ORIGINAL ACRST-3125

OFFICIAL TRANSCRIPT OF PROCEEDINGS

NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

Title: **475th ACRS MEETING**

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Work Order No.: **NRC-1460**

LOCATION: **Rockville, MD**

DATE: **Wednesday, August 30, 2000** **PAGES: 207 - 364**

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

AUGUST 30, 2000

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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475th MEETING

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Two White Flint North, Room T2-B3

11545 Rockville Pike

Rockville, MD

Wednesday, August 30, 2000

The committee met, pursuant to notice, at 8:30 a.m.

MEMBERS PRESENT:

DANA A. POWERS, Chairman

GEORGE APOSTOLAKIS, Vice-Chairman

MARIO V. BONACA

THOMAS S. KRESS

GRAHAM M. LEITCH

ROBERT L. SEALE

WILLIAM J. SHACK

JOHN D. SIEBER

ROBERT E. UHRIG

GRAHAM B. WALLIS

P R O C E E D I N G S

[8:30 a.m.]

DR. POWERS: We will now come to order. This is the second day of the 475th meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting, the committee will consider the following; performance-based regulatory initiatives; license renewal guidance documents; operating advance of Indian Point Nuclear Power Plant 2; and, Siemens, our S-RELAP-5 Appendix K small-break LOCA code. We will also examine proposed ACRS reports.

The meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Mr. Howard Larson is the Designated Federal Official for the initial portion of the meeting.

We have received no written statements or requests for time to make oral statements from members of the public regarding today's session.

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 they can be readily heard.

Do any of the members have opening comments they would like to make for today's session?

[No response.]

DR. POWERS: Seeing none, we will move to the first item of business, which is performance-based regulatory initiatives. Sieber, I believe you're going to lead us through this.

MR. SIEBER: Yes, Mr. Chairman. By way of introduction to this subject, we did have a discussion of the high level guidelines for performance-based activities in June and we considered a draft letter at that time.

On the other hand, we've now had two more months to think about all of this, so we may or may not wish to renew our interest in that draft letter.

Also, by way of introduction, this is all based on an initiative in 1998, with the publishment of a white paper on risk-informed and performance-based regulation, which is, to my view, sort of a gospel since it provides all the definitions that anyone could ever want to have related to risk-informed regulation and performance-basing.

An outcome of that was an SRM, where the Commission directed the staff through research to develop a high level guideline and the most recent edition of that high level guideline that I have is one that as handed out yesterday, which is a pre-decisional draft from Research to the EDO, which contains the latest revisions and explanation thereto.

So with that brief introduction, what I would like

to do is introduce Mr. Prasad Kadambi, from Research, who will lead us through this subject.

MR. KADAMBI: Thank you very much, Mr. Sieber. Good morning, Mr. Chairman and members of the committee.

I believe our Division Director, acting Division Director, Dr. Farouk Eltawila, has some opening remarks.

MR. ELTAWILA: Thanks, Prasad. Yesterday, you had two presentations, one on option two and the other one on option three, and I think we'd want you to look at the performance-based regulation as the third tool for these activities, ongoing activities here.

Every activity that the NRC is going to be undertaking in terms of amending the regulation, whether it's coming from internal stakeholders or external stakeholders, we go through the process. The process will be based on the agency performance goals.

If it meets these performance goals, we look for them if they are going to be risk-informed and if there is risk-informed, we look for the second option, can any of these be made performance-based. That would be the preferred option that the agency will be taking.

So the first thing is we go through a certain screening criteria. If the regulations need to be amended, we'll amend them, and then we will decide whether we want to be performance-based, risk-based and performance-based, or

we go back to traditional ways.

So that's the way I would like you to look at them in that regard.

The other thing, we apply the guideline, as Prasad is going to present, into the area of hydrogen control, which was presented to you yesterday, and we'll try to show the linkage between how you deal with the issue in a risk-informed and then how you expand on it to be performance-based, and hopefully you look at this from this perspective.

Thank you.

MR. KADAMBI: Thank you. Again, my name is Prasad Kadambi. I'm in the Office of Research. I'm joined in today's presentation by Bob Youngblood and Chris Smith. They helped us conduct the case studies and they will be presenting information about the case studies, which will be the centerpiece of our presentation today.

As Mr. Sieber mentioned, you heard from the staff just a couple of months ago, so I will try not to be repetitive in anything, but I would like to reiterate a couple of points.

The word "high level" in the title really has to do with the level of conceptualization in that. It does deal with the sorts of things that are in the white paper, which Mr. Sieber mentioned, and in the strategic plan and

these sorts of things.

As a result, we feel that the guidelines can be applied to all three arenas of the agency's activities, reactors, materials and waste arenas.

The other point in the title, the word "performance-based activities" comes in, and that really addressed NRC activities at this point. Mostly it deals with developing or changing regulatory requirements.

DR. POWERS: What is ISL?

MR. KADAMBI: ISL is a company that has provided us technical assistance on this. It used to be part of Scientech. And if you have anymore questions, maybe when Bob Youngblood --

MR. YOUNGBLOOD: That's correct. I'm Bob Youngblood from ISL. I work in the Rockville office of ISL, which is essentially equivalent to the former Rockville office of Scientech, which provided NRC support. There was a parting. Scientech transferred us in February.

MR. KADAMBI: What I would like to do is begin with an outline of the presentation. As I mentioned, the case studies will be central to this. I will begin with an overview that provides a snapshot of where we are today.

We will talk about interrelationships among the regulatory activities that Dr. Eltawila mentioned, and, again, here, the white paper plays a central role. It

provides the definitions and attributes for articulating these interrelationships. And we'll talk about the staff's plans and end with the conclusions.

By way of overview, we did speak to ACRS and then subsequently to ACNW on July 25, with similar presentations. We have tried to emphasize that performance-based regulatory approaches compliment risk-informed regulatory approaches and the traditional means of regulation.

I believe everybody has a copy of the draft Commission paper, which is now being reviewed at the EDO level. By a strict definition of the interpretation of the SRM, we may have concluded at one time that the guidelines would be enough to meet the SRM, but we have actually gone beyond that and I believe the case studies represent that.

Also, in response to the public comments, we have tried to note and respond to concerns about some stakeholders feeling that the focus of the performance-based efforts would emphasize burden reduction at the expense of safety.

What I would like to point out is that performance-based regulation does not mean either less regulation or more regulation, but I hope it means smarter regulation.

The guidelines themselves are, admittedly, process-oriented and I don't think that necessarily detracts

from their usefulness. And by usefulness, I'm talking about raising the right kinds of questions for an analyst to deal with a regulatory issue.

The guidelines themselves are in three groups; viability, assessing change, and the high level regulatory principles that the agency adheres to.

The guidelines are not meant to be a cookbook, but what we have found in applying in the case studies is that when used in the context of a simplified expert panel, as we did, they did provide useful information and at this point, because they have demonstrated their usefulness in two distinctly different areas, and as you will hear about it, we feel that it's ready for agency-wide application and that's how we are going forward to the Commission.

Meanwhile, the staff is, of course, continuing its efforts in the other initiatives, the risk-informed regulations. We are updating the risk-informed regulation implementation plan. There have been workshops held on the matter of using risk information in the NMSS types of activities.

And as we gain experience in these areas, we feel we are getting closer to the objective of having a well integrated approach to regulatory initiatives.

At this point, I will request Bob to start with the first of the case studies.

MR. YOUNGBLOOD: Good morning. I'm Bob Youngblood of ISL and I will be talking about case study one. What we've done in case study one is take the body of risk information put together by the option three people, who drew from years of work in this area and summarized it for their own purposes, and taken a piece of that information and basically postulated a need to be addressed by what we're calling here a regulatory framework.

We're not using the word requirement here, because we don't mean just requirement, but the whole suite of rule, guidance, technical specifications, because it's useful, I think, to look at the whole safety mission a little more globally than just at the rule level.

As preface, risk information, the kind of thing risk information will do generically is identify what's important, tell you potentially how reliable the function you're talking about needs to be, and place the function that you're going to look at in context of what's going on in the scenarios that it is supposed to play a role in.

And the following bullet in this case study, what we're pointing out is the risk information from the option three team emphasized the potential importance of station black-out scenarios at some plants, emphasized the importance of addressing core melt phenomenology in the sense that it may create harsh environments that systems may

need to cope with, and the loads that you need to address in preventing containment failure from combustion of gas have to be evaluated in the context of other loads that may exist at the time you get the combustion.

At this point, I guess I'm implicitly assuming that you had this discussed a lot yesterday and that I did not need to sort of talk about the threat to containment from combustion of gas.

So based on that risk information, the high level --

DR. POWERS: Let me ask a question about that.

MR. YOUNGBLOOD: Sure.

DR. POWERS: The threat to containment. In thinking about the threat to containment due to the combustion of gas, do you distinguish between steel containments and concrete containments?

MR. YOUNGBLOOD: Buried implicitly in the next chart, we do, because I believe that their work looks at, for example, the generation of carbon monoxide. We're not going to get into the level of detail that you're going after with that question.

DR. POWERS: What I'm thinking of is that we have some evidence that steel containments fail catastrophically, whereas concrete containments fracture, leak, but they don't fail catastrophically.

Wouldn't one want to make a distinction between the two then?

MR. YOUNGBLOOD: Yes, but not necessarily in this talk at the level that I'll be working at. I'll be -- well. I think the discussion that you're advocating I think would be naturally raised in the context of the next couple of slides. I'll still resist it, but that's where it will belong.

Now, the guidelines start right off looking at parameters that are potentially monitorable parameters, and so the next slide is about beginning to look for those parameters and placing them in some sort of context.

And there are different kinds of parameters that one could look at. One kind of parameter is the parameters that talk about the physics and chemistry of getting the job done, which we're here calling capability parameters, which, for fluid systems, would be things like flow rates, possibly, and for this system, for a system to remove combustible gas, will bear on things like the temperature that units achieve and how many of them you've got and where they're located and atmospheric mixing and other figures of physics, chemistry things that bear on whether the function will actually be successful.

DR. KRESS: Most of those things I see up there are uncertain and would have distributions. Are you

considering each of these having a probability distribution, like the containment pressure or the severe accident loads or the amount of combustible gas present when you --

MR. YOUNGBLOOD: Potentially, yes. I have not -- I'm not in the loop on the option three work, but I think that a big part of their recommendation is a very careful evaluation of things like this one here, amount of gas and the rate generated. The combustible gas source term needs a lot of evaluation, for example.

I think the answer to your question is yes.

DR. KRESS: In that case, your second line up there would be some sort of overlap of probabilities rather than just greater than.

MR. YOUNGBLOOD: Yes, yes, yes.

DR. KRESS: At some level.

MR. YOUNGBLOOD: Yes. Yes.

DR. KRESS: That sort of thing.

MR. YOUNGBLOOD: Yes. All I meant to imply by that symbol was some sort of comparison.

DR. KRESS: Some sort of comparison, yes.

DR. APOSTOLAKIS: Coming back to Dr. Powers' question, that would refer to the containment capability, I believe, would it not?

MR. YOUNGBLOOD: Yes.

DR. APOSTOLAKIS: And is that branch developed

further and does it affect the developed branch or the containment pressure?

MR. YOUNGBLOOD: Well, the purpose of even having it there is to place your evaluation of the pressure in the context so that you can make that comparison.

In preparing this slide, I put it there because some containments are such that the loads that you get compared to the capability are not much of an issue and really to place in context the fact that we're going to be talking about the kind of plant that needs igniters.

So I didn't mean to get into the steel versus concrete discussion here and didn't prepare to do that.

DR. APOSTOLAKIS: The point is that everything that you are analyzing on the left is conditional --

MR. YOUNGBLOOD: Yes.

DR. APOSTOLAKIS: -- over here on the right.

MR. YOUNGBLOOD: That's right. And I think that's a strong feature of what the option three people are saying and it's part of what they mean by risk-significant scenarios. You're supposed to look at the scenarios that have appreciable frequency, get the phenomenology right and go from there.

DR. APOSTOLAKIS: So somehow I think you should put the right words there or symbols to indicate that.

MR. YOUNGBLOOD: Okay.

DR. APOSTOLAKIS: Because right now you have an inequality.

MR. YOUNGBLOOD: Okay. Of course.

DR. APOSTOLAKIS: People might think that these two are independent.

MR. YOUNGBLOOD: No.

DR. BONACA: When you indicate the containment capability, are you considering the ultimate capability of containment, as estimated, for example, for the IPEs, or are you considering the committed containment capability that is on the basis of technical specifications?

MR. YOUNGBLOOD: It's my sense of the option three people that they mean ultimate, but --

MR. ELTAWILA: There is a distribution. I think we will do it exactly like we did it for the IPE direct containment heating, take the containment failure probability function versus the load and the intersection between the probability and the load, and that will give you the ultimate, the failure of that containment.

So it's both of them are distributed.

MR. YOUNGBLOOD: But I would like to make a point I maybe should have emphasized earlier, and that is that in going through this case study, what we have tried to do is take the risk insights that come in over the transom, they identify a need, they tell you what the risk significant

scenarios are, what the phenomenology is.

They point out that in black-out, you may not have power that you might have wanted to run igniters. So you need to address that.

So it's the -- and I'm just taking all that for granted, letting them set the safety priorities and I would classify the uncertainty issues that you are raising in that realm.

Now, not to say we don't have to address them once they have been set, but it seems to me that many of these questions are related to the risk-informing task and that once that's done, what we're trying to do, once the mission has been stated, we're trying to look for parameters, kicking off the guidelines exercise.

DR. APOSTOLAKIS: So I think it would be useful to cull all this risk information as the context within which you are doing this.

MR. YOUNGBLOOD: Yes.

DR. APOSTOLAKIS: This is a popular word these days.

MR. YOUNGBLOOD: Yes.

DR. APOSTOLAKIS: PRA defines the context within which performance parameters will be defined.

ELTAWILA: Correct.

MR. YOUNGBLOOD: Great. Okay. And so the

parameters that come out of the bottom here, they are physical parameters having to do with unit capability. There are configurational parameters and there's just a plethora of capability type parameters that one would --

DR. APOSTOLAKIS: Is capability the right word there?

MR. YOUNGBLOOD: I'm not sure that it's the perfect word, but it's a word that many people working in a related area under the reactor oversight process would use in this context.

DR. APOSTOLAKIS: The only problem is that you are using it also to talk containment capability.

MR. YOUNGBLOOD: Well, I don't think the usage is inconsistent, but when we're referring to parameters, we just are talking about the physical mission and I guess containment capability is part of that.

It happens that the focus of this discussion is on the igniter capabilities, but all of these things are -- if we were trying to apply the guidelines to containment capability, that would certainly be a consistent usage of the term, I think.

DR. APOSTOLAKIS: So these are really the monitoring capabilities that you have to identify in order to assess viability, right? I'm trying to understand.

MR. YOUNGBLOOD: Right. So guideline one asks are

there measurable or calculable parameters and what I just tried to do is illustrate what sort of thing you might get in the way of a capability parameter.

In the interest of brevity, we will not plan to show a slide about reliability/availability parameters, but those would certainly also be important and will be discussed in subsequent slides.

So we have parameters to talk about the mission, parameters to talk about reliability/availability, and all of those aspects are elements of what you try to do with the safety requirement, do a job and do it with some reliability.

DR. APOSTOLAKIS: Now, by guidelines, you refer to the four attributes of a performance-based measure.

MR. YOUNGBLOOD: The things in this treatment are called the viability guidelines, which really the -- yes.

DR. APOSTOLAKIS: Measurable parameters and so on.

MR. YOUNGBLOOD: That's right.

DR. APOSTOLAKIS: It seems to me that there is a guideline that's missing there. Namely, that we should try to set the performance measures at as high a level as we can, high in the sense that you showed.

MR. YOUNGBLOOD: Yes.

DR. APOSTOLAKIS: In other words, if you go back to your tree.

MR. YOUNGBLOOD: Yes.

DR. APOSTOLAKIS: If I could do something and measure or eliminate or whatever the amount of combustible gas present, then I wouldn't need to worry about the physical parameters and everything else.

MR. YOUNGBLOOD: That's right.

DR. APOSTOLAKIS: So there has to be some logic progression there that I can't really do that, so I go to the next level.

MR. YOUNGBLOOD: That's right.

DR. APOSTOLAKIS: Then maybe I can't do that, then I go to the next level. Because if we don't do that, we may end up, again, with an extremely prescriptive system, where we just set performance measures all over the place.

MR. YOUNGBLOOD: Now, there is a guideline that does that, although maybe less explicitly than you would like, and that's the flexibility guideline. The third one says you want flexibility. Now, if you let me argue that the higher you are, the more flexibility you have, which I believe would be generally correct, then that guideline at least touches on the point you're raising.

DR. APOSTOLAKIS: You are right, Bob, but I would not like it to be implicit.

MR. YOUNGBLOOD: Okay.

MR. KADAMBI: There is an explicit statement of

this concept in the guidelines to assess change and it occurs in the guideline that says the performance-based approach can be incorporated into a regulatory framework.

DR. APOSTOLAKIS: Please put that back up. I'm sorry.

MR. KADAMBI: That's okay. That is what we call the Guideline II-F.

DR. APOSTOLAKIS: Page?

MR. KADAMBI: Page 1-3.

DR. APOSTOLAKIS: Roman Numeral F, then what? I mean, not F, F is not Roman. Which one is it?

MR. KADAMBI: It is II-F and it is the combination of the four amplifying guidelines, really. But the idea of that --

DR. APOSTOLAKIS: Are we looking at the same page? You said 1-3 of --

MR. KADAMBI: The Attachment 1.

DR. APOSTOLAKIS: Oh, Attachment 1.

MR. KADAMBI: I'm sorry. The Attachment 1 is the actual guidelines themselves.

DR. WALLIS: So this is what says the performance-based approach can be incorporated into the regulatory framework. Is that the one?

MR. KADAMBI: Right. And by regulatory framework, what we are trying to say is there is a --

DR. WALLIS: Why do you use the conditional all the way through? Why don't you say "is" instead of "would be?"

MR. KADAMBI: Well, because these are guidelines that hopefully lead the analyst to ask the question and they are not meant to be go/no-go types of conditions.

DR. WALLIS: So they are deliberately a little vague in using "would" instead of is.

MR. KADAMBI: Yes. There is a level of design in there. Are you there, Dr. Apostolakis? Maybe it isn't as explicit as we would like.

DR. APOSTOLAKIS: Point me again to where exactly that is. I'm on the right page, 1-3. F?

MR. KADAMBI: 1-3, and it is the guideline that is identified by capital F.

DR. APOSTOLAKIS: Right.

MR. KADAMBI: And what that is meant to convey is that the regulatory framework which consists of what I think of as a hierarchy in which the Code of Federal Regulations occurs at the top and there are lower level guidance documents, have to be considered in terms of the functionality that is to be provided, and that in applying the feasibility guidelines, you look for the specific elements in the framework and that is where I believe the question that you're asking would be answered.

DR. APOSTOLAKIS: But would it hurt to make it explicit that we would like the measures to be at as high a level as we can?

MR. ELTAWILA: I agree with you, Professor Apostolakis. It will not hurt. It's not explicit in the guideline and I think it's a good idea. We'll take it into -- yes, absolutely.

DR. APOSTOLAKIS: It is an essential element of removing unnecessary burden, right? Because, you know, you can be as prescriptive in a probabilistic -- in a risk-informed, performance-based system as you are in the old system.

MR. KADAMBI: You are right.

DR. APOSTOLAKIS: So what I would say then, Bob, is that give prominence to this when you present this, go down the hierarchy. Then the next statement should be can -- now we ask the question, can we have performance-based criteria at the loads. No, we can't. And we go down one, no, we can't. And that really sends a clear message that you are forced to go logically to lower levels, where you finally say, yes, here I can do something about it.

MR. KADAMBI: That's exactly the process that is involved.

DR. APOSTOLAKIS: But it doesn't come across during the presentation, and I think that would be extremely

valuable.

MR. KADAMBI: Thank you for that point, yes.

MR. YOUNGBLOOD: With that as preface, we've discussed briefly the idea of capability parameters of reliability/availability parameters.

And now the next slides basically just step through guidelines, applying each of the four viability guidelines to parameters of that kind.

So here the guideline is recapitulated at the top of this slide, which is number six, measurable or calculable parameters to monitor plant licensee performance exist or can be developed. Capability parameters clearly exist.

Once you pick a technology, which we're implicitly here thinking of igniters, many of those things are implicit. Environmental qualification is part of that and those are parameters and here I have tried to list ones that are not necessarily amenable to performance monitoring, but this guideline is only asking part of the question.

DR. APOSTOLAKIS: Let's look at the reliability/availability.

MR. YOUNGBLOOD: Sure.

DR. APOSTOLAKIS: This refers to what, reliability of what?

MR. YOUNGBLOOD: The function of getting rid of combustible gas as it's generated in the context of the

risk-significant scenarios that cause it to be generated.

DR. APOSTOLAKIS: So it's a function.

MR. YOUNGBLOOD: Yes.

DR. APOSTOLAKIS: And then division?

MR. YOUNGBLOOD: In listing division and unit reliability, I chose -- I assumed that a licensee might choose to have enough redundancy that would be more than one division and that a division would have units in it.

DR. APOSTOLAKIS: So essentially, then, what you're doing there, again, is you are following an implicit top-down approach.

MR. YOUNGBLOOD: Yes. Exactly.

DR. APOSTOLAKIS: Where you say I want this function, this function is performed by these systems.

MR. YOUNGBLOOD: Exactly.

DR. APOSTOLAKIS: For each system, this. So, again, the previous comment applies.

MR. YOUNGBLOOD: Yes, it does.

DR. APOSTOLAKIS: That, again, because if I just look at that and I don't talk to it, then, again, I may start putting requirements on all of these.

MR. YOUNGBLOOD: That's right.

DR. APOSTOLAKIS: I believe that's something that really needs to be emphasized in the report and the presentations, because this is the essence of trying to have

a performance-based system, it seems to me.

I know you guys agree. It's just that communication sometimes is very important and you will not be the ones implementing this throughout the agency.

MR. YOUNGBLOOD: Right. The first four guidelines, the ones we're talking about here, have been around for a long time and I believe that in agreeing with you --

DR. APOSTOLAKIS: It pains you a lot.

MR. YOUNGBLOOD: No, no. In this case, it's not painful. But I think that we are also talking about a scheme where there will be several parameters involved and not just one and there may be aspects of the system that are dealt with by means other than performance-based monitoring.

In other words, there will be a multi-parameter approach to this system. And I think in the early days of this whole discussion, which is many years old now, I think that the original formulation of some of these guidelines contemplated an all or nothing single parameter approach implicitly, and that one reason it doesn't come across is that we're still using language from five years ago, but didn't recognize that.

DR. APOSTOLAKIS: We should.

MR. YOUNGBLOOD: We should.

DR. KRESS: So if I'm looking for performance

measures on, say, the power supply to these things, I would look under this reliability/availability.

MR. YOUNGBLOOD: That's right. And, again, the risk information emphasized the need to have that work in black-out.

DR. WALLIS: If you try to answer the question will it work, you said something about mixing, but you can't monitor mixing. Therefore, you ignore it. Mixing is important to radiological work.

MR. YOUNGBLOOD: Yes. I foolishly brought up mixing. Actually, in the option three work, it's treated in a separate area and in the SECY, I believe --

DR. WALLIS: You went through the things that affect whether it will work or not and mixing is one of them.

MR. YOUNGBLOOD: That's right.

DR. WALLIS: And then you decided not to monitor it because you can't do it.

MR. YOUNGBLOOD: No. Actually, I left it off the slide because it's not part of what I was looking at.

DR. WALLIS: Why did you leave it off? There are things that affect performance which you left off, as well as put on. You left them off because they were difficult to measure or for some other reason?

MR. YOUNGBLOOD: No. I think that the active

systems involved in mixing would be eligible for treatment as any other active system would be.

DR. WALLIS: Like the containment fans.

MR. YOUNGBLOOD: Yes, whatever they are, but we just did a piece of the puzzle and all the -- yes. The piece of the puzzle we did is this piece right here and mixing would be part of that somewhere on here, and isn't the piece that we did.

DR. WALLIS: To do anything that affects performance, it would seem to me you have to consider and then evaluate in some way and then decide what to do with.

MR. YOUNGBLOOD: Yes, you would.

DR. KRESS: You're saying if you did this in a complete manner, you would do that.

MR. YOUNGBLOOD: Yes, absolutely.

DR. KRESS: But you're just giving us an illustration.

MR. YOUNGBLOOD: Absolutely. Yes. In fact, this isn't about option three. It's about the guidelines.

DR. APOSTOLAKIS: But that raises another question, though. We have agreed that we have to be hierarchical. Now, let's come to the same horizontal level, which involves, say, five parameters, that all affect whatever it is about.

MR. YOUNGBLOOD: Okay.

DR. APOSTOLAKIS: Now, if you look at the physics of the problem, these parameters are entering some equation or something. Is there any guideline that says that perhaps controlling two of those is sufficient and I don't have to do something for the others or you would go ahead and control all five and performance measures for all five, even though there will be some redundancy or the end diversity perhaps that way?

So what is the philosophy at that level?

MR. KADAMBI: I believe, as you work through the availability guidelines, some of the parameters that you choose in Guideline I-A would turn out to be not as valuable as -- there will be some kind of a prioritization, I believe, as you work through the guidelines. This is the sort of thing that we learned as we went through the case study.

Now, ultimately, I believe that after you determine a set of parameters that meet the viability guidelines and you say that these are perhaps the parameters I want to work with, then you get into the second set of guidelines that assesses change and you try to do the sorts of things and efficiency and effectiveness and also the guideline that tries to assess net benefit in terms of how much -- what do you have to do to get the performance monitoring for these.

That's what would lead you to say that not all those parameters are equally valuable, that some are more valuable.

DR. APOSTOLAKIS: I agree with what you said, but it seems to me that at that level, you will have, again, the perennial conflict between defense-in-depth and a rationalist approach.

Because of defense-in-depth or the structuralist interpretation, you would tend to have more, because you would like to have higher confidence that you are really controlling the thing.

On the other hand, you may end up imposing unnecessary burden.

So there has to be something explicit there as to how one would balance those two. Now, maybe what you just said is good enough, I don't know, but is there an explicit discussion of this somewhere or is it hidden under effectiveness?

MR. KADAMBI: Well, for right now, because we are focusing on guidelines that would apply, in a sense, across the board in all three arenas, we have avoided getting into this kind of detail which would work differently if you're dealing with reactors as opposed to materials as opposed to weights.

DR. APOSTOLAKIS: But I would be perfectly happy

to have you write down what you just said. I think it's extremely important for the implementers of this to be aware of these inherent conflicts.

DR. KRESS: Otherwise, you're going to have an eternal debate between the licensee on how many of these I need.

DR. APOSTOLAKIS: But the people who will take your reports and try to implement them, probably they will have to go through this process again and rediscover the wheel, so to speak.

MR. KADAMBI: That's the reason why we feel the management directive that we have proposed as one of the immediate follow-on activities will address how these things work in a level of detail that's not covered in this paper.

DR. APOSTOLAKIS: But I would be happier if you put down on paper what you told us the last minute. I mean, it's clear to me that you are aware of the problem. It's just that I want to emphasize it.

MR. KADAMBI: Understand.

DR. APOSTOLAKIS: So others will be aware of it, too.

MR. YOUNGBLOOD: On the preceding slide, I listed capability parameters and reliability/availability parameters.

The next guideline asks whether objective criteria

for these parameters exist or can be developed. For the capability parameters, it falls out of the phenomenology that needs to be analyzed for those sequences and the nature of the technology itself.

And for reliability/availability, you can derive a criterion from a LERF guideline of ten-to-the-minus-five per year, for example, and a challenge frequency of this function, which might be plant-specific.

DR. APOSTOLAKIS: Why isn't that part of the maintenance rule? Am I missing something?

MR. KADAMBI: It could well be. It could well be part of the maintenance rule.

DR. APOSTOLAKIS: Would or is?

MR. KADAMBI: We don't know enough about it.

MR. YOUNGBLOOD: Could you amplify that question a little bit?

DR. APOSTOLAKIS: You're talking about the reliability and availability of trains and components, isn't that what the maintenance rule is supposed to do?

MR. YOUNGBLOOD: Yes, it does. I think the licensee gets to derive those and here I think we're talking about a different provenance of those criteria, but, you know, long division is long division.

DR. APOSTOLAKIS: I mean, you mentioned earlier the fan coolers. This is an SSE, right? System, structure

or component. Presumably, there will be some maintenance rule.

MR. YOUNGBLOOD: There is tremendous overlap between this whole topic and everything in the maintenance rule. Why are you querying it for development of this?

DR. APOSTOLAKIS: Because the maintenance rule probably will not care -- in fact, it will not care about surface temperature, so it's not within the scope, is it? I don't think, the way I understand it.

So your first bullet is --

DR. POWERS: The maintenance rule would care if the surface temperature did not get high enough to do the function of the igniter.

DR. APOSTOLAKIS: But it's the igniter that's the focus.

DR. POWERS: Yes, whether it can do its job or not.

DR. APOSTOLAKIS: Yes.

DR. POWERS: That would be something that the maintenance rule would care about, what the specific temperature is.

DR. APOSTOLAKIS: Anyway, you are right. There is tremendous overlap.

MR. KADAMBI: And I would like to emphasize that this is an illustrative example for the guidelines and not

so much to get into the technical regulatory issues involved.

MR. YOUNGBLOOD: One last point to be made.

DR. APOSTOLAKIS: By the way, not everything I say is a criticism.

MR. YOUNGBLOOD: I understand.

DR. APOSTOLAKIS: Don't be so defensive.

MR. YOUNGBLOOD: So far it's a good day.

DR. WALLIS: When you do this exercise, you say it's illustrative for the guidelines, are you going to end up giving us some indication of why this is better than the present system?

MR. KADAMBI: We hope that it will come out as part of the way we --

DR. WALLIS: You make some hopeful statements about increasing efficiency and reducing burden, and I can't evaluate at all from the case study whether it increases or decreases burden of effectiveness and efficiency.

ELTAWILA: First of all, we have not gone through the whole exercise completely, but I can illustrate, for example, yesterday, in the discussion that we had the situation that the igniter for the ice condenser in Mark 3 containment is vulnerable during station black-out.

So either you will have to require an additional power supply for this igniter or you have to accept a

risk-based criteria, as Dr. Kress indicated yesterday, which will say I will accept a very low frequency in this case.

Here you might have a third alternative, saying can I have certain characteristics or performance that I can measure and I can rely on to substitute for either not to be performance-based, risk-based, or to have additional requirements of the igniter.

So that's when you really apply it systematically, you might reach a different conclusion.

DR. APOSTOLAKIS: It seems to me that the greatest benefit of this is what I insisted earlier on seeing explicitly, that the principle is that you should set the performance criteria at as high a level as you can and you will give flexibility to the licensee to use methods that the licensee deems appropriate to demonstrate that the criteria have been met.

If we are successful at that, then the whole thing will indeed be useful.

Now, an additional benefit is that in many instances, you will be able to define the context using risk information, but that is not the only thing you are doing, as I understand.

MR. KADAMBI: In fact, the second case study will show that.

DR. APOSTOLAKIS: Right. So the most important

thing is to try to define these performance criteria at the high level, so we will not be burdensome.

MR. KADAMBI: Correct.

DR. WALLIS: Listening to Farouk, it seems to me, also, that you might well increase safety by focusing on this and knowing what you're doing better.

MR. KADAMBI: Exactly. That is a very important point.

DR. APOSTOLAKIS: Absolutely.

DR. KRESS: George, this business of setting parameters at the highest level, it seems to me like it needs additional guidance on what criteria you use to decide which level is the highest level you can, and that's what I see is kind of missing so far.

DR. APOSTOLAKIS: In some sense, the four attributes that we have seen many times --

DR. KRESS: Measurable doesn't --

DR. APOSTOLAKIS: That's right.

DR. KRESS: You can live with it if it fails, those things.

DR. APOSTOLAKIS: I think those will guide you to say, gee, I can actually have it at this level.

MR. YOUNGBLOOD: If we get to slide 1-D, that point will be touched on.

DR. APOSTOLAKIS: Do you think you will ever get

there?

MR. YOUNGBLOOD: Not if poor Chris is going to get to speak. Okay. I'll move on now to slide eight, guideline I-C, flexibility exists or can be developed.

On the previous slide, we concluded for reliability/availability that the top -- that the functional reliability would follow from high level guidance. Now, how well a division or a unit would have to perform is a function of the actual design configuration.

In that sense, there's a lot of flexibility potentially and I think in reality for this system in meeting reliability/availability guidance by laying your design out differently.

Once you pick a technology, I don't think there is very much flexibility in the capability parameters. The criteria, I think, tend to be fixed there by technology and phenomenology. But I think there's a lot of flexibility below the level of the functional reliability.

DR. APOSTOLAKIS: Let me understand this a little better, because I'm not familiar with the phenomena here. You're talking about surface temperature.

MR. YOUNGBLOOD: Yes.

DR. APOSTOLAKIS: What surface is this?

MR. YOUNGBLOOD: It's a surface in the igniter, that the igniter has to get hot to ignite and tech specs

require --

DR. APOSTOLAKIS: Is this is a measurable requirement?

MR. YOUNGBLOOD: Yes. And current tech specs actually require that it be measured.

MR. ELTAWILA: It's not the temperature itself. It's the current and voltage, and that correlated to a surface temperature.

MR. YOUNGBLOOD: Yes. In going through, in stepping through the guidelines, I tried to sort of cast the net widely and not bias it toward parameters I knew I wanted. So I tried to throw in other parameters to show them kind of falling off the wagon as we looked at other guidelines. I'm not sure that --

DR. APOSTOLAKIS: But I guess the thought that occurred to me was it's one thing to say these parameter should serve as a performance measure and quite another to also -- well, not quite another, but part of this thinking process should be whether there are methods that are widely acceptable for achieving this.

MR. YOUNGBLOOD: Yes.

MR. KADAMBI: That is definitely part of it.

MR. YOUNGBLOOD: Well, Guideline I-D asks the question whether having set the criterion, by the time we realize it's not met, have we tolerated an unacceptable

safety situation.

DR. APOSTOLAKIS: Now, Dr. Wallis probably would ask you what is an immediate safety concern. If he doesn't, I do. What is an immediate safety concern? Do you have a definition of an immediate safety concern? I'm learning.

MR. KADAMBI: I would answer that question by saying that it is -- you know, context is everything, like in a lot of things.

DR. APOSTOLAKIS: You should be working on ATHENA.

MR. KADAMBI: Because these are high level guidelines and, you know, what are the safety concerns in a materials area or in a waste area may be different, quite different from a reactor area, where you have the magnitude of what constitutes the level of safety concern, as well as the time element and, you know, does one have enough time to react to something that is considered a safety concern.

DR. APOSTOLAKIS: If I were to be extremely critical, which I don't intend to do, I might say there may be someone who really hates PRA and is very happy with the existing way of doing business in his or her branch and says everything we do now is a safety concern for us. So I cannot apply your methodology because everything is a safety concern.

So what is it in this approach that would make that person rethink or reassess his or her position?

MR. KADAMBI: My answer to that question has to go to the second set of guidelines, which, if you apply the performance goals that the Commission has given us and you deal with the four pillars, as they are called in some cases, in an honest way, I think it would naturally lead you to ask the kind of question that would make this person that you are referring to question their current thinking.

DR. APOSTOLAKIS: How about if I say the following? I have an immediate safety concern if the corresponding node in the event tree, which started the whole thing, is down. Am I defining a safety concern then in a way that would really help people?

DR. KRESS: I think an equivalent definition might be if my conditional core damage frequency has arrived at a certain level.

DR. APOSTOLAKIS: Yes.

DR. KRESS: And I think you could do it the same way.

DR. APOSTOLAKIS: In other words, we are both using the event tree.

DR. KRESS: Using the event tree to define what your safety concern is.

DR. APOSTOLAKIS: Rather than saying, gee, the temperature is lower than I thought it was and that's an immediate safety concern, because that's buried down in the

detail.

DR. WALLIS: George, I did highlight the section that you asked the question in my name about. And the answer in the paper that we were given is -- one of the answers is that a sufficient safety margin exists.

So you don't have an immediate safety concern if a sufficient margin exists, which simply begs the question, because now you ask, well, how do you know if you have a sufficient safety margin.

DR. APOSTOLAKIS: And I think Tom's answer comes close to answering your question; namely, that safety margin in this case would be the conditional core damage frequency, given that that node is --

DR. WALLIS: But that has to be, I think, more explicit.

DR. APOSTOLAKIS: I believe so. Otherwise, it's open-ended.

MR. KADAMBI: I would submit that that's the sort of statement that would occur in the reactor arena when that concept is dealt with for reactors.

DR. APOSTOLAKIS: Well, you can find similar things for other applications. But, again, I think you should feel free to elaborate on these things and give examples and say what you just said. In the reactor arena, you have the event trees and you do this.

Now, that doesn't mean that you have to have examples from every single application, but it is you give an idea to people as to what an immediate safety concern might be.

MR. KADAMBI: At one time, the Commission paper was twice as long as it is.

DR. APOSTOLAKIS: We can triple it.

MR. YOUNGBLOOD: I think some of the points that you were just discussing are what's meant by the sub-bullets of the third bullet on slide nine here. In doing this work, again, I was thinking in terms of the LERF guideline, ten-to-the-minus-five per year, and some such guideline as that can be used to answer.

DR. APOSTOLAKIS: We stand corrected, in this case, it's the LERF.

MR. YOUNGBLOOD: In the spirit of the reactor oversight process, applying CDF and LERF guidelines. I think if you were way beyond those guidelines, then that would be a safety concern.

DR. APOSTOLAKIS: As a matter of fact, we also have guidelines in one of the regulatory guides as to what kinds of spikes in the CDF and LERF we can tolerate and for how long.

DR. KRESS: Those ought to be --

MR. YOUNGBLOOD: Yes.

DR. APOSTOLAKIS: So we can bring those in here.

MR. YOUNGBLOOD: Yes.

DR. KRESS: And in the defense-in-depth, I wouldn't focus solely on LERF. I would have guidelines associated in both CDF and LERF.

DR. APOSTOLAKIS: If it is relevant. But that fits nicely into this.

MR. YOUNGBLOOD: Now, for this particular function, just to complete the exercise, we won't go into numbers here, but I think that between the LERF guideline, the CDF challenge frequency, and so on, the reliability that we would be looking for in this function is not extremely high and that it would be relatively feasible as active systems go to do performance monitoring to get the reliability/availability that we needed.

DR. KRESS: Now, let me ask you a question on this particular specific one.

MR. YOUNGBLOOD: Okay.

DR. KRESS: We are really probably only concerned about station black-out sequence. The overall LERF guidelines that we've been tossing around is for the summation over all sequences.

MR. YOUNGBLOOD: Right.

DR. KRESS: And supposedly you wouldn't want one particular sequence to contribute most of that.

MR. YOUNGBLOOD: Right.

DR. KRESS: And the question that I would have then is, is the LERF guidelines that you're talking about here some fraction of the ten-to-the-minus-five or is it ten-to-the-minus-five, or how do you allocate that among the sequences?

MR. YOUNGBLOOD: What I was answering was the immediately safety concern question. I would say that if your LERF went from ten-to-the-minus-five total to several times ten-to-the-minus-five as a result of failure of this function, then that would begin to be an immediate safety concern.

How you set the parameters --

DR. KRESS: If one sequence kicked you over, you're saying.

MR. YOUNGBLOOD: If failure of this function kicked you over by an amount equal to several times ten-to-the-minus-five, then that would get into a region that some would want to call a safety concern.

Your question, I think, goes really more to how we allocated -- how we got the criteria in the first place, because we want the combustion piece of LERF to be much less than ten-to-the-minus-five, and that figures into our functional reliability that we need.

I would argue that that's part of the

risk-informing task. They need to tell me how important that function -- how reliable that function needs to be. And there is allocation involved, I think, and I want them to do it.

DR. KRESS: That was my point. There's going to have to be an allocation in here.

MR. YOUNGBLOOD: Yes.

DR. KRESS: And that's not necessarily the ten-to-the-minus-five LERF.

MR. YOUNGBLOOD: That's right.

DR. KRESS: Okay.

MR. YOUNGBLOOD: So what we conclude from this exercise is that the guidelines fostered a useful discussion and if they didn't before, maybe they have today.

I think that big chunks of the regulatory framework that we would talk about here could be performance-based to a significant degree. Not all of it. I think there are pieces of it that can't be addressed that way. I think the guidelines properly say that they can't be addressed that way.

And so having carried out this discussion and it's seeming to make sense, I think we violently agree with many of your points, but the guidelines, such as they are, I think, led to a useful discussion of this thing.

DR. APOSTOLAKIS: If you emphasize in your

write-up the points that we raised this morning, I think this is a very good piece of work.

MR. KADAMBI: I agree.

DR. APOSTOLAKIS: How come you don't disagree now? You don't say a word.

MR. KADAMBI: You made me an offer I couldn't refuse.

DR. KRESS: This whole set of high level guidelines requires PRA input, it seems to me. Now, there are certain regulations in certain areas where PRA just doesn't help any. You're just saying this doesn't apply to those areas. You've got to do something else there.

MR. KADAMBI: If we can carry on to the next case study, we'll try to address that.

DR. WALLIS: Could I just go back a little bit about the summary slide here?

MR. YOUNGBLOOD: Sure.

DR. WALLIS: What you've showed us is a change in how the regulations would be implemented in this particular case. Is that what you're showing?

MR. YOUNGBLOOD: I carried out the discussion as if there were no rule in place.

DR. WALLIS: No change in the regulation.

MR. YOUNGBLOOD: As if there were no existing rule and we were trying to make a new one.

DR. WALLIS: Oh, I wasn't aware of that. I thought you were going to show that this could be compatible with an existing rule. You're actually going to propose to change the rule?

MR. YOUNGBLOOD: What I did was take risk information that says here is a need to be met, how would we build a regulatory framework to meet that need. Now, there happens to be a lot of ruling.

DR. WALLIS: Well, if you're going to change the rule, for me, anyway, you would need more arguments about why this is now a better rule than we had before.

MR. YOUNGBLOOD: I agree. I agree.

DR. WALLIS: That didn't come across at all.

MR. YOUNGBLOOD: Yes.

DR. WALLIS: There was no comparison. I wasn't convinced --

MR. YOUNGBLOOD: One of many things that didn't come across. I think that we should be expected to quantify the risk that we accept under a given oversight scheme, which is different from the PRA quantification we do today, and compare it, because oversight schemes will have different observation periods, different parameters that they look at, different uncertainties associated with how much you really know about the plant.

I think that that's a field of study that we

aren't doing enough of. If that's what you meant, I completely agree.

DR. POWERS: If I can interrupt just a second, to understand. Do we have an idea how long this will continue?

MR. YOUNGBLOOD: Two minutes.

MR. SIEBER: Great. That's how much time is left.

MR. KADAMBI: I'd like to just get into the second case study, because it demonstrates the range of applicability of the guidelines.

MR. SMITH: Good morning. I'm Chris Smith, from ISL. I will talk briefly about case study two.

To start off, this one is very different from what Bob just talked about, in that here we took a more focused look at an existing rule and applied the guidelines to see how performance-based is a rule as it is.

Actually, we took a recently revised rule, the requirements to respiratory protection, Subpart H of 10 CFR 20. To start off, we looked at the changes that had been made.

Now, the rules were revised in October of last year and then became effective in February of this year.

They made several changes that resulted in greater licensee flexibility. So decided that this was a good case to throw the guidelines at and see if the guidelines supported this claim that they are, in fact, more

performance-based.

We took the viability guidelines and we walked them through in detail a couple of the specific changes to the rule. I guess one thing I should make clear is rather than Bob's looking at the entire regulatory framework, we just looked at the rule part and what was changed there.

So in this sense, this is another case where it's different than what you just saw. This is more of taking the guidelines and assessing an existing rule.

This table actually shows a fair amount of information all at once, so I'll try to walk through it as briefly as possible.

The three specific rule changes we looked at involved -- one of them, the first one was a modification to the requirement that discussed what had to be considered when a licensee performed their ALARA analysis.

The new revised rule added text saying that the ALARA analysis performed as part of the Subpart H requirements should consider non-radiological safety factors. Now, this isn't necessarily something that the licensee wasn't already doing. It's something that wasn't in the existing rule prior to the revision.

DR. KRESS: Chemical toxins?

MR. SMITH: Correct. That would be a good example, chemical toxins or inert air or high heat or any

other kind of OSHA type worker risk that's not radiological.

And we took that requirement and we ran through the four viability requirements, do parameters exist, do subjective criteria exist, is there licensee flexibility, and is there sufficient margin to safety.

And we looked at the old rule versus the new rule; that is, we looked at the delta; did the change result in increasing the viability of performance-basing this area.

And looking through it, the parameters didn't change, the criteria didn't change, the flexibility increased, which might not seem straightforward right when you look at it, because we added the requirement to the rule, but in essence, the requirement was already there. We just allowed them to consider it in one analysis rather than splitting it up into two.

So as a result, your ALARA may now result in a newly higher dose based on the way you schedule the work, but the worker risk would be reduced.

So in that sense, we looked at it as this increases the licensee flexibility. They've got one analysis to look at worker risk and they can have more options as to looking at something which may result in slightly higher risk -- or slightly higher dose, but result in lower risk.

So in that sense, we looked at the change to the

rule resulted in greater flexibility and the safety margin was, if anything, increased. Like I said, looking at both in one analysis, you're going to maximize your margin of safety for total worker risk rather than just dose.

So in that sense, we looked at the revised requirement as actually increasing the margin of safety.

DR. KRESS: When you do this, in the reactor arena, I don't know whether this was for the materials arena or not, but in the reactor arena, the probability of having to protect yourself against radiological hazard --

MR. SMITH: Is small.

DR. KRESS: It's small, but it's higher and the probability of having to protect yourself against chemical, I believe, or maybe smoke. I don't know what the probabilities are, but my point is it seems to me like in assessing this whether you increase the margins or decrease has to account for those probabilities some way, and I didn't see that in your assessment.

Somehow it's a probability times consequence and all I -- and I didn't see how you got both of those into the equation.

MR. KADAMBI: What we are considering here is a combination of the parameters that provide for safety of the worker and what we were told by the staff expert in this area is that when people are actually working in the reactor

environment, it is the non-radiological factors that pose a much higher risk than the radiological factors.

And therefore, the end result is that workers are more safe with the new rule.

DR. KRESS: So you did include this probability.

MR. KADAMBI: Yes.

MR. SMITH: Yes.

MR. KADAMBI: Let's move on. They've got to get through.

MR. SMITH: Okay. Quickly, talking about the --

MR. ELTAWILA: Dr. Powers, how long do you want us to continue? Because I would like to keep it on time. So how many minutes?

DR. POWERS: Why don't you cut it off at quarter of?

MR. ELTAWILA: Okay.

MR. SMITH: I just want to talk about this next requirement that we looked at, because I think it brought up a good important point that we didn't necessarily see ahead of time, but learned from the application of these guidelines.

The new requirement was revised to include quantitative fit test criteria into the rule itself.

DR. APOSTOLAKIS: Can you point to the screen, please?

MR. SMITH: I'm talking about this cell right here.

DR. APOSTOLAKIS: Okay.

MR. SMITH: The rule was revised to actually add fit test criteria into the rule, whereas before it previously just said the licensees shall have a program, documented program, and all the guidance documents contain the actual fit test requirements that had to be met.

Clearly, this is a move into something that is more prescriptive, but when we looked at the -- when we ran the viability requirements across this rule change, we found out that these fit test criteria are being used in generating the dose calculations, which are being used as performance parameters in many areas.

So when you're calculating your dose based on somebody wearing a mask, it assumes that the fit test that they had is working, the mask is working as designed.

Therefore, having the fit test criteria in the rule is necessary to ensure that those performance parameters are accurately recorded.

So even though it is more prescriptive, using the viability guidelines leads you to understand that this portion of the rule is not something you would pursue to be performance-based and it makes sense to have it more prescriptive.

MR. ELTAWILA: Prasad, maybe you want to wrap up the discussion.

MR. SMITH: And I think the summary, I think, is already what I've said.

DR. WALLIS: Your written summary said they support the validity of the viability guidelines and wasn't telling me why the viability guidelines were being tested by this case. They were being used, but were they being tested in some way?

MR. KADAMBI: The point of the case study was, in fact, to test the guidelines to see whether they are ready for prime time, as it were. And in this case study, we also went beyond the viability guidelines. We had enough information, because this was a rule already on the books, we could assess the guidelines as changed, the next sector of guidelines.

And what we found is that, yes, if we had gone through these guidelines with the rule change that was proposed back in October of last year, we would have come out with saying that, yes, it makes sense to change the rule in this way and there would be net benefit to be gained from it in terms of safety, as well as in terms of flexibility and, in some cases, actually increasing the safety margin.

That's really the bottom line. And if I may, let me just -- sorry to go through these musical chairs like

this, but I think we have already covered this. Farouk already went through the fact that we are going to be using this in other kinds of areas, including risk-informed, as well as the traditional approaches.

Our plan, I would like to just focus on this a little bit. We are going to apply the guidelines in ongoing and future changes.

Right now, our immediate plans are to apply the guidelines in some of the option three effort. As part of the risk-informed regulation implementation plan, there is going to be a class of regulatory initiatives that are identified as being not appropriate to be risk-informed. We don't necessarily know what they are right now, but whatever that turns out to be, we would examine whether the performance-based guidelines might help us obtain regulatory improvement in those cases.

The management directives that we hope to develop will, in fact, focus the questions more towards specific activities and we fully intend to incorporate the kind of specificity that has been brought out in the discussion today.

A communications plan, basically, what we would like to do is people know about these guidelines and even people outside the NRC, such as those involved in consensus standards, may find it useful to apply the performance-based

guidelines when they seek to make consensus standards more performance-based.

The planning, budgeting and performance measurement process will really take into account a combination of all these assessments when allocating resources for a particular rulemakings or other changes to the regulatory framework that we would undertake.

DR. KRESS: Let me ask you a question about that. The examples we gave improved both safety and gave flexibility and reduced burden.

Let's suppose you had a case where you reduced burden, but actually increased risk a little. Do you have guidelines on what to do about that particular condition? Is that allowed?

MR. KADAMBI: I believe, depending on the circumstances, it would be allowed. If you look at the guidelines in Roman Numeral II, guidelines to assess change, because there the performance goals of the agency are very prominent and if we can substantially maintain safety while decreasing unnecessary burden, that would support the agency's performance.

DR. KRESS: It's those words like "substantially maintain safety" that bothers Professor Wallis. Is this a reverse regulatory analysis of some kind?

MR. KADAMBI: I hope the words in the guidelines

themselves are better than the ones I used off the cuff. But in concept, that is really --

DR. KRESS: But in concept, that's allowed.

MR. KADAMBI: Yes. True.

DR. KRESS: But we're not sure what the criteria are.

DR. POWERS: I guess I'm a little perplexed then. If I come back to the individual respirator protection, how do I use many of the societal goals that I've got to assess that?

DR. KRESS: I don't think you can use some society goals there. It's like some performance-based regulations, where you have to have other kinds of goals.

DR. POWERS: I wonder what those would be.

DR. KRESS: That's another thing. I think you need to establish the goals separately for some of these rules other than just rely always on CDF and LERF.

Certainly in the NLSS materials area, you're not going to have CDFs and LERFs. You may have equivalent to a LERF, but you have to have goals right at the start, which I would call acceptance criteria or something, and then you work down from that.

But for this case, this is an ALARA goal. I think you have a different -- you apply the different goal just as if you have to meet it like you would a CDF or a LERF.

MR. KADAMBI: To not detain the committee much longer, I believe we did meet the elements of the SRM that we set out to accomplish. We did obtain stakeholder input. We observed that the advisory committees can see these guidelines and practices, they exercise their oversight responsibilities.

The guidelines are subject to improvement and certainly the comments that we've received today will be part of what we will use to improve the guidelines.

We do expect that there will be better integration as we move forward and gain experience in all these initiatives.

Mr. Chairman, thank you very much for your time.

DR. POWERS: Thank you very much. I guess we're in a position now to move on to our second topic for the day, which is license renewal guidance documents. Dr. Bonaca.

DR. BONACA: Mr. Chairman, as you know, the NRC and the industry have been developing a set of license renewal guidance documents. These documents are intended to help the industry develop applications for license renewal and to help the NRC in its review of individual applications.

These documents appear to be close to being released for public comment and the ACRS is planning to

review these documents during the October 19 and 20 subcommittee meeting of the License Renewal Subcommittee of the ACRS, and is planning to write a report on the guidance documents at the November meeting.

This morning we have the staff coming to tell us the status of these documents and when they will be released for our review.

With that, I will leave it to the NRC to take us through the description of the standards.

MR. GRIMES: Dr. Bonaca, if I may. My name is Chris Grimes. I'm the Chief of the License Renewal and Standardization Branch, and as part of my introduction of Dr. Sam Lee, who is going to make the presentation this morning, I would like to inform you that just about an hour ago, we notified NEI and the Union of Concerned Scientists that we are shipping to them today copies of Generic Aging Lessons Learned report, our revised Standard Review Plan for License Renewal, a draft regulatory guide that proposes to endorse an NEI guide, Revision 2, dated August of 2000.

And the collection of documents is going to be distributed over the next several days. I expect a press release later today announcing the availability of the document and a Federal Register notice should be published tomorrow announcing the availability of the documents for comment and our plans for a workshop to be held on September

25.

DR. POWERS: What is the time period you have allowed for the comments?

MR. GRIMES: The Federal Register notice requests comments by submitted by October 16, which is a 45-day comment period.

But as Dr. Lee will describe, we have already solicited substantial stakeholder input in the development of these drafts that we're issuing for comment.

Our purpose today is to walk you through the organization and construction. I would note that Noel Dudley has done an admirable job of carving up the guidance documents to make assignments to the individual ACRS members and we're going to explain to you what you can expect to see in the documents.

We have one set of the documents here to show you today and on Friday we would deliver an additional 15 sets for the ACRS.

WE also will have all these guidance documents up on the web, if not now, later today. I think that we turned the CIO on just moments ago to go ahead and move the web site over the external server.

So we are in the midst of the launch. These represents another major milestone in the license renewal program that fulfills a commitment that we made to the

Commission last fall in response to the issue that was raised by the industry called credit for existing programs for license renewal in SECY-99-148.

So we are still on schedule, we are still marching forward to make improvements in the license renewal program, and today we'll describe to you the material that will be provided to the ACRS during the public comment period.

DR. UHRIG: Is this material significantly different than the material that we've already been provided with? We have large volumes of GALL.

MR. GRIMES: The trick is how significant is significant. I would say that it is significantly different because of the level of effort that has been put into revising the generic aging lessons learned, since we released the initial draft in December, last December, in support of the first workshop.

But you aren't going to see the new programs that have occurred or anything. It has been more in terms of the level of detail that we've gone into in identifying which programs do which things. But Dr. Lee will cover some more of that during his presentation.

DR. BONACA: Just one comment. When some restructuring of documents has been performed for some specific reason, I've seen, for example, some significant restructuring of the GALL-2 report, and I would appreciate

some information of why and it would help us in using some of the review already performed to date and see how we can expedite the review of the new documents.

So with that, I leave it to you.

MR. GRIMES: I would also like to note that accompanying me here at the table is Dave Matthews, the Director of the Division of Regulatory Improvement Programs, and Dr. P.T. Kuo, who is the Section Chief that supervised the development of the generic aging lessons learned SRP and reg guide.

With that, Dr. Lee?

MR. LEE: My name is Sam Lee. I'm from the License Renewal and Standardization Branch. Like Chris has mentioned, this has been a major project by NRC and we have significant work input from the NRR, Division of Engineering, Division of Systems Integration and Inspection, and also our Division of Reactor Improvement.

Also, we have significant input from the Office of Research and the work is done mostly by the two national labs, which are Argonne National Lab and Brookhaven National Lab.

Also, the reviewers who have been involved in the initial license renewal applications, they are also part of this effort.

So we tried to capture a lot of experience, a lot

of effort into this product.

At the table, I have people from the License Renewal and Standardization Branch, Jerry Dozier, Tammy Bloomer and Rani Franovich. They are the licensee renewal leads for individual chapters of the SRP, of the GALL report.

The four documents we have in here are the GALL report, the generic aging lessons learned report, and we have the standard review plan, which is this, and then we have the reg guide, NEI-9510, which is actually the reg guide, just a couple pages up front endorsing the NEI-9510, which is attached in the back. So these are the four documents that we have.

We will leave you this copy today and we will give you more copies, I guess, on Friday. We will also touch a little bit on the schedule and then we have some specific questions, and we'll just go over that review.

As background, like Chris said, this started during the review of the initial license renewal applications. Both the staff and industry recognized that many of the license renewal programs to manage aging are existing programs.

So that generated an NEI letter and we generated this SECY-99-148, and that resulted in a Commission direction. That directive started to prepare the generic

aging letters report, the GALL report. They evaluated existing programs and document the basis for acceptance and also identify where existing programs should be augmented.

DR. WALLIS: Can I ask you about the GALL report? For some reason, we got some reports from Dr. Pollard, of Concerned Scientists.

MR. LEE: Yes.

DR. WALLIS: Was the intent that he wanted them put in the GALL report?

MR. LEE: I guess the GALL reported started a couple years ago when we started looking across --

DR. WALLIS: I was wondering, how did you dispose of something like that? Did you put it in the GALL report or did you refute it or what did you do?

MR. LEE: In some cases, we actually added it into the GALL report. They submitted -- Union of Concerned Scientists --

DR. WALLIS: Is there a mechanism for refuting arguments like that or responding?

MR. LEE: We actually had internal documentation to actually document that we reviewed this report, this is what we found.

DR. WALLIS: It seems to me that something like that, which looks like a severe criticism, needs to be responded to very carefully and well.

MR. LEE: We will consider that. But the information has been captured into this GALL report now.

MR. GRIMES: Dr. Wallis, if I may add that during the December 1999 workshop, David Lochbaum criticized us for developing the GALL report without having considering their perspective in terms of aging issues.

So our response to that was as we worked with NEI to review their views about aging management programs, we also undertook a review of the UCS reports to determine whether or not they identified any unique or different perspectives on aging effects that warranted aging management programs.

But you are correct, we need to be very careful about the context in which we describe the nature of that review and its results and how they are used in GALL.

MR. LEE: And then the second bullet is to develop the standard review plan to focus on areas that we need to augment programs. And the Commission directed us to involve stakeholders early and that's why we have workshops and we actually get input from Dave Lochbaum.

Then we have to brief the Commission on -- we have to issue the documents for public comment and then brief the Commission on the public comments received, and these documents are going to the Commission for their final approval next year.

And after we have additional experience, and we will, the Commission directed the staff to go back to the Commission with recommendations, if any, for future rulemaking to improve the license renewal process.

These four documents here interrelate, so they kind of work together. The GALL report is the technical basis document for the standard review plan and the standard review plan provides guidance for the staff. In this case, it's a focus on areas where existing programs would be augmented.

Then the reg guide endorses 9510. Our goal is to endorse 9510 with no exception. And 9510 lays out a process for the applicant to follow to prepare the license renewal application and it actually lays out what is an acceptable format of the application. And the standard review plan actually uses that format when we formulate the standard review plan.

So we have tried to make all these documents consistent. And one of the things that I guess we have to admit is because we the GALL and SRP are evolving, so NEI recognized that they would have to do additional work to 9510 to make it consistent with the final GALL and the standard review plan. So you might see some inconsistencies during, but that's not the intent.

We had early stakeholder involvement. We had

workshops, we had many meetings, all these meetings with NEI. The Union of Concerned Scientists sent in five reports that we have reviewed and then the next step is a workshop, I guess, on September 25. That's in the auditorium.

DR. BONACA: You are telling me one of the things that the ACRS would look at is, in fact, how well these documents are integrated in a way that they provide clear guidance and there isn't conflict and also that both the applicant and the reviewer can have a common understanding.

You are telling me that there is still some lack of integration in these documents with the NEI document.

MR. LEE: I would not call that integration, because NEI doesn't know --

DR. BONACA: Because it's work in progress.

MR. LEE: Work in progress. They are trying to catch up. And the SRP they are still changing. We just need to fine tune it and finish that up.

DR. BONACA: Okay.

MR. LEE: Here is the schedule. We are at this point right now. We are issuing this for public comment. Actually, the Federal Register notice will go out tomorrow. Then we have a workshop and we have to brief the ACRS in October-November in more detail, and we are going to brief the Commission on public comments received in November.

The way we understand it is this date is being

changed right now, but that was the last thing we have. So this is being changed.

MR. GRIMES: I was notified by the Office of the Secretary late last night that they couldn't get all of the invitees together on the 27th, and so they are now polling the Commission for an alternate date and it now looks like the Commission briefing will be held on December the 5th.

MR. LEE: Then we have to brief the committee again next year for the Commission approval in March of 2001.

The GALL report, this document is an evaluation of existing programs and provide a basis why existing programs are adequate and certainly to be augmented for license renewal. It addresses the aging effects, it identifies the programs, and then it calls for the program evaluation.

It has the ten elements, the ten program elements you look at, such as what kind of inspection technique, what kind of frequency, what kind of acceptance criteria, what kind of corrective action, what control do they have.

And the GALL report is actually in two volumes. So this might be a little change from what you had seen in December. In December, this was the introduction section. It got pulled out and made what we call the volume one, which is just a summary. So this is basically a summary, which was the introduction in the December version, if you

look at the December version. WE pulled that out.

Also, in here, we have provided a cross-walk from the SRP into the GALL. So you find certain things, the SRP said where did that come from, and in GALL, you go through here. There is some table that points you to the particular items in GALL, so you can trace that. So we call that a bridge between the SRP and GALL.

It also has some indexes in here. So if you want to look for a particular system, you try to find where it is in GALL, so there is some indexes in here to help you do that. So that's the purpose of this GALL.

DR. WALLIS: Independent review of this, is the ACRS the only body that's looking at the whole thing that might be regarded as an independent body?

MR. LEE: This document --

DR. WALLIS: Do we have the whole responsibility to do the independent review or is someone else also helping you with that?

MR. GRIMES: The ACRS has the whole responsibility, until such time as we find someone who volunteers as part of the public comments to take it on.

DR. WALLIS: So you haven't got an expert group or anything.

MR. GRIMES: No. We do not have a designated expert group or a peer review group for this report.

MR. LEE: I guess some entity, like the ASME, they have assimilated the document, but they will be through the public comment period.

Here is the GALL and this is pretty much like what you had seen in December. The majority of the evaluation is in Chapters 2 through 8. So that has not been changed.

If you look at the GALL report, the structure is still the same as back in December. I just want to show some pages.

So it's still the same as back in December. It goes through the structure and component, what environment it's in, what material it's in, and more aging effects, and more of the programs, and that goes through this ten-element evaluation, and then conclusion, whether it is adequate or you need to augment it. So this hasn't changed since December.

But what has changed is sometimes it gets real bulky to keep repeating this ten-element evaluation. So we start putting things in what we call Chapter 11, which is basically extracted this part and put over here, and then in here we just say see Chapter 11 and then we give the number. So that's a format change.

And we suggest, for convenience, so if you go to Chapter 11, okay, you will not find all the aging management programs in Chapter 11. Only certain things they kept repeating many things, it's more convenient just to put them

in one place, we thought. Some of these, they are still in the table.

And then, I guess, the other new things in here, compared with the December version, is we have this called a TLEA chapter, which is like a few pages. Doing the initial application review, some of the applicants choose to propose an aging management program to address the TLEA, a program to address fatigue, or the nuclear program to address EQ. So based on that experience, we've written up what we have accepted in the initial license applications for aging management of TLEA. So there are examples in there.

We also had a new chapter, which is Chapter 1. This is a one page description of the ASME code. The staff, when we go through this, we allow the ASME code a lot. So the staff thought maybe we should provide basis in a description of the ASME code, and that's what they use.

And then we go on to the standard review plan. The standard review plan references the GALL report, so it incorporates the GALL report, and then it focused the staff review in the area where some programs would need to be augmented.

And some of the features in here, this has not changed from the previous version, if you've seen the previous version.

DR. BONACA: This has not changed?

MR. LEE: The structure has not changed. The information has changed, because we're going through comments and the conforming change, so we make all the conforming change.

There are tables in each chapter of the standard review plan which captures information from GALL, basically summarizes information in GALL. And that had changed because GALL had changed.

And in here, the GALL Volume 1, we provide you a cross-walk from this table back to this paper here. So you say, gee, where did that come from, and go here, go to here, it says this is item such and such, then go here and then you can find it. At least that's the purpose.

DR. WALLIS: This is also electronic, so that if you want to make the cross-reference, it's something that helps you do to that?

MR. LEE: Right now we don't have that, no. We have this, I guess, on the web and then this is in Microsoft Word.

DR. BONACA: The logic on how all these documents come together, it's in the SRP.

MR. LEE: Basically, the SRP pulls it together. It takes information from NEI-9510, it takes information from GALL, and from the reg guide. But then the 9510 cut off early in terms of giving the applicant guidance in terms

of how to go through the process.

DR. BONACA: I understand that. But if the members have to look for a guiding document that would walk us through, it would be the standard review plan.

MR. LEE: It might not walk you through that much, because it's -- this is the place where it ultimately will.

MR. GRIMES: I'll be bold enough to say the standard review plan is the guiding document and that that's where you should look for the best articulation we have of the expectation on decisions regarding adequacy of aging management.

DR. BONACA: The reason why I'm asking that question is there is our concern is that when the reviewer has to write an SER, there is a complexity here to the amount of volumes and how they are integrated.

So that it is important that one document is recognized as a guide through all this set of documents.

MR. LEE: Yes. For the staff to write the SER, all it needs is the standard review plan. That's the goal.

DR. BONACA: Yes, but so many of the bases are sunk into the reporting documents and certainly we want to make sure the review is a thorough review and looks at the technical issues and doesn't just reference something, but the reviewer is able to understand how to get into the reports and get to the issues.

MR. KUO: I just want to point out, in the standard review plan, there is a section specifically for reviewers that we call the review procedure.

DR. BONACA: Great. That's what I was looking for.

MR. LEE: Okay. This uses the format from the 9510. But like I said, there's some consistency problem with the format in that 9510 does not have the complete benefit of GALL. So in certain places, you might say describe this program, but then GALL says no further evaluation is needed. So the SRP doesn't pick that up. So you see a little inconsistency there, but we will fix that by next March when we issue it for final.

And here is the table of contents for the standard review plan and this hasn't really changed from the earlier version, if you're seen it. It goes through the rule requirements, the administrative portion, and then here is the scoping, here is the methodology for identifying the structures and components subject to license renewal requirements.

And also here is the guidance in how do you actually check the results, to make sure the results come out okay. And Chapter 3 is the aging management review and here is where the GALL report comes in. So you see an individual section here corresponding to the chapters in the

GALL report.

The only exception is that in here we combine the containment and structure together in one section in the standard review plan. GALL has it in two chapters.

And here are some of the TLEAs that we have identified based on the initial review of the applications. So their comments, we can put them in there. And then we have technical positions and one of them is on the ten program elements, what does all that mean, and other things.

And the details of the table of content is in the last two pages of your hand, so you can look at that.

Here is the reg guide and this provides guidance for the applicant to prepare the application. Back in '96, we issued a draft reg guide to endorse NEI-9510 Revision 0. Since then, we have gained a lot more experience based on the review of the initial applications. We have done some scoping reviews, and now NEI has revised that and given us a Revision 2 and the current draft reg guide, we would propose to endorse that.

Here is the table of content on 9510. Basically, it goes through the rule requirements. It talks about how to identify your structures that are subject to license renewal requirements, how to do aging management and the TLEA evaluation, and then provides a format of the application.

One of the useful things that this document has is this has an appendix which identifies which structures and components are active or passive. So that has a nuclear aging management review.

DR. SHACK: Sam, as you're pulling the string on these things and you go from the SRP to GALL, you're eventually going to end up with references to documents like the owner's group reports which are used to provide justification.

Are there going to be publicly available versions of all of those reports?

MR. LEE: We are working with EPRI. A lot of these reports are EPRI reports. So now EPRI is giving us public versions, also. The answer is yes, we are providing at least a non-proprietary version.

We issue the FRN, the Federal Register notice, we asked for comments on this document and, in particular, we're interested in comments that goes to the extent of which existing programs adequately manage aging. That is the whole focus.

Then we have four specific questions; does the GALL report actually provide sufficient -- some programs should be augmented, identify that, and also in here we have a question on being more specific. We have a process that endorses correlations of the ASME code and we explain that

in the FRN and then in here we said they are the codes that are not endorsed by 55(a) or by the process, how should we handle that in GALL.

Also, the GALL report identifies the aging effects for certain structures and components.

If an applicant decided for their plant that that aging effect is not applicable, should they provide information in the application?

And that is the last I have and like Chris said earlier, the comment period ends October 16, a 45-day comment period.

MR. GRIMES: Following up on a question that Dr. Wallis asked earlier regarding peer review by other organizations. Sam mentioned that we're continuing a dialogue with the ASME to try to get ASME feedback on GALL and how well it reflects the code programs to manage aging effects.

Also, I would say that we're soliciting public comments and when we say provide too much credit, there are two ways that we might have provided unwarranted credit for programs.

One is lack of technical basis. That is, there is some technical flaw in our logic. Another aspect is that we didn't articulate it clearly. There's a distinction between whether or not we had good cause and whether we explained

good cause.

So we will be trying to seek out expert peer review from other organizations; in particular, the other code bodies. And to the extent that we can get other recognized organizations to contribute voluntarily, we will do that.

The ACRS, fortunately, we can ask of you, but some of these other folks, we have to get them to volunteer their attention.

DR. SEALE: Some time ago, I gave a reference back to Mr. Dudley of some people in the DOE establishment who are doing work in the aging management area. Some of the materials they're talking about are not exactly the materials you're interested in, but some of them are.

These are the people at Los Alamos. Have you gotten any feedback from them?

MR. GRIMES: We haven't even contacted them yet. I do have the name of the contact, but we consciously decided that we would let Los Alamos recover from a fire and security questions and we were pressing to get GALL issues. But we do intend in contacting Los Alamos and sharing their experience for the weapons programs.

DR. SEALE: In the elastomers area, in particular, I think you have a lot of common interests.

DR. BONACA: I have a couple of questions regarding -- is

there a way in which we can understand how the experience from the Oconee and the Calvert Cliffs applications have been folded in the report? Is there any supporting documentation that you have, a summary? You may have developed something for just your use that shows a checklist of how you addressed some of the issues in the report.

MR. LEE: We don't have such a summary.

DR. BONACA: Don't have such. Okay.

MR. GRIMES: The primary means of incorporating the lessons from Calvert Cliffs and Oconee was drawing on the same talent pool. I think the easiest way for us to be able to respond would be that if you have a question about particular -- whether or not Calvert Cliffs or Oconee contributed to a particular element of GALL, just ask us and we'll --

DR. BONACA: I'll give you an example of why I ask the question. I reviewed the latest SRP version I had, not this one, and I was looking at the scoping and screening portion and it's a very important one.

I was left with the impression that, and maybe I'm wrong, I haven't gone through in detail, but that although the Oconee experience is reflected somewhat, the next plant that comes up will have the same difficulties in sorting out the accidents that are a part of the licensing basis and so on and if that is the impression and that impression is

correct, then one could say that this is not a standard review plan and that will allow for different applicants to end up with different sets of assumptions, of accidents, actually, that are going to be in their basis.

In that sense, I would say then the Oconee experience is not properly utilized in support of the SRP.

Now, again, I'm not making a judgment. That was an impression I had.

MR. GRIMES: I can see how you might get that impression and I would tell you that when we reflected on the Oconee experience, we considered Oconee to be relatively unique with respect to the scoping issue and we attempted to translate that experience into something that we considered to be more typical or generic.

And we have specifically asked Arkansas to give us feedback because they pattern themselves after Oconee. They do not have the same kind of quality assurance categorization process.

So we will be attempting to test whether or not our translation is clearly articulated when we do our --

DR. BONACA: Let me give you an example. Clearly, our intent is not one of helping write the SRP, but certainly it would have helped me if, for a plant licensed, fully licensed to current requirements, at least to have been provided the set of accidents that you would expect to

be there, just as a reference, for example, and I didn't see that.

And because it would help me to understand how an older plant or understand even the applicant for an older plant in what accidents he has to explain that are not part of his own licensing basis.

It's just a suggestion, and I didn't see that help.

MR. GRIMES: Actually, we are hoping that the ACRS will provide us comments on how to write the report so it's clear and we will consider that as one of the comments as we go through the public comment process. That is, the possibility of adding a list of accidents to consider as part of the scoping process.

DR. BONACA: And the other question I had was there were a number of license renewal generic issues that were significant, I believe about 100 or so, and I imagine that they have been resolved and have been addressed in the body of the guidance documents.

MR. GRIMES: We went through the inventory of generic renewal issues and we disposed of over two-thirds of them. We have document -- we've got a database that we can go back to identify where we expected to -- where we think we resolved them in GALL or the SRP. We've got about a half a dozen generic renewal issues that we're going to continue

to pursue; for example, improving guidance for fatigue management, considering environmental effects. The issues that continue to warrant dialogue.

DR. BONACA: Okay.

MR. LEITCH: How are they proceeding? Are they more or less on hold until this new program is approved? What is the status of the plants that are in the pipeline now?

MR. GRIMES: The plants that are under review right now are being reviewed using the practices that we established on Calvert Cliffs and Oconee and the staff will be able to take benefit of this improved guidance to develop its safety evaluation, but the standard for the safety evaluation is going to -- it will have to stand on its own.

It can't use this for reference. It can only use this as a knowledge base.

MR. LEITCH: Thank you.

DR. BONACA: Any other comments from the members or questions for the presenters?

[No response.]

DR. BONACA: If not, thank you very much for the presentation and for the effort. We've come a long way. Mr. Chairman, back to you.

DR. POWERS: Thank you. I echo your sentiment that this has been an extraordinary undertaking. I think I

need to go through all the challenges that it poses.

I will emphasize that it's an extraordinary undertaking. You're asking the ACRS to read a phenomenal number of pages. It's at least ten percent of what we're usually asked to read each month. So it's significant.

I would remind the members that this is part of the statutory charter, so we really have to do it this time.

With that, I will recess us until quarter of the hour, in which we will get to hear very interesting discussion of the operating events at the Indian Point Nuclear Power Plant.

[Recess.]

DR. APOSTOLAKIS: Back into session. Indian Nuclear Power Plant Unit 2, the cognizant member is Professor Seale.

DR. SEALE: Well, I guess you could almost subtitle this "Where is Washington Irving when you need him," because all hell seems to be breaking loose there for a little while in the Hudson Highlands and Ichebod Crane's old country. I think that's where it was, anyway.

A year ago tomorrow, there was a reactor trip, which has been indicated as having complications that took place at Indian Point 2. It was a trip. There were problems with the diesels and one thing and another, and I think we're going to hear this from the folks there.

Then that will be a relatively short presentation, I understand, and then we're also going to hear about a steam generator tube failure that took place on the 15th of February.

So you had an exciting time, I guess, here recently anyway. Mr. Marsh, are you going to be the --

MR. MARSH: I'm right here.

DR. SEALE: You're hiding.

MR. MARSH: I'm hiding from you. Good morning. My name is Tad Marsh and I'm the Chief of the Events Assessments and Generic Communications Branch in NRR.

DR. SEALE: Okay.

MR. MARSH: I have a couple of introductory comments and then we're going to turn it over to our team up at the front here to do the presentation for you.

This is a joint presentation by NRR and by regional management and staff on the two events that you described. Now, with the regions, NRR reviews, as you know, and screens operational events as they occur. We also work with the regions to decide what's the best way for the agency to respond based on the severity of the events.

Our branch looks at the events and whether there's any generic implications or any generic communications that are needed. So that sets kind of the backdrop for who the players are in this team for you today.

As a further backdrop for you, I'm sure you know that operational experience is showing us that plants are behaving better lately. There haven't been very many significant events.

In the last perhaps 20-21 months, we've had three AITs in this country. What you are going to hear about today are the events surrounding two of those AITs.

So we look at these events with some significance, as they do represent some fairly significant occurrences.

I'm going to turn it over to Eric now, who is going to introduce the team and begin the presentation.

MR. BENNER: Thank you, Tad. As Mr. Marsh indicated, we are here to discuss two events which occurred at the Indian Point Unit 2 Nuclear Power Plant; specifically, an August 31st trip, loss of off-site power to four 480 volt vital buses, and then a subsequent loss of emergency power to one of those vital buses; also, a subsequent draining of a safety-related battery.

The second event will be a February 15, 2000 steam generator tube failure. Again, as Mr. Marsh indicated, both of these events resulted in the NRC sending an augmented inspection team and we have the leaders of the two steams, specifically Jimmy Yerokon and Ray Lorson from Region I to discuss the particulars of each event.

Their presentations will provide sequence of

events, licensee response, root cause investigations and safety significance. Also, as part of each event, we have Jim Trapp, the Senior Reactor Analyst from Region I, to discuss risk implications. We also have representatives from the licensee and members of the technical staff here to help answer any questions.

Mr. Goodwin and myself, who work for Tad, can assist in any discussions of what we're doing generically in response to these events.

Brian Holian, Deputy DRS Director from Region I here, will conclude.

So at this point, I will turn it over to Jimmy to discuss the first vent.

MR. YEROKON: Good morning. My name is Jimmy Yerokon and I'm from the NRC's Region I office, and I led the 1999 August event AIT at Indian Point 2.

I have been with the NRC for about 11 years. Prior to that, I was in the industry, with about ten years of experience, mostly as a startup engineer. Before that, I finished degrees in mechanical engineering and physics.

Before I get to the event, I just wanted to point out, I have an electrical simple drawing on my right side here to help make my presentation easy. As we get to the various points where I need to refer to the diagram, I will do so and that should be very helpful.

Basically, for the event of August of '99, I will group the discussion into three phases. The first phase, I'll talk about the initiation process, how the event initiated, and then I will get into the complications, which is the bulk of the discussion, things that went wrong, and I will finish up with the end result of what the event eventually resulted into.

On August 31, there was an automatic reactor trip at IP-2 and the automatic reactor trip was caused by a spurious actuation of one of the channels of the reactor protection system, OT Delta T. That is the over temperature, delta temperature channels.

What happened is at that time, maintenance people arrived, who had some pre-planned maintenance activity going on in one of the channels of that OT Delta T circuitry, and that channel or that circuit had a spurious actuation or a spurious spike, and that that gave the 204 logic and there was an automatic reactor trip.

So the trip was as designed, when you have 204, the logic. And as designed for a plant trip, there are four 6.9 KV buses that provide the on-site power, supply that switch to the off-site power supply.

The on-site power supply comes through this unit auxiliary transformer and that feeds the buses one, two, three and four that have the station power, station service

or like the RCPs, the main feedwater pumps and stuff like that.

And you have the off-site power line coming here through this station auxiliary transformer that provides power to bus five and bus six, and those two buses, through step-down transformers, provide power to the vital 480 volt buses, buses 5A and 6A, although bus 3A and 2A also get their power supply stepped down from bus two and three.

But anyway, when you have a plant trip as designed for the site, these buses switch because you've lost the aux transformer from the unit. They all transfer to the off-site power supply.

And when that happened, there's obviously a voltage dip on the bus and the buses are filling the station power supply. And all this was as designed for plant trip.

The problems or the complications started shortly afterwards, within about three minutes of the plant trip. Suddenly the four vital buses all had their supply breakers trip open. So there was a disconnect from the off-site power line.

And as designed for a loss of off-site power to those four buses, the diesels, they have three diesels, those three diesels started as designed and they started to load up on the buses.

Now, the next issue that occurred that was

unexpected was within about 10-12 seconds of the diesels trying to load up on the buses, diesel 23, which was the power supply to bus 6A, suddenly the breaker for that diesel opened up.

Now, I will discuss later the reasons for all the unexpected events that occurred. But the breaker opened up, leaving bus 6A without any power supply. It didn't have off-site power to it nor emergency power supply to it, also.

With the loss of power, complete loss of power to bus 6A, the loads obviously were without power and one of the loads on that bus, the one that gets into the aspect of my discussion, is for battery 24. So with the power supply lost, the battery 24 on bus 6A was physically handling the load on a 125 volt A/C instrument bus.

After about seven hours, with several activities going on, and I will touch in the course of my discussion, the battery was depleted and with the battery depleted, there was loss of power supply from that 125 volt A/C instrument bus and several control room enunciators apart from that instrument bus, and there was a loss of those control room enunciators. Now, although those control enunciators are not safety-related, but they do serve -- there are some safety systems that have enunciators that reflect their conditions as part of those enunciators.

As part of the management procedure for the site,

with the loss of 75 percent of enunciators for safety systems, it calls for declaration of unusual event, which was declared at 9:55 p.m. on that day of the event.

Several hours later, they were able to restore power to bus 6A. The diesel was -- the breaker was closed back up. They had some troubleshooting activities, trying to determine the reason for the breaker of the diesel opening to the bus.

That breaker went open and over-current. So they took all the loads of the bus, they did some measuring, some troubleshooting, and several hours after this, they were able to satisfy themselves that it was safe to close the breaker back to the bus. They did so. The diesel was restored to the bus.

And after a short while, they were able to restore the off-site power supply to buses 5A, 2A and 3A. And a couple of hours later, they restored off-site power to bus 6A and secured the diesel.

With that, the event was basically over. Now, the safety significance for this event; obviously, you have the loss of bus 6A, loss of complete power to bus 6A, and off that bus, you have one of the motor-driven auxiliary feedwater pumps. You also have a train of ECCS pumps, injection, RHR, service water, cooling water. So those pumps were lost for that duration.

Although ECCS was not required, that train was lost. Also, there was the loss of battery 24, which resulted in loss of instrument bus 24 and loss of the control room enunciators analysis for safety systems. That factored into the safety significance of this event.

Also, there was increased burden obviously to the operators. They had to deal with trying to restore off-site power to the buses and also emergency power to bus 6A. Some equipment that was lost during this event, one of them was there was a control valve from the turbine-driven auxiliary feedwater pumps, one of the generators that failed open, and with that, they lost one motor-driven auxiliary feedwater pump and a valve for the turbine-driven failed open. So they had to cycle the turbine-driven auxiliary feedwater pump on and off for level control in one of their areas for some period of time.

After spending some few days in there, the AIT found several root causes and contributing factors for this event and we were able to group these into four main areas.

We grouped them on configuration control, which mostly included the hardware issues. We also grouped some of them in management oversight. There were some obvious technical support problems both during the event and some that were there before the event occurred, and we found some inadequacies in some corrective actions, mostly some

problems that existed before the event that had not been adequately corrected.

In the configuration control area, which includes most of the hardware issues, the first one they had was a problem with a load changer that works all the station auxiliary transformer.

The changers are supposed to work if left in the automatic control mode, is when you have a loss of power from the on-site power source and the on-site loads transfer to the off-site power, you obviously expect a dip in voltage and the changer, what it does, it controls voltage upward from this transformer, such that it maintains it constant. So you don't have the voltage set point at the 480 volt, you don't sense that to cause the loss of off-site power to the buses.

In short, when you lose off-site power and you transfer to the off-site, the design is such that you don't lose the off-site to the 480 volt buses.

The changer had been maintained in the manual mode as opposed to the automatic mode. So when that transfer blew to the off-site power source, there was no automatic control to step up the load on the secondary side and the voltage dip was such that the degraded voltage relays for the safety buses, the 480 volt buses, since -- the voltage dip went below the set point and the relays picked up. So

that was the reason for the breakers opening up from the off-site power source to the vital buses.

DR. SHACK: Now, is this a procedure problem, an error problem?

MR. YEROKON: The top changer was the design, it was supposed to be in the automatic mode. There were some previous problems that needed to be repaired and for some hardware issues and also scheduling issues, the repair had not been made for about a year or so.

So it was in manual mode.

DR. SHACK: All this time.

DR. SEALE: This was a known and approved action. That is, they knew that they had it in the manual and that that was not according to the design specification.

MR. YEROKON: That's correct. So that was the first real complication. The second one, with the buses, the vital buses being powered by the diesels as expected for the loss of off-site power, you also had the instance where the breaker from EDG-23 tripped open on over-current, and the reason for that is one of the over-current -- the protection on the breaker, the short time over-current relay had been set at 3,200 amps instead of the required 6,000 amps.

And the setting was -- they thought they had it at 6,000, but actually it was 3,200 and there were some

problems in the instrument used to measure the set point for the trip current.

So when you had a loss of off-site power to the buses, the diesel startup, the loads started coming onto the bus. There were three heavy loads. I think it was component cooling water system, aux feedwater, and there was a third one that were trying to secure on the bus, and the combination of currents was enough to trip the amps on that breaker that was set at 3,200 as opposed to 6,000.

DR. UHRIG: Are there separate loads on the three generators?

MR. YEROKON: Yes.

DR. UHRIG: But it's not a common bus.

MR. YEROKON: That's correct.

DR. UHRIG: In other words, you could not have transferred those loads to the other two generators.

MR. YEROKON: That's correct. It's separate trends, a trend A and a trend B.

MR. HOLIAN: Jimmy, while you're heading to the next slide, one clarification on that tab changer. In the past, Jim Trapp, when he introduces himself, he's a previous licensed operator. Also, in the past they had operated in manual on the tap changer years before. So that had been done.

But when they had a license amendment and it

tightened up their degraded voltage set points for that year, it should have been probably in automatic.

MR. LEITCH: Did the load sequence onto bus 6A, as designed, or was there also a problem with the timing of the sequencing?

MR. YEROKON: There was also some minor problems with the sequencing. The sequencing relays, they had for the three heavy loads I talked about, which are the aux feedwater, the component cooling water pump and the service water pump, there was a combination of electro pneumatic and electronic type sequencing relays for those.

So with the stop in the electro pneumatic relay, plus or minus for the sequencing, there was some overlap such that it was possible for all three loads to be coming on at the same time, are supposed to be sequencing at different times.

Now, if the breaker had been set correctly at 6,000 amps, that will have not been enough to cause the problem, to cause the breaker trip. But the combination of the overlap and the erroneous setting of the breaker --

DR. WALLIS: It's just a transient surge from starting up three things at the same time.

MR. YEROKON: Right.

DR. UHRIG: Isn't that the purpose of the sequencing, though, is to avoid that, to separate the transients?

MR. YEROKON: Yes. But like I said --

DR. UHRIG: But the combination of the three steady-state or two steady-states and one transient were too much.

MR. YEROKON: Yes. The overlap from the three loads was possibly too much for the wrong setting. If it was the 6,000 and you go up to 4,000, it would still be okay. So you had all that combination.

DR. BONACA: Did they realize that the battery charger was re-energized and, therefore, the -- it took a long time before the actual enunciators were lost, right? Seven hours?

MR. YEROKON: Right.

DR. BONACA: But did the plant realize that the battery was discharging?

MR. YEROKON: Yes.

DR. BONACA: Because they knew this was taking place.

MR. YEROKON: Yes. They knew it was going on, but several things. They thought they had a real over-currents on the loads on bus 6A. So they were trying to find the reason for the over-current. It wasn't clear. It was then before they found out it was some error in the setting. So they didn't want to look back on the loads on the bus for what the problem was.

They also had the loss of off-site power to the

other buses, so they were checking the loads on those other buses also to see if there was some real -- there were two issues. They thought they had real problems. They were doing all this for several hours. That's why.

They were aware the battery was draining. They knew -- as a matter of fact, the FSAR described I think it's like a two, maybe 2.5 hour duration expected on the battery and it went on for much longer than that.

So that was not much they really could do about it, I guess.

I grouped the other three areas, they kind of go together, the management oversight, the technical support, and the corrective actions.

During the event, there were some real problems, I guess, we find in the management oversight aspect. There was a planned outage scheduled to occur shortly, later on, I think a few weeks or shortly after this event occurred.

So the focus while this even was going on we found was on shutdown work plans. The plant was tripped. I guess there was some preparation going on. You know, we have a trip, we go into the outage we had planned. So we thought that was a misplaced focus.

There was also problems with the coordination and use of resources. There were several things that were happening. The battery was draining. There was a concern

with bus 6A, off-site power to the four buses really.

So what equipment do you go after first and what do you fix, all that was going on.

Also, there were some issues before the event, obviously, that caused all these things to line up. The setting for the degraded voltage relays for the vital buses, when the voltage dips enough, the relays pick up, but also there is a time delay before you actually open the -- before the breakers are opened and that time delay is to allow for the recovery of the voltage dip.

Well, the licensee tested the pick-up for the relays, but the drop-out of the -- the time delay comes in about three minutes. If it's recovered, there's another setting that does not allow the relay to trip the breakers.

They checked the pick-up for the relays, but they never checked the set values. So there was some question about even if the voltage had recovered enough, the relay would probably still have opened the breakers.

DR. WALLIS: So I think what you're saying is that they set up all these things waiting to happen. They were set up for some time before. They were just waiting for the initiation.

MR. YEROKON: Absolutely.

MR. SIEBER: Is it station personnel who sets the relays or is it some off-site group?

MR. YEROKON: It's the station personnel do the setting on the relays and also on the over-current amp. It's done by the site.

As part of the technical support, also, before the event, the procedures they had for emergency declaration, there were some weaknesses we found in those. Actually, when they lost off-site power to the four vital buses, for some time duration, they should have declared an initial event, instead of waiting for the control enunciators. So that was some weaknesses in their procedures.

They didn't have a procedure for recovery of a vital bus. With bus 6A losing all power supply, there was no procedure in place to help in the recovery of that bus. So they didn't have a procedure for recovery of a single vital bus loss of complete power.

Also, we had some instances of inadequate corrective actions. The initiator for the event, the spurious actuation of the OT Delta T, that spike on channel four wasn't the -- they had some instances, I think four or five days before the event, where there were some spikes on that channel and knowing that there was still some planned maintenance going on on that same circuitry, where the spike occurred in 204, that happened.

So there was some deficiency with the RPS, I think we thought they didn't have timely corrective action to it.

Also, the load top changer, as Brian mentioned earlier, that was known. There was a licensing basis that relied on that being in the automatic mode and it was in manual for about a year.

DR. SEALE: Could I ask? After the fact, did they go back and make sure that there weren't some other breakers that were mis-set because of the instrument that had given them the false reading on 6A?

MR. YEROKON: Yes, they did. Yes. The check -- the breaker, I think, was a DB75 type of breaker. So they checked similar breakers and they also expanded to some that are now even DB75s, but they had some grouping methods and they must have seven or eight breakers they looked at.

DR. SEALE: And the meter, I guess, that gave them the bad reading, was that bad technique or was it a bad meter problem?

MR. YEROKON: It was a bad technique.

DR. SEALE: So you had to re-train some of the electricians.

MR. YEROKON: That's correct. What they were doing, the secondary side of the amp current was where they had been checking as opposed to the priority side. The station next door was doing the right testing, so they were able to go there and borrow some equipment to do the right check.

DR. SEALE: And maybe an instructor.

MR. YEROKON: That was corrected.

MR. SIEBER: A question on your OTDT. Spikes are pretty common on those in all plants that have them and typically utilities will reduce power when they're going to work on -- put one channel in trip, so that spike isn't as high and doesn't come to the set point.

Did they do that before they did their maintenance on the second channel?

MR. YEROKON: No, that was not done. And the spike was not because of the maintenance.

MR. SIEBER: That's true, it was spurious. It happens all the time.

MR. YEROKON: There was no power reduction to implement that maintenance.

MR. SIEBER: Ordinarily, that would be what a utility operator would do to avoid the possibility of the trip and maybe five, six percent power is how far down they would go. Typically, that will avoid a trip from that.

DR. WALLIS: You said spurious spikes occur all the time?

MR. SIEBER: Yes.

DR. WALLIS: Then they're hardly spurious.

MR. SIEBER: A single spike is not predictable.

DR. SEALE: Random spikes, not spurious.

DR. UHRIG: It started at 2:30 in the afternoon. When did the situation come under complete control here? Did it exceed the seven hours that the battery --

MR. SIEBER: It was three in the morning.

DR. UHRIG: Three in the morning.

MR. YEROKON: The battery was -- it took about seven and a half hours for the battery to deplete. The unusual event occurred, it was about -- at 3:30 the following morning.

DR. UHRIG: So it's 13 hours. How about the availability of personnel? Did the people who were on the day shift stay over?

MR. YEROKON: When the event occurred in the afternoon and the battery depletion started going on, they kept personnel behind to deal, because they had, like I said, various issues unknown, and they kept -- they brought extra people in.

But there was still the issue in the management oversight with the focus on the right issues to deal with, the resource loading, getting to do the right task.

So they had the personnel, but it was just the management of the personnel. And also the focus on outage planning that was also taking place.

DR. UHRIG: Because the people involved in outage planning probably would not have been those capable of

handling this type of problem, would it? Or the management personnel.

MR. YEROKON: There were some management personnel that should have been involved with trying to deal with the problem that were also involved with the outage planning.

DR. APOSTOLAKIS: I have a question. I gather from your description of the event that there were several latent errors, like the switch was not on automatic, it was on manual and so on, that preexisted, of course, and the trigger of the trip.

MR. YEROKON: Yes.

DR. APOSTOLAKIS: And you have identified a number of issues here on this slide. Are you familiar with the revised reactor oversight process?

MR. YEROKON: Yes.

DR. APOSTOLAKIS: If that process were in place, would it have identified these issues?

MR. YEROKON: The load top changer, I'd say no to that. There's no reason why the oversight process would go look into the top changer. So that probably wouldn't have been picked up.

DR. APOSTOLAKIS: You would not have picked up the weak response during the event, would you?

MR. YEROKON: I'm not sure I --

DR. APOSTOLAKIS: Because there is no way to pick

it up.

MR. HOLIAN: In the response to the revised oversight program, you would still have an event response, similar. At the end slide, I'll compare these two events a little bit and the fact that the steam generator tube failure event did occur prior to initiation of the revised oversight program, but the region's response to both events was similar.

Now, if your question is back on prior to the event --

DR. APOSTOLAKIS: Right.

MR. HOLIAN: -- would it have been picked up under the revised oversight program, I guess I would comment that prior to this event, under the old program, portions of it were missed. I think that's what Jimmy is mentioning. That thing was in manual. It was in a backlog. That was an extensive backlog for the plant.

So even under the old program, there were aspects maybe that the NRC inspectors also didn't realize the issue of the top changer in manual.

So I don't know if we've done a formal review. I know we've done a review of looking at the significance of the events under the revised oversight program, that was part of a Commission paper, to look at would they be classified similarly under the revised oversight program,

and that has happened.

DR. APOSTOLAKIS: But the revised program does not wait until something happens. It would have the performance indicators and the baseline inspection program.

DR. KRESS: But one of those performance indicators is the number of trips.

DR. SEALE: None of these would have shown up on the screen.

DR. APOSTOLAKIS: The number of trips is not a problem here. Probably is the integrity of the safety systems.

DR. KRESS: I know, but this would have been entered into the number of trips performance in that case.

DR. APOSTOLAKIS: But before the trip, I'm looking for the latent errors before the trip.

MR. HOLIAN: Unless it was in the inspection program where an inspector would have picked it up, a PI wouldn't have picked it up, I don't think.

MR. TRAPP: When we talk risk significance, though, if we had put these conditions through the SDP process, which we would have done post-event, then these would have come up to be risk significant issues.

DR. APOSTOLAKIS: I'm talking about pre-event.

MR. TRAPP: Pre, we wouldn't have been able to identify them.

DR. APOSTOLAKIS: So I think the conclusion is that parts of this would not have been picked up.

MR. HOLIAN: Right.

DR. APOSTOLAKIS: Now, there is a disagreement between this committee and the staff regarding the so-called safety conscious work environment, what we call safety culture. And it seems to me that your first two bullets at least there, the weak response during the event and focusing on shutdown work plans and so on and coordination, and the weak technical support before the event are part of the safety culture, because that's a very broad area.

The disagreement is that the staff claims that there is no need to pay special attention to the work for safety conscious work environment, because if it's not good enough, we will see the results either in the performance indicators or something will happen and the baseline inspection program will pick it up.

This committee claims that there is some validity to this argument, but it's an untested assumption and there are aspects of safety culture that probably will be too late when you see them.

I am under the impression, and please correct me if I'm wrong, that we are right. When you say weak response during the event, I just don't know how a baseline inspection program can pick that up or the performance

indicators are completely out of the question.

When you say weak technical support before the event, again, I have difficulty seeing how the revised reactor oversight process can pick that up.

So you are providing, I think, ammunition to this committee with this description that these untested assumptions are actually not very good assumptions.

Now, how do you respond to this?

MR. HOLIAN: The first comment I would like to make is under the revised oversight program, one of the keystone inspections is the problem identification and resolution inspection. I know that that inspection has been beefed up for looking at safety conscious work environment. There is one aspect of that that must be addressed in each of the inspection reports.

So there has been, from my view, a little bit of a shift towards documenting a review on an annual basis of that aspect and that's -- so that's an appropriate inspection, from the staff's view here, to put it in.

A lot of the problems here at IP-2 that you will see at the summary slide are corrective action problems that have existed for years and if you classify that under the broad term of safety consciousness at the station, I know it's used in other terms of is an employee willing to raise safety concerns, that's more often the case.

But if you were to broadly state it for an effectiveness in the corrective action program, that shows a long history at IP-2 and is something that I think both programs were tracking and the revised oversight program, I would say, would still be able to track that adequately.

DR. APOSTOLAKIS: That's why I was careful not to include the third bullet in my argument, because I was sure you would give me that answer. But for the first two bullets, I don't think that helps.

And what makes matters worse is that we don't think or some of us on this committee do not think that there is a common understanding even of what a safety conscious work environment is, and yet we see various events or things that one would use the word weak, as you have done there, to describe parts of that safety conscious work environment.

So it's a mystery to me why the agency is not paying more attention to this thing when you gentlemen, when you actually do your job and you're doing a very good job analyzing incidents, time and time again, get into management issues, you identify these weaknesses, but then when it comes to the oversight process or worse, when the Office of Research tries to do something in this area, somehow we don't do anything.

You probably have already suspected that there is

a lot of background to what I'm saying.

MR. YEROKON: The last slide just sheds some light on the risk significance associated with this issue.

MR. TRAPP: I'm Jim Trapp and I'm one of two reactor analysts in Region I, and I'm going to discuss a little bit about the risk significance. And all the risk significance that I discuss are a collaboration between Region I SRAs and our PRA Branch in the Office of Research, and we've also got input from Con Edison.

The conditional core damage probability for this event was estimated to be about 2E-to-the-minus-four and this is the NRC estimate. The licensee's estimate was about 1.88E-to-the-minus-four. And to put it in perspective -- very close. WE thought we were very close, until NRC said we were not very close at all. That was a surprise to us.

DR. APOSTOLAKIS: What is the core damage frequency that Indian Point 2 has estimated?

MR. TRAPP: Baseline is, with internal flooding, 3.3E-to-the-minus-five. That's internal events.

MR. YEROKON: I think he meant estimates.

MR. TRAPP: I'm sorry. That's their baseline CDF.

DR. APOSTOLAKIS: And what is the uncertainty they have around it or is that the mean value?

MR. TRAPP: That's the mean value.

DR. BONACA: For internal events only?

MR. TRAPP: That's correct.

DR. APOSTOLAKIS: Does it have a --

MR. TRAPP: With flooding.

DR. APOSTOLAKIS: Well, you would classify this as an internal event, though.

MR. TRAPP: Right.

DR. APOSTOLAKIS: Do you have any idea what their upper bound is?

MR. TRAPP: No. No, I don't. I'm not even certain that they have -- that they've done that. I shouldn't say, but I'm not certain that they have that.

DR. KRESS: Typically, it's a factor of ten on CDF. Just under ten.

DR. APOSTOLAKIS: Three or four usually.

DR. POWERS: If you want an estimate on it, you can always look at the design Indian Point study, because they did an uncertainty analysis there.

DR. APOSTOLAKIS: So you are talking about almost an order of magnitude change here.

MR. TRAPP: It would be like operating at full power for approximately four years.

DR. APOSTOLAKIS: And, again, coming back to your findings about weak response and inadequate management attention and so on, I know for a fact, even though I haven't looked at this particular PRA, that these kinds of

issues, organizational factors, are not in the PRA.

Should I conclude then that if I put them in the PRA, my core damage frequency would be significantly affected, not necessarily go up to ten-to-the-minus-four, but here is something that happens because of all these things, latent errors and so on, and it changes my core damage probability by this much?

I mean, is my PRA in serious trouble because I have not included these kinds of events?

MR. TRAPP: I'm probably not the best person to answer you.

DR. POWERS: He honestly didn't expect an answer.

DR. APOSTOLAKIS: I might note that there was a report issued by the Union of Concerned Scientists recently and you certainly support some of their arguments with your presentation.

MR. TRAPP: Undoubtedly, right. Because it was those latent errors in the design, in the tap changer and the latent error in the breaker setting that was really the cause of this event, and if you factor that into the IPE, what you really have is every time you have a reactor trip, you're going to lose power to the --

DR. APOSTOLAKIS: So this is a real omission then in the PRA.

DR. BONACA: For the review of the corrective

action program or the conditions of it, the amount provides some insight?

MR. TRAPP: But as you know, I guess, when you do the PRA, you have to start with something. You have to assume that the design is the design, you have to assume the tech specs are going to be followed. If you don't follow the tech specs and you don't have the design, then I don't know where you would start.

DR. APOSTOLAKIS: Do you really have to?

DR. BONACA: I don't know.

DR. APOSTOLAKIS: Somebody ought to check.

DR. BONACA: I asked the question before because you mentioned before that there were some issues with the corrective action program, a big backlog, and so there would be a correlation there that one could make regarding this issue of human performance or some aspects of safety conscious work environment.

MR. HOLIAN: Yes. I don't know if, in real time, to put a percentage on that, drop their IPE number, to try to quantify that.

DR. BONACA: I didn't mean that. But there seems to be a reliance in the new oversight process on the corrective action program.

MR. HOLIAN: Yes.

DR. BONACA: And that seems to be the most direct

indication of human performance and safety conscious work environment.

MR. HOLIAN: Yes. And one other aspect of that, probably just a reminder, is that the revised oversight program, on the problem identification and resolution, also each inspection report throughout the year tries to address an aspect of that and that's supposed to be pulled up in the annual.

DR. BONACA: But you believe that one could develop a performance indicator based on some metrics of the corrective action program of an individual unit.

DR. APOSTOLAKIS: Is that an unfair question?

MR. HOLIAN: It would be worthwhile. I think based on the revised oversight program's reliance on that, I think it is one of the key inspections that we do and so from a regional perspective, we put a lot of emphasis on looking at that aspect.

So if it could be done, it would be worthwhile.

DR. BONACA: Because the units have developed some metrics that they look at for their own corrective action program and they seem to be pretty reliable. The categorization of the significance.

MR. HOLIAN: Significance categorizations, trending.

DR. BONACA: How long it takes to reduce it down,

the backlog. I mean, so many -- there are a number of indicators that are pretty significant.

DR. APOSTOLAKIS: But, again, I would like to note, in this context, that on slide ten, you're only addressing the third bullet. These indicators you are referring to would not handle the first two bullets.

So just relying on the corrective action program leaves out a significant part of what we think we understand by safety conscious work environment.

MR. LEITCH: I think it may get at the second bullet. If you take a look at the corrective action program, the age of the corrective actions and the backlog, it may, although not have identified these two specific issues, it may give some indication of the technical support prior to the event.

For example, if you look at the number of operator work rounds, which were, I think, significant in this particular situation, that should give you advance warning of a problem in the technical support area.

DR. APOSTOLAKIS: And I agree that this may very well be true in many instances. But still, all these things are done in an ad hoc manner. Nobody -- I have yet to see a report or a paper or something that says here is a way to correlate these things to understand, to look for these things when you see this and that.

For some reason, we have decided as an agency not to pursue that. I mean, there is no question that there is a lot of stuff one can do with these things and perhaps the answer will be a corrective action program that would be expanded to include other things that are now unfortunately called organizational issues there, where the agency should not touch them.

DR. BONACA: There are indicators that the utilities still use that look more at the two top ones. There are indicators of impediments to the operators.

DR. APOSTOLAKIS: But this agency has not looked into this.

DR. BONACA: I know, I understand.

DR. APOSTOLAKIS: And this is a utility. So obviously these indicators are not 100 percent successful.

DR. KRESS: When they test diesel generators to see what their reliability is to start up and carry load, it wouldn't have picked up this undercurrent problem with the relay.

MR. SIEBER: No.

DR. KRESS: I would have thought it would, but I'm asking the question, would it?

MR. SIEBER: For start, run and load tests, it would, provided it was done in automatic.

MR. TRAPP: My impression is that when they --

Jimmy, help me here. When they test the diesels in that manner, they don't load them to that set point.

DR. KRESS: I see.

MR. TRAPP: That's a pretty heavy load to test the diesels at.

DR. KRESS: It may be a deficiency in the test procedure.

MR. SIEBER: Yes.

MR. YEROKON: That's correct. The one test that could have come close to picking up on this issue is the one that's done every refueling outage, and I'm not sure how the sequencing is applied during that testing.

If the sequencing works fine, then you won't pick it up. It has to overlap for that current. So it's possible once every refueling to test that, but, also, it's possible the testing would not reveal the inadequacy with the set point. The other tests monthly don't go to that area.

DR. POWERS: If I could touch on a question on this CCDP of two-times-ten-to-the-minus-four. If memory serves, the recovery process itself on the event involves some under-cooling.

MR. TRAPP: I'm sorry?

DR. POWERS: Involved under-cooling.

MR. TRAPP: I don't recall that, but it certainly

would have been factored into our analysis.

MR. YEROKON: I think if you discuss the assumptions for the --

MR. TRAPP: We are going to zip through the assumptions that were made for that. It might help. But I'm not sure we did that aspect of it.

DR. APOSTOLAKIS: Was this presentation, Professor Seale, supposed to be shown?

DR. SEALE: Yes.

MR. TRAPP: To put the CCDP in perspective, two years ago, in '98, David Besse had a tornado loss of off-site power, some problems with a diesel. Their CCDP, issued in the ASP and NUREG, was 5.6E-to-the-minus-four. So they were roughly a little higher than we were. They operated about a day on the diesel. So that's just to give some perspective. So this was about three times less than what was seen at Davis Besse.

The dominant sequence, when you lost 6A, you lost -- the key here was you were moving decay heat through the steam generators. So the important aspect from an operator point of view was to keep aux feed or feed going into the steam generators.

The other key here is you lost primary once-through cooling, because the Indian Point operates with the block valves closed and they're electric. So you would

need 6A to open one of the PORV block valves to get once-through core cooling.

So the way it usually works is if you lose aux feed, you go to once-through core cooling. They didn't have that option.

They lost the 23 aux feed pump, they lost the PORV block valve, and they lost 6A. The diesel, 22 diesel was supplying 21 motor-driven pump. They have two motor-driven pumps, aux feed pumps, one turbine-driven pump.

So that piece of equipment was key to them to keep the 21 aux feed pump running.

Jimmy expressed some of the problems they had with the turbine-driven pump, but certainly that was functional.

So really the dominant core damage sequence for them is that they lost the 21 motor-driven aux feed pump, they lost the turbine-driven pump, and they failed to recover feedwater, then they would have gone to core damage because they didn't have once-through core cooling.

One of the interesting aspects of this loss of off-site power that would be different is the 6.9 power stayed on. The key is here you lost the power going to the 480 volt buses. The 6.9 power was available, so you still had a condensate pump and you still had the feedwater train. So that was a little different than your typical loss of off-site power, and we had to factor that into the risk

analysis.

Of course, if you lost the 22 diesel, you'd also lose the 23 motor-driven aux feed pump. So that cut set would also be factored in.

Conservatisms in the analysis is no credit was given for 480 volt bus recovery and the key here is that the operators would -- if need be, if they lost the 23 or the 21 aux feed pump and the turbine-driven aux feed pump, they could have repowered 6A. That breaker is set -- the amps were set about half, but if you just put on the 23 aux feed pump, put everything else and pull the lock, close the breaker, that pump would have been re-energized. So that wasn't part of our analysis. We didn't give them credit for that.

The other part of the analysis is the 21 aux feed pump has a separate supply of power through Unit 1. This is the Appendix R alternate A/C power source and there's some switches down locally that you can switch in alternate power from the old retired Unit 1.

That was also not factored in, that they could have repowered the motor-driven pump had the 22 diesel failed. That wasn't factored in.

And, of course, since the 6.9 buses were still energized, there was a chance that they could have restored power from the normal off-site power supply. That evolution

wasn't proceduralized and required some manipulations in the logic, the black-out logic.

So that recovery action would probably not have been able to be done very quickly.

The other key assumption here from a risk point of view was, of course, that the -- as I discussed, the feed-and-bleed requires two out of two for success. That's another conservatism in our assumption, in that if the turbine-driven aux feed pump or the motor-driven had worked for a period of time, the one out of two PORV might have been adequate to do once-through core cooling, and that analysis hadn't been performed.

DR. BONACA: Why is the PORV blocked? Is it because of spurious safety injection concerns?

MR. TRAPP: It would be the PORV block valve, so it would either be that you're afraid your PORVs are leaking or you're afraid that -- you know, it does eliminate one path for a small break LOCA in that if your PORV inadvertently opens, now you won't have the LOCA, so there's some balance there.

DR. BONACA: So a temporary block is not -- for a period of time, these plants were running with a blocked PORV because of concern with spurious safety injection. That would be a significant impact on the IPE values they have presented, because I think they have relied on

bleed-and-feed in those assessments.

MR. YEROKON: The blocked valves are closed, but you also realize they have safety paths supplied to them. So it wouldn't be a significant impact, because you have a safety source.

MR. TRAPP: There is a risk balancing going on there. You're taking away your small break LOCA probability before they fail open, but you're losing now, that if you lose the bus like they did, you lose feed-and-bleed.

DR. BONACA: Most of these PWRs have credited bleed-and-feed and that's a significant capability that if you deny that, that would be a significant contribution increase to core damage frequency.

MR. YEROKON: The credit is okay as long as you have the safety power supplied to it, which they did.

MR. TRAPP: From the model, as long as you model it with the PORV block valves closed, so you don't lose the bus. As long as you do that correctly, then you're okay.

DR. SEALE: Could we move along now?

MR. YEROKON: Thank you.

MR. LORSON: Good morning. My name is Ray Lorson. I'm going to follow the short presentation and discuss the steam generator tube failure event which occurred at Indian Point 2 on February 15th.

I was the augmented team inspection leader that

followed up inspection.

I've been with Region I for approximately nine years.

I've been a resident inspector at several sites, and currently, I'm the senior resident inspector at Seabrook Station.

I'm going to discuss for the sequence of events that occurred, talk a little bit about the safety significance of the event.

We'll look at some of the root cause areas which complicated the event during the recovery, and Jim Trapp will talk about the risk significance of the event.

We're going to start with a short video that the licensee made of the conditions inside the failed tube.

The tube that had the failure was the row 2, column 5 tube in the number 24 steam generator, and we'll start with the tape.

Okay.

Here we're inside the row 2, column 5 tube. You can see the beginnings of the crack. The crack is approximately 3 inches long and approximately 1/8th of an inch in width in some locations.

The crack will come into --

DR. WALLIS: We are inside a tube?

MR. LORSON: We are inside a steam generator

U-tube, that is correct.

DR. SIEBER: This is up in the U-bend?

MR. LORSON: Yes. You can see the crack here. Some of the widest points in the crack was approximately an eighth of an inch.

DR. POWERS: Looks like a hole.

MR. LORSON: And we'll get to the end of the crack here in a second.

As I mentioned, it was approximately 3 inches long.

DR. UHRIG: That was obviously taken at no pressure, right?

MR. LORSON: That is correct. This was taken by the licensee.

DR. UHRIG: If there was any pressure at all, it would probably spread it more.

DR. WALLIS: Why does it suddenly get bigger? It just moved?

MR. LORSON: You're asking about the shape of the crack?

DR. WALLIS: Yeah.

MR. LORSON: The probe is actually entering into the tube.

So, it's just strictly the characteristics of the crack are changing.

DR. WALLIS: Changed its focus or something?

MR. LORSON: No, it's the probe itself actually transversing through the tube.

DR. WALLIS: We're just looking at one piece of the crack here, then.

MR. LORSON: We actually started at the beginning of the crack and we went over to the end of the crack.

DR. WALLIS: So, this is some sort of medical technology they're using?

MR. LORSON: Actually, what you didn't see -- and we tried to cue the tape right up, but just shortly before that part, you could have saw the instrument that was actually inserted into the actual tube sheath itself, and it was basically a small-diameter-type camera.

The event was caused by primary water stress corrosion cracking of the row 2, column 5 tube in the number 24 steam generator.

We just saw an indication that was present in the tube.

The initial primary to secondary leak rate was approximately 150 gallons per minute. That was at the initiation of the event.

DR. WALLIS: Did it get bigger later on?

MR. LORSON: No, actually, that was the maximum primary to secondary leak rate, and the actual leak rate

went down over time.

DR. KRESS: You find this leak rate by measuring the make-up water required?

MR. LORSON: I'm sorry?

DR. KRESS: How do you determine this leak rate? By measuring the make-up water required to go into the primary system?

MR. LORSON: The licensee did a mass balance on the primary plant.

Based on that, they could determine the make-up volume that was required to operate the plant.

DR. UHRIG: They did this after the plant was shut down.

MR. LORSON: That is correct.

DR. UHRIG: Is this a four-loop or a three-loop plant?

MR. LORSON: Indian Point 2 is a four-loop Westinghouse pressurized water reactor.

DR. UHRIG: It's about 1,100 megawatts?

DR. SIEBER: Typically, for Westinghouse steam generator, they totally plug rows 1 and 2. Did Indian Point plug either 1 or 2?

MR. LORSON: Not prior to the event.

DR. UHRIG: This is the original steam generators.

MR. LORSON: Yes.

DR. SIEBER: Not annealed.

Did they have indication prior to the event that there was some kind of leakage? Usually you can pick that up by analysis.

MR. LORSON: Yes, and I'll talk about that briefly.

DR. SIEBER: All right.

MR. LORSON: During the event, there were several complications associated with the attempt to place the plant into cold shutdown.

That was one of the focus areas for the team, and we'll talk about that during this presentation.

The results of the tube rupture are that the plant remained in an alert status for approximately 24 hours, and there was a minor radiological release.

The next slide, we're going to discuss the sequence of events.

On February 15th, at approximately 7:17 p.m., the operators detected secondary plant radiation monitors, which was indicative of a primary to secondary tube leak, and they also noted a decreasing pressurizer level.

The operators carried out the immediate actions that were identified by the emergency operating procedures and by the abnormal operating procedures.

As you can see through the sequence of events, the

affected steam generator, the number 24, was isolated by 8:31 p.m.

At 9:02 p.m., the operators began a manual primary plant cool-down to reduce reactor coolant system temperature. The cool-down that they initiated was very large, and it resulted in a rapid drop in the pressurizer level such that the operators were required to manually initiate safety injection at 9:04 p.m.

At approximately 11:38 p.m., the tube leakage was initially stopped as the steam generator pressure and the reactor coolant system pressure were approximately zero, the differential pressure between those two pressures.

As I mentioned earlier, there were some complications in placing the plant shut-down cooling system in service.

However, on February 16th, at 12:39, the licensee did place the shut-down cooling system in service, achieved cold shut-down at 4:57 p.m., and terminated the alert declaration at 6:50.

The next slide will discuss briefly the safety significance of the event.

The team determined that the operator -- the initial operator response was prompt and appropriate and noted that the licensee was successful in achieving a cold shutdown condition.

However, as I mentioned previously, there were several operator performance and procedural issues, equipment issues that were identified which delayed achieving the cold shut-down conditions.

There were also some problems noted in the area of emergency response, and as I mentioned earlier, the event did have a minor radiological release. However, the team determined that there was no measurable off-site radiological release from this event and concluded there was no impact on public health and safety.

DR. KRESS: At 150 gpm's is a fairly sizeable leak. Did anybody go in and examine the adjacent tubes to this crack to see if there was any measurable effect on the adjacent tubes?

MR. LORSON: I think the issues related to the condition of the steam generator were looked at in a subsequent or a follow-up NRC inspection. I think Brian may talk about that a little bit at the conclusion of my presentation.

The purpose of the augmented inspection team that we formed following the event was primarily to focus on the event.

DR. BONACA: I have a question.

There is a set time, I believe, to balance primary pressure and secondary pressure. That's one of the

objectives of the procedure, of the emergency operating procedure. What's the time?

MR. LORSON: The time when they initially --

DR. BONACA: No, no, no, I'm talking about the target time for which the EPGs, the emergency operating procedures are set.

MR. LORSON: I'm not aware of any specific time that's listed in the emergency operating procedures. However, I think the --

DR. BONACA: It's part of the licensing of these procedures, I believe. You have to demonstrate that you can achieve balancing of primary and secondary pressure within a given time.

If I remember, it's less than an hour, I thought.

MR. LORSON: I'm not aware of any requirement.

DR. BONACA: But I didn't see any discussion of that.

MR. TRAPP: We'll discuss that a little when we go into risk significance.

DR. WALLIS: The leak is flashing steam water when it comes out of the hole?

MR. LORSON: Yes.

DR. WALLIS: It's a mixture of steam and water.

MR. LORSON: Yes.

DR. WALLIS: And is it going into a sub-cooled or

a saturated liquid?

DR. KRESS: It depends on where the break it.

DR. WALLIS: The worst situation would be steam going into sub-cooled water.

MR. LORSON: Right. The break would have occurred up at the upper portion of the U-bend. There I would expect primarily going into a steam environment.

I did mention there was a minor radiological release.

Here, we see the major pathways.

A majority of the release that occurred through this event basically occurred as the activity from the primary plant entered the faulted steam generator and transversed into the -- basically the air injector off-gas system.

The licensee -- or I should say Indian Point 2 has a design feature such that there's the radiation detector downstream of air-injector release point, and if it detects a high-radiation condition, it automatically redirects the air jet to release -- instead of going into the atmosphere, back into the primary plant containment, and this action occurred very, very promptly during the event, and approximately 90 percent of all the activity that was released during the event was basically initially bottled in the primary containment. It was subsequently released

through an elevated monitor release point, subsequently.

DR. WALLIS: Root cause doesn't include anything about why the crack occurred?

MR. HOLIAN: This inspection, the AIT, did not have that as its charter.

There was a subsequent inspection and then, of course, the NRR review looking at that was also something I'll address at the end.

DR. WALLIS: Is this a fairly common event?

MR. HOLIAN: No. I'll address it right now. The issue in the licensee's root cause event was the noise levels in the steam generator.

DR. WALLIS: Was there tube vibration?

MR. HOLIAN: No, no tube vibration. We'll touch on that at the end. They had indications of hour-glassing. I'll touch on some of that at the end.

MR. MARSH: There have been about 6 steam generator tube ruptures in this country since the '76 time-frame.

One of the things we did in determining how the agency should respond was look at the manner in which we responded to those events, and we were consistent in terms of the agency's response team evaluations in terms of how we looked at it.

MR. LORSON: Okay.

Getting back to the radiological releases, I did mention that a majority of the release pathway was gaseous release from the containment that was released approximately a day following the event through an elevated monitored release pathway.

There were other gaseous releases that were attributed to the event, primarily due to leakage through secondary plant components.

Also, there was a liquid release through the steam generator blow-down lines.

Basically the initial -- during the initial portion of the event, some of that water became contaminated with primary system activity.

However, as I mentioned, there was no measured radioactivity at any of the off-site monitoring locations, and consequently, we determined that the event had no impact on public health and safety.

DR. KRESS: The activity measured -- the air injector that injects the air outside --

MR. LORSON: That is correct.

DR. KRESS: Is that a gamma monitor?

MR. LORSON: There is a radiation detector that's downstream of the air injector, and I believe that is a gamma detection instrument.

DR. KRESS: So, it would have picked up, what,

krypton?

MR. LORSON: It would have picked up one of the noble gases, and it repositioned during the very initial stages of the event.

It repositioned very, very quickly from the atmosphere to the containment.

DR. UHRIG: How long was the waste held in containment before it was released?

MR. LORSON: It was held in containment, as I recall, approximately one day prior to release.

DR. UHRIG: There would be some decay.

MR. LORSON: There would have been some decay, correct.

We have a pretty good idea, though, of the activity that is released through the containment pathway, because there is, as I mentioned, a radiation monitor on that particular pathway, and so, for sampling and flow rates and monitor indications, you can get a pretty good estimate of the activity released.

DR. KRESS: There is no way to determine how much of I-131 was released, I guess.

MR. LORSON: Not that I'm aware of. I don't know whether or not there was more sampling done inside the containment prior to that.

DR. KRESS: They would have to sample to determine

it.

MR. LORSON: Not to my knowledge.

DR. UHRIG: Did they have any fuel leakage in the core at the time of the incident?

MR. LORSON: Not that I recall.

As I mentioned, one of the areas the team looked at was we noted that there was some delays associated with achieving cold shut-down conditions, and we identified several root cause areas which were attributed to the delays.

Specifically, there were issues associated with operator performance, procedural adequacy, equipment performance, and also, emergency response of the licensee's organization.

The first area we're going to focus on is operator performance.

As I mentioned earlier, the team determined that the licensee's initial response was prompt and appropriate and felt that the operators had good procedural adherence overall.

There were some deficiencies, however, in establishing the plant into the cold shut-down condition, and that was basically attributed to a couple of factors:

One, as I mentioned, that the initial plant cool-down was very rapid.

That led to the need to manually initiate safety injection, which then complicated further operator response during the event.

DR. UHRIG: Was that a design deficiency, or was that an operator deficiency?

MR. LORSON: I believe it was a combination of the two factors, and we primarily determined it was an operator deficiency in that, when the operator manually initiated the cool-down, he achieved a great cool-down than what he had intended.

DR. UHRIG: I know that several sister plants have this problem of too much cold water coming in in a situation like this.

MR. LORSON: This is not a question of too much cold water coming into the plant. It's a question of releasing too great a volume of steam through the manual steam bypass valves.

DR. UHRIG: All right.

MR. LORSON: So, the design or equipment problem might be, is that these valves can be difficult to operate, and there might not be good feedback of the specific valve position to the operator.

So, it's really a combination of the two issue, operator performance and also the equipment probably wasn't the easiest equipment to operate.

MR. LEITCH: This plant has N-16 monitors. I wonder if you have any comment about the value of those N-16 monitors in early appraisal of the situation.

In other words, my question basically is, had they not had the N-16 monitors, would it have seriously inhibited their analysis of the situation early on?

MR. LORSON: I believe the N-16 monitors were a value to the plant, because it gave them a good indication prior to the event that there, in fact, was a leak from the number 24 steam generator.

However, I think that, even without the N-16 monitors, the operators had adequate information prior to the event and at the initiation event to make the proper plant operating decisions.

Also, there were some issues associated with operator recognition of plant configuration.

A couple examples include the component cooling water valve line-up to the heat exchangers. There was some confusion with the operators with respect to the valve configuration necessary to place the heat exchangers in service.

That led, again, to a delay in placing the shut-down cooling system in service, and also, at one point during the event, when the operators were attempting to lower reactor plant pressure to basically stop the continued

primary to secondary leakage, there were some issues associated with the line-up of the auxiliary spray system such that it took them a longer period of time to lower plant pressure than what would have been expected.

In the area of procedural quality, the team determined that the procedures, the emergency operating procedures and the abnormal operating procedures to guide the initial response were good. There were, however, several procedural deficiencies that challenged the operator during the plant cool-down phase.

The first issue, there was a delay in placing the shut-down cooling system in service because of an apparent procedural discrepancy over the initiation set-point at which to place the shut-down cooling system in service.

Also, the system configuration problems that we had talked about on the previous slide, where operators had some difficulty in recognizing the proper configuration of some components necessary to continue on and place the systems into -- shut-down cooling system in service -- we felt that the procedures could have done a better job of stepping the operators through the actions necessary to place some of these systems in service following the safety injection even.

And then, finally, the team determined that the licensee's procedure for monitoring reactor coolant system

temperature while the plant was on the shut-down cooling system -- we identified a potential deficiency associated with the method that the procedure uses to calculate reactor coolant system temperature.

The team reviewed equipment performance during the event.

We determined that the necessary event mitigation systems worked properly, and that included the reactor protection system, the auxiliary feedwater system, and the safety injection system.

The team noted, however, that there were several preexisting equipment problems that did challenge the operators in placing the shutdown cooling system in service. I have four of the problems listed here.

The first two problems involved the ability to maintain condenser vacuum. There was two times during the event where condenser vacuum was lost because of equipment problems.

These were pre-existing equipment problems, and the operators were challenged, then, to basically recover condenser vacuum to continue using the condenser as a heat sink to continue with the primary plant cool-down.

There was an existing design deficiency associated with the containment valve seal water system. This system is designed to minimize leakage through containment

isolation valves.

There's only a few plants in the country that have this particular system, and there was a pre-existing design deficiency such that, after the safety injection event occurred, the operators were challenged to go out and take some actions necessary to maintain the system in a operable or stand-by condition.

Also, the final bullet there talks about the pressurizer power-operated relief valve design problem.

The licensee has a modification in place to correct this particular problem.

However, during the event, the operators were required to enter the containment prior to establishing the plant in cold shut-down conditions to basically install a back-up nitrogen supply to the pressure-operated relief valves.

DR. POWERS: Is this something that would be recognized in their IPE?

MR. TRAPP: It was an LTOP issue to get nitrogen.

MR. LORSON: The next area that the team looked at was emergency response.

The team determined that the licensee's emergency response protected the health and safety of the public. In particular, the event was classified promptly, and we determined that the licensee performed a good critique of

the event.

There were, however, several problems associated with the implementation of the emergency plan, including the augmented emergency response facility staffing was not completed within the time requirements that were specified.

There were problems associated with the accountability of personnel on-site to respond to the event.

The emergency response data system was not operable for several hours, and that was a preexisting equipment problem.

There were some problems noted involving implementation of the media response plan such that there was -- in one case, there was a local town official who was not notified of the event per a existing licensee commitment.

There were problems associated with some of the infrastructure in the emergency response facilities, and then the team also identified issues associated with the timeliness and quality of technical support that was provided to the operators.

Following the event, the NRC, Region I, conducted a supplemental emergency preparedness inspection.

There were several white findings issued associated with this event, and Brian will talk about that in his remarks.

DR. POWERS: You have indicated a variety of problems here.

Have they been all through the significance determination process?

MR. LORSON: Following our inspection, there was a follow-up inspection in both the emergency preparedness area and also for the issues that were identified by the augmented inspection team.

There was a follow-up inspection, and each of the issues was characterized through the significance determination process.

As I mentioned, in the emergency preparedness area, there were some white findings associated with this inspection.

In the non-emergency preparedness follow-up inspection, my understanding is that there were primary green findings.

MR. HOLIAN: Six or seven green findings. And while we're on the topic, I can mention the three white EP issues, if you'd like, now.

They were the three issues that had been tracking on a history of EP problems.

They were untimely augmentation, accountability issues, and finally, the dissemination of information to the joint news center.

DR. POWERS: I guess I'm more interested in the fact that we can go to an excessive cool-down and that still stays in the green category.

How do I understand how we came up with that -- I mean the documentation I have is it's a green.

I don't see how the logic went to arrive at that conclusion.

MR. TRAPP: I guess one way to look at it, characterize it, is the bar is core damage.

Opening up the steam dumps to the condenser and cooling down too quickly, while it was an operational perturbation, really didn't increase their -- or decrease their margin to core damage that significantly that it would reach our threshold of a white.

As you know, the human performance STP aspects are still somewhat under development, so you know, maybe there will be more in the future on that.

MR. LORSON: I think, also, to try to put that in perspective, when the team determined that the initial cool-down was excessive, there are technical specifications, limits associated with the amount of temperature change you can have on a cool-down event per unit in time, and the licensee -- the number in the tech specs for Indian Point 2 is 100 degrees in a one-hour period.

I believe the final number was that they achieved

approximately a 104-degree cool-down in, I think, the worst-case rolling one-hour period.

So, they slightly exceeded the limit that was in the technical specification.

However, that does mean to say that there weren't transient cool-down rates during that cool-down event which exceeded the 100-degree-per-hour average rate, and that particular cool-down analysis was looked at by the licensee in a separate engineering analysis, and they concluded there was not an adverse impact on the structural integrity of the reactor vessel as a result of that cool-down.

MR. TRAPP: It was an hour after the initiating event, too.

They had already stabilized, equalized, and pretty much -- I wasn't in the emergency center at that point, but I think the event was pretty much contained by that point, and then they got on the steam dumps a little hard.

DR. POWERS: Well, there's a reason for those technical specifications on the cool-down rate.

MR. MARSH: If I can add a licensing perspective, it's not to say that cooling down excessively is an acceptable way of achieving cold shut-down, but from the standpoint of the licensing analysis, the steam generator tube rupture licensing analysis, that event assumes that there is a double-ended guillotine break of the tubes, you

have a full off-set, and you end up with a lot of flow out the primary end of the secondary, and you actually get an automatic scram, you get full safety injection, and you end up with a pretty rapid cool-down in the primary. That's the stylized -- and loss of off-site power, and you achieve cold shut-down in a pretty short time-frame.

That's not to say that events like this, where you end up with a longer time to achieve cold shut-down, which get aggravated by excessive cool-downs and by safety injection, are the way that this unit should have been operating post that event, but just from a licensing perspective, it was within that analysis.

DR. POWERS: What I'm dancing around and avoiding saying bluntly -- and I'll say it bluntly -- is I'm worried about PTS, and I'm not sure our significance determination process takes us down the PTS pathway here, and so, we end up with a green finding on something that shouldn't be green. That's what I'm worried about it.

MR. MARSH: I think the STP process, as we pointed out, has as its benchmark core damage --

DR. POWERS: Yeah.

MR. MARSH: -- as opposed to PTS limits.

MR. LORSON: As I mentioned earlier, Jim Trapp is going to discuss the risk significance of the event.

MR. TRAPP: This is an interesting event to do a

risk analysis on, because we looked at the CCDP of the event and then we're also applying the revised oversight program to these issues, the steam leak issues, and the 1997 steam generator tube inspection.

So, I'm going to get kind of Dr. Jekyll and Mr. Hyde on you.

I'm going to tell you that the risk of the event was pretty low and we applied the ROP, initially we'd come up with fairly significant risk, and I also want to caveat in this the inspection report on the steam generator tube inspection hasn't been issued yet, and it's still a process being developed.

We still need a regulatory conference, and there will be input by the licensee, and we haven't had all that put together yet.

So, things may change.

DR. POWERS: Well, when you do your calculation of the CCDP, do you have a chain of events that result in vessel fracture that are built into your modeling, so you can look at -- suppose that the cool-down rate was a little higher in transitory periods and judge whether -- what the probability of getting into an event R is.

MR. TRAPP: The way our model would work is we would have the steam generator tube rupture as the initiating event. The human actions that you need is

equalization and, you know, isolation of the feedwater.

DR. POWERS: You're going to come to a success path in this model when, in fact, it's a compound event. It's something that PRAs just don't handle very well right now, and if -- suppose that we had a transitory period of 1,000 degrees an hour in there and got into a PTS event -- it just doesn't show up in the way the PRA is designed.

So, you don't get a good CCDP on this event. It's too complicated.

MR. TRAPP: I guess on the positive review point, I'll just throw this out.

They don't have high-pressure injection here. The safety injection pumps are about 1,200 pounds, and they already had the break in the RCS, and the pressurization part of it there would be challenging.

MR. LORSON: The other thing I think that might affect the PTS concern is the initial cool-down was rapid, but from normal operating temperature to about 100 degrees below normal operating temperature.

So, at the time when the safety injection occurred, the reactor vessel --

DR. POWERS: Yeah, you're not in the vulnerable period, but when you're calculating the CCDP, you're going into a what-if scenario, you know, what if things were just a little different, and I don't think you've got the tool

available to you to explore this what-if the way we'd really like to explore it.

I presume that a good calculation of CCDP takes things both ways.

DR. APOSTOLAKIS: No, it's biased toward bad things.

DR. UHRIG: Was there any impingement on other tubes of the water coming out?

MR. HOLIAN: I was going to address that just briefly.

They did do a visual examination of the adjacent tubes, and I believe there was no indication.

MR. TRAPP: The initial CCDP estimate we did the night of the event based on the models.

Using the licensee's IPE data, just dividing the contribution from tube ruptures divided by the initiating event frequency of tube ruptures, you came up with 7.7 to the minus 5, and this was largely the basis for us dispatching the AIT.

We knew these numbers were conservative, because we knew the leak rate was nowhere near the double-ended guillotine rupture, you know, four to six hundred gallons per minute that would be assumed in the PRA, and since the tube rupture event is very human action-dominated, you know, the smaller leak rate gives you a lot longer times to do

equalization and other evolutions for the operators, and we knew the risk would be much lower.

The licensee revised their CCDP number based on the longer times available for doing the human actions, and now the charging pumps were available to back up the SI pumps, if needed.

So, making these two assumptions, they came up with a CCDP of 2.2 to the minus 6.

So, this would be a low-to-moderate risk-significance event.

The other aspect of this was to look at the 1997 tube inspection and do sort of a what-if. Our premise here would be, if the inspection was deficient, if the tube could have ruptured, what would be the risk if you had a double-ended guillotine rupture of a tube?

The way this risk analysis worked -- and this is what we call in the new STP the delta CDF, not the CCDP, and this new process, the way it works is the delta CDF that you calculate is assumed to be equivalent to the delta LERF.

So we calculated a delta CDF and a delta LERF, and some of the assumptions we made were that the steam generator tube failure frequency was -- due to the degradation of '97 -- was once per reactor year, and this was down from like a 1.3E to the minus 2 per reactor year, was the baseline.

We assume that half the tube failures would result in a rupture, rather than a leak that was seen at Indian Point.

I mentioned before we assumed that the delta CDF is equivalent to the delta LERF, and the analysis that was done largely by NRR also included induced steam generator tube ruptures and steam line breaks and primary over-pressure events such as ATWS events, and the results of this analysis, like I said, are still pending, they should be out shortly, but the risk significance of doing a delta CDF calculation came up with high risk.

DR. BONACA: I understand the risk significance, and I want to point out again that I believe condenser vacuum was lost twice.

So, there was a significant reliance on atmospheric dump, and so, it was fortunate that we had a clean core, so there was no activity in the primary side.

I mean if you had some contamination or activity actually in the primary side, you will have releases out there, and you know, the public probably is as concerned about these releases as we are about risk significance when we do these evaluations.

Again, I think that, if you go back to look at the goals that you have for the emergency operating procedure, you'll find there is a time that you have to shoot for for

balancing the pressure and stopping releases, and here there was a significant issue with the potential for releases lasting over hours, right? It lasted several hours.

MR. LORSON: That's correct.

The plant remained at pressure and temperature longer than what you would have liked to because of the delays that we discussed in terms of achieving the cold shut-down condition.

MR. TRAPP: But of course, off-site doses wouldn't generally -- that analysis wouldn't rely on the condenser.

MR. HOLIAN: The final summary slide, quickly.

There are supplemental inspections and activities going on for both of these events.

Quickly, on the August '99 event, we did have a inspection team that followed up to the AIT and found that the short-term corrective actions were adequate for re-start. There was also enforcement action taken, which was a separate inspection that followed those issues.

It did indicate some mixed performance in the recovery efforts.

There are some longer-term corrective actions that are still being picked up, and I'll pick that up under the agency focus aspect.

Emergency preparedness issues have been evident for a couple years at Indian Point 2. They were evident

during the steam generator tube failure event.

I summarized the three white findings, which is a degraded cornerstone under the EP issue, and they did do, in the June time-frame, a remedial drill to demonstrate adequate performance.

Steam generator tube failure root cause -- we talked earlier about that.

I'd just remind the ACRS that at the point after this tube failure, NRR took on the aspect of working with the safety evaluation for, at that time, would plant re-start be allowed or not.

The region took on the aspect of following up with the AIT and looking at the root cause of the event.

The new program, in particular, asks you to look at was there performance issues that related to this root cause? The licensee's root cause evaluation submitted was the noise in these older steam generators, in effect, masked the signals in the '97 time-frame.

As Jim Trapp has mentioned, the inspection report is due to go out shortly from Region I. It's in the final stages of concurrence.

There was a quick-look report put out in July of this year, just a month or so ago, and it did highlight three performance issues that the special inspection found, and that was -- noise was one of them, high levels of noise

in these steam generators, the old steam generators.

There were issues with this -- in the '97 time-frame now -- this being the first PWSCC, a PWSCC indication was found in the apex, in the U-bend area, and which was a new degradation mechanism for this utility, and secondly, and related to that PWSCC indication, was they did have evidence of denting at the top tube support plate, which could lead to hour-glassing and further lead to PWSCC.

So, those three issues are summed up in that quick-look inspection, and there will be more detail -- much more detail coming out in the inspection report on previous root cause, and that was one reason why that additional risk estimate was done on the condition of the generators being put back in service from the '97 time-frame to when the tube failure occurred.

DR. UHRIG: Was this plant old enough to have had phosphate treatment?

MR. HOLIAN: Yes. They did switch over. I don't know the time-frame, exactly, early on.

I did want to add one other item on root cause. You know, the Surry plant had a tube rupture early on, and this is akin to that.

This plant did have some tech specs put in prior to the Surry time-frame to look at hour-glassing and this phenomenon.

So, it was something that they were tracking in some ways.

I do also want to mention that, in the quick-look report, which is just a two-page summary, the licensee has disagreed with the inspection findings, the performance issues in particular, and as we go down here -- it's not mentioned here, but on the steam generator tube failure root cause, there's tentatively a meeting with the licensee under the new program, a regulatory conference in the region that's tentatively been set up for September 26th.

That's usually about a month after we get an inspection report out, where the licensee will come in and, once again, debate or discuss those performance issues and the risk assessment that was done.

Finally, there was an information notice that was put out on the steam generator tube failure event, in general.

Agency focus plant -- I'd just like to mention that, as of the last senior management meeting, Indian Point was one of two plants, an agency focus plant, D.C. Cook being the other aspect in a special category.

The items that you see there are key categories that have been issues that the region has been tracking for several years at Indian Point 2 and were categorized in that agency focus letter that went to the utility in May.

The agency focus meeting has been scheduled for September 11th on-site up at Indian Point 2 to check the status of Indian Point's business improvement plan in these areas.

MR. LEITCH: Do I understand correctly that the licensee has now decided to replace the steam generator?

MR. HOLIAN: Oh, I'm sorry. That's a good summary statement.

Yes, they are in the midst of replacing them right now.

The inspection has started.

That decision was made three weeks or a month ago. They have a team on-site that's done a couple down in Florida and is scheduled to do Calvert Cliffs.

So, they're on a schedule, they're well into it, and hope to have them replaced by the end of November-December time-frame.

MR. MARSH: I'd like to also add that, in terms of a generic communication, the agency is still considering the need for anything coming out of the Indian Point 2 event, whether any of the particulars of the performance issues need any further actions.

DR. SHACK: For the other PWRs, have they plugged their row 2 U-bands?

MR. HOLIAN: Most have done row 1 and 2, I

believe, and this utility had done row 1 and had not done row 2.

DR. SHACK: But most have done both rows.

MR. HOLIAN: Yes.

DR. UHRIG: Did they have significant cracking in the support plates due to the phosphate treatment originally?

MR. HOLIAN: Originally there was a wide variety of indications, and some of it was support plate cracking.

They actually had -- the hour-glassing was crunching of the tubes, and actually, the flow slot deforms in an hourglass.

They did have a tech spec for monitoring that. That was one of the issues that will be brought out in the inspection report.

DR. SEALE: I understand we have a couple of people from the utility here.

Would you like to add anything to the comments that have been made?

MR. GROTH: Good morning. Thank you.

I'm John Groth. I'm the chief nuclear officer at Indian Point 2. I appreciate the opportunity to come and talk with you today.

The August event we have used to our advantage to improve our ability to do self-assessments and to learn some

lessons that will stand us in good stead, and we are making progress in correcting those problems.

For the February 15th event, I'd like to point out a couple of things.

In the process of cooling down the plant, you use the non-faulted steam generators, not the faulted steam generators, so you're not releasing anything to the environment.

So, please remember we've got a four-loop plant and we have three other ways to reduce the temperature in that plant, not relying upon the one that is faulted.

I'd like to also share with you some of the lessons that we've learned in this case.

As has been indicated by the inspectors, the difficulty came not in the initial response but, rather, in the stabilization period.

As we look into our training programs, not only our own but across the industry, we've found that all of us have concentrated on the initial actions: How do you respond to the casualty? How do you get the plant into condition where you're stable?

We really didn't practice that next phase, which is, in fact, the more difficult, because we've practiced the others so well.

We're now practicing the other. We've shared that

with the industry, and around the industry, we're doing that, because we all found that, as we tried to do that follow-on activity, it is very complex, and it becomes very challenging, and it takes a long time, and that's something that is very important, particularly in how we, as an industry, train the emergency plan area.

I'm sure all of you have, at one time or another, watched an emergency plan drill.

We impose a series of casualties that are unrealistic to drive the plant very quickly to a point where you have a release.

The scenario is not a realistic one.

It is time-related, and it's designed to have it done in a very short order, and what we've done over these years is pre-condition our audience to believe that this is what's going to happen.

This becomes a very difficult problem for all of us, because the understanding that one of these events requires time to develop, time to analyze, and time to respond to is not there, and consequently, you have an expectation within our audiences for things to move more quickly, to be more dramatic, to be more, I'm going to say, difficult and challenging, and it's very, very hard for them to watch grass grow.

We need to think again in our industry on how

we're doing these things and how, in fact, we teach our audience just how badly we deform the plant in the first case to get to a condition where we can practice the release piece, and then the next piece is the understanding and the training that's involved in how one of these events really transpires.

We thank you for the opportunity to come and make comment today, and we would be pleased to take any questions you might have that might help, but thank you for the opportunity.

DR. SEALE: Are there any questions?

[No response.]

DR. SEALE: You reminded us of something just now that I think is very important, and that is that, as we have these experiences, we always want to be sure that we listen, because there are some messages that are being passed along to us, and you certainly have pointed out this protracted response problem, and I can certainly appreciate what you're saying there, that that could be a distortion that could bother you in the long run.

So, that's a very good point.

Does any of the members of the committee have anything to ask any of the NRC people or the people from the utility?

[No response.]

DR. SEALE: Well, here again, I think we find that, anytime we have the opportunity to hear from the operators and from the NRC's inspection people, we learn something, and I know that we have today.

George, your comments, I thought, in connection with the new plant evaluation process, were very much to the point. We may want to talk about this a little bit more in some frame or mode with the Commission.

All of you, I'd like to thank you for your preparation -- you obviously were well-prepared, and we appreciate that.

I know you're going to have fun talking to the people up there in that public meeting that's coming up, and so, maybe we helped polish up some of that, too.

So, with that, I'll pass it back to the Chairman.

DR. POWERS: Thank you, Bob.

I'd echo my sentiment that this is quite a nice presentation that you put on here, information-packed, and I think it's particularly significant for this committee, because we're getting to see some of the theoretical aspects of the new reactor oversight process in the harsh light of reality, and so, we're going to -- these are view-graphs that aren't going to get thrown away.

They're going to be used over and over again, not so much on this incident but in the overall evaluation of

how we're doing on this new reactor oversight process, and we really thank you for taking the time to put this material together for us.

Mr. Wallis, may I ask, will you need transcription for your presentation after lunch?

DR. WALLIS: I think that's up to you, sir.

DR. POWERS: Okay.

In that case, I think we can bring the transcription to a close for the day, and I will recess us for lunch until 1:30.

[Whereupon, at 12:27 p.m., the meeting was concluded.]

REPORTER'S CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

NAME OF PROCEEDING: 475TH ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

PLACE OF PROCEEDING: 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.

Mike Paulus

Mike Paulus
Official Reporter
Ann Riley & Associates, Ltd.

HIGH-LEVEL GUIDELINES FOR PERFORMANCE-BASED ACTIVITIES

PRESENTATION TO ACRS FULL COMMITTEE

AUGUST 30, 2000

OFFICE OF NUCLEAR REGULATORY RESEARCH

N. Prasad Kadambi, RES/REAHFB

Robert Youngblood, ISL, Inc.

Christopher Smith, ISL, Inc.

OUTLINE

- OVERVIEW
- CASE STUDIES INVOLVING APPLICATION OF THE GUIDELINES
  - CASE STUDY OF HYPOTHETICAL REGULATORY FRAMEWORK FOR "CONTROL OF COMBUSTIBLE GASES"
  - CASE STUDY ON SUBPART H TO 10 CFR PART 20, "RESPIRATORY PROTECTION AND CONTROLS TO RESTRICT INTERNAL EXPOSURE IN RESTRICTED AREAS"
- INTERRELATIONSHIP AMONG REGULATORY INITIATIVES
- STAFF'S PLANS
- CONCLUSION

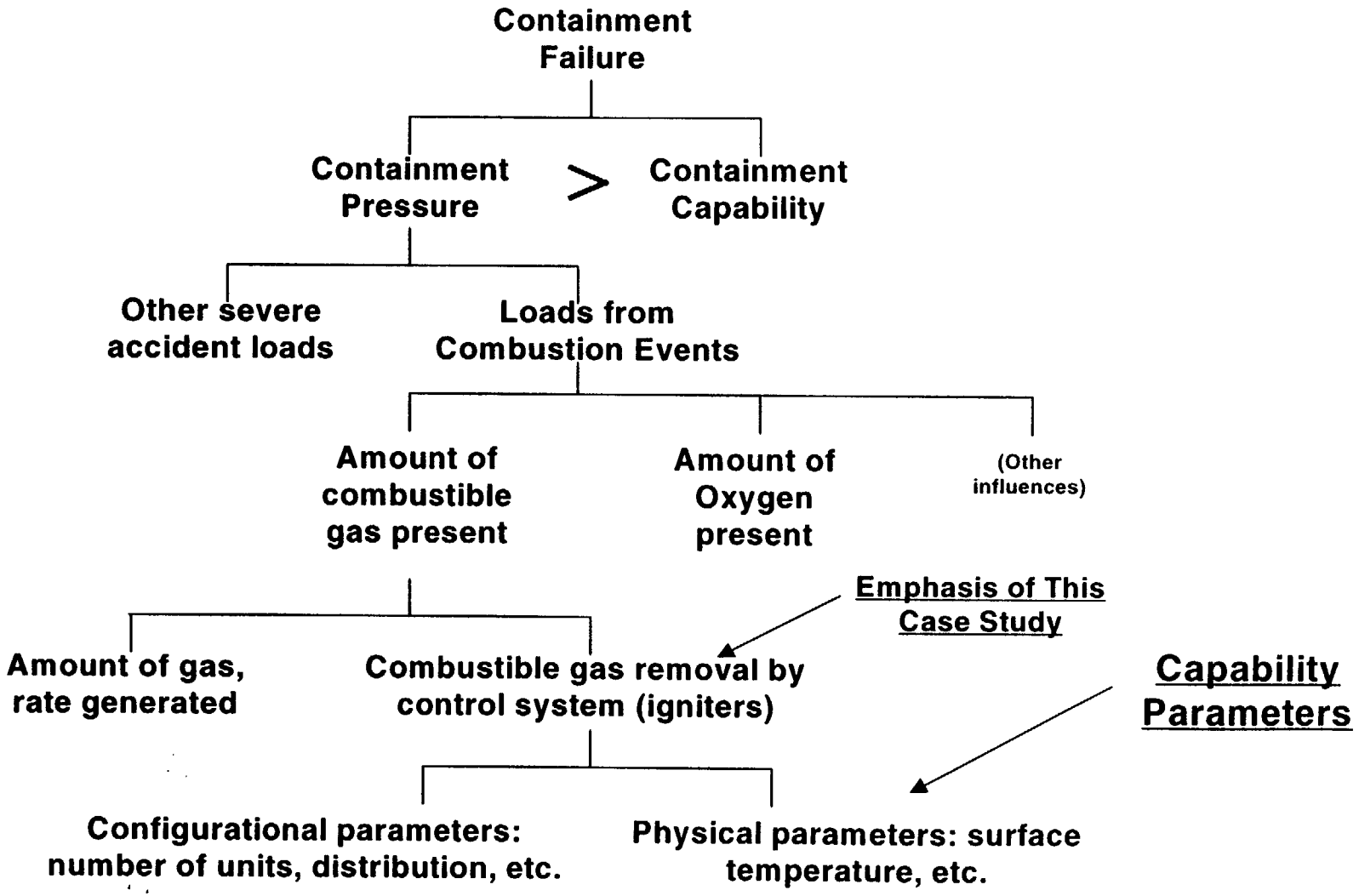
OVERVIEW

- THE STAFF BRIEFED ACRS ON JUNE 8, 2000 AND ACNW ON JULY 25, 2000.
- COMMISSION PAPER PROVIDES FINAL GUIDELINES, RESPONSES TO PUBLIC COMMENTS AND CASE STUDIES.
- THE CASE STUDIES ARE DESIGNED TO TEST WHETHER THE GUIDELINES ARE USEFUL.
- STAFF CONCLUDES THAT GUIDELINES ARE READY FOR AGENCY-WIDE APPLICATION
- MEANWHILE STAFF HAS CONTINUED SUBSTANTIAL EFFORTS ON RISK-INFORMED REGULATIONS, E.G.,
  - UPDATE TO THE RISK-INFORMED REGULATION IMPLEMENTATION PLAN.
  - PUBLIC WORKSHOP ON RISK-INFORMED APPROACHES TO NUCLEAR MATERIALS REGULATORY APPLICATIONS.
- THE STAFF IS DEVELOPING THE BASIS FOR INTEGRATING THE ACTIVITIES PURSUANT TO REGULATORY INITIATIVES.

Case Study 1
Combustible Gas Control

- This case study applies the viability guidelines to a hypothetical regulatory framework on combustible gas control in certain containment types
- Risk information can be used to establish what the requirement needs to accomplish:
  - Safety mission (what is important)
  - What the reliability / availability needs to be
  - Conditioning on the characteristics of the functional challenge (support availability, phenomenology)
- In this case study, risk information has established the following:
  - Uncontrolled combustion of gases evolved in accidents can lead to containment failure and large radiological release
  - Potentially important sequences involve
    - Station blackout, affecting availability of power sources
    - Core melt phenomenology, affecting operability of systems in containment
    - Severe accident loads from phenomena other than combustion, influencing the impact of loads from combustion
- High-level statement of requirement: Prevent containment failure from uncontrolled combustion of gases in risk-significant scenarios.
- Begin application of guidelines by searching for monitorable parameters
  - Capability parameters (flowrates, heat removal rates, ...)
  - Reliability / Availability parameters

Establishing Capability Parameters



Guideline IA: Measurable (or calculable) parameters to monitor acceptable plant and licensee performance exist or can be developed

- Capability (of igniters)
  - Surface temperature
  - Distribution and number of units
    - Not related to ongoing performance; fixed property of design
  - Environmental qualification parameters
    - Not amenable to performance monitoring
- Reliability / Availability:
  - Functional reliability
  - Division reliability
  - Division availability
  - Unit reliability
  - Unit availability

- Note: support systems need to be considered

Guideline IB: Objective criteria to assess performance exist or can be developed

- **Capability (of igniters)**
  - **Surface temperature, distribution and number of units**
    - **Parameters are established through model evaluations**
  - **Environmental qualification**
    - **Criteria can be developed from phenomenology**
- **Reliability / Availability:**
  - **Functional reliability is determined in light of functional challenge frequency and (e.g.) LERF guidelines**
  - **Given the functional reliability, and the design configuration, criteria can be established for division and unit level reliability & availability parameters**

Guideline IC: Licensee flexibility in meeting the established performance criteria exists or can be developed

- **Capability (of igniters)**
  - **Within a given technology, some limitations on flexibility would be implicit (Needed surface temperature determined by phenomenology, etc.)**
  - **Choice of technology could be allowed**
- **Reliability / Availability:**
  - **Flexibility exists in that there are different ways to achieve needed functional reliability**
    - **More redundancy in design means more (igniter) unit outages can be tolerated, different levels of unit reliability can be tolerated**
    - **Specifying availability averaged over a specified time period is in some ways more flexible than specifying an allowed outage time**

Guideline ID: A framework exists or can be developed such that performance criteria, if not met, will not result in an immediate safety concern

- Capability parameters: For typical testing frequencies, degradation in monitored aspects of capability would be detectable within a short time
- Reliability / Availability Parameters: The reliability and availability needed in this function at most plants could be confirmed by monitoring (testing)
- The risk accepted when performance criteria are not met depends on
  - the length of time over which they are not met,
  - the likelihood of a functional challenge, and
  - the consequences of functional failure
- For this function, the combination of analysis, frequency of challenges to this function, and the LERF guidelines would be used to support acceptable time scales for detecting and addressing performance issues

Case Study 1
Summary

- **Capability parameters**
  - **Aspects of capability such as environmental qualification are not amenable to performance-based treatment**
    - **Parameters and criteria exist, but it is not practical to confirm performance**
  - **Some capability parameters satisfy guidelines other than flexibility.**
    - **To achieve licensee flexibility, choice of technology needs to be allowed**
- **Reliability / Availability parameters satisfy all four viability guidelines**
- **This regulatory framework could be performance-based to a significant degree**
- **The guidelines were useful in evaluating the viability of a performance-based approach in this regulatory framework**

CASE STUDY 2

- THIS CASE STUDY IS FUNDAMENTALLY DIFFERENT FROM THE FIRST CASE STUDY - THE PURPOSE IS ASSESSMENT RATHER THAN IDENTIFICATION

- PERFORMANCE-BASED GUIDELINES ARE APPLIED TO A RECENTLY REVISED RULE

- ASSESSMENT FOR THIS CASE STUDY IS LIMITED TO THE RULE LEVEL OF THE REGULATORY FRAMEWORK

CASE STUDY 2

- FOCUS APPLICATION OF THE GUIDELINES ON THE RECENT **CHANGES** MADE TO THE RESPIRATORY PROTECTION REQUIREMENTS (SUBPART H OF 10 CFR 20)
- VIABILITY GUIDELINES WERE THOROUGHLY APPLIED TO THREE (3) SPECIFIC CHANGES TO THE SUBPART H REQUIREMENTS
- THE REMAINING GUIDELINES WERE APPLIED TO ALL THE CHANGES TO THE SUBPART H REQUIREMENTS
- DO THE GUIDELINES SUPPORT THE CHANGES MADE TO THE REQUIREMENTS?

CASE STUDY 2

APPLICATION OF THE GUIDELINES IS ONLY MADE AT THE RULE LEVEL

RULE CHANGE	RULE FUNCTIONALITY	GUIDELINE APPLICATION
REQUIREMENT TO INCLUDE NON-RADIOLOGICAL SAFETY FACTORS IN ALARA ANALYSES INCREASES LICENSEE FLEXIBILITY	MINIMIZE WORKER RISK DUE TO AIRBORNE HAZARDS	VIABLE FOR PERFORMANCE-BASED APPROACH INCREASE IN FLEXIBILITY MAKES THE REVISION MORE AMENABLE TO A PERFORMANCE-BASING
REQUIREMENT TO MEET QUANTITATIVE FIT TEST CRITERIA AND TESTING FREQUENCY ADDS PRESCRIPTIVE REQUIREMENTS TO THE RULE	ENSURE PROPER EQUIPMENT FUNCTION	LIMITED VIABILITY FOR PERFORMANCE-BASED APPROACH POTENTIAL FOR AN IMMEDIATE SAFETY CONCERN IF PROPER FIT FAILS DURING USE PRESCRIPTIVE REQUIREMENTS NECESSARY TO ENSURE ACCURATE DOSE CALCULATIONS
REVISED EXPLICIT CONSIDERATIONS FOR RESPIRATORY EQUIPMENT SELECTION NEUTRAL IMPACT ON LICENSEE BURDEN	ENSURE SELECTION OF PROPER EQUIPMENT	LIMITED VIABILITY FOR PERFORMANCE-BASED APPROACH POTENTIAL FOR AN IMMEDIATE SAFETY CONCERN IF WRONG EQUIPMENT SELECTED

CASE STUDY 2

- THE REMAINING GUIDELINES WERE APPLIED TO THE CHANGES TO THE SUBPART H REQUIREMENTS AND SUPPORT THE CHANGES MADE TO THE REQUIREMENTS

- CONCLUSION: THE RESULTS OF APPLYING THE PERFORMANCE-BASED GUIDELINES WERE CONSISTENT WITH THE CHANGES MADE TO THE SUBPART H REQUIREMENTS

- THIS CASE STUDY DEMONSTRATED THAT PRESCRIPTIVE REQUIREMENTS ARE SOMETIMES NECESSARY TO ENSURE THE ACCURACY OF PERFORMANCE INFORMATION

INTERRELATIONSHIPS AMONG REGULATORY INITIATIVES

- REGULATORY INITIATIVES ARISE FROM COMMISSION DIRECTION, OPERATING EXPERIENCE, STAKEHOLDER INPUT, STAFF INITIATIVES
- SCREENING PROCESS DETERMINES WHETHER TO PURSUE INITIATIVE, AND IF SO, WITH WHAT PRIORITY
- ELEMENTS OF THE REGULATORY FRAMEWORK CONSIDERED FOR CHANGE AS PART OF THE INITIATIVE ARE IDENTIFIED
- REGULATORY APPROACH IS SELECTED - (1) RISK-INFORMED AND PERFORMANCE-BASED, (2) RISK-INFORMED, (3) PERFORMANCE-BASED, AND (4) TRADITIONAL
    - THIS SELECTION RELIES ON GUIDELINES DEVELOPED AS PART OF THIS PERFORMANCE-BASED INITIATIVE AND THE RISK-INFORMED INITIATIVE
    - THE REGULATORY APPROACH MAY DIFFER FROM ONE LEVEL OF THE REGULATORY FRAMEWORK TO ANOTHER
    - BLEND OF APPROACHES WILL BE APPROPRIATE IN MANY AREAS
- PROCEDURES APPLICABLE TO ISSUANCE OF REGULATORY PRODUCTS (BACKFIT ANALYSIS, REGULATORY ANALYSIS, RULEMAKING PROCESS) REMAIN UNCHANGED

STAFF'S PLAN

- STAFF WILL APPLY GUIDELINES IN ONGOING AND FUTURE CHANGES TO THE REGULATORY FRAMEWORK AS APPROPRIATE:
  - GUIDELINES WILL BE APPLIED TO OPTION 3 EFFORTS UNDER RISK-INFORMED INITIATIVE
  - GUIDELINES WILL BE APPLIED TO SUITABLE CANDIDATE IDENTIFIED AS BEING NOT APPROPRIATE TO BE RISK-INFORMED
  - MANAGEMENT DIRECTIVES WILL BE DEVELOPED TO SUPPORT AGENCY-WIDE IMPLEMENTATION OF GUIDELINES
  - COMMUNICATION PLANS WILL BE DEVELOPED TO ENCOURAGE STAKEHOLDER IMPLEMENTATION OF GUIDELINES
- STAFF WILL PROVIDE A REPORT TO THE COMMISSION AT THE END OF FY-2001.
- THE PBPM PROCESS WILL TAKE INTO ACCOUNT THE RESOURCE IMPACTS OF APPLYING THE GUIDELINES FOR EACH CHANGE TO THE REGULATORY FRAMEWORK.

CONCLUSIONS

- STAFF HAS RESPONDED TO THE ELEMENTS OF THE SRM AND HAS GONE BEYOND IT TO DEMONSTRATE USEFULNESS OF THE GUIDELINES.
- INTERNAL AND EXTERNAL STAKEHOLDER INPUTS HAVE BEEN CONSIDERED IN THE FINAL GUIDELINES.
- ADVISORY COMMITTEES CAN OBSERVE APPLICATION OF THE HIGH-LEVEL GUIDELINES FOR PERFORMANCE-BASED ACTIVITIES THROUGH THEIR OVERSIGHT OF THE REGULATORY PROCESS.
- IMPROVEMENTS TO GUIDELINES WILL BE CONSIDERED AS EXPERIENCE DICTATES.
- IMPROVED INTEGRATION AMONG REGULATORY INITIATIVES WILL BE ACCOMPLISHED AS MORE EXPERIENCE IS GAINED.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
AUGUST 30, 2000

LICENSE RENEWAL GENERIC ACTIVITIES

Sam Lee - Senior Material Engineer RLSB/NRR

License Renewal Generic Activities

Agenda

- Background, Overview and Schedule
- Generic Aging Lessons Learned (GALL)
- Standard Review Plan
- Regulatory Guide and NEI 95-10
- Solicitation of Comments

Background

- Guidance provided by SRM for SECY 99-148
  - Document basis for acceptance of existing programs
  - Focus on areas where existing programs should be augmented
  - Develop documents with stakeholder participation
  - Brief Commission on public comments
  - Commission approval
  - Recommendation on rulemaking after additional review experience

Overview

- GALL report and SRP intended to work together
- Draft Regulatory Guide (DG-1104) proposes to endorse NEI 95-10
- Invite stakeholders comments
  - Workshop held on December 6, 1999
  - 12 public meetings held from March-July 2000
  - Workshop scheduled for September 25, 2000
- Documents have been integrated to the extent practicable

Schedule

Item	Date	Actual
Issue draft GALL, SRP, and RG/NEI 95-10 for public comment	8/00	8/31/00
Public meeting and workshop to gather public comments	9/00	9/25/00
NEI revise NEI 95-10	10/00	
ACRS License Renewal Subcommittee Meeting	10/00	
ACRS Full Committee Meeting	11/00	
Commission briefing on public comments on draft GALL, SRP, and RG/NEI 95-10	11/00	11/27/00
ACRS meeting on GALL, SRP, and RG/NEI 95-10	2/01	
Commission approval of GALL and SRP	3/01	
NEI comment on need for rulemaking	4/01	
Public meeting to discuss need for rulemaking	5/01	
Staff recommendation to Commission on rulemaking	7/01	

Generic Aging Lessons Learned Report

- Build on previous GALL report (NUREG/CR-6490)
- Review aging effects
- Identify relevant existing programs
- Evaluate program attributes to manage aging effects

Generic Aging Lessons Learned Report

Table of Contents for Volume 1 (Summary)

Generic Aging Lessons Learned Report

Table of Contents for Volume 2 (Tabulation of Results)

Standard Review Plan

- Reference GALL report for crediting existing programs
- Incorporate lessons learned and resolution of license renewal issues
- Compatible with standard format of license renewal application

Standard Review Plan

Table of Contents

Regulatory Guide for License Renewal

- DG-1047 issued 8/96
  - endorsed Nuclear Energy Institute (NEI) 95-10, Rev 0
- DG-1104 to be issued 8/00
  - proposes to endorse NEI 95-10 Revision 2

NEI 95-10 Revision 2

Table of Contents

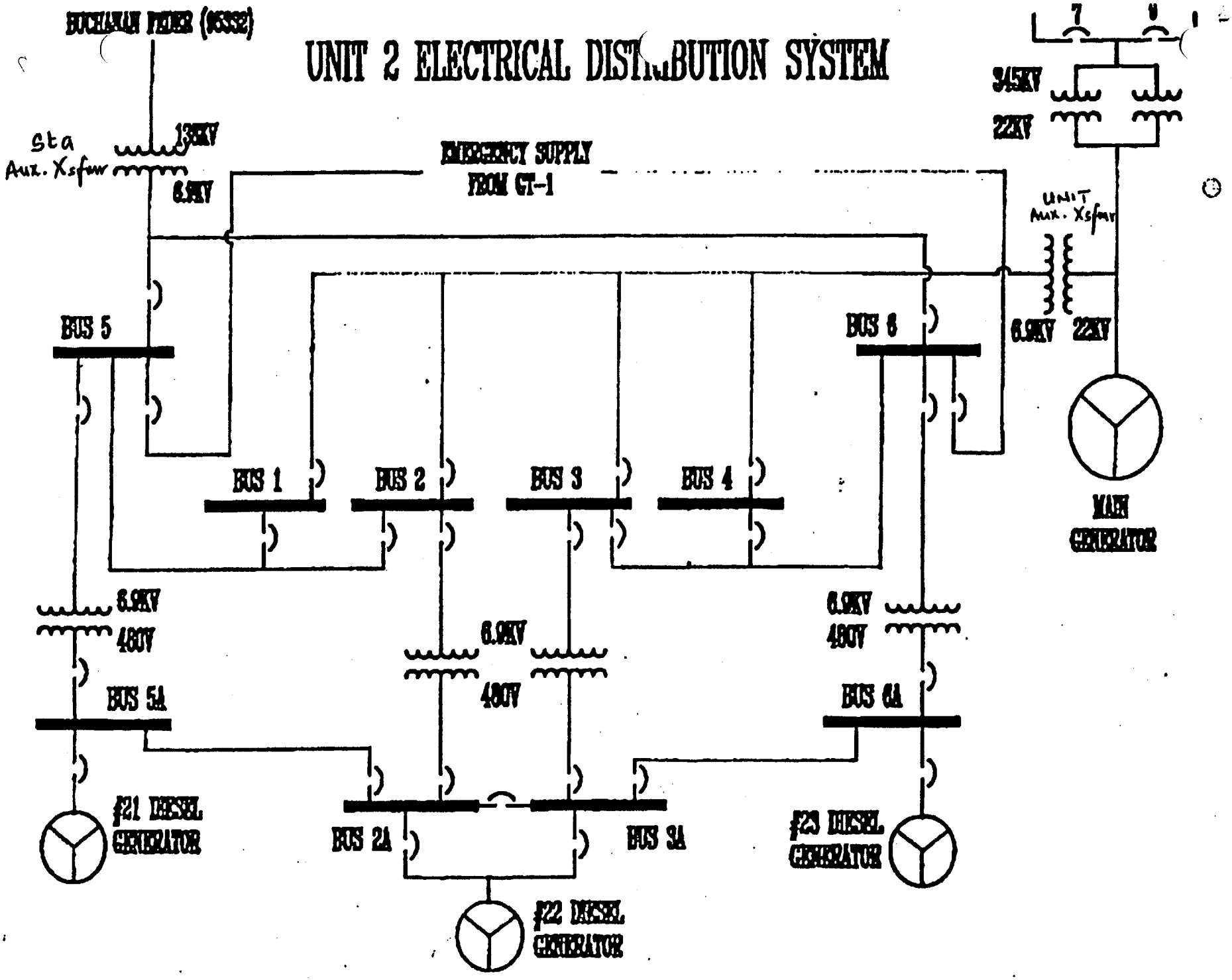
Solicitation of Comments

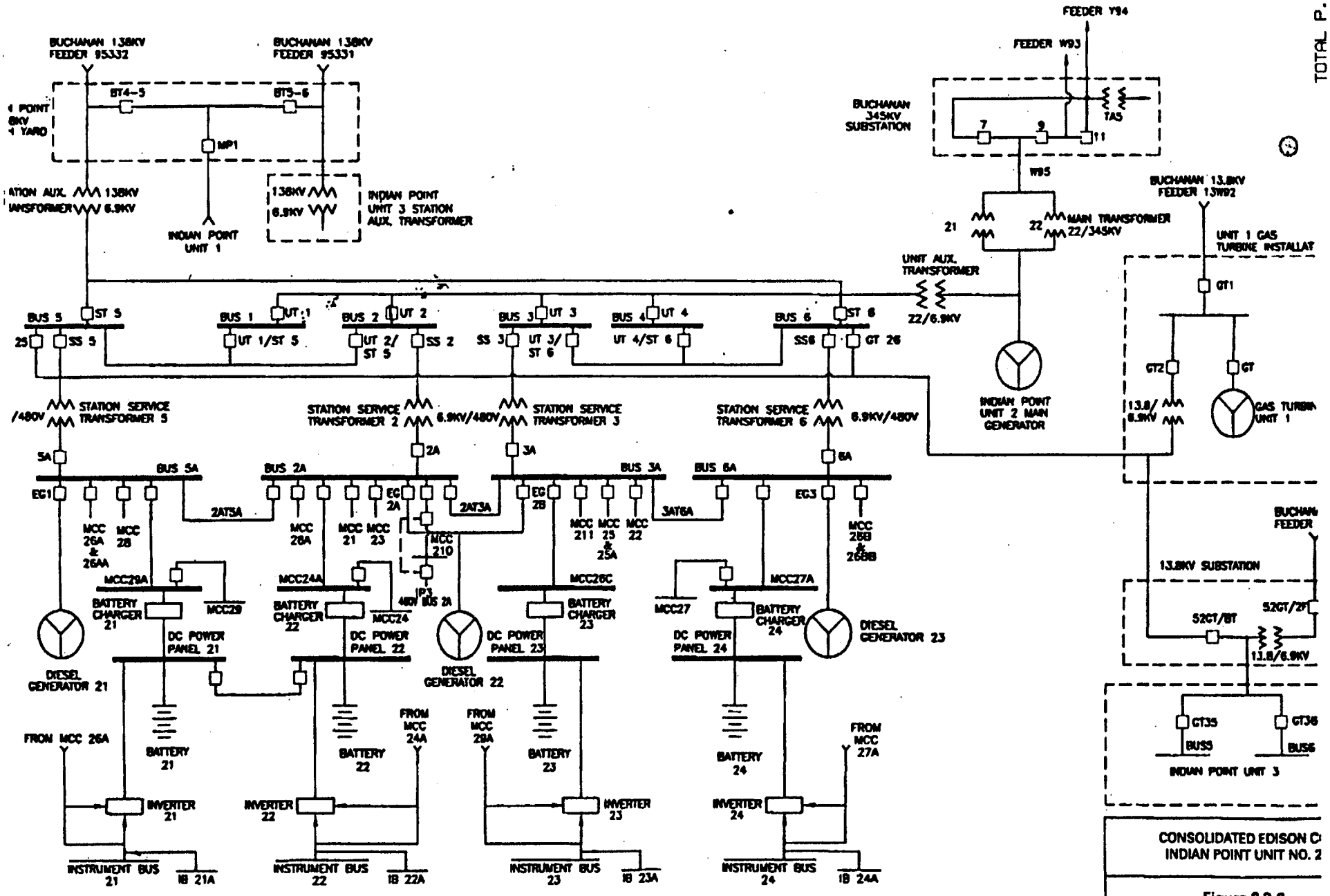
- Does the draft GALL report provide sufficient credit for existing programs?
- Does the draft GALL report provide too much credit without sufficient technical basis?
- How should the GALL report reference editions of national codes and standards that are not subject to the Commission's approval process?
- Should the applicant be required to justify the omission of any aging effects identified in the GALL report that the applicant determined not to be applicable?

STANDARD REVIEW PLAN FOR LICENSE RENEWAL
TABLE OF CONTENTS

STANDARD REVIEW PLAN FOR LICENSE RENEWAL
TABLE OF CONTENTS (CONTINUED)

UNIT 2 ELECTRICAL DISTRIBUTION SYSTEM





TOTAL P.15

CONSOLIDATED EDISON C
INDIAN POINT UNIT NO. 2

Figure 8.2-2
Electrical Power Systen
Diagram

ACRS BRIEFING
AUGUST 30, 2000
INDIAN POINT 2 EVENTS

EVENT 1: REACTOR TRIP AND
PARTIAL LOSS OF VITAL POWER
AUGUST 31, 1999

EVENT 2: STEAM GENERATOR TUBE FAILURE
FEBRUARY 15, 2000

INDIAN POINT 2 EVENTS

PRESENTERS

- Opening Remarks: Ledyard B. Marsh
  - Chief, Events Assessment, Generic Communications and Non-Power Reactors Branch, NRR
- Introduction: Eric J. Benner, NRR
- 8/31/1999 Event: Jimi T. Yerokun, Region I
- 2/15/2000 Event: Raymond K. Lorson, RI
- Risk Insights: James M. Trapp, RI
- Closing Remarks: Brian E. Holian
  - Deputy Director, Division of Reactor Safety, Region I

INDIAN POINT 2 EVENTS

INTRODUCTION

- Reactor Trip and Partial Loss of Vital Power
  - August 31, 1999
- Steam Generator Tube Failure
  - February 15, 2000
- Aspects of Events to be Discussed:
  - Sequence of events
  - Licensee response
  - Safety Significance
  - Root cause areas
  - Risk insights

Reactor Trip and Partial Loss of Vital Power

- Initiator
  - Reactor Trip
    - Channel 3, OTDT in "Trip" for Maintenance
    - Spurious Actuation of Channel 4, OTDT
- Complications
  - (1) Offsite power lost to all vital 480 volts buses
  - (2) Essential power (EDG) lost to 480 volt bus 6A
- Result: Loss of one 125 VAC Instrument bus
  - Loss of >75% CR Annunciators
    - Declaration of Unusual Event

SEQUENCE OF EVENTS

- Reactor Trip - Aug 31, 1999, 2:31 P.M.
  - Four 6.9 kV Buses Transfer From Unit to Station Auxiliary Transformer - as designed
- Offsite Power Lost to Vital 480 Volt Buses
  - (2A, 3A, 5A and 6A)
  - EDGs Started
- EDG 23 Output Breaker to Bus 6A Opens
  - Battery Charger 24 De-energized

Sequence of Events (continued)

- Battery 24 Depleted (~ 7.5 hours)
  - Loss of 125 VAC Instrument Bus 24
  - Loss of > 75% CR Annunciators
- Unusual Event Declared (8/31, 9:55 P.M.)
- Emergency Power Restored To Bus 6A
- Unusual Event Terminated (9/1, 3:30 A.M.)
- Offsite Power Restored to Bus 6A

SAFETY SIGNIFICANCE

- Loss of Bus 6A
- Loss of Battery 24
- Increased Burden to Operators

ROOT CAUSE AREAS

- Configuration Control
- Management Oversight
- Technical Support
- Corrective Actions

CONFIGURATIONAL CONTROL

- Station Aux. Transformer Load Tap Changer
  - Control Room Switch Not Maintained in "AUTO"
- Vital Bus Degraded Voltage Relay Setting
  - Reset Set Point Not Verified
- EDG 23 Breaker Over-Current Trip Setting
  - Not Properly Set (3200 Vs. 6000 amps)

MANAGEMENT OVERSIGHT, TECHNICAL SUPPORT AND CORRECTIVE ACTIONS

- Weak Response During The Event
  - Focus on Shutdown Work Plans
  - Coordination/Use of Resources
- Weak Technical Support Before The Event
  - Degraded Voltage Relay Setting
  - Procedures - EP, 480 Volt Bus Recovery
- Inadequate Corrective Actions
  - Prior RPS OTDT Anomalies
  - Repair of Load Tap Changer

RISK SIGNIFICANCE

- CCDP ~ 2E-4
- Dominant Sequence
  - Loss of one MDAFW Pump + Loss of TDAFW Pump + Failure to Recover Feedwater
- Key Assumptions
  - No Credit for 480 Volt Bus Recovery
  - Bleed and Feed Success needs 2 of 2 PORVs

INDIAN POINT UNIT 2
Steam Generator Tube Failure
February 15, 2000

- Sequence of Events
- Safety Significance
- Root Cause Areas
- Risk Significance

EVENT DESCRIPTION

- **Initiator: PWSCC of the R2C5 tube of the #24 SG; initial primary to secondary leak rate of approximately 150 gpm.**

- **Complications: Several operator, procedural and equipment problems delayed establishing cold, shutdown conditions.**

- **Results:**
  - **The plant remained in an "Alert" Status ~24 hours**
  - **Minor radiological release.**

SEQUENCE OF EVENTS

February 15, 2000

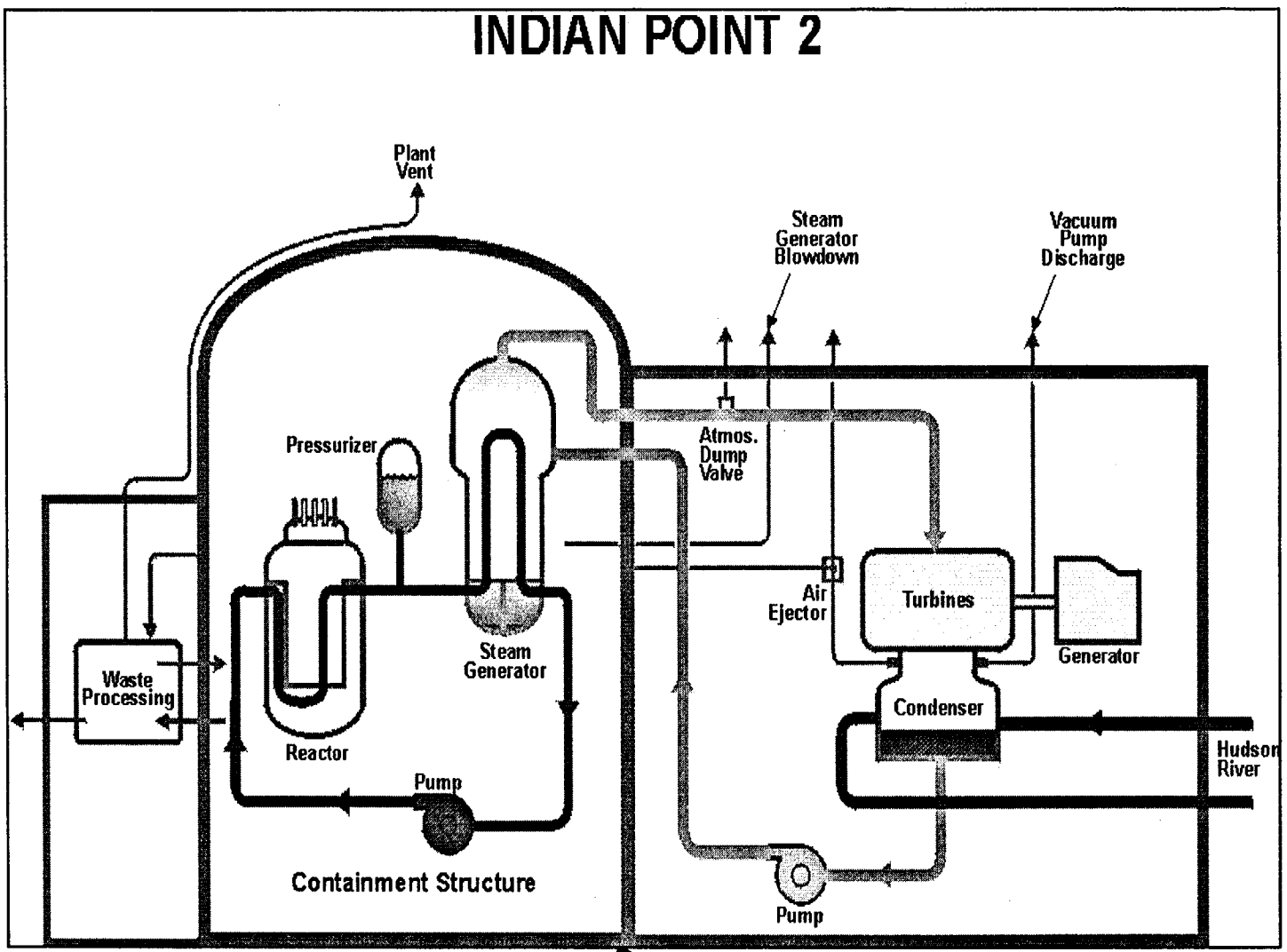
7:17 p.m.	--	Operators Identified Increased SG Leak
7:29 p.m.	--	Declared Alert
7:30 p.m.	--	Tripped Reactor
7:41 p.m.	--	State/County Officials Notified
8:31 p.m.	--	Isolated Affected SG
9:02 p.m.	--	Operators Initiated Plant Cooldown
9:04 p.m.	--	Manually Initiated Safety Injection
11:38 p.m.	--	Tube Leak Stopped

February 16, 2000

12:39 p.m.	--	Shutdown Cooling System
4:57 p.m.	--	Achieved Cold Shutdown
6:50 p.m.	--	Terminated Alert

SAFETY SIGNIFICANCE

- Initial Operator Response Prompt/Appropriate
- Licensee Successful in Achieving Cold Shutdown
- Several Operator Performance/Procedural Issues, and Equipment Issues Identified Which Delayed Achieving Cold Shutdown Conditions
- Several Emergency Response Problems
- No Measurable Offsite Radiological Release Impact (consistent with calculated results)
- No Impact on Public Health and Safety


INDIAN POINT 2
Plant Vent
Steam Generator Blowdown
Vacuum Pump Discharge
Atmos. Dump Valve
Pressurizer
Air Ejector
Turbines
Generator
Steam Generator
Waste Processing
Condenser
Reactor
Hudson River
Pump
Containment Structure
Pump

ROOT CAUSE AREAS

- Operator Performance
- Procedural Adequacy
- Equipment Performance
- Emergency Response

OPERATOR PERFORMANCE

- Initial Response Prompt and Appropriate; Procedure Adherence Good Overall
- Some Deficiencies in the Plant Cooldown Phase
  - Initial Cooldown Excessive (led to SI)
  - Operator Recognition of Plant Configuration (CCW Valve Configuration, Auxiliary Spray)

PROCEDURE QUALITY

- Procedures (AOPs/EOPs) to Guide Initial Response were Good

- Several Procedural Deficiencies Challenged Operators During the Plant Cooldown Phase

  - Delayed Placing Shutdown Cooling In-Service
  - System Configuration (CCW Valves, Aux Spray)
  - Shutdown Conditions (RCS Temperature)

EQUIPMENT PERFORMANCE

- **Event Mitigation Systems Worked Properly**
  - Reactor Protection System
  - Auxiliary Feedwater System
  - Safety Injection System
- **Some Pre-existing Equipment Problems Challenged Operators**
  - Automatic Condenser Vacuum Control Valve
  - Condenser Mechanical Vacuum Pump
  - Containment Valve Seal Water System Design Problem
  - Pressurizer Power Operated Relief Valve Design Problem

EMERGENCY RESPONSE

- Emergency Response Protected Health and Safety of Public
- Event Classified Properly/Good Critique of Emergency Response

- Emergency Plan/Implementing Procedure Problems
  - Augmented Emergency Response Facility Staffing Not Timely
  - Accountability Problems
  - Emergency Response Data System (ERDS) not Operable for Several Hours (Pre-Existing Problem)
  - Problems in Implementation of the Media Response Plan
  - Emergency Response Facility Equipment Problems
  - Technical Support Timeliness and Quality Issues

- Supplemental EP Inspection

RISK SIGNIFICANCE

Actual Event Risk:

- **Initial estimated CCDP for a SGTR ~ 1E-4 GEM/SPAR & ~7.7E-5 based IPE**
- **Revised CCDP based on actual leak rate was ~ 2.2E-6**

Key Assumptions:

- **Actual SGT failure leak rate ~ 100gpm - HRA revised accordingly**
- **Charging pumps available for HP makeup**

SDP Conditional Risk Assessment:

- **Delta-CDF is used to determine risk significance of inspection findings**
- **Deficiencies with the 1997 SGT inspection program have a high delta-CDF and are risk significant**

Key Assumptions:

- **SGT failure IE frequency ~ 1/RY**
- **½ tube failures result in ruptures**

SUMMARY

Supplemental Inspections/Actions

August 1999 Event
Emergency Preparedness
Steam Generator Tube Failure Root Cause
Issuance of Information Notice 2000-09

Agency Focus (5/23/00)

Communication and Coordination
Engineering Support
Configuration Management /Control
Equipment Reliability/Large Backlog
Operator Knowledge, Station Training, Procedures
Emergency Preparedness

Public Meeting

September 11, 2000 - On Site