Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

ACRST-2081

Title: Advisory Committee on Reactor Safeguards
Severe Accidents Subcommittee

TR04 (ACRS)
RETURN ORIGINAL
TO BJWHITE
M/S T-2E26
415-7130
THANKS!

Docket Number: (not applicable)

Location: Rockville, Maryland

Date: Wednesday, November 6, 1996

Work Order No.: NRC-901 Pages 1-121

9611150142 961106
PDR ACRS
T-2081 PDR

ORIGINAL

150002

NEAL R. GROSS AND CO., INC.
Court Reporters and Transcribers
1323 Rhode Island Avenue, N.W.
Washington, D.C. 20005
(202) 234-4433

ACRS Office Copy - Retain
for the Life of the Committee

D I S C L A I M E R

PUBLIC NOTICE
BY THE
UNITED STATES NUCLEAR REGULATORY COMMISSION'S
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

NOVEMBER 6, 1996

The contents of this transcript of the proceedings of the United States Nuclear Regulatory Commission's Advisory Committee on Reactor Safeguards on NOVEMBER 6, 1996, as reported herein, is a record of the discussions recorded at the meeting held on the above date.

This transcript has not been reviewed, corrected and edited and it may contain inaccuracies.

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

+ + + + +

ADVISORY COMMITTEE ON REACTOR SAFEGUARD (ACRS)

+ + + + +

SUBCOMMITTEE ON SEVERE ACCIDENTS

+ + + + +

WEDNESDAY

NOVEMBER 6, 1996

+ + + + +

ROCKVILLE, MARYLAND

+ + + + +

The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 1:00 p.m., Mario H. Fontana, Chairman, presiding.

COMMITTEE MEMBERS:

MARIO H. FONTANA, Chairman

THOMAS S. KRESS

DANA A. POWERS

ROBERT L. SEALE

WILLIAM J. SHACK

ACRS STAFF PRESENT:

AMARJIT SINGH

ALSO PRESENT:

KURT COZENS

RICHARD EMCH

JIM GROVER

ANTHONY HUFFERT

DAVID E. LEAVER

SHERI MAHONEY

JAMES METCALF

CHARLIE MILLER

A-G-E-N-D-A

Agenda Item	Page
Introduction	4
Proposed SECY Paper	5
Grand Gulf License Application	46
EPRI Report	58
ACRS Discussion	

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

(1:01 p.m.)

CHAIRMAN FONTANA: The meeting will now come to order. This is a meeting of the ACRS Subcommittee on Severe Accidents. I am Mario Fontana, Chairman of the Subcommittee. The ACRS members in attendance are: Thomas Kress, Dana Powers, Robert Seale, and Bill Shack.

The purpose of this meeting is to gather information on the proposed SECY paper concerning the approval of license applications using a revised source term at operating reactors. The Subcommittee will hear from representatives of: the NRC staff; the Nuclear Energy Institute, NEI; and Energy Operations, Inc. concerning this issue.

Amarjit, Jit, Singh is the cognizant ACRS staff engineer for this meeting.

The rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the Federal Register on October 21, 1996.

A transcript of the meeting is being kept and will be made available as stated in the Federal Register notice. It is requested that the speakers first identify themselves and speak with sufficient clarity and volume so that they can be readily heard.

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

We will proceed with the meeting. And I call on Mr. Emch of NRR to begin.

(Slide)

MR. EMCH: Good afternoon. I'm Rich Emch. I'm the Section Chief of the Radiation Protection Section of the Nuclear Reactor Regulation. I will be making a presentation this morning.

With me are: Charlie Miller, Chief of the Emergency Preparedness and Radiation Protection Branch; and Tony Huffert, who has been one of the key staff members working under my group on this source term and the implementation, the plans, our plans for this implementation. There are other people here from the staff representing RES. And I believe there may be one or two people from our task force from NRR.

This is a fairly far-reaching issue. And so within the staff, we have had to put together a task force of a sort of a multidisciplinary task force to help us deal with this issue.

So my main area is accident analysis, radiation protection, the dose analysis part of DBAs, but I'll be saying a few words about other things. And, where

necessary, I'll get some help from the table to answer any questions you my have.

One thing probably worth noting here is that there is a Commission paper that is being prepared -- you'll see it at the bottom -- to go to the Commission. It was originally going to be at the Commission before we had this meeting, that we thought the day was set such that we weren't going to be able to have time to come to the ACRS before the Commission paper went to the Commission.

We have had some last minute negotiations to figure out exactly what the Commission paper should say. And because of that, the Commission paper hasn't gone yet, but it's also not in a form, unfortunately, that I was able to give you a draft today.

As I recall, we gave you a draft several weeks ago, Jit. Okay. I would caution you that there have been fairly substantial changes in it since that draft. So don't pay too much attention to especially the part of that draft that talks about staff plans. We've had a lot of discussions and a fair amount of changes since that draft.

Even though I can't give you a draft today, what I will be talking about is part and parcel of what that Commission paper says, the draft says now.

My understanding is we're not requesting a letter from the ACRS. However, certainly if you folks after hearing the presentations, if you folks feel that you need to write such a letter, that's your prerogative.

We find the reason for the presentation today is to inform you. Some of you folks have done work in some of these areas. And, therefore, it would be our expectation that you might be able to give us a few pointers somewhere along the way here. So I'd be happy to hear those, too.

(Slide)

MR. EMCH: Actually, there's a lot of history that goes to this. Way back in 1962 the TID source term was developed. We have been using that source term ever since. There has been a lot of research and a lot of analytical evaluations that have been done along the way. And the result of all of that was a new source term, NUREG-1465, that was issued in February of '95.

Both the industry and the NRC immediately recognized that this was something that the industry probably would want to make use of. And so we asked the industry to handle it in a generic fashion so that the NRC could review 5 or 6 or maybe a dozen applications that would, then, be generic and be applicable to a number of plants, instead of us trying to do like 3,000

plant-specific amendments.

In response to that, NEI developed the generic framework document. You'll note later on it's designated as GFD. But, anyway, generic framework document. And they submitted that in November of '95.

Since then, along the way, we have held a number of meetings to talk about what their submittal was going to look like, what the NRC had in mind. And we just recently briefed CRGR last month on the staff's plans. And, as it indicates there, we will be sending a Commission paper forward soon.

CHAIRMAN FONTANA: Can you tell us what CRGR thought or is that any of our business? Well, don't poison our opinion.

MR. EMCH: That's all right. There's not a whole lot to tell you, actually. There isn't anything in the slides about what CRGR said. Actually, I thought it was pretty positive.

They quickly recognized that the real fun, so to speak, will be in the details, which we will deal with as we go through the pilot plants. And so they said, you know, at some point they want to revisit this. But I thought it was pretty positive in that they really didn't redirect us.

Charlie, is that your sense?

MR. MILLER: This is Charlie Miller from NRR.

I think what we found was that at the time we made this presentation to the CRGR, they were very interested in the subject as an informational briefing. As Rich said, what they're really interested to see is what comes out the other end and what's proposed to come out of the other end.

And I think at that time they will really in accordance with their charter be interested in how we plan on implementing that at more than one plant.

CHAIRMAN FONTANA: Thanks.

(Slide)

MR. EMCH: Okay. This will begin our summary of our review. The objective of the document was to establish aa generic methodology for applying the revised source term at operating plants.

NEI in this document gave us four classifications or categories of plant changes that they would expect their members to use or to be interested in. And they also developed four principles that would be the guiding light, so to speak, for the use of this new source term.

(Slide)

MR. EMCH: We'll quickly show you first the kinds of things they want to do with it. I've always

found in the past that scientists and engineers want to know: What's this going to be used for? So we'll flap that up there first. Okay?

The four categories, allowable leak rate changes. This would be containment leak rates or changes in leak rates for penetrations.

Isolation valve timing changes. This is the closure times; for instance, how fast main steam line isolation valves or containment isolation valves would need to be closed.

Filtration unit simplification. That's a code word for take out the filters. They're charcoal and HEPA filtration units for the control room and for some of the ESF systems.

And last of all is mitigation system actuation timing. An example of that is a number of plants have standby gas treatment systems or they may call them something else that they use to draw a partial vacuum or negative pressure on a secondary containment, for instance.

And it's been suggested that with the new source term, those systems wouldn't have to draw -- the requirement that they draw down in 15 minutes or something like that could be relaxed because with the new source term, there's going to be -- you know, the stuff will be

later arriving. And so those are the kinds of things that have been suggested.

MEMBER POWERS: The 1465 source term, as I recall, describes the radionuclide inventory arriving in containment but does not say anything about subsequent happenings to that radionuclide material.

So when you think about applications of the classes that you have listed up there, several of them have to do with what the radioactive material looks like in containment after some protracted period of time. How do you address that?

MR. EMCH: Okay. First off, while 1465 didn't give a lot of specifics, it did have a section that talked about some of the removal mechanisms that would be available in containment, but it didn't really pin anything down. It just said, "Here are some of the things that are available."

Beyond that, we would use calculational methodologies, which I'm going to talk a little bit about later on, at least in a simplistic view. But those calculational methodologies will have to assess how much of the radionuclide, what removal mechanisms are available, either from passive, natural, you know, like gravitational settling or spray systems or filtration systems or whatever.

And so the collocation, the modeling has to be done and included in our programs.

MEMBER POWERS: I was thinking more in terms -- those things are all important that you mention.

MR. EMCH: Yes.

MEMBER POWERS: I was thinking more in terms, however, of iodine partitioning out of aqueous solution into the atmosphere as organic iodide, possibility of tellurium doing the same thing, possibility of ruthenium doing that.

MR. EMCH: The chemistry and pH control issue there.

MEMBER KRESS: Particularly with respect to the filtration unit simplification issue, I think.

MEMBER POWERS: Or leakage.

MEMBER KRESS: Or the leakage rate, too.

MEMBER POWERS: It's another one where that's possible.

MR. EMCH: Yes. The issue of chemistry control, pH control is definitely a part of this evaluation. As you pointed out, one of the changes here is that, whereas in TID it was assumed to be mostly elemental, now it will be mostly particulate, although there still is elemental and organic in the source term.

And, well, you know, for instance, just on the

surface, that might suggest that maybe the charcoal filters aren't as important as we used to think they were. Maybe the HEPA filter is more important.

(Slide)

MR. EMCH: Okay. The four principles. Principle Number 1 paraphrased is that essentially the existing licensing basis of a plant is acceptable. In other words, the licensing basis that was the calculations that were done using the TID source term and that were reviewed by the NRC, in some cases many years ago, for the plant are still acceptable.

And the NRC agrees with that. We have said that there is no safety need, no safety reason to go back and make people reanalyze using the new source term. So backfitting is not required. The analyses that were done with the TID are sufficient, are acceptable, are adequate.

MEMBER KRESS: And you base that conclusion on what?

MR. EMCH: One of the things that we have done, we have had a fair amount of opportunity to do some examination of this because we have been using the new source term, various forms of it, on the advanced plants, CE 80 plus the AP600. And along the way we've done some other kinds of calculations, some looking at regular power plants.

And I think pretty much our conclusion is that if you -- I'm going to talk in a moment about old framework or current framework and new framework. But just for a moment, if you take the TID source term and you do the calculations with a current framework, the current criteria, the current calculational methods, and you get a dose or a set of doses and you turn around and look at that same design with a new source term, a revised source term, the calculational methods that we think are most appropriate to go with that and with the criteria, the 25 TEDE criteria, all the calculations we did showed if it met the old way, it will meet the new way. That's really the underlying basis for that statement.

MEMBER KRESS: I didn't interpret that principle to have anything to do with the new source term. I interpreted that to mean that we're licensed with what we've got. Therefore, we're not required to use the new source term or to change anything because of the new source term.

MR. EMCH: That's correct. I interpreted your question as being: Why do you think that's okay technically? That's what I was trying to answer.

MEMBER KRESS: Yes. I guess my question was I can't possibly see that there would be any argument about that. And I didn't even know why it was brought up in the

first place.

MR. EMCH: There hasn't been.

MEMBER KRESS: Yes.

MR. EMCH: There hasn't been. There hasn't been any argument about it.

MEMBER KRESS: Unless we suddenly discovered by the new knowledge that the existing licensing basis was unsafe.

MR. EMCH: Right. It would take something pretty --

MEMBER KRESS: It would take --

MR. EMCH: -- a pretty substantial surprising finding to move away from that, yes. I think you might ask: Why is it even up there? I think it was NEI was attempting to really baseline where are we at on this subject, and I think they felt --

MEMBER KRESS: Okay.

MR. EMCH: -- it was important to say --

MEMBER KRESS: It was important to say that.

MR. EMCH: -- "Don't anybody go jump off a bridge. What we've got is okay."

MEMBER KRESS: If they want to keep it that way, fine.

MR. EMCH: What that means is and what we understand is there are probably a number of utilities.

I've talked to a number of utilities who say, "I like my licensing basis, my design basis just fine. I don't see that that -- I don't have anything that I want to use that new source term to do. So it will be years before I even think about it." And that's perfectly okay.

Principle Number 2, complete implementation of the new source term as a substitute for the existing licensing basis is acceptable. Just simply that. NEI says, "Okay. If you could use the old one, now we can put the new one in and do the calculations. And that should be okay.

And I think the NRC generally agrees with that concept, although a couple of things that we need to mention is: first off, we believe that if you're going to use the new source term, you need to do an integrated assessment.

MEMBER KRESS: What does that mean?

MR. EMCH: Okay. I have some stuff later, but let me try it now. Okay. What we say by integrated assessment is, instead of just saying, "Okay. I'm going to take this piece of equipment out of the plant" or whatever and it affects the DBA doses for the LOCA this way, our belief is that there may be more to it than that. Yes, there are effects on the LOCA dose, but there may also be effects from that on other design bases analyses

that may have nothing to do with dose. Okay.

A quick example: Containment isolation valve closure times. Very first time we looked at that, we thought, "Well, you know, that's pretty much a dose issue. You can go from 5 seconds to 15 or 30 or whatever it is. And it probably won't make much difference in terms of the dose with a new source term because of the timing of the phases."

A little bit closer analysis or a little bit closer look said, "Well, you know, there are other things that come into play here. There's the issue of whether the valve could close against the pressure if you wait a while. There are issues of whether debris would hang up the valve coming into play so that you wouldn't be able to close later on. There's a back pressure that comes into play for the ECCS requirements."

So, as an example, we saw, hey, it's not just a simple matter of put a new source term in and calculate a new dose. There are other things that come into play. And one --

MEMBER KRESS: That's what you mean by an integrated assessment.

MR. EMCH: Right. And one of the most important things there is especially, which leads into the second one, when you start talking about taking out a

piece of equipment that used to be in the plant; for instance, filter trains, and saying it's just not going to be there anymore.

That has a very definite effect in terms of the DBA dose calculations, but we ask ourselves, we need to ask ourselves: Okay. It was part of the defense-in-depth that made this plant a robust safety analysis for the staff.

And so that when the staff started asking questions about severe accidents, it provided part of that robustness that allowed us to say we think that that's pretty well taken care of. Okay. We think severe accidents are not a big issue.

And so if you go into this and you say, "Take out something that we used to regard as part of that, as defense-in-depth," now we need to ask ourselves: Is the design still as robust to handle challenges like severe accidents, severe accident challenges?

MEMBER KRESS: So you don't think this question of the source terms needs to be limited to design basis space? Somewhere in there you ought to think about severe accidents?

MR. EMCH: No. As a matter of fact -- yes, that's very definitely a position by NRR management that we need to make sure that we haven't removed any of the

real safety margin associated with a plant's ability to handle severe accident challenges.

(Slide)

MR. EMCH: Third principle. Yes?

MEMBER KRESS: Sorry. I guess I missed on Principle 2. Did you say in general the staff is in agreement with that principle?

MR. EMCH: Yes. It's probably worthwhile for me to state right now we're in general agreement with all four principles. Okay?

MEMBER KRESS: Okay.

MR. EMCH: There are concerns that we have. And I'll express them, just as I have here. But in general we're okay with the principles.

Okay. Selective implementation, Principle 3. Industry felt that selective implementation; in other words, only using the new source term for certain kinds or parts of the analyses, should be acceptable as long as it was shown to make sense, I guess is a simple -- I don't remember the exact words, but that's pretty close. As long as it was shown to make sense, they felt that selective implementation should be allowed. Okay?

Of all of them, this is probably certainly one of the places where the staff has felt the most uneasy. We, for instance, thought at one point there are

discussions about there are timing-only applications. There are chemical form-only applications.

Let's talk about timing only for a moment. We thought at one point that the containment isolation valve closure time was an example of something that might be a timing-only application, that it might be something where you wouldn't even need to do dose calculations. You might just be able to say, "Just based on the insights of the new source term, it's at least 30 seconds before the gap phase shows up." Okay? And so if it hasn't shown up, then you ought to be able to use just on an insight -- you wouldn't even need to do a dose calculation, just say, "As long as the time frame is less than 30 seconds, it should be okay." All right? I'll use that as an example of a timing-only application. As I pointed out earlier, it didn't turn out to be quite that simple. Okay?

So I guess it's our belief that it is possible that we can have some selective implementation of timing-only applications. When we start to look at some of the other selective implementation, like a chemical form only, we're less enamored with that idea.

We believe that, really, once you get to the point where you have to do dose calculations to approve the change, that you really need to use the entire revised source term. We don't believe you can just go in and just

put the chemical nature -- you know, just say, "Okay. Well, now iodine is in this form, instead of this form." We believe that we need to do a more complete calculation and look and assess the integrated impact.

MEMBER KRESS: Design basis accident?

MR. EMCH: Yes. But, as I pointed out before, integrated impact won't just be design basis. It will look to see if there are impacts in other areas as well, severe accidents, equipment qualification, whatever.

Okay. Principle Number 4, the dose calculations based on the existing methods and limits are acceptable. And what they really mean by that is if you take the current methodology, -- you know, that's the framework, the TID, and the current limits, the 25 rem whole body and 300 rem thyroid -- if you just substitute the new source term for the old one in that calculational framework and then you could do your calculations and see if it matches up to the current criterion, that should be acceptable.

For a number of reasons, the two most important reasons that we're not sure about that is the TEDE dose, the concept of the TEDE methodology; and the issue of which two hours you're going to do the calculation for the exclusionary boundary.

We believe that the whole framework -- how

much further is the framework slide? Maybe I'll just go to that. Okay.

MEMBER KRESS: Let me ask you about this.

MR. EMCH: Yes.

MEMBER KRESS: It's my impression that dose calculation only affects the leakage rate. Am I right?

MR. EMCH: Only affects the leakage rate.

MEMBER KRESS: A bad leakage.

MR. EMCH: I'm not following you, sir.

MEMBER KRESS: 10 CFR 100 type calculation using these acceptable doses of 25 rem --

MR. EMCH: Right.

MEMBER KRESS: -- on every source term. What that does is fixes your leak rate that you're allowed to have following containment.

MR. EMCH: That's certainly one of the things that it does, yes.

MEMBER KRESS: My impression was it was the only thing.

MR. EMCH: Okay. It does that. Also, it comes into play as to the capability of ESF systems, like filters and things like that.

MEMBER KRESS: They get involved in the calculation, right.

MR. EMCH: Yes. Okay. Right.

MEMBER KRESS: If it were an existing plant, all those things are fixed.

MR. EMCH: Initially they would be, but one of the things -- let's stop and ask yourself: Why would an operating plant want to pick this thing up and use it? And the answer that I keep coming up with is the only reason that they would have for going through all the revised calculations and everything is to make some changes. Right. Okay.

So if they make some changes, then you get into: Well, what does it impact?

MEMBER KRESS: They're not going to change their sprays.

MR. EMCH: We hope not. Okay. We don't believe that that will happen. In my staff's worst moments --

MEMBER KRESS: So I still maintain if they don't change their sprays, the only thing this calculation does is affect leak rate.

MR. EMCH: Okay. That's one of the things. If you remember the slide that I put up with the four categories, timing of valve closure, timing of system starting, and coming on line, there are other places that it can come into play. Probably leakage --

MEMBER KRESS: Yes, there is a valve closure

time, but mostly this is just leakage, which I think has very little risk impact.

MR. EMCH: That's my understanding, yes, sir, that small and even -- well, I have to be careful. I'm a little out of my area.

Certainly small changes in the leakage have virtually no impact on the risk. That's what I understand from the risk folks who are involved with this. And I think that was a conclusion that was drawn in the changes to Appendix J that were --

MEMBER KRESS: Yes. That was part of Appendix J.

Okay. I just wanted to be sure I was thinking correctly when I was thinking about this principle. Thank you for --

MR. EMCH: I'll come back to this in a moment if we need to. Let's go to the framework, to the issue of frameworks.

MEMBER POWERS: Can I interrupt you and take you back?

MR. EMCH: Yes, sure.

MEMBER POWERS: You said that your first principle was the current licensing basis is adequate. Does that include equipment qualification?

MR. EMCH: Yes.

MEMBER POWERS: If it's qualified under a TID source term, then it's qualified under this?

MR. EMCH: Yes.

MEMBER POWERS: That's interesting.

MR. EMCH: Well, I gave you the quick pad answer. There are others. Certainly I believe that there has been some investigation of that. I believe there was a SECY paper that specifically talked about that and made some estimates about what the possible impact in that area could be.

And I think the conclusion was drawn that while the new source term because of the chemical nature and all that might indeed raise the dose in some instances, that it was felt that the bounds were good enough that we wouldn't have to do anything there. That's the longer answer.

CHAIRMAN FONTANA: Going back to Principle Number 2, you have an item there, "removal of accident mitigation hardware."

MR. EMCH: Yes.

CHAIRMAN FONTANA: And presumably you agree with this principle. But I remember reading somewhere here, which I can't find right now, that a statement was made that the staff would not allow removal of, I think it was, charcoal filters because it wanted to maintain

defense-in-depth.

MR. EMCH: Right.

CHAIRMAN FONTANA: What's the difference between that statement and this one that says that --

MR. EMCH: It doesn't seem to make sense to you, does it? Okay. You remember I said you probably saw that when you were reading the draft Commission paper that we did give you to you several weeks ago.

CHAIRMAN FONTANA: Oh, okay. That's old.

MR. EMCH: That's one of the areas where there's been some adjustment in our thinking.

CHAIRMAN FONTANA: Okay.

MR. EMCH: I think the current one still says that we are reluctant because of the issue of defense-in-depth, although it leaves the door open that with proper analyses, a conclusion could be drawn that it might be that there are some things that could be done here.

CHAIRMAN FONTANA: Okay. Thanks.

MR. EMCH: Where was I? I'm going to finally make it to the frameworks. Okay.

(Slide)

MR. EMCH: Start off by saying that current Part 100 does not specify a source term. Okay? If you go to Part 100 and read it, you will find in a -- I forget

how the lawyers say this. It's a footnote, I believe, or a note that mentions the TID source term. And, in fact --

CHAIRMAN FONTANA: By reference.

MR. EMCH: Right. All of this stuff was bubbling to the surface at about the same time in the old AEC. And the criteria and the calculational methods, the Part 100 framework, so to speak, really was designed around the TID source term. Okay?

The TID source term is everything is immediately released. You know, 50 percent of the iodines and 100 percent of the noble gases and 1 percent of the solids and all of that are immediately released from the core to the containment atmosphere at t equals zero seconds. Okay?

And then the Part 100 talks about doing the calculation over the next 2 hours for the exclusionary boundary. So it's the first two hours. And then there are criteria that are expressed in terms of whole body and thyroid dose criteria.

All of that is wrapped. It all kind of comes together. It's a framework. The way the staff actually does the calculations, for the whole body dose, we look at the noble gases. For the thyroid dose, we look at the iodines.

Very early on, many years ago, a decision was

made not to include the one percent of solids. I'm sure there was a number of considerations. It was felt that that would make a small difference in the doses, especially the whole body and thyroid doses. And it was going to complicate the calculation greatly.

MEMBER KRESS: And since you're in design basis space, why, it's appropriate to not have to include things like that if you think you're scoping the thing anyway.

MR. EMCH: Oh, yes, yes. The staff made --

MEMBER KRESS: You don't have to get all the details.

MR. EMCH: Yes. The staff drew conclusions about how they were going to use this thing and make an appropriate design basis. And that's one of the conclusions they made. Okay.

So that's the current framework. It includes all kinds of things like I said 50 percent of the iodine comes out of the core. Fifty percent of that is assumed to plate out immediately so that you're really only working at t equals zero with 25 percent of the iodine. And there's just lots of -- the whole thing is put together around, designed around the TID source term.

(Slide)

MR. EMCH: Now we're talking about the revised

source term, where the releases come out in phases. And there's a time lag, the time frame. It's not t equals zero. It's over a couple of hours or a few hours.

And the revisions, I'll say the proposed revisions, the Commission has approved issuance of revised Parts 50 and 100 for new plants, but it hasn't actually been published yet. So we still have to call it proposed. Okay?

But the revised proposals were really based on, designed around the revised source term. Now, that doesn't mean that they can't -- you know, this time we thought we'd try to be a little smarter and say, "Okay. What about if there were some other proposals for source terms?"

And we tried to include that in here. But this rule really was developed to be consistent with the revised source term. And some of the ways that that shows up is in the any or worst two hours.

Now it doesn't make as much sense to do the first two hours if the worst of the releases may happen later on sort of thing. And, also, that revised rule brought forth the concept of the TEDE dose methodology for accident purposes.

TEDE had already been put into place for occupational doses in Part 20, but this revision to Parts

50 and 100 put it into place for accidents, brought the subject forward to use TEDE doses for accidents. And it sets a criterion of 25 rem TEDE.

We're going to come back to this from time to time, the two frameworks: the old framework set up to go along with the TID and a new framework that is set up to go along with the way 1465 describes it, the revised source term.

MEMBER KRESS: We wrote a letter on the new framework essentially agreeing with it completely.

MR. EMCH: Yes. Yes, that's correct. I think you did ask us a question about the dose factors associated with the TEDE.

MEMBER KRESS: Yes, we had some problems with that.

MR. EMCH: Right. Okay. I think we got that --

MEMBER KRESS: In principle we agreed with --

MR. EMCH: I think we got that straightened out. Okay. So back --

MEMBER POWERS: Are you going to explain that to us?

MR. EMCH: Pardon?

MEMBER POWERS: Are you going to explain that to us again?

MR. EMCH: I wasn't planning to. Please don't make me explain that again.

MEMBER POWERS: I definitely will not ask you to do it today, but would you sometime?

MEMBER SEALE: And what you did last time wasn't an awful lot of help. So that's not a good place to start from.

MR. EMCH: Okay. This might not be a good time to suggest that it wasn't me doing the talking last time.

Okay. So back to Principle 4 for just a moment, remembering the two frameworks. Our initial reaction to Principle 4 was: Hey, if you're going to use the new source term, we need to use this framework. Okay? So our initial reaction was that we didn't think it would be acceptable to simply slip the new source term into this framework.

Now, after a little more looking at it, a little more thinking about it, some of the things that the industry has suggested to us, we're of the belief now that we're going to use this rebaselining that I'm going to talk about in a few minutes to help us figure out whether it really makes any difference or not. Okay?

It may be for the advanced plants, it seemed to make some difference because they didn't have spray

systems and things like that. For a current plant that has a spray system, for instance, first and worst two hours, the doses will essentially be the same. So we're going to be looking to see. It may be possible to be completely agreed with the Principle 4. We just have to find out in the rebaselining.

We'll get to rebaselining in just a second. I need to talk for just a moment about rulemaking and exemptions, about the possible need for them.

(Slide)

MR. EMCH: I mentioned that one of the things about the revised source term is the phased timing of the releases. And I also mentioned for the advanced plants that we have looked at the calculation on a worst or any two hours, as opposed to the first two hours.

If it was decided that it made a difference for operating plants and that we really did need to do worst 2 hours or any 2 hours, as opposed to the first 2 hours, one of the places, one of the things that hangs us up there is the words of the existing Part 100 that talk about doing the dose evaluation for the 2 hours immediately following onset of the release.

So that might be something that will require rulemaking or a change in rules and could lead us to have to do exemptions for the pilot plant amendments. So

that's one possibility.

A second possibility is, of course, the current Part 100 talks about the dose criteria in terms of whole body and thyroid. And the TEDE really covers all the nuclides, not just noble gases and iodine. And the TEDE concept as well integrates all of the body organs, all of the other nuclides in a coherent fashion so that you cover everything with a TEDE dose.

And if a decision was made that because of the additional nuclides in the revised source term, it may be that after we do the rebaselining, we'll find out that that's important. It may be that we'll find out that it's not important.

For a moment harking back to the decision that got made after the TID that you didn't need the one percent solids, it may be that it just isn't that important. So we'll find out in rebaselining.

And the point of this is this is important in that later on when I'm talking to you about what the staff plans are, one of the issues that's up in the air is whether we will need rulemaking or exemptions. It makes a big difference in the staff's plans if we decide that we do need rulemaking and exemptions.

(Slide)

MR. EMCH: Okay. Rebaselining. We're going

to evaluate Grand Gulf and Surry, a BWR and a PWR. They were both included in NUREG-1150. The reason for picking those plants, specifically we wanted plants that were evaluated in NUREG-1150.

It doesn't make much difference in terms of calculating the DBA doses, but in terms of going further and looking, "What does it mean in terms of the impact for the severe accidents?"; the amount of evaluation that was done of these plants in NUREG-1150 provides a base that we can look at to see if it makes any change. And that's the advantage of going with those two plants. It doesn't hurt any that Grand Gulf also happens to be one of our pilot plants.

Okay. We'll calculate the design basis accident consequences using the revised source term. We'll perform sensitivity studies to provide us information on the implementation issues, some of which I've already mentioned, selective implementation, removal of accident mitigation equipment, whether or not rules and exemptions are necessary, all those kinds of things we expect to be able to look at in sensitivity studies, as well as look at the various kinds of uses that licensees might want to make. You know, take this piece of equipment, this piece of equipment out.

And we probably will look at what happens

without a spray, without a containment. I know it seems stupid, but people in my staff stay up all night worrying about things like this.

We will also use it, as I mentioned before, to help us scope other potential design and licensing basis impacts. And then, of course, the last one, which we mentioned before, is assess the severe accident impacts of possible design changes.

MEMBER KRESS: Does that mean right for a PRA?

MR. EMCH: I don't think so. However, this isn't one of my stronger areas. Okay? The discussions that we've had with the people in the staff who are more familiar with this, if you remember, I said that we were taking plants that were from 1150. That down here is the reason for that, is really the reason for that, the idea that we may not have to actually completely redo any PRA analysis or anything, that we may be able to tell just by comparisons with the stuff that has already been done in 1150.

MEMBER POWERS: Eleven-fifty produced for both of those plants distributions on the source term. Your 1465 has some genesis from those as some kind of bounding, but not too bounding --

MEMBER KRESS: Amalgamation.

MEMBER POWERS: It's bounding, but not too

bounding.

MEMBER KRESS: Yes.

MEMBER POWERS: Sort of we don't know what.

MR. EMCH: I'm glad to see you have as much trouble describing it as I do. Yes, sir. Okay.

MEMBER POWERS: Well, one of the things we asked for in our letter was some assessment on what the level of conservatism of the 1465 source term was. Now you're going to go in, and you're going to do an analysis on these Grand Gulf and Surry both. And you're going to use a source term that's essentially a point estimate of those ranges.

MEMBER POWERS: Isn't that going to elicit somebody asking you a question?

MEMBER KRESS: It's a circular argument.

MR. EMCH: Okay, let's see it if I can follow this. Quite simply, we've been here too many times when you haven't asked that question, so I suspect that we do it again.

MEMBER POWERS: Quite, frankly, if I was in the business of intervention and you charted out your point estimate on that, and I said, that's great, and I believe every word of what you said to me, but I also notice these very erudite people that did 1150 got some higher numbers, and so why don't you use those.

MEMBER KRESS: No, but the answer here is -- I think the answer here is look at that calculation, and it's sort of a benchmark to see if you're using that one, gives you something close to the mean than those others, or a little higher.

And then you do this sensitivity analysis, which means you're not evaluating the same plan. You're evaluating the same plan of changes, and they you're going to see what that does to you.

I think it is a way to see what the influence of potential use to the for existing plants.

I would expect if they feed back this amalgamated source term into calculation -- I don't know what that calculation is. That's a design basis calculation.

MEMBER POWERS: No, no. I'm talking down at the bottom here.

MEMBER KRESS: At the bottom. Okay, well that's spin off for the same plants. That's for plants that have had things done to them.

MR. EMCH: I think I get a better idea what you're talking about. I do have a possible answer for that. I thought some about that myself.

You already pointed out that the revise source term was something that sort of grew and could be thought

of as -- 1150 could be thought of as a precursor, at least one of the steps on the way to the new source term.

How we're going to do it in DBA space, we're going to take it as a point estimate and we're going to plug it into our calculations, and we're going to have other conservatives built around it and that sort of thing.

And I don't really thing, in terms of how they evaluate severe accidents, or how they do their evaluations, I don't think it's going to make any difference at all.

The techniques, the approaches, the calculational methods are just so much different, they don't use point estimates in severe accidents. They use ranges, they use distributions.

And so, it's not like you can just simply say for a severe action evaluation I'm going to take what happened in DBAs, and I'm going to take the next two columns out of NUREG 1460 and plunk it in and see what happens. The calculational methods, the MELCORS and all that sort of stuff, already have the underlying basis of the new source term built into them. That's my view of it at least.

Does that help you?

MEMBER POWERS: Actually I'm not the one

that's going to need help. I think you're the one that's going to need help --

MR. EMCH: Oh, okay,

MEMBER POWERS: -- on that question.

MEMBER KRESS: Let me tell you again my view of that.

MR. EMCH: All right.

MEMBER KRESS: You do this DBA calculation with a new source term, and it tells you can do something to your plant and still meet the criteria. That something might be change of leak rate, might be change of valve timing, might be throw away the filter, might be not having a spray. I don't know what it will be. There may be some things that the new design basis tells you can do.

Then you say, okay, will we allow that. It's within the new design basis. You say, well, we need some risk information on this.

So you take the plant, which has had a risk analysis done to it, you know what its risk status is, and you redo the risk with these changes in some sort of sensitivity form, and you look a the new risk numbers, and you make a judgment as to whether those changes actually impacted the risk or not. And that gives you guidance on whether you would allow these things, just based on the design basis analysis calculations.

That's how I viewed what you're doing.

MR. EMCH: I think that's a pretty good description.

MEMBER KRESS: Yes. And I don't know how you do that exactly without -- That's why I asked you if you're going to run this through another PRA, and I don't know how you do it exactly without that.

MR. EMCH: Right. What you have in mind may be a little more detailed than what I have in mind, but I have to be honest, what the staff has in mind is still being developed there, so I can't -- It may be that we'll end up exactly where you said, yes.

Okay. Geez, we've already talked about this, but examples of things that we'll be looking for in the sensitivity studies. We'll first just takes the plant as it sits, no changes at all. Put the new source term in, see what it means in terms of the doses. Then we'll look at possible effects of design changes.

By the way nobody should interpret the fact that we've mentioned getting rid of containments and sprays as being a suggestion. That's one thing we're going to look at.

We'll look at the importance of first versus worst 2 hours, we'll look at the importance of the different kind of dose methodologies, and just see, does

it make any difference or not, technically.

Pilot plants. You probably know the list to that. One possible surprise to you might be Oyster Creek. Browns Ferry, Grand Gulf, Indian Point 2, Perry, and just within the last few weeks we've decided -- Oyster Creek said they wanted to become a pilot plant and we decided there was enough different, yet enough the same -- it's kind of a hard explanation to draw -- to make them a pilot plant.

And if they're totally unique, it doesn't any good to make them a pilot plant because it doesn't teach us anything about the other plants. So they have to be unique in some ways, but yet somewhere or another the same.

MEMBER KRESS: Oyster Creek's the mark 2?

MR. EMCH: Actually I believe Oyster Creek is a BWR-2, mark 1, is that correct?

MEMBER KRESS: 2 is the --

MR. EMCH: 2 is the BWR product line, so it makes it a pretty early BWR.

MEMBER POWERS: You lack an ice condenser on this list?

MR. EMCH: Pardon?

MEMBER POWERS: You don't have an ice condenser on this list.

MR. EMCH: There's probably a number of things.

You will notice there's four BWRs and 1 PWR. In some ways we were sort of at the mercy of who applied as to who went on the list.

MEMBER SEALE: It sure looks like GE always throws the plants away and starts over, doesn't it?

MEMBER POWERS: Yes, but they meet the CDF criteria.

MR. EMCH: There was a time when I was in the tech spec group that I used to think that.

Okay, staff plans.

We're going to send a letter to NEI, telling them the things that we've just been telling you here. We're going to perform the rebaselining analysis. At the same time that we're starting the rebaselining we will begin review of the pilot plants. Probably slowly, but we at least need to look and see what kind of changes they're proposing. We at least need to look and see what kind of -- I'll just use the word analysis or calculational credits they're asking for.

For instance, there's a myriad of things that go in to the calculation about how does it get from inside the containment atmosphere to outside the plant. And so, we'll have to look through the pilot plants to figure out

what kinds of phenomena are attempting to be credited by the pilot plants so that we can put that into the rebaselining.

And also an important point there is figure out -- Some of these kinds of things may well be phenomena or systems that we've never really attempted to model before, and that we don't have calculational techniques to deal with, and if there's a lot of that then we'll have to find ways to deal with that that may include getting contract help or any number of other things. Of course it becomes a complication of the review.

As I said before, it will help us determine whether rulemaking exemptions are necessary, or we will determine after going through some of this. Then we'll begin the rulemaking process if it's decided that its needed.

Complete the pilot plant reviews. Issue the amendments, including the exemptions if necessary.

This will not be done in a vacuum. Okay. The Commission has expressed a lot of interest in this process, and I'm sure that we'll be talking to them about it soon. And I'm sure probably somewhere around the time when we make the decision about rulemaking and exemptions we'll have to talk to them probably about the time we get ready to actually issue any exemptions. I suspect that

they'll want to hear some more about this then too. And as we pointed out earlier, when you ask about CRGR that's when they're going to become very much interested.

If it turns out that exemptions are not necessary, going back to the generic theme that I mentioned at the very beginning of the presentation, we'll take the license, we'll issue the pilot plant amendments, and then turn around and prepare generic letters so that follow-on plants can make their applications quickly, and hopefully we'll be able to review them quickly without a lot of reinvention of the wheel.

There will always be some plant-specific differences that we'll have to deal with but we'd like to minimize those.

Along the way we'll complete rulemaking if it's decided as necessary, and then, either this way or this way we'll eventually start reviewing the follow-on applications.

And of course the question everybody always wants to know, schedule.

We debated whether we should put tentative next to schedule, but we'll just --

Complete rebaselining and decisions on need for rulemaking exemptions, mid-1997. You know whenever somebody uses the word mid that they're hedging their bet.

And then complete the pilot plant reviews in late '97.

Now, on the pilot plant reviews, and to some extent up here also, I mentioned a moment ago that we've seen in some of the discussions we've had with the pilot plants already some calculational credits that I've had some of the members of the task force come to me and say, if they want to take credit for that, we don't have a model for dealing with that right now, and we're going to have develop one or get one, or just decide to leave it out.

And if it turns out that we need to do a lot of -- If we need to do a lot of model development, where we have to use contractors and things like that, then that complicates things and would probably affect this date.

And I'm finished, unless you folks have some more questions.

CHAIRMAN FONTANA: Any additional questions for Mr. Emch?

There's going to be more.

MEMBER POWERS: It's just apparent that he's got an awful lot of work ahead of him.

CHAIRMAN FONTANA: Later on this afternoon we'll discuss what are the things that we should be discussing at the Full Committee meeting, and get back to that issue.

Okay. Thank you very much.

Ms. Mahoney?

MS. MAHONEY: Yes?

CHAIRMAN FONTANA: You're up next.

MS. MAHONEY: Good afternoon. I'm Sheri Mahoney from Entergy Operations, the Grand Gulf Nuclear Station. I'm a licensing engineer there.

Entergy has been very interested in the revised source term for quite some time. When they put the draft out we were looking at it then. And since then we've been following the issue very closely.

We're active in participating in the effort. We participate on the NEI Task Force, and you've heard we're one of the pilot plants. We also chair the BWR Owners Group Committee on the revised source term. And as you heard Rich say, we're going to be the BWR rebaselining plant, and we're very pleased to do that. We're really excited about working with the staff on that effort.

You're going to hear from NEI on some very specific details later, but we'd thought it would be useful for you to hear just a single utilities viewpoint on implementing the revised source term.

There's a lot of issues out there, and these are just the ones of importance to Entergy really.

Actually what I've heard from Rich, it really

sounds a lot better than what we heard in October. We thought that we were going down the path of rulemaking and that that would create a long delay for anybody to be able to use the revised source term.

One of the issues that that brought out was that, even though there are cost beneficial changes and there are dose changes that everybody talks about with the revised source term, there are safety beneficial changes that we can get by using it, and any delay would just delay those changes being implemented.

The rulemaking part -- It sounds like that the NRC has decided to reconsider that. They're going to use the baselining to decide whether or not that needs to happen. But even if they find out that the TEDE and the 2 hour spotting window is important, we think that there is a way in the current regulatory structure to deal with that without rulemaking.

We believe that the rebaselining should be performed, but the scope should be limited. And from what I heard from Rich, it looks like that they are going to limit the scope and have that effort completed in a reasonable length of time. We were afraid that it might stretch out such that we might never get finished with the rebaselining effort.

MEMBER KRESS: On your comment on

rulemaking --

MS. MAHONEY: Yes?

MEMBER KRESS: -- what are the criteria for when rulemaking is or isn't necessary? How does one make that judgment is what I'm asking?

MS. MAHONEY: If you can't comply with what's currently in, in 10 CFR, then rulemaking would be required. But as long as you can comply with that -- I mean there are additional requirements that if they're imposed, there are ways that you can use SRPs and reg guides to limit any additional requirements, and I've got a slide on that.

So we think that the implementation should go forward as quickly as possible, and that it should be high priority.

I told you about when we were looking at some safety improvement. I wanted to give you a couple of examples of what we're talking about.

This first one is a mouthful. It's, elimination of the automatic isolation function of selected primary and secondary containment penetrations.

These are penetrations that do not communicate directly with the contaminated atmosphere. There are systems like instrument air, firewater, plant service water, variable chilled water; systems that we found in

our IPE to be very important for mitigating consequences of the accident.

Currently, these systems have to isolate from the start of a release, immediately.

MEMBER KRESS: What signals them to start? What's the automatic signal?

MS. MAHONEY: It's LOCA.

MEMBER KRESS: LOCA?

MS. MAHONEY: Right. The LOCA signal isolates --

MEMBER KRESS: So you look at the pressure of the primary system?:

MS. MAHONEY: I'm not sure about that. I don't think it's on pressure. I think it's on the LOCA signal that you'll have an isolation.

MEMBER KRESS: All the things that go in to make a LOCA signal.

MS. MAHONEY: Right. Water level and end the pressure.

Right now the way it works, once those systems isolate immediately the operators are trained and required by procedure to go ahead and bypass the isolation. Something they do in the simulator, and they found that it's important to do that because if you lose those important systems you're just going to cascade; you're

going to lose more and more important systems.

Like on the instrument air, you're going to lose air to your valve actuators; you're going to lose it to your airlock seals. For the cooling waters you're going to lose a number of different cooling water systems if you don't have the make-up for those.

The second example --

MEMBER SEALE: I was going to say, I guess there are adverse consequences of losing and then regaining these by isolation or by bypass, if you will --

MS. MAHONEY: Right.

MEMBER SEALE: -- that you could avoid if you didn't lose them in the first place.

MS. MAHONEY: Exactly. Exactly. Because you need them. The operators are going to go ahead and bypass them, so you've got that delay. The operators are focusing on getting that done, instead of focusing on mitigating the consequences of the accident. They should be able to have this. With the NUREG they would have it.

We've got a fairly aggressive safety analysis staff at our plant. We're lucky enough to have those guys. They understand the analysis very well. If we could find any other way to get this to happen we would have already done it. The NUREG is the only way that we have found that we're going to be able to effect that

change.

The second change -- you've already heard Rich talk about this -- the relaxation of the general automatic containment isolation value closure times. Those closure times are very stringent. Big valves have to close in like 4 seconds. There's a lot of stress put on the valves by doing that, and it doesn't seem to make sense that you have to have all this stress on the valves. You have to increase your ESF bus loads immediately when the release hasn't even started yet.

I mean, I don't think I can add much more to what Rich said. But that's a safety benefit, because you can reduce the component stresses, you can reduce the ESF bus loads.

When I came here today, we kind of already thought the NRC had decided that Part 100 had to be -- They were going to prevent us from doing that. I see they're going to use rebaselining to find that out.

Within that there's a couple of sections in 10 CFR, Part 100, that I think the staff believes may cause some problems with rulemaking. And that's, for 2 hours immediately following onset, the postulated fission product release, that would prevent you from using a 2 hour sliding window.

What a total radiation does to the whole body

in excess of 25 REM, or what radiation does in excess of 300 REM, the thyroid from iodine exposure, that would prevent the use of TEDE.

But we think that there is a way that these additional requirements, that TEDE and the 2 hour sliding window can be accommodated within the current rules.

MEMBER KRESS: Without rulemaking.

MS. MAHONEY: Without rulemaking.

This is where it gets a little -- This is where we kind of depart.

We believe that you can use the SRP and the reg guides, and then the 10 CFR 5059 process to bring about these changes. It's the current process, and we think that it would just be consistent with the way we already do things.

The SRP and the reg guides, they already provide guidance on the dose calculation methods. There's specific details that are in those that are necessary to perform the dose calculations.

There's also some places in the SRP where the acceptance criteria for particular changes is some fraction of Part 100. Like if there's an event that has a higher frequency of happening, then the limit's going to be lower. Some part of a small fraction, maybe that's 10 percent, maybe that's 25 percent.

So that's already there. The SRP and reg guides are currently used for that. And we think that those documents could be revised to go ahead and allow an option to use the revised source term, if you included TID -- if you included TEDE and the 2 hour sliding window as some greater acceptance criteria or some list. It would actually be more requirements placed on using the NUREG.

MEMBER KRESS: And that would go a lot faster than rulemaking?

MS. MAHONEY: We believe so. Because the rulemaking, by our experience, 3 to 5 years is not unusual. And we believe that if it goes down that path it's just going to be that much longer before we can take advantage of the safety beneficial changes.

CHAIRMAN FONTANA: Is this likely to end up as a decision by a legal staff?

MS. MAHONEY: Probably.

CHAIRMAN FONTANA: Sorry.

MS. MAHONEY: I'll try not to outguess them. Yes. Once 5059 starts getting involved it's start getting a little squirrely. But once these documents are revised then 5059 applies. Because TID is not part of the regulations. Licensees have committed to use it; there was nothing else. We had to use a TID source term. Now

there is something else.

So it's the commitment, not the regulation that ties us to the TID source term. And you change your licensing basis and your commitments through 5059. We think it's appropriate. It's consistent with the way we do business now, and we ought to take advantage of it.

The use of rebaselining, we're very excited about this. We think that there's a lot that can be gained, because NUREG Fortune 65 doesn't really give you all the details necessary for performing the dose calculations, but the EPRI framework document does. It was developed for that purpose, and we think that in the rebaselining the NRC can take advantage of what's in the EPRI framework document to validate those values, to improve on those values. Those things could then be put in the SRP as guidance for licensees.

The scope of the rebaselining effort. To begin with we thought that this might stretch out to be years, but it's a much shorter schedule than we thought. So I'm really actually not that concerned with this anymore. I would say the way that the NRC wants to do it sounds good, and that we are more than happy to participate in that effort -- actually honored.

MEMBER POWERS: I noticed in the examples that you selected at the beginning of your talk, you picked

examples where I think the confrontational difficulties that arise in going and applying 1465, you've avoided those.

Has that been a conscious decision?

MS. MAHONEY: No, actually not. We just looked at all the changes that we had and said which ones have the safety benefit, and they just happened to be ones that are very simple, really.

MEMBER POWERS: Yes. There are really straight forward applications of the source term.

MS. MAHONEY: Yes, that's what we think.

Not done on purpose. I mean, there are changes that we're interested in that would be cost savings changes, but we're more interested in these few because they're a hard spot.

MEMBER POWERS: And I think a lot of us -- I think there are people, myself included, that think cost savings changes do have safety benefit because it allows resources to go to safety of other areas --

MS. MAHONEY: Right.

MEMBER POWERS: -- so I wouldn't be apologetic about it cost savings.

What I'm interested in is, do you think you'll ever get into items that are computationally difficult?

MS. MAHONEY: Yes. Absolutely. I mean it may

be a little bit down the road, but we definitely will. I mean, we're a fairly aggressive plant, so we would --

MEMBER POWERS: I've noticed that.

MS. MAHONEY: -- so we would intend to take advantage of whatever we could, without being stupid; without cutting into your margins so severely that it would limit any other possible changes you might want to make. We're pretty concerned about keeping a fairly large margin.

CHAIRMAN FONTANA: Wait a minute. Before you remove that --

MS. MAHONEY: Yes?

CHAIRMAN FONTANA: -- what do you have in mind about another research project?

MS. MAHONEY: Well, that's what I was talking about. As we got into rebaselining it just might balloon; that there's one other thing that needs to be looked at, and one other, and one other, and that it would just never end.

So we were thinking that there should be finite criteria for what rebaselining was supposed to do.

CHAIRMAN FONTANA: I see what you had in mine.

MEMBER SEALE: Finite and durable.

MS. MAHONEY: Right.

In order to achieve the safety benefit without

undue delay we request the ACRS to endorse early implementation of the revised source term, through this process if necessary. That remains to be seen, but we think that is appropriate to do it like that. If this were current practice, we would encourage that.

CHAIRMAN FONTANA: Thanks. Any additional questions from the committee?

Any questions from over there?

Later, again, we'll discuss what we should take up with the Full Committee.

MS. MAHONEY: Right.

CHAIRMAN FONTANA: Well thank you very much. You make some cogent arguments, particularly with respect to the automatic isolation. That looks like that it's really important.

MEMBER SEALE: Yes, the committee has a history of being concerned about ambitious requirements, or let's say high level requirements being based on the performance of those valves, limiting their competence or their capability to do anything.

MS. MAHONEY: Right.

CHAIRMAN FONTANA: Well, thank you very much.

MS. MAHONEY: Thank you very much.

CHAIRMAN FONTANA: The next area is the EPRI report which is scheduled for about an hour and a half.

I think it would be a good idea to take a break now, and be back at 2:35.

(Whereupon, the foregoing matter went off the record at 2:16 p.m.)

CHAIRMAN FONTANA: The meeting will readjourn. Readjourn? What did I say? We're going to start up again. This is what we're going to do -- reconvene.

The next speakers are from Nuclear Energy Institute, and Mr. Kurt Cozens is going to be the next speaker. Are you on at the same time?

MR. COZENS: Yes, I was going to introduce Dave.

CHAIRMAN FONTANA: Oh, you're going to do that. Okay. I got you.

MR. COZENS: Good afternoon. I'm Kurt Cozens from NEI. I am the Project Manager at NEI responsible for the revised source term implementation. I also chair the NEI task force on revised source term.

We have two presentations, actually, today. The first one will be dealing with our framework document, what it is, and I think we've heard a fair amount about that already, so that may help our speed of presentation. But we'll also be discussing in a little bit more detail, but still at a fairly high level, the pilot plants and the projects that they are intending to implement through this

process to give the ACRS an appreciation for what the current level of thinking is and some of the general approaches that will be addressed.

That presentation will be done by Dr. Dave Leaver from Polestar, who is an EPRI contractor.

And before I go on and leave the podium to Dave, let me make one editorial change in how we are addressing some things. The framework document was actually prepared and written by EPRI under the -- Dave Leaver and Polestar being the primary authors on it. I wanted to give appropriate credit to EPRI for their good support in this area.

And with that, once Dave is done, I'd like to come back and talk to the ACRS about some procedural approaches that we've recommended to the staff on how we might implement the revised source term.

So with that, let me turn the microphone over to Dave. And when he's done, I'll come back.

CHAIRMAN FONTANA: Okay.

DR. LEAVER: Okay. Is that loud enough? Can you hear me okay?

Okay. Thank you very much, Kurt.

I appreciate the opportunity to speak to the subcommittee on revised source term. I want to recognize and point out my colleague, Jim Metcalf, back there who

worked on this framework document effort and is working on revised source term applications to operating plants closely with me.

Also, we have here a number of the licensees who have submitted -- representing licensees who have submitted applications of the revised source term for their plants, as well as some additional licensees that are interested in the subject. And it may be that some questions come up that would be appropriate for them to answer. We can have the advantage of being able to call on them.

Okay. I'm going to talk about three things, three areas. First, just a very brief perspective on the evolution of the revised source term, how it came about; and secondly, talk a bit about the framework document, the EPRI/HEI framework document, which Rich Emch discussed in his talk as well, some of the information that we had provided in the -- what I would I guess call Rev. 0 of that document in late 1995.

And finally, I'll talk at a high level only, just because of time constraints here today, on the examples of pilot plant applications. And I'll mention the TVA Browns Ferry plant, the Perry plant, which is Cleveland Electric, Con. Ed.'s, Indian Point 2, and GPU Nuclear's Oyster Creek.

Now, as far as the development of the revised source term, we started thinking about this in the late '80s because of the ALWR project. What we had was, in effect, new design plants, certainly taking advantage of existing improvement in technology, but nonetheless, the idea was to be innovative and make these plants better plants, better even than what we have -- than today's modern plant.

And one of the areas that we thought was important to look at was the source term, because of the fact that a lot had been learned since the mid '60s when the technical basis for the existing DBA source term was developed. A lot was learned from the aftermath of the TMI accident.

There was a tremendous amount of severe accident research that was done, experiments, NUREG 1150, all kinds of things that suggested that we could be more accurate in the way we describe the source term, which in turn would be beneficial to the design, the idea being, let's design the ALWRs for an accident that is more like a real accident, rather than one that is really somewhat artificial, which TID -- not that TID hasn't done well by existing plants.

So we started this effort in 1989, and in '91 we submitted two reports to NRC on revised source term for

ALWRs, along with changes to the utility requirements document. And just for those of you that may not be familiar with that, that's the industry's set of design requirements for the advanced plants that has been worked on here over the last five to six years, sponsored by the U.S. utilities, overseas utilities, and the Department of Energy. It has been reviewed by the NRC, the utility requirements document. And, in fact, an SER was issued.

Anyway, so the basic idea of the revised source term and the technology was captured in these reports and in the URD. The NRC then published its draft NUREG 1465 in the middle of '92, and then a final in 1995.

As Rich Emch mentioned, the NUREG 1465 primarily focuses on the release part of the source term. That's where the details are on the time and chemical form and release magnitudes. And our work is -- I would say compares quite favorably to what is in 1465. We really have no quarrels with what's in 1465. 1465 treated the removal part of the problem only in a general way, and we have, through our ALWR work, as well as work on operating plants, have gone ahead and developed methodologies for doing that part of it, and particularly in areas that weren't covered in 1465.

Now, the NRC issued two letters in 1994 discussing the application of the revised source terms on

operating plants and indicating this was something that could be done cautiously, and mentioned the fact that there could perhaps be relaxations to an operating plant's simplifications that could be achieved with maintaining safety.

And on the basis of these letters, NEI and EPRI and the utilities wanted to consider this in more detail, so the industry developed the framework document over the late '94/'95 timeframe and submitted it to NRC at the end of 1995.

In parallel with the framework document, there were some pilot plants that were interested in applying a revised source term. Three of these applications were submitted in 1996, and there will be several more, or at least a couple more anyway, in 1997. And I'll be talking about several of these -- the framework document, as well as several of these pilot plant applications, at kind of a general level.

Now, the framework document is -- the objectives were to -- I guess we wanted to try to meet some industry needs and some NRC staff needs. First, we wanted to support licensee efforts to apply the revised source term and to do it in a safe and cost-beneficial way. We wanted to provide licensees with a consistent approach, so that we could avoid a situation of having --

if 20 plants do it, have 20 completely different ways of doing it. That's not a good way to do business if you can avoid it.

And finally, we wanted to obtain NRC staff acceptance of the generic approach, so that the licensees would have some confidence that they would know how to proceed. And in parallel, we felt that some pilot plant applications would put some meat on these bones, and so the pilot plant process, as I said, is going on in parallel.

Now, the initial effort on the framework document was submitted the end of '95. We have had a number of meetings with NRC, as I believe Rich mentioned, perhaps four or five over the last year and a half, in which we've gotten a lot of oral feedback from the staff. We have learned quite a bit from doing the plant-specific applications that we've done so far, which I'll talk about more in a moment. We anticipate getting written comments from the staff. I believe Rich mentioned today that that is their plan.

So we are giving consideration to updating the framework document to reflect all of this experience. And what I'm going to present to you in the next several viewgraphs is -- I guess the best way to describe it would be a snapshot of what our current thinking is, which has

departed a bit from where we were in December of '95 with the original issue of it. And it's possible that it may evolve some more, depending upon what comments we actually get from the NRC.

But we're -- I guess the message I wanted to convey is that we're trying to listen to what people are saying in comments and what we're learning from our own applications, to try to make the document even better than it was the first time.

Now, this staff -- apologize for all the words. I'll get this all on one slide, just you can kind of compare them, one to the other. But Rich Emch mentioned principles that were -- the four principles that were in the December or November 1995 framework document, and we have retained those principles, although we anticipate possibly there may be some changes to update them.

And we also are considering adding two principles. This could -- what you see here could change, depending upon things that we learn here in the next few months, in terms of how extensive an update we do to the framework document. But let me just go through these principles quickly.

The first one is the one that Rich mentioned, which is basically you don't have to backfit revised

source term to operating plants. It's a licensee choice.

Secondly, the concept of substituting NUREG 1465 and associated removal methodology, which 1465 may not have fully covered, as I mentioned, that that's an okay concept, to substitute that for the existing DBA source term and along with maintaining an adequate margin of safety.

The third principle had to do with selective implementation of some, but not all, aspects of the revised source term. We recognize that staff has some concerns about that, and we certainly plan to consider staff comments on that. We have learned some things about this since we wrote this principle two years ago that I think could be reflected in the modification as well.

The fourth principle is -- this is a modified version of what was in the November '95 document, and what we're saying here is we think that existing Part 100 requirements, which are whole body/thyroid, are -- first of all, they're required by regulation, they should be met, they are adequate for safety, with the revised source term, we believe.

We are also saying that the TEDE dose with the worst case two-hour interval, that calculation will be provided even though the regulatory basis would continue to be the Part 100 regulatory limits, which is what's in

the Code of Federal Regulations today.

The fifth principle, which is a new one that we're considering, is stating that in applying a revised source term the existing GDC 19 requirement, which is the requirement for control room operator dose, if you'll recall, that we believe that based on the way the Code of Federal Regulations language is written -- this is just our opinion, of course -- as well as from a technical standpoint, that that requirement could be met either by calculating the whole body and its equivalent to other parts of the body, which are the words out of the Code of Federal Regulations today, or by calculating the TEDE dose.

And then, finally, the sixth principle, which is a new one that is under consideration, and these words were in the original framework document, but they were diluted somewhat. They were not pulled together as a single principle, and we're now considering having a principle that states that consideration should be given to the integrated safety impact of the application of the revised source term together with the associated plant changes.

And this is the kind of thing that Rich referred to in his talk, although I think he was doing it in the context of principle 2. So, I mean, it doesn't

really matter whether you call it principle 2 or principle 6; the idea I think is the same.

Now, I want to just talk a little bit about this -- principle 2, principle 4, and principle 5. Principle 1 I think is fairly straightforward -- no need to go back to it. Principle 3, I don't want to say any more about it, really, because we need to I think hear a little bit more from the staff on that. And in principle 6, we are considering this.

At this point, we don't have any more details, really, to give you on what this integrated safety assessment would involve. But I think it would involve the same kinds of things that you were talking about when Rich gave his talk, looking not only at calculating the doses for the DBA, but in some sense the overall safety impact of whatever changes it is that you're making.

CHAIRMAN FONTANA: I guess the question there is: how much work is it going to end up being if you --

DR. LEAVER: Yes, that's the question.

CHAIRMAN FONTANA: And you don't know yet.

DR. LEAVER: We want to be careful to not overdo it, or otherwise people will get so discouraged with this whole process they'll just -- they won't even try it.

Okay. So on principle 2, this is just, if you

will -- there are words in the framework document that discuss it. This is just an attempt to sort of illustrate graphically what we're talking about. What you have -- the issue here is what we're saying is we want to be able to apply -- and I don't think anybody is arguing with this -- apply the revised source term as a substitute for the existing source term. And all we're really doing is trying to put in context this idea of margin of safety.

If you take, for example, the LPZ dose, which is a 30-day dose -- this could be control room dose as well -- over a period of time, what you might find with the revised source term is there is some period where nothing is released. Then, a release occurs, and at the end of 30 days you have some dose that you -- that would be calculated.

If you were to do this calculation with the revised source term, with no changes to the plant at all, just take NUREG 1465 and whatever additional methodology you need to do the removal part of your problem, you come up with some number. Then, presumably, the reason that the licensees are interested in doing this is because there are some plant improvements they could make to simplify O&M, reduce radiation exposure to workers, make plants safer.

You might see some delta between what you --

the dose that you would get with the revised source term with no plant changes and the plant changes. The plant changes might result in some modest increase in the dose. This, to us, would be in the spirit of and acceptable in the sense of maintaining a margin of safety.

This line here is license acceptable limit, which would be for that particular plant what their licensing basis states in terms of an acceptance limit. That could be what's in the Code of Federal Regulations -- for example, 300 rem for the LPZ, or it's possible that some plants may have been licensed at some thyroid dose limit for LPZ less than 300 rem.

Our experience, for the plants we've seen so far, is the licensing basis is 300 rem. As long as we're below this line, then the idea is we have done our job in terms of addressing the regulatory -- the margin of safety that's regulated by the NRC.

CHAIRMAN FONTANA: Well, you don't really know what that margin of safety is, and that's why I like the way you drew it, with no top to the arrow.

DR. LEAVER: Yes. I tried --

CHAIRMAN FONTANA: But your point is --

DR. LEAVER: We fiddled with this slide. You're right. That's right.

CHAIRMAN FONTANA: If you're below that line,

you'll know that your --

DR. LEAVER: You know you've got a problem.

CHAIRMAN FONTANA: Yes.

DR. LEAVER: Exactly.

CHAIRMAN FONTANA: Yes.

DR. LEAVER: Now, this slide says nothing about --

CHAIRMAN FONTANA: Of course, there's another part of this, too, is that if you make a plant change, there might be some unanticipated consequences. That's --

DR. LEAVER: Right.

CHAIRMAN FONTANA: That's an argument.

DR. LEAVER: This slide does not address the question of the integrated safety impact.

CHAIRMAN FONTANA: Yes.

DR. LEAVER: And that's why I think we need to do, you know, something -- whether it's a combination -- you know, it may be that you can do something generically that would give you a lot of confidence, and that would minimize what one might have to do on a plant-specific basis. But frankly, we don't -- obviously, you can't say this categorically about every possibility. But generally, the kinds of changes that people are making we don't see as having a big effect on risk.

As you were talking this morning or earlier

this afternoon about leak rate, for example. You know, leak rate will increase the dose, no doubt about that, but hopefully not very much and we can calculate that. And in any case, it's not a big risk issue.

MEMBER SEALE: Well, delta could be negative.

DR. LEAVER: It could be. That's right. It wouldn't have to be positive. Could be negative.

MEMBER SEALE: As a matter of fact, if you slow her valves down, they probably seat better when they do seat.

DR. LEAVER: Yes. And that might be a hard thing to calculate and capture in a risk sense, but yes. And I agree with what Dana Powers said earlier today, too, which is that if you can do things that simplify O&M, reduce costs, presumably you can do a better job on the things that really matter. Again, that's a hard thing to quantify, but I think that's a real effect.

Okay. Now, on principle 4, which is the one having to do with Part 100 and the TEDE dose, and this is -- Rich Emch's presentation dealt in detail with the two frameworks, if you will. We have thought a lot about this, because there is a great deal of stuff here in terms of if we have to wait for a rulemaking it just puts a tremendous cloud of uncertainty over this whole process, and I think people are going to get discouraged.

Licensees will get discouraged.

But what we believe about this -- in fact, NEI did send a letter to NRC staff on this subject a couple of weeks ago that spelled out our thinking. We think that the existing Part 100 requirement for whole body and thyroid is, in fact, adequate for safety when using the revised source term.

On the basis of our experience, and I will show you a calculational example in a moment -- and let me try and say this in a way that it's understood. For operating plants, the whole body and thyroid doses that are done under Part 100 we believe will be of the same order as TEDE, in terms of fraction of the licensing acceptance limit.

So, in other words, we would not expect -- if you were to do the whole body and thyroid doses under Part 100 for a revised source term application for some plant, and then turn around and do the TEDE calculation, we would not expect that you would get a drastically different result in terms of the acceptability of the doses. Okay.

CHAIRMAN FONTANA: Are you proposing that the two calculations be done?

DR. LEAVER: Yes. We're proposing -- what we're thinking about anyway at this point -- this is not a

done deal, but it's our current thinking -- is that what we would put in the framework document is that plants should do the Part 100, which specifies whole body and thyroid and the zero to two hours, because that's the regulation and that's what you have to do.

And, in addition, the plants would provide a parallel off-site TEDE calculation as part of their submittal. Now, that would not be the regulatory basis. The regulatory basis would be what's in the regulation. But this parallel off-site TEDE calculation would give confidence that there is not something funny going on with TEDE.

Okay. The last principle I wanted to talk about was GDC 19. What we're saying here is something that we've -- I think we've talked informally with the staff about. I know people off and on have been talking about this for a number of years in the industry. GDC 19, as written, says -- and I have put some quotes in here -- "that control room doses should not exceed five rem whole body or its equivalent to any part of the body for the duration of the accident."

Now, when you go to the standard review plan, that's interpreted. And what that says is five rem whole body, 30 rem thyroid, and 30 rem skin, 30 days. And that's pretty much what people have done, at least the

plants that were done post SRP.

Okay. Now, it's our opinion that an equally valid -- and I would say valid both from a regulatory and a technical standpoint, to the extent that, you know, we can venture forth an opinion on this matter -- is that under GDC 19 it would be equally valid to calculate TEDE, since it includes the whole body component, and it addresses an even more comprehensive set of organs.

So we think that TEDE should be an acceptable alternative to the existing -- to the interpretation of GDC 19, which is in the existing SRP. And our thought is that we would attempt to capture this concept in an update to the framework document. We have kind of hinted at this in the existing framework document, but it wasn't very visible. So that's what we're thinking about.

Okay. Now, the last thing I want to say about the framework document is just briefly on methodology. The framework document I think really is -- has got three elements to it. One element I did not talk about, but we have a section in there that talks about why do we even care about doing the revised source term for operating plants. And, of course, what that gets down to is improvements in the plant, and we've attempted to categorize the types of improvements that licensees are interested in. And, in fact, Rich Emch had a slide on

that at the beginning of his presentation.

And I would be happy to answer any questions for any of the licensees that are here, talk to you about why they are doing this. But in the absence of any questions, I'll not talk about that further.

The second thing in the framework document are the principles, which I just discussed.

The third area is methodology. We have attempted to address methodology. On the release side, that was easy, because we basically said, "We're pretty happy with NUREG 1465. If you want to do something different, you have to justify it."

On the removal side, we have attempted to define what we believe would be an acceptable methodology. We have not been able to address all of the details. Some of these calculations are fairly complex, and they just aren't -- there's just no way that in a generic document that is intended to cover all plant designs and all situations that you can really cover that level of detail.

But we do have some modest level of detail in there, and the focus on the removal is -- deals with removal of airborne aerosol, because that's really the name of the game for the revised source term, assuming that you control pH and maintain your iodine as I-minus, as an aerosol.

MEMBER KRESS: In those considerations of removal mechanisms, do you think it was appropriate to allow diffusiopheresis as part of that?

DR. LEAVER: Diffusio?

MEMBER KRESS: Yes, in terms of design basis accidents.

DR. LEAVER: Yes. Diffusiopheresis is included -- for those of you that don't know, diffusiopheresis is where aerosol would be driven to a cold surface by the condensation of steam on that surface. We have included diffusiopheresis effect in work that we have done on the AP600, where you have this massive steel shell, which has a water film on the outside, and which is designed as part of the design basis to eventually suck heat out of the containment. You are going to get steam condensation on that surface.

For operating plants, we have not included it, simply because we were unaware that there are any situations where you really would be able to take credit for it. For example, for a concrete containment where heat removal is by sprays or by fan coolers, it is not an important effect. So it's not in there now, and I don't have any plan to -- we don't have any plans to put it in there.

MEMBER KRESS: Is it part of the spray

efficiency?

DR. LEAVER: Well, you can get steam condensation on droplets. Yes. That we have included in our model for spray removal.

MEMBER KRESS: The reason I'm asking is, you know, design basis accidents are supposed to, in my mind, scope a lot of accidents. There are sort of surrogate accidents that one uses. And in a lot of accident sequences the timing of when there is steam condensation effects, on the sprays and walls, with respect to when the fission products and aerosols are there, it varies a lot from accident sequence to accident sequence.

And if one used a surrogate accident and allowed some sort of -- I don't know what one does about that timing, how much steam is in there, and how much diffusiopheresis does one allow in a surrogate design basis accident. When you're looking to --

DR. LEAVER: Yes. I understand.

MEMBER KRESS: That's why I asked the question.

DR. LEAVER: I understand your question. I think it's an excellent question and one which we could certainly -- it's a little bit hard to talk about unless you're talking about a plant-specific situation. But just to -- I'll probably say more about this than I should with

the time we have, but let me just try a 30-second or one-minute --

What we've done, in general, on the removal part of the problem is to try to do it in a reasonably conservative way but still mechanistic. We think that if you -- and this is -- we recognize that this is more work for the industry and a bit more work for the staff to have to review these more detailed calculations, but you really lose an awful lot if you resort to simple models that completely ignore certain phenomena, just for the sake of making life simple.

You also -- people say, "Well, gee, you know, don't you want to be really conservative, and these simple models are conservative?" And sometimes they are, but the problem is they're not always conservative.

I have a slide which I'll show you afterwards. I don't have a viewgraph of it. But what we have found is that some of the SRP models are actually non-conservative in certain situations. So it's -- we've tended to try to do things a little bit more mechanistically.

On the issue of condensation on spray droplets, if you are reasonably conservative in your description of how much steam you get --

MEMBER KRESS: That's the problem.

DR. LEAVER: Well, I think we know how to do

that. I don't know. I mean, I think you'd have to look at an actual calculation and talk about the pros and cons of that to really nail that down. But what I'm saying is that as long as you don't go overboard in terms of your estimate of how much steam you get, and as long as your result isn't overly sensitive to the matters of timing and that sort of thing, I think it's a robust enough process that you can include it.

What we don't want to -- what we're trying to do here is to really recognize the important phenomena and not just ignore phenomena that we know are there. It may be that they're hard to quantify exactly, in which case we have to be careful how we do it. But we want to try to include them.

MEMBER POWERS: Speaking of phenomena --

DR. LEAVER: Yes.

MEMBER POWERS: -- that arise that are real, that we know occur, that are difficult to quantify, how have you handled the problem of electrostatic charging of the particles?

DR. LEAVER: I guess that's one you could do a Ph.D. thesis on. But our sense is that it probably -- we have not included that effect in our calculations. Our sense is that if one were to do that that it would probably -- it's probably conservative to not include it.

So we think -- we're pretty comfortable with not including it. We also have other -- enough other conservatisms generally in what we're doing on the removal side that we think would overwhelm that effect.

MEMBER POWERS: Well, I certainly know at least one author that has taken the position that it's conservative to neglect it. But he certainly didn't provide a proof on that. Do you have a proof?

DR. LEAVER: I don't have a proof, no. No, I don't have a proof.

CHAIRMAN FONTANA: What's not written --

DR. LEAVER: There are a lot of things I don't have a proof for.

CHAIRMAN FONTANA: What's not written in the last bullet is that the overall -- if you kept everything exactly the same and used the 1465 source terms compared with the other ones, you are clearly going to come well below the old source terms. What's not written there is that you're going to maintain the same level of conservatism considering the plant changes that you're going to put in place. Is that correct?

DR. LEAVER: You're saying -- I just want to go back to your first statement, Mario. You're saying this line here, which is the revised source term with no plant changes, is clearly going to be below what you

calculate with existing --

CHAIRMAN FONTANA: I would guess --

DR. LEAVER: Not necessarily.

CHAIRMAN FONTANA: Well, even so. But I guess I -- what that third bullet on the other slide says --

DR. LEAVER: Yes.

CHAIRMAN FONTANA: -- is the delta will be such that you are still under the licensing basis. See, the bullet doesn't say anything there about plant changes, but you're implying it, aren't you?

DR. LEAVER: Let me just read it and see what it says. Yes. The intent is that the -- when I say "removal methodology," I mean the rule or methodology that's used in the application of the revised source term with the plant changes.

CHAIRMAN FONTANA: Okay. Yes.

DR. LEAVER: Yes.

CHAIRMAN FONTANA: Yes. I thought it must.

DR. LEAVER: Yes. So this is our intent. I mean, we -- you know, obviously we have to demonstrate this. And the framework for this is that chart I showed earlier as to what we mean by that. You know, we're --

CHAIRMAN FONTANA: Yes.

DR. LEAVER: The intent is to stay below this line. And then the other thing that this viewgraph is

saying is that we are attempting to be reasonably conservative when we do this quantification. We think 1465 is reasonably conservative. Sure. It may not bound anything anybody can think of, but we think it's reasonably conservative, and we think our removal methodology approach is reasonably conservative, and we know the DBA I over Qs are conservative. So the whole package we think is comparable to accepted licensing practice.

Okay. Now, these examples -- I'll go through these fairly quickly, but please, you know, if anything in here catches your eye and you want to talk a bit more about the -- we have the most -- I think for all four of the plants I'm going to talk about we have someone here from the plant.

For Browns Ferry, we used 1465. We followed the framework document in areas that weren't fully covered in 1465, and that included natural settling of aerosol in the drywell, gravitational sedimentation, limited suppression pool scrubbing, considerably less than what's actually allowed by the standard review plan, as a matter of fact.

MEMBER KRESS: Any scrubbing credit for saturated pool?

DR. LEAVER: We calculated estimated pool

temperature, and I believe it's not saturated, right, Jim? Yes. So we did that calculation.

MEMBER KRESS: Then it was saturated. So you didn't have to --

DR. LEAVER: Right. So the issue -- it turns out the thing that limits you here isn't the fraction of aerosol that gets scrubbed for what flows through the pool. It's how much doesn't go through the pool. That really controls it.

And as I said, I believe we end up taking less credit than what's allowed by the standard review plan. That's one of those instances where things can be non-conservative if you're not careful.

Main steam line aerosol retention -- this is in the spirit of what was in the BWR owners group methodology. I don't know if you're familiar with that, but the BWR owners group developed a methodology which actually was applied to the TID Reg. Guide source term, which is primarily elemental iodine. And that was done and approved by the staff.

MEMBER KRESS: Did you do all of these for all of the Chapter 15 DBAs?

DR. LEAVER: It turns out for Browns Ferry that only the DBA LOCA --

MEMBER KRESS: Is the only one.

DR. LEAVER: -- is affected. Had we made a plant change that impacted the result for another accident, we would have had to do that. But in this case, it didn't.

We used more current thyroid dose conversion factors -- ICRP 30 -- and we calculated existing Part 100 whole body and thyroid.

The plant changes that were included in the calculation are listed here. There was increased MSIV leakage. It went from -- I don't -- I guess 11.5 scfh per line to 100 scfh per line, 250 total, four lines, 250 total. There was fission product holdup and retention in the main steam lines and main condenser. The plant change was making the tail end of the steam lines and condenser are seismic.

We took no credit for charcoal in the standby gas treatment system, which is an exhaust gas treatment system that -- for accidents in the reactor building.

MEMBER KRESS: But you didn't put in any more iodine other than what's in the 1465?

DR. LEAVER: We used the 1465 source term.

And then there was also no credit taken for the control room, which is called the CREVS -- control room emergency ventilation system -- charcoal, which is a charcoal for I believe the recirculation system for

filtering control room air.

Also, pH control is planned and is under evaluation at this plant, and the tech. spec. amendment that went in -- while the calculations included all of these things, the tech. spec. amendment only addressed the first two. It did not say -- at this point in time, they have not said anything about charcoal in either the standby gas treatment system or control room, although I believe at some point in time it is their intent to do so.

CHAIRMAN FONTANA: Is making the condenser seismic -- does that help because it doesn't leak? It doesn't actually affect any --

DR. LEAVER: Well --

CHAIRMAN FONTANA: -- removal mechanism, does it?

DR. LEAVER: No. No, it doesn't, Mario. But the thing is you can't legally, or at least as the regulations are interpreted by the NRC, you cannot get any credit in a DBA for something that isn't -- you can't show is still going to be there after an SSE.

Okay. The dose results for Browns Ferry are given here, just to give you a sense of what we're doing. This is thyroid dose, which tends to be the more interesting ones, more limiting than whole body.

These are the existing results. The low means

low -- fuzzy logic here. Several rem -- you know, a ways away from the limit.

Revised source term you'll see is really quite comparable. And by "revised source term" I mean using the revised source term release and removable methodology with the plant changes that I listed on a previous slide.

Now, this amendment was submitted to the NRC for approval in January of 1996.

Okay. The Perry plant is really quite similar, and I won't go through all of this stuff but it's quite similar to the previous slide. I will just mention, though, that Perry is a Mark III, which means that it has a containment building designed for pressure that surrounds the drywell. And that containment building -- in a sense, it looks a little like a PWR. That containment building has a safety grade spray system.

So we have credited that spray system for this Mark III, and we did an aerosol spray removal calculation. We could have used the standard review plan formulation for aerosol spray removal, but it turns out that that's a fairly simple model. There are effects that are ignored in that model, and so we tried to be a bit more mechanistic.

The plant changes here were -- one of them was elimination of the main steam isolation valve leakage

control system. That is a system that sucks from between the inboard and outboard main steam isolation valve, discharges through a filtration system in an annulus that surrounds the containment building.

We increased MSIV allowable leakage, same as we did for Browns Ferry. There is aerosol retention in the main steam line. In the case of Perry, they have a third isolation valve in the main steam line. They have the inboard valve, inboard of the drywell, the outboard valve, and then they have a third valve about another 50 feet down the steam line which was provided on -- I'm not sure what the reason was for doing that originally in the design, but it is a safety grade seismic valve.

So we have credited the aerosol retention out to that valve, but we have not credited the condenser. So they are not planning on doing seismic for the condenser, which by the way is a big deal in some plants. I mean, it involves a lot of analysis and possibly even some hardware changes, enough so that some plants would -- just couldn't -- just would get discouraged and wouldn't do it. It would be too expensive.

We took no credit for the charcoal filter in the annulus, which is a rather thin space that surrounds the containment for collecting leakage and filtering it. But the HEPA, of course, is in there. We delayed the

actuation of control room recirc. by 30 minutes.

MEMBER KRESS: Why is that?

DR. LEAVER: This one?

MEMBER KRESS: Yes.

DR. LEAVER: Perhaps Emin Ortalam could expand on this.

MEMBER KRESS: You did it because you could.

DR. LEAVER: Well, no, we did this because the control system for actuating control room research is significantly simplified, the maintenance and testing of that. If you --

MEMBER KRESS: That's what I mean. You did it because you could, and it gives you lots of --

DR. LEAVER: Right.

MEMBER KRESS: -- lots of --

DR. LEAVER: We did it because it's an improvement in plant operations, and we were able to tolerate the very small change in dose. You could hardly even see it.

We had a reduced credit for control room charcoal. We were not able to meet our dose limits by taking charcoal out entirely, which is rather interesting, in the control room. It turns out that the control room in this plant -- I don't remember -- it's a recirculation system, and as long as you have some modest credit for

charcoal filtration, and I believe we assume 50 percent, your doses do just fine. If you take it out entirely, the doses go up and we're uncomfortable with that. So we left it in.

The package that the Perry plant submitted to the NRC included the LCS removal, increased MSIV leakage, and aerosol retention in the steam line, the no-condenser credit. All of these other changes were in the calculation, but I believe will be the subject of future submittals.

Now, the doses for Perry look like this. This, again, is thyroid dose. We did whole body thyroid.

In the control room, you were right up against the limit. With the revised source term release and removal methodology, and the plant changes that I mentioned, the control room dose is about 16 rem. The site boundary and LPZ doses -- this is zero to two hours, of course, and this is 30 days -- are I think pretty comparable to what they had before. This is what they had before, and this is what we're getting now. And this licensing amendment was submitted for NRC approval in August of '96.

CHAIRMAN FONTANA: Now that's zero to two hours. That's not --

DR. LEAVER: Yes, this is zero to two hours.

That's right.

Okay. The third example I have is Indian Point, and this work was done at Consolidated Edison by Westinghouse. Jim Grover, who is sitting back here, prepared this slide. And really, it's very conceptually quite similar to the other applications -- that they used 1465, they followed the framework document in areas not covered by 1465, but they also used one of the SRP models. They used the SRP model for spray removal.

In this case, they did look at not only the LOCA DBA radiological accident. They looked at some non-LOCA events as well, because they felt that that was important. And one thing I wanted to mention is they increased the gap release fraction by 20 percent over what's specified in NUREG 1465 in order to account for high burnup effects. This is for accidents where long-term cooling is maintained -- for example, fuel handling accidents and the rod ejection accident.

They calculated both whole body/thyroid and TEDE dose, and I'm going to show you those results in a moment. The plant changes that Indian Point made were they removed the in containment filters, both HEPA and charcoal. This plant has a fan cooler system which had, or has, filters in it, and they also have the spray system. For safety improvement and operations and

maintenance simplicity, they want to remove these filters.

They also eliminated the spray additive from the spray system, and they're going to achieve pH control with trisodium phosphate in the sump. And they made a change to control room ventilation system. They are modifying it for a pressurized control room.

MEMBER POWERS: Can I ask a question about this 20 percent increase in the gap release fraction?

DR. LEAVER: You can ask a question. Yes, sir.

(Laughter.)

MEMBER POWERS: I was pretty sure I could.

(Laughter.)

I wonder what the basis for choosing to go from five percent to six percent gap release fraction was.

DR. LEAVER: Well, no, it wasn't -- this is just for accidents in which long-term cooling is maintained. The five percent number is -- for example, is the gap release when you're on your way to core melt. The number that is in NUREG 1465 for these accidents is three percent, and so it's a change from three percent to 3.6 percent.

Is that right, Jim?

And this was done on AP600, and I guess it was discussed and people felt comfortable with it as adding

margin to account for high burnup effects. That's about as much as I can tell you. Maybe Jim Grover can add to that.

MEMBER POWERS: I wonder what we've seen experimentally on these gap releases. There have been several experiments now --

DR. LEAVER: Right.

MEMBER POWERS: -- with high burnup fuel.

DR. LEAVER: Oh, on high burnup fuel.

MEMBER POWERS: And I think the Japanese experiments, in particular, are measuring the gap release for at least the noble gases. I don't know what else, but certainly for the noble gases. And I wonder if they're seeing numbers that are consistent with that.

DR. LEAVER: I have not seen experimental data on the high burnup fuel. I have seen a lot of experimental data on more, you know, typical burnup fuel. And what we've seen is that the peak gap release fractions are around two percent, maybe two and a half. The average is under one percent, and so we felt pretty comfortable with -- we felt that five percent was -- provided quite a bit of margin, as did the three percent.

If there is data on the high burnup effects, then I guess we should look at it. I just hadn't seen it.

MEMBER POWERS: Well, you would not think that

low burnup fuel would be in any way applicable, because you're getting a fuel -- a change in the microstructure, and in particular you're putting volatiles out at the boundary. And if memory serves, I have certainly heard of release fractions for particular tests and particular configurations, etcetera, etcetera, etcetera, where things -- numbers like 20 percent of the krypton inventory is coming out in the experiment.

DR. LEAVER: All right. Well, I haven't seen these papers, Dana, but I certainly would like to look at them.

I don't know ii -- Jim, do you have any comments on that?

MR. GROVER: Yes. My name is Jim Grover with Westinghouse Electric.

The use of the 20 percent was a number that -- or a 20 percent increase culled from the initial gap release of three percent, up to 3.6 percent, was a value that was agreed upon between Westinghouse and the staff in a meeting in May of '95, as we were discussing the methodology to be used for the AP600, because the concern was that the NUREG 1465 is intentionally vague in regard to high burnup fuel. I'm trying to say it -- Section 3.6 talks about "The source term contained in this report is based on fuel behavior results obtained at lower burnup

levels where fuel pellet remains intact upon cladding failure," and it goes on.

And staff cautions that "Until further information indicates otherwise, source term may not be applicable for fuel at high burnup levels."

So, no, we have not looked at the material, and we're not aware of material that you are referring to. But we believe that this was an appropriate consideration of the high burnup effects, essentially that something needed to be done. We had the historical increase of -- by 20 percent, based on -- was it NUREG CR-5009 on high burnup fuel. That was used to, you know, applying that factor, increase the gap fraction from 10 percent to 12 percent. That's about all of the information I can give at this time.

MEMBER POWERS: Okay. I'd caution you that I'm operating from memory, but you might want to look at proceedings of a CSNI meeting held in Cadarache, France, like a year and a half or two years ago, to see what the Japanese have actually been measuring.

DR. LEAVER: Will do.

MR. GROVER: Okay. I know the ANS 5.4 model does not project anything like this.

MEMBER POWERS: It can.

MR. GROVER: Yes.

MEMBER POWERS: It's not -- it won't take into account the fuel restructure.

DR. LEAVER: Yes, we'll look at it. Appreciate the comment.

Okay. So the dose results were Indian Point, and here we have a TEDE calculation, just to give you some perspective, comparing TEDE with whole body/thyroid for this plant.

For thyroid, we have three columns here. First is the existing FSAR. The second is the NRC's SER on this plant, which gives you doses -- that calculates doses somewhat higher than what is in the SER but still below the licensing acceptance limits. Then here is the result with the new source term -- this result being, as before, the release and removal side of the revised source term plus the plant changes.

The TEDE calculation, if you look at the site boundary, we did it -- and this was actually worked on by Westinghouse. There is a zero to two-hour and then a worst two-hour. The TEDE limit -- if you were to use the new Part 50 rule that the NRC issued, or maybe it hasn't been issued yet but is about to, the limit is 25 rem.

So you can see, first of all, that the TEDE dose is maybe 60 percent, something like that, which is not wildly different from what you see here. This is a

little bit higher, but it's not wildly different. And the other thing that's interesting is that the worst two-hour gives you about a 10 percent, maybe a little less than 10 percent, increase in the TEDE dose.

We think this is fairly typical. I would point out that this plant does not hold up the leakage that -- what goes into the containment immediately begins to leak, and that leakage goes directly to the environment, because there is no structure around the containment that collects leakage and filters it, for example. Where there would be a delay, that's part of the reason why you don't see much of a difference between the zero to two-hour and the worst two hours because zero to two hours is almost the worst two hours.

A plant that held leakage up, you would see more of a difference than a five to 10 percent difference that you see here, although you'd see that same difference with the old source term. That's not a function of the source term; that's just a function of the fact that the leakage -- it's a leakage from containment that's held up for some number of minutes. As you slowly pressurize the surrounding structure, you're going to see some delay in terms of the transport off site.

MEMBER KRESS: What do you conclude from these results?

DR. LEAVER: Well, I guess -- let me get to a -- I have a conclusion slide. Let me -- I'll just say it. I think what I would conclude from this, though you cannot conclude this would be true for every plant, it tends to suggest that when you do the whole body and thyroid dose calculation, if you get acceptable results, that you wouldn't expect to see dramatically different results doing the TEDE.

Now, I can't tell you that that will be true for every plant-specific situation, but our experience is that this is generally what we've seen. We saw it for System 80 plus, for example.

MEMBER KRESS: This is justification, then, for your decision not to use the TEDE or --

DR. LEAVER: That's a little bit strong, Tom. I think it gives us confidence, some degree of confidence, that if the regulatory requirement were to be whole body and thyroid as it is today in Part 100, using the revised source term, that that is still going to give you reasonable assurance of adequate safety that if you were to do TEDE doses that you wouldn't expect to see a big difference, and so you can have as a regulatory basis the whole body and thyroid dose.

We are, as I said, probably going to commit to submitting the TEDE dose in addition, but we wouldn't

propose that as a regulatory basis. We don't think you need to do that.

MEMBER KRESS: This is backup information.

DR. LEAVER: Exactly. Backup information. Just to give everybody a warm feeling.

Okay. The Indian Point license amendment was submitted in August of '96.

And the last example I have is Oyster Creek. This one is in progress, and we wanted to mention it, just so you'll be aware that this is work that's being done. The thing that I guess is most different about this application compared to the others -- this is a BWR Mark I, it's an older Mark I than Browns Ferry, but it's still a Mark I -- is that there are safety grade sprays in the drywell. And this I think is the only BWR that I know of anyway that has that.

They are not currently credited for fission product removal, but they are credited for DBA heat removal.

MEMBER POWERS: I think most of the Mark I's have them. Some of them have disconnected them.

DR. LEAVER: Right. But this one we are doing work now in an attempt to model this and take credit for it for fission product removal.

The submittal is planned for the spring of

'97, and the objectives in this case are to satisfy the post-TMI requirement for control room habitability. That's the main driving issue here. They need to demonstrate adequate control room doses, and possibly increase MSIV leakage, although that's -- I don't know whether they're going to be able to do that.

MEMBER POWERS: I'm going to hear what the significance of the last sentence is.

DR. LEAVER: This one?

MEMBER POWERS: Yes. "pH controls not needed. Essentially, no chloride bearing material in containment."

DR. LEAVER: Right.

MEMBER POWERS: What is the connection between one and the other?

DR. LEAVER: The chloride -- maybe I should have been more specific here, but I was just trying to keep the slide brief. The chloride bearing material I'm talking about is chloride bearing electrical insulation cable, and it is -- it turns out it is the main source of acid in an accident. And if you don't have -- if your cable insulation has none of this, the whole pH control issue a lot easier.

MEMBER POWERS: If you're using pH control to prevent iodine partitioning?

DR. LEAVER: Yes.

MEMBER POWERS: How well does that work on organic partitioning in a radiation field?

DR. LEAVER: I'm not sure what your question is. The pH control -- maintaining pH really above about five or six will tend to keep the I-minus that's in the water as I-minus. Okay? That's what is driving us to do pH control. If the I-minus goes to I-zero, then the atomic form of iodine gas will partition, you will get some I2 in the gas base. That can lead not only to leakage of I2, but also to formation of more organic. That process is not well understood.

But in any case, we have -- what we are generally doing in these plants is to demonstrate that we were able to maintain pH above six or seven, so we don't have to do anything different than what is specified in NUREG 1465.

MEMBER POWERS: I think you want to reexamine that whole business, because I think you're wrong on this. I think there are two things that are going against you. First of all, the radiation field obviates a lot of pH effect. Second of all, pH organic iodine can occur, form in solution. It doesn't have to form in the gas phase.

Third of all, it may not be simply a partitioning of iodine from the water into the gas phase, but it, in fact, may be a process whereby you get that

partitioning and then you get subsequent radiation-induced reaction of the volatile iodine to form iodates that behave as aerosol particles. That reaction essentially acts like a pump, and it really doesn't matter what the partitioning coefficient is. That's just controlling the rate of partitioning.

DR. LEAVER: Well, okay. We can talk about that.

MEMBER POWERS: I think it's a whole lot more complicated than just saying, "Well, we need pH6, so we can forget about this."

DR. LEAVER: What we have done is used the information that was in 1465, which was rather general on this subject, and much more detailed information that was in several Oak Ridge reports that were published in the '94/'95 timeframe, to look at the formation of acids and bases during the course of the accident, and to then use that as a basis of looking at what the pH of the sump water would be, and then from that looking at the formation of I-zero and the partitioning of iodine into the gas phase. If there are other effects that are important here, then we should look at them.

MEMBER POWERS: The Oak Ridge reports were quite good, but they represent work that was done substantially before the reports have been published. And

there are a lot of fairly aggressive programs, especially in Europe in this area, and there has just recently been a CSNI specialist meeting on this that shows what some of their codes can do in this area.

I think you would find some of their accident analysis results really quite interesting in this regard.

DR. LEAVER: Okay. We'll definitely look at it. Appreciate the comment.

Okay. Then, by way of conclusion, these four bullets here, I guess part observation, part conclusion. First of all, the revised source term methodology is not a new thing. As I said, we started in the late '80s. We've done a lot of work in the context of ALWRs. Two plants are proceeding to design certification using the revised source term; the System 80 plus, which already has an FDA; and AP600, which is in hot pursuit of an FDA.

Also, we've done a lot of work on this in the context of operating plants. We think that the understanding is getting pretty good. We think that the methodology is more -- really more technically accurate than the existing source term. It is more mechanistic. This does require more up-front effort on the part of the licensing and the NRC, but hopefully not more long-term effort. The up-front effort would pay off, and we think this effort is worthwhile since it puts the whole analysis

on a much sounder basis -- a sounder technical basis, a sounder regulatory basis, can be explained much more readily, what we're doing and why we're doing it.

We think that existing regulations are adequate for application to operating plants. That is, the Part 100 whole body/thyroid still works fine for revised source term. And we think that GDC 19, one could either do whole body or TEDE, as allowed by the regulations, and technically that also is sensible. We think that exemptions -- our opinion is that exemptions need not be required.

And finally, there is a need to expedite NRC reviews on the pilot plant submittals, so that these plant improvements can be realized. And Kurt Cozens is going to expand on that a little bit.

CHAIRMAN FONTANA: Okay. Any --

DR. LEAVER: Unless there are any questions.

CHAIRMAN FONTANA: Do you want to take questions now --

DR. LEAVER: Sure.

CHAIRMAN FONTANA: -- or do you want to wait until later? Any additional questions for Dr. Leaver? I guess not.

One thing that I would like to see at some point is the magnitude of the effect that Dana brought up

-- how --

DR. LEAVER: The effect of the radiation environment on the --

CHAIRMAN FONTANA: Yes. The --

DR. LEAVER: -- iodine?

CHAIRMAN FONTANA: Yes.

DR. LEAVER: I'll have to look at the latest CSNI specialists' meeting --

CHAIRMAN FONTANA: So you know how --

DR. LEAVER: -- results.

CHAIRMAN FONTANA: Yes.

Okay. Thanks.

DR. LEAVER: Okay. Thank you.

MEMBER KRESS: It probably wouldn't make much difference if you used the first two hours.

MEMBER POWERS: It won't make any difference at all. Your iodine timing is well within the -- if you take credit for sprays, then it will make a difference. But if you don't have sprays, then in the first 24 hours your iodine concentrations are totally dominated by aerosol physics.

MEMBER KRESS: That's right.

MEMBER POWERS: Unless you've got something really active within the particles. And in some of these analyses we do have to carry out 30-day dose in which the

iodine is in everything.

MEMBER KRESS: I think that's where it would show up, in the --

MEMBER POWERS: Absolutely. The first -- aerosols just are really important, because they carry such a hugh amount. But I think we just have to be awfully suspicious --

MEMBER KRESS: You have to be awfully concerned about the removal of the charcoal filters being there for other reasons.

MEMBER POWERS: Well, I was going to say I think we have to be suspicious of this pat answer and just keep the pH high.

MEMBER KRESS: Yes.

MEMBER POWERS: Because, quite frankly, we have a really lousy database on radiation chemistry and aqua solution at high pH.

MEMBER KRESS: I'll have to plead conflict of interest on that one.

MEMBER POWERS: There is no conflict of interest on the point of information.

(Laughter.)

CHAIRMAN FONTANA: Dave, I don't know if -- I guess I ought to say at this point that he has jumped on me for the same kind of statement. So that's --

(Laughter.)

DR. LEAVER: Yes. He has jumped on me for things before that --

(Laughter.)

That's why we're here.

MR. COZENS: Can I be heard?

CHAIRMAN FONTANA: Okay. Yes, I think we can hear you.

MR. COZENS: Let me just reintroduce myself. I'm Kurt Cozens with NEI.

You've actually heard most of the punch lines of what I'll be speaking today, but let me kind of summarize some activities that we have done through the NEI task force on revised source term and submitted some recommendations to the NRC staff, as it concerns not so much the technical approach that we're taking to addressing utilization of the revised source term, but the process by which we permit licensees to implement this technology.

You know, we've been working with the NRC staff since about June of 19 -- was it 1994, and although -- as many projects, sometimes progress is slow, sometimes progress is fast. It's really a real concern to licensees about the duration it will take before the industry is able to use this technology that the industry has worked

so hard to develop, that has had a lot of input from industry, and we want to look at that from a perspective of, is there a way that we could expedite utilization of this new technology, the revised source term?

So with that in mind, let me kind of just quickly review what we've heard all day. Basically, that back in October the staff did indeed inform us that definitely rulemaking was going to be necessary. We were pleased to hear that, you know, we're at the point of reconsideration of that decision, and that we're going to use some additional technology to consider that.

Well, after having had this meeting with the NRC, and going through their bases for why the rulemaking would be necessary, the fact that they wanted the TEDE to be used in the maximum release in a two-hour period, that did not really fit within the definition of the existing Part 100, was the basis for the rulemaking. Well, we think there is an alternate approach to thinking about that.

In parallel with some of the work they are planning to do, they wanted to do the baseline, which Rich has discussed already today. And they would do the pilot plant reviews, just as they have talked about them previously. The real catch is the pilot plants would have to be approved via an exemption, a 50.12 exemption I

believe is the -- what the staff is considering.

We think we can avoid having to go through looking at exemptions. Based upon the information we had back in early October, we're talking about a minimum of 12 months to do the baseline and pilot plants evaluation. I'm pleased to see the aggressive schedule the staff is indeed looking at that, you know, but we're still on the same basic order of magnitude. I encourage the staff to pursue the aggressive schedules.

But this is one of the areas that really concerns us. If we go to rulemaking for this, it will be three to five years from today, at least, before we would be able as an industry to take advantage of this new technology. This is a concern, because there is a big gap between these power plants getting approval via exemptions and the rest of the industry being able to use this technology. This is a lot of wasted resources that could be going towards much better use in operating our power plants safely.

So in that light, we developed some thoughts on how could we take advantage of this new technology and submitted a letter to the Acting Director of NRR on October 28th, just a few days ago. This is -- well, I'll call it an alternate approach, but it is really working within the scope of the current regulations.

It addresses the staff's technical concerns, as Dave Leaver has just spoken about. I'm not going to belabor that point too much. It addresses our concerns about having to get exemptions for pilot plants. It does take advantage of something that Dave had on a slide, but I don't think he highlighted it. There is a precedent already for this approach.

The System 80 ALWR approval -- what is it? Design -- what do we call this thing?

MEMBER SEALE: Design certification.

MR. COZENS: Design certification and approval did take advantage of the current regulations as they are presently written on the books. They did do the whole body, the thyroid calculation, as the licensing basis for their analysis. And they also provided for information a TEDE calculation. So the approach that we've been talking about has a very good example of where it has been used before.

So we think that -- we wonder, why is this not possible to be used again? And we don't see that rulemaking is going to enhance or distract from public health and safety. We could still address all of the technical concerns, all of the regulatory concerns, and still maintain public health and safety.

Now, the alternate approach that we're talking

about -- as Dave I think probably even better than I can explain -- basically, it is a parallel set of calculations, doing whole body and thyroid exposure calculations in the zero to two-hour release, thereby demonstrating regulatory compliance.

TEDE would done for information, TEDE calculations and the maximum release in any two hours, to examine the questions that the staff has indeed raised as, should we be certain that we know where this really is? And as Dave had indicated, there may not be a huge difference in these answers. We may be on the same order of magnitude. So that is the approach that we have suggested to the staff in this letter that we have submitted to them.

Furthermore, and I'm going to go over this quickly because Dave has indeed talked to you about it already, it's that GDC 19 and our reading of the regulations does indeed presently permit TEDE. So this would be an option which method the licensee would choose to use. So one could demonstrate compliance with the current regulations as written using TEDE or the whole body/thyroid to demonstrate compliance, and then would indeed submit those to the NRC staff.

So our letter, which we have submitted, has indeed asked the staff to expedite the schedule. We are

concerned about a very long, lengthy period of time. We believe there are is alternate approach demonstrating compliance with the current regulations, and also addressing technical concerns that the staff has raised.

But more important, this would expedite the ability to have plant improvements and also safety enhancements by moving up the time schedule for which this could be done. This would be timely both for NRC and the industry, and it expedites the schedule upon which new technology developed over many years at a great expense can indeed be implemented into the industry.

Let me just pick on this for a little bit more. We did an informal survey of utilities. NEI sent out a request for information about, "Okay, utilities. How many of you are really planning to use the revised source term?" There was an expression of interest. We received responses back from 43 plants. Of those 43 plants, 41 said they were interested in using the revised source term. Admittedly, this is not a commitment to use the revised source term right now, but it is an expression of interest, and they all were pretty much interested in using it in the next year or two.

Again, I can't commit plants by saying this, but there is a high degree of interest in using this new technology. We believe there is benefits from an

operability point of view, from an economic point of view, and from a safety enhancement point of view.

Possibly in the future, at some later date, you know, if we go through this and get into the bandwagon of operating the -- of utilizing the revised source term, we might suggest going to rulemaking to streamline the process, but not to define the process but to use it. You know?

There are things we could do. I'm sure I could comfortably say that licensees would prefer to only have to do one set of calculations versus a parallel set of dual calculations. But if it takes dual calculations to justify what we need to do to show that we're safe to operate, I'm sure in this environment the licensees would indeed be willing to do that.

So possibly some time in the future we may consider, and would indeed support, moving towards a rulemaking to streamline the process.

But just in summary, you know, the benefits of the approach that we're suggesting that was described very well by Dave illustrates regulatory compliance. It addresses the NRC staff's technical concerns. It is a conservative approach. Dave has gone into some of the details of where the conservatives are, and it will permit early plant improvements, including safety enhancements,

to be implemented in a timely fashion and of benefit to all concerned.

Really, this is kind of a cap on the industry's entire presentation. And if you have any questions, I'd be happy to answer them.

CHAIRMAN FONTANA: Okay. Thanks.

Any questions of Mr. Cozens?

MR. COZENS: I might -- if there are no questions, let me just ask one back to the ACRS. We are presently scheduled to make a presentation at the full committee of the ACRS tomorrow. We are, indeed, interested what aspects of our dual presentation you would be interested in hearing about, or if there is a need at all even to present to the full committee.

CHAIRMAN FONTANA: Well, that's what we were going to discuss next.

Did any of the committee members have comments on what should be discussed with the full committee?

MEMBER POWERS: I guess I can't help but wonder if it is premature to expose the full committee to this material and all of the presentations. I think it was very useful information for the subcommittee, and it looks like something that you will want to monitor via the subcommittee as it progresses along.

MEMBER KRESS: As an alternative, Mario, could

you just make a summary report to the full committee?

MEMBER POWERS: I would -- I think that's an excellent suggestion. I thought that the staff presentation gave a good overview to it, so that if you absolutely had to have somebody speak that would be fine. But a summary by Mario might be perfectly adequate at this point.

CHAIRMAN FONTANA: Well, I'm in agreement with the thrust of what all of the speakers said today, really. The question is, if they have a strong feeling, if they would like to -- well, the first question is, is there any need for a letter? I don't think there is, unless someone feels a need for one. Any industry people?

MEMBER POWERS: It strikes me that it's just -- I mean, we've got -- there's nothing to write a letter about yet, because it's all planning.

CHAIRMAN FONTANA: Yes.

MEMBER POWERS: I mean, other than say it looks like a pretty good plan, and most of the items of contention between the staff's original plans and the industry seem to have been resolved.

CHAIRMAN FONTANA: Well, one of the questions that -- one of the questions that I had initially was the need for rulemaking, and it looks like they have converged some on that.

One problem that I've got with rule -- nobody wants to tackle rulemaking, but how do you get rid of outdated rules if no one will ever do it?

MEMBER POWERS: And a larger issue to look at.

(Laughter.)

CHAIRMAN FONTANA: Bigger than both of us, right.

I guess I can get on my standard speech how you're still trying to patch better information on to a relatively deterministic regulatory structure. It would be nice if you could do a full scope PRA and really know what the -- or at least have uncertainty distributions on some of these things and really know where you are relative to -- and know what the level of -- what the margins are and make decisions on that basis. But I think considering where we are now, I think you guys are doing about as good as could be -- as well as could be done.

Well, do you feel I ought to make just a review for the full committee? Or do you think they will listen?

MEMBER KRESS: Yes. I think I share the industry's view. This seems -- you know, as a subcommittee member, I am very well satisfied with what I've heard, and I can't see any need for comments or letters to anybody. Just of a summary of what we've

heard, for information purposes, from you to the full committee, because I think they are on the right track and --

CHAIRMAN FONTANA: Okay.

MEMBER KRESS: -- it's getting there. And if you see anything to give them advice on or to complain about.

MEMBER SEALE: I guess I think it might be interesting as they go through developing their case if they could at some point substantiate the statement that what they propose is, at worst, risk neutral.

MEMBER KRESS: Yes. That's going to be difficult, because a lot of the things they are talking about doing in the way of changes to the plant design don't even show up in this according to my information. So it's hard to tell you -- to say whether it's risk neutral or not.

But, Mario, to qualify what I said before, I think if the continuing discussions between the staff and the industry come down to a point where there is disagreement on whether or not rulemaking is needed or not, then that might be a point where we might want to express an opinion at that time.

CHAIRMAN FONTANA: Okay.

MEMBER KRESS: I think that's a real

significant issue that probably our opinion of it would be worth --

CHAIRMAN FONTANA: We do want to keep track of this issue. I guess Dana suggested doing it through the mechanism of the subcommittee. When do you think might be a good time to have another subcommittee meeting to check progress?

MEMBER SEALE: Well, I think when they have something to say.

MEMBER POWERS: I think that dictates on their progress.

Let me address Bob's question. I found some of the things that Dave Leaver presented from the results of the various applications suggesting that we are very close to this neutral.

MEMBER SEALE: Yes.

MEMBER POWERS: And I really might have to give the people that developed 1465 a round of applause. I didn't figure they came that close.

MEMBER SEALE: Yes. Yes.

CHAIRMAN FONTANA: Does staff have any opinions on when might be a good time for a review? Or do you want to think about it and get with Jit?

MR. EMCH: Rich Emch again. I liked the point -- I forget who said it -- about come back when you have

something to say.

(Laughter.)

And I'm not quite sure that I can tell you what that date will be right now, but that sounds good to me.

CHAIRMAN FONTANA: So Jit will stay in contact, right? Right. Okay.

MEMBER SEALE: And I'll be available to help drive the wagon.

CHAIRMAN FONTANA: Okay.

MR. EMCH: Let me see if I understand this. We will make a presentation, you will present a summary, and we probably will come listen just to see if anything new and exciting happens.

CHAIRMAN FONTANA: Good idea. Okay.

Are we done? Okay.

MR. MILLER: This is Charlie Miller. I'd like to make just one comment for the staff in closing and reflect upon what we've heard here today, just so that no one walks away with any misconception.

My comments aren't meant to try to throw cold water on anything that was said today by any party. But the only caution that I have to be left with as a manager overseeing all of this is that there are several factors, and there are several steps that we are going to go

through as we do our evaluations.

When we talk about debate as to whether rulemaking is needed or not needed, I have to remind everybody that while the industry, the staff, and the ACRS all may formulate an opinion on that, we have to seek counsel from the Office of General Counsel, because we have found that when we had those kinds of discussions sometimes they had a different view than we do on the literal reading of regulations. So I'd just like to make sure that everybody is aware of that.

MEMBER SEALE: And then I think that's why I suggested that if you could validate the claim of risk neutrality, that might influence --

MR. MILLER: And --

MEMBER SEALE: -- their perception of the magnitude of what it is you're trying to do.

MR. MILLER: And I'd like to propose that, you know, at the time that we come back and talk to the subcommittee that we've had an opportunity, based upon our evaluations, to have our discussion, so that when we come here we'd be able to speak --

MEMBER SEALE: Yes.

MR. MILLER: -- one voice.

MEMBER SEALE: good.

MR. MILLER: Secondly, I'd like to make a

comment concerning schedules. Rich has put up what he thought was our best shot at schedules at this point in time, but I have to remind everyone that our schedules are always subject to introduction of higher priority work. The staff is constantly reevaluating schedules, especially when safety significant issues come up that we are heretofore unaware of, and we get those every day.

I'll just use the example of the things that have gone over the past year or year and a half with regard to some of the plants in the northeast and how much of the time that that occupies of the staff. So I'm obligated to say that we have to factor all of the priorities together and balance this effort versus the other efforts that we're doing. Nevertheless, we plan on, you know, devoting considerable resources and continuing to try to do this to try to accommodate the schedules.

CHAIRMAN FONTANA: Yes. Of course, NEI did ask for as high a priority as you could reasonably --

MR. MILLER: Yes. Yes.

CHAIRMAN FONTANA: Okay.

MR. MILLER: Thank you.

CHAIRMAN FONTANA: Any additional comments? If not, the meeting is adjourned.

(Whereupon, at 4:07 p.m., the proceedings in the foregoing matter were adjourned.)

C E R T I F I C A T E

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: ACRS
SEVERE ACCIDENTS SUBCOMMITTEE

Docket Number: N/A

Place of Proceeding: ROCKVILLE, MARYLAND

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.

Irene Gray

IRENE GRAY
Official Reporter
Neal R. Gross and Co., Inc.

1

INTRODUCTORY STATEMENT BY THE CHAIRMAN OF THE
SEVERE ACCIDENTS SUBCOMMITTEE
11545 ROCKVILLE PIKE, ROOM T-2B3
ROCKVILLE, MARYLAND
NOVEMBER 6, 1996

The meeting will now come to order. This is a meeting of the ACRS Subcommittee on Severe Accidents.

I am Mario Fontana, Chairman of the Subcommittee.

The ACRS Members in attendance are:

George Apostolakis, Thomas Kress, Dana Powers, and Robert Seale.

The purpose of this meeting is to gather information on the proposed SECY Paper concerning the approval of license applications using a revised source term at operating reactors. The Subcommittee will hear from representatives of the NRC staff, the Nuclear Energy Institute (NEI), and Entergy Operations, Inc. concerning this issue.

Amarjit "Jit" Singh is the Cognizant ACRS Staff Engineer for this meeting.

The rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the Federal Register on October 21, 1996.

A transcript of the meeting is being kept and will be made available as stated in the Federal Register Notice. It is requested that the speakers first identify themselves and speak with sufficient clarity and volume so that they can be readily heard.

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

(Chairman's Comments-if any)

We will proceed with the meeting and I call upon Mr. Emch of NRR to begin.

ACRS Briefing

Staff's Plans for Implementation of the Revised Accident Source Term at Operating Power Plants

R. Emch/DRPM-NRR

Background

- **Final NUREG-1465 Issued in February 1995**
- **NEI Generic Framework Document Submitted to NRC for Review in November 1995**
- **NRC/NEI Meetings Held in October 1994, June 1995, October 1995, January 1996, and October 1996**
- **CRGR Briefing in October 1996**
- **Commission Paper Due November 1996**

Summary of Staff's Review of NEI's GFD

- **Objective is to Establish a Generic Methodology for Applying Revised Source Term at Operating Plants**

- **Plant Changes Classified in Four Groups**

- **Generic Framework Based on Four Principles**

Summary of Staff's Review of NEI's GFD (continued)

- **Four Groups of Plant Changes Desired**
  - **Allowable Leak Rate Changes**
  - **Isolation Valve Timing Changes**
  - **Filtration Unit Simplification**
  - **Mitigation System Actuation Timing**

Summary of Staff's Review of GFD
(continued)

- **Four Principles of GFD**

  - **Principle 1: Existing Licensing Basis is Acceptable**

    -- **backfitting not required**

  - **Principle 2: Complete Implementation of New Source Term as Substitute for Existing Licensing Basis is Acceptable**

    -- **integrated assessment needed**

    -- **removal of accident mitigation hardware**

Summary of Staff's Review of GFD
(continued)

- **Principle 3: Selective Implementation of Revised Source Term is Acceptable**

  -- **timing-only applications**

  -- **if dose calculations are necessary, use of entire revised source term needed**

- **Principle 4: Dose Calculations Based on Existing Methods and Limits is Acceptable**

  -- **new analytical framework including TEDE and *any* 2-hour dose evaluation period may be necessary**

Analytical Framework

- **Part 100 does not require a specific source term, but designed for TID-14844**

- **Current framework**
  - **TID-14844 source term (1962)**
  - **first 2-hour dose evaluation period**
  - **separate whole body and thyroid dose criteria**

Analytical Framework
(continued)

- **Revised Parts 50 and 100 designed for revised source term**

- **Framework developed for advanced LWRs**
  - **NUREG-1465 source term**
  - ***any* worst 2-hour dose evaluation period**
  - **Total Effective Dose Equivalent dose criteria**

Possible Need for Rulemaking and Exemptions

- **Phased timing of revised source term**
- **Existing Part 100 requires dose evaluations for 2 hours immediately following onset of release**

* * *

- **Additional radionuclides in revised source term**
- **Existing Part 100 requires evaluation of whole body and thyroid doses**

Rebaselining

- Evaluate BWR (Grand Gulf) and PWR (Surry) from NUREG-1150
- Calculate DBA dose consequences using revised source term
- Perform sensitivity studies to provide information on implementation issues
- Scope other potential design and licensing basis impacts of possible design changes
- Assess severe accident impacts of possible design changes

Rebaselining Sensitivity Studies

- Current plant design
- Effects of possible design changes
- Importance of *first* vs *worst* 2-hour dose evaluation period
- Importance of whole body/thyroid dose calculation methodology vs Total Effective Dose Equivalent methodology

Pilot Plants

- Browns Ferry (BWR)
- Grand Gulf (BWR)
- Indian Point-2 (PWR)
- Perry (BWR)
- Oyster Creek (BWR)

Staff Plans

- Send letter to NEI
- Perform rebaselining analysis
- Begin review of pilot plants
- Determine whether rulemaking and exemptions are necessary
- Begin rulemaking process (if needed)

Staff Plans
(continued)

- Complete review of pilot plants and issue license amendment (and exemptions if needed)
- Prepare generic letters (if exemptions are not needed)
- Complete rulemaking (if needed)
- Review follow-on applications

Schedule

- **Complete rebaselining and decisions on need for rulemaking and exemptions**

  - Mid 1997

- **Complete pilot plant reviews**

  - Late 1997

Entergy Viewpoint on Revised Source Term Implementation

ACRS Meetings

November 6 & 7, 1996

Sheri Mahoney
Entergy Operations, Inc.
and Gulf Nuclear Station

Overview

- There are changes that are beneficial to plant safety that cannot be made without implementing the revised source term (RST)
- Rulemaking is not necessary - lengthy delay due to process while current regulatory structure (SRP, Regulatory Guide, 10CFR50.59) already provides a path to implement the RST
- Rebaselining should be performed but scope of the project should be limited
- NUREG-1465 implementation should not be delayed any longer and should be a high priority

Safety Improvement Examples

- Elimination of the automatic isolation function of selected primary and secondary containment penetrations
  - Penetrations do not communicate directly with a contaminated atmosphere
  - Penetrations would be remote manually isolated from the control room as plant conditions dictate
  - Provides a net safety benefit through reduced core damage frequency (IPE insight)

- Relaxation of the general automatic containment isolation valve closure times
  - Current stringent closure times add unnecessary stress to plant components
  - Re-gearing valve actuators to allow for slower stroke times reduces component stresses and ESF electrical bus loads

Does 10CFR100 Require a Change?

- NRC desire for rulemaking is driven by a narrow interpretation of 10CFR100.11 which states:
  - "...for two hours immediately following onset of the postulated fission product release..." - (2-hour sliding window)
  - "...a total radiation dose to the whole body in excess of 25 rem or a total radiation dose in excess of 300 rem to the thyroid from iodine exposure" - (use of TEDE)
- We believe we can address additional requirements (2-hour sliding window, TEDE) within the current rules

Current Regulatory Structure (SRP/RG/10CFR50.59)

- SRP/RG:
  - provide guidance on current methods
  - require acceptance criteria for particular changes as a fraction of 10CFR100 limits
  - can be revised to allow an option to use the RST, including TEDE and 2-hour sliding window
- 10CFR50.59:
  - Licensees are committed in their license basis to use TID source term in dose calculations
  - The commitments, not regulations, tie us to TID source term
  - Commitments and license basis are changed through 10CFR50.59 evaluation
- Implementation of RST in this manner is consistent with current practice

Use of Rebaselining

- NUREG-1465 does not provide all the method and assumption details necessary to perform acceptable dose calculations; however, the EPRI Framework Document provides important details

- Rebaselining is a means for NRC to validate and improve these details and to develop SRP guidance

- Scope of rebaselining effort should be limited to
  - establishing acceptable analytical methods and assumptions
  - improving overall understanding of the effects of implementing the RST
  - another "research project" should be avoided

Conclusion

In order to achieve safety benefit without undue delay, we request the ACRS to endorse early implementation of RST through 10CFR50.59

54

EPRI/NPG

Revised Design Basis Accident Source Term Methodology and Applications

Presented to Advisory Committee on Reactor Safeguards

Dr. David E. Leaver
Mr. James Metcalf
Polestar Applied Technology, Inc.

November 6, 1996

EPRI/NPG

Revised DBA Source Term Topics for Discussion

- Development of Revised DBA Source Term
- EPRI/NEI Framework Document on Revised Source Term for Operating Plants
- Examples of Pilot Plant Applications - Browns Ferry, Perry, Indian Point 2, Oyster Creek

EPRI/NPG

Development of Revised DBA Source Term

- The ALWR Program (utilities, EPRI, DOE-ARSAP) initiated effort in 1989
- In 1991, industry submitted to NRC two reports on a revised source term for ALWR application along with associated changes to the ALWR Utility Requirements Document
- NRC published draft NUREG 1465 in June, 1992, and final in 1995
- NRC letters of July 27, 1994 and September 6, 1994 indicated that the revised source term could be applied to operating plants
- EPRI/NEI framework document submitted to NRC in 1995
- Three pilot plant applications submitted in 1996 (and several more expected in 1997)

Safety&Reliability Assessment Target

EPRI/NPG

Status of Framework Document

- Objectives
  - + To support licensee efforts to apply the revised source term to achieve safe, cost beneficial changes to operating plants
  - + To provide licensees with a consistent approach for implementation of the revised source term
  - + To obtain NRC staff acceptance of this generic approach for implementation
- Consideration is being given by industry to updating the framework document to reflect recent meetings with NRC staff, experience gained from recent plant specific applications, and NRC staff written comments expected in November

Safety&Reliability Assessment Target

EPRI/NPG

Updated Framework Document - Fundamental Principles

Principle 1 (same as existing)
Continued use of the existing design basis source term for operating plants is acceptable (i.e., no backfitting of the source term is necessary).

Principle 2: (same as existing)
Application of the revised source term as a substitute for the existing design basis source term is acceptable based on implementation of NUREG 1465 and on maintaining adequate regulatory margin of safety.

Principle 3: (same as existing - staff comments will be considered)
Selective implementation of some, but not all, aspects of the revised source term is acceptable based on adequate technical justification.

Principle 4: (modified - under consideration)
In applying the revised source term, whole body and thyroid dose calculation using existing Part 100 regulatory limits is required by regulation. Total effective dose equivalent (TEDE) calculation using the maximum 2 hour interval and dose limits in the new Part 50 rule for advanced plants should also be provided.

Principle 5: (new - under consideration)
In applying the revised source term, the existing GDC 19 requirement for control room dose can be met either by calculating whole body (5 rem) and its equivalent to other parts of the body, or by calculating TEDE (5 rem).

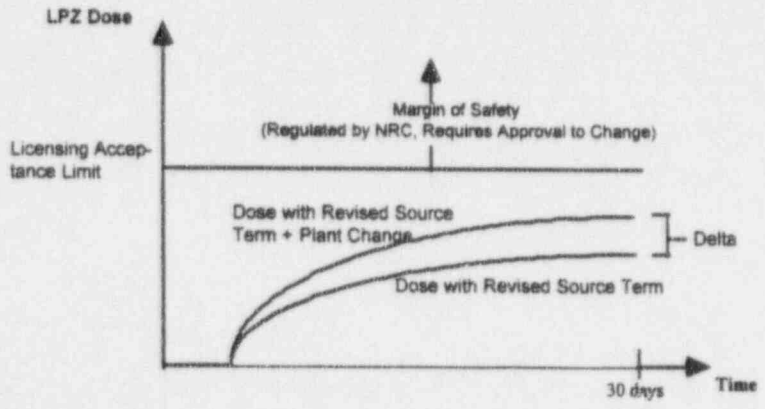
Principle 6: (new - under consideration)
In applying the revised source term, consideration should be given to the integrated safety impact of the aspects of the plant licensing basis affected by the revised source term application with associated plant changes.

DEL 9/98 6

Safety&Reliability Assessment Target

EPRI/NPG

Principle 2 - Illustration of Margin of Safety



DEL 9/98 6

Safety&Reliability Assessment Target

EPRI/NPG

Principle 4 - Existing Part 100 Dose and TEDE

- Existing Part 100 requirement for whole body and thyroid doses is adequate for safety and can be used with the revised source term
- For operating plants, whole body and thyroid doses under Part 100 are expected to be of the same order as TEDE in terms of fraction of the licensing acceptance limit
- Consideration is being given by industry to changing the framework document to provide a parallel offsite TEDE calculation - System 80+ precedent

DEL 9/98 7

Safety&Reliability Assessment Target

EPRI/NPG

Principle 5 - Existing GDC 19

- GDC 19 states that control room doses should not exceed "5 rem whole body, or its equivalent to any part of the body, for the duration of the accident."
- This is interpreted in SRP 6.4 to be 5 rem whole body, 30 rem thyroid, and 30 rem beta skin over 30 days.
- An equally valid approach under GDC 19 would be to calculate TEDE since it includes the whole body component and addresses an even more comprehensive set of organs
- On this basis, TEDE is an acceptable alternative to the existing SRP dose calculation

DEL 9/98 8

Safety&Reliability Assessment Target

EPRI/NPG

Updated Framework Document - Methodology

- For release, utilize NUREG 1465 for timing, chemical form, and release magnitude, or justify alternative.
- Removal methodology is addressed generically with the main focus on airborne aerosol removal, i.e., containment spray, natural removal in BWR drywell and main steam lines, and BWR pool scrubbing.
- Removal methodology is intended to be reasonably conservative such that, when combined with the NUREG 1465 releases and the conservative DBA meteorology and existing licensing acceptance limits, an overall level of conservatism comparable to existing DBA dose analyses is maintained.

EPRI/NPG

Examples of Completed Applications - Browns Ferry

- Used NUREG 1465 release, timing, and chemical form
- Followed industry framework document in areas not fully covered in NUREG 1465
  - Drywell natural removal
  - Limited suppression pool scrubbing
  - Main steam line aerosol retention
  - More current thyroid dose conversion factors
  - Existing Part 100 (WB and thyroid) dose calculation for EAB and LPZ
- Plant changes which were evaluated:
  - Increased MSIV leakage (100 scfh per line, 250 scfh total)
  - Fission product holdup and retention in main steam lines and main condenser (main condenser made seismic)
  - No credit taken for reactor building SGTS charcoal
  - No credit taken for control room emergency ventilation system (CREVS) charcoal
- pH control is planned and is under evaluation

EPRI/NPG

Browns Ferry Dose Results

	Thyroid Dose (rem)	
	Existing ST	Revised ST
Control Room	18	17.9
EAB	low	3.2
LPZ	low	5.8

Browns Ferry licensing amendment submitted to NRC for approval in January, 1996

DEL 9/96 11

Safety&Reliability Assessment Target

EPRI/NPG

Example of Completed Applications - Perry Plant

- Used NUREG 1465 release timing, and chemical form
- Followed industry framework document
  - + Drywell natural removal (deposition and sweepout)
  - + Containment aerosol spray removal
  - + Main steam line (MSL) aerosol retention
  - + More current thyroid dose conversion factors
  - + WB and thyroid dose calculation
- Plant changes factored into the analysis:
  - + Elimination of main steam isolation valve (MSIV) leakage control system
  - + Increased allowable MSIV leakage (100 scfh per line, 250 total)
  - + Aerosol retention in MSL (to third isolation valve only - no condenser credit)
  - + No credit for annulus charcoal filter
  - + Delay in control room recirculation
  - + Reduced credit for control room charcoal
  - + Increased allowable ESF leakage and containment bypass leakage
- pH control (with sodium pentaborate) is under evaluation

DEL 9/96 12

Safety&Reliability Assessment Target

EPRI/NPG

Perry Dose Results

	Thyroid Dose (rem)	
	Existing ST	Revised ST
Control Room	29.1	16.2
EAB	141	157.9
LPZ	145	130.3

Perry licensing amendment submitted to NRC for approval in August, 1996

EPRI/NPG

Examples of Completed Applications - Indian Point 2

- Used NUREG-1465 gap fractions, core melt release fractions, core damage release timing, and iodine chemical form
- Followed industry framework document and SRP in areas not fully covered in NUREG 1465
  - Used SRP spray removal model
  - Increased gap release fraction by 20% for accidents where long term cooling is maintained to account for high burnup effects
  - Used more current thyroid dose conversion factors
  - Calculated both WB/thyroid dose and TEDE dose
- Plant design changes which were included in the revised LOCA dose evaluation
  - Removal of post-accident in-containment filters (HEPA and charcoal)
  - Elimination of spray additive (includes plant change to achieve pH adjustment by trisodium phosphate in baskets)
  - Control room ventilation system modified to pressurize the control room

EPRI/NPG

Indian Point Dose Results

Thyroid Doses (using current dose acceptance criteria)

	Existing Analysis		Analysis with
	FSAR	SER	New Source Term
Site Boundary	116 rem	180 rem	224 rem
LPZ	248 rem	270 rem	147 rem
CR	high	high	24 rem

Total Effective Dose Equivalent (using revised dose acceptance criteria in 10CFR50.34)

Site Boundary (0-2 hr)	13.4 rem TEDE
Site Boundary (worst 2 hr)	14.6 rem TEDE

IP 2 license amendment was submitted for NRC approval in August, 1996

DEL 9/96 18

Safety&Reliability Assessment Target

EPRI/NPG

Example of Application in Progress - Oyster Creek

- Using NUREG 1465 release, timing, and chemical form
- Following industry framework document in areas not fully covered in NUREG 1465
  - Drywell spray removal
  - Limited suppression pool scrubbing
  - Main steam line aerosol retention
  - WB and thyroid reported for Part 100; TEDE to be reported as well
- Submittal planned for March 1997
- Objectives
  - Satisfy NUREG-0737 requirement III.D.3.4 (CR Habitability)
  - Possible increase in allowable MSIV leakage (based on results)
- pH control may not be needed (essentially no chloride bearing material in containment)

DEL 9/96 19

Safety&Reliability Assessment Target

EPRI/NPG

Conclusions and Observations

- The revised source term methodology has evolved considerably as part of the ALWR effort and subsequent application to operating plants
- The methodology is more technically accurate (i.e., mechanistic) than the existing source term; while this requires more up front licensee effort and NRC staff effort for review, this up front effort is worthwhile since it puts the source term analysis on a sounder basis
- Existing regulations are adequate for application to operating plants; exemptions are not required
- There is a need to expedite NRC reviews of pilot plant submittals

#5

IMPLEMENTATION OF THE REVISED SOURCE TERM

Presented to the

Advisory Committee on Reactor Safeguards

By

Kurt Cozens

NEI

November 6, 1996

NRC STAFF STATEMENTS
OCTOBER 2, 1996

- Rulemaking required
  - Use TEDE and calculate maximum release in "any" two hour period
  - Technical positions differ from 10 CFR Part 100 requirements
- Pilot plant applications will be reviewed in parallel with NRC baseline studies
  - Successful pilot plant applications to be enacted via exemptions
- Schedule -- Approximate
  - Baseline and pilot plant evaluations
    - » 12 months minimum
  - Rulemaking to be initiated after completion of baseline studies and pilot plant reviews
    - » 3 to 5 years

APPROACH WITHOUT RULEMAKING

- NEI letter sent to Acting Director, NRR on October 28, 1996
- Request use of alternate approach which does not require rulemaking
  - Addresses NRC technical concerns and complies with current regulations
  - Pilot plant exemptions not required
  - System 80+ precedent
  - Rulemaking is not needed to maintain public safety
- Perform parallel calculations for Part 100
  - Whole body and thyroid; 0 - 2 hour release
    - » Regulatory compliance
  - TEDE and maximum release in "any" two hours
    - » Technical information

APPROACH WITHOUT RULEMAKING(continued)

- GDC 19 allows use of either whole body/thyroid or TEDE
  - "5 rem whole body, or its equivalent to any part of the whole body"
  - TEDE considers whole body exposure and equivalent exposure to other parts of the body in a single summation
  - Licensees should select the method and will submit results that demonstrate regulatory compliance.
- Encourage NRC staff to expedite schedule
  - Plant improvements, safety enhancements
  - Timely for both NRC and industry
  - New technology application
- A future rulemaking could be developed to:
  - Streamline the revised source term implementation process

NEI

BENEFITS OF ALTERNATE APPROACH

- Demonstrates regulatory compliance
- Addresses NRC staff technical concerns
- It is a conservative approach
- Permits early plant improvements including safety enhancements