes. Right. If you have a rough spot, it will provide a potential site for initiating a crack.

CHAIRMAN WALLIS: Is it independent of age of the pipe. Does the pipe get rougher as it gets older or smoother?

MR. COLLINS: No. Certain processes may create sites, corrosion, pitting and all may create sites.

CHAIRMAN WALLIS: Austenitic steels and oxygen environment don't suffer any kind of change in the surface?

MR. COLLINS: Most austenitic stainless steels form a protective oxide film which is quite thin.

CHAIRMAN WALLIS: And the non-stainless steels don't?

MR. COLLINS: It depends on the oxygen level that you form a very stable oxide film in these materials.

Water chemistry says that you would not allow massive corrosion to occur.

CHAIRMAN WALLIS: That's massive. So I don't need to worry about the effect of age on this roughness?

MEMBER ARMIJO: It doesn't change very much unless there was a lot of corrosion going on. Then it would tend to literally smooth out unless you got into a pitting phenomenon and then you'd have another initiator --.

CHAIRMAN WALLIS: But there are, there is a removal of material. We know that there are sudden thoughts of these pipes where material is actually removed. The wall gets thinner. So there must be some effect on the surface if there's erosion.

MEMBER ARMIJO: It would tend to be more of a smoothing --

CHAIRMAN WALLIS: Smooth? Does it produce channels and things?

MEMBER POWERS: The worst reactive piece in a surface --

CHAIRMAN WALLIS: You'd think so, you'd think so. So it smoothes, these bends that get eroded, the wall thinning occurs. They're smoother where they're eroded than they were when they started?

MEMBER MAYNARD: Not necessarily. It depends on what mechanism is causing that, especially if there's any cavitation involved of water -- I've seen some pipes that are like a lot of itty bitty pits where it's been from an erosion from a cavitation.

CHAIRMAN WALLIS: Doesn't that affect this roughness he's talking about?

MEMBER ARMIJO: I think those could lead to other initiators of fatigue, but I think the roughness here that you were asking about was the initial as fabricated roughness and he's --

CHAIRMAN WALLIS: But he is moving this curve by a factor of 12 or something because of roughness --

MEMBER ARMIJO: Right, known variability in roughness in the --

CHAIRMAN WALLIS: As built.

MEMBER ARMIJO: As built.

CHAIRMAN WALLIS: As built. There are places where the steel actually erodes and if it erodes for the pitting mechanism, the roughness changes.

MEMBER ARMIJO: That's correct.

CHAIRMAN WALLIS: Okay, and that's not considered in this analysis?

MEMBER POWERS: I would not look at that pitting in the same way I looked at roughness. Pitting -- it's different and --

CHAIRMAN WALLIS: Finish is different than roughness.

MEMBER POWERS: It's large scale.

MEMBER SIEBER: This isn't the dominant failure mode of piping anyway. If you get a lot of corrosion in pitting, that becomes the dominant failure mode.

CHAIRMAN WALLIS: Well, maybe there's a synthesis between the two.

MEMBER SIEBER: It might occur a day

earlier.

MEMBER POWERS: Or 10^{45} years.

MEMBER SIEBER: Depending on where you're standing.

(Laughter.)

MR. COLLINS: We have the correlations to determine this correction factor, the actual conditions, to incorporate environmental effects we take the usage factors in air, U-1, U-2, and multiply it by the corresponding correction factor and we get the cumulative usage in the environment.

So the way we calculate the usage in air is to use a design curve which is consistent with the existing data or conservative with respect to the data. The current Code curves for carbon steels and low-alloy steels can be used, but since they use this adjustment of 20 on life, you could reduce the conservatism by using the design curves proposed in this reg. guide. For austenitic stainless steels the existing Code curve is not conservative, is nonconservative with respect to the data and the new curve, which has been proposed, should be used.

I'll get Hipo give some of the details about the position.

MR. GONZALEZ: Thank you, Omesh. Now I'm

going to go through a summary of the regulatory position that is in the reg. guide.

Regulatory Position 1 has -- is related to carbon and low-alloy steels. It basically gives you the guidance on how to perform the evaluations, incorporate environmental effect in the fatigue analysis. First, you have to calculate the fatigue uses in air with the current ASME Code analysis procedure, plus use the -- you're allowed to use the ASME Code air curves or the UNAL air curves for carbon and low-alloy steels.

MEMBER ARMIJO: And the reason for that is because one is more conservative. If you want to use it, go ahead.

MR. GONZALEZ: If you use the ASME current code, it will be more conservative. So that's an option that we -- the designers want it to be more conservative, then they can use it.

Then we'll calculate the F_{en}, the environmental factor to the equations and then calculate the environmental fatigue uses factor with the data equation, uses factor equation.

Regulatory Position 2 is for --

CHAIRMAN WALLIS: Can you apply this usage factor to the ANL model, not to the ASME model?

Right? You have to apply the F to the ANL model.

MR. GONZALEZ: At the end to --

CHAIRMAN WALLIS: That's what it's based on.

MR. GONZALEZ: You will apply the F_{en} to the use factor.

MR. FERRER: This is John Ferrer. For the carbon steel, we've given them two options. ANL has developed a model based on their procedure for environmental, for the air curves. And if you use that ANL curve, you will use the ANL model with the ANL F_{en} factor with the ANL calculated for fatigue uses.

The other option that we've left in the reg. guide is so we could stick with the existing ASME fatigue curve which is more conservative. That would be up to the designers' option. And if they would do that, they would use the F_{en} factor with the ASME calculated fatigue usage.

CHAIRMAN WALLIS: Which has no real basis in the experiment. It's just a compromise of some sort.

MR. FERRER: It's conservative compared to a position we're recommending here for the carbon steel.

CHAIRMAN WALLIS: Only for carbon steel where ASME is conservative?

MR. FERRER: Right.

CHAIRMAN WALLIS: Okay, thank you.

MR. FERRER: Somebody corrected me, and low-allow steel.

MR. GONZALEZ: Regulatory position 2 will apply to austenitic stainless steels. In this case, we'll have to use the new ANL model stainless steel curve when performing the ASME Code analysis procedure. And then use the F_{en} equation and calculate the environmental fatigue issues factor.

Regulatory Position 3 applies to the nickel-chromium-ferric alloys will be Alloy 600, 690 and you can use the new ANL model air stainless steel curve for the nickel-based alloys and then use it with the ASME Code analysis procedures. Plus use the F_{en} equation that is in there, in the technical basis. Again, calculate the environmental fatigue uses factor.

In summary, this reg. guide will endorse the new air code for stainless steels and will also endorse the F_{en} methodology. It will give guidance on incorporating environmental correction fatigue, excuse me, for incorporating and the environment correction fatigue, the fatigue design analysis and this is shown in Appendix A of the NUREG report. And also, the report describes in detail the technical basis.

Now I'm going to move to the resolution of the public comments. The draft guide and the draft NUREG 6909 report were published on July 24th this year and it was public comment for 60 days comment period. This comment period ended September 25, 2006.

We received a lot of comments. Eight correspondents submitted a total of 56 comments on the draft guide and the draft NUREG reports and all comments were addressed individually.

The resolution of the comments are reflected in the final reg. guide and the final NUREG report. And there were about six main issues that we identified in the comments.

This next slide is just showing the example of the table that I provided to the ACRS with all the comments and the responses, staff response. You can highlight that there were comments provided by ARIVA, NEI, GE and even Japan, some commenters from Japan.

MEMBER ARMIJO: Also ASME.

MR. GONZALEZ: Yes, ASME, of course, sorry. The six issues that, main issues that were discussed. This is a list of the six. I'm going to go quickly to some of them and probably give more detail in the main ones.

The first one has to do with the operating experience and applicability of the specimen data. The comments were that there's no operating experience that supports the need for this conservative design rules. There were numerous examples of fatigue cracking and nuclear power plant components reported in an EPRI report that we reference here, 106696.

And the second comment was on questioning the applicability of the specimen data being representative of the actual components in service and applicability of the lab data to conform the behavior has been demonstrated by mock-up and component tests. And in fact, it's the basis for the current ASME Code T-curves.

MEMBER POWERS: I wonder, do you understand why someone would say gee, there's no operating experience that supports the need for looking at these things?

MR. GONZALEZ: Probably they also were referring to the -- any component failure experience. There's no component failure actually to fatigue. But there has been indications and flaws that --

MEMBER POWERS: Yes, it seems to me there have been a half a dozen things, especially thermal striping and things like that that suggest that nuclear components are. I'm just wondering what would motivate somebody to say there's no operating experience.

MR. FERRER: I think that the motivation behind that comment is that they have not been able to translate the experience into showing, demonstrating there was an environmentally-enhanced fatigue initiation --

MEMBER POWERS: I see what you're saying.

MEMBER ARMIJO: But they couldn't show that there wasn't either.

MR. FERRER: Yes. One of the reasons is it's very difficult to have enough detailed data to do that evaluation.

MEMBER SIEBER: This kind of evaluation focuses on heat ups and cool downs of the entire plant, as opposed to striping or oscillations of valves or things like that.

I don't think there has been any of these steep cycle failures.

MEMBER ARMIJO: Sort of the classic fatigue failure.

MEMBER POWERS: Thank heavens.

MR. GONZALEZ: The second issue is under details on the approach, the methodology. There were references made. The comment was there were references made in other guidance in the report and the papers listed in the report are for reference use only. The regulatory position on the draft guide contains the methodology that is endorsed by the reg. guide and by the staff.

The second one, I'm going to read this. Since the Draft Guide 1144 utilizes similar F_{en} methodology that has been evaluated in MRP-47, the issues in MRP-47 are considered to be equally applicable to Draft Guide 1144 methodology. Some, but not all of the issues raised in MRP-47 have been specifically addressed in the Draft Guide 1144, so based on this, the MRP would like to see more clarification on remaining issues including Draft Guide 1144 and the supporting documents.

I responded that the -- our staff responded is that the level of analytical details discussed on these comments are additional items under MRP are beyond the scope of this regulatory guide. We only address the F_{en} methodology has to be used.

The third issue is on adding the nickel

base on fatigue curves and we already incorporated in the final guide, in the final NUREG, the nickel-based alloy curves and F_{en} methodology.

The fourth comment is that an increase in the component usage factor will lead to more analyzed piping break locations to more installed pipe whip restraints and to the science that will be more detrimental for normal operating conditions. And we had a discussion yesterday on this and the staff responds the staff will consider just defining the modification with the appropriate technical basis of the fatigue criteria for the postulation of pipe breaks if implementation of the criteria results in a significant increase in the number of required pipe whip restraints.

And in addition, the necessity for additional pipe restraints will disappear with a susceptible leak before break analysis.

The fifth issue -- the commenter believes that the attentive methods for fatigue analysis provided in the report and the draft guide are too conservative and should not be used for the design of new reactors. So we responded that the staff position is based on a 95 percent confidence that there is less than 5 percent probability of fatigue crack initiation. And the implementation of this criteria resulted in a carbon steel and low alloy steel air curves which are less conservative than the ASME code curve.

The six issue has to do with the ASME code case that ASME will develop a code case including the ASME methodology that we presented, that is presented in the reg. guide. The NRC staff will consider endorsing the code case through its normal process for revising regulatory guide 1.84.

I want to show in this slide that the main revisions that were made from the draft guide to the final regulatory guide 1.207. And the two main points, we incorporated the ASME methodology for nickel-base alloy material in the reg. guide in the Regulatory Position 3 and the NUREG report in Section 6. And also, there was a revision of the high cycle fatigue regime. The regime was 10^6 or more cycles. And there were some editorial changes that were clarifications of the technical basis report.

The conclusion to this presentation, we feel that Reg. Guide 1.207 is ready for issuance and the final Reg. Guide and the final NUREG 6909 report reflects the resolution of the comments. Both documents plan to be published in March 2007 and we are seeking ACRS concurrence to publish the final effective guide.

Thank you.

MEMBER ARMIJO: Any questions for Mr. Gonzalez?

MEMBER MAYNARD: What does the staff believe, what's the biggest impact this change will be to the licensees or the designers? And what's the biggest benefit from a safety standpoint? Just summarize that.

MR. FERRER: I think the biggest impact, I think ASME presented it and it may require them to do some more detailed stress analysis to show compliance with the new criteria.

Another impact that they brought up was a potential for increased number of pipe rupture locations and we've, in response to that comment said we will consider adjusting the criteria so that we don't get a big increase in the number of pipe rupture locations.

The biggest benefit to safety is based on the study that we did on the resolution of GSI-190 that this is not a major safety concern, however, there is -- we would predict an increase in the amount of leakage to occur if you had significant fatigue damage that wasn't accounted for in the criteria.

MR. CULLEN: This is Bill Cullen from the Office of Research.

I'd like to also add a couple of points here that occasionally seem to be lost in the conversation. Remember that this procedure that is described in the Reg. Guide, both gives and gets, we are giving back to the industry because we have reduced the code lines, created the code lines based on factors of 2 and 12, rather than 2 and 20.

That's a give. On the other hand we have developed very carefully, very statistically accurately this concept of an F_{en} to account for the environment, though we are getting back something in that sense. They do now, the licensees bringing in these applications will have to account for the effects of the environment.

But on that score, I'd like to also add another point. As you look at these equations for F_{en}, you'll notice that they contain factors for dissolved oxygen level, contain factors in the cases of the carbon and the non-alloy steel, contain factors for the sulphur content of those steels. We fully expect that the materials that are going to go into these new reactors will be far better than the materials that are in the existing fleet. If these guys choose good materials for their carbon and low-alloy steels, if they choose materials with low sulphur contents, that F_{en} factor pretty much disappears.

And if they keep the dissolved oxygen under control, if the boilers keep their hydrogen water chemistry carefully controlled, the dissolved oxygen contents are going to be very low. The F_{en} virtually disappears. Not quite. Not quite, but virtually disappears.

So I want to make those points very well that I think we should have new paradigms in the new reactor fleet, the GEN 3 Plus Plus fleet that will strongly affect the way this code gets applied and I'll speak solely for myself, I'm not at all convinced that this is going to be a hardship on the designers of the new reactor fleet.

MEMBER SIEBER: You could actually say that it would require a higher degree of control over the chemistry.

MEMBER ARMIJO: It might.

MEMBER SIEBER: To avoid an impact.

MEMBER ARMIJO: It might.

MR. CULLEN: There would be that

consequence, that is true.

MEMBER SIEBER: That's a good thing, I think.

MR. CULLEN: Right.

MEMBER ARMIJO: Any other comments or questions from the Committee?

MEMBER POWERS: Just a phenomenological question. Dissolved oxygen is important in some circumstances and we have people trying to control dissolved oxygen. Every once in a while they fail.

Has anyone ever looked at episodic events of high oxygen in a background of low oxygen and how it affects things?

MR. COLLINS: Yes, there have been studies where they change oxygen and now the question is this loading, somebody mentioned these are start ups and shut downs or turbine trips. Depends where they occurs. If it's a long period, then it may have, but normally those are very short.

MEMBER POWERS: And short is a small effect is what you're saying?

MR. COLLINS: I think once the water chemistry is back --

MEMBER POWERS: It readjusts itself?

MR. COLLINS: Right, right.

MEMBER ARMIJO: All right, if there's no more questions for the NRC staff, I'd like -- I guess I'll have the ASME representative and then Mr. Gurdal. So it's Mr. Erler first. Sure, wherever you're comfortable.

MR. ERLER: I am Bryan Erler, the Vice Chairman of the Board of Nuclear Codes and Standards for ASME. And we had a good discussion yesterday at the subcommittee meeting and I appreciate the opportunity for that.

ASME has been a leader in developing the fatigue criteria for over 40 years. I think we've been taking a look at the data. We look across at all of the monitoring of what happens and try to make sure that we design rules and what I mean design rules, how to design a plant adequate to be safe for the life of the plants.

We're committed to working with regulatory body to make sure that we consider all the facts and one of the things that I'd like to make sure it's clear is that clearly in the original criteria document, we've talked about environment. Environment was included in a discussion of 2 and 20. It wasn't explicitly identified as to which, how much comes from each of the elements of the variables, but we recognize it was a significant contributor.

I think the difference that we have here in the discussion has been primarily in the fact that where we're starting from. In an introduction by Dr. Jennifer Ule, she stated that it was addressed to get a guide. We wanted to get a guide out to address environmental -- so they started with the objective of developing a guide for including fatigue into the curves.

What the NRC -- I don't think they made a case to say that it needs to be done. The design basis curves have been serving the industry quite well. ASME Committee, made up of the experts that we have around the world and certainly experts in metallurgy and fatigue have been reviewing the same data for 25 years and keep evaluating not the question of how do we -- is do we need to and it's both questions are being addressed as we, as a committee. And the debate has been significant by many, many experts across the board and many committees. We have a Fatigue Committee. We have a Design Committee. We have several task groups and it's a challenge to make sure that we're doing the right thing.

At the same time, ASME has been very effective at making sure we're addressing environmental impact of fatigue. We have passed several appendices in Section 11 in order to deal with Appendix L. We've addressed code cases to make sure that we're addressing the in-service inspection side of it.

So in case, from the very beginning in the 1960s, we have been aware of it and have been following all of the data. It's where does it fit into the design curve that we're talking about now. Where does it really fit in our design basis and where do we have to go?

If we go and look back at the experience now we've had in Section 11, in collecting the data in ISI and we see a license renewal, then we're really in very good shape with regard to these plants. We have allowed an additional 20 years. You look at the transients. You look at the performance and fatigue has not been a driver in terms of limiting the life of the plant.

There's a lot of items with fatigue in terms of vibration, temperature striation, other -- corrosion comes into the picture, but fatigue in itself as an entity particularly environmental fatigue or contributing part of fatigue has not been a key driver. I think that's the part that the Committee

Members really wrestle with quite a bit.

CHAIRMAN WALLIS: But there have been fatigue failures.

MR. ERLER: There have been --

CHAIRMAN WALLIS: Fatigue has led --

MR. ERLER: Not due to the fact that the design basis of the code was inadequate. If you look at the Japanese and the French, they've proceeded with their design rules dealing with this as not changing the RCCM and not changing the Japanese code in dealing with environmental fatigue and they are based on the ASME Code.

So I don't think we're -- we're kind of -- we follow and work with the experts around the world and work with the NRC and will work with them. Obviously, if we want -- one of the challenges if we say okay, we're going to put environmental fatigue into the code, what we would do is we would probably change significantly design basis and look at all of the new variables and say what should we use as far as our total design basis, rather than just say let's put an impact of environment.

And that's where some of the discussion comes, is our overall curve of 20 adequate and has it served us well? So that's a debate that we can --

well, will go on for a long time. But we do know we need to keep our codes consistent with the regulatory rules.

CHAIRMAN WALLIS: I ask you this question. How big does F have to be before you decide you do need to make a change to incorporate the environmental effects? Apparently, you don't think it's necessary, but clearly, if this effect got big enough, you'd have to do something.

MR. ERLER: That's correct. I mean if you look at --

CHAIRMAN WALLIS: Is it a question of it not being big enough? Is that the issue and how big would it have to be?

MR. ERLER: I really can't address that because it's -- if you look at the various code cases and various changes we've had, we've had F_{en} code cases drafted up and get voted down. We've had revised curves drafted up and voted down. And everybody has their different set of rules, you now, different set of reasons for it.

And the negatives are very clearly documented in our balance that we have. And some of it has to do with the issue of not a significant contributor or why should we just address fatigue, the environment when we really have other issues and we should go back to the complete drawing board of our design approach and then the issue comes up, but what we had served us well, so it's kind of a -- the consensus process amongst experts makes it a a challenge to say I can't speak for ASME and give one answer.

I can tell you what -- the stories of what's been going on for 20 years and why our focus has been on the operating cycle.

CHAIRMAN WALLIS: It's more of a technical rationale. It's sort of a voting down as the decision, a collective decision.

MR. ERLER: It's a technical --

MEMBER POWERS: It seems to me that the staff agrees with you, don't they? Doesn't the staff say yes, you can go ahead and use the ASME curves?

MR. FERRER: The ASME air curve for carbon steel and then you apply the F_{en} factor. The question is we should apply the F_{en} factor.

MR. ERLER: I think the issue of working with the staff on an appropriate solution, given the directive that says we should include it, I think is a different objective for the Committee and maybe, when you issue the reg. guide, that kind of puts us on notice that the U.S. is saying you want explicitly covered environmental action, not just part of the 20 and 2. It's -- we want something that's in there.

And given that direction, the Board will go back to the committees and go back and we'll provide that, the direction, if that's the decision of the staff and of the regulator. I guess the point that we're making is that that's not necessarily the uniform position around the world or of the experts. The experts, you know, are quite happy debating this issue. So the issue therefore is showing the cause or the need is the challenge that we have.

The other part that I really wanted to address a little bit because we didn't see it until yesterday is the response, the six responses.

The first response is the need response and I think referring to the EPRI document really wasn't a good answer in terms of showing -- it includes all other kinds of failures that you have and are not just fatigue and not just environmental impact of fatigue. I think it's worth the staff showing specifically the need based on specific experience for operating plants.

The other issue, if you look at item 2, they agreed with the fact that it's difficult to implement the F_{en} and the issues that are identified in MRP-47 are still an issue, but what they say is that becomes our problem. They're making it sound like the industry can go ahead and implement the F_{en} procedure. There's issues in here that basically say it's beyond the scope of this guide. They leave it up to us to try to figure out how to implement it. That's kind of -- it didn't really answer the issue.

The other one that I think that they agreed with us on, two, is the fact that it has the potential of adding more pipe-break restraints and more pipe-break locations which could lead to more pipe-break restraints and so okay, we're going to take that away now. We'll change that. Which is a good thing. I'm glad to get rid of breaks any place, as long as it has a legitimate basis that we have.

But the fact of the matter is is the usage higher in those locations, really? And you really don't know because it just says that by the F_{en} method, it will show higher usage factors in certain locations.

So they've agreed basically as to how to resolve it. It's sort of an IOU. We won't make you put in restraints later on.

So I mean there's a lack of really

addressing some of the specific comments that we have sent and working with the staff, I think it could be a benefit of the rest of the industry. I mean that's the benefit of the committees that we have is the experts and the experience.

These are not just vendors. These are people who do research in the labs, who are present on the committee, people who are at universities. We've got some of the vendors, we've got engineering firms. So it's a range and people from around the world and that's a little different group to develop a solution than just hiring Argonne to find a solution.

Using the benefit of what the expertise is we would certainly like to work with the staff more diligently to --

CHAIRMAN WALLIS: This is an aside. F_{en}, to me, is as fine an elements method used to get the stresses in the first place and that's part of the whole problem. F_{en} meaning two different things in this context, which is not a very good idea.

MR. ERLER: This is a factor for environmental.

CHAIRMAN WALLIS: But it's too bad that you -- but it sounds very similar. So it's very good to change -- yes.

MEMBER ARMIJO: Thank you very much. Thank you. I think our last speaker and we're -- if you hold the time, Mr. Gurdal, we'll be on time. five minutes. You've got a full five minutes.

CHAIRMAN WALLIS: Then you're going to stop it, right?

MEMBER ARMIJO: No, then I'm going to have five minutes.

CHAIRMAN WALLIS: Okay.

MR. GURDAL: My name is Robert Gurdal, that's G-U-R-D-A-L. I'm from Lynchburg, Virginia with ARIVA. Thank you for giving me the opportunity.

First, is to come back to what Mr. Erler just said, most of the fatigue failures the plants have seen is again to the best of my knowledge, from transients which were not known, but not from the fact that fatigue analysis was done without the environmental effects and then suddenly, because of the environmental effects, you have a failure; especially for thermostratification in a surge line. That's the best example. All those thermostriping and then you have all those SCC phenomenon. I think at the low 600 welds of the surge line and different -- but not in the surge line itself. The surge line itself which is ossiated steel, very important, 30 years, at least for the ARIVA plant and I think it could even be 35 years, I've not seen a fatigue failure which would be catastrophic, of course, but not even a crack detection. Now that's what I would say and that's to the best of my knowledge.

And that was to Mr. Erler. To the gentlemen of the NRC there is something there they said to look at the DO. The austenitic steel and the fatigue curve, the new fatigue curve, of course, are completely independent of DO. So it does not matter. You don't need to do anything with a DO for the stainless steel, and there is no s-factor for stainless steel. So, for stainless steel and Omesh can say and say if it's correct, it would be only temperature and strain rate.

Strain rate is extremely difficult to calculate in the FEA, finite environmental analysis, so that at the end it's only temperature and maybe you have to take the most severe strain rate, that's extremely severe, factor 10, probably, maybe 8, I don't know. Plus the fact that the new inert curve is more severe. And, again, the surge line has not seen fatigue failure due to the environmental effects of 35 years or something like that. So that was even before my comments. I'm sorry about that. I'm probably already through.

The other thing may be a surprise today during the break is that ARIVA does not get the answers to our technical comments before the reg. guide is issued, 1.207. So if it's issued on March 15, whether it's in the morning or in the afternoon, it does not matter. At the same time we get our comments. So, that means we lost our time. That means, that what it means, correct?

I mean, why did we work, we had those conversations with the French, we lost our time, correct? I mean --

MEMBER ARMIJO: You say, you mean wasted your time?

MR. GURDAL: Yes.

MEMBER ARMIJO: Okay.

MR. GURDAL: Oh, did I say lost? Yes. Wasted our time.

MEMBER ARMIJO: Okay.

MR. GURDAL: We worked for nothing. All right. Oh, okay. A big thing is that it's important to know for the industry that because of those new rules, which will come out in March, we need to redefine all our transients and make them a lot more accurate, detailed, including strain rate calculations. In other words, the stain rate is a function of the transients, so a big manager was telling me the other day we have to turn around completely the conservatism which used to be in the transients and which is very important is going to be now completely in the fatigue analysis.

In the transients they will have to be exact, but exact I mean within maybe 10 percent and which leaves a very big problem at the operation, how do you call that? The room? You know, where they have to follow the transients to be sure -- that's going to be of course a nightmare, to say the truth. But they need to live with it. That's for the new plans. So that's just a comment.

So, in addition, that's in addition to having the big location. So it's going to be more severe because if there is a small deviation for a transient, you cannot go back to your design, functional spec., which is called the transients, and go and okay, it's all right, it's all right. No, you have to go back to the F_{en} analysis. Okay, so that's going to be something.

Now, all right, that was the last, hopefully that's my last topic. And it's that there is a paper, a technical paper from PVP 2006 which has gained so much importance and that's on those tests from Ireland that Omesh has mentioned, and there are two things about that that I wanted to say. I wrote it, but I'm going to try to say it quicker than that, is the first one is I think when we perform comparisons between the test results and anything that we develop we should really compare with the design curves and not to the best-fit curves, because that gives you how much margin you have compared to the design. Because what you do is design for the component and not best-fit from the specimen. That was the first comment. Is that clear?

And we haven't done that. I mean, we have done it within our company but it was not shown today. Or yesterday.

Second comment on that is the famous comment, probably on the surface, and it's the fact that there are four tests which are exactly the same except for the flow rate. Too high flow rate and too low flow rate. Otherwise, those flow tests are exactly the same. It comes out that three of those tests are what they call not polished and one is electro-polished. That was so lucky that they had that. Because the electro-polished gave a number of cycles to failure to 3,800 if I cut the last two digits, and the other one is three numbers, 3,600 two times and 3,400.

If you make the ratio and you stay with a high flow rate, the factor is 1.06. If you take the minimum of the other three, so the most severe, the factor is 1.12. In the method of what we saw today, this is the end for me, he gives the low number of 2 for that factor and 3 and one-half high. So, it's the difference between 2.62.7 on one side and 1.1 on the other. That's it.

MEMBER ARMIJO: Okay. Thank you. Thank you. Well, any --

MR. GURDAL: We have a lot more.

MEMBER ARMIJO: Oh, we could, we'd be here all day. But thank you for being brief.

MR. MAYFIELD: Mr. Chairman, if I could, this is Mike Mayfield from Division of Engineering and the Reactors. A couple of things that were said that just in the last few minutes that I wanted to address.

I certainly agree with Mr. Erler that this has been an active debate going back 25 years that I know of personally. I would also say that it's not a unanimous view among the international technical community. There are at least one more views than there are experts in the room at any given time.

So this thing has been pretty much all over the map. The staff has moved forward because we believe that there is sufficient evidence that this environmental effect on fatigue life needs to be addressed.

The second issue that has come up a number of times is, well, the service experience does not indicate that there are a huge number of environmentally-induced fatigue failures. If, in fact, the service date indicated a large number of fatigue failures where the environmental effect was a driving consideration, we would be having an entirely different conversation with this committee and with the industry. We're looking to back-fit this requirement and do additional analysis.

We agree that the ASME methodology fundamentally is not flawed. There is a lot of conservatism in it. However, as we move forward and as the ASME has made changes, quite appropriately, to the design methodology, there is the potential for higher cyclic stresses in piping components over the lifetime of a plant. And we believe that there is sufficient evidence to show an environmental effect, particularly that's going to show up in the later life, if in fact you have these higher cyclic stresses.

We believe that you put those things together, there is a preponderance of evidence that says this regulatory guide is timely and needs to move forward as we look a designing and licensing new power plants.

We, from the new reactor side, we certainly hope the committee will endorse the publication of the reg guide.

Thank you.

MEMBER ARMIJO: Okay. We've got two minutes. I just ask the committee members for any other comment.

MEMBER ABDEL-KHALIK: Can I make a comment?

MEMBER ARMIJO: Yes. Of course.

MEMBER ABDEL-KHALIK: Thank you. You know, we are all familiar with water chemistry guidelines and frequently they change. And the question is is there something that would automatically trigger the licensee to re-analyze the fatigue strength of various components if they're contemplating a change in water chemistry guidelines?

MEMBER ARMIJO: Yes.

MEMBER POWERS: If they knew, if they knew it was significant, it could have a significant impact, I think they would do it, sure. I don't know if that would be a regulatory requirement, but if I was an operator I'd sure want it --

MR. MAYFIELD: I'm sorry.

MEMBER SIEBER: There has been a couple of instances where a licensee, particularly in license renewal space, has had enough transients, you know, heat-ups and cool-downs on the plant, where they're approaching their maximum analyzed number and therefore a re-analysis would be appropriate.

MR. MAYFIELD: This is Mike Mayfield. The issue comes in if they're going to do something in plant operation that would violate their licensing basis or their design basis, they're going to have to re-analyze to address it to show that they stay within accepted limits.

MEMBER SIEBER: Before they do it.

MR. MAYFIELD: Before they do it.

MEMBER ARMIJO: Okay. Okay. Well I think that will wrap up the presentation. I think we'll have plenty of time to discuss the committee position this afternoon or --

MEMBER POWERS: There is with all of these standards this issue. We have on the one hand an NRC staff whose interest is solely focused on protection of public health and safety. Whereas the balance of the community of experts has various kinds of pressures on them and motivations. I wondered if Mr. Mayfield would care to comment on that?

MR. MAYFIELD: I suppose it would be inappropriate to simply say no?

(Laughter.)

From my own involvement with the codes and standards, and I think it's actually a positive as a part of the consensus standards process where you do in fact bring diverse views to the table in establishing codes and standards through that consensus process. And I think that you generally get a very robust product that addresses common interests of not only plant operation and efficiency, effectiveness, but also generally addresses public heath and safety. Just because they also have a vested interest in it from a consensus standards process.

I think this one of the, this environmental effects issue is one of those areas where the staff, with its driving consideration of public health and safety, has a different view that we believe outweighs the various views from the consensus standards process.

That's one of the things that we have historically discussed with ASME, that at the end of the day, through our endorsement of the ASME code and the various code cases, at the end of the day we have to make the health and safety finding and, once in a while, it doesn't happen very often, but once in a while, the staff has to do something that is inconsistent with where the code is. We then, we don't do those things lightly. We don't do them very often. But we, and we, I think, rarely have done them when we haven't known that we were in conflict with the code.

And when we are in a situation where we have to make that kind of finding and take that step, we try to work, as we go forward with the code, to reconcile the dispute, but at the end of the day we have to make a finding that we believe is consistent with public health and safety and the regulations.

Does that help?

MEMBER POWERS: That was a superb answer.

MR. MAYFIELD: Thank you. I'd like to know myself.

(Laughter.)

MEMBER MAYNARD: I think we'll have a

chance to discuss this later in more detail. I just don't want the lack of comment at this point to necessarily give the impression that I'm in full compliance or in full agreement. Because I don't think its -- I think there's a better time probably to discuss some of that.

CHAIRMAN WALLIS: Okay, thank you. We'll take a break until 1:30. Lunch break is 1:30, something easy to remember, not fractional. we'll take a break to 1:30.

(Whereupon, at 12:35 p.m., the meeting was recessed, to reconvene at 1:30 p.m.)

A F T E R N O O N   S E S S I O N

1:34 P.M.

CHAIRMAN WALLIS: Before we get started with our business -- oh, okay. Before we get started with our business, I would like to recognize one of our outstanding staff members, Ethel Barnhard, who has after approximately 40 years working with the Committee will retire on January 3, 2007. Ethel has handled several different jobs for the ACRS over her tenure on the staff. This includes managing the Committee's reference library and ensuring compliance with FACA requirements, for document retention retrieval, possibly the only person left in the Agency who knows how to read microfiche film.

(Laughter.)

Manages the classification of Committee documents and assures that we appropriately handle classified material. She prepares the NUREG documents that include compilation of ACRS ACNW reports and letters. She's also responsible for handling Freedom of Information Act requests relevant to ACRS ACNW activities.

There are a long lists of tasks she's handled for the Committee which I will not go into, but I'm beginning to wonder as I read these who is going to do it when she is gone.

(Laughter.)

And the thing I really note, the thing I really note which is my contact with her and I think many of our contacts with Ethel is how the exceptional job she has done in handling computer hardware and software matters for the Members and for the ACRS ACNW office staff. Without her, I probably wouldn't be able to run my computer at all.

She has been rock solid in her devotion and support of the ACRS or what amounts to most of her professional career. Her professionalism and willingness to assist the Members and the staff have been very much appreciated, so thank you, Ethel, very much indeed.

(Applause.)

As we are on the record, I think we should move on with the next item of business.

The next item of business concerns emergency planning. Our cognizant Member who has really come up to speed on the business of this Committee is Michael Corradini. I'll pass it on to you to lead us through the next couple of hours.

Mike, please.

MEMBER CORRADINI: Thank you, Mr.

Chairman. So I'm Mike Corradini. I share the responsibility of reviewing the design certification applications for the current chairman of the Future Plant Design Subcommittee, Dr. Kress.

The purpose of this part of the meeting is to review the staff proposed revisions to the NUREG-0800 Standard Review Plan, section 15.3 entitled Emergency Planning. The proposed revision to SRP 13.3 was published in the Federal Register for public comments, and the comment period has expired.

We will hear presentations from the representatives of the Offices of Nuclear Security and Incident Response, NSIR, and New Reactors NRO, regarding the proposed changes, technical bases for those changes, and the resolution of the public comments. We will also hear from the NEI regarding their comments on the proposed SRP. So we'll proceed and I'll call upon Dan Barss or the NSIR to begin.

MR. BARSS: Thank you. Dan Barss, I'm a Senior Emergency Preparedness Specialist. I use that word senior carefully, that means I've been here the longest and also they titled me as that. Also, emergency planning is an interesting field. You know, everybody is an expert in emergency planning. Fortunately for me, I'm the one that gets paid for it.

So hopefully if I do my job right, I'll continue to get paid for it today.

As was said, we're going to talk about the Standard Review Plan, NUREG-0800, particularly section 13.3, a small section of that very large document. We're also going to talk about the DG-1145, the COL application guide section 13.30, though it may not be titled exactly that in the document. It is basically covering the same section, the same type of material. And those documents were written by the same person to make sure we had some continuity between them hopefully.

Before I get into them, I want to take a little tour through the regulatory process and talk about emergency planning a little bit, because I think it's good to have that fresh in our minds as we begin a discussion of emergency planning. As I've said, everyone is an expert and we made a few changes in the last few years or ten years or so, that may affect how we do business.

This diagram has been used many times in public. It shows starting in the center here, the nice round circle, the combined license review and hearing. That's where the rubber meets the road and somebody gets a permit eventually to build a reactor.

Coming into that combined license they could choose one of two paths, or I guess multiple paths, as you heard this morning coming there. They could come with an early site permit. They could come with a standard design, they could come with both, or they could come with neither.

And I want to talk a little bit about how emergency planning fits in each of those different parts of the process as we go along.

MEMBER APOSTOLAKIS: Which part of this column on the upper left hand corner is the ACRS?

MR. BARSS: You guys fit in all three, the standard design, the early site --

MEMBER APOSTOLAKIS: I know --

MEMBER POWERS: We're the blue background.

MR. BARSS: Emergency Planning has been and continues to be part of the licensing process. I list there on the slides some of the pertinent regulatory sections. We'll talk a little more about some of them as we go forward. And most important to remember, there was a presidential decision in December 7, 1979. In that decision, the President re-emphasized the importance of the NRC and the continued statutory responsibility we had for the radiological health and safety to the public. That same presidential decision though is the one that really established FEMA, which is now part of DHS. And a role which they play in the emergency planning process concerning reactors, and it's important to remember that as we look forward.

CHAIRMAN WALLIS: The President got involved because of TMI? Is that why?

MR. BARSS: Yes, that was following the Three Mile Island event and the events that came after.

MEMBER APOSTOLAKIS: I'm a little curious. You moved again. You're quick. Why when we cite other regulations, it's always so many? I mean, emergency planning in 50.33 and 50.47, what's the difference?

MR. BARSS: Well, in 50.33 and 50.34, that's the part, if I remember correctly, and my staff will correct me if I'm wrong, talks about the PSAR and the FSAR and it identifies different portions of different parts of emergency planning that you have to address at different levels going into that. 50.47 is the primary, and we'll talk more about that as we move forward. However, emergency planning regulations along with Appendix E, 50.54 is conditions of license and we'll talk about that as we move forward too.

They all play into it.

MEMBER APOSTOLAKIS: So in most of these is just mentioned, it's 50.47 where --

MR. BARSS: 50.47 is the 16 planning standards. But they all play a part in the requirements of when things are submitted and what's required. EP is sprinkled throughout the document.

You need to remember how EP came about. EP or some type of emergency planning was there from the beginning, but part of 1979 it was not heavily emphasized. In fact, I have a copy of the sites' emergency plan prior to 1979, and it's about 15-20 pages. That same document now is probably 15 books because of the changes that have happened and the amount of planning involved.

And it was after the Three Mile Island accident that actually 50.47 came about, and those 16 planning standards which built on some of the work that had gone on before that. So EP was, I don't want to say a backfit, but EP was kind of embellished greatly back then, and as time went on some of the licenses that were already in place, and those that were in the process of building they had to answer a lot of additional requirements then.

And for the new applicants, hopefully

we're not adding new requirements to them but holding them to the same standards which has gone before. And that's kind of the whole point I want to make as we go through this, is your already existing set of standards.

Focusing now on emergency preparedness, there is what's called the reasonable assurance finding for emergency preparedness that has be reached before we issue a license.

CHAIRMAN WALLIS: Reasonable assurance of what?

MR. BARSS: Reasonable assurance that the applicant, or that the plans that are in place, both the applicants and the state and local governments can adequately protect the health and safety of the public in the event of a radiological emergency. That's the reasonable assurance finding, that we believe that they have in place the mechanisms that they could protect the health and safety of the public if there was an emergency. That's what the reasonable assurance findings based on and focuses to.

MEMBER CORRADINI: So this isn't really not directly relevant, but just two examples pop in my head and maybe if they're not applicable, one is Shoreham and one is Seabrook.

MR. BARSS: Well, Shoreham and Seabrook are two late examples of what happened. And without spending a lot of time on them, in the Shoreham case you had the state and local authorities decided that they didn't want to participate in the process. And therefore -- I'll talk about this in a bit too further on -- therefore, there was a need for us to figure out a licensing process where what do we do with that situation? And that's where 5047C, and I'll talk about that as we move forward, was created. And eventually that plant was licensed, but there was a business decision made by the license holder to not operate that plant and it was since decommissioned and disassembled.

In the Seabrook case --

MEMBER CORRADINI: It wasn't the local, state and local, but across the state lines, state and local, if I remember correctly?

MR. BARSS: Well, I'm not sure who.

MEMBER CORRADINI: It was Massachusetts, it wasn't New Hampshire.

MR. BARSS: Well, in the Seabrook case it was the Massachusetts part of the emergency planning zone that wasn't participating. That's correct.

MEMBER APOSTOLAKIS: I'm sure they had a

good reason.

MEMBER POWERS: Actually, they focused on one of the toughest aspects of emergency planning, and that's how you treat transients and tourists.

I'd like to ask, you've highlighted here reasonable assurance. There's another aspect of emergency planning and that is adversity of plans, and I hope you'll be able to talk about that diversity as well as we go through here.

MR. BARSS: Yes, I address that later. I'm aware of that question coming. Thank you for the forewarning. Now I didn't finish quite there.

That 5047A, part of our regulations, I think is somewhat unique at least for emergency planning in that it specifically requires in there that we, the NRC, make the final decision as to whether or not we have this reasonable assurance and whether or not the license can be issued. But it clearly states in there that we rely on FEMA, now known as DHS, for part of that finding.

They look at the off-site part of the planning and give us their findings and determinations. We look at the on-site part of the planning, and then the results of their review come to our ultimate conclusion and we remain the licensing authority. But we share the responsibility for that review work with DHS and with FEMA. It says FEMA in our regulations, FEMA is now DHS because of changes.

MEMBER APOSTOLAKIS: So what is the relationship between FEMA and the NRC? I mean, they set regulations and then we have to meet them or have our own or what?

MR. BARSS: The regulatory authority rests with the NRC. In our regulations that stipulate what is required for the emergency planning are the NRC regulations, 10 CFR. You will find in 44 CFR 350 a companion set of regulations that FEMA has, and it repeats the 16 planning standards that you find in 5047.

The common document that we use for our evaluation we'll talk a little more about this as we go forward, is NUREG 0654, which is also known as FEMA rep 1. It's a joint document that was developed by us and published jointly by us.

There is also a Memorandum of Understanding, you see there, the last thing on the slide. It's published in 44 CFR 3503A, appendix A. That's an MOU between our two agencies which basically talks about how we do that licensing and how we share those responsibilities, who does what and establishes a steering committee to basically govern the day-to-day operations of that.

MEMBER APOSTOLAKIS: But in the actual implementation of the emergency plans, FEMA plays a role too?

MR. BARSS: When you get into response, yes. FEMA and many federal agencies play response.

MEMBER MAYNARD: For exercises, in passing we have been evaluators. They evaluate the off-site.

MR. BARSS: That is correct. There is an exercise prior to licensing the plant, prior to where any site is allowed to have a reactor, there's what we can call a qualifying exercise. And biannualy after that, there's a requirement that there be an exercise that involves state and locals as well as the utility participate. And those are generally evaluated, I would say generally but they are all evaluated to my knowledge, the biannual exercise, by the NRC looking at the on-site, by FEMA or DHS, looking at the off-site part of that. If there are deficiencies identified, they need to be corrected whether they are on-site or off-site. And we'll talk a little bit about that too as we move forward.

MEMBER MAYNARD: While we're on the division responsibilities, I may have misread it but it seems to me that in either the reg. guide or the draft guide, it talked about the licensee needing to submit off-site procedures, and I don't believe that has been in the past and it looks like it could really cause -- guess I would like to have some comments on that. It doesn't seem appropriate to me.

MR. BARSS: We'll talk about that a little bit later.

MEMBER MAYNARD: Okay, that's fine.

MR. BARSS: That's in here.

CHAIRMAN WALLIS: I am going back to my reasonable assurance of public health and safety. I don't quite know what that means. I mean, if you have 10,000 people on the beach and something happens at Seabrook, do you expect no injuries of any sort to those all 10,000 people? What does reasonable assurance mean?

MR. BARSS: That's a good question. It means in our concern that you have a plan that you can implement, that could provide for the evacuation. The basis of emergency planning --

CHAIRMAN WALLIS: But it could be a very poorly implemented plan, and there could be quite a few injuries.

MR. BARSS: Remember, the purpose of

emergency planning is not dose avoidance, but dose reduction. And that's the intent here is to save dose, if you can, if there is going to be an event.

CHAIRMAN WALLIS: You have to have some idea of how, when your plan is good enough. I'm not quite sure. Maybe you're going to explain that to us? There are good ways of telling when your plan is good enough.

MR. BARSS: And that's what our review process and our exercise process is, is the review establishes whether or not you have a workable mechanism that meets the requirements that we've established. And then through exercise, you demonstrate the capability of implementing that plan and being able to --

CHAIRMAN WALLIS: Your objective is to have nobody suffer in any way?

MR. BARSS: No, I did not say that. I said the purpose of emergency planning is dose savings. To have a plan in place that if there is going to be an event, you have a way of mitigating that somehow. And if you can't mitigate it but there's going to be an off-site release, that you have a way of reducing or minimizing the dose that the public could be receiving.

MEMBER POWERS: There is somewhere in the various things that the Agency has published on emergency planning, a very nice hierarchy, where it says the first thing to do is avoid a lethal dose. Then once you've been able to do that it moves down into the point that you have nobody being dosed at all. But it takes it stepwise into thinking about things. It's a nice hierarchy.

MR. BARSS: You need to remember, the emergency plans are developed and we talk about the ten mile and 50 mile EPZ. There was a whole range of considerations that went into, or how big of a plan -- amount of planning area do you need, which accident do you have to worry about, and the conclusions that were made long ago is you don't worry about any particular accident. You look at a range of them and you have to have the capability to implement what would be necessary for the worse case accident, but you don't want to have to plan for the worst-case accident because that would be rather constraining or limiting.

What you need is something that you can expand, should that happen. And you kind of pick something that is reasonable and I don't want to say in the middle, but that is reasonably implementable and plannable.

As we've already talked about, there are 16 planning standards in NUREG 0654. They are found in

-- I'm sorry, in 10 CFR 50.47(b). That's where the 16 planning standards, you find them in the regulation. Also in appendix E to 10 CFR 50 is additional requirements for emergency planning. Originally, appendix E was what was there, the 50.47(b) stuff what was added later after Three Mile Island. In reg. guide 1.01, that's where we the NRC tell the world that we will use the Reg 0654 FEMA-REP-1, Rev.1 as the acceptance criteria for our review of emergency plans in accordance with the regulations. In also reg. guide 1.01, I believe it's revision 4 of that, we identify NEI 99-01 as an alternate set of emergency actions or EALs that can be used.

There are others, schemes, other emergency actions or schemes that can be used but the N 99-01 document is the latest and probably the most viable and what we expect most people to go to and I believe Alan Nelson will talk about that a little more later today.

There are some other things in emergency preparedness in the regulations I want you to be aware of. As I said, 10 CFR 50.54(q) is a license condition that applies after the license is issued. That requires an applicant to maintain in effect an emergency plan that meets the previously stated requirements. Once they've got the license they have to continue to do that.

There is also in 50.54(s) again, conditions of license, what I call the deficiency 120-day clock. If, in running an exercise or our inspections or whatever, we identify a deficiency or FEMA identifies a deficiency in the off-site plans, we can initiate what's known as a 120-day clock, which gives the applicant or the licensee at that point the opportunity to correct whatever that deficiency is. And they get that time frame because emergency preparedness is kind of a backup measure to the multiple barriers and things which we have. It's important but it's not critical to the safety at that point. It's only a planning deficiency usually that needs corrections, so we want to see it done timely but it's not an immediate action.

At the conclusion of that 120-day clock or process, and it's a whole process that it goes through, if the applicant hasn't, or the licensee hasn't successfully remedied or at least shown us a plan of how they're going to remedy that, the agency does have the opportunity or the ability to shut the plant down until such time as that is corrected. So that capability exists in our regulations today.

MEMBER BANERJEE: Are these plans mainly evacuations and --

MR. BARSS: No.

MEMBER BANERJEE: -- shelter or what --

MR. BARSS: Yes.

MEMBER BANERJEE: -- what are the crux of this?

MR. BARSS: Well the plans are, one, the first part is identifying that you have an emergency. The second part of that is knowing who to contact. And the third part is once you contact them, providing them a recommendation as to what's going on and what they, you think they need to do as a licensee. Then it's the responsibility of the off-site agency, whichever level that information goes to and the decision-makers are, is to decide what type of protective action they would need to take and then implement that protective action based upon the conditions, the recommendations, the local conditions, the weather conditions, many factors. And that could be --

MEMBER BANERJEE: But what are the options they have?

MR. BARSS: The options are shelter, tell people stay where they are. Evacuate, a combination of those. It depends on the event and the conditions. There is --

MEMBER BANERJEE: Iron tablets?

MR. BARSS: Potassium iodide, KI, is one of the options involved that they can --

MEMBER BANERJEE: There aren't that many things you can do, right?

MR. BARSS: Pardon?

MEMBER BANERJEE: Are there a lot of things that you can do, or --

MR. BARSS: Well, those are the three primary ones. It's shelter, evacuate or take KI. That's --

MEMBER POWERS: There are within each one of those many subcategories. You could have preferred sheltering. You could have radial evacuation. You could have non-radial evacuation.

MEMBER MAYNARD: Another big part of the plan is the staff necessary to try to mitigate whatever release, so a big part that's going on is to try to prevent any release too. That's all part of the emergency plan too.

MR. BARSS: And the important thing here is, the plan is probably the most important thing in that, you have established and you do this through your exercises, the communication links, where people know who to talk to. They know how it functions. Because we don't know what the accident is going to be. And what the conditions are going to be when the accident happens.

So you have to kind of, I don't what to say wing it, but emergency planning, a lot of emergency planning, emergency response is done on a wing-it basis. You take what plans you have. You take the conditions you have, and you figure out what's the best course of action using that information and move forward. Having a structured plan that you practice regularly gives you a structure and a knowledge base to wing it effectively.

(Laughter.)

CHAIRMAN WALLIS: You've got to move a large number of people who are all doing different things. I may be out there, or not me or someone may be near Vermont Yankee out there on a winter's day cross-country skiing somewhere, you know. And there's an accident. How is this person to know something has happened?

MR. BARSS: If he's out cross-country skiing, then he deserves what comes to him -- we have standards.

(Laughter.)

MR. BARSS: That's an important consideration. And there are hunting areas, all kinds of fishing areas ---

MEMBER BONACA: You do have sirens --

MEMBER MAYNARD: You have a siren system.

MEMBER BONACA: And ultimately, the state is the one responsible for implementing whatever they want to do.

MEMBER CORRADINI: Just to, just to get back to Professor Wallis' question though, just to push the point. I mean, at least in Wisconsin, the same FEMA or the emergency planning at least there whenever I hear a siren, the first thing one thinks of is tornado. And there is a series of radio stations or connection points that you then have to go to if you want to know more. Either it would be radio or television to find out what that siren means. But that, as I remember it, since --

CHAIRMAN WALLIS: When I hear a siren, I think my local fire department is out putting out a fire.

MEMBER CORRADINI: Oh, it's a different siren for the FEMA --

MR. BARSS: Generally, the siren is a 3-minute blast so you will know that there's something going on. But, more importantly, each of the plans has to have specific to its area, and this is one of the things that DHS looks at, figure out how to handle transients like that. If you have large recreational areas, we expect them to have specific plans as to how they will get that information to them.

A lot of the time it is done with posters, information, things in the phone book, posters at the facility. There's hopefully training for people that work at the facility and they would know to tell people, here's what you do in this event.

So there is a lot of that that goes on ahead of time and that's part of the exercise, I guess, to make sure that those plans can be implemented, that those people know how to do that and can accomplish it.

CHAIRMAN WALLIS: I don't want to belabor this, when we went to Vermont Yankee for a power uprate, we had a lot of people from the public there who talked to us and made statements. And one of the things that came up many times was this lack of confidence in emergency planning. They said they had sort of rehearsals and things and the buses didn't show up at the school and things didn't happen.

Is that being sorted out effectively or is this something that's in their perception which is not true or what?

MR. BARSS: Without discrediting those folks, I would say it's in there perception and not true, because we have an evaluation done on those exercises and if there are findings, we make sure that they're correct, that DHS does that.

CHAIRMAN WALLIS: So it could be rumors and things?

MR. BARSS: It could be rumors. And we do get what we refer to as allegations, frequently, from individuals, where they say hey, you know, this is supposed to happen and it's not happening and here's my reasoning and then we go out and we investigate these things and we resolve those allegations and get back to the people.

We take each and every one of those instances very seriously. We even have these things come up when we have public meetings for the new sites where people will come up and say hey, this is an existing site, well I have a problem with what's going on there now. That becomes if not an allegation, something that we do look at and consider and make sure that the question is answered.

MEMBER MAYNARD: Not all exercises are full-blown exercises where you actually evacuate people and everything like that.

MR. BARSS: I would say we never evacuate people. Our regulations specifically state that we're not supposed to make people move because that would be unnecessarily --

MEMBER MAYNARD: But there are times when you have an exercise you'll have maybe one school bus and you'll have one group. It's all voluntary. It's not a mandated thing, but typically, you're not going to get all the buses. You make sure that you can find the people that you need and everything like that, but it could be the public could easily perceive that things aren't happening if they don't see those things, but they really are being taken care of.

CHAIRMAN WALLIS: I guess it must be very difficult because suppose there's a major snowstorm in a place and you have this happening. One thing, the range of the sirens is decreased and also people can't move.

MR. BARSS: That's where you rely on the

local authorities to make the right decision based upon the existing conditions.

CHAIRMAN WALLIS: Ad hoc.

MEMBER MAYNARD: That's one of the major considerations. Some times you come into sheltering as opposed to evacuation and stuff.

MR. BARSS: As I've said, you've got the plans, but the important thing is you have knowledge of people to make the right decision.

MEMBER MAYNARD: But the other thing, if you have some severe weather, licensees have requirements also to report if they have a situation that has degraded their ability to execute their plan and what compensatory measures that they've put in place for that too.

MR. BARSS: And in fact, when we have hurricanes or other major events such as that, we do monitor around the plants. We make contact with DHS to find out whether or not there are concerns that we need to be aware of and if there are, we make sure that the appropriate things are taken care of. The most notable example of that is Hurricane Andrew. It went through Florida and the site there, Turkey Point site, and in fact, the plant remained shut down for a considerable amount of time until the roads were cleared because there were palm trees laying all over the road. The plant was in good shape and could run, but the evacuation wasn't cleared, so they remained shut down until such time as those things were remedied and there was better off-site conditions.

Just two last points. I don't know if I talked about the reality presumption; 50.47(c) came about pretty much because of the Shoreham and the Seabrook type events. What that section of the Code of Federal Regulations is basically it says if there is a situation where the off-site agencies have refused to participate or no longer want to participate, the licensee or the applicant can provide an emergency plan to cover that situation. And we can evaluate that plan and what is known as a reality presumption, as I've called it here is, when there is a real emergency, the state and locals are going to use whatever plan is available and they will act to protect their public and based upon that, we have the authority through the regulations and the ability to approve those plans and have confidence that they can be implemented when the time comes to do that. So that provision exists in our plan or in our regulations already.

Again, a point, remember, there are two

sets of plans. Actually, I would say there are multiple sets of plans. There is the on-site, the utility plan; and the off-site, which could be the state and local. When you start talking about locals, you've got counties, you've got townships, you've got towns, you've got hamlets and there can be up to 20, 25 different individual plans involved in one -- for one utility. So there are multiple plans that need to be reviewed and looked at.

MEMBER MAYNARD: Multiple states too.

MR. BARSS: Multiple states, multiple jurisdictions and sometimes countries, depends on where they build them.

Going back a little bit, in Part 50, it's a two-step process where we issued a construction permit and then later we issued an operating license. That process, as we know, from the Shoreham and Seabrook and other plants, was a difficult process so in 1989 we were directed. We came back with an alternative licensing process which you're familiar with. It's called Part 52. And I won't spend a lot of time on that, but it was to improve the regulatory efficiency at greater predictability. It's essentially the same information as Part 50, the process is a little different. It combines that construction and operating license into one license, one permit, and it adds these what we call ITAACs, inspection, test, analysis and acceptance criteria. And that criteria, that acceptance criteria, that's what provides us the reasonable assurance that the facility is going to be constructed and will operate in conformity with the license and the applicable regulations. That's what's built into the process now.

Understand that as we go through the Part 52 process before they can load fuel, they have to clear those ITAACs. They can clear the ITAACs individually as they go along through construction. We will publish that in the Federal Register at least 180 days before this scheduled initial fuel loading. There is a publication made in the Federal Register of that intent for operation and that provides then an opportunity for one last chance at hearings for any intervenors or petitioners, if they can show at that point that the acceptance criteria has not been met.

Important to remember in the licensing process now in Part 52 and it's currently in 52.79(d) in the proposed or changes to the regulation will be 52.79(22). It's important that they, in their application provide to us, the NRC, certifications from off-site agencies that have emergency preparedness responsibilities that those agencies agree that the plans are practicable, that those agencies are committed to further development of those plans including field demonstrations which can be interpreted to be exercises and whatever else they need to do, and that those off-site agencies are committed to executing the responsibilities, so before we're going to begin reviewing that COL, we have to see those certifications and those certifications have to accompany that application.

MEMBER MAYNARD: This is compatible with the 50.47(c) as far as if you end up with the situation where there's, they're not playing, so to speak?

MR. BARSS: If there is agreement that the plans are practicable and they're committed to further developing and that they agree to execute those, I think that they're participating or if they agree to them. So you get -- this allows you to get out of that adversarial relationship where they say we're not going to participate, not involved.

MEMBER MAYNARD: What if they don't provide --

MR. BARSS: If they don't, then if they're not agreeing that the plans are practical, then I think we're at an impasse and I would leave it to our lawyers to decide what we do there.

MEMBER CORRADINI: Actually, Otto is bringing up something that we were kind of thinking about here which is so if A, B and C are not met, then they can't go forward with the COL.

MR. BARSS: That is my read of this is you wouldn't go forward with the COL.

MEMBER CORRADINI: But just to say it from the standpoint of in deference to 50.47(c), in that case, there was a construction permit. I'm just doing the old version of this. There was a construction permit. They built the plant, it's been inspected. They're now trying to obtain a fuel load and there's no participation by the state and local or some portion of the state and local agencies. And then 50.47(c) is triggered. There's no equivalent in 52. That's what I'm kind of -- that's what I'm kind of asking here.

MR. BARSS: The equivalent in 52 is that the licensee can submit a plan that they developed on their own in Part 52, just as they can in Part 50. But there still needs to be this certification that the plans are practical, that they're committed to, that the off-sites are committed to participating in that and that they'll execute their responsibilities.

If you can't get that certification, then I'm not sure what they do.

CHAIRMAN WALLIS: How do you certify the plants are practical?

MR. BARSS: I'm not sure yet.

MEMBER CORRADINI: Let me ask this question differently, would you expect the -- so let's break it down into pieces. If it was on an existing site, a practical plan from all, you have empirical evidence what were past practical plans, so that would be it.

If it was a green-field site, in some terrain, geography, whatever that was similar to existing sites, but wasn't an existing site, still you have some empirical evidence of practical. So it would have to be a not making those two areas where I'd have some potentially unusual set of

Am I off-base? I'm just trying to think --

MR. BARSS: As far as what is practical, I guess that's in the eye of the beholder there and coming to decision. If someone has developed a plan --

CHAIRMAN WALLIS: Certification can't be so flexible that it is just in the eye of the beholder.

MR. BARSS: You need to remember that emergency planning is expected to be an integrated plan. This isn't just the utility saying okay, I'm going to build a plant and here it is. There needs to be an agreement that these -- this is how we're going to do business and is this going to work? And that's where the practical part comes in, that there's agreement to that.

We certainly have -- we've got 65 sites out there built in many different regions of the country with different government and organizations and different people, so it's quite practical to develop an emergency plan for just about anywhere. It's just getting the parties to agreeing and working at it to make that happen.

CHAIRMAN WALLIS: The big challenge from the public about this practicability, presumably there's some way in which you can respond which is convincing?

MEMBER CORRADINI: There's somebody who seems to be waving.

MR. MUSICO: Excuse me, if I can help?

This is Bruce Musico. I'm a Senior Emergency Preparedness Specialist. I worked with Dan on this document in Emergency Planning.

Just to clarify an issue, the question was if we failed to obtain or the applicant failed to obtain the appropriate certifications from the off-site, could they still get the COL. The answer is yes, they could. If you look at 52.79(22)(c)(ii), it says "if certifications cannot be obtained after sustained good-faith efforts by the applicant, then the application must contain information including a utility plan, sufficient to show that the proposed plans provide reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency at the site."

In essence, if you obtain the appropriate certifications that address these criteria, there's no need for utility plan. The off-site state and locals are playing. If you cannot obtain these for whatever reasons, then they couldn't get the COL and the utility plan would have to be developed to account for off-site emergency planning. So I hope that clears it up for you.

MEMBER MAYNARD: That is helpful.

MEMBER ARMIJO: How could a utility plan

work without the cooperation of the local and state--

MEMBER POWERS: The Commission's decision was, in fact, that the local authorities would, in the event of an emergency, participate. It's impossible to believe that they would not.

MR. BARSS: That's where 50.47 comes in and the reality presumption is that when the problem is there, they're going to act to protect and save the public. They're not going to ignore that fact. They're going to have to.

MR. MUSICO: Let me add to that. This is Bruce Musico again. 50.47(c) is sometimes referred to as the realism rule. There's a presumption or assumption that where you have state and local agencies that have stated in some way that they are not going to play, if there is an emergency at the plant, they're not just going to run away. There's a presumption that in reality, they're going to utilize any existing plan that can help them protect the public around that area. That's called the realism rule, 50.47(c).

Now that was what occurred about Seabrook and Shoreham and some staff view that as a band-aid to the rules. Subsequent to that, my understanding is that Congress directed the NRC to fix the problem, hence the development of Part 52 to account for all these issues before the plant is built.

If you look at the administrative legislative history of the Part 52 rulemaking, you'll see that language in the discussion where it talks about you want to settle these issues prior to spending $2 billion building a plant and then finding you can't operate it.

MEMBER MAYNARD: And I think from a practice standpoint, it's not going to be an issue much with the new plants coming on, recognize that for the plants when the existing rules were imposed, many of these plants were either already built or in the process of being built.

Now I don't think too many people are going to build one in an area where they did not believe they would get some support from them.

CHAIRMAN WALLIS: This agency's responsibilities, would that include, for instance, local police department?

MR. BARSS: Yes.

CHAIRMAN WALLIS: But there are police departments in towns in New Hampshire and Vermont. Is there no confidence in the citizenry at all? There are all kinds of things that happen in small towns with police departments, give rise to scandals and hassles and dismissals.

MR. BARSS: They are all part of the planning process.

CHAIRMAN WALLIS: They're all part of this. You're dealing with people. I can just see all kinds of things that come into this.

MEMBER MAYNARD: They have to have a responsibility.

MR. BARSS: They're part of the process. They're part of the planning. They have responsibility, but there are state laws and regulations that identify who has the decision-making process and who has signature authority for those things and that's where you need to get the certifications.

MEMBER BONACA: Plus, I mean, there is a planning phase. For example, all the roads by which you are going to evacuate are identified and the rules are made on who controls them. I mean there is full planning in place. Now they also tested the emergencies, in fact, because if only the plant does the emergency exercise, there is local authority that is trying to get lessons learned. So to what degree may work in a natural condition, I don't know. But the planning is there.

MR. BARSS: Another thing to remember too is that the Nuclear Emergency Plan, or the Radiological Emergency Plan is generally a small subsection of the all hazards emergency plan that a community will have. It's not the only thing that they have to worry about. They've got trains going through their community, they've got trucks from the highway with chemicals in them, things like that. This is just another hazard, but it's only one of many. And most police and fire departments and most emergency services people know how to deal with those things and deal with them quite frequently. And this is just another aspect of the planning that they do.

MEMBER SIEBER: And it's not only local police, it's the county sheriff and the state police, and they have a hierarchy they use if they need additional assistance.

MR. MUSICO: Let me add something. This is Bruce Musico again. To address the question more specifically with respect to individual police departments, one of the items that we look at in order to support our reasonable assurance determination in most cases is the existence of letters of agreement that have been put together that are available prior to us making that final finding.

Now understanding that the reasonable assurance determination made pursuant to 10 CFR 50.47(a) is not a conclusion of absolute assurance. It's reasonable assurance. And the way that we make that reasonable assurance, there may be deficiencies, but we utilize NUREG 0654 primarily, which has very detailed evaluation criteria in it. We look at the individual evaluation criteria and looking at it as a whole, we determine can they reasonably respond to an emergency. Is the super structure in place, are the agreements in place, and we make a call on it. Again, it's a subject matter expert call, in our judgement is there are reasonable assurance? I don't believe reasonable assurance is defined anywhere, but again reasonable assurance is not absolute assurance.

MR. BARSS: All right. Let me move forward if I can, and this may create more fireworks but there is in the proposed regulation a new 50.54(gg), which allows operation --

CHAIRMAN WALLIS: G or --?

MR. BARSS: GG. It's double g, it's double g. That's correct, it's not a typo. It allows operation of up to five percent power with off-site deficiencies. That's very much like what is already in there under 50.47(d) in the existing regulation, and basically that provision became necessary looking at the ITAAC process and how it works in that the on-site agents or the on-site plan and the utility is the ones reasonable for ITAACs, but there can be things off-site that need to be developed further after the COL is submitted. Certainly there will be, but they can't really write an ITAAC because it's the licensee that has to do ITAACs, not the off-site. So there may be conditions or things which need to be finished or resolved after the exercise has been conducted, and that's what this provision is meant to employ or to accommodate. And remembering that there is the 50.54(s), which we talked about earlier, that we maintain the ability to shut a plant down any time, should there not be reasonable assurance to adequately protect the health and safety of the public.

MEMBER KRESS: Was the determination made that five percent power public health and safety is safe enough even without an evacuation?

MR. BARSS: It's not that there is not an evacuation. There are criteria in 50.54(g) and in 50.47(d), they're exactly the same criteria. There are seven criteria with regards to the off-site plan that we do need to look at, and have some level of confidence that they exist. So it's not saying that there is a complete absence of any off-site planning. It's saying that the off-site planning may not be fully complete or may not be the FEMA finding of reasonable assurance there. But I would say that there are major pieces of that plan in place and functional.

MEMBER KRESS: That's part of the definitions of deficiencies in, that they not be a bridge out of --

MR. BARSS: Bridge not built yet --

MEMBER KRESS: Or something.

MR. BARSS: Generally, a bridge-out, and it happens frequently in construction and things like that, they have alternate means and the locals know how to do that. That's not really a significant --

MEMBER KRESS: But I was wondering, if off-site deficiencies actually has some sort of definition?

MR. BARSS: It does. In the FEMA regulations, there is a definition for that. I'm not sure that I can quote it exactly, but basically if I remember right it says that in an exercise, if you identify something that in real life would have prevented them from protecting the health and safety of the public, then that's considered deficiency. If they cannot physically do what their plan says they should be able to do, that's a deficiency. And that needs to be fixed. It's a fairly high bar.

MEMBER KRESS: It seems to imply to me that the five percent power is okay without an evacuation, or without emergency planning.

MR. BARSS: Well, the source term is low enough at that point.

MEMBER KRESS: Well, I just wondered if that was the basis of that.

MR. BARSS: That is, I think, the basis for that number is the fact that the --

CHAIRMAN WALLIS: Why is the source term low if you have five percent power for a very long time. MEMBER CORRADINI: You'd have to do the equivalent of 20 years at five percent power to get close to that.

CHAIRMAN WALLIS: In saturation.

MEMBER MAYNARD: First of all, I don't think you're going to find plants operating for a long period of time at five percent power. What this really allows them to do is go ahead and load fuel and do a lot of the testing for plant systems, and get some of their physics testing out of the way. But you're not going to set there a long time. You're not going to make any money off of five percent power. You're better off shutting down.

CHAIRMAN WALLIS: But you're operating at full pressure and temperature and all of that?

MEMBER MAYNARD: Yes.

CHAIRMAN WALLIS: So the typical accident might be very similar.

MEMBER SIEBER: If your boiler --

CHAIRMAN WALLIS: Just as your inventory is left?

MEMBER CORRADINI: Decay heat is proportional to your power. You're not going to have high burn-up fuel.

MEMBER MAYNARD: It depends on how much inventory you've got.

MR. BARSS: Let me move forward, if I can. Part 52, the combined license, there are, as we said, two additional considerations there. In the combined license you can incorporate by a reference a design certification and an early site permit. That adds a degree of excitement or difficulty to us in the emergency planning world and I'd like to explore some of that with you.

One of the things to remember though that once we issue an early site permit in a design certification, the things which we resolve in those permits or those certifications is -- are considered or they're precluded at that point from reconsideration at the COL stage. That gives the applicant some finality in that once we've made that finding on the design certification, or the early site permit, particularly pertaining to emergency planning, they get the finality and that issue is not reopened, once they come in for the COL. That's what's important to them and buys them a lot in this process and why they might pursue, particularly the early site permit in looking at emergency planning.

In subpart B of Part 52 is where it talks about the design certification. It's important to note there are no specific requirements for EP in the design certification.

In the early site permit, which is independent of plant design, it can be done for 10 to 20 years and it's renewable for another 10 to 20 years. And its intent was to resolve early issues such as site safety, emergency preparedness and environmental protection.

In the early site permit regulations in 52.17, we find some unique things. First, is (b)(1).

They are required, anyone who has applied for an early site permit, to identify the physical characteristics of the site that could cause a significant impediment in developing emergency plans.

Everyone that applies for an early site permit has to do that. Then they're allowed two other options. That's the minimum; (b)(1), all of them have to do that. They can choose either (b)(2)(i) or (b)(2)(ii), (b)(2)(i) being a major feature's plan where they could submit certain features and those features can be identified probably most easily if you take the 16 planning --

CHAIRMAN WALLIS: Let's go back to this. Almost all of these new plants will be on sites where there were existing reactors. They have an existing emergency plan. It must be very easy to say we have an existing emergency plan, here are its features.

MR. BARSS: That's correct. That is the great advantage of using the existing site. Yes.

MEMBER POWERS: And it has never been -- it is not easy to do this.

MR. BARSS: It is not easy.

CHAIRMAN WALLIS: It's already there. They already have this emergency plan. And presumably it's been approved and everything.

MEMBER POWERS: No, they don't. They have an emergency plan for an existing facility.

MEMBER SIEBER: They have to get new letters of agreement.

CHAIRMAN WALLIS: Is it going to be very different.

MR. BARSS: It could. I will talk about that as we go forward. That's one of our considerations is how they treat that existing plan in their application.

Remember two options to them here, major features would be taking those 16 planning standards and addressing some or all, some parts of -- some of them or some parts of all of them, but not the entire part.

If they come in under (b)(2)(ii), complete integrated plans, at that point they basically have to send everything that they would for a COL at the early site permit stage and that buys them the most as far as certainly, is they can get their emergency planning part of it cleared at the early site permit stage.

MEMBER CORRADINI: So a clarification here, so you said it and I just want to repeat it so that I get it right. That under (b)(2)(i), they wouldn't address all 16 of the features, necessarily.

MR. BARSS: It's up to them to choose what they want to address.

MEMBER CORRADINI: And complete integrated implies addressing all 16 of the features? That's what I guess I'm trying to --

MR. BARSS: That's correct. Under (b)(2)(ii) complete integrated, they have to address the full spectrum of emergency planning as they would at the COL stage.

MEMBER CORRADINI: And then just to get back to Graham's question, when Dan was kind of explaining this to us, does that mean that under (b)(2)(ii) that then they would relate the plan to the other sites -- the other units that would b eon the site?

Is that coming later? Okay, fine.

MR. BARSS: I'll get into that as we go forward. That's a significant issue.

MR. MUSICO: Dan, excuse me, can I clarify something? This is Bruce Musico again. The distinction between the planning standards under major features are somewhat different than the planning standards under complete integrated plan. Where the planning standards for major features consist of 14 of the 16 basic planning standards, and then you have an additional planning standard that deals with the evacuation time estimates.

The scope of detail in the major feature planning standards are such that they merely require a description of various aspects of the plan, the proposed plan that's not in place yet. Compared to that, the complete and integrated plan would add two additional planning standards dealing with exercises and recovery/re-entry operations and what it would require is the implementation versus just a basic description of the earlier stage, it would require the implementation of the plants.

So major feature requires a description of what the plans would be. Complete integrated would require not only a description, but the implementation.

MR. BARSS: Not to confuse too much, but there is a minimum level and that's the description that Bruce has referred to, that we would need to see in the major features part, but the way the regulation is going forward and the intent of the staff and our discussions with NEI is the major feature can be that minimum which is kind of laid out now in R002 and Supplement 2 to NUREG 0654 in that there's a minimum threshold of descriptions, but they can also flesh out the entire -- if they picked number two or B of those planning standards, they could flesh out the entire part of that and get that and they maybe did F and G, but that's the only ones they addressed, they could get those major features and get some certainty on those. But they're not getting the full plan.

MR. MUSICO: One more clarification, that's a good point. What Dan has just described is the proposed final rule for Part 52 that's not out yet. It's out for review. What I described is the current Part 52 rule.

MEMBER CORRADINI: Go ahead.

MR. BARSS: Hopefully, we don't have you too confused on that. We need to move forward.

There are also in 52.17(b)(3) if they choose either the minimum which is only the impediments part for the major features, they have to describe the contacts they've made and the arrangements with the off-site agencies that have the emergency preparedness responsibilities. If they choose the (b)(2)(ii), complete integrated plans, then they have to meet those same criteria we talked about under the COL application and that is that the plans are practical, that the off-site agencies are committed to further development and that they will implement or execute the responsibilities when the time comes.

Now let's get eventually, finally to the standards themselves.

MEMBER POWERS: Let me ask before you go to the next slide, but you may want to answer in connection with your next slides rather than immediately, have you attempted to benchmark your requirements and review standards for emergency planning against those of other countries?

MR. BARSS: I wouldn't say that we have done a line-them-up comparison, but I would say that many people on our staff have experienced through travel and review work. For example, myself, I've done two OSARTs. If you're familiar with what an OSART is, one in Mexico and one in the Czech Republic. So I have some knowledge of how their programs are implemented and how they do them.

Recently, this year, we sent someone to England and watched a plan or an exercise there. We had someone in Russia this year also from our staff. So we are aware and knowledgeable of how they do it. A lot of them use our regulations and our guidance or shadow it somewhat. But as far as benchmarking, have we lined them up side by side, I would say we have not done that specifically. But I believe that we are on parallel with them and I don't think that --

MEMBER POWERS: The fact that you might be commensurate with Czechoslovakia or Mexico or Russia is comforting, but I would think that you find some interest in comparing yourself against those that might take a different view and not be parroting American regulations such as Germany or France or Sweden and I -- or Belgium.

MR. BARSS: South Africa, too.

MEMBER POWERS: I'm quite certain that you would learn nothing in comparison yourself to South Africa, but you might learn something in Japan. And I'm wondering why that wouldn't be a good idea to not saying that they have anything better or worse or anything like that, but more as a benchmark, an edification, an exploration of the space for emergency planning.

I have no reason to think that they do a better job than you do. As you know, I have quite a great deal of confidence in your abilities in this area. But just for the -- the problem is that you lack peers. To some extent, FEMA might constitute peers of yours, but in truth because of your unique responsibilities to radiological protection of the health and public, you lack peers in this country. And so you have to go search for peers and your peers, you know, with equal levels of experience and equal sizes of nuclear communities would probably lie in Europe and Japan and probably not in Czechoslovakia or Mexico or Russia.

MR. BARSS: Let me add, beyond the scope of our discussion today, but currently before the Commission, in fact, is we did a review of our emergency plan regulations and our guidance documents and submitted it to the Commission some recommendations and they're right now writing the SRM and it may come out today or in the near future. We've seen a draft already. But in that we're proposing to go through our regulations and to refresh some of them, do some revision work add in some of the things that have come out since 9/11, some of the security things that need to be put in the regulations and as part of that process, the process, we did some looking at some of the international things. And I believe as we go forward, and those that are responsible for that are in the room, we will do that, to look at that. That is a longer range project.

MEMBER POWERS: Long range, yes. Not on any crisis review. It's again peer review. Quite frankly, you carry a huge burden because you're kind of on your own right now and I think that if I were in your position I would relish the opportunity to share it with somebody with somewhat similar kinds of burden and experience.

MR. BARSS: I'm faced with the pleasant opportunity of doing that on a long-rang.e However, I do have a rather tight budget and time line getting ready for some new reactor applications that are coming in. So understanding that --

MEMBER POWERS: I understand there's penny wise and pound foolish.

MR. BARSS: Yes, I appreciate that wisdom. Let me move forward now. We've covered many of the points, but into the guidance documents themselves. The standard review plan 13.3 addresses emergency planning. It provides for us and when we do our review, how to review the emergency preparedness part on a construction permit, an operating license, an early site permit, the standard design certification and also combined license. They're all covered in that same document.

The document includes the many things listed there. I'll try to expedite some of this, but it talks about the interfaces throughout the standard review plan, who looks at different sections of it and how we interface with different parts of it, the siting criteria and things like that, the instrumentation. Those all play into emergency planning and how we interact with those different parts of the plan or of the review itself.

It identifies the regulatory requirements. It establishes the acceptance criteria and identifies existing regulatory guidance to use. It provides the technical rationale. It outlines the review procedure that would be followed by a reviewer. It proposes some generic evaluation findings that can be used. There is an extensive reference list included in there and it also includes the generic EP ITAAC table which we'll talk more about in just a moment.

One of the considerations we've built into the standard review plan is how do we deal with existing programs? We mentioned this earlier. This is important because an applicant has the opportunity to do many different things and in the three applications or four applications we've seen so far, for early site permits they've chosen each a different path it seems. They can -- I don't want to say ignore, but they can set aside the existing plan and create a separate and independent plan for the new facility.

They can use the existing plan almost wholly and just make minor modifications to it to add in the new features of the new facility or they can do some hybrid combination of both of those. And it depends upon what the applicant chooses to do, what amount of review work we have and what we have to look at. But what we have tried to state and make clear to everybody is that when we are looking at an existing program, the part we want to look at is is what's there applicable to the proposed reactor?

Is the information they're using applicable to this site, this design and does it apply? Is it up to date? Is it current in the form that they're providing it and does it reflect or incorporate that new reactor into the process?

That's how we plan on dealing with existing programs, using those three criteria as we look at them going forward.

MEMBER BONACA: Just a question I have, on this Section 13.3 ultimately, at the end of the game, the emergency plan will be what? Does it matter if you enter through with the, you know, early site permit or if you can't. So this is more, I mean, how flexible is the process to the fact that the applicant will maybe miss some information, but ultimately will have to get back to the emergency planning anyway at a later time, I mean.

MR. BARSS: At the COL stage, he won't miss anything. We're not going to let him

MEMBER BONACA: Right.

MR. BARSS: At the early site permit stage, it depends on what he chooses to do. But if he's chosen the minimum of just the significant impediments, it's not a very high hurdle to jump over. If he's chosen the major figures, he can address whatever he feels he can appropriately cover. If he's chosen the complete integrated plan at that stage, then it all needs to be in there. Like Ragu, it's all got to be there.

MEMBER BONACA: But you're leaving it pretty open, I mean.

MR. BARSS: It's open, but it's up to the applicant to choose which path they're taking. Once they've chosen that path, there's constraints as to what they need to do.

MEMBER POWERS: We'll be coming back to that in just a little bit. It can take any one of the 16 categories for his major features, and he does so and he comes in and he persuades gosh and darn he's got the best damn thing I've ever seen in my life. He doesn't come into effect for 20 years, some not all of us, 16. But in some cases, that no longer reviewable plan is out of date badly. It may not be applicable anymore.

MR. BARSS: We expect that they will update that information when they come into the COL.

MEMBER POWERS: They're required to update it after they get started. But I'm not sure they're required to update it when they come in for the COL.

MR. BARSS: I believe we've built that into the regulation, that they are required to do that when they submit it. And we built in there, at the industry's encouragement, if you're familiar with the 50.54(q) process, which says basically an applicant or a licensee can make changes to the plan. And these are done, emergency plannings are dynamic. We expect them to change and to grow. And they can make changes to that plan without our approval as long as they don't decrease the effectiveness of the plan. If they do something that's going to decrease the effectiveness of the plan, they need our approval first.

And we've stated in the regulation at least as it's proposed now that when they submit those revised plans or those updated plans, if they made changes under the 50.54(q) process or a like process that don't affect, or don't decrease the effectiveness, that's okay. But if they are going to decrease the effectiveness, they have to specifically tell us because that requires our review. But there is a process built into it.

MEMBER POWERS: You've answered my question.

MR. BARSS: EALs, Emergency Action Levels, and I believe Alan Nelson will talk a little bit more about that. The existing document NEI 9901 is applicable, but some of the EALs, and we expect them to use that document or whatever else they choose, but that's the one we expect most of them will use. We expect them to use that and most of those EALS will be applicable.

However, with the passive plant designs, particularly the AP 1000 and the ESBWR, there are a lot of those EALs that are currently existing that would no longer apply, such as ones dealing with off-site power and on-site diesels. You no longer worry about them with the passive plant, at least not from a safety standpoint. So there's some significant modifications that need to be made to some of those

EALs. And the industry is working on that and we expect -- we'll let Alan tell us about what they're doing with that.

We do expect them to use the guidance that's in that document in developing those new EALs to address the passive reactors. The inspection test and analysis acceptance criteria or ITAAC. There's a generic table in there, these were developed by us and industry and DHS and public participation through a series of workshops, and as you know if you read the comments from NEI in the Standard Review Plan and also DG 1145, we've included the table of those.

We've expanded upon that table from what was reviewed and added some additional ITAACs that we think are usable. It's important to remember that these were based on existing criteria in NUREG 0654. That's where we started when we started looking at what could be ITAAC-able, as we call it.

What the staff did was look for those things which we felt the applicant could not show us at the time of the application, but they needed to physically build something before they could show us that. That's the kind of thing that we thought they could ITAAC, and that's kind of the process we went through in developing them. When we expanded that, we were thinking particularly about an early site permit-type applicant, where you're talking about a 20 year or more time period before they may use that.

There may be a need for them to expand that ITAAC a little bit, where the original set that were developed were more focused on a COL applicant, where the construction was more likely to be within three to five years, than it was 20 years or more out window. So that's one of the reasons we added things.

We think ITAAC are the friend to everybody because they add some flexibility to the process and give the ability to do that flexibility. We support it. It's important to recognize that what we propose for the generic ITAAC are not all inclusive, nor are they exclusive. We expect that the applicant will have to pick and choose from them and all of the things that are in NUREG 0654 and decide which ones they want to ITAAC.

The important thing to remember is the burden is on the applicant to propose those ITAACs. It's their responsibility to propose them and their responsibility to accomplish them and to report to us the accomplishment of them. We inspect to make sure that's been accomplished. But the ITAAC really are theirs to propose them to do. And these will be developed and approved on a case by case determination, depending on the applicant and what they're doing.

Off-site EP guidance. This is one of the comments that we'll get to later. But our document is rather scant referring to off-site things. It pretty much says what's on the slide there, that we will use the current REP-series guidance documents, the associated memorandums. These are guidance memorandums that FEMA published over the years and a document published in February of 2003, called Radiological Emergency Preparedness Planning Guide. It's kind of an update. Those are, as far as we're aware, the current available documents and that's what are going to be used until such times there are new or additional documents provided or produced.

MEMBER CORRADINI: So there is nothing else simply because of the lack of it being exercised, or --

MR. BARSS: Well, I wouldn't say being exercised. These documents are looked at and used every day as FEMA does their daily business. The people that are responsible for the off-site planning and the FEMA reviewers are very aware and know what their documents are and what they're using, and those that do the off-site planning are aware of them.

It's not that these things are a mystery and not well-known, but they are somewhat I would say in a state of flux because of the changes of FEMA from one organization to another and back again. Not that their guide's documents change, but there's been a lot of changes there and for that and probably other reasons there's not been a refurbishment of them or a publication of them. But certainly that's a project that is ripe for work on, I guess.

Again, FEMA is an independent agency. I don't speak for them. We rely upon them for their participation in this process and we work hand in hand with them. So these are their guidance documents pretty much.

MEMBER CORRADINI: Well, let me just translate what you said to go back to. So there is early in 13.3 guide on the second page it says something like it goes off -- it says, at a minimum, and applies it to the ESP, but I think it's applicable to COL also. At a minimum, the review includes, that is for off-site, it includes physical characteristics unique to the proposed site that could pose a significant impediment to emergency plans and the description of contacts or arrangements made with state, local, and federal government agencies, etcetera. So these three bullets essentially give further guidance beyond that, because as I search through the 13.3 for off-site guidance in terms of how you review it, what should you look for when you review it? As you said, it's scant.

MR. BARSS: It is. And NUREG 0654, which is a common document, is the base backbone that they will use. But there are additional guidance memorandums and things that they use that embellish upon that. And they are well known in the community of reviewers that I guess would be using them.

MEMBER CORRADINI: Okay, thank you.

MR. BARSS: Standard design criteria for emergency planning. As I said, there is nothing required. However, we do provide guidance in Section 13.3 about that. Specifically, that the features that may be addressed, they need to be technically relevant to the design. They shouldn't be site specific and they should be usable at a multiple number of sites or units. That's one of the criteria we expect for what we would be looking at in design certification.

Generally speaking though, EP aspects are a programmatic type thing and would usually be left up to the COL applicant and not the designer to address. Some of the things that they could address though are the facilities, the functions, and the equipment that support emergency planning. Particularly, the TSE or the technical support center, the operational support center, personal decontamination facilities, things like that. They could choose to describe if they wanted to. There is guidance available which talks about where the location of those things should be the size, habitability of them, ventilation systems, things like that and they would need to comply with those guidance documents if they do choose to address them.

The emergency response data system or the safety parameter display system, SPDS, the voice and data communications, those are other things that they could also address should they choose to, but that's up to a designer, if they want. Again, no requirement.

MEMBER CORRADINI: So if I could just turn to, Mr. Chairman, we're officially at the point where we should turn to NEI comments. Can we proceed a little bit longer on this because we're switching over to DG1145.

CHAIRMAN WALLIS: We seem to be getting

very close to the end. Let's wrap this up quickly and move on.

MR. BARSS: Okay, basically DG1145 provides guidance on EP information in a combined license as we talked about this morning. For custom design, one that's not referencing a certified design with an early site permit and it also addresses certified design in the certified design with an early site permit. That just basically tells the applicant what information they need to provide us and it addresses information that should be in both the application and the emergency plan.

There are basically two things that they need to submit to us. One is their application and there is a lot of information that would be in it and then along with that is the actual emergency plan itself.

When I say application and additional information, the additional information is things like the state and local plans. Those are not the applicant's plans, but are things to submit. DG1145 also addresses how to deal with multi-unit sites and some considerations there that we've addressed and again, that talks about the plans and how to integrate the plans and it also talks about the EP ITAAC and gives guidance on them.

We had some preliminary questions from you folks which I hope I've answered to some degree and I think we talked about many of them here. What substantive changes did Section 13.3 have? Really, there's no substantial changes in 13.3, but it integrates the Part 52 process. The things that are really new is the EP ITAAC, the predictive reasonable assurance finding be made, basically the COL stage instead of after they've demonstrated it in an exercise They still have to do that exercise before making a predictive finding much sooner and the timing of that exercise is different in the new Part 52 process, where that exercise had to be completed before operating. If the license was issued, it has to be done before they can load fuel in order to meet that ITAAC that they will be presenting to us.

Guidance on green-field sites was another question you had. In our opinion, existing guidance is applicable. We have 65 sites out there and they are all green-site at one time, so it's not something new to us. We do have guidance to address that. The green-field site was considered when we developed the ITAAC, that was one of the things in our mind, at least when we generated our initial -- that that is what do you with a site that's brand new and how could they do this?

We continue discussions with DHS to figure out what we need to review and on what level for a green-field site. It needs to be clear to everyone, the applicants and those present that the plans need to be submitted at the COL application stage and we do require those plans, but implementing procedures are not required with the COL application. The implementing procedures come later and they have time to develop that information as they go along.

Preliminary question we received about the completeness of the ITAAC table for the early site permit and I think I explained it, we've added a few ITAAC in there. Again, it's not all inclusive or exclusive and it's got the flexibility for the applicant to include what they want.

MEMBER CORRADINI: I'll wait until you get to comments.

MR. BARSS: Okay, diversity of the planning options, Mr. Powers asked about and it does include evacuation, sheltering or KI. If you look at NUREG 0654, particularly the planning standards or the subcriteria mentioned in there, J10, F, G and M, it gets into very specifics about using KI, about doing evacuation or about sheltering. That's part of the planning process and what we expect them to include in their plans to have those considerations as part of the planning, so there is the full spectrum of response capability there and then they can choose as appropriate when they need.

MEMBER POWERS: What experience tells us is that the combination of inspection emphasis and staff's prejudices leads licensees to draw logical conclusions and to deemphasize J10M, in favor of J10G and J10F is site- and locale-dependent, so whether they address it or not is -- but it's really the discrepancy between on sheltering and evacuation.

As we move toward plants whose risk-dominant accident is going to be a seismic event or the infrastructure to support evacuation, emergency plans gets degraded along with the plant, sheltering becomes much more important.

My question to you is how do we counteract this emphasis that in the inspection of plans and the review of plans the emphasis on evacuation at the expense of sheltering?

MR. BARSS: And in fact, supplement 3 that was put out some time ago really pointed to evacuation as the preliminary thing we expected them to do. So that's true, there is an emphasis on that in the current mindset, I would say.

I think following our presentation here later today, you're going to have Randy Sullivan here talking about some studies that they're doing and one of the studies he's working on is looking at that. We're using Sandia Lab, look at what other things can you do instead of evacuating all the time, when would sheltering may be a better possibility? And that is being studied by this and will be factored in. We're giving a look at our regulations and our guidance and we'll be revising them in the future here. So we're not blind to that that consideration is going forward. But as far as the current standard review plan, we've not factored a change in there to our guidance documents.

MEMBER POWERS: Shouldn't we -- the new plants we're talking about are going to have internal events, core damage frequencies that are quite low, yet the seismic hazard is going to be handing in roughly 10^{-5} or maybe 10^{-6}, but it's somewhere in that region. And so it's going to be just totally dominant over the internal events. And quite frankly any seismic event capable of damage to the nuclear power plant is going to damage all your infrastructure for supporting these magnificent -- you're simply not going to have overpasses and bridges for evacuation processes.

And so, you know, we're planning for the events that are not going to occur, it seems to me and that's silly.

MR. BARSS: I understand your point. I don't have an answer for you today.

MEMBER POWERS: I only ask you to think about it.

MR. BARSS: It's an important consideration.

MEMBER POWERS: Luckily we're building plants where seismic won't be the dominant risk.

(Off the record comments.)

CHAIRMAN WALLIS: Very quickly, is KI required?

MR. BARSS: They are required by our regulations to consider KI as a protective action. It is up to the individual states whether or not they implement or have a plan for that. And in fact, you're probably familiar with that we have offered to buy potassium iodide for states that choose to use it and not all of them have taken us up on the offer.

MEMBER APOSTOLAKIS: How is the seismic

issue handled in existing plans, existing emergency plans?

MR. BARSS: Seismic is considered --

MEMBER APOSTOLAKIS: I mean the issue of the same earthquake damage the civil infrastructure.

MR. BARSS: That's why you have a flexible emergency plan and you have local authorities that know their communities and the roads and things like that and if there is an event like that, it will be up to them to look at what available infrastructure they have left and determine what they can do and how they can do it.

MEMBER APOSTOLAKIS: So that's not part of the planning?

MR. BARSS: It is part of the planning in that you don't -- but you don't plan for an earthquake that wipes out all your bridges, I wouldn't say that. That's not specific --

MEMBER POWERS: But you have to.

MEMBER BONACA: But you would focus on sheltering.

MR. BARSS: Then you would focus on sheltering at that point.

MEMBER CORRADINI: I guess -- if I could just interject, so I think where Dana is going with this is and maybe this is -- I'm slicing it a bit is that the 13.3 doesn't necessarily speak to this, but the 0654 and the supplement you mentioned in some sense, as you said seems to be pointing people to a direction that's not as diverse as we might need to.

So does that mean that we're going to have to -- that there's going to be a relook at 0654? Is that in the plan?

In other words, to address what Dana's concern is, which seems quite valid, it's not 13.3. It's really the base document that 13.3 points to that gives him guidance that might be leading him down one preferable path and may not be appropriate for the future.

Is there any plan to look at 0654 again?

MR. BARSS: Yes. 0654 is one of the documents that we are currently planning to work on, I believe. I see Catherine back there and she's shaking her head in the affirmative, so that's on our list of things to look at. I wouldn't say that this specific concern was on our radar prior to today's discussion, but it certainly is now and will be. And I'm not sure in the studies that Mr. Sullivan has been conducted with Sandia, whether or not that's played into it, but it's certainly a data point that we would consider and we appreciate the insight that you bring to that.

There were comments from the public, primarily from NEI. One about not opening the existing site emergency plan for review. That was the three criteria I talked about earlier, whether or not it's applicable to the new reactor, up to date and addresses the new reactor. That's how we intend to handle that. It's up to the applicant as to how they address their existing plan and what they submit to us for the new site. We agree that they shouldn't fear their existing plan being open for review. However, I would add that as we do these reviews, if we do identify problems or things there, that deal with the site, then we would expect them to be corrected.

However, I would also add that these plans have been around for a long time. They've been exercised and tested and we have reasonable assurance for them, so I'm not so concerned that that's going to be a big issue. And it has not, to this date, been a big issue for the three we've done and the fourth one we're working on now where they've been open for this review.

We did ask a lot of questions initially that caused some concerns. Hopefully, we've reined in our question asking to keep it focused on the right thing, but I don't think we did any harm to anybody's plan or planning programs in that.

Expansion of the ITAAC was expressed as a concern and I've already addressed that as to why we did it and we think it is a good thing and beneficial. I don't believe in the comments we got that anybody said there was anything wrong with what we expanded, but just that they were disappointed that we had gone beyond what had already previously been discussed in the public forum.

Use of the term "generic communications" was mentioned, particularly because we seem to reference a lot of generic communications and it's clear that many of our generic communications require no action on the part of the applicant or the licensee and that continues to be true. We don't expect them to address all those generic communications in their application, only the ones that require specifically that they have taken action.

But we do want applicants to be aware, because there is as time as gone forward, there's a lot of people retiring and new people coming into this industry. There's a lot of lessons that can be learned from reviewing those old documents, those old information notices that are out there so we don't repeat the mistakes of the past. So we think it's important that they have those documents available to them so they can learn from those things.

Submittal of implementing procedures, we agree with that comment that was made that we do not require the submittal of implemental procedures for the off-site. They are required for the on-site, but that is later in the process, before fuel loading, but the off-site procedures had never been required to be submitted and we are not requiring them now at this time to be submitted in our regulations. And the comment about the absence of DHS or FEMA rep planning preferences, limited off-site response plan related review criteria.

Again, it's not in our document other than a vague reference to what's already existing. But those are existing documents and as I've said fairly well known in the community that uses them.

MEMBER CORRADINI: So if you're done with that one, I had a question about that one. So I didn't -- maybe I missed it and the NEI representative will remind us of it, but I guess I would like to understand that more about their concern there, because that was one of our concerns about trying to understand how limited information there was.

MR. BARSS: I will let Alan Nelson get the rest of that.

MEMBER CORRADINI: Okay, then I have another one which is so given what occurred with Katrina and evacuation, were there any lessons learned that one can point to this relative to -- guidance now, not necessarily what the 13 -- so, we're branching again. This is not really within the realm of the 13.3, but within the realm of what you would point somebody to to review in terms of guidance for the applicant?

MR. BARSS: I will say that there are probably some lessons learned that we can gain from Katrina. We are in the process now of studying that. We did a study some years ago, just a couple of years ago we completed one, where we took the last 15 years worth of events that had happened where there were evacuations of some size. We pared it down to 50 specific ones that were reviewed and we looked at that and learned from them and we're applying that.

The Hurricane Katrina and Rita happened after that was done. They are significant events and they did have significant consequences. We have opened a contract with the Sandia Labs to look at those again. So we are in the process of studying that.

There were lessons learned published by I believe FEMA, DHS, other government studies. Most of them have dealt with internal government processes and things that the government could do better, but they have not been directed to off-site emergency planning, particularly in the radiological areas, things that they should make changes. So there really have not been lessons learned that are applied directly to the REP program, but we are studying that and looking for them, and we will certainly include them at the appropriate time and place.

MEMBER CORRADINI: Thank you.

MEMBER POWERS: You would be surprised if one learned profound things from Katrina evacuation, because there seems to be a distinction between natural event emergencies, especially one like Katrina where there's substantial warning period of time, and what are called technological events, which are abrupt and poke at the human's natural concern over things that you don't know much about. Thing like chlorine tank releases and stuff like that, where there is this mortal dread.

Whereas a hurricane, especially if you

live in a hurricane region, is something that's quite frankly the problem is that people don't want to evacuate. Seldom is that a problem --

MEMBER CORRADINI: The manmade versus the natural.

MEMBER POWERS: -- that poison is coming under the door stop. I just don't hold -- I think the lesson that's going to come out of Katrina is that it's good to have emergency plans. And that's all I personally hold out there. I think that within this 50 that he speaks of, there are set of 26 or so, maybe a few less than that, much more likely to hold information than Katrina.

The one thing that I think comes out of looking at these is that there is are a lot of myths about evacuation that can get dispelled. You hear myths like oh well, evacuation is terrible because lots and lots of people get killed in evacuations and things like that. I think that you find that in fact evacuations aren't particularly fatality prone.

MEMBER APOSTOLAKIS: Does evacuation planning include taking care of the people after you evacuate them?

MR. BARSS: Yes --

MEMBER APOSTOLAKIS: Katrina, there is a

lot of lessons there. I don't think they did a good job with that, did they?

MEMBER POWERS: Like I said, I myself hold out no hope for learning very much from Katrina. I think there's something else --

CHAIRMAN WALLIS: Well, I think the public learned some.

MEMBER POWERS: I think what you will learn is that having the plan is a good idea. And Katrina will simply teach you, gee, if you have a poor plan for handling people that are evacuated, you're going to get a lot of catastrophe. I don't think it's going to --

MEMBER APOSTOLAKIS: Katrina --

MR. BARSS: But the radiological emergency plans do have reception centers built into the process in monitoring capabilities for people coming to them.

MEMBER APOSTOLAKIS: But do you see a case where you will have to evacuate the numbers of people that have to be evacuated in Katrina. I mean, you're talking about --

MEMBER BONACA: Well, that's an issue. I mean, Katrina, the tragedy of Katrina was a major city being hit. Now power plants, they don't have that many people around, so you can move them out to a degree if you have any constructions still that you can use. It's a big difference.

MEMBER APOSTOLAKIS: Who is in charge, by the way, when this happens?

MR. BARSS: When what happens?

MEMBER APOSTOLAKIS: A major accident.

MR. BARSS: Well, the utility remains the responsibility for operating the plant and notifying people of the event. Depending upon the governmental structure, the responsibility for protecting the health and safety of the public usually rests with the state, with the governor, that can be delegated. Like Texas, if I remember right, it's a county judge that has that responsibility about the planning. So it depends on the jurisdiction and who makes the final decision.

MEMBER APOSTOLAKIS: The agency is what?

MR. BARSS: As far as the NRC goes, we have a role and FEMA and DHS has a role under the federal plans to provide advice and information. But the actual protecting of the health and safety of the public, that lies with the state. That is their responsibility.

MEMBER POWERS: I believe that FEMA and NRC share the responsibility for coordinating federal response.

MR. BARSS: That's correct. And when we're called upon by the State, we provide that assistance. And we have an elaborate system in process which we process which we practice --

MEMBER APOSTOLAKIS: This federal response takes place only if the governor says do it?

MEMBER POWERS: There are a couple of instances where the federal response is provoked without the governor, but in general, the governor has to ask for it.

MEMBER MAYNARD: And typically they will declare a state of disaster emergency, which is a magical term that then opens up mechanisms.

MR. BARSS: That's correct.

MEMBER MAYNARD: Roles and responsibilities are defined as part of the emergency plan.

MR. BARSS: Yes, and that's the purpose of the emergency plan is to establish those things ahead of time as to who does what and who calls who and who has the authority request that assistance should it be needed. That's the whole idea of the plan.

CHAIRMAN WALLIS: I'm surprised at this idea that we didn't learn something about Katrina.

Well, maybe we didn't but I think the public perception really changed as a result of Katrina. It does affect the public perception for emergency planning for a nuclear event.

MEMBER BONACA: I mean, a nuclear plant, even in a crowded area, you still have a void with respect to what you had in Katrina, hit a major center like that, so, the issue there, the challenge was to move our people from a very highly-populated area through roads that were inaccessible.

MEMBER MAYNARD: I think one of the key differences you would see with a licensee having a radiological emergency that activated the emergency plan, roles, responsibilities, training is already taken place and you have some leadership driving it and you're going to end up with the people in one location. With a natural event the government agency seemed to be hesitant to take advantage of some of that and co-locate and drive that. So, I think in a radiological event, you know, you have a driving force and you have a central location and you have the leadership in one area to where it would drive more things to happen.

What I did not see happening in Katrina, I did not see the agencies communicating, working together, making things happen.

MEMBER POWERS: Get some local leadership issues, the mayor and the governor --

MEMBER MAYNARD: Those are always interesting kinds of questions.

MEMBER POWERS: They didn't contribute much.

MR. BARSS: I heard the comment that we hadn't learned anything from Katrina. It's not that we didn't learn anything, but specifically the REP Program, we -- specific to the REP program, we, the NRC and DHS as an agency have not made any recommendations to the REP program to make changes based upon the lessons learned. We will do that once we've completed our studies and identified there are specific things to the REP program that need changing.

MEMBER CORRADINI: Okay. So, if this is a good point let's move on to hear from NEI and then we'll wrap it up with comments from the --

CHAIRMAN WALLIS: Will you try to get us back on time?

MEMBER CORRADINI: Yes. I'm shooting for 3:30.

MR. NELSON: Thank you and good afternoon. My name is Alan Nelson, Director of Emergency

Preparedness at NEI. I have Marty Hug here with me from my staff, and let me first thank you for the opportunity and before I get into my presentation, a number of the issues and topics that were discussed this afternoon were clearly expounded on by the NRC and in some ways there may need to be some clarification between what our comments said and as we proceed because we have been engaged with the staff and had several meetings with them.

I'd like to go back to a couple of topics that I, I think are critical for us to discuss or at least to have a better understanding.

The programs that are in place today around these nuclear sites have been used for real events. An example, outside of Raleigh, I think about a month or so ago, the Apex chemical plant evacuated 17,000 people. It's not that far from the Sharon-Harris plant. The program in place in that community for the nuclear was utilized in many parts to evacuate those people.

In the real world today, this year alone, there were 17 unusual events and two alerts. Those events in themselves don't constitute protective actions, okay. They are notifications and to the state and locals to let them know that an event has occurred at a site and to make them aware if they need to man their emergency operating facilities in the case that the events escalated. In the case of, no events this year were, you know, needed to take that progression.

One of the topics that was discussed, the licensee, local and states are partners in emergency preparedness. The licensee evaluates the event under classification system, whether it be a unusual event, alert, site emergency, general emergency being the highest of the, that would require some protective action to be made. That protective action, as you discussed, could be sheltering evacuation and the consideration of KI range or combination of those.

You discussed to some detail reasonable assurance and how do you determine there is reasonable assurance that these programs or these plans will protect the public in the off-site environment within the EPZ and sometimes the ingestion pathway.

I think that, looking at the 16 planning standards, okay, which really weren't labeled out, they are to find an organization, on-site and off-site. A classification methodology of what events will require what actions and how do you determine them.

Notification, how are you going to notify them on a 24/7-type basis? Can you notify the public, whether it be by tone-alert radios or by sirens or by a reverse 911? The facilities, are they equipped, maintained and tested? Communicating among the public, pamphlets and so forth, makes the public understand what events and what actions they would need to take in an emergency as well as the transient. You talked about some skiing, if he's staying in a hotel, he gets that information. If he's staying nearby in someone's home, they have that information.

And then there's the specifics of training. Those make up, constitute the basic of the plan in itself. If any one of those points of those 16 planning standards are not met, that defines a deficiency. And how do they evaluate the assessment of reasonable assurance, looking at those planning standards during an exercise, looking at them as a thorough review through the FEMA process, as well as an annual letter to FEMA that states that they have done multiple activities in support to assure a readiness of that program.

I just wanted to give you an idea of some of the things that you talked with the NRC. It will give you a level of confidence of how these programs are used in the real world, how a deficiency is defined and how they are implemented and trained on during the course of a year.

Turning to the topic of today, NEI has formulated a task force of experts to look at the emergency preparedness. As you can see, there are 10 licensees that are involved and a series of four reactor types that are being evaluated at this time. We have met, almost on a monthly/weekly basis and conference calls to review and discuss many of the projects that we have at hand. The key projects that we've listed are of course the emergency action levels which began with a NUMARC document, became 99-01 and now we're looking at a rev. 5 which is for the operating plant and we're going to talk a little bit about NEI 07-01.

We have provided comments to the staff and met with them on a series of occasions, public meetings on the Draft Guide 1145 in the standard review plan.

99-01, which is the basis for today's emergency preparedness programs and identifying the classification system has been endorsed in Reg. Guide 1.101. It's for the existing fleet. Right now, about 70 percent of the fleet uses 99-01 and that's a barrier-based process versus the remaining 30 percent uses 0654 which is an event base.

You talked about do you revise 0654? In this case, it's supplemented by the NRC's endorsement of the NEI methodology. So you don't have to do a whole landscape retooling of 0654. You can provide supplements. In that case, that's what we did and we requested endorsement.

The EISs themselves recognize about six or seven, what we call tabs or events that can occur that need to be observed and recognized by the operators in order to make a classification of an unusual event alert, site and general emergency.

The 07-01 which is in draft right now is looking at the AP 1000 and the ESBR and adapts the 99-01 methodology. And we will develop it as a stand alone, but the philosophy and the methodology are concisely used together. So there is a pedigree between them. Because we want our operators to use the same pedigree methodology at an existing site as they would for a new site.

Taking a look at 13.3, as the NRC staff had said, we submitted comments by November 9th and we had reviewed the ALWR, the task force had provided those comments.

Specific comments were addressed by the NRC, was the reactor that the staff wanted to look at, existing procedures at the site and this becomes -- I think we're going to need to discuss this further with the staff because where it becomes a concern is that those procedures and those programs are already approved. So if they were to make a finding, does that mean that that particular license portion is invalid? And that's where it drives the concern.

I understand the expansion of the original agreed on ITAAC, but there are certain elements that are crossed over from one ITAAC to another. I think there was a radiologic ITAAC that was seen somewhere else and there seemed to be a mix and match. There ought to be a single set of ITAAC that applies and I think that with further discussion with the staff we could probably have a better understanding and see where that approach comes to be.

The generic communication issue is very interesting. There are, I believe, correct me if I'm -- I think in the SRP there are 133 cited references. Sixty-eight of those are NUREGs and so forth. From 69 on, there are information notices, what they call EPOS, RIS and a whole gaggle of opinions and ideas.

In developing a plan for submittal, the

staff has asked us to reference where in that plan where those references. So you've got 133 that may get RAIs and say well, you didn't reference number 90, but wait a minute, 90 you said -- you know, we think those ought to be stripped out of there, taken out. On one hand, you're saying those are generic communications, but on the other hand, you may be looking to see those referenced in the plan itself. So that's why the industry is sensitive to what is an actual reference in a legitimate.

And again, we appreciate the staff's review of our comment on the requirement to submit off-site procedures as a new requirement that I think Dan adequately discussed.

I would say the single most concern that we have brought before you is the guidance or -- we applaud the NRC and the staff for the guidance they've provided in the SRP in itself. We find that it's short on the limited guidance and expectations for the FEMA review.

The fact that, as Dan had stated, it's this, this and this. It's not included in the SRP. Our current thinking is we, as a task force at NEI, should consider developing a template for this off-site submittal. There is some consistency of review.

If there isn't a template or a standard SRP for both the on-site and the off-site, there will be a series of RAIs that will cause a great deal of confusion on what is required and what is the standard in which to be evaluated. That in time will cause delays in the whole approval process of the ALWR. And we certainly don't want this portion of it to say to be the Achilles' heel of the review process so that the process can be on time, on schedule and potentially streamlined in some manner.

Of course, we look forward to working with the NRC as well as DHS and continue our discussions in 13.3 and we will engage, we will have a first draft of 07-01, we believe next week to present it after the first of the year and seek the staff's endorsement in a Reg. Guide 1.101 as we had in the past for the EALs. In that regard, the licensee, whether it be a Westinghouse or a G.E. type model, they, in fact, will reference 07-01 as brought to maturity.

MEMBER BONACA: What kind of changes do you have because of the passive reactors on the emergency action levels?

MR. NELSON: I think Dan had mentioned the AC, what was the other one that was brought up?

MEMBER BONACA: Okay.

MR. NELSON: Marty, what was some of the -- you've been working with Westinghouse --

MR. HUG: GDC power requirements, use of digital indication versus --

MEMBER BONACA: He can't speak from there.

MR. BARSS: We had two there. These passive plans depend on large tanks of water which are new and there's a certain level which that tank may be emptied and that's a concern. So that's some of the things we're looking at.

MEMBER APOSTOLAKIS: that confuses me a little bit. Is the ASBWR a passive plant?

MR. NELSON: Yes.

MEMBER APOSTOLAKIS: The dominant contributor loss of preferred power?

MR. NELSON: Yes.

MEMBER APOSTOLAKIS: So what are we talking about here?

I mean AC power apparently is important.

VICE CHAIRMAN SHACK: If your internal events CDF is 3 times 10^{-8} something dominates.

MEMBER APOSTOLAKIS: No, but still -- no. I thought the argument was for passive plants you don't need off-site power. And here I have a passive plant where the dominant contributor is loss of off-site power. Is that something that is obvious to everyone?

CHAIRMAN WALLIS: You need more than just a passive system.

MEMBER APOSTOLAKIS: All plants have reactor systems because they don't create a mess with the passive.

MR. HUG: Marty Hug, NEI. I work for Alan Nelson. It does come in time in an accident sequence where loss of AC power and subsequently then loss of DC power would be an issue. It would be somewhere around 72 hours into the event and at that point in time the reactor would still inherently stay safe. However, the operators at that point in time because of loss of battery power would not have an available indication.

MEMBER BANERJEE: Long-term cooling always needs power.

MEMBER APOSTOLAKIS: It just strikes me as strange that the licensee says, I mean the vendor says this is what dominates the risk and the emergency plan says --

MEMBER BONACA: The point that Bill made, that's because you get down to such a low risk, you have some procedural sequences there that where you've got long term you depend on full power.

MEMBER CORRADINI: Can I broaden the discussion though just to follow the point. I want to go back to what Dana, I wrote it down as something that we might want to at least comment on, maybe not recommend, relative to 06-54 and supplements.

And you kind of said back that -- unless I wrote it down wrong, 75 percent of the current operating plants do not use 06-54 nor the supplements, but use rather the --- I can't remember what you call them, essentially the NEI action guidelines, action plans, whatever.

So let's play out the concept that his concern is which is now I've gotten to the point that the new plants, passive, quasi-passive, maybe passive, are of low enough CDF from internal events that now it's external events that dominate. What is the NEI procedure say relative to a seismic event and how would that change the emergency planning guidance?

So I'm --

MR. NELSON: It wouldn't change the off-site reaction. It would still require the same notifications, whether it be an unusual event alert or --

MEMBER CORRADINI: Right, but let me just

-- maybe you weren't in the room when Dana brought this up which I thought was a good point which is that the supplement 3 of 06-54 tends to favor, suggest to favor evacuation. What would NEI suggest when I now have flipped it and the external event which essentially wipes out all possibilities or large portions of possibilities for evacuation, what would be the guidance or how has the guidance changed with these new plant designs from the NEI side, if they would be the supplement or the substitute for what 06-54 might say.

MR. NELSON: I'm not in a position at this time to answer the question because there are studies underway. I think that would address what the margin might be. That may be a future topic that we might want to pursue.

MEMBER BONACA: Emergency Action Level is pretty much keys on loss of barrier, right?

MR. NELSON: Correct.

MEMBER APOSTOLAKIS: But about the issue, there is an assumption there, Mike, that we establish the emergency plans for the dominant contributors. That's not true, because even for existing plants, the seismic risk is very often on the same order as contribution from other events. So the question remains even for the existing plants.

MEMBER BONACA: The actual levels are based on a number of barriers that you have lost, okay, so if you have no loss of barrier and so you have a situation where you might be within the 72 hours, you're still cooling, etcetera, I don't know what the actual level will be. It will not be a general emergency. It's simply your barriers are still intact.

So the question is not so much what the event is, but what the conditions of the plants are, given a certain time. Now clearly however you get there, if you have AC power, you save the day because at that point if you have no failed barriers, you don't proceed to work through the degradation and you can cool.

I can see how the loss of power, it would, in fact, generate an event where in the long term you just can't -- you need to have power to feed and you don't have it.

MEMBER APOSTOLAKIS: Are you agreeing then that for passive systems, the requirements regarding off-site power should be reduced for at least 72 hours because the passive systems will save the day and then for long-term cooling?

MEMBER BONACA: Yes, it seems to me that that's the kind of scenario I can see here.

MEMBER APOSTOLAKIS: Why? Why?

MEMBER BONACA: Okay, because they say for 72 hours you have passive systems working, okay? Now that implies at some point after the 72 hours you're going to --

MEMBER APOSTOLAKIS: You're forcing me now to become a structuralist defense-in-depth guy. The whole thing is a defense-in-depth issue.

MEMBER POWERS: As well you should be, George.

MEMBER APOSTOLAKIS: I have always been.

(Laughter.)

MEMBER APOSTOLAKIS: I don't think this is a defense-in-depth issue. That's why you have emergency planning.

MEMBER BONACA: I was answering the question about the seismic and the point I'm making is that the emergency action levels are not based on the event. They're based on the loss of barriers that you may have --

MEMBER CORRADINI: Throughout the plant.

MEMBER MAYNARD: They're based on the likelihood of a release. They're based on the likelihood of a --

MEMBER BONACA: So whatever causes that, you know, and the reason is that otherwise you have the people speculating what will happen here. Well, fundamentally you have to ascertain if your barriers are intact, then you have to maintain cooling, but so that's --

MEMBER CORRADINI: Let me just -- maybe I'm misunderstanding. I'm trying to take notes for things that might be discussion points and I want to make sure I get it.

But what I sense from what Dana was saying before which made sense to me was if I get in a situation where the initiator is external and it changes how I would fundamentally respond external, outside of the off-site, then there's got to be some sort of appropriate guidance so that you have a diversity of how you'd respond. That's what I guess I'm getting at. So I'm kind of curious what's in the NEI version of this since I didn't realize that 75 percent of the plants were kind of taking that approach versus the 06-54 approach. That was new to me.

MR. NELSON: Let me recommend something. As we pursue the completion of 07-01, let me ask you if we can come back and give you a detailed review of the document and the process in which we can to the conclusions we had and I think I may answer a great deal of your questions. It's complete understanding of the design, the impact, the barrier approach within that design and how we've maintained the pedigree of 99-01 and the off-site response.

MEMBER BONACA: The plant will determine the emergency action level.

MR. NELSON: Absolutely.

MEMBER BONACA: The state, to which the information goes, will be determining what to do, depending on the conditions outside of the site. So therefore, they may decide, the state may decide that they're going to shelter because they cannot move quickly people out, irrespective of how bad the plume may be at some point.

MEMBER APOSTOLAKIS: Right, but the big question in my mind is this is after the fact. There is an event and I see what has happened. When I plan, because you know, that's what it's called, emergency planning, what assumptions do I make? And it seems to me that for the passive plans, the assumption is that whatever the vendor says is true, that for 72 hours, the passive system will work five and then you don't need electric power. And then that's where I get uncomfortable because defense-in-depth says what if, what if it doesn't work, what if the earthquake itself has distorted the geometry of the system so you don't get the flow that you think you would be getting? Then you say, oh my God, I made a mistake?

MR. NELSON: The fundamental question though is the design is reviewed and approved by the staff to assure, you know, that is 72 hours enough? That's one -- so the design and systems are approved and reviewed by the staff.

We're going to present EILs that match up to that approval and then the EILs and themselves 07-01 go out for public comment or will go out for the staff review and as I said we --

MEMBER APOSTOLAKIS: The point I wanted to make to your comment again is that the actual levels are not tied to the design of the plant. They're tied to the event, to the conditions of the plant which is do you have the barriers' integrity? You have cladding, you have primary site and the containment. If the answer is yes, it will not be a general emergency. If it will be a site emergency, it will be an alert, something of that kind.

Now then the accident has evolved and

there will be a response to that. This still centers around not whether it's 72 hours that will occur, whatever. It's centered around have I lost control of the barrier. When you have the first barrier penetration, you begin to lose -- then there will be an escalation of the --

MEMBER CORRADINI: Yes, I think we can continue.

MEMBER KRESS: I think, Mario, it's more of an impending loss of power.

MEMBER CORRADINI: I was going to ask for Member comments, but that's where we're going.

MEMBER KRESS: You don't wait for the barrier to be lost.

MEMBER BONACA: No, no. I understand that.

MEMBER MAYNARD: Based on the loss or the potential loss or likelihood.

MR. NELSON: Loss or potential loss.

MEMBER BONACA: Essential level is based on communication.

MEMBER CORRADINI: So now were in the discussion mode. I've heard from almost everybody, all the Members. I wanted to know if Jack or Bill or Graham or Sam would have any other discussion points?

Said, too, I apologize.

MEMBER ABDEL-KHALIK: No problem.

MEMBER CORRADINI: I missed the TV.

MEMBER ABDEL-KHALIK: I have a question regarding the concern that has been raised regarding co-locating a new reactor at an existing site and how that might open the review of an existing emergency plan.

Philosophically, if in the process of you know, co-locating a new reactor at an existing site you find a deficiency in the existing emergency plan, what's wrong with reviewing it?

MEMBER CORRADINI: This is addressed to NEI, I assume.

MEMBER ABDEL-KHALIK: NEI and/or the staff.

MR. BARSS: This is Dan Barss. The staff's answer is if we find that the deficiency in the existing plan, they're going to have to fix it. No questions are asked.

MEMBER MAYNARD: I would think that probably issue is not so much an oh my God, a deficiency. It's a review of something that maybe could be done different or maybe under the new requirements would require one thing, the old requirements are different and how do you handle that discrepancy between the old versus the new?

MR. NELSON: But not an oh my God, which way is better, but you still meeting the same objective.

MR. BARSS: And generally, the old requirements are the same requirements. It really does not change the emergency planning requirements. The only thing that changes is the timing of when we look at them, review them that is really the change, but the requirements have not changed.

MEMBER CORRADINI: Said, any other, any follow-up?

MEMBER ABDEL-KHALIK: Yes. That's fine. thank you.

MEMBER CORRADINI: Other Members? Jack?

MEMBER SIEBER: The requirements haven't changed.

CHAIRMAN WALLIS: Yes. My only question is how does all this discussion we've been having here, reflect what we're going to say about Section 13.3?

MEMBER CORRADINI: I took a lot of the notes because some of it, Dana has left the room, but I think some of what Dana's concerns are are valid, but they aren't relative to 13.3. They're relative to what is referenced and then gives technical guidance on which things are reviewed. So they're more of a discussion point, not really relative to 13.3.

CHAIRMAN WALLIS: thank you.

MEMBER CORRADINI: So Mr. Chairman, I think we're done.

CHAIRMAN WALLIS: We're done. Great. Thank you very much indeed.

MEMBER CORRADINI: Thank you very much.

CHAIRMAN WALLIS: I thank the staff too for their presentation.

We do have another major item after the break. It may last another couple of hours. We'll take a break until 10 minutes to 4.

(Off the record.)

CHAIRMAN WALLIS: Please come back into session.

I'd like to proceed with our agenda. The next item on the agenda is the state-of-the-art reactor consequence analyses, and Bill Shack is our cognizant member, and I turn to him to lead us through the presentations and discussion.

VICE CHAIRMAN SHACK: Okay. We've heard a little bit about the state-of-the-art reactor consequence analyzes in earlier presentations, but the only written documentation we have at the moment is the SECY and the SRM, and so this is our chance to find out what's been going on since the last time we heard about it, which was mostly the planning stage, and I'm just very curious to know what we will find out today.

And Bob Prato from the Office of Nuclear Regulatory Research is going to be leading the staff presentation today.

MR. PRATO: Good afternoon. Again, I'm Bob Prato. I'm the program manager for the --

VICE CHAIRMAN SHACK: You need a microphone close to you. There you go.

MR. PRATO: I'm Bob Prato, the program manager for the state-of-the-art reactor consequence analysis.

It seems like once every decade I get a project interesting enough to come in front of this distinguished panel, and certainly this --

MEMBER KRESS: Lucky you.

(Laughter.)

MR. PRATO: The consequence analysis qualifies.

I'm new to the project. My expertise is

primarily project management, but I do have a whole slew of experts sitting out in the audience, and if need be, I will call on them to help answer any questions.

PARTICIPANT: The slew?

MR. PRATO: There is a group out there. would you like me to introduce a few of them?

MEMBER KRESS: I see some experts.

MR. PRATO: Okay. The agenda today is going to be we're going to cover the code improvements. We're going to talk about plant groupings. We're going to talk a little bit about scenario selection, LNT versus threshold, and then there's going to be an emergency preparedness presentation by Randy Sullivan.

The last item is just administrative, and we'll touch on that after the important stuff is over.

Our objective is to provide the ACRS a list of code improvement plans for MELCOR and MACCS, and to inform you of our intent not to improve annular resolution for SOAR-CA. Since the development of these slides that may have changed, and I'll explain that when I get to that topic.

We also want to provide you with the plant grouping list for your information. In front of --

CHAIRMAN WALLIS: This is supposed to be an information meeting, that you're telling us what you're doing, or is this one where you expect us to contribute?

MR. PRATO: It's primarily information, but we would like feedback on certain topics. Any time ACRS has feedback, we'd like to hear it first at the meetings.

MEMBER APOSTOLAKIS: Is LNT something that I'm supposed to know what it means?

MR. PRATO: Linear no threshold.

MEMBER APOSTOLAKIS: Now I do. So that's what it is.

MEMBER KRESS: It drives all of the cancer risks.

MEMBER APOSTOLAKIS: I've got it.

MR. PRATO: We're going to also discuss the options for considering with regards to scenario selection the approach we currently intend to adopt, and we would like feedback on this subject particularly.

We're going to discuss our thoughts and opinions on applying LNT versus threshold, and again, if you have feedback on this, we would like to hear it as well.

And we plan to provide you with a presentation on the site specific simulation of off-site emergency response for SOAR-CA by Randy Sullivan.

MR. YEROKUN: If I may just try to -- I hate to interrupt early in the process, but my name is Jimi Yerokun. I'm Branch Chief in the Office of Research.

I need to clarify something. Somebody asked a question as to is this just for information. For this project, you know, one of the things we need to do, we're coming to the ACRS. We have technical issues on technical decisions we have to make as we go along. This is an appropriate junction to come here. There are some topics being discussed that we are prepared to make some technical judgments so we can move on with the project.

So it's not merely just information to the ACRS. You know, these issues, the technical concerns that ACRS might have on these issues, you know, we ar really anxious to hear those so that as we move along, you know, we don't go off and start doing this project and, you know --

MEMBER APOSTOLAKIS: This may be the final analysis. Are we writing a letter this time or not?

CHAIRMAN WALLIS: Well, these may be

rather off-the-cuff remarks because we haven't had material to study.

VICE CHAIRMAN SHACK: Yeah, that's the problem. We don't know because we have no material to look at for the meeting, except for the SECY and the SRM. So whether we'll write a letter or not sort of depends on what we happen to hear today and what we think about it.

CHAIRMAN WALLIS: We don't want to make a premature judgment if we haven't had material sufficient to reach a judgment.

MR. YEROKUN: I'm sorry. We're not asking for a --

MEMBER APOSTOLAKIS: You're not asking for that?

MR. YEROKUN: No.

CHAIRMAN WALLIS: You're not asking for a letter?

MR. YEROKUN: No, we're not asking for a letter, but --

CHAIRMAN WALLIS: Not. Okay. Thank you.

MR. PRATO: Okay. I've got a list of all the improvements, but the primary issue that we think is of interest is the annular resolution.

We had four MELCOR code improvements, and we are implementing --

CHAIRMAN WALLIS: Is this a new code, MELCORE (phonetic)?

(Laughter.)

MEMBER KRESS: The "E" gets marked off.

PARTICIPANT: It's the European version.

MEMBER APOSTOLAKIS: You got it covered already.

(Laughter.)

MR. PRATO: I'm being indoctrinated?

We had ten MACCS-2 code improvements, and we are implementing eight out of that ten for sure, but there are two that we are not, and I think these two are two that we need to discuss with you.

The wet disposition model aerosol size dependency, and that's specific to precipitation. The greatest impact in stimulation with relative inefficiency swelling, which generally is not a concern.

So the bottom line is there's very little benefit from this in our analysis, and we're putting that off as part of the max improvement project, and it's not going to be part of SOAR-CA.

The annular resolution is another issue. the annular resolution, right now the Europeans and the Asians are using 32 sectors. MACCS currently uses 16.

There were three things that initially drove us to deciding not to include it initially. There were concerns that this improvement may be driven by results rather than by technical justification. In other words, the European models have shown that when you do increase the resolution, you get a significant drop in dose, which would significantly change the outcome.

So because that was the initial report to us, it was a motivation for us to consider it for improvements, but we were concerned that that was driving the message, that it had an attractive outcome.

The other thing was this whole number of --

CHAIRMAN WALLIS: If it's more realistic, why is it bad?

MEMBER KRESS: It may not --

MR. PRATO: I'll get to that, sir.

MEMBER KRESS: It seemed to me like the choice had something to do with the fact that if you make it coarser, like 16 instead of 32, that you somehow might have accounted for meandering of the plume rather than a straight line plume. And that had some benefit in terms of accounting for that sort of thing that you really didn't account for.

CHAIRMAN WALLIS: So it's a conservatism to account for things --

MEMBER KRESS: Yeah. It's attendant to --

CHAIRMAN WALLIS: -- you might have not modeled very well or something?

MEMBER KRESS: Yeah.

MEMBER APOSTOLAKIS: What is conservative? Our way?

MEMBER KRESS: Yeah, 16 would be more conservative than 32.

CHAIRMAN WALLIS: But if you put in proper mixing, I would think it would not be.

MEMBER KRESS: Well, the mixing is in pretty well. It's just the fact that you think the plume goes in a straight line.

CHAIRMAN WALLIS: But mixing doesn't know you're going in a straight line.

MEMBER KRESS: Oh, yeah, it matters, but --

CHAIRMAN WALLIS: Well, maybe we should move on.

MR. PRATO: There were a number of

budgeting and scheduling issues. The 16 sectors is very deeply into our code, and doing the changes as well as the QA and the validation, it's not an easy task, and it would probably take a number of weeks beyond what we had initially intended to --

CHAIRMAN WALLIS: Well, if 16 is better than 32, how about eight?

MEMBER KRESS: Well, it's a judgment call.

MEMBER SIEBER: Or one.

MR. PRATO: And the third item was that we were considering other improvements that would compensate for the larger sectors. We were thinking about improving plume meander mode improvements and network evacuation models into our code.

Initially we decided not to include this, but with second thought and further investigation in the technical benefits for this, we are reevaluating it, and we had our staff at Sandia, the Sandia contractor, call the technical expert and had discussions with him, and we're going to have further discussions before we make our final decisions.

We are also investigating the possibilities of improving the schedule and the budget on this so that if we decide to go ahead with it, that we can still meet our overall schedule.

MEMBER KRESS: Meandering plume implies to me you're looking at real time, whereas MACCS is sort of an averaged probabilistic thing over a whole lot of time frames, where the plume may be going in all sorts of different directions you don't know about. I don't see the advantage of having a meandering plume in MACCS unless you're going to use it for real time analysis, and there are other codes to deal with that.

I mean, I'm giving you early input on some of these things.

MEMBER SIEBER: Well, plumes don't meander anyway.

MEMBER KRESS: Well --

MEMBER SIEBER: They go in river valleys and up the creeks and stuff like that.

MEMBER KRESS: That's right. That's right. They do that.

MEMBER SIEBER: And that's where all of the people live.

MR. PRATO: Do you want further discussion on this?

CHAIRMAN WALLIS: Can you move on?

MEMBER KRESS: I just wanted to give some input.

MR. PRATO: The next item is the plant

grouping. What you have is a list of the eight different plant classes that we've identified, and on one of the slides in the back, it shows each individual plant that was put in each group. This is being provided for your information.

If after you review this you have concerns with it, we'll be glad to address those concerns.

MEMBER CORRADINI: So there's ten plants? There's eight groupings, but one Westinghouse dry ambient, one dry atmospheric, and one dry atmospheric four-loop and three-loop. Do I have this right?

PARTICIPANT: That's all the same group.

MEMBER CORRADINI: Oh, okay.

PARTICIPANT: It's just different containment designs.

MEMBER CORRADINI: Okay. All right. So I have another question, and I apologize for this since we're still on plant grouping.

Is it thermal power that makes me worry about differentiating between a Westinghouse two and three-loop and a four-loop? I don't understand that differentiation. I mean, there's --

MR. TINKER: Charles Tinkler from the Office of Research.

Oftentimes the three-loop subatmospheric plants have been grouped separately in past PRA and various studies of this nature. So we made the distinction for the three-loop, but rather than create yet another group for two-loop plants, we elected to combine those with the three look because of the greater proximity to the same thermal rating than from the four-loop.

MEMBER CORRADINI: So it is a thermal power differentiation between Category 7 and 8.

MR. TINKER: It is a thermal power consideration with the two loops to group them with the three loops as opposed to combining them with the four loops.

MEMBER CORRADINI: Okay. Thank you, Charles.

MEMBER SIEBER: And for your information, too, the plants that are three-loop subatmospheric are no longer subatmospheric.

MR. TINKER: We are aware that two of the subatmospherics have come in with the alternate source term and then applied to go to a --

MEMBER SIEBER: Right, and it is completed now.

MEMBER KRESS: Now, when you do these, are you going to do the actual sites, the real site for those plants, or are you going to --

MR. PRATO: We'll get into those details in a few minutes.

MEMBER KRESS: Okay. I hope so.

DR. BANERJEE: Just for my information, does MACCS stick into account topography?

MR. PRATO: No. No, it doesn't.

CHAIRMAN WALLIS: It doesn't?

MEMBER CORRADINI: That would be the meandering versus the averaging.

DR. BANERJEE: No, no, just to know where the plume goes.

MR. PRATO: No, it doesn't.

MEMBER KRESS: It goes in the direction of the wind.

DR. BANERJEE: And spreads in a Gaussian way.

MEMBER KRESS: Yes.

MR. PRATO: Yes.

MEMBER KRESS: Depending on the mixture.

CHAIRMAN WALLIS: There's nothing about valleys and hills and things like that?

MR. PRATO: No.

MEMBER SIEBER: For MACCS it does.

CHAIRMAN WALLIS: But we know the plumes

do things in valleys.

PARTICIPANT: It would be a little bit more difficult of a calculation.

CHAIRMAN WALLIS: But the tone isn't to do a good calculation. It's to represent a reality reasonably.

DR. BANERJEE: But it's certainly within our capabilities today to do that.

MEMBER SIEBER: Well, I don't think they have --

MR. PRATO: Our goal for this project is not to present a conservative representation. It's to present a realistic representation, as close to realism as we can get it.

CHAIRMAN WALLIS: With no topology.

MR. PRATO: Excuse me, sir?

CHAIRMAN WALLIS: With no topology?

MR. PRATO: We have limitations.

CHAIRMAN WALLIS: Well, all the plumes I see from my house go down in valleys and things like that and around mountains.

MEMBER KRESS: It can be done.

MEMBER CORRADINI: I just want to say I'm just kibitzing with Dr. Kress. I think that would be a fairly difficult calculation.

MEMBER KRESS: It wouldn't be MACCS anymore.

MEMBER CORRADINI: No, it wouldn't.

MEMBER KRESS: It would be another code almost.

MEMBER CORRADINI: It would be much more three dimensional. It would be a much more complex calculation, particularly, and I'm not exactly sure if it was a hot release, that you would actually care that much about it relative to where it's released in the plume. So there would be --

DR. BANERJEE: There are codes which do this for chemical plants.

MEMBER SIEBER: Yes.

DR. BANERJEE: And they were developed at Lawrence Livermore, for example.

MEMBER SIEBER: Particle cell type codes.

MEMBER CORRADINI: Right, but the calculations today exist, but the calculations for Chernobyl that I've seen with Lawrence Livermore code is quite, quite substantial.

MEMBER KRESS: MACCS has probability of winds blowing in a particular direction and at different speeds, and those probabilities are averages over years times. So sometimes a wind is blowing along a valley and sometimes it's not. It's blowing another way, and I don't know how you really -- and the probabilities are developed from measurements, actual measurements at the site right near the plant, anyway.

I don't know how you incorporate topography and more details of meandering.

MEMBER CORRADINI: What you're thinking of is you'd have to do essentially a realization or a simulation and then impose some sort of arbitrary meteorological conditions that evolve, and that's not how MACCS does it.

MEMBER SIEBER: You take the wind droves and you --

CHAIRMAN WALLIS: But the Connecticut River Valley, there are drifting plumes up and down the Connecticut River Valley all the time. I see them all the time from my house, and that's where Vermont Yankee is. It seems ridiculous to do some sort of a calculation for Vermont Yankee without considering the fact that there's a major river valley there.

MEMBER KRESS: Some of that would have been reflected in the fact that the wind rows will reflect it had been blowing in that direction most of the time.

CHAIRMAN WALLIS: Well, I hope it is included in that, yeah. I hope it is.

MEMBER SIEBER: Well, I think what they're doing here is to try to do a relatively simple calculation using the best codes that they have in house, and this is it.

CHAIRMAN WALLIS: But you don't just for engineering purposes do a calculation. You do what's appropriate for the situation.

MEMBER SIEBER: Well, yeah, you can get more complex if you've got the money.

CHAIRMAN WALLIS: Okay. Well, we should perhaps go on.

MEMBER CORRADINI: Yeah, let's just move on. We sort of know where we're at here at this, and we can come to this later.

CHAIRMAN WALLIS: Can we move on from that one? Yes, thank you.

MR. PRATO: Use of core damage frequency versus release frequency. The Commission directed the staff to examine significant radiological release scenarios having essential likelihood of one in a million or greater per year as an initial focus.

With this in mind, full scope Level 2 PRAs are not available for all plants, limiting the staff's ability to select scenarios based on release frequency. For the purpose of SOAR-CA, the NRC is considering defining release broadly as early or late, large or small, on the basis of this definition: all core damage events will release in the release.

That includes core damage events that do not have containment failure. Okay? And the release would be based on normal leakage similar to what happened at TMI.

CHAIRMAN WALLIS: I think we understand this. It does not have core damage with no release at all if the containment is intact.

MR. PRATO: No, there is release.

MEMBER KRESS: No, there's some release.

CHAIRMAN WALLIS: Well, maybe there is, but it's --

MEMBER CORRADINI: It's small, but it's --

CHAIRMAN WALLIS: It's very different, yeah.

MEMBER APOSTOLAKIS: But I don't understand this slide though. It says we don't have a Level 2 PRA, which is correct. We don't. We have estimates of the frequency of large early release. So that limits the staff's ability to select scenarios.

I thought you didn't know what was being released. Do you? Because you don't have a Level 2 PRA.

MR. PRATO: We don't have a Level 2 PRA.

MEMBER APOSTOLAKIS: Right. Therefore, we don't know what?

MR. PRATO: We don't have release frequencies.

MEMBER APOSTOLAKIS: But it's not only the frequency that matters, is it? It's also what you are releasing, and you don't have that.

MR. PRATO: And I'm sure that that was included in the intent.

MEMBER APOSTOLAKIS: Okay.

MR. PRATO: It's not only the frequency, but also the materials that are being released as well.

MEMBER APOSTOLAKIS: The materials. So now the conclusion is that the staff is evaluating scenarios using the core damage frequency. You still don't have, you know, information regarding what has been released.

MR. PRATO: That's correct.

MEMBER APOSTOLAKIS: So I don't understand. I mean, let's say that the current PRAs give you a Level 2 minus, which is just the frequency of release. They don't give you the Level 2 result. By backing off that, and you're going back to the core damage frequency, somehow things become better?

MR. HUNTER: This is Chris Hunter, Office of Research.

No core is going to be used to calculate actually what is released. Basically this slide, what we're just trying to say is in house we don't have Level 2 PRAs for the plants, and this all has to do with the screening threshold on the scenarios that was given in the SRM and the Commission paper, the one in a million per year release frequency, which was given as initial focus.

So this slide, basically what we're trying to say is we can't realistically calculate in house release frequencies for scenarios. So we're going to use core damage frequency as a surrogate, and then we'll feed the scenarios into MELCOR, and that will produce actually what is released.

MEMBER APOSTOLAKIS: But the sequences that dominate core damage, are they the same as the ones that dominate releases?

MR. HUNTER: Basically what we're seeing is if we apply a threshold, we're going to see similar sequences. However, if we applied a release frequency, those numbers would drop and in some cases we might have very little or even no scenarios based on the plant class. If we use a strict ten E to the minus six release frequency.

MEMBER KRESS: The idea is that when you make the calculation of the consequences, which is what you're after, that you want to be sure you capture most of the consequences.

Now, what I hear you saying is that we can select sequences that are mostly dominant in producing those consequences just by looking at the core damage frequency and making a cutoff on the core damage frequency will not consider sequences below a certain level.

I have a little difficulty with that because the consequences involve both the frequency of core damage and the quantity released and when it's released --

MEMBER APOSTOLAKIS: And the containment.

MEMBER KRESS: -- and the containment, and I have a little problem thinking that you're going to capture the majority of the consequence, which is what I think you're after, by doing that.

Is there some systematic way you can demonstrate that that will do the job for you?

MR. PRATO: I think the point is though the Commission give us an initial starting point of ten to the minus six. If we use core damage frequency, we're going to capture everything that has a consequence, a release frequency equal to greater than E to the minus six.

MEMBER KRESS: Okay. Using what, ten to the minus six cutoff?

MR. PRATO: Yes, for core damage frequency.

MEMBER KRESS: That would be responsive to the SRM.

MR. PRATO: That's correct.

MEMBER KRESS: I'm not sure it's responsive to what you want to accomplish.

MEMBER APOSTOLAKIS: No, but this is just a frequency. I mean, so you have a sequence that ends of core damage or you take it all the way to the release?

MR. PRATO: We take it all the way through it.

MEMBER APOSTOLAKIS: But you say you don't have a full Level 2 PRA.

MEMBER KRESS: But they will. They'll use --

MR. PRATO: We plug in -- we plug in the scenario into MELCOR, and we end up with a source term.

MEMBER CORRADINI: So can I try it a different way?

MEMBER KRESS: Yeah.

MEMBER CORRADINI: Just so I've got it right and you guys will correct. So let's pick something. Let's take a loss of off-site power, just to pick an old fashioned one.

And so now you have a loss of off-site power. You get a frequency of X. It now is of low enough frequency and generating or it's of high enough frequency and generates core damage such that it's in the bin where it's going to be computed.

So now you go off and compute and you plug in the conditions from that into the set of boundary and initial conditions for MELCOR, and it goes crunching away and produces a release.

You then do a max calculation and you've got a point, and then you do that at 103 locations, and you get 103 points. Have I got it?

PARTICIPANT: Right.

MEMBER CORRADINI: Okay. So the only other part of this that I want to get clear is so that if I have a containment that's robust, you will be erring in the side of conservatism because you'll use the core damage frequency as your filter because a robust containment could have a probability of --

MEMBER KRESS: Containment would be a part of the calculation.

MEMBER CORRADINI: No, no, but I'm trying to get to the filtering, which is thou shalt not consider sequences below a certain frequency. By using the frequency measure, you're assuming all releases are essentially probability one; that something is going to be released that will be significant enough to compute.

Do I have this right?

MR. TINKER: That is correct. Now, where that falls short is if you think for a general scenario or sequence that there is a significant fraction of those plant damage states that involve an intact containment.

MEMBER CORRADINI: Say it again. I'm sorry.

MR. TINKER: If we select based on our screening criteria a general scenario and as part of that general scenario there are a number of cut sets that would involve an intact containment, we would be overstating the probability of a release.

But we stated --

MEMBER CORRADINI: Overstating or understating?

MR. TINKER: Overstating. We would be overstating the probability of a release because a probability of a release would be that frequency that we had selected minus those cut sets that involve an intact containment because various containment systems continue to function, presuming you have some ultimate heat sink that you can remove.

But in the example you gave, you know, these station blackouts, you're hard-pressed to argue that you won't eventually get containment failure in a station blackout.

Now, are there a lot of contributors to core damage that are going to loom large where you have no safety systems, no way of getting water to the reactor vessel, but you were able to somehow get substantial quantities of water and heat removal to the containment?

I guess we would want to suggest at the outset, going in at least, that they're not going to be significant contributors overall to the core damage frequency. Much has been done in the last ten to 15 years to improve flexibility in plumbing and piping systems such that if pumps are available and pumping capability is available, there are ways to redirect water to the reactor vessel.

That has pushed that differential, made that differential smaller than it once was. It will still show up once in a while, and we will look at that, and we expect to get feedback from the industry on those.

I can give you other anecdotes like the hardened wet well vent of a Mark I that can prolong survivability of the containment and turn an earlier release to a later release.

MEMBER CORRADINI: But what you're going to be missing is early versus late.

MR. TINKER: We will consider that. Okay? That kind of differentiation, that kind of distinction we will reflect in these calculations.

We expect to take these basic scenarios, ask for industry feedback on SAMGs, EDMGs so that we can capture that in the calculation.

MEMBER CORRADINI: So can I go one step --

MR. TINKER: So --

MEMBER CORRADINI: I'm sorry.

MR. TINKER: But don't confuse that with

our screening criteria to identify important scenarios.

MEMBER CORRADINI: I understand.

CHAIRMAN WALLIS: Well, that's what I'm trying to get at. We should be going beyond this screen. I'm trying to figure out what I'm being told by what's on this screen.

Is the only thing you're saying that you're going to use CDF frequency as a cutoff?

MEMBER KRESS: Correct.

CHAIRMAN WALLIS: I didn't get that message. I never got that message.

MR. HUNTER: The main purpose of this slide was in previous ACRS meetings we've said we're using release frequency because we --

CHAIRMAN WALLIS: Is evaluating scenario selection using core damage frequency, but then that doesn't tell me what you're doing with it. It's simply a screening for a cutoff value. Is that all it is?

MR. HUNTER: Yes.

CHAIRMAN WALLIS: Then it would be very nice if that had been said at the beginning.

MEMBER APOSTOLAKIS: That's inconsistent with the exchange between Mike and the gentleman here.

MEMBER CORRADINI: No.

MEMBER APOSTOLAKIS: The sequence that leads you to core damage, do you add the extra events then in the actual calculation to account for containment functions?

MR. HUNTER: Yes.

PARTICIPANTS: Yes.

MEMBER APOSTOLAKIS: So you do. It's used only to select the frequency.

MR. HUNTER: Yes, but like I said, if it is apparent from the description or if in examination of the scenario the possibility of prolonged containment integrity or permanent containment integrity is a potential outcome, it's not for a station blackout, but if the scenario involves multiple other common mode failures, but the containment could be intact, we will examine to see what fraction of those could involve an intact containment and then we would have to adjust that frequency to account for the fact that either SAMGs or EDMGs would enable that containment to remain intact for some substantial period of time.

MEMBER APOSTOLAKIS: But if I look at the ultimate result of this study, I will be able to find a sequence that says the initiating event, such-and-such a system fails. The core is damaged. Then the containment spray system doesn't work. Something else in the containment doesn't work, and you have these consequences. I will be able to find it.

MR. HUNTER: Yes.

MEMBER APOSTOLAKIS: Okay.

MR. TINKER: Now, let me just say one other thing. We are mindful that there are certain unique scenarios that may create an opportunity for more severe consequences that have a lower frequency, and we especially look at those, and we view the criteria for those in a somewhat different way.

MEMBER CORRADINI: they're not in the computation. Is that a fair way of putting it?

MR. TINKER: No. I'm just saying that, you know, the IS LOCA scenario.

MEMBER CORRADINI: Oh, okay.

MR. TINKER: A bypass scenario. Because it is fundamentally different, we do not rigorously apply that ten to the minus --

CHAIRMAN WALLIS: You say you look at them in a different way. That means you --

MR. TINKER: We look at them in a different way.

CHAIRMAN WALLIS: -- took them into

consideration and you evaluated.

MR. TINKER: Now, we don't look at them with no consideration of frequency. For example, if they have an extremely low frequency, there may be grounds for eliminating them because their frequency is incredibly low, and that's because ten to 15 years of risk analysis and examination of these issues has identified the importance, and people have taken measures to cause those scenarios to have low frequency.

MEMBER CORRADINI: I had a slightly different question, if I'm allowed. I don't know, unless people still want to beat up Charlie on this one.

So now let's say you've picked, back to station blackout. So the CDF gives you the set of initial conditions from the plant state that says, "Okay. Now, go forward and simulate."

But then George asked one thing, which is now there are certain systems that as the accident progresses, the systems will function or won't function or partially function.

But then there's uncertainties in the physics that the code doesn't know. It just computes. So how are those uncertainties going to be taken care of and how are the uncertainties going to be taken care of relative to the initial conditions that if I give a plant state, I might get -- so you know where I'm going with this -- I might have 30 percent molten, 50 percent molten, 80 percent molten. It may be a ten centimeter hole, a 20 centimeter hole, a who knows hole.

Where does that wiggle room fit into the computation?

MR. TINKER: Well, the preliminary plan was not to go down the traditional road of event trees, accident progression event trees to determine multiple end states --

MEMBER CORRADINI: Oh, okay.

MR. TINKER: -- with branch points and split fractions. The preliminary thinking for this project is that the capability exists with MELCOR to do an ordered sampling or a different sampling scheme, you know, an LHS type, Latin hypercube sampling scheme --

PARTICIPANT: A Monte Carlo --

MR. TINKER: -- so that we could simply develop -- we could examine the parameters that we think influence phenomenological uncertainty and to a degree stochastic uncertainty, how many times a valve has to lift before it fails open, actuarial data, as well as thermal data, and then for important scenarios, do an integrated uncertainty analysis on phenomenological accident progression and perhaps all the way through the MACCS calculation, as a coupled calculation.

Because typically people have done these sorts of things to look at what is principally thermal hydraulic information. How does it affect the timing of vessel failure, hydrogen generation. Those are all interesting parameters, but they're not interesting relative to release. So there may be ways to look at the uncertainty in the release pathway, the extent to which it travels to an aux. building and other buildings.

So we want to look at that a little more broadly, and the current thinking is we would examine uncertainties in that fashion.

MEMBER APOSTOLAKIS: Is there going to be a time when we will actually see some of these results at the subcommittee level?

MR. TINKER: Absolutely.

MEMBER APOSTOLAKIS: Okay. Now, I think here is an example of risk communication or miscommunication because I think you should complement this last statement there to explain what you mean by scenario. Because I think most of us, I think, thought that a scenario ends at the core damage and you said, no, it doesn't.

You're just selecting those, but then you're putting the extra events that are needed to go out.

CHAIRMAN WALLIS: Who thought the scenarios ended at core damage?

MEMBER APOSTOLAKIS: What?

CHAIRMAN WALLIS: I never thought they ended at core --

MEMBER APOSTOLAKIS: Some of us I said.

CHAIRMAN WALLIS: It's to predict releases, the whole purpose of this exercise.

MEMBER APOSTOLAKIS: You were excluded.

MEMBER KRESS: Some means more than one.

MEMBER APOSTOLAKIS: Yes.

MEMBER KRESS: I still have a question about this frequency selection on CDF. Suppose you run your Level I and find two sequences that have five times ten to the minus seven. Will you add those in as one of the --

MR. HUNTER: If they're similar. It depends. You know, looking at our Level 1, the SPAR models, you're going to have similar type sequences that give you essentially -- you have the same system unavailabilities and similar paths to core damage.

MEMBER KRESS: No, I'm assuming they're entirely different sequences, but --

MR. HUNTER: If they're that close, we'll consider uncertainty into the fact that they might --

MEMBER KRESS: So ten to the minus six is not a firm --

MEMBER SIEBER: No.

MEMBER KRESS: It's a guidance.

MR. HUNTER: Right. That's our initial focus. We're going to factor in uncertainty in those calculations, and like I said, or like Charlie says -- excuse me -- we're considering scenarios that might bypass containment or potentially have higher consequences with lower frequencies.

Right now we've preliminarily essentially lowered the threshold for those types of sequences by an order of magnitude.

MEMBER APOSTOLAKIS: You said that you don't want to go into the accident progression event trees; is that correct?

MR. TINKER: Well, I said for addressing accident progression uncertainty to determine the multiple end states that we weren't planning on using the accident progression event tree methodology, you know, the logic structure of an event tree. We have a code. We have a mechanistic code that we can use to examine those rather than arbitrarily assigning a split fraction and then arguing about split fractions and the effect of the split fraction.

To a large extent, we think we can parameterize that uncertainty.

MEMBER APOSTOLAKIS: Why do you say arbitrarily? I mean, why should it be arbitrary? Is that what 1150 did? It was arbitrary?

VICE CHAIRMAN SHACK: It relies less on judgment.

MEMBER APOSTOLAKIS: Yeah, right.

CHAIRMAN WALLIS: I must say through all of this I am praying for a structured presentation so that I can be led through so that I can understand what is going on. With all of this question and answer and dancing around all kinds of stuff, I really need to be led through something here.

VICE CHAIRMAN SHACK: This is almost the heart of it though. I mean, to get to this core damage frequency and then to go through the MELCOR calculation to the release is --

CHAIRMAN WALLIS: That's trivial?

VICE CHAIRMAN SHACK: No, no.

CHAIRMAN WALLIS: That's all trivial?

VICE CHAIRMAN SHACK: No, no, that's very instructive to understand what they intend to do.

DR. BANERJEE: Do you take seismic into account?

MR. PRATO: We're going to be talking about that as well, sir. We've got a number of options. We can set those options, and then we're going to tell you what our --

CHAIRMAN WALLIS: would it be useful to return to the structured presentation that you prepared? Would that be useful?

MR. PRATO: It might be.

MEMBER APOSTOLAKIS: Now, Graham, what was the probability that the speaker would say no?

(Laughter.)

DR. BANERJEE: If he had good judgment.

MR. PRATO: Selection of scenarios. This slide shows you the tools that we have available to us. We have 103 up to date SPAR models, and we have 13 external events SPAR models that are up to date. Other than that, for seismic, we have 37 IPEEE PRAs that are 1996 vintage old information, as well as 66 seismic marginal analysis which are 1996 vintage information.

For IRIS, we have 23 PRAs and 85 methods, methodology that EPRI developed that also is old information. It dates back to 1996. And that's what we have available to us right now.

So let's talk about scenario selection.

MEMBER APOSTOLAKIS: So what does this slide mean now?

MR. PRATO: Which one?

MEMBER APOSTOLAKIS: The one that's on the screen now.

MR. HUNTER: The purpose of this slide is just to show you our current in-house limitations of what we have, especially concerning external events.

MEMBER APOSTOLAKIS: You don't have NUREG 1150?

MR. HUNTER: We do, but since we're trying to look at all 103 sites, you're looking at a very limited scope with essentially four plant left.

MEMBER APOSTOLAKIS: But are you implying here that margin analysis is useful to you?

MR. HUNTER: It's not going to be applying a screening threshold because there's no quantified data. The sole purpose of this slide was just to show you what we have currently in house.

MR. PRATO: And why our options are what they are and why we're going to proceed in the direction we plan to proceed in right now. Okay?

CHAIRMAN WALLIS: So this might constrain what you can do, right?

MR. PRATO: Right now that's correct, sir, without additional information.

CHAIRMAN WALLIS: Okay.

MR. PRATO: We've had a number of options, and when we went through all of those options, we came up really with only two that are viable.

CHAIRMAN WALLIS: Where does FAR fit in this?

MR. PRATO: Excuse me?

CHAIRMAN WALLIS: Does FAR fit into this at all?

MR. PRATO: It will, sir.

CHAIRMAN WALLIS: It does?

MR. PRATO: It will. I'll show you in just a moment.

CHAIRMAN WALLIS: Okay.

MR. PRATO: Okay? Okay. The two options that we feel are viable is internal event CDF with uncertainty considerations and internal event CDF with uncertainty and external event considerations.

As we go through the next couple of slides, please keep in mind that the real issues are how do we select the scenarios. For example, do we consider external events?

And the other is do we do scenario selection by class of plant or by individual plant, and those are the two questions we have to wrestle through to get through to where we came up with the methodology that right now we're considering to proceed on.

MEMBER APOSTOLAKIS: So why isn't there a third bullet, internal events and external events CDF?

MR. PRATO: We do have one. Internal events CDF with uncertainty and external event considerations.

MEMBER APOSTOLAKIS: Considerations, but why not external events CDF? There are some plants --

MR. HUNTER: The reason why we're being a little bit vague about that is because right now we won't have core damage frequencies assigned for all external events, including seismic. So we're going to have to do that in a slightly different manner than our internal event core damage frequency estimates.

MEMBER APOSTOLAKIS: But there are

estimates for some plants of the seismic and fire contribution.

MR. HUNTER: Correct. There's essentially 33 sites have submitted size of PRAs.

VICE CHAIRMAN SHACK: I mean, when you have the seismic PRA in the file you'll use it. For the others you'll have to take an estimate of whether a seismic CDF from this plant is okay to use for the plant that I don't have a seismic on.

MR. HUNTER: Correct. What we're wrestling with is can we apply essentially plant class or industry-wide data from the limited sources of quantified data that we have, especially seismic.

CHAIRMAN WALLIS: Can I go back to my --

MR. PRATO: I remind you that 37 seismic PRAs we have in house is old information. It dates back to 1996 and it really hasn't been updated since.

CHAIRMAN WALLIS: Fires are not internal events; is that right?

MR. HUNTER: No, fires are considered external events.

CHAIRMAN WALLIS: So, again, I don't understand why it's not here.

MR. PRATO: It's being considered.

CHAIRMAN WALLIS: It's not. It doesn't

say anything about fires on this slide.

MEMBER APOSTOLAKIS: External events.

MR. PRATO: External events, sir.

MEMBER KRESS: The second bullet.

CHAIRMAN WALLIS: Oh, it's enclosed in external events.

MR. HUNTER: Yes.

CHAIRMAN WALLIS: Ah, thank you very much. But are they just considered? You don't look at the FAR CDF?

MEMBER APOSTOLAKIS: Well, they said that if they have it they will.

VICE CHAIRMAN SHACK: If they have it they do.

CHAIRMAN WALLIS: When they have it they did. Well, it may be --

MEMBER APOSTOLAKIS: "Consider" is a very broad term.

PARTICIPANT: And they'll estimate when they don't.

MEMBER SIEBER: But look at this. One hundred and three --

CHAIRMAN WALLIS: I know, but I'm just trying to figure out why you have a list of options that doesn't put down fire when fire is often bigger than internal events. That's what puzzled me. Okay.

MR. PRATO: I'm going to refer you to these two slides back in your package. I'm going to try to put them up on the screen here.

MEMBER APOSTOLAKIS: On the long paper; is that --

MR. PRATO: Yes, sir.

VICE CHAIRMAN SHACK: And the muddy colors.

MEMBER APOSTOLAKIS: Multi-colors.

VICE CHAIRMAN SHACK: Muddy colors.

DR. BANERJEE: Let me ask you a question which some of us are puzzled by. Why did you pick these classes rather than doing at least initially a pilot project for a specific plant? Was there a reason for that, plants about which you have a lot of information?

MR. PRATO: And basically that's what we're going to be doing. We have a reference plant, and then we're going to have a group of -- right now we're thinking about the first initial group of three or four plants from each of the first two, the Westinghouse four-loop and the BWR --

DR. BANERJEE: You are going to speak specific plants and do it?

MR. PRATO: Yes.

CHAIRMAN WALLIS: Could I get this from some member of the public point of view? I mean, you want to consider anything that's important in evaluating the consequences, don't you? And all of these technologies of how you're going to choose this and the next thing, really the only thing that's important is that you have really picked out what matters. That's the only thing that's important to the public.

You have analyzed what matters. Is that what you've done here?

MR. PRATO: With the limitations that we have.

CHAIRMAN WALLIS: Is that what you've done here?

MR. PRATO: We do have limitations.

CHAIRMAN WALLIS: But, I mean --

MR. PRATO: There are code limitations.

CHAIRMAN WALLIS: -- all of this business about picking scenarios and stuff doesn't tell the public anything about the fact that you have covered what matters, does it?

MEMBER APOSTOLAKIS: Within your limitations, will you be confident that you will have captured what matters?

MR. PRATO: I believe so, but you have to --

CHAIRMAN WALLIS: Is that clear?

MR. PRATO: -- go through a process to get to the information in this matter.

CHAIRMAN WALLIS: Is that clear?

MR. PRATO: Part of that process is determining how we're going to present that information and how we're going to group that information.

MELCOR, sometimes their runs are in days. MACCS right now on the average is ten hours per run.

CHAIRMAN WALLIS: Well, when you write your final report, I hope you make it clear that this process, which is somewhat confused to me, really does cover what matters.

MEMBER APOSTOLAKIS: At least it's conservative.

CHAIRMAN WALLIS: Right. Okay.

MEMBER APOSTOLAKIS: That's what you mean, that it's sort of a bounding analysis.

CHAIRMAN WALLIS: You have actually looked at things and you've covered the things that matter.

MR. PRATO: We certainly are, sir.

CHAIRMAN WALLIS: You haven't excluded things that are important. That's a very simple thing to say.

VICE CHAIRMAN SHACK: To say, yes. To do, that's another.

CHAIRMAN WALLIS: You seem to be making excuses for why you can't do the proper job. Maybe I should be quiet, but I'm puzzled by what you're saying here.

MEMBER APOSTOLAKIS: So are you going to explain to us this screen?

MR. PRATO: Yes, sir. The important piece on this slide, there were two items I think that are important to point out. The one that's to scale down here, that shows what the color coding represents, and then if you look at the note, Note 1 and 2, the relatively high ATWS CDF for Plant 2 and 10 are due to the conservative modeling assumptions contained in these SPAR models. These modeling artifacts are currently being corrected.

Okay. So what we're trying to let you know is that we don't believe that these will fall in the red area, but will probably fall in the green or the yellow.

And the second item --

MR. HUNTER: Bob, if I may interrupt.

MR. PRATO: Go ahead.

MR. HUNTER: Basically this is the core damage frequencies for the dominant scenarios or maybe even on the initiating event basis. Basically what we're trying to just show you here is just what the SPAR models are generating and show the different scenarios on a per plant basis within the first two plant groups.

That's all we're really trying to show and basically what we're saying is the initiating events or scenarios that are colored green are basically you're looking at they're particular less than 5E minus seven or in a lot of cases a lot lower than that.

CHAIRMAN WALLIS: So you have picked seven scenarios which matter.

MR. HUNTER: No, we're not trying to say we're picking seven scenarios.

CHAIRMAN WALLIS: Well, where did these seven scenarios come from? Why did you choose them and how much of the total --

MR. HUNTER: That's basically the dominant scenarios that are coming up, the --

CHAIRMAN WALLIS: And they cover 95

percent of the likely releases or what?

MR. HUNTER: What we're basically trying to show is per scenario, per plant, the core damage frequency estimated per plant, and from that we're trying to essentially get an overall plant group look to see what really the dominant scenario is per the class.

CHAIRMAN WALLIS: Now, just talk right into plain English. You've looked at seven possible accidents, which cover --

MR. HUNTER: No, we looked at --

CHAIRMAN WALLIS: -- a certain percent of the possible hazard to the public.

MR. HUNTER: We looked at the entire internal events model. Basically what we're saying is if there's -- there's probably more scenarios than this. Well, there are more scenarios. However, they are a lot lower and pretty much off the map.

These are essentially -- they were either a dominant scenario for multiple plants or just one or two plants. All we are trying to show is in some cases you see essentially reds for every plant, and in some cases you see a mixture, and there's plant specific differences for the mixture.

CHAIRMAN WALLIS: How much of the picture are you covering doing it this way? Are you omitting 50 percent of what matters? Are you omitting five percent of what might matter or what?

MR. HUNTER: This is the entire internal events modeling. So, I mean, this includes LOCAs, ATWS, station blackouts.

MEMBER APOSTOLAKIS: No, I think the question is you list seven scenarios. If I add the frequencies of these scenarios, is it 95 percent of --

MR. HUNTER: It's about 95 percent of the core damage frequency.

CHAIRMAN WALLIS: And is that 95 percent of the situations where you actually release significant radioactivity?

MR. PRATO: Those that exceed one in a million per year, one to the tenth to the minus sixth. It includes them, yes, sir.

MEMBER CORRADINI: I think the way I'd answer it is yes, because if I assumed a probability of containment failure of one, it's still in that less than five percent category. That's the way I'd think of it, Graham, right?

CHAIRMAN WALLIS: Right.

MEMBER CORRADINI: In other words, let's say there's Scenarios 8 through 30 that they're not --

CHAIRMAN WALLIS: I'm just trying to think that if I go back home and try to explain to my colleagues what you've done, how do you put it into plain English, right?

MEMBER CORRADINI: Well, let me try because this is my way of trying to understand the answer.

The answer is all of the greens are too low. All of the yellows are maybe too low. All of the reds are definitely worrisome, and then if you ask about completeness, Scenarios 8 to upty-ump are there, but their probabilities are so low, and even with a probability of --

CHAIRMAN WALLIS: Even if you have a big consequence we don't have to worry about it.

MEMBER CORRADINI: Even though the probability of containment failure is one, the probability is still a small percentage.

But that hasn't answered the second part of your question, which is even though the probability is less than something or other, it still may have a very large consequence.

CHAIRMAN WALLIS: Right.

MEMBER CORRADINI: Okay? So there's a tail. There's a tail in this, whatever the --

CHAIRMAN WALLIS: So if I'm risk averse in some way, I might want to conserve those a swell. Right. Okay. So I'm very interested --

MR. PRATO: And again, we're using the guidance of the Commission to initially start with one --

MEMBER APOSTOLAKIS: Right.

MR. PRATO: -- to the minus six, and this is more conservative because it is CDF, not release frequency.

MEMBER APOSTOLAKIS: Now, the total CDF that is listed on the second column, is this the mean value?

MR. HUNTER: It's a point estimate.

MEMBER APOSTOLAKIS: Yeah?

MR. HUNTER: It's a point estimate.

MEMBER APOSTOLAKIS: What does that mean? It's a mean.

MR. HUNTER: Something like a mean value.

MEMBER APOSTOLAKIS: Something like a mean.

MR. HUNTER: It will be very close to the mean.

MEMBER APOSTOLAKIS: Okay. Now, the slide before said use SPAR or whatever, factoring in uncertainties. So how would you factor in uncertainty here?

MR. HUNTER: Basically what we're trying to say here typically you're looking at uncertainty factors of possibly two or three in natural parameter uncertainty if you're calculating it, and how we're saying this is essentially if we factor in uncertainty, we're going to assume that the yellows are essentially reds. That's how we're kind of using it.

MEMBER APOSTOLAKIS: I see.

MR. HUNTER: So essentially, scenarios that are close to the threshold but are below, factoring in uncertainty, they're going to be essentially we're going to consider them above the threshold.

MEMBER APOSTOLAKIS: Okay.

MR. PRATO: Let me move on to the BWR slide, please. And I'm going to walk you through.

CHAIRMAN WALLIS: So it's very interesting that the failure of the core CP seals LOCA (phonetic) is more significant than al these other LOCAs?

MR. PRATO: That's the latest information according to SPAR.

MR. HUNTER: Yes, large CP seal LOCAs will dominate because it can be generated from blackouts and, you know, losses of service water. You see it in many different --

CHAIRMAN WALLIS: All these other LOCAs we've been fascinated with for years are irrelevant?

MR. HUNTER: Pretty much.

(Laughter.)

MR. HUNTER: From a risk standpoint, pretty much.

CHAIRMAN WALLIS: That's because you've done such a good job of protecting against them. Is that it?

MEMBER APOSTOLAKIS: So let me ask a question. Are you on the BWR?

MR. PRATO: Do you want to go back to the page, sir?

MEMBER APOSTOLAKIS: Yeah.

MR. PRATO: It's just a --

MEMBER APOSTOLAKIS: Yeah, it really doesn't matter what. If I look now at Scenario 6 for -- yeah, the Scenario 6 is loss of service water or component cooling water with failure of the reactor coolant pump seal and I have a LOCA.

MR. HUNTER: Correct.

MEMBER APOSTOLAKIS: Now, this sequence

takes me to core damage.

MR. HUNTER: yes.

MEMBER APOSTOLAKIS: So this will be supplemented by additional event if they're into containment before you do your calculations?

MR. HUNTER: Right. We'll have to factor in the -- yes. This won't work because essentially you might be without containment spray, but you'd have coolers and other such mitigation factors.

MEMBER APOSTOLAKIS: So this is not verbatim the scenario you're analyzing.

MR. HUNTER: No, this is just explaining up until core damage, all of these --

MEMBER APOSTOLAKIS: I understand that. So this is not the scenario that will lead to consequences. You will have to consider additional containment functions.

MR. HUNTER: Yes.

MEMBER APOSTOLAKIS: Yes. Okay. Very good. Now I understand.

CHAIRMAN WALLIS: Is surface water a safety significant system?

MR. HUNTER: It's a support system that essentially feeds --

DR. MAYNARD: Some plants call it surface water. You have to put in a -- there's a service water and an essential service water, and it is that safety related or essential service water part that is important to safety.

MEMBER APOSTOLAKIS: Yeah, this is what I'm --

CHAIRMAN WALLIS: That's sort of extraordinary though. I mean, here's something like surface water, which is just of the faucet.

MEMBER APOSTOLAKIS: This is one of the --

CHAIRMAN WALLIS: And there's the seals of a pump. There's the seals of a pump, which is really not a major part of the system at all, and yet you've got more reds in that column than you've got in almost all of the others.

MEMBER APOSTOLAKIS: Yeah, that's right. This is one of the great results of the reactor safety study, Graham, the importance of the support systems.

CHAIRMAN WALLIS: Yeah, I realize that, but it's so extraordinary that these things turn out to be much more important than all of these safety systems we worried about so much.

MEMBER APOSTOLAKIS: Right. This was a great insight, and it has been confirmed many times by industry response from PRAs.

MR. PRATO: Okay. Let me walk you through a simple process. Okay? Let's take 5(a). Okay. What we're going to do is we're going to have a reference plant, and we're going to run that reference plant through MELCOR and come out with a source term for each one of these dominant scenarios.

MEMBER APOSTOLAKIS: Yeah.

MR. PRATO: And then we're going to take the input from each plant, each individual plant, put the input into MACCS using the source term from the reference plant, okay, and run our MACCS calculation to determine consequence. Okay? that's our intent.

The question is, okay -- I'll go back to the previous question -- when we identify the dominating scenarios, okay, do we run every single plant through that exercise or do we leave out Plant No. 9 because it's green?

Now, if you look at the BWR scenarios, if we did it based on individual plant, we would have to leave out Plant 16 because it's all green, and there would be no consequence to report for that site.

If we base it on class of plants and run the dominating scenarios for all of those plants within that class of plant, we will have a consequence analysis for each. It will be linked to the frequency, but the bottom line is it's the only way we're going to get consequences for all the plants, is if we do it by class of plant.

CHAIRMAN WALLIS: What is black on this picture?

MR. HUNTER: Black in this picture typically means it's a plant specific scenario. Typically the SPAR models in their benchmarking process have identified a specific action or specific licensee PRA modeling.

CHAIRMAN WALLIS: Is black worse than red or better than green?

MR. HUNTER: Black is not modeled.

MEMBER SIEBER: It doesn't exist.

CHAIRMAN WALLIS: It doesn't exist.

MR. HUNTER: Yes.

CHAIRMAN WALLIS: So it's just a maybe. You don't know. Black is a don't know?

MR. HUNTER: It's a no.

PARTICIPANT: Black in a non-modeled event.

MR. HUNTER: Right. It's a non-modeled event. It's actually an attempt by the SPAR models to match the licensee --

CHAIRMAN WALLIS: Does that mean that

they're not important or it just means you can't do them?

MR. HUNTER: Not applicable.

PARTICIPANTS: Not applicable.

MEMBER APOSTOLAKIS: I think it makes sense, what they're doing.

VICE CHAIRMAN SHACK: So far so good.

MEMBER APOSTOLAKIS: Yeah, I mean, with the last explanation it makes sense to me.

MR. PRATO: Okay. Now, the question is --

MEMBER APOSTOLAKIS: I mean, I wanted to make a positive statement.

(Laughter.)

CHAIRMAN WALLIS: You mean having black holes is a positive --

MEMBER APOSTOLAKIS: I'm sorry?

CHAIRMAN WALLIS: You mean having black holes makes sense? Is that what you mean?

MEMBER APOSTOLAKIS: Well, that's what the RAC said.

MR. HUNTER: Now, the real question is looking at these, these are internal events only. These are generated just from the spire mouse (phonetic) right now. So how do we integrate the external event, what we have, the information we have?

MR. PRATO: And our intent is to do an information to licensees, ask the ones that have updated their information. Based on the information that we get from the updated Level 3 PRAs, we will come up with a mean and apply it to the plants that don't have updated information.

MEMBER APOSTOLAKIS: What is the ultimate goal of this? You calculate the consequences and then?

MR. PRATO: The ultimate goal is to find a source term for each plant, for each applicable scenario, and run that source term to max for each plant to insure that -- to get a consequence.

VICE CHAIRMAN SHACK: But you're still debating over whether to compute source terms for classes of plants and then do the max calc. on an individual basis or to do --

MR. PRATO: We have --

VICE CHAIRMAN SHACK: -- source terms for each plant.

MR. PRATO: We got kind of limited for that. We're limited in the plants we can do because of the time it takes to run them.

MR. HUNTER: It complicates things because as we showed, we have limited information on external events for every plant. So it does simplify it if we can look at it on a class-by-class basis for external events.

MEMBER APOSTOLAKIS: My question was not answered. So, okay, you calculate the consequences. Now what? Is somebody going to make a decision of some sort or are we just calculating this?

MEMBER CORRADINI: This is essentially -- I thought they told us whenever it was, in September --

MEMBER APOSTOLAKIS: Yeah.

MEMBER CORRADINI: -- it was essentially a replicate of the siting study where the siting study showed.

MEMBER APOSTOLAKIS: right.

MEMBER CORRADINI: So is that not the point of all of this?

MR. PRATO: It is, but we're considering other things.

MEMBER APOSTOLAKIS: Like?

MEMBER CORRADINI: Like, yeah.

MR. PRATO: First of all, I believe the siting study only used LNT. We're going to include other thresholds.

MEMBER APOSTOLAKIS: Okay.

MR. PRATO: And we're going to get to that in just a minute. And then we're considering other ways of presenting the information. We don't want a range of consequences. We would like to try to combine that and come up with a single consequence, and we have been directed by the steering committee to try and figure out a way to do that, and we're not ready to present anything on that approach.

MEMBER APOSTOLAKIS: No, but my question is -- maybe you mentioned it at the beginning. I wasn't here. After the study is completed --

MR. PRATO: Yes, sir.

MEMBER APOSTOLAKIS: -- who is going to us it for what purpose?

MR. PRATO: We had a variety of purposes. I'm sorry I didn't write them down, but the bottom line, this -- Jason, do you remember the list of purposes and potential applications?

MR. TINKER: Well, the original SECY has a section that talks about potential regulatory uses.

MEMBER APOSTOLAKIS: Okay. What?

MR. TINKER: Well, other than, you know, the important aspect of providing an updated picture of the consequences, it is believed that this kind of work could provide new insights into those aspects of behavior that dominate consequences by inference, by inference risk, although this is not strictly speaking a risk study.

MEMBER APOSTOLAKIS: Right.

MR. TINKER: So to the extent we want to improve our understanding of what now dominates the consequences, it provides the technical basis for prioritization of future activities to examine where you might want to achieve improvements.

MEMBER APOSTOLAKIS: Improvements --

MR. TINKER: Improvements in both performance and understanding.

MEMBER APOSTOLAKIS: But, for example, would you say that maybe the SAMGs need some changes or is that out of the question?

Would the emergency planning need some?

MR. TINKER: If practical and feasible changes were identified that could alter the path of some of these calculations, if these analyses point to such opportunities, then they would be a subject for more discussion, but you know --

MEMBER APOSTOLAKIS: But there is no specific goal at this time. It's just do it, gain the inside, see what you have.

MR. TINKER: Well, we think -- we think

we're providing a realistic picture of the consequences from the important scenarios is an important outcome in itself. But we would also see this as an opportunity to improve our risk communication with the public, with all our stakeholders, and like I said, to the extent it provides a vehicle for examining where additional improvements in analysis could take place, while this is state of the art, it will still probably identify areas where some improvement may be warranted to further understand.

CHAIRMAN WALLIS: But, Charlie, for instance --

MR. TINKER: You're going to that state at the end of all of these calculations. We would expect that to be at the end of this set of calculations.

CHAIRMAN WALLIS: Well, Charlie, for instance, if you look at Scenario 4, which has the most of the reds, you might say, well, maybe something is to be done about RHR reliability.

MR. TINKER: Yes, but I'll caution you. The fact that it shows up high in CDF does not necessarily mean it's going to have significant --

CHAIRMAN WALLIS: But that's what's confusing about using CDF all the time.

MR. TINKER: It is still the screen. Okay? But we will do the consequence calculations, and if the consequence calculations for particular scenarios reveal a strong uncertainty influence or where there may be, you know, something that becomes apparently from examination of the SAMGs or EDMGs, they would be the subject for any further discussion.

But myself personally, a personal view, it provides an excellent vehicle for examining the EDMGs, extensive damage mitigation guidelines.

MEMBER APOSTOLAKIS: Right. Okay.

MR. TINKER: New measures that have been put in place at the plants in the last several years. This provides a vehicle for systematic evaluation of those through the important scenarios.

MEMBER APOSTOLAKIS: So you may even relax some of those?

MR. TINKER: I didn't say that.

MEMBER APOSTOLAKIS: I know you didn't. That's why I'm asking.

(Laughter.)

MR. TINKER: No, no.

VICE CHAIRMAN SHACK: Effectiveness, George.

MR. TINKER: No, but I mean, those

additional measures -- and they are important measures -- were done under a different umbrella and were not done looking through the full gamut of scenarios, and this is a vehicle for doing that, and frankly, it's the vehicle by which we can assess the true magnitude of the benefit of those measures.

We believe those measures have benefit, but we do not know the full extent. They may prove to be much more beneficial than we realize at this point.

VICE CHAIRMAN SHACK: How did the SAMGs work into this now? You're getting to a core damage state and then MELCOR takes over.

MR. TINKER: Well, this tells us our going in plant damage state. That plant damage state will be modified by SAMGs or EDMGs. Operators may bring in other systems. Operators may use cross-connects.

VICE CHAIRMAN SHACK: So you'll end up doing multiple calculations for these things then.

MR. TINKER: There could very well be iterations on some of these.

MEMBER APOSTOLAKIS: And I suspect what's going to happen is that ten years from now after this has been completed, where we have a similar project, calculate the actual risk and then Tom Kress will be so happy, right?

MEMBER KRESS: If I'm still alive.

PARTICIPANT: He'll still be alive.

VICE CHAIRMAN SHACK: Maybe we'd better move on.

MEMBER APOSTOLAKIS: But, Graham, these reds have been known all along and the decisions have been made not to do anything about it. So that's not the issue here. This is just a selection of the scenarios because look at the actual. I mean, at some point you have to say, you know, that risk is low enough.

CHAIRMAN WALLIS: But it's going to look rather strange to the public, the things you --

MEMBER APOSTOLAKIS: Well, the public has to learn a little bit, too.

CHAIRMAN WALLIS: More loss of water from the faucet essentially.

(Laughter.)

MEMBER APOSTOLAKIS: Use different shades of green then. What can I tell you?

MR. PRATO: Okay. So that was the first option. Our two options were to use just uncertainty or to use external events, and we went through the external events. We plan to incorporate external events. We're going to ask for updated --

VICE CHAIRMAN SHACK: Assume that first option was a strawman, right?

MR. HUNTER: Yes, yes. We're going to be factoring uncertainty, and we're going to factor in external events. We just don't know to the extent of how we are going to factor in external events yet.

MR. PRATO: And our current plan is to request information from the licensee. Those that have updated information will incorporate it appropriately, and those that don't will come up with a mean and include those in the blanks that we have for external events.

We believe that this is our best approach. It's a relatively simple approach for plants with no external event PRAs. There's just no other way we can consider external events if we don't have an alternate means of including it for those that have not updated the PRA.

We don't have a feel yet for how many have or have not updated it, but we'll provide you with that information as we go along.

CHAIRMAN WALLIS: Now, you didn't have anything on your big charts with reds and greens about fires.

MR. PRATO: What was that?

CHAIRMAN WALLIS: In your reds and greens, you didn't have the external events include fires, and we know that fire PRAs tend to give similar CDFs to these internal events PRAs, right?

MR. HUNTER: Correct.

CHAIRMAN WALLIS: So if you're using CDF as a screen, you ought to consider --

MR. HUNTER: And we are.

MR. PRATO: Right now we just don't have the external event information, and we wanted to present you with a basic approach with what information we had.

MR. HUNTER: We'll have a similar chart.

MR. PRATO: This will be updated. That drawing will be updated.

CHAIRMAN WALLIS: You'll have a similar chart for fires?

MR. PRATO: No, we'll have --

CHAIRMAN WALLIS: The various scenarios produced by fires?

MR. HUNTER: What we'll have is we'll have preliminary looks. Fires are going to give you very similar scenarios to what we already have. They're going to -- the dominant fire scenarios are typically going to give a similar trend as to what we're seeing in internal events.

In regards to seismic, because of essentially the 33 plants that essentially had IPEEE center PRA submittals, we're going to have to look at those a little bit differently.

CHAIRMAN WALLIS: You're going to take these fire scenarios and put them through MELCOR and all of that kind of stuff?

MR. HUNTER: It might be a sensitivity case. If it turns out to be where the MELCOR run for those type of scenarios are different than the internal event scenarios, we'll look at what's dominating. You know, if we have essentially low E to the minus six but the external event scenario is actually going to have a higher core damage frequency, but also be more limiting in the cases of recovery and equipment available. So we'll take in those factors.

CHAIRMAN WALLIS: Can we move on?

MR. PRATO: Yes, sir.

That brings us to LNT and thresholds. The Commission directed the staff not to solely rely on conservative collective dose models. They told us to use a range. In our plan to implement the guidance, the direction from the Commission, we identified a range of zero to five rem and the Commission approved that plan, in the SRM.

MEMBER KRESS: Question. When you make the max calculations for the cancers, you stop at some distance?

MR. PRATO: When you use LNT, it goes all the way out to 1,000 months.

Okay. Go ahead.

MR. SULLIVAN: Randy Sullivan.

Distance is an input parameter. It's a decision we have to make, what distance to choose.

MEMBER KRESS: Isn't that equivalent to using a threshold?

MR. SULLIVAN: It is, but really we want to address the threshold issue as the threshold issue and the distance issue as the distance issue.

MEMBER KRESS: So you can make the threshold determine your distance. Is that the way you plan on doing it?

MR. SULLIVAN: No. I mean --

CHAIRMAN WALLIS: The threshold is zero. It's a pretty long distance.

MR. HUNTER: But they don't have to be internally consistent though.

MR. SULLIVAN: There's several reasons to choose a distance, the accuracy of models, what you're attempting to do, et cetera, et cetera. One byproduct of choosing a distance is that you reduce the number of tiny doses that are given to a lot of people, but really we're attempting to address the threshold issue as the threshold issue and the distance issue as the distance issue rather than use one as a surrogate for the other.

I don't know that we're prepared to go all the way into that, but we can discuss it as much as --

MEMBER KRESS: I think it's a good idea to separate them. We use the same set of -- use a set of thresholds for the same distance. It gives you an idea of what the threshold means.

MR. SULLIVAN: That's true.

MEMBER CORRADINI: So if I could just get to say it differently. So these will be sensitivities. The distance will be a sensitivity and the threshold will be a sensitivity on certain select cases.

MR. SULLIVAN: That's not quite our intent. We will choose a distance. It will be based on judgment and arguments, and we haven't done that yet, but we're on it, and we're --

CHAIRMAN WALLIS: What sort of distances are you likely to pick?

MR. SULLIVAN: Fifty-two, fifty or 1,000.

CHAIRMAN WALLIS: Miles?

MR. SULLIVAN: Right.

MEMBER KRESS: Yeah, those are traditional numbers.

CHAIRMAN WALLIS: Thank you.

MR. SULLIVAN: And we're struggling with that. We don't know the answer right now.

CHAIRMAN WALLIS: Now, in terms of this threshold, it's not just the threshold you need, but where do you go when you start up from the threshold? How do you leave the threshold and how do you get onto some curve which you believe?

MR. SULLIVAN: I'm prepared to discuss threshold a bit if you'd care to.

CHAIRMAN WALLIS: I'm just curious about how you get from the threshold to --

MR. SULLIVAN: I didn't understand your question.

CHAIRMAN WALLIS: Well, first of all, it tells you when you start, right?

MR. SULLIVAN: No.

CHAIRMAN WALLIS: Where do you go from there?

MR. SULLIVAN: No. It's two separate

subjects. Distance is a subject. When we --

CHAIRMAN WALLIS: No, I'm talking about threshold. Distance is irrelevant.

MR. SULLIVAN: Fine. Right now the linear no threshold model is used internationally as I'm sure you know.

CHAIRMAN WALLIS: Goes down to the origin. It's a straight line.

MR. SULLIVAN: Exactly.

MEMBER APOSTOLAKIS: A straight line to the origin.

CHAIRMAN WALLIS: And there's no threshold. You have to figure out how you get up to the straight line from the threshold.

MR. SULLIVAN: Oh, well, that's what we're going to have to figure out.

CHAIRMAN WALLIS: So vertically up to the threshold from the --

MR. SULLIVAN: We're going to use zero threshold and five rem.

CHAIRMAN WALLIS: And then you go vertically up to the straight line?

MR. SULLIVAN: No, and then something in between.

CHAIRMAN WALLIS: Oh, so you have a curve of some sort.

MR. SULLIVAN: But we're not going to present a curve. The idea on the table, we're considering methods. It would be -- one method is to publish a range. One method is to pick a threshold. Right now what we're discussing is perhaps an expert elicitation to do something in between, but the staff is struggling with that. That's not decided.

Did that answer your question at all?

MEMBER APOSTOLAKIS: Is there any evidence that would say that, say, five rem is a likely threshold? I mean, you're treating it completely as a sensitivity parameter.

MR. SULLIVAN: It's almost a matter of conviction. The major international groups have decided that there is not enough evidence to do away with linear, no threshold. However, there are many people and societies, the Health Physics Society, in America, the French that feel that some threshold is appropriate.

MEMBER APOSTOLAKIS: But it's not specified.

MR. SULLIVAN: But the evidence for regulatory purposes, linear no threshold is used. You know, is this a regulatory purposes document? You know, we're going to have to struggle with what to use, and we've come up with some preliminary ideas yesterday.

CHAIRMAN WALLIS: Isn't your purpose for public consumption, to give them something believable?

MR. SULLIVAN: Yes, it is.

CHAIRMAN WALLIS: Not just to pick things?

MR. SULLIVAN: Well, you can't just pick things. That's exactly right. That's why we're struggling.

MEMBER APOSTOLAKIS: But if they show, for example, that makes a big difference in the consequences whether the threshold is one or five. That's a useful insight because they're also saying we don't know which one it is.

CHAIRMAN WALLIS: But then what do you tell the public? Do you say it's more likely to --

MEMBER APOSTOLAKIS: You do exactly that.

MR. PRATO: That's what we're struggling with. How do you present this information?

MR. SULLIVAN: What we're going to tell the public is the NRC's judgment of what the likely consequences are from these kinds of accidents. That's what the document is going to do.

Now, we're going to have to back that up.

CHAIRMAN WALLIS: It could make a big difference. It could make a very big difference if it's zero or five.

MR. SULLIVAN: Yes, it does.

CHAIRMAN WALLIS: Close to a big population center or --

MR. SULLIVAN: Let me give you a data point. The Health Physics Society says you should pick five.

MEMBER APOSTOLAKIS: Wow.

MR. SULLIVAN: All right? Now, the international bodies --

CHAIRMAN WALLIS: I'll bet you can find someone who says you should pick zero.

MR. SULLIVAN: You can find plenty of people who say you should pick zero, but usually they're from ICRP or NCRP as opposed to somebody who actually does this for a living, but nevertheless --

MEMBER APOSTOLAKIS: You mean these are part-timers?

(Laughter.)

PARTICIPANT: Is that on the public record?

MR. SULLIVAN: Let's just say -- let's just say that that's one --

MEMBER APOSTOLAKIS: Like an advisory committee, right?

(Laughter.)

MR. SULLIVAN: That's one man's opinion.

PARTICIPANT: Semi-useless.

MR. SULLIVAN: Well, actually we've thought of going to the advisory committee.

MEMBER KRESS: I think it would be a very useful exercise to do what you're saying just to see what effect it has.

MEMBER APOSTOLAKIS: Sure, sure.

MEMBER CORRADINI: So if I can go back to distance, since we're doing things that are useful, I'm very curious. So have you talked out what are the benefits from a small distance, middle distance, and clearly a large distance? Because it seems to me if you're going to do this sensitivity --

MEMBER KRESS: That could be another one.

MEMBER CORRADINI: WITNESS VAIL: -- that would be a sensitivity. I would think you would be open for criticism if you did not do.

MR. SULLIVAN: I think that's exactly right. You know, there are staff members who believe 1,000 is correct. There are those who believe 50 are correct. We're going to --

MEMBER KRESS: Or parameterize that, and you'll get different results depending on --

VICE CHAIRMAN SHACK: It's only money and time.

MEMBER KRESS: -- specific sites.

MEMBER CORRADINI: Well, that's what I guess I wanted to ask, since Dr. Shack threw that one in. When you do a MACCS calculation, since I'm not familiar with that part of the calculation, and it is not time dependent but really an average of how it flows, that's a fairly quick calculation or am I wrong about that?

MR. SULLIVAN: When you don't use a threshold, it's a fairly quick calculation. If you go to a threshold that really draws the run time out.

MEMBER CORRADINI: Does it draw it out as a function of the distance you consider? I would think no.

MR. SULLIVAN: No, I think distance is a parameter, yeah, but I mean the more cells we have to calculate a result in --

DR. BANERJEE: But for your 1,000 mile calculation, if it's sufficiently nodalized, surely you get your 50 and your 500 or 300 as part of it.

MR. SULLIVAN: The issue is whether you

really think those are realistic results, and--

MEMBER KRESS: A lot depends on wind rows and the population distribution as to whether or not you might end up going to the desert and not hit anybody.

CHAIRMAN WALLIS: You should calculate it out until it stops being important.

DR. BANERJEE: The time and variant calculation.

MEMBER KRESS: Oh, yeah, definitely.

DR. BANERJEE: And you pick your wind direction or whatever based on the class of weather.

MEMBER KRESS: But you also input your population distributions.

MR. SULLIVAN: If you go out to 1,000 miles --

DR. BANERJEE: But that's not changing. I mean it's there.

MEMBER KRESS: No, that's not changing.

DR. BANERJEE: So all I'm saying is as part of your 1,000 mile calculation, if your population is static, if your wind direction doesn't change and your 1,000 mile calculation, it's not a meandering plume --

MEMBER KRESS: Yeah, that's right.

DR. BANERJEE: -- then everything else is a subset of that.

MR. SULLIVAN: Yeah, exactly.

CHAIRMAN WALLIS: But you can't just pick numbers of miles. I mean, if you're still killing all of the people at 1,000 miles, you should go to 2,000 miles. You go on until you stop killing people.

MR. SULLIVAN: We don't believe you're killing people at 1,000 miles is the argument that we're going through.

CHAIRMAN WALLIS: But you should stop when you stop having any consequences, but you go as far as you need to go in order to predict a realistic consequence.

MEMBER KRESS: And that will be site dependent.

DR. BANERJEE: That will depend on whether you have a threshold or not, right?

MEMBER CORRADINI: So this leads me to the obvious question, which I'm sure you do this because you don't really want to spend a lot of money for the sake of it. Somebody can come up with a hand calculation. It was in 10 CFR 100 in the '50s, that you could do it forever and it's a closed form solution relative to a dispersion calculation. Have you done these hand calculations to know the sensitivity of the number you'd expect?

TID 14844 tells you how to do it with a closed form formula. Has anybody in the staff started doing those calculations to, shall I say, bound a computer calculation?

MR. SULLIVAN: Heavens, no. We don't even have a scenario to get a source term to get to MACCS. You know, it's a --

MEMBER CORRADINI: No, and that's what I -- you misunderstand my point. My point is what Sanjoy is getting at or what Graham is getting at is there are cruder calculational methods that would give you some insight as to whether 50, 250 or 1,000 is reasonable.

DR. BANERJEE: It's hard to do with multiple radionuclides. I mean, if you had a very simple release scenario like --

MEMBER CORRADINI: If you were able to build 100 plants with 10 CFR 100 and 14844, it would seem to me you could do a hand calculation to see what the global parameters might be. I'm curious if you did that.

DR. BANERJEE: If you take a very simple decay law or whatever, you know, you can do much of this by hand.

MEMBER APOSTOLAKIS: There was a question earlier that when you say a threshold of five, that means below five is zero?

MR. SULLIVAN: Yes.

MEMBER APOSTOLAKIS: Okay.

CHAIRMAN WALLIS: Well, tell me about plumes. Now, at Chernobyl there was a big plume and very energetic and it blew over France, and according to the French for a long time nothing ever happened in france, but then after going off to France, it landed in Scotland and it had tremendous effects in Scotland.

So now, how does your miles and diffusion account for the fact that this thing skipped France and landed in Scotland?

MEMBER CORRADINI: This is not Chernobyl. You don't really want to --

CHAIRMAN WALLIS: It's not Chernobyl? You're going to allow Chernobyl to happen?

MS. MITCHELL: The energetic release, there isn't a code -- Jocelyn Mitchell from the Office of Research -- there isn't a code that will model the explosive release that releases it into --

CHAIRMAN WALLIS: Oh, so this is something you're not going to model at all.

MR. SULLIVAN: It can't happen.

MS. MITCHELL: Right. We don't have the reactivity --

CHAIRMAN WALLIS: It won't happen?

MS. MITCHELL: -- initiated accidents, have been designed out --

CHAIRMAN WALLIS: But it has happened.

MS. MITCHELL: -- of U.S. plants.

CHAIRMAN WALLIS: Oh.

MR. SULLIVAN: You need some, you know, charcoal to help.

DR. BANERJEE: But people have tried to model Chernobyl. So presumably it can be done.

MEMBER KRESS: Sure.

CHAIRMAN WALLIS: But you have to know something about the weather.

MS. MITCHELL: People usually don't model the first day's very explosive release, and there were probably about four major wind shifts that occurred during the next eight days, and they take the measured values of Cesium-137, and they back calculate to determine what the source term was on that day.

So the fact that you can now take the source term and use the met. models and find that you can get the answer to me seems incestuous.

DR. BANERJEE: Well, it depends how far away and what you did, but this is sort of traditional also with release models for chemical plants where they actually take the data and the met. data, and then they back out what actually happened and then tried to predict in real time where the plume is going.

These are called "trace." No relation to the TRACE we talk about, but they try to do that.

MR. SULLIVAN: If we're going to discuss Chernobyl, I'd like to give you one data point. We're 20 years on from Chernobyl, and according to linear no threshold, there should have been a blip in the leukemia rate in Europe and there is not. All right?

So you mentioned consequences from Chernobyl. Of course there were grave consequences, but not latent cancer fatalities, as were expected by the LNT theory.

VICE CHAIRMAN SHACK: Maybe we had better move on to the rest of the presentation.

CHAIRMAN WALLIS: Well, this is the reason for bringing up Chernobyl. Is it something which actually happened? And you seem to be in a world where you're just creating models of something and there must be some connection between the two.

MEMBER APOSTOLAKIS: They have a different design of reactor.

(Simultaneous conversations.)

MEMBER KRESS: -- gave you the right answer. Chernobyl is not one of the scenarios for a U.S. plant. It doesn't show up.

MEMBER APOSTOLAKIS: So what is the next subject?

MEMBER KRESS: Why bother with it? There's no U.S. plants --

DR. BANERJEE: Well, what most of these things show is that human error is the main contributor to --

MEMBER KRESS: You can't even get a Chernobyl with human error with a U.S. plant.

THE REPORTER: One at a time.

MEMBER KRESS: One at a time.

DR. BANERJEE: Chernobyl and these other accidents, sure, is that most of the probability comes from human error.

MEMBER KRESS: Sure. That's a lesson learned.

DR. BANERJEE: Yes.

MEMBER KRESS: From Chernobyl, sure. But supposedly we've accounted for that in the PRA.

DR. BANERJEE: Are we accounting for human error in the PRA?

MEMBER KRESS: yes.

CHAIRMAN WALLIS: The PRA.

DR. BANERJEE: You were telling us that all of these different models for human error exist and none of them agree with each other and --

MEMBER APOSTOLAKIS: Accounting does not make me aware.

DR. BANERJEE: All right?

MEMBER APOSTOLAKIS: Accounting is like considering.

(Laughter.)

VICE CHAIRMAN SHACK: Hopefully it's not quite the same.

MR. SULLIVAN: I understand that the committee was interested in how emergency response would be modeled in the SOAR-CA project. We have been working on this since the inception of the project. We have an outline that I hope I can communicate clearly as to how we're going to model emergency preparedness.

But let me say at the outset we've got substantial resources, but not infinite. We've attempted to set aside enough time and money to do a decent evolutionary job of modeling emergency preparedness. It will not be an exact model for, you know, 65 sites, 62 sites. We just cannot do that.

But we can certainly make several steps forward in how we model emergency preparedness. We think this substantially improves the realism. We did this during the security assessments and some of the other classified work to more realistically model the movement of people and the response of off-site response agencies to protect the public.

All nuclear plants have EP programs. they're inspected. They're drilled.

I have some assumptions. They're pretty basic assumptions. Officials will implement the plan. You mentioned Katrina. That is perhaps an example of when the plans weren't implemented. We expect these plans to be implemented. They're drilled several times a year. They're inspected very other year. We believe these are real programs.

CHAIRMAN WALLIS: they don't go out to 1,000 miles.

MR. SULLIVAN: I'm sorry?

CHAIRMAN WALLIS: They don't go out to 1,000 miles.

MR. SULLIVAN: No, we certainly don't. We go out to ten, and we expect ad hoc actions beyond ten should they be necessary. We believe that the public will largely obey what they're told. That's borne out by the report that I cite at the bottom there.

Emergency workers will do their job. That's borne out both by the report and a series of recent focus groups that we conducted across five sites.

DR. BANERJEE: But ten must depend on topography and things like that, right?

MR. SULLIVAN: It depends on geography, on geopolitical boundaries. For instance, Duane Arnold is 16 miles due to Cedar Rapids being included. Vermont Yankee is nine miles in one direction due to an unpopulated forested area.

It's really a state decision. NRC would have accepted, you know, whatever FEMA approved as long as it compared with --

DR. BANERJEE: How far is Brattleboro from Vermont Yankee?

MR. SULLIVAN: Sorry. Can't tell you. It's --

DR. BANERJEE: We took some heat there. That's why I'm, asking you.

(Laughter.)

MR. SULLIVAN: Yeah, I understand that was -- you had that memorized. Is that what you're saying?

Is Brattleboro in the EPZ? I'm not sure.

DR. BANERJEE: I don't know, but --

MR. SULLIVAN: I was thinking maybe it wasn't.

PARTICIPANT: It's outside the EPZ.

CHAIRMAN WALLIS: Fifteen miles or something? It's not far away.

MEMBER SIEBER: Yeah, it's not. It's outside.

MR. SULLIVAN: Okay. One of the major differences between what we're going to do in CIRC and what we've done in the past is we're going to attempt to model implementing the plan as we go along.

The first start of that is I need scenarios. When I can see the scenarios, I will be able to, with the help of my peers, declare the emergencies as those EALs are reached. So there will be an alert. There will be a side area emergency before the general emergency for the vast -- well, for all of these scenarios that we're considering. I mean, I haven't seen the final scenario. So I'm projecting from what I've seen so far.

You see, there's precautionary actions taken at the alert and the site area emergency. Sirens are sounded. Schools are closed. Certain special needs groups are prepared for evacuation or maybe even evacuated. Parks and Lakes are cleared.

We're going to model all of that this time because that's a large percentage of the population.

CHAIRMAN WALLIS: You assume they all work. You don't do a PRA which says what's the probability that the sirens won't work and the probability that things won't work. You don't do that at all, do you?

MR. SULLIVAN: No.

CHAIRMAN WALLIS: Because there has been problems. I think Vermont Yankee was running samples when the sirens were not operational, and --

MR. SULLIVAN: The sirens at Vermont Yankee are more than 96 percent operational.

CHAIRMAN WALLIS: They are now. They are now.

MR. SULLIVAN: They have been.

CHAIRMAN WALLIS: But there was a period when they had a problem with them.

MEMBER APOSTOLAKIS: All of them? All of them were inoperable?

CHAIRMAN WALLIS: I don't know whether it was all of them. There was --

MR. SULLIVAN: Sirens fail.

MEMBER APOSTOLAKIS: Clearly one or two.

MR. SULLIVAN: It's usually one or two, and sirens do fail. There's a backup called route alerting that we're also going to model. It's possible that a small segment of the population don't hear the sirens.

CHAIRMAN WALLIS: Some are deaf.

MR. SULLIVAN: Well, yeah, but they'd be special needs, and special needs are treated in a different way. We intend to tease out many, many cohorts from the population. With a good evacuation time estimate, I can get reasonable estimates site by site on the size of those problems.

CHAIRMAN WALLIS: So if we're in a room like this and a siren goes out on Rockville Pike, do we hear it?

MR. SULLIVAN: Dozens of your beepers and cell phones go off in here.

CHAIRMAN WALLIS: They do?

MR. SULLIVAN: there's a thing called societal notification that is real. So it's not just the sirens. It's your office calling you and your neighbors calling you and your relatives calling you, and the TV might be on.

CHAIRMAN WALLIS: So if you're ever in the school and it's a big event and there's a big concert and a lot of noise and all of the parents and all of the kids and all of the teachers are in one room. Someone is going to come in and say, "I've heard a siren"?

MR. SULLIVAN: Yeah.

CHAIRMAN WALLIS: That's what's going to happen?

MR. SULLIVAN: Yes, as a matter of fact. The kid that's outside smoking may come back in and say that the siren sounded, et cetera, et cetera.

MEMBER APOSTOLAKIS: But I wasn't smoking.

(Laughter.)

MR. SULLIVAN: At least I didn't inhale.

Societal notification is a real thing, and it does exist, and it's not just sirens. It's the whole picture.

MEMBER APOSTOLAKIS: And when people hear the sirens, what do they do?

MR. SULLIVAN: Yes. Good question. What we want them to do is turn on their television. We think a good 15 percent of them get in their cars and --

CHAIRMAN WALLIS: There has been a loss of off-site power, which has affected all of the televisions. There's a blackout in the whole northeast.

MEMBER APOSTOLAKIS: You have to have a radio with batteries.

DR. MAYNARD: The message goes out by radio also, and the radio stations have dedicated power supplies. For the ones that you choose to be your official notification system --

CHAIRMAN WALLIS: So you have to use your car radio or something which is still working?

DR. MAYNARD: Yes, right. In all of the public buildings you have a mechanism. You don't have to depend on people hearing the siren inside the building because if you notice even around here, when we have like a fire alarm you have people that come through to make sure people know to get out or whatever. The same thing in all of the public schools in the public buildings. So you're not relying on people inside hearing.

MEMBER APOSTOLAKIS: I think information spreads very quickly. I mean, there's no question about it because you're not -- sometimes something unusual happens somewhere and within ten, 15 minutes everybody in the building knows about it.

MR. SULLIVAN: Tell my wife and it goes even faster perhaps.

MEMBER APOSTOLAKIS: You're on the record. You're on the record.

VICE CHAIRMAN SHACK: World Trade Center showed how fast it can go. the World Trade Center issue showed how fast it can go. It had a practically fully evacuated building, too.

MEMBER APOSTOLAKIS: I found out through Athens. My mother saw it on television and called me. Amazing.

MEMBER SIEBER: You know what it's like to walk down 100 flights of stairs.

MEMBER APOSTOLAKIS: Because it was the evening time there. It was the evening news.

MR. SULLIVAN: We're going to be working out of the evacuation time estimates, and we're going to tease a lot of data out of them, but it is still going to be judgment involved in this whole thing.

Fortunately, we were able to modify MACCS or it is being modified to accept numerous cohorts. There's literally a dozen cohorts that you could identify. There's the school children whose evacuation will begin at an alert or a site area emergency, depending on the state and county plan. There's the shadow evacuation. There's people leaving the parks, et cetera, et cetera.

We can identify, you know, literally a dozen cohorts where we can more realistically model the population movements.

DR. BANERJEE: So MACCS has built into it these evacuation models and things or how does it work?

MR. SULLIVAN: yes.

DR. BANERJEE: Because things are changing in real time, right?

MR. SULLIVAN: yes, it's perfect. I'm going to get to that in just a slide or two. So bear with me.

There are limitations. I'm not going to be able to analyze 62 sites and account for time of day, time of year, good weather, bad weather, bridges out. I'm going to have to do a judgment based agglomeration of those conditions. We're going to be doing three to five scenarios per site. I can't do three to five EP runs on top of the three to five scenarios. The matrix gets too big.

So we're simply going to have to use

judgment and take an evolutionary step forward in modeling emergency response.

Now, there's another very useful modification that's been done to MACCS that will answer your question, sir. As a population moves in an emergency planning zone, some of them have limited access highways. Like Duane Arnold, for instance, has a limited access highway going through the middle of the planning zone. We think traffic moves faster there than it does on a two-lane road.

On the other hand, in Cedar Rapids, for instance -- I'm using Duane Arnold, not that -- they'll eventually get modeled one way or another, but it's an illustrative example.

In Cedar Rapids proper we expect traffic to move slower. All right? Well, MACCS previously couldn't model a change in speed in space. It could do something in time.

It's now modeled. I saw a demonstration of a change to MACCS. It will be wind MACCS when it gets qualified, where you can directionally change -- you can change the direction of the population and their speed as they enter a crowded area of a free area.

MEMBER KRESS: I don't know how you

consistently match that to wind rows, which is a probability of the plume going in that particular direction. I don't know how you properly match those things up.

MEMBER SIEBER: You can't.

MR. SULLIVAN: You touched on a subject that has caused us a lot of thought.

CHAIRMAN WALLIS: Do you tell them which way to go?

MR. SULLIVAN: I'm sorry?

CHAIRMAN WALLIS: You tell them which way to go depending on the wind?

MR. SULLIVAN: See, as I said, I can only model this site once. I can't model it 16 times. MACCS, when it does a calculation, it picks a weather sequence of ten or 12 hours, and it runs it. It then points that weather sequence in each of 16 sectors. It then creates a very rich -- and multiplies consequences times the wind rows' probabilities. But the population is the population.

Have I lost you yet? Because I have lost myself several times.

MEMBER KRESS: I think you've got it.

DR. BANERJEE: Direction and weather class, I take it.

MR. SULLIVAN: No. One weather, one weather sequence is then moved around in 16 directions.

CHAIRMAN WALLIS: One weather sequence?

MR. SULLIVAN: One weather sequence --

MEMBER KRESS: They use a battery.

MR. SULLIVAN: -- is moved around in 16 weather directions.

DR. BANERJEE: And then you give it a probability distribution.

MR. SULLIVAN: Yes. And then you choose some 600 or 200 weather sequences. That's where the stability class, et cetera, comes in. But each result is a rich hunk of data with the wind pointed in 16 directions.

From an EP point of view, I can only model this site once. I can't model it with 16 different wind directions times 62 sites. I don't have the resources to do that. So I'm going to have to make a judgment, and entailed in that judgment is that in general it would be a quadrant being evacuated, Pennsylvania being the exception. I'm going to use the quadrant ETE data rather than the 360 ETE data and apply it to the 360 ETE.

We've got to make simplifying assumptions like that to come out of this project, you know, with a reasonable answer.

Now, once again, the end product is going to be a probabilistic representation of consequences. There are no absolute cases. We don't blow the wind at the town and blow the wind at the corn. It's probabilistic representation. I'm just trying to do my best to improve the EP model as a piece of this.

Did that make sense to anybody?

MEMBER KRESS: Yeah, but good luck on that.

(Laughter.)

MR. SULLIVAN: Well, okay.

MEMBER SIEBER: Are you going to model Pennsylvania with the 360 evacuation?

MR. SULLIVAN: I am because that's what their plan calls for. We intend to use the state plan and county procedures to the extent that we can. I have an issue with that, that I'll discuss in a little bit though.

DR. BANERJEE: The other plans are what, quadrant evacuations?

MR. SULLIVAN: What I tried to communicate was in general when an -- in general? There's never been an evacuation called under current emergency plans, but when we practice them, we evacuate three or four sectors, 22 and a half degree sectors. That's about a quadrant.

So in a general emergency, the utility recommends evacuation in the direction of the wind. That might be changed later on if there's a wind shift or whatever, but it's about a quadrant.

I've got quadrant data in even the oldest ETEs. So that's what I'm going to use. Some of the more modern ETEs have finer data, but you know, we have to find our way through it.

It's possible that protective actions could be needed beyond the ten mile EPZ. We don't know that to be the case, but it's possible. The emergency preparedness planning basis recognizes this potential, although unlikely, and expects that the planning within the EPZ will form a substantial basis for ad hoc actions outside of the EPZ.

We intend to model that as best we can also.

In general, MACCS models are radial evacuation, but it will also model a lateral evacuation. There is no evacuation route that is radially outward. This is one of the false over conservatisms of MACCS.

Walk with me for a second. First off, if there's a plume in a sector, MACCS assumes it's in the center of that sector. It then assumes that the evacuation route is in the center of that sector. What that means is there's a cohort of the population directly under the plume for the whole ten miles. That never happens. That is not realistic.

So earlier you heard the talk about going to 32 sectors rather than 16. That's an attempt to add realism with this over conservatism. All right? So if the wind will bounce a little bit, it will bounce into the next sector, you know, rather than staying in a 22 and a half degree sector.

That's the purpose of that, and we had originally thought we couldn't implement that. I understand that we're rethinking it.

But another way to add realism is to model the evacuation routes, and we're now able to do that with wind MACCS. So it may be coarse. We can't model every evacuation route in 62 sites, but we'll model them coarsely at the very least.

We're going to model KI. States that use KI, we're going to do something with it. Thyroid cancer is not the rate determining step here, but we're going to model it as best we can.

I've got issues. One of them is it's all very --

CHAIRMAN WALLIS: Is there any kind of verification of your model?

MR. SULLIVAN: My model hasn't been invented yet. I'm hoping that --

CHAIRMAN WALLIS: No, but it seems to me, you know, it's wonderful. It may be very good, but it maybe somewhat of a fantasy. How do you relate it to reality?

MEMBER KRESS: It could melt down a reactor.

CHAIRMAN WALLIS: Is there any way you can?

DR. BANERJEE: But you know, there have been a lot of things like chlorine releases which have been followed by evacuations, and even fairly populated regions have been evacuated, a few hundred thousand. I think in --

MR. SULLIVAN: Oh, yes.

DR. BANERJEE: -- a couple hundred thousand. So you've got --

CHAIRMAN WALLIS: Real examples.

DR. BANERJEE: Yeah, you've got real data.

CHAIRMAN WALLIS: It would be interesting to compare. You try to model a real historical event.

DR. BANERJEE: There was a rail car that --

MEMBER KRESS: Not with a probabilistic model.

DR. BANERJEE: -- and they have to evacuate --

CHAIRMAN WALLIS: Run it several times and see how close you can get.

DR. BANERJEE: -- a very large population.

MR. SULLIVAN: Once again, this is a probabilistic representation of consequences. It's not really meant to be a real case. There is no real case.

MEMBER KRESS: And I don't think you can even match it to a real case. I don't see the value of that.

MR. SULLIVAN: I'm going to point the wind in 16 directions. I'm going to multiply the consequences by the wind rows, you know, times the population. There is no real case. It is a probabilistic representation of consequences.

So is it realistic? I mean, I think as we go along presenting it to committees like this for review --

DR. BANERJEE: To get the consequences, you're multiplying things by probabilities, but when you're trying to model, say, now more realistically evacuation routes and stuff like that, that you can actually compare to some real data because that's deterministic.

The probabilities are coming through the wind direction.

MR. SULLIVAN: Actually the ETEs, especially the modern ETEs for large population sites, are really quite sophisticated, and since I'm going to be working out of them, you know, when I have these, you know, that's what you would compare to the historical experience.

What I'm doing here is an agglomeration of time of year, time of day, and wind direction and coming up with a--

CHAIRMAN WALLIS: Then the close up ten miles or something, this is --

MR. SULLIVAN: Well, --

CHAIRMAN WALLIS: But if you go beyond that, then it's not clear there are any evacuation routes.

MR. SULLIVAN: Yeah, that's exactly right. There's no ETE for the distance beyond that. We're going to have to model it as best we can should it be necessary.

Go back one. This is an important point.

So it's all very well for me to have a path forward on how to model emergency preparedness, but I'm going to be making assumptions on behalf of 32 states, and we think that there might be some opportunity for input from those 32 states to help us with a set of guidelines that we can repeat.

Now, we can't present, you know, five scenarios to 32 states and walk them through it and ask them how they would make each decision, but we certainly can ask them a series of questions that will help us with guidelines so that we can at least comport with the opinions of our stakeholders.

So we're not going to do this in a vacuum. Some ETEs are very old where in rural sites the population is small and declining, and they haven't updated their ETEs because they're not required to. We're going to have to work with some old evacuation time estimates in some cases.

We have already talked about this probabilistic representation. When we do a threshold calculation, the run time in MACCS gets very long. so in order not to -- and it is done by cohort. So in order to minimize that we will take some cohorts off the table, and what I mean by that is if it's eight hours or 12 hours to release in a given scenario and the sirens are sounded at an alert or a site area emergency, there will be a shadow evacuation. Ten percent of the population, 15 percent of the population is going to get in their cars and leave.

The schools will be evacuated at a site area emergency. In the case of Duane Arnold, which I've studied, that's 49 of 170,000 people would be moved out of the EPZ. There's no real reason to put those cohorts through MACCS. You know, we know they can leave within 12 hours. So we'll just simply say the population is now 15 percent smaller.

So we're going to make some simplifying assumptions like that, where it's appropriate.

MEMBER ARMIJO: Will you make assumptions on people who just can't leave, hospital people --

MR. SULLIVAN: Yeah.

MEMBER ARMIJO: -- people who are --

MR. SULLIVAN: We get that out of the ETE. I'm sorry. Yes. The ETE treats that as special needs populations, and once again, in the case of Duane Arnold, just because we used it as an example to learn this stuff better, they have a 22 hour estimate for special needs, and although some of that is -- the school is about eight hours, but beyond that, there is nursing homes and hospitals that require ambulances, and even the National Guard, and evacuation of those people could be as long as 22 hours.

However, they're sheltered in substantial facilities. A good number of them is moving long before. Twenty-two hours is a final ambulance leave a ten mile EPZ. So yes.

Then there's another cohort of people who don't hear the sirens, but are warned by the follow-up route alerting.

And finally, there's a cohort of people who refuse to leave. We're going to treat them perhaps outside the system, but they will be treated in one way or another.

I hold out to you that they're a special class of citizen.

CHAIRMAN WALLIS: Well, the people who are opposed to nuclear power, one of their strategies is to declare that they won't leave.

MR. SULLIVAN: Okay.

MEMBER SIEBER: Yeah, but that doesn't mean that they won't leave.

(Laughter.)

PARTICIPANT: We all make choices in life.

MR. SULLIVAN: Well, I mean, rather than do this huge analysis and show, you know, the potential for early fatalities because people who were warned by the sirens and warned by the police refuse to leave, we could perhaps treat that in a special way that, yes, indeed, if people don't leave, you know, there could be fatalities, right?

I mean, so that's -- usually when you see the early fatality numbers in this kind of analysis, it's the .5 percent of the population who refuse to leave.

MEMBER APOSTOLAKIS: But then it's not -- I mean the nature of the risk is different.

MR. SULLIVAN: It certainly is.

MEMBER APOSTOLAKIS: Because now it's not involuntary anymore.

MR. SULLIVAN: That's --

MEMBER APOSTOLAKIS: They were warned and they refused to go. I mean, society in general treats those kinds of risks differently. So you know --

MR. SULLIVAN: And I think we should, too. So we don't know what the publication looks like, but we're thinking that that cohort should be treated differently.

MEMBER SIEBER: It should be on the cover.

MEMBER CORRADINI: Now, when you say MACCS is a probabilistic calculation, every time I run MACCS I get essentially another sample in a distribution. So essentially I have to run MACCS over and over again even to get my distribution. It does it, right?

MS. MITCHELL: If I can understand your question, when you run a MACCS calculation, right now the only probabilistic aspect of it is the weather so that you have 8,760 possible hours in a year that that the accident could actually begin, and so that is sampled, and you may take several hundred of the 8,760 values, and so you get an answer that way.

Each one of those weather scenarios represents others, and so each one has a weight. So if I choose this one, it has a weight. If I choose another one, it has another weight.

MEMBER CORRADINI: Oh, and the answer I get then is the weighted estimate of that?

MS. MITCHELL: Is the weighted value over the weather.

PARTICIPANT: But it's deterministic.

MS. MITCHELL: Yeah, it's deterministic. Once you choose the weather, then it goes on.

CHAIRMAN WALLIS: But the effective

weather on evacuation ability is not taken into account?

MS. MITCHELL: You could. You could, indeed, take into account an uncertainty in the delay time before somebody starts to move and/or the speed with which they move when they start by putting in a range of values and degrees of belief in those values, and then running MACCS in a sampling mode, which would require then running multiple MACCS runs.

DR. BANERJEE: At the moment you just have to do one, right?

MS. MITCHELL: At the moment, you can choose whether you do one or you do many.

MEMBER CORRADINI: Now, for this one, would you do the estimate for a bad weather? Would you do the average result or you'd do a bad weather case?

MS. MITCHELL: We normally use for a single MACCS run, we normally sample the weather with several hundred of the 8,760 possibilities. So when you get an answer, it's an answer over the weather, weighted average over the weather.

MEMBER CORRADINI: Okay.

MS. MITCHELL: Okay? And the question of whether or not you wanted to look at the uncertainty in all the other parameters, you can do that by running multiple MACCS runs in an LHS mode.

MR. SULLIVAN: So that's how we plan to model emergency response. I'm sure we're going to learn a lot from the pilot plans then and course correct as we go along.

MEMBER ABDEL-KHALIK: Bill, I have a question.

VICE CHAIRMAN SHACK: Yes, Said.

MEMBER ABDEL-KHALIK: Let's say you're going to do this for Waterford 3 and assume in your analysis like you explained that everyone will do his or her job, and all of the evacuation will be done as planned. Do you think the public in that area and they meet in the vicinity of that plant, who are really the customers of this analysis, will believe this result?

MR. SULLIVAN: Yes.

CHAIRMAN WALLIS: With 100 percent probability, right?

MR. SULLIVAN: I think there will be those who don't believe it, those who don't listen, but my job, our job on this project is to do the best job we can to present the NRC's judgment of the potential consequences.

MEMBER ABDEL-KHALIK: I have selected the name of the plant sort of with care.

MR. SULLIVAN: Balance of forethought is the word.

(Laughter.)

MEMBER ABDEL-KHALIK: Right. And I'm just wondering that given the recent history with evacuation in a certain vicinity, in a certain area, that if you go through this process, that your customers will really believe what you're telling them.

MR. SULLIVAN: Okay. I have a data point for you. As we discussed the Katrina incident with emergency responders around the country, we find that they take great umbrage with the idea that they would not implement their plans.

We think that the plans around nuclear power plants will be implemented. They are tested regularly. They are drilled regularly, and they're inspected. They are certified annually as being adequate. So we think there's a higher level of assurance that these plans will be implemented and will protect public health and safety than, for instance, there was -- I wouldn't have had so much confidence if we're talking about a major city.

CHAIRMAN WALLIS: No, you cannot be 100 percent confident. If I do a thermal hydraulic analysis of a problem which is difficult and I haven't solved before, I would say maybe I would be lucky to get something, 75 percent confidence that I got the right answer when I first did it.

You're going to do something very -- you're going to do something very complicated here that no one has really done before, and you're going to say the answer is perfect. Now, that can't be right.

MR. SULLIVAN: I'm not saying the answer is perfect. No, individuals will fail. Things will go wrong. As a matter of fact, during biennial exercise, roads are closed and the off-site response organization is --

CHAIRMAN WALLIS: Well, there's a huge amount of uncertainty about how closely your model represents reality, isn't there?

MR. SULLIVAN: I --

CHAIRMAN WALLIS: Some uncertainty.

MR. SULLIVAN: There's certainly some uncertainty.

MEMBER APOSTOLAKIS: Well, there are also cases. I remember in Canada they evacuated what, 100,000 people within a few hours.

DR. BANERJEE: Well, a few hours.

MEMBER APOSTOLAKIS: Yeah. I mean, that's remarkable, I think.

MR. SULLIVAN: We just looked at 239 evacuations between 1992, is it, and 2003? There's an evacuation in the U.S. every three weeks, big evacuation, 1,000 people, more than one building, and those evacuations, all of them, all 232 were successful in saving lives.

Now, they weren't all, you know, smooth. We then studied 50 of them, and we picked out some of the worst case ones to study because we thought we could learn something from them. They all saved lives. They all moved people. The public does what they are told. The emergency workers show up. Even ad hoc plans will get people moving in the right direction.

Now, up until Rita, Hurricane Rita, an evacuation never killed anybody. Now, sometimes the hazard caught up with the tail end of an evacuation -- it was usually wild fires -- and killed people, but an evacuation itself never killed anybody until Hurricane Rita.

And that's one of the reasons we want to study these new evacuations, because it's new data, but we have good data that evacuations are done ad hoc, and they're successful, and they save lives. These evacuations are planned and inspected. They have sirens. So we think there's a higher level of probability that they will be successful.

CHAIRMAN WALLIS: But see, they are evacuated from, let's say, ten miles. How far do they have to go before they stop their car?

MR. SULLIVAN: Some of them go to Grandma's house.

CHAIRMAN WALLIS: Well, how far should they be told to go?

MEMBER SIEBER: They should go 1,000 miles.

MR. SULLIVAN: Some go --

CHAIRMAN WALLIS: Is there any --

MR. SULLIVAN: Actually they are not told.

CHAIRMAN WALLIS: Does it matter?

MR. SULLIVAN: They are told to get out of the EPZ, either go to a congregate care center. The data shows that ten, 12 percent go to a congregate care center. We're rigged for 20 --

CHAIRMAN WALLIS: You were talking earlier about modeling hazards to health out to 1,000 miles.

Does that mean that people should try to go 1,000 miles?

MR. SULLIVAN: Certainly not.

CHAIRMAN WALLIS: No.

MR. SULLIVAN: Frankly, I think modeling out to 1,000 miles is not a good representation of reality, but you know, the project will have to decide where it's going to go.

MEMBER CORRADINI: How far away are the care centers typically?

MEMBER SIEBER: Twenty-five miles.

MR. SULLIVAN: Twenty-ish, at least 15.

CHAIRMAN WALLIS: Isn't there a problem of gas? I mean, what's the average range of a car on an average day if he doesn't fill up his tank? You know, that must be a consideration.

MR. SULLIVAN: It depends on what car they own.

MEMBER SIEBER: Yes.

(Simultaneous conversations.)

DR. BANERJEE: If it's an SUV like yours --

(Laughter.)

MEMBER CORRADINI: Do you mean my Hummer?

DR. BANERJEE: Your Hummer.

MEMBER APOSTOLAKIS: But I don't understand what --

DR. BANERJEE: Hydrogen power.

MEMBER APOSTOLAKIS: -- where are you going with this, Graham?

CHAIRMAN WALLIS: Well, I'm just wondering when you ask if people believe it, I mean, the question is when you present these results, how are you going to present them in terms of the sort of range of the uncertainty around what you're presenting and all of that? That seems to be a rather awkward, but essential thing you have to do.

MR. SULLIVAN: Well, we're certainly open to guidance. I mean, we don't know how the results of the study are going to be presented yet. That has really not been decided. We're still looking.

MEMBER ABDEL-KHALIK: I guess my question was sort of motivated by the basic issue of who are the customers for this analysis and what will they do with the information that you gave them.

And that's why I asked myself. I mean, you go through and do this for the people living in that part of Louisiana, and then you tell them this is the result of our analysis, and they will sort of ignore you.

MEMBER APOSTOLAKIS: My personal view is that the customers are not these people. The customers are the Commission and the state and federal agencies that will respond.

MR. SULLIVAN: Anything to add?

MEMBER APOSTOLAKIS: Not the general public.

DR. BANERJEE: But these documents will have a long term effect on the perception of nuclear power by the general public.

MEMBER CORRADINI: But, I mean, just look at it the opposite way. You have the 1982 study that's been out there for 25 years and nobody is running away from the power plant sites. I very carefully memorized what happened in Kiwanee and Point Beach relative to the '82 study.

MEMBER KRESS: '84, wasn't it?

MEMBER CORRADINI: No, I thought it was '82.

PARTICIPANTS: '82.

MEMBER CORRADINI: '82, the site character, whatever it's called, and --

DR. BANERJEE: I'm not saying they'll run away.

MEMBER CORRADINI: No, no, but I guess my view is from what at least the first presentation gave us and then this one, they're trying to do I want to call it an update, a re-do job of it, and I can't believe the consequence is going to be higher than what I saw in '82, and I didn't see massive panic around the sites in the northern Midwest.

So my first assumption would be we're going to get a more realistic, reasonable first ut at it.

I do think, though relative to your evacuation, I think you're right about distances there, but I think in some sense it would be very interesting that you can unwrap certain things about if you only had evacuation in the first ten, whatever it is, miles in certain directions, outside of that how the consequence or the dose is not affected, and how you might actually not want to move them as much.

Dana is not here at the moment, but this whole idea about sheltering versus -- there is another Ph.D. thesis out of MIT by Burke in 1981. I remember all of these.

MEMBER APOSTOLAKIS: That was before my time.

MEMBER CORRADINI: Yeah, it was before you were there. I apologize.

but the doctoral student at the time indicated that sheltering was by far the most reasonable thing to do beyond a very few miles out. So I would be very curious to see if you change your evacuation strategy within this context what interesting results you'd get relative to that.

I think there's a lot of interesting stuff that can come out.

MEMBER BONACA: The materials to report will not disappear, especially for those scenarios which are now reproduced by a new study, but I don't know.

CHAIRMAN WALLIS: Do you want to --

MEMBER BONACA: I said the 1982 study would not disappear. It's still there.

MEMBER CORRADINI: Right.

MEMBER BONACA: But figuring for those scenarios which are not repeated or reproduced in the new study. Is there any --

MEMBER APOSTOLAKIS: Presumably this would be more realistic. Why are you saying this?

MEMBER BONACA: Yeah, of course.

DR. BANERJEE: There is one sort of Achilles heel of this though. This is not based on risk. It's based on sort of frequency.

MEMBER CORRADINI: In some sense --

MEMBER KRESS: You know, one thing they could do about that is have this CDF cutoff of ten to the minus six. They might take at least one of the plant types at several sites and do a cutoff of ten to the minus seven and see if it makes any difference, but it wouldn't be definitive because it would just be a sample, but that might be something they could do without a lot of resources.

MEMBER CORRADINI: I'm sure Tom will give them a suggested one.

MEMBER KRESS: Yeah, I can pick out one for them. I'll let them do that.

MEMBER BONACA: I really would like to know about the issue of 1982 study, you know, the comment I made. I think you were responding to that. I would like to know what you think about that.

MR. TINKER: Well, we do expect that as part of this study that we will, as part of the report, explicitly discuss the connection between this study and the 1982 study, and without prejudging I don't reasonably think we'll see anything that resembles the SST-1 release from the 1982 study. So we will explicitly describe for the reader why that scenario, why that release is no longer feasible or applicable to nuclear power plant sites.

MEMBER BONACA: Okay. That answered my question.

MR. TINKER: So if they're looking for why is the SST-1 not in this study, this report will address why it is not in the study.

MEMBER BONACA: Good.

VICE CHAIRMAN SHACK: Unless there's another burning question, I'd like to pull this to a halt since we need to discuss some issues here before we leave tonight and we're getting late.

MR. PRATO: Just before I sign off, I'd like to just make one additional statement. Our objective here is to provide the most realistic results within the limitations of our tools. If you can help us do that, that's what we're looking for. If you see us going in the wrong direction, we would appreciate that feedback. If you can think of other realistic approaches that we can add to our approach, that's what we're looking for from this committee.

And we are going to be updating you regularly, and we're going to be asking for feedback regularly, and as we develop written documents, you will get that information.

MEMBER CORRADINI: Yeah, I mean, when will we see, say, the first report on a real attempt to do this process on a plant? I mean, you said that was sort of your --

MR. PRATO: Probably, we probably won't be processing any information until the February time frame at the soonest, I would think.

MEMBER APOSTOLAKIS: That's early enough.

MR. PRATO: At the soonest, and probably more likely time frame is probably March, but there's a lot of process development that we need to do, and as we do that, we will provide you with that information.

MEMBER APOSTOLAKIS: But you'll come here, say, some time in the June time frame?

MR. SULLIVAN: Oh, I think I'd like to see you before that.

MEMBER APOSTOLAKIS: Well, in March they're going to have a draft report. They will not rush to give it to us.

MR. PRATO: No, no, no, no.

MEMBER APOSTOLAKIS: No, what?

DR. BANERJEE: Updated.

MR. PRATO: We didn't mean to imply that.

MR. SULLIVAN: They're not going to have anything by then.

MEMBER APOSTOLAKIS: You have results in March?

MR. PRATO: No.

MEMBER APOSTOLAKIS: Some results?

MR. PRATO: We believe that we're shooting to get that up from the licensees that we need to process.

MEMBER APOSTOLAKIS: Oh, before you start.

MR. PRATO: At starting the models and the process.

MEMBER APOSTOLAKIS: But you will not have exercised the model.

MR. PRATO: No, sir.

MEMBER APOSTOLAKIS: And you want to come here before you do that? Is that what you're saying?

MR. SULLIVAN: Well, I think it's very important to engage the ACRS very periodically. You know, for example, this meeting here was very important for us to discuss our scenario selection, how we viewed CDF versus release, et cetera.

You know, as we continue to have issues that we believe we need and we would like input, feedback and direction from the ACRS, we will come here as often as needed.

In addition to that, as results are

developed and reviewed, we would expect, you know, to present them to the ACRS also. I mean, right now it's very important to recognize that we are still developing the process. You can't start the calculations until a lot of these decisions are made.

MEMBER APOSTOLAKIS: Why isn't there a subcommittee meeting on this? I mean, we can't keep doing this, have the full committee.

MR. SULLIVAN: Well, part of it was we simply thought that this was of interest to the whole committee.

MEMBER APOSTOLAKIS: Today I agree, but I mean do you plan to --

MR. SULLIVAN: Yes. I mean, we will proceed with subcommittees as appropriate.

MEMBER APOSTOLAKIS: Which subcommittee is this? The new one?

VICE CHAIRMAN SHACK: I'm not sure which one it's under.

MEMBER APOSTOLAKIS: You're chairing it, right?

VICE CHAIRMAN SHACK: I'm -- I don't know. It's under regulatory policy, I guess.

MR. PRATO: I believe that Sam has scheduled a meeting for March. I think it's --

MEMBER APOSTOLAKIS: Of the full committee?

MR. PRATO: -- the 8th or the 19th. I'm not so sure.

MEMBER APOSTOLAKIS: The full committee?

DR. BANERJEE: This is submitting of the -- yeah, okay, yeah.

MEMBER APOSTOLAKIS: This is the shock supplement.

VICE CHAIRMAN SHACK: Whatever committee we stick it under, right.

CHAIRMAN WALLIS: The name doesn't matter. It's what they do that matters.

MEMBER APOSTOLAKIS: It does, it does.

DR. BANERJEE: But if it's a while updating of the full committee, that's not so bad.

MEMBER APOSTOLAKIS: No, but I mean as they get into details, it seems to me one hour is not enough.

DR. BANERJEE: No. I'm just saying --

MEMBER APOSTOLAKIS: I mean, there should be a briefing of the full committee.

DR. BANERJEE: Yeah, yeah, update.

MEMBER BONACA: I think the March meeting, however, was focused on the performance of scoping studies for new designs. You remember we recommended the security issues.

DR. BANERJEE: I mean, do we want to get into MACCS?

VICE CHAIRMAN SHACK: I think we want to get into everything in this at some point. It's just a question of when it's appropriate to do that.

MEMBER BONACA: Well, I mean, that's the time that we're discussing he would be ready. He would want to come and talk to us for an hour or so about their plan.

MEMBER SIEBER: An hour and a half.

CHAIRMAN WALLIS: Do you want to discuss this later on off the record when we make plans for the future? Are we finished now?

MEMBER SIEBER: Before you go off the record, I think Alan Nelson would like to make a statement.

CHAIRMAN WALLIS: Oh, we have somebody that wishes to make a statement? Bill, do you want to do that?

MEMBER SIEBER: Biff Bradley would like to.

CHAIRMAN WALLIS: Biff Bradley. Okay.

MEMBER KRESS: NEI here.

MR. BRADLEY: Biff Bradley, NEI.

Just briefly, while we understand and empathize with the intent of the Commission on undertaking an update of this study, one thing, we can't even see the SRM or SECY. So we don't have a full understanding of the rationale for the Commission in proceeding in this area. So we've had to learn what we can from interactions with the staff and meetings like this.

I just want to say we have two large general areas of concern. One is the fact that this is being done as a pure consequence study, and understand that the original study was done that way, but in the interim since that study was done, we've had a safety goal policy statement. We have QHOs, and we have measures of comparative risk.

We also have a PRA policy statement that says PRAs should be used in matters as appropriate, and it seems in 2006 to do a pure consequence study is not the right way to be proceeding. We believe the study should be a risk study or a safety study or a study that looks at the fleet relative to the QHOs or something along those lines, and that it's going to be extremely difficult no matter how you try to package this to produce a pure list of fatalities plant by plant for every plant, and to have good understanding of that in the context of risk.

The second point I'd like to make is I think it was elucidated today. There is a very large number of unanswered questions about technically how this study is going to proceed, everything from scenario selection to how EP is modeled.

We're concerned that there's a lot of scheduler pressure on the stuff to proceed, and they're proceeding with the study and data collection and actually proceeding with the analysis of actual operating plants apparently before all of these issues are getting resolved. It's a parallel path kind of effort, and we're pretty concerned about that.

In that regard, we've already submitted 40 technical questions to the staff relative to technical aspects of the study, some of which came up today, and I'd just like to say those are our two major areas of concern right now.

MEMBER APOSTOLAKIS: That's an interesting point you're making, Biff. In fact, that's a good question. Why isn't this study doing the Level 3 PRA?

CHAIRMAN WALLIS: Unavailable.

MEMBER APOSTOLAKIS: Why not? Do you think the consequences is much less a job? It could be longer. It doesn't have to be completed by the set date.

That would make more sense, I think, in the sense that now you are really calculating risk. Because Biff has a point, I think. I mean, you know, we are focusing, again, on consequences. People can pick a couple of results and start using them the way that suits their purpose, and we have the safety goals.

I mean, after you get the consequences, what do you do? You compare them with the '82 study, but still that doesn't say much. Is that acceptable? Does it meet any criteria, any goals?

I appreciate there is a lot more work, but since we're undertaking this, why not? I think that's an interesting point. I mean we could have a Level 3 PRA.

MEMBER CORRADINI: So, George, can I ask you a question?

MEMBER APOSTOLAKIS: Yes.

MEMBER CORRADINI: I was just asking Tom. Why isn't this the equivalent of a Level 3 PRA?

MEMBER APOSTOLAKIS: Because they're not going all the way to latent deaths and early fatalities.

MS. MITCHELL: We are.

PARTICIPANTS: Yes, they are.

MS. MITCHELL: But when you say PRA, I figure that what you probably that you --

MEMBER APOSTOLAKIS: With the probability.

MS. MITCHELL: With the probabilities.

MEMBER APOSTOLAKIS: With the probabilities, yeah.

VICE CHAIRMAN SHACK: Well, they will.

MEMBER APOSTOLAKIS: But they're not giving probabilities.

MS. MITCHELL: We're not because the Level 1 doesn't have -- we don't have a Level 1 PRA with uncertainties for 103 plants.

MEMBER CORRADINI: Ah, you're going to give a point estimate.

MEMBER APOSTOLAKIS: Even the Level 2 you are not handling probabilities, correct?

MR. TINKER: But we talked about the use of the CDF for the screening. We expect that there will be some means to modify that CDF frequency to account for issues like the difference between that and release frequency, incorporating the plant improvements which have taken place.

It is the expectation that this report

will not see -- there cannot be a divorcing of consequences from the probability of frequency of events. There has to be a close connection in any discussion of consequence with the frequency of these events. We're just reluctant to say this is a full bore, full blown Level 3 PRA.

But I've described our approach to addressing uncertainty. That's different from the Level 2 approach to uncertainty, but we do expect that we will combine the elements of the Level 1 with the consideration of uncertainty and consequences.

MEMBER APOSTOLAKIS: I'll come back to a comment I made earlier, and it's still not clear to me why you're not following that way. This agency spent a lot of resources when it did NUREG 1150. I mean, the methodology is there, right? They have developed the codes.

I mean you chose not to use their accident progression reviews for whatever reason, but it's not like we're asking -- well, I'm not asking. I'm just speculating -- why not take that methodology, update it if you need to, but that produced risk estimates. I mean, if you go to the -- in fact, I was very pleased to see that you guys put it on the Web site. So now students go and use it and so on.

You can go and find the curves for latent fatalities. There is a beautiful discussion in the text, what the major contributors are to early fatalities. Why not try to reproduce that then and have the risk estimate? Would that increase your amount of required effort by -- I don't know -- a factor of five or is it -- well, whatever it is though, but it makes sense, it seems to me, after so many years after 1989 when 1150 was published to take advantage of it.

When you said earlier that, you know, we are not using the progression trees and we're using something else, my mind didn't go all the way to risk at that time, I must admit.

MEMBER CORRADINI: So, I mean, I'm reflecting, I guess. I don't disagree with what George is saying though, but in some sense this is a progression. It seems to me if you go chronologically, we're essentially retracing what occurred 25 years ago, right? In the sense that, first, you had --

MEMBER APOSTOLAKIS: No.

MEMBER CORRADINI: Well, but really it's true. I mean, this siting study was done in '80 and '81 following the design Indian Point study which said, you know, there was this bifurcation that either it's coolable as the dickens and don't worry about it or, oh, my God.

Now we're back to what could it be at various plant sites, right? And then which led to NUREG 1150 and containment working group information. So it's a natural progression.

I would guess that this is due to be ended in a year?

MS. MITCHELL: Three years.

MEMBER CORRADINI: Three years, and eventually they may want to do more.

CHAIRMAN WALLIS: So looking back to this question of Level 3 PRA, if all of the plants in the country had a Level 3 PRA, you could just look at those results and reach conclusions, couldn't you?

MEMBER CORRADINI: but I think there is something --

CHAIRMAN WALLIS: But is that true?

MEMBER APOSTOLAKIS: Unless they are using updated models.

CHAIRMAN WALLIS: One reason for all of this effort is that we haven't required that the plants have a Level 3 PRA.

MEMBER CORRADINI: But if I might just

interject though, there's something that Charlie said in the explanation that I thought was very good technically. Maybe I misheard it, but the way they're approaching the containment loads or the in between study, which are all of the uncertainty, is much more physically palatable than what was done in NUREG 1150.

However good NUREG 1150 was, it was pretty hodge-podge in terms of how the containment failed. If I understood what's being done here, this is technically much more defensible. To the extent that they can actually show that that's the case, this has a very big benefit that has nothing to do with the end state or calculational state, but might do the next Level 3 PRA.

DR. BANERJEE: It depends on what sort of models are going into MELCOR to do this.

MEMBER CORRADINI: Sure, but if you go back to NUREG 1150, this one unfortunately I got involved in. So I remember distinctly. There is a lot of calculations there that were not highly robust and a lot of decision making that required people making judgments.

In this case, to the extent that you've done it, they're making a series of calculations based on a plant state and running through those calculations where you essentially now have a relatively well known tool that's walking you through the calculations.

That strikes me as a much better technical approach, personally, unless I misunderstood what we've done.

DR. BANERJEE: But I hope we have council look at it at some point.

MEMBER APOSTOLAKIS: Right. We need a subcommittee meeting.

MEMBER BONACA: I think so, too.

MR. TINKER: I didn't want to get into how we view the 1990 vintage of accident progression event tree logic tools versus MELCOR, but it's clear. The underlying basis for this is we've done 20 years of phenomenological research on severe accident behavior. We do not believe that those old models in PRA reflect that understanding. We've done tests. We've done analysis. We've done tests around the world, most recently fievish (phonetic) tests and so forth that provide a great deal of information that is not reflected in most of the NRC's examination of Level 2 and Level 2-Level 3, and this is meant to update that level of understanding.

MEMBER APOSTOLAKIS: But you are not

updating all the way. That's the question. Why don't you go all the way?

I agree with you.

MR. TINKER: Now, we've touched on this. We talked about what fraction of the core damage events we think we're capturing here. You heard numbers like 90, 95 percent of the core damage frequency. We didn't make similar statements about percent of the risk. I think we will be able to say more about that in the future.

MEMBER APOSTOLAKIS: Okay, all right.

MR. TINKER: But that's the focus here. The idea is that we have this '82 study where we're talking about alpha mode failure and things of that nature.

Now, that may be a good example for some people, may not be for others, but we think there are many instances where those past studies were by today's standards extraordinarily, extremely conservative because they identified LERF states that we don't think exist.

MEMBER APOSTOLAKIS: Maybe that's a good time to stop this.

MEMBER BONACA: Yeah, I think so.

CHAIRMAN WALLIS: Bob, are you ready to

stop? You don't look as if you're eager to present any more.

MR. PRATO: I'd be happy to go home.

CHAIRMAN WALLIS: Are you happy? Are the members happy?

It has been very, very informative, I must say, and --

MEMBER BONACA: I think we need to have a subcommittee meeting.

CHAIRMAN WALLIS: -- there are so many things to grasp.

MEMBER APOSTOLAKIS: The problem with subcommittee meetings is you don't have everybody.

CHAIRMAN WALLIS: Thank you very much.

MR. PRATO: Thank you, sir.

MEMBER APOSTOLAKIS: This was very good.

MR. PRATO: Thank you.

CHAIRMAN WALLIS: We now are ready for a break. Is that true? The members are determined to work.

We'll break until 6:30.

(Whereupon, at 6:16 p.m., the meeting was adjourned.)

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Advisory Committee on Reactor Safeguards 538th Meeting

Docket Number: n/a

Location: Rockville, MD

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Charles Morrison
Official Reporter
Neal R. Gross & Co., Inc.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

November 20, 2006 (REVISED)

SCHEDULE AND OUTLINE FOR DISCUSSION
538th ACRS MEETING
DECEMBER 7-9, 2006

THURSDAY, DECEMBER 7, 2006, CONFERENCE ROOM T-2B3, TWO WHITE FLINT NORTH, ROCKVILLE, MARYLAND

1) 8:30 - 8:35 A.M. Opening Remarks by the ACRS Chairman (Open) (GBW/JTL/SD)
   1.1) Opening statement
   1.2) Items of current interest

2) 8:35 - 10:30 A.M. Draft Final Regulatory Guide, DG-1145, "Combined License Applications for Nuclear Power Plants" (Open) (TSK/DCF)
   2.1) Remarks by the Subcommittee Chairman
   2.2) Briefing by and discussions with representatives of the NRC staff regarding Draft Final Regulatory Guide, DG-1145, "Combined License Applications for Nuclear Power Plants," and resolution of significant public comments.

   Representatives of the nuclear industry and members of the public may provide their views, as appropriate.

10:30 - 10:45 A.M. ***BREAK***

3) 10:45 - 12:15 P.M. Draft Final Regulatory Guide, DG-1144, "Guidelines for Evaluating Fatigue Analyses Incorporating the Life Reduction of Metal Components Due to the Effects of the Light-Water Reactor Environment for New Reactors" (Open) (JSA/CGH/CS)
   3.1) Remarks by the Subcommittee Chairman
   3.2) Briefing by and discussions with representatives of the NRC staff regarding Draft Final Regulatory Guide, DG-1144 and the resolution of public comments.

   Representatives of the nuclear industry and members of the public may provide their views, as appropriate.

12:15 - 1:15 P.M. ***LUNCH***

4) 1:15 - 3:15 P.M. Proposed Revisions to Standard Review Plan Section 13.3, "Emergency Planning" (Open) (MLC/DAP/MB)
   4.1) Remarks by the Subcommittee Chairman
   4.2) Briefing by and discussions with representatives of the NRC staff regarding proposed revisions to Standard Review Plant Section 13.3, "Emergency Planning," and related matters.

   Representatives of the nuclear industry and members of the public may provide their views, as appropriate.

3:15 - 3:30 P.M. *****BREAK*****

5) 3:30 - 5:30 P.M. State-of-the-Art Reactor Consequence Analysis Project (Open) (WJS/HPN)
   - 5.1) Remarks by the Subcommittee Chairman
   - 5.2) Briefing by and discussions with representatives of the NRC staff regarding status of the staff's efforts associated with the state-of-the-art reactor consequence analysis project.

   Representatives of the nuclear industry and members of the public may provide their views, as appropriate.

5:30 - 5:45 P.M. *****BREAK*****

6) 5:45 - 7:00 P.M. Preparation of ACRS Reports (Open)
   Discussion of proposed ACRS reports on:
   - 6.1) Draft Final Regulatory Guide, DG-1145, "Combined License Applications for Nuclear Power Plants" (TSK/DCF)
   - 6.2) Draft Final Regulatory Guide, DG-1144, "Guidelines for Evaluating Fatigue Analyses Incorporating the Life Reduction of Metal Components Due to the Effects of the Light-Water Reactor Environment for New Reactors" (JSA/CGH/CS)
   - 6.3) Proposed Revisions to Standard Review Plan Section 13.3,"Emergency Planning" (MLC/DAP/MB)
   - 6.4) State-of-the-Art Reactor Consequence Analysis Project (Tentative) (WJS/HPN)
   - 6.5) Collaborative Research on Human Reliability Analysis Methods (GEA/EAT)

FRIDAY, DECEMBER 8, 2006, CONFERENCE ROOM T-2B3, TWO WHITE FLINT NORTH, ROCKVILLE, MARYLAND

7) 8:30 - 8:35 A.M. Opening Remarks by the ACRS Chairman (Open) (GBW/JTL/SD)

8) 8:35 - 9:30 A.M. Proposed Revisions to Regulatory Guides and Standard Review Plan Sections in Support of New Reactor Licensing (Open) (OLM/DCF)
   - 8.1) Remarks by the Subcommittee Chairman
   - 8.2) Discussion of proposed revisions to Regulatory Guides and Standard Review Plan Sections that are being made in support of new reactor licensing.

9) 9:30 - 10:30 A.M. Future ACRS Activities/Report of the Planning and Procedures Subcommittee (Open) (GBW/JTL/SD)

9.1) Discussion of the recommendations of the Planning and Procedures Subcommittee regarding items proposed for consideration by the full Committee during future ACRS meetings.

9.2) Report of the Planning and Procedures Subcommittee on matters related to the conduct of ACRS business, including anticipated workload and member assignments.

10:30 - 10:45 A.M. ***BREAK***

10) 10:45 - 11:00 A.M. Reconciliation of ACRS Comments and Recommendations (Open) (GBW, et al./SD, et al.)
Discussion of the responses from the NRC Executive Director for Operations to comments and recommendations included in recent ACRS reports and letters.

11) 11:00 - 11:30 A.M. Election of ACRS Officers for CY 2007 (Open) (JTL/SD)
Election of Chairman and Vice-Chairman for the ACRS and Member-at-Large for the Planning and Procedures Subcommittee.

11:30 - 1:00 P.M. ***LUNCH***

12) 1:00 - 7:00 P.M. Preparation of ACRS Reports (Open)
Discussion of proposed ACRS reports on:

12.1) Draft Final Regulatory Guide, DG-1145, "Combined License Applications for Nuclear Power Plants" (TSK/DCF)

12.2) Draft Final Regulatory Guide, DG-1144, "Guidelines for Evaluating Fatigue Analyses Incorporating the Life Reduction of Metal Components Due to the Effects of the Light-Water Reactor Environment for New Reactors" (JSA/CGH/CS)

12.3) Proposed Revisions to Standard Review Plan Section 13.3, "Emergency Planning" (MLC/DAP/MB)

12.4) State-of-the-Art Reactor Consequence Analysis Project (Tentative) (WJS/HPN)

12.5) Collaborative Research on Human Reliability Analysis Methods (GEA/EAT)

SATURDAY, DECEMBER 9, 2006, CONFERENCE ROOM T-2B3, TWO WHITE FLINT NORTH, ROCKVILLE, MARYLAND

13)	8:30 - 12:00 Noon **(10:15-10:30 A.M. BREAK)**	Preparation of ACRS Reports (Open) Continue discussion of proposed ACRS reports listed under Item 12
14)	12:00 - 12:30 P.M.	Miscellaneous (Open) (GBW/JTL) Discussion of matters related to the conduct of Committee activities and matters and specific issues that were not completed during previous meetings, as time and availability of information permit.

NOTE:

- Presentation time should not exceed 50 percent of the total time allocated for a specific item. The remaining 50 percent of the time is reserved for discussion.
- Thirty-Five (35) hard copies and (1) electronic copy of the presentation materials should be provided to the ACRS.

ACRS Full Committee Meeting

Presentation on DG-1145

December 7, 2006

Draft Regulatory DG-1145, "Combined License (COL) Applications for Nuclear Power Plants (LWR Edition)"

Eric R. Oesterle, Lead PM
NRO/DNRL/NGIF

DG-1145 Overview

Purpose

- Provide guidance to potential applicants on format and content for a combined license (COL) application pursuant to 10 CFR 52
- COL referencing neither a certified design (CD) nor an early site permit (ESP)
- COL referencing a CD but not an ESP
- COL referencing a CD and an ESP

DG-1145 Overview (cont'd)

Background and Developmental Basis

- Industry guidance for COL applications (NEI 04-01)
- NEI 04-01 provided guidance for "base case" COL application
- NRC interactions with external stakeholders identified several COL application scenarios
- Staff recognized the need for more comprehensive guidance for COL applicants

DG-1145 Overview (cont'd)

Development Basis

- RG 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)
- Updated SRP revisions (including draft 1996 updates)
- Draft NEI 04-01 guidance for COL applications
- NRC design certification and ESP experience
- SECY papers and associated SRMs

DG-1145 Overview (cont'd)

Development Basis (cont'd)

- Proposed Part 52 rule issued on March 13, 2006 (71 FR 12782)
- Monthly public workshops (March 2006 – September 2006) ~ 500 comments
- All draft work-in-progress sections publicly available via NRC's website by June 30, 2006
- DG-1145 issued for 45-day public comment period on September 7, 2006 (71 FR 52826)

DG-1145 Overview (cont'd)

Format and Structure

- Part C.I – guidance for a COL applicant that references neither a CD nor an ESP (consistent with proposed 10 CFR Part 52.79)
- Part C.II – additional technical information (consistent with proposed 10 CFR Part 52.80)
- Part C.III – COL applicants referencing CDs and ESPs
- Part C.IV – Miscellaneous Topics

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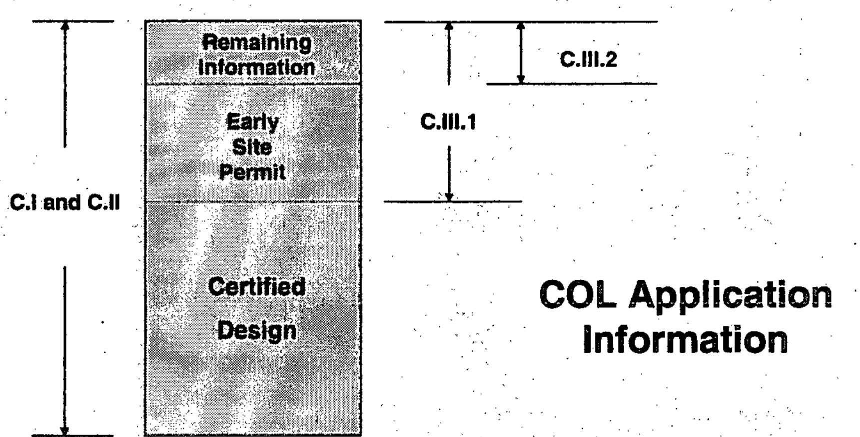
DG-1145 Overview (cont'd)



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DG-1145 Overview (cont'd) Format and Structure – Part C.I

- C.I.1 Introduction and General Plant Description*
- C.I.2 Site Characteristics
- C.I.3 Design of Structures, Systems, Components and Equipment
- C.I.4 Reactor
- C.I.5 RCS and Connected Systems
- C.I.6 Engineered Safety Features
- C.I.7 Instrumentation and Control
- C.I.8 Electrical Power
- C.I.9 Auxiliary Systems
- C.I.10 Steam and Power Conversion System
- C.I.11 Radioactive Waste Management
- C.I.12 Radiation Protection
- C.I.13 Conduct of Operations
- C.I.14 Verification Programs
- C.I.15 Transient and Accident Analyses
- C.I.16 Technical Specifications
- C.I.17 Quality Assurance and Reliability Assurance
- C.I.18 Human Factors Engineering
- C.I.19 Probabilistic Risk Assessment Information and Severe Accidents*

DG-1145 Overview (cont'd)

Format and Structure – Part C.II

C.II.1 - Probabilistic Risk Assessment (PRA)

C.II.2 - Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC)

C.II.3 - Environmental Report

DG-1145 Overview (cont'd)

Format and Structure – Part C.III

C.III.1 - Information Needed for a COL Application Referencing a CD (consistent format with C.I)

C.III.2 - Information Needed for a COL Application Referencing a CD and an ESP (consistent format with C.I)

C.III.3 - Finality of an EIS Associated with an ESP

C.III.4 - COL Action Items

C.III.5 - Design Acceptance Criteria

C.III.6 - COL Application Timing

C.III.7 - ITAAC for COL Applications Referencing a CD and/or an ESP

DG-1145 Overview (cont'd)

Format and Structure – Part C.IV

C.IV.1 - COL Application Acceptance Review Checklist
C.IV.2 - Submittal Guidance for COLs
C.IV.3 - General Description of Change Process
C.IV.4 - Operational Programs
C.IV.5 - General and Financial Information
C.IV.6 - Limited Work Authorizations and Site Redress Plan*
C.IV.7 - Pre-Application Activities
C.IV.8 - Generic Issues
C.IV.9 - deleted
C.IV.10 - Regulatory Treatment of Non-Safety Systems (RTNSS)
C.IV.11 - relocated to App. I (responses to public workshop questions)
C.IV.12 - Applicability of Industry Guidance*

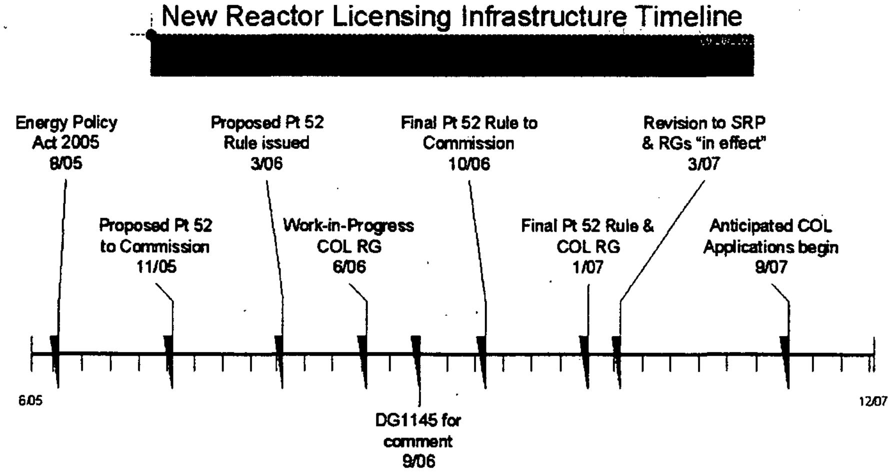
DG-1145 Overview (cont'd)

Status

- Comment period on DG-1145 closed on October 23, 2006
- Approximately 700 total comments received
- Staff is currently working to resolve public comments and revise DG-1145, as appropriate, and conform to proposed final Part 52 rule
- Process in place to ensure consistency between DG-1145 and the SRP and Reg. Guide updates
- Plan to publish final (RG 1.206) after incorporation of public comments and final issuance of the Part 52 rule
- Staff considering additional public forums to update external stakeholders on RG 1.206 prior to publication

DG-1145 Overview (cont'd)

New Reactor Licensing Infrastructure Timeline



DG-1145

PRA & Severe Accident Evaluations

ACRS Presentation

Donnie Harrison
Senior Reliability & Risk Analyst
NRR Division of Risk Assessment (DRA)

December 7, 2006

Discussion Topics

- Recent Change to Proposed 10 CFR Part 52
- Bases for Regulatory Guidance
- Objectives of PRA & Severe Accident Evaluations
- Chapter 19 Regulatory Guidance

2

Recent Change to Proposed 10 CFR Part 52

- Proposed 10 CFR Part 52 rulemaking included new 52.80(a) requirement for COL applicants to submit plant-specific PRA
- After completion of DG-1145, the NRC position changed to accept the industry comment to delete this requirement - PRA maintained available for staff inspection at the applicant's office
- Requirement deleted throughout Part 52, including the existing requirement for design certification applications

3

Impact of Change to Proposed 10 CFR Part 52

- DG-1145 will need to be revised to reflect the change in NRC position
  - Majority of guidance presented in C.II.1 (PRA) will need to be incorporated into C.I.19 (FSAR Chapter 19)
- Since FSAR Chapter 19 is a qualitative, summary description of the PRA, results, insights, uses, etc., staff audits will be necessary to fully understand, review, and confirm the bases for the PRA results and insights and adequacy for the PRA uses/applications

4

Bases for Regulatory Guidance

- NRC Policy Statements and SECYs/SRMs
- Experience with Design Certification reviews for CE System 80+, ABWR, AP-600, and AP-1000
- 10 CFR 52.79 PRA/Severe Accident Requirements

5

Objectives of PRA & Severe Accident Evaluations

- Derived from NRC Policy Statements and SECYs/SRMs
- Two Groups of Objectives
  - Identify and assess the balance of preventive and mitigative features (including operator actions) such that the plant design reflects a reduction in risk compared to existing plants(contemporary with Severe Accident Policy Statement of 1985)
  - Specific uses and applications of the PRA results and insights in support of other programs (e.g., RAP, RTNSS, ITAACs, COL and interface requirements)

6

Chapter 19 Regulatory Guidance

19.1 Introduction

19.2 PRA Results and Insights

19.3 Severe Accident Evaluations

19.4 PRA Maintenance

19.5 PRA-Related ITAACs, COL Action Items, & Other Commitments

19.6 Conclusions

7

DG-1145: Workshop Issues and Public Comments

Eric R. Oesterle, Lead PM
NRO/DNRL/NGIF

DG-1145: Workshop Issues and Public Comments

- Development began in January 2006
- Draft work-in-progress sections posted on the NRC's website following completion to facilitate public workshop discussions
- Monthly public workshops on DG-1145 held from March 2006 to September 2006
- Resolved and incorporated 500 public workshop comments to issue draft for public comment (Appendix I)

DG-1145: Workshop Issues and Public Comments

- Issued DG-1145 for public comment on September 7, 2006
- Comment period closed October 23, 2006
- Staff received approximately 700 public comments on DG-1145
- Comments also reflect external stakeholder concerns raised during the monthly public workshops on development of DG-1145

DG-1145: Workshop Issues and Public Comments

- COL information availability
- Verification activities (inspections vs. ITAAC)
- First-of-a-kind-Engineering (FOAKE) inspections/audits
- Engineering design verification (EDV)

DG-1145
Conformance, Completeness, and Consistency

Eric R. Oesterle, Lead PM
NRO/DNRL/NGIF

DG-1145: Conformance, Completeness, and Consistency

- Staff is currently working to resolve public comments and revise DG-1145
- Conform DG-1145 to proposed final Part 52 rule and updated SRPs
- Internal staff review for consistency, completeness and usability began in early October 2006 (DG-1145 Reading Team)
- Team has confirmed approx. 1/3 of public comments and has made additional comments to those provided by public

DG-1145: Conformance, Completeness, and Consistency

- DG-1145 to be published final as Regulatory Guide 1.206
- RG 1.206 to be published following Commission approval of Part 52 rule and resolution of public comments
- Staff considering additional public forums to update external stakeholders on RG 1.206 prior to publication

DG-1145: Workshop Issues and Public Comments

- Plants incorporating passive safety design features
- Plant-specific PRA (LRF, CCFP, COL PRA Information)
- Maintenance Rule (breakout session)
- Digital I&C (breakout sessions)
- ITAAC

DG-1145: Workshop Issues and Public Comments

- Environmental Reports and Finality of an EIS associated with an ESP
- Human factors engineering
- Radwaste treatment facilities
- Including guidance contained in responses to public workshop questions

RG 1.207 - *GUIDELINES FOR EVALUATING FATIGUE ANALYSES INCORPORATING THE LIFE REDUCTION OF METAL COMPONENTS DUE TO THE EFFECTS OF THE LIGHT-WATER REACTOR ENVIRONMENT FOR NEW REACTORS*

Hipólito J. González
Corrosion and Metallurgy Branch
Division of Fuel, Engineering and Radiological Research
Office of Nuclear Regulatory Research
(301) 415-0068
hjg@nrc.gov

Omesh K. Chopra
Nuclear Engineering Division
Argonne National Laboratory
(630) 252-5117
okc@anl.gov

Presented to
Advisory Committee on Reactor Safeguards
Rockville, Maryland
December 7, 2006

Agenda

- Motivation
- Discuss RG 1.207
  - Objective and Implementation
  - Technical Basis
  - Regulatory Positions
- Resolution of public comments on DG-1144 and draft NUREG/CR-6909
- Conclusion

RG 1.207 User Need

- NRR User Need Request 2005-004 (January 7, 2005):
  - Develop guidance for determining the acceptable fatigue life of ASME pressure boundary components, with consideration of the LWR environment
  - For use in supporting reviews of applications that the agency expects to receive for new reactors.
  - Industry immediately notified

- High priority RG to be completed by March 2007

How RG 1.207 relates to the Regulatory Requirements

- General Design Criterion 1
  - Safety related SSC must be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function performed

- General Design Criterion 30
  - Components included in the reactor pressure boundary must be designed, fabricated, erected, and tested to the highest practical quality standards

- 10 CFR 50.55a (c), endorses ASME BPV Code for design of safety-related systems and components (Class 1)
  - ASME BPV Code Section III, includes fatigue design curves

- Fatigue design curves do not address the impact of the reactor coolant system environment

Objective and Implementation of RG 1.207

Objective

- To provide guidance for determining the acceptable fatigue life of ASME pressure boundary components, considering the LWR environment
  - Major structural materials: carbon steels, low-alloy steels, austenitic stainless steels, and Ni-Cr-Fe alloys (e.g., Alloy 600 and 690)
- Describes an approach that the NRC staff considers acceptable to support reviews of applications for new reactors

Implementation

- Applies to **New Plants**
- **No Backfitting is intended** (conservatism on current reactors)
- Regulatory guides are not substitutes for regulations, and compliance with regulatory guides is not required.

How the Technical Basis was Developed?

Technical Basis Report: NUREG/CR-6909 Rev. 1 – Effect of LWR Coolant Environment on Fatigue Life of Reactor Materials

Omesh K. Chopra
Nuclear Engineering Division
Argonne National Laboratory

Argonne NATIONAL LABORATORY

Issue - Environmental Effects on Fatigue Life

- Fatigue data indicate significant effects of LWR environment
- Data are consistent with each other & with much larger database for fatigue crack growth (da/dN)
  - in LWR environments, effects of material, loading, and environmental parameters are similar for fatigue ε-N & CGR data
- ε-N data have been evaluated to
  - identify key parameters that influence fatigue life, &
  - define range for these parameters where environmental effects are significant, i.e., establish threshold & saturation values
- If these conditions exist during reactor operation, environmental effects will be significant & must be addressed
  - subsection NB-3121 recognizes that the data used to develop the fatigue design curves did not include tests in environments that might accelerate fatigue failure

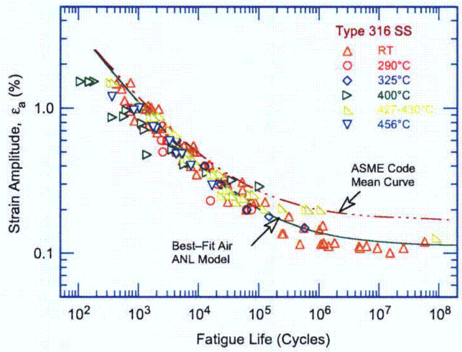
Fatigue Life

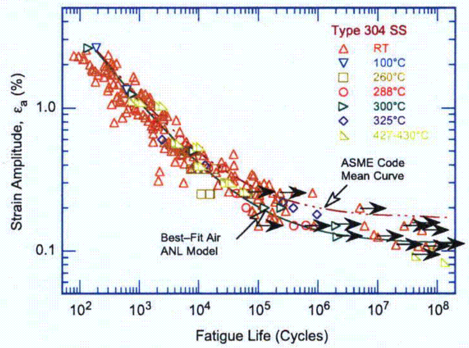
- Existing fatigue data define fatigue life of specimens as cycles to 25% load drop; typically this corresponds to a ≈3 mm crack
- Surface cracks ≈10 μm deep form early during fatigue loading
- Fatigue life associated with growth of cracks; 10 to 3000 μm
- Represented by two stages:
  Initiation: growth of cracks, < 300 μm
  Propagation: growth of cracks 300-3000 μm (EPFM)
- LWR coolant environment affects both stages:
  initiation & propagation

ASME Code Fatigue Design Curves

- Code design curves based on data obtained on small, smooth specimens in RT air under constant loading conditions
- To use small–specimen data for reactor components, best–fit curves must be adjusted to cover effects of variables that influence fatigue life but were not investigated in the data
  - such variables include mean stress, surface finish, size, & loading history. Data scatter & material variability must also be addressed
- To obtain Code design curves the best-fit curves were
  - first adjusted for effects of mean stress on fatigue life
  - then reduced by factor of 2 on stress & 20 on life to account for these variables, but not an aggressive environment

Current Code Mean Curve for Austenitic SSs





- Current Code mean curve is not consistent with existing fatigue data in air, at ε_a <0.3% it predicts significantly longer lives
- New design curves have been proposed that are consistent with the existing fatigue data

Environmental Effects on Carbon & Low-Alloy Steels

- The effects of critical parameters on fatigue life:
- – Steel type: effects identical for carbon & low-alloy steels
- – **Strain amp**: strain threshold near fatigue limit; no effect below threshold
- – Strain rate: logarithmic decrease in life below 1%/s, saturation at 0.001%/s; moderate effects above 1%/s
- – Temperature: linear decrease in life above 150°C; moderate effects below 150°C
- – Dissolved Oxygen: logarithmic decrease in life above 0.04 ppm, saturation at 0.5 ppm; moderate effects below 0.04 ppm
- – Sulfur: effects increase with increasing S level, saturation at 0.015 wt.%
- – Surface roughness: life of rough specimens is decreased in air; in high–DO water, surface roughness has little or no effect on fatigue life
- – Flow rate: in high–DO water, effects decrease with increasing flow rate

Environmental Effects on Austenitic Stainless Steels

- The effects of critical parameters on fatigue life:
  - Steel type: effects identical for wrought & cast austenitic stainless steels
  - **Strain amp**: threshold near fatigue limit; no effect below threshold
  - Strain rate: logarithmic decrease in life below 0.4%/s, saturation at 0.0004%/s; moderate effects above 0.4%/s
  - Temperature: linear decrease in life above 150°C; moderate effects below 150°C
  - Dissolved Oxygen: in high–DO, effect may be lower for some steels; in low–DO, effect significant for all steels & heat treat conditions;
  - Surface roughness: life of rough specimens decreased in air & low–DO water
  - Flow rate: no effect of flow rate on fatigue life in high-purity water

Carbon and Low-Alloy Steels

Air $\ln[N] = 6.583 - 1.975 \ln(\varepsilon_a - 0.113)$ (CSs)
$\ln[N] = 6.449 - 1.808 \ln(\varepsilon_a - 0.151)$ (LASs)

Env $\ln[N] = 5.951 - 1.975 \ln(\varepsilon_a - 0.113) + 0.101\, S^*T^*O^*R^*$ (CSs)
$\ln[N] = 5.747 - 1.808 \ln(\varepsilon_a - 0.151) + 0.101\, S^*T^*O^*R^*$ (LASs)

where
$S^* = S$ ($S \leq 0.015$ wt.%)
$S^* = 0.015$ ($S > 0.015$ wt.%)
$T^* = 0$ ($T < 150$°C)
$T^* = T - 150$ ($T = 150$ to 320°C)
$O^* = 0$ (DO < 0.04 ppm)
$O^* = \ln(DO/0.04)$ (0.04 ppm < DO ≤ 0.5 ppm)
$O^* = \ln(12.5)$ (DO > 0.5 ppm
$R^* = 0$ ($R > 1$%/s)
$R^* = \ln(R)$ ($0.001 \leq R \leq 1$%/s)
$R^* = \ln(0.001)$ ($R < 0.001$%/s)

- These expressions represent average fatigue life of the median material

Wrought & Cast Austenitic SSs

Air $\ln[N] = 6.891 - 1.920 \ln(\varepsilon_a - 0.112)$

Env $\ln[N] = 6.157 - 1.920 \ln(\varepsilon_a - 0.112) + T^*O^*R^*$

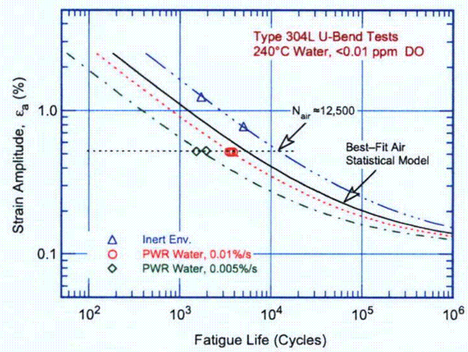
where

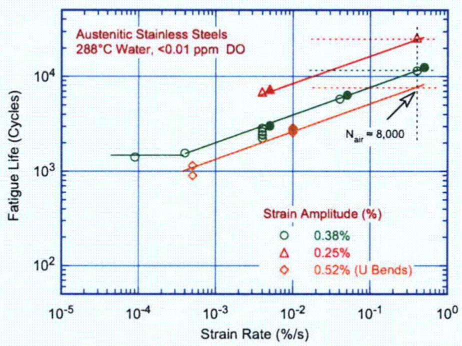
$T^* = 0$	$(T < 150°C)$
$T^* = (T - 150)/175$	$(150 \leq T < 325°C)$
$T^* = 1$	$(T \geq 325°C)$
$O^* = 0.281$	(all DO levels)
$R^* = 0$	$(R > 0.4\%/s)$
$R^* = \ln(R/0.4)$	$(0.0004 \leq R \leq 0.4\%/s)$
$R^* = \ln(0.0004/0.4)$	$(R < 0.0004\%/s)$

- These expressions represent average fatigue life of the median material

Stainless Steel Tube U-Bend Tests in PWR Water at 240°C

- Applicability of laboratory data to component behavior has been demonstrated by several component tests





- Measured environmental reduction factor
  F_{en} =10,000/1,728 =5.8 at 0.0005%/s & =10,000/3,624 = 2.8 at 0.01%/s.
  Predicted values are 5.5 and 3.6, respectively

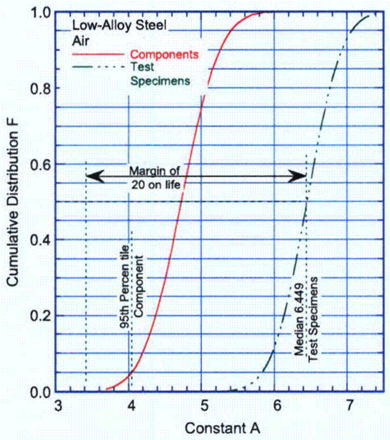
Fatigue Life of Components

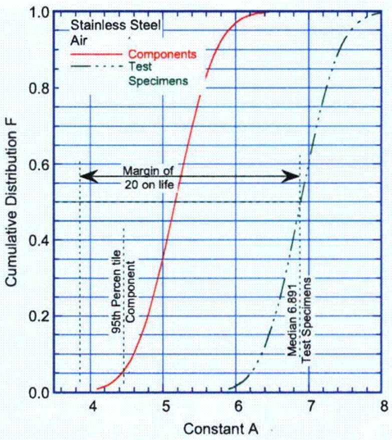
- Available information reviewed to better define adjustment factor on life that must be applied to mean-data curve to account for effects of variables that influence life but were not explicitly addressed in the data

Parameter	ASME Code	Presented Study
Material Variability & Data Scatter	2.0	2.1 - 2.8
Size	2.5	1.2 - 1.4
Surface Finish	4.0	2.0 - 3.5
Loading History	–	1.2 - 2.0
Total Adjustment Factor	**20**	**6 - 27**

- – Monte Carlo simulations performed to determine distribution of A for adjusted fatigue curve that represents behavior of actual component.
- – Use material variability & data scatter results from present analysis
- – Assume a lognormal distribution for effects of size, surface finish, & loading history, & min and max values of adjustment factor assumed to represent 5th and 95th percentile, respectively
- – Assume effects can be considered as independent based on engineering judgment

Fatigue Design Adjustment Factors





- Monte Carlo analysis suggests adjustment applied to mean values of specimen fatigue life to bound component fatigue life of 95% of population is ≈12. Thus, current Code requirements of factor of 20 on life is conservative by about a factor of ≈1.7 for components

Methods for Incorporating Environmental Effects

- Two approaches proposed for incorporating effects of LWR coolant environments into Code fatigue evaluations:
  - develop new fatigue design curves for LWR environments
  - use an environmental fatigue correction factor F_{en}
- Because fatigue life in LWR environments depends on several loading & environmental parameters, design curve approach would require developing multiple design curves to cover range of conditions or a conservative bounding curve
- The F_{en} approach is relatively simple and flexible enough to address effects without unnecessary conservatism

F_{en} Method for Incorporating Environmental Effects

- F_{en} is defined as ratio of fatigue life in air at RT to that in water under service conditions

$$\ln[F_{en}] = \ln(N_{RTair}) - \ln(N_{water})$$

$F_{en} = \exp(0.632 - 0.101\ S^*T^*O^*R^*)$ (Carbon Steels)

$F_{en} = \exp(0.702 - 0.101\ S^*T^*O^*R^*)$ (Low-Alloy Steels)

$F_{en} = \exp(0.734 - T^*O^*R^*)$ (Stainless Steels)

$F_{en} = 1$ ($\varepsilon_a \leq 0.07\%$ CLAS & $\leq 0.10\%$ SSs)

- To incorporate environmental effects, fatigue usage based on air curve is multiplied by F_{en}

$$U_{en} = U_1\ F_{en,1} + U_2\ F_{en,2} \ldots.\ U_n\ F_{en,n}$$

Fen Method (Contd.)

- For CSs & LASs, current Code design curves are either consistent or conservative with respect to existing data
  - usage factors can be based on current Code design curves, or
  - to reduce conservatism, use design curves based on ANL models and adjustment factors of 2 & 12
- For austenitic SSs & Ni-Cr-Fe alloys, current Code design curve for SSs is nonconservative with respect to existing data
  - usage factors should be determined from the new design curves based on ANL model and adjustment factors of 2 & 12
  - current Code design curve should not be used because it will yield nonconservative estimates of CUF

Regulatory Positions

Regulatory Position 1: Carbon and Low-Alloy Steels

✓ Calculate fatigue usage in air with ASME Code Analysis procedures +
  - ✓ ASME Code air curves, **or**
  - ✓ New ANL model air curves

✓ Calculate the F_{en} using
  - ✓ Equation A.2 (CS),

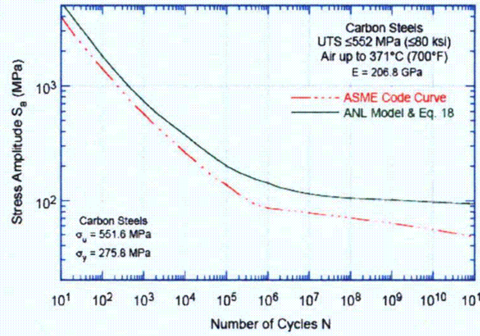
    $F_{en} = \exp(0.632 - 0.101\ S^{*}T^{*}O^{*}\dot{\varepsilon}^{*})$
  - ✓ Equation A.3 (LAS)

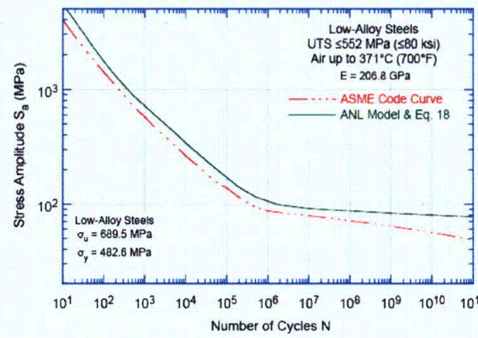
    $F_{en} = \exp(0.702 - 0.101\ S^{*}T^{*}O^{*}\dot{\varepsilon}^{*})$

    (Appendix A of NUREG/CR-6909)

✓ Calculate the environmental fatigue usage (U_{en})

$U_{en} = U_1 F_{en,1} + U_2 F_{en,2} \ldots . U_n F_{en,n}$





Regulatory Position 2: Austenitic Stainless Steels

✓ Calculate fatigue usage in air with ASME Code Analysis procedures +
  - ✓ **New ANL model air SS curve**

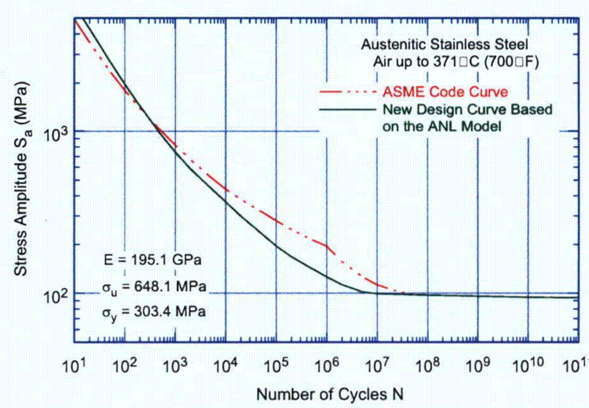
✓ Calculate the F_{en} using
  - ✓ Equation A.9

    $F_{en} = \exp(0.702 - 0.101\ S^{*}T^{*}O^{*}\dot{\varepsilon}^{*})$

    (Appendix A of NUREG/CR-6909)

✓ Calculate the environmental fatigue usage (U_{en})

$U_{en} = U_1 F_{en,1} + U_2 F_{en,2} \ldots . U_n F_{en,n}$



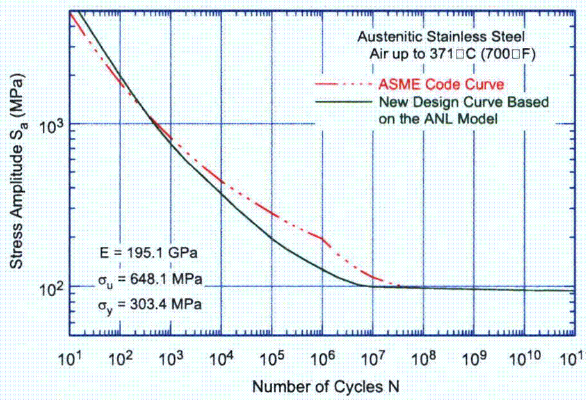
Regulatory Position 3: Ni-Cr-Fe Alloys (e.g., Alloy 600 and 690)

- ✓ Calculate fatigue usage in air with ASME Code Analysis procedures +
  - ✓ **New ANL model air SS curve**
- ✓ Calculate the F_{en} using
  - ✓ Equation A.14

    $F_{en} = \exp(\,T^* O^* \dot{\varepsilon}^*\,)$

    (Appendix A of NUREG/CR-6909)
- ✓ Calculate the environmental fatigue usage (U_{en})

$U_{en} = U_1\, F_{en,1} + U_2\, F_{en,2}\, \ldots\, U_n\, F_{en,n}$



Summary

- RG 1.207 endorses the use of new air curve for SSs
- RG 1.207 endorses the F_{en} methodology
- Guidance on incorporating environmental correction factor to fatigue design analyses
  - Appendix A of NUREG/CR-6909 Rev. 1
- NUREG/CR-6909 Rev. 1 describes in detail the technical basis

Resolution of Public Comments

- July 24, 2006 - DG-1144 and draft NUREG/CR-6909 published for public comments (60 day comment period)

- Public comment period ended September 25, 2006

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Resolution of Public Comments (cont.)

- 8 correspondents submitted a total of 56 comments on DG-1144 and draft NUREG/CR-6909
  - All comments addressed individually

- Final RG 1.207 and NUREG/CR-6909 Rev. 1 reflects the resolution of these comments

- 6 main issues identified

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Resolution of Public Comments (cont.)

Staff Response to Public Comments on DG-1144 and Draft NUREG/CR-6909

#	Source*	Comment**	Response
1	I- 1a.	Each Comment appears individually in this column.	NRC staff response for each comment.

*

Source I:	Ronnie L. Gardner, AREVA NP, Inc.	ML062920056
Source II:	Takao NAKAMURA, The Kansai Electric Power Co., Inc.	ML062790143
Source III:	James H. Riley, Nuclear Energy Institute	ML062790136
Source IV:	C L. Funderburk, Dominion Resources Services, Inc.	ML062790144
Source V:	Makoto HIGUCHI, Ishikawajima-Harima Heavy Industries Co., Ltd.	ML062790138
Source VI:	Robert E. Brown, GE Energy Nuclear	ML062790141
Source VII:	Gerry C. Slagis, G.C. Slagis Associates, Consulting Engineering	ML062620349
Source VIII:	Kenneth R. Balkey, Nuclear Codes and Standards, American Society of Mechanical Engineers	ML062790139

**. Comments are quoted directly from the letter submitted by the commenter.

Resolution of Public Comments (cont.)

- Six issues (comment id #'s):
  1. Operating experience and applicability of specimen data (1, 7, 14, 16, 45)
  2. Details on approach (22, 24, 27, 37)
  3. Ni-Cr-Fe alloy fatigue curve (20, 25, 44)
  4. Burden due to increase in locations required to be analyzed (2, 43)
  5. Overly conservative position (4, 5, 15)
  6. ASME Code case (56)

1. Operating experience and applicability of specimen data (1, 7, 14, 16, 45)

Issue:

- *There is no operating experience that supports the need for these conservative design rules.*
- *Comments questioning the applicability of specimen data being representative of actual components in service.*

Staff Response:

- Numerous examples of fatigue cracking of nuclear power plant components reported - EPRI TR-106696.
- Applicability of laboratory data to component behavior has been demonstrated by mock–up and component tests (references provided in previous presentation). In fact, is the basis for the current ASME Code fatigue curves.

2. Details on approach (22, 24, 27, 37)

Issues:

- *References made to other guidance containing similar Fen approach (Japan) also acceptable/endorsed?*
- *"Since DG-1144 utilizes a similar Fen methodology to that evaluated in MRP-47, Rev.1, the issues identified in MRP-47, Rev.1 are considered to be equally applicable to the DG-1144 methodology. Some, but not all, of the issues raised in MRP-47, Rev.1 have been specifically addressed in DG-1144. Based on this, the MRP would like to see clarification on the remaining issues included in DG-1144 or the supporting document".*

Staff Response:

- The papers listed in NUREG/CR-6909 are for reference only. Section C, Regulatory Position, of the regulatory guide contains the methodology endorsed by the staff.
- The level of analytical detail discussed on additional items on MRP-47, Rev.1 are beyond the scope of this regulatory guide.

3. Ni-Cr-Fe alloy fatigue curve (20, 25, 44)

Issue:

Provide guidance for Ni-Cr-Fe alloys (e.g., Alloy 600 and 690).

Staff Response:

The staff incorporated F_{en} methodology for Ni-Cr-Fe alloy materials into RG 1.207 (RP 3) and NUREG/CR-6909 Rev. 1 (Section 6).

4. Burden due to increase in locations required to be analyzed (2, 43)

Issue:

Increase in the CUFs will lead to more analyzed piping break locations, to more installed pipe whip restraints, and to designs that will be more detrimental for normal (thermal expansion) operating conditions.

Staff Response:

- Staff will consider a justified modification with the appropriate technical basis of the fatigue criteria for postulation of pipe breaks if implementation of the current criteria results in a significant increase in the number of required pipe whip restraints.
- The necessity for additional pipe restraints will disappear with a successful LBB analysis

5. Overly conservative position (4, 5, 15)

Issue:

Commenter believes that the alternative methods for fatigue analysis provided in NUREG/CR-6909 and DG-1144 are too conservative and should not be used for the design of new reactors.

Staff Response:

The staff position is based on a 95% confidence that there is less than 5% probability of fatigue crack initiation. Implementation of this criteria resulted in a carbon steel and low-alloy steel air curves which are less conservative than the existing ASME Code curve

6. ASME Code case (56)

Issue:

"*ASME will continue to develop other Code Cases covering alternative ways of addressing [the impact of the LWR environment]... and the Code Case will be issued early in 2007. Once these Code Cases are issued, ASME requests the NRC to endorse these Code Cases in a revision of the Regulatory Guide 1.84*".

Staff Response:

The NRC staff will consider endorsing available ASME Code Cases through its normal process for revising Regulatory Guide 1.84.

Revisions made from DG-1144 to RG 1.207

Main revision:

- The staff incorporated F_{en} methodology for Ni-Cr-Fe alloy materials into RG 1.207 (RP 3) and NUREG/CR-6909 Rev. 1 (Section 6).
- High Cycle Fatigue Regime (> 10^6 cycles)

Other:

Some editorial changes for clarification on the technical basisNUREG/CR-6909

Conclusion

RG 1.207 is ready for issuance

- Final RG 1.207 and NUREG/CR-6909 Rev. 1 reflects the resolution of these comments
- Final RG 1.207 and NUREG/CR-6909 Rev.1 will be published by March 2007 (High priority RG)
- Seeking ACRS concurrence to publish final effective guide

Proposed Revision to Section 13.3, "Emergency Planning" (EP) of the Standard Review Plan (SRP) & Combined License Application Guidance (DG-1145)

Presented By

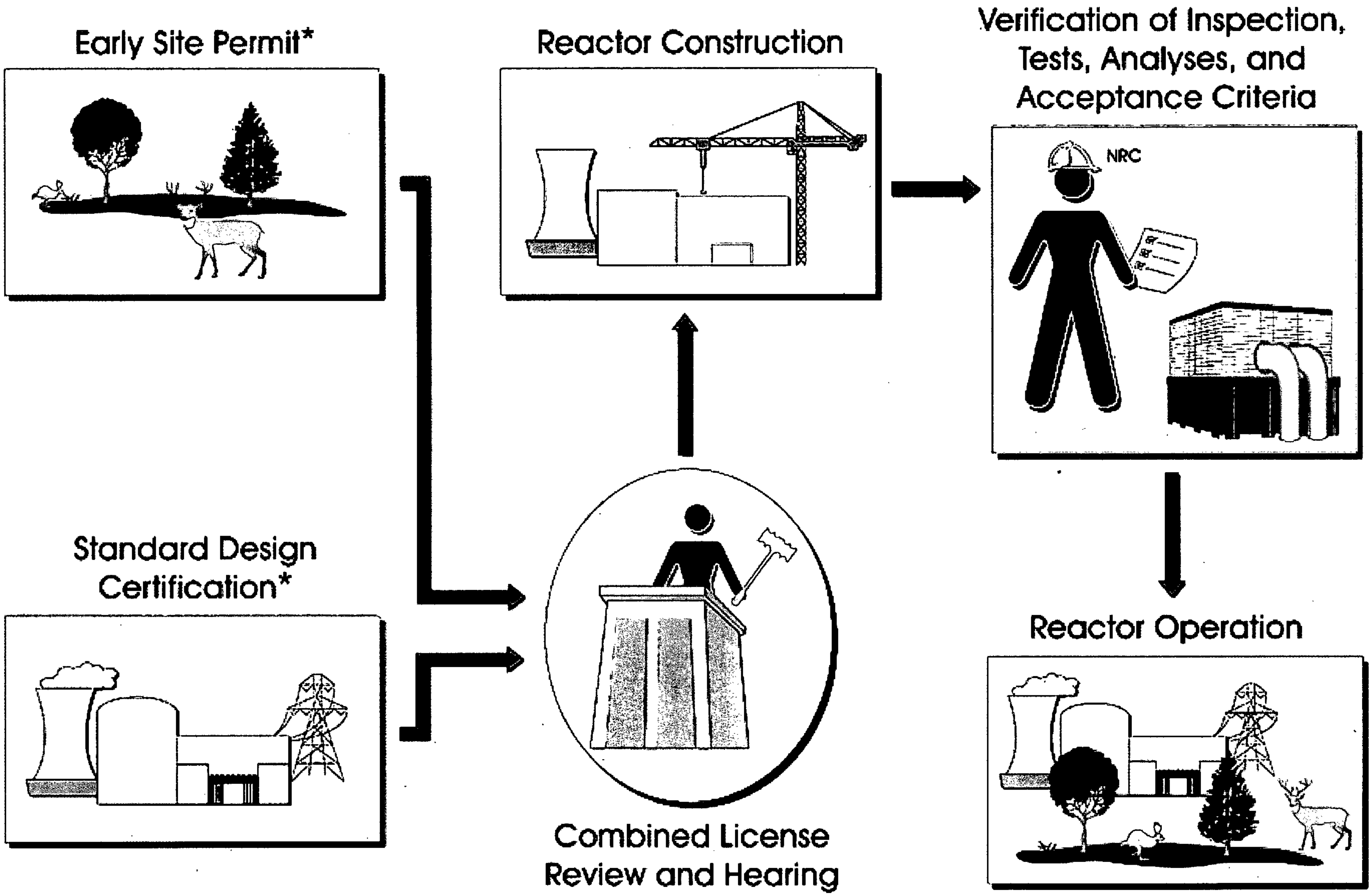
Daniel M. Barss
Sr. Emergency Preparedness Specialist
Division of Preparedness and Response
Office of Nuclear Security and Incident Response
U.S. Nuclear Regulatory Commission
DMB1@NRC.GOV
301-415-2922

Section 13.3, "EP" of the SRP and DG-1145

- Standard Review Plan (SRP) (NUREG-0800) Section 13.3, "Emergency Planning"

- COL Application Guidance (DG-1145) Section 13.3, "Emergency Planning"

Combined Licenses, Early Site Permits, and Standard Design Certifications



* or equivalent process

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process

- Emergency Planning continues to be a part of the licensing process. (10 CFR 50.33, 50.34, 50.47, 50.54, and Appendix E, and 10 CFR part 52)

- President's decision of December 7, 1979 reemphasizes the NRC's continuing statutory responsibility for the radiological health and safety of the public.

Section 13.3, "EP" of the SRP and DG-1145

<u>Regulatory Process *(cont'd.)*</u>

- Emergency Preparedness "Reasonable Assurance" finding needed prior to issuing License - 10 CFR 50.47(a)
- **NRC** makes this finding based on:
  - A review of FEMA (**DHS**) findings and determinations concerning **offsite** plans
  - and **NRC** findings and determinations concerning **onsite** plans.
  - NRC/FEMA Memorandum of Understanding establishes working relationship - 44 CFR 353, Appendix A

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

- 16 Planning Standards of 10 CFR 50.47(b)
- Requirements of 10 CFR 50, Appendix E
- Regulatory Guide 1.101
  - NUREG-0654, FEMA-REP-1, Rev. 1 Acceptance Criteria
  - NEI 99-01, Rev. 4, EALs

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

- Emergency Preparedness (EP)
  - A "Licensing Condition" - 10 CFR 50.54(q)
  - Deficiency 120 day clock - 10 CFR 50.54(s)
  - Reality presumption - 10 CFR 50.47(c)
  - Supported by two sets of plans:
    - "Onsite" emergency plan (Facility plan)
    - "Offsite" emergency plan (State & local plans)

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

- 10 CFR Part 50
  - 2-Step Process:
    - Construction Permit
    - Operating License

An EP Perspective on New Reactor Licensing

Regulatory Process *(cont'd.)*

- **10 CFR Part 52 – Alternative licensing process**
  - **Established in 1989**
    - Improve Regulatory Efficiency
    - Add Greater Predictability
    - Essentially the Same Information as Part 50
    - Combines Construction Permit & Operating License with Conditions for Plant Operation – Combined License (COL)
    - Specify Applicant Inspection, Tests, Analysis and Acceptance Criteria (ITAAC)

An EP Perspective on New Reactor Licensing

Regulatory Process *(cont'd.)*

- **10 CFR Part 52 – Alternative licensing process**
  - **Acceptance Criteria**
    - Provide Reasonable Assurance that the facility has been constructed and will operate in conformity with the license and applicable regulations

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

- **10 CFR Part 52 – Combined License**
  - **NRC**
    - Authorize fuel load ONLY after ITAAC met
    - Periodic Federal Register Notice as ITAAC met
    - 180 days prior to scheduled initial loading of fuel
      - *Publish notice of intended operation in Federal Register*
    - Hearing opportunity if petitioner demonstrates that Acceptance Criteria not met

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

- COL
  - **10 CFR 52.79(d)** ***proposed 10 CFR 52.79(22)***
    - Obtain Certifications from agencies with EP responsibilities that:
      - (A) Plans are practicable
      - (B) Commitment to further develop plans including field demonstrations
      - (C) Commitment to execute responsibilities

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

- COL
  - ***Proposed 10 CFR 50.54(gg)***
    - Allows operation up to 5% power with offsite deficiencies
    - Much like existing requirement in 10 CFR 50.47(d)

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

- **10 CFR Part 52 – Combined License**
  - **COL can incorporate by reference**
    - Design Certification
    - Early Site Permit
  - **Issues resolved in ESP or Design Certification are precluded from reconsideration at COL Stage**

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

- Standard Design Certification
  - ***10 CFR 52 Subpart B***
    - Allows certification of Nuclear power facilities separate from filing an application for construction or combined license
      - No specific EP Requirements

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

- Early Site Permit (ESP)
  - Independent of Plant Design
  - Valid for 10 – 20 Years, Renewable
  - Resolve early issues on
    - Site Safety
    - Emergency Preparedness
    - Environmental Protection

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

- **Early Site Permit (ESP)**
  - ***10 CFR 52.17***
    - (b)(1) Unique Physical Characteristics that could pose significant impediment to developing EP
    - (b)(2)(i) Major Features (NUREG-0654, Supplement 2)
    - (b)(2)(ii) Complete and Integrated Plans

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

- ESP *(cont'd.)*
  - ***10 CFR 52.17*** *(cont'd.)*
    - (b)(3) Describe contacts and arrangements with agencies with EP responsibilities [(b)(1) & (b)(2)(i)], ***OR***
    - Obtain Certifications from agencies with EP responsibilities that [(b)(2)(ii)]:
      - (3)(i) Plans are practicable
      - (3)(ii) Commitment to further develop plans including field demonstrations
      - (3)(iii) Commitment to execute responsibilities

Section 13.3, "EP" of the SRP and DG-1145

- Standard Review Plan (SRP) (NUREG-0800) Section 13.3, "Emergency Planning"
- COL Application Guidance (DG-1145) Section 13.3, "Emergency Planning"

Section 13.3, "EP" of the SRP and DG-1145

SRP Section 13.3, EP

- Provides for review of EP in
  - Construction Permit (CP)
  - Operating License (OL)
  - Early Site Permit (ESP)
  - Standard Design Certification (DC)
  - Combined License (COL)

Section 13.3, "EP" of the SRP and DG-1145

SRP Section 13.3, EP

- Identifies Review Interfaces within SRP
- Identifies Regulatory Requirements
- Establishes Acceptance Criteria to existing Regulatory Guidance
- Provides Technical Rationale
- Outlines Review Procedure
- Proposes generic Evaluation findings
- Extensive Reference list
- Generic EP ITAAC Table

Section 13.3, "EP" of the SRP and DG-1145

SRP Section 13.3, EP

- Consideration of existing programs
  - Is it applicable to proposed reactor
  - Is it up-to-date
  - Reflects and incorporates new reactor

Section 13.3, "EP" of the SRP and DG-1145

SRP Section 13.3, EP

- Emergency Action Levels (EALs)
  - NEI 99-01applicable EALs used
  - NEI 99-01 EAL development guidance
  - Passive reactor designs EALs

Section 13.3, "EP" of the SRP and DG-1145

SRP Section 13.3, EP

- Inspection, Test, Analysis, Acceptance Criteria (ITAAC)
  - Generic EP ITAAC provided in Table 13.3.1
  - Develop with Industry & public participation
  - Based on existing NUREG-0654 criteria
  - Not all-inclusive, or exclusive
  - Applicant proposes and accomplishes
  - Case-by-case determination

Section 13.3, "EP" of the SRP and DG-1145

SRP Section 13.3, EP

- Offsite EP Guidance
  - Current REP-series guidance documents
  - Associated Memoranda
  - Radiological Emergency Preparedness: Planning Guidance, February 28, 2003

Section 13.3, "EP" of the SRP and DG-1145

SRP Section 13.3, EP

- Standard Design Certification EP (not required)
  - EP features are technically relevant to the design, and not site-specific, and usable for a multiple number of units or sites
  - Programmatic aspects of EP are COL applicants' responsibility
  - Facilities, functions, and equipment to support EP
    - TSC, OSC, Personnel Decontamination
      - Location, size, habitability, ventilation systems
      - ERDS, SPDS, Voice and data Communications

Section 13.3, "EP" of the SRP and DG-1145

DG-1145 Section 13.3, EP

- Provides guidance on EP information in a Combined License for a
  - Custom design
  - Certified Design
  - Certified Design with ESP

Section 13.3, "EP" of the SRP and DG-1145

DG-1145 Section 13.3, EP

- Addresses EP information in a Combined License
  - Application & Emergency Plan Content
  - Multi-Unit Site considerations
  - EP ITAAC

Section 13.3, "EP" of the SRP and DG-1145

ACRS Preliminary Questions

- Substantive change to Section 13.3 is incorporation of Part 52 process
  - EP ITAAC
  - "Predictive" reasonable assurance finding
  - Timing of exercise

Section 13.3, "EP" of the SRP and DG-1145

ACRS Preliminary Questions

- Guidance for "green-field" sites
  - Existing guidance is applicable
  - Considered in development of generic EP ITAAC
  - Continue discussion with DHS
  - Plans needed at COL application stage
  - Implementing Procedures developed later

Section 13.3, "EP" of the SRP and DG-1145

ACRS Preliminary Questions

- Completeness of EP ITAAC Table for ESP
  - Generic EP ITAAC provided in Table 13.3.1
  - Develop with Industry & public participation
  - Based on existing NUREG-0654 criteria
  - Not all-inclusive, or exclusive
  - Applicant proposes and accomplishes
  - Case-by-case determination

Section 13.3, "EP" of the SRP and DG-1145

ACRS Preliminary Questions

- Diversity of planning options including evacuation, sheltering, and KI
  - NUREG-0654, J.10.f – KI
  - NUREG-0654, J.10.g - Evacuation
  - NUREG-0654, J.10.m - Shelter

Section 13.3, “EP” of the SRP and DG-1145

Comments from public review period

- Not open the existing site emergency plan for review
- Expansion of ITAAC
- Use of the term “generic communications”
- Submittal of offsite implementing procedures
- Absence of DHS/FEMA/REP, planning references and limited offsite emergency response plan related review criteria.

Section 13.3, "EP" of the SRP and DG-1145

Questions?

Daniel M. Barss
Sr. Emergency Preparedness Specialist
Division of Preparedness and Response
Office of Nuclear Security and Incident Response
U.S. Nuclear Regulatory Commission
DMB1@NRC.GOV
301-415-2922

Proposed Revision to Section 13.3, "Emergency Planning" (EP) of the Standard Review Plan (SRP) & Combined License Application Guidance (DG-1145)

Presented By
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Division of Preparedness and Response
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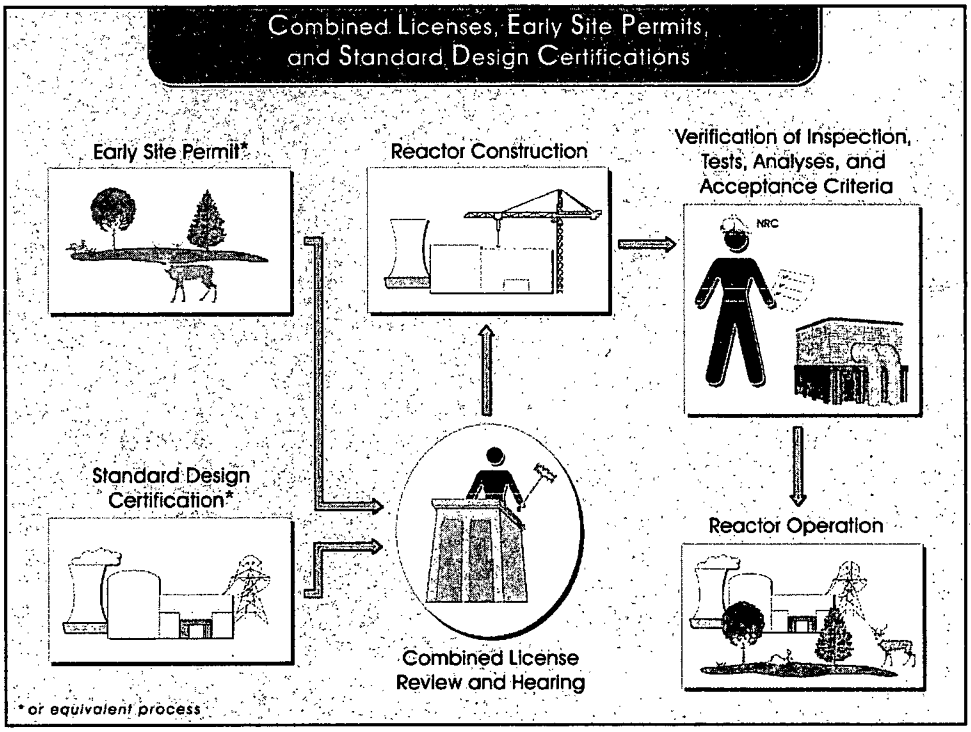
DMB1@NRC.GOV
301-415-2922

Section 13.3, "EP" of the SRP and DG-1145

- Standard Review Plan (SRP) (NUREG-0800) Section 13.3, "Emergency Planning"
- COL Application Guidance (DG-1145) Section 13.3, "Emergency Planning"



Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process

- Emergency Planning continues to be a part of the licensing process. (10 CFR 50.33, 50.34, 50.47, 50.54, and Appendix E, and 10 CFR part 52)
- President's decision of December 7, 1979 reemphasizes the NRC's continuing statutory responsibility for the radiological health and safety of the public.

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

- Emergency Preparedness "Reasonable Assurance" finding needed prior to issuing License - 10 CFR 50.47(a)
- **NRC** makes this finding based on:
  - A review of FEMA (**DHS**) findings and determinations concerning **offsite** plans
  - and **NRC** findings and determinations concerning **onsite** plans.
  - NRC/FEMA Memorandum of Understanding establishes working relationship - 44 CFR 353, Appendix A

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

- 16 Planning Standards of 10 CFR 50.47(b)
- Requirements of 10 CFR 50, Appendix E
- Regulatory Guide 1.101
  - NUREG-0654, FEMA-REP-1, Rev. 1 Acceptance Criteria
  - NEI 99-01, Rev. 4, EALs

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

- Emergency Preparedness (EP)
  - A "Licensing Condition" - 10 CFR 50.54(q)
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  - Reality presumption - 10 CFR 50.47(c)
  - Supported by two sets of plans:
    - "Onsite" emergency plan (Facility plan)
    - "Offsite" emergency plan (State & local plans)

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

- **10 CFR Part 50**
  - **2-Step Process:**
    - Construction Permit
    - Operating License

An EP Perspective on New Reactor Licensing

Regulatory Process *(cont'd.)*

- **10 CFR Part 52 – Alternative licensing process**
  - **Established in 1989**
    - Improve Regulatory Efficiency
    - Add Greater Predictability
    - Essentially the Same Information as Part 50
    - Combines Construction Permit & Operating License with Conditions for Plant Operation – Combined License (COL)
    - Specify Applicant Inspection, Tests, Analysis and Acceptance Criteria (ITAAC)

An EP Perspective on New Reactor Licensing

Regulatory Process *(cont'd.)*

- **10 CFR Part 52 – Alternative licensing process**
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    - Provide Reasonable Assurance that the facility has been constructed and will operate in conformity with the license and applicable regulations

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

- **10 CFR Part 52 – Combined License**
  - **NRC**
    - Authorize fuel load ONLY after ITAAC met
    - Periodic Federal Register Notice as ITAAC met
    - 180 days prior to scheduled initial loading of fuel
      - *Publish notice of intended operation in Federal Register*
    - Hearing opportunity if petitioner demonstrates that Acceptance Criteria not met

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

- COL
  - **10 CFR 52.79(d)** ***proposed 10 CFR 52.79(22)***
    - Obtain Certifications from agencies with EP responsibilities that:
      - (A) Plans are practicable
      - (B) Commitment to further develop plans including field demonstrations
      - (C) Commitment to execute responsibilities

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

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  - ***Proposed 10 CFR 50.54(gg)***
    - Allows operation up to 5% power with offsite deficiencies
    - Much like existing requirement in 10 CFR 50.47(d)

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  - **Issues resolved in ESP or Design Certification are precluded from reconsideration at COL Stage**

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- Standard Design Certification
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    - Allows certification of Nuclear power facilities separate from filing an application for construction or combined license
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Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

- **Early Site Permit (ESP)**
  - **Independent of Plant Design**
  - **Valid for 10 – 20 Years, Renewable**
  - **Resolve early issues on**
    - Site Safety
    - Emergency Preparedness
    - Environmental Protection

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

- **Early Site Permit (ESP)**
  - ***10 CFR 52.17***
    - (b)(1) Unique Physical Characteristics that could pose significant impediment to developing EP
    - (b)(2)(i) Major Features (NUREG-0654, Supplement 2)
    - (b)(2)(ii) Complete and Integrated Plans

Section 13.3, "EP" of the SRP and DG-1145

Regulatory Process *(cont'd.)*

- ESP *(cont'd.)*
  - ***10 CFR 52.17*** *(cont'd.)*
    - (b)(3) Describe contacts and arrangements with agencies with EP responsibilities [(b)(1) & (b)(2)(i)], ***OR***
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  - NEI 99-01applicable EALs used
  - NEI 99-01 EAL development guidance
  - Passive reactor designs EALs

Section 13.3, "EP" of the SRP and DG-1145

SRP Section 13.3, EP

- Inspection, Test, Analysis, Acceptance Criteria (ITAAC)
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  - Develop with Industry & public participation
  - Based on existing NUREG-0654 criteria
  - Not all-inclusive, or exclusive
  - Applicant proposes and accomplishes
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Section 13.3, "EP" of the SRP and DG-1145

SRP Section 13.3, EP

- Offsite EP Guidance
  - Current REP-series guidance documents
  - Associated Memoranda
  - Radiological Emergency Preparedness: Planning Guidance, February 28, 2003

Section 13.3, "EP" of the SRP and DG-1145

SRP Section 13.3, EP

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Section 13.3, "EP" of the SRP and DG-1145

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- Addresses EP information in a Combined License
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Section 13.3, "EP" of the SRP and DG-1145

ACRS Preliminary Questions

- Substantive change to Section 13.3 is incorporation of Part 52 process
  - EP ITAAC
  - "Predictive" reasonable assurance finding
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Section 13.3, "EP" of the SRP and DG-1145

ACRS Preliminary Questions

- Guidance for "green-field" sites
  - Existing guidance is applicable
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  - Continue discussion with DHS
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Section 13.3, "EP" of the SRP and DG-1145

ACRS Preliminary Questions

- Completeness of EP ITAAC Table for ESP
  - – Generic EP ITAAC provided in Table 13.3.1
  - – Develop with Industry & public participation
  - – Based on existing NUREG-0654 criteria
  - – Not all-inclusive, or exclusive
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Section 13.3, "EP" of the SRP and DG-1145

ACRS Preliminary Questions

- Diversity of planning options including evacuation, sheltering, and KI
  - – NUREG-0654, J.10.f – KI
  - – NUREG-0654, J.10.g - Evacuation
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Section 13.3, "EP" of the SRP and DG-1145

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- Not open the existing site emergency plan for review
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Section 13.3, "EP" of the SRP and DG-1145

Questions?

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DMB1@NRC.GOV
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State-of-the-Art Reactor Consequence Analyses ACRS Meeting

December 7, 2006

Robert J. Prato
Office of Nuclear Regulatory Research

AGENDA

- MELCOR AND MACCS CODE IMPROVEMENTS
- PLANT GROUPING
- SCENARIO SELECTION
- LNT – vs – THRESHOLD
- EMERGENCY PREPAREDNESS
- ACRS ISSUES AND QUESTIONS

CODE IMPROVEMENTS

- 4 of 4 MELCORE CODE IMPROVEMENTS ARE BEING IMPLEMENTED
- 8 OF 10 MACCS2 CODE IMPROVEMENTS ARE BEING IMPLEMENTED
- 2 MACCS2 CODE IMPROVEMENTS ARE NOT BEING IMPLEMENTED
  - WET DEPOSITION MODEL AEROSOL SIZE DEPENDENCE
  - ANGULAR RESOLUTION

PLANT GROUPINGS

- GE, Mark 1
- GE, Mark 2
- GE, Mark3
- B&W, Dry Ambient
- CE, Dry Ambient
- <u>W</u>, 4 loop, Ice Condenser
- <u>W</u>, 2 and 3 loop, Dry Ambient, and Dry Sub-atmospheric
- <u>W</u>, 4 loop, Dry Ambient, and Dry Sub-atmospheric

USE OF CDF / RELEASE FREQUENCY

FULL-SCOPE LEVEL -2 PRAs ARE NOT AVAILABLE FOR ALL PLANTS, LIMITING THE STAFF'S ABILITY TO SELECT SCENARIOS BASED ON RELEASE FREQUENCY.

FOR THE PURPOSE OF SOAR-CA, THE NRC IS CONSIDERING DEFINING "RELEASE" BROADLY AS EARLY OR LATE, LARGE OR SMALL. ON THE BASIS THIS DEFINITION, ALL CORE DAMAGE EVENTS WILL RESULT IN A RELEASE

HENCE, THE STAFF IS EVALUATING SCENARIOS SELECTION USING CORE DAMAGE FREQUENCY.

Selection of Scenarios to Use for Consequence Analysis

Current PRA Tools

MODELS/METHODOLOGY	NUMBER OF PLANTS WITH MODELS
INTERNAL EVENTS	
SPAR Models	103
EXTERNAL EVENTS	
EE SPAR Models	13
IPEEE- Seismic PRAs	37
IPEEE- Seismic Margin Analysis	66
IPEEE- Fire PRA	23
IPEEE- FIVE Methodology (FIVE+, FIVE/PRA, and FIVE/FPRAIG)	80

SCENARIO SELECTION OPTIONS

- INTERNAL EVENTS CDF WITH UNCERTAINTY CONSIDERATIONS
- INTERNAL EVENTS CDF WITH UNCERTAINTY AND EXTERNAL EVENTS CONSIDERED

INTERNAL EVENTS CDF WITH UNCERTAINTY

- USE SPAR CDF FACTORING IN UNCERTAINTY, EXCLUDE EXTERNAL EVENTS, TO DETERMINE SCENARIO SELECTION
- IMPLEMENT USING INDIVIDUAL PLANT RESULTS OR SELECT DOMINANT SCENARIOS FOR CLASS OF PLANT
- NOT VIABLE, BETTER OPTIONS AVAILABLE
  - SIMPLISTIC APPROACH
  - EXCLUDES EFFECTS OF EXTERNAL EVENTS

INTERNAL EVENTS CDF WITH UNCERTAINTY AND EXTERNAL EVENTS CONSIDERED

- USE SPAR CDF FACTORING IN UNCERTAINTY AND EXTERNAL EVENTS TO DETERMINE SCENARIO SELECTION

- EXTERNAL EVENTS CAN BE INCLUDED USING OLD DATA OR NEW DATA (SCENARIOS and CDFs) OBTAINED FROM LICENSEES. WHERE NEW DATA NOT AVAILABLE, CONSIDER USING MEAN VALUES

- IMPLEMENT USING INDIVIDUAL PLANT RESULTS OR SELECT DOMINANT SCENARIOS FOR CLASS OF PLANT

- VIABLE OPTIONS AVAILABLE
  - BEST APPROACH FOR INCLUDING EXTERNAL EVENTS
  - SIMPLISTIC APPROACH FOR PLANTS WITH NO EXTERNAL EVENTS PRAs

LNT – vs – THRESHOLD

- The Commission directed the staff not solely rely on conservative collective dose models to assess latent cancer health effects from low doses of radiation, but to utilize a range of potential latent cancer health effects estimated from low levels of radiation.
- The staff identified a range of thresholds from 0 to 5 rem.
- To use a range of 0 to 5 rem, would require the use of Linear, no threshold for the treatment of "0" dose in modeling, and for the remaining range of doses would require a threshold.
- Options for Doses, the staff is considering the use of 0, 100 mrem, 1 rem, and 5 rem
- The staff is considering different methods of presenting the results that we will be prepared to present at the next ACRS meeting.

EMERGENCY PREPAREDNESS

Site-Specific Simulation
Of Offsite Emergency Response
for SOARCA

ACRS ISSUES AND QUESTIONS

Site-Specific Simulation of Offsite Emergency Response for SOARCA

Randolph L. Sullivan, CHP

Presentation to ACRS

December 7, 2006

EP Modeling

- Modeling the protective response afforded by NPP Emergency Preparedness (EP) programs substantially improves realism
- All NPPs have regularly inspected and exercised EP programs
- Modeling realistically represents NRC Defense-in-Depth Policy

ASSUMPTIONS

- Officials will implement emergency plans
- The public will largely obey direction from officials
- Emergency workers will implement the plans
- Basis from NUREG/CR-6864, "Identification and Analysis of Factors Affecting Emergency Evacuations" and PAR Study Focus Groups

Emergency Declaration

- Emergencies will be declared when EALs are reached
- Control room readings not available to SOARCA project, but can be inferred from MELCOR output
- "SRO discretion EAL" may be considered

Precautionary Actions

- Early precautionary actions are taken at Alert and Site Area Emergency
- Evacuation of special needs populations
  - Schools
  - Parks
- Prepare nursing homes
- Sirens sound and the public is notified
  - Shadow evacuation

Population Movement

- Evacuation Time Estimates (ETEs) provide:
  - Site-specific evacuation travel times
  - Population preparation time
- Divide population into cohorts
- Cohorts start at different times and move at different speeds

MACCS2 is being modified to accommodate multiple cohorts

Time of Day

- Accounting for variations in cohort travel for time of day, time of year, weather, peak population densities, etc. goes beyond current scope/resources
- A composite estimate for each cohort will consider these variations
  - Assumptions documented

Travel Speed

- Limited access roads and towns affect evacuation speed
  - Reflected in cohort travel speed where practical
- **MACCS is being modified to allow variation of travel speed by cohort in space and time**

Beyond the EPZ

- Protective actions beyond the EPZ are required by regulation but detailed planning is not
- Need would be identified via dose projection (plant, state, NRC) but implementation is ad hoc
- Population density, scenario timing, road networks and shadow evacuation will inform estimates of public preparation time and evacuation speed
- Less detailed than within EPZ

Radial Evacuation

- MACCS2 models radial evacuation
- Evacuation routes are not radially outward
- MACCS2 has been modified to easily model lateral movement
  - Improves realism
- Travel speed will be estimated for each cohort and modified by roads and towns

KI

- Considered for programs that use it
- For pre-distributed KI assume 50% of the population takes it
- For programs that do not use KI, 0% will be assumed
- Where KI is distributed at congregate care centers (and the like), 20% assumed
- Assumptions used for all cohorts

ISSUES

- Assumptions made regarding discretionary protective action decisions by offsite response organizations (OROs)
  - Develop ORO advisory group
- Some ETEs are very old
  - Develop models based on best available information

ISSUES

- Probabilistic representation of weather affects modeling of evacuation
  - Estimate cohort speeds as though one quadrant were evacuated
- MACCS2 run time for latent cancer fatality threshold calculations is affected by number of cohorts
  - Minimize evacuation cohorts (e.g., some leave before release)

Questions?

Randy Sullivan
(301) 415-1123
RXS3@NRC.GOV

Plant/Containment Class Matrices

BWRs

MELCOR Class	Class 1			Class 2		Class 3
	GE 2 / Mark 1	GE 3 / Mark 1	GE 4 / Mark 1	GE 4 / Mark 2	GE 5 / Mark 2	GE 6 / Mark 3
1	Nine Mile Point 1	Dresden 2	Browns Ferry 2	Limerick 1	Columbia	Clinton
2	Oyster Creek	Dresden 3	Browns Ferry 3	Limerick 2	LaSalle 1	Grand Gulf
4		Monticello	Brunswick 1	Susquehanna 1	LaSalle 2	Perry
5		Pilgrim	Brunswick 2	Susquehanna 2	Nine Mile Point 2	River Bend
6		Quad Cities 1	Cooper			
7		Quad Cities 2	Duane Arnold			
8			Hatch 1			
9			Hatch 2			
10			Fermi 2			
11			Hope Creek			
12			Fitzpatrick			
13			Peach Bottom 2			
14			Peach Bottom 3			
15			Vermont Yankee			
	2	6	14	4	4	4
	22			8		4

Total # of BWRs = 34

PWRs

MELCOR Class	Class 4	Class 5	Class 6	Class 7*			Class 8	
	B&W / Dry Amb.	CE / Dry Amb.	W 4-Loop / Ice Cond.	W 2-Loop / Dry Amb.	W 3-Loop / Dry Sub.	W 3-Loop / Dry Amb.	W 4-Loop / Dry Sub.	W 4-Loop / Dry Amb.
1	ANO 1	ANO 2	Catawba 1	Ginna	Beaver Valley 1	Robinson 2	Millstone 3	Braidwood 1
2	Crystal River 3	Calvert Cliffs 1	Catawba 2	Kewaunee	Beaver Valley 2	Farley 1		Braidwood 2
4	Davis-Besse	Calvert Cliffs 2	D.C. Cook 1	Point Beach 1	North Anna 1	Farley 2		Byron 1
5	Oconee 1	Fort Calhoun	D.C. Cook 2	Point Beach 2	North Anna 2	Shearon Harris		Byron 2
6	Oconee 2	Millstone 2	McGuire 1	Prairie Island 1	Surry 1	Summer		Callaway
7	Oconee 3	Palisades	McGuire 2	Prairie Island 2	Surry 2	Turkey Point 3		Comanche Peak 1
8	TMI 1	Palo Verde 1	Sequoyah 1			Turkey Point 4		Comanche Peak 2
9		Palo Verde 2	Sequoyah 2					Diablo Canyon 1
10		Palo Verde 3	Watts Bar					Diablo Canyon 2
11		San Onofre 2						Indian Point 2
12		San Onofre 3						Indian Point 3
13		St. Lucie 1						Salem 1
14		St. Lucie 2						Salem 2
15		Waterford 3						Seabrook
16								South Texas 1
17								South Texas 2
18								Vogtle 1
19								Vogtle 2
20								Wolf Creek
	7	14	9	6	6	7	1	19
	7	14	9	19			20	

Total # of PWRs = 69

Notes

* Reviews are still need to be performed to determine grouping of these plants. After the reviews are completed, 2–3 additional MELCOR classes may be formed from the plants currently listed in Class 7.

Attachment 1

Mark I BWRs Internal Events Screening

Date Modified: 12/01/06

Plant Name	Total CDF	LLOCA	MLOCA	SLOCA	ISLOCA	ATWS	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Plant 1	4.E-06											
Plant 2	3.E-06											
Plant 3	1.E-05											
Plant 4	8.E-06											
Plant 5	4.E-06		Note 1			Note 2						
Plant 6	4.E-06											
Plant 7	2.E-06											
Plant 8	5.E-06					Note 2						
Plant 9	1.E-05											
Plant 10	3.E-06											
Plant 11	4.E-06											
Plant 12	5.E-06											
Plant 13	1.E-06											
Plant 14	1.E-05									Note 3		
Plant 15	1.E-05											
Plant 16	8.E-07											

***Scenario Descriptions*:**

1. Reactor transients with unavailabilities of high-pressure injection systems (HPCI/RCIC) and RCS depressurization.
2. Station blackout with unavailability of high-pressure injection systems (HPCI/RCIC) and the failure of operators to recover emergency power within 30 minutes.
3. Station blackout with failure of operators to recover emergency power prior to battery depletion. This scenario could have sequence contributors with and without successful shedding of DC loads to extend the battery life.
4. Reactor transients with unavailabilities of RHR which leads to the unavailabilities of SPC/SDC/CSS, along with unavailabilities of containment venting or late injection. This scenario includes non-recoverable losses of service water/CCW.
5. Reactor transients with common-cause failure of the SRVs to open. This scenario is a plant-specific scenario to Plant 15 (i.e., derived from licensee PRA).
6. Reactor transients with common-cause failure of the transformer power supply inverters leads to the unavailabilities of all high- and low-pressure injection systems. This scenario is a plant-specific scenario for Plant 15 (i.e., derived from licensee PRA).

***Notes*:**

1. There is no MLOCA event tree for Plant 5.
2. The relatively high ATWS CDFs for Plants 5 and 8 are due to conservative modeling assumptions in these SPAR models. These modeling artifacts are currently being corrected by INL.
3. Plant 14 has dominant sequences with and without a stuck-open SRV. The CDF sum for the sequences involving a stuck-open SRV equal 4×10^{-6}. The CDF sum for the sequences involving a stuck-open SRV equal 3×10^{-6}.

Westinghouse 4-Loop, Large Dry PWRs Internal Events Screening

Date Modified: 12/01/06

Plant Name	Total CDF	LLOCA	MLOCA	ATWS	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5a	Scenario 5b	Scenario 6	Scenario 7
Plant 1	2.E-05				Note 2							
Plant 2	3.E-05			Note 1	Note 2							
Plant 3	5.E-06				Note 2							
Plant 4	5.E-05				Note 2							
Plant 5	4.E-05				Note 2							
Plant 6	9.E-06				Note 2							
Plant 7	9.E-06											
Plant 8	8.E-06											
Plant 9	5.E-06				Note 2							
Plant 10	1.E-05			Note 1	Note 2							
Plant 11	5.E-05											
Plant 12	4.E-05				Note 2							
Plant 13	4.E-05				Note 2							

***Scenario Descriptions*:**

1. ISLOCA from the RHR system.
2. Steam generator tube rupture (initiating event).
3. Reactor transients with unavailabilities of AFW and bleed and feed.
4. Station blackout with failure of turbine-driven AFW pump and the failure of operators to recover emergency power within 1 hour.
5. (a) Station blackout with failure of operators to recover emergency power prior to battery depletion.
   (b) Station blackout with RCP seal failure (LOCA) and failure to recover power prior to battery depletion time or 4 hours (which ever is less).
6. Loss of service water or CCW (non-recoverable or operators fail to recover) with failure of RCP seals (LOCA).
7. SLOCA with failure of RHR/HPR or RHR/LPR.

	Color Coding Scale	
	Cont. Bypass	No Cont. Bypass
Green	CDF < 5E-8	CDF < 5E-7
Yellow	5E-8 ≤ CDF < 1E-7	5E-7 ≤ CDF < 1E-6
Red	CDF ≥ 1E-7	CDF ≥ 1E-6

***Notes*:**

1. The relatively high ATWS CDFs for Plants 2 and 10 are due to conservative modeling assumptions contained in these SPAR models. These modeling artifacts are currently being corrected by INL.
2. ISLOCA is only calculated for 3 of the 12 plants within this group. However, due to the future use of the same ISLOCA event tree for all PWR SPAR models and similar valve orientations, the ISLOCA CDFs for all plants within this group are expected to be in the range of the three completed plants.