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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

499th MEETING, DAY 2

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THURSDAY, FEBRUARY 6, 2003

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ROCKVILLE, MARYLAND

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The Committee met at the NRC, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 8:30 a.m., Dr. Mario V. Bonaca, Chairman, presiding.

COMMITTEE MEMBERS PRESENT:

MARIO V. BONACA	Chairman
GEORGE E. APOSTOLAKIS	Member
F. PETER FORD	Member
THOMAS S. KRESS	Member
GRAHAM M. LEITCH	Member
DANA A. POWERS	Member
VICTOR H RANSOM	Member
STEPHEN L. ROSEN	Member
WILLIAM J. SHACK	Member
JOHN D. SIEBER	Member
GRAHAM B. WALLIS	Member

ACRS STAFF PRESENT:

JOHN T. LARKINS Director

SHER BAHADUR Associate Director

SAM DURAISWAMY Technical Assistant

HOWARD J. LARSON Special Assistant

TIMOTHY KOBETZ

ALSO PRESENT:

CHRISTINA E. ANTONESCU

RALPH E. ARCHITZEL

MARK CUNNNINGHAM

RANI FRANOVICH

ROBERT L. GILL, JR.

ED HACKETT

GARY M. HOLAHAN

BP JAIN

ALAN KOLACZKOWSKI

KOFI KORSAH

PT KUO

JOHN LEHNING

GREGORY D. ROBISON

NATHAN SIU

SUNIL WEERAKKODY

RICHARD T. WOOD

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

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

(8:32 a.m.)

CHAIRMAN BONACA: The meeting will come to order.

This is the first day of the 499th meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting, the committee will consider the following: Catawba-McGuire license renewal application; draft regulatory guide DG-1107; water sources for long-term recirculation cooling following a loss of coolant accident; and draft generic letter 2003-XX, related to the resolution of GSI-191; assessment of debris accumulation on PWR sump performance.

Three, PTS reevaluation project; technical basis for potential revision to PTS screening criterion; draft final version of regulatory guide DG-1077, guidelines for environmental qualification of microprocessor based equipment important to safety in nuclear power plants.

And finally, proposed ACRS reports.

This meeting is being conducted in accordance with the provisions of the Federal

Advisory Committee Act. Dr. Larkins is the designated federal official for the initial portion of the meeting.

We have received written comments from Mr. William Horin of Winston & Strawn, counsel to Nuclear Utility Group on equipment qualification regarding draft regulatory guide DG-1077.

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

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

We do not have in front of us any item of interest yet. So I'll announce that when we get that.

With that, we will start with the first presentations on our agenda. That's the Catawba and McGuire license renewal application.

We met as a subcommittee for this license renewal application on October 8, 2002. At that time the SER came to us with the 41 open items, and by the time we got into the meeting, I believe the open items were reduced to only 11.

Since that time, those open items have been resolved. The final SER with all closed items came to us on January 6th, 2003, and I believe we are ready to hear from the staff and the applicant.

And so I will turn to Dr. PT Kuo for the presentation.

I would like to just be aware of the time restrictions. We have many items on our agendas. You have time scheduled until 10:15 a.m., and I believe the applicant is pretty anxious to go to the presentation and beat the snow storm.

(Laughter.)

CHAIRMAN BONACA: So that would be an incentive for us to stay on schedule.

MEMBER POWERS: So we can really ask a lot of questions here and stretch this one out a little bit for these guys.

CHAIRMAN BONACA: All right, okay.

MEMBER SIEBER: Mr. Chairman, I'd like to point out that I must recuse myself due to conflict of interest from the Duke Energy situation.

PARTICIPANT: Thank you.

CHAIRMAN BONACA: So noted.

With that, Dr. Kuo.

DR. KUO: Thank you.

Good morning. We will try to keep the schedule as much as we can.

CHAIRMAN BONACA: Yes, sure.

DR. KUO: The presentation will be pretty brief.

My name is PT Kuo, the Program Director for the License Renewal and Environmental Impacts Program. With me on my right is Rani Franovich. She is the Safety Project Manager for the review of the McGuire-Catawba license renewal application. She will be leading the staff presentation today, with the support from the technical reviewers.

In addition to those who will be sitting in from at the table with her, we will also have the key tech. reviewers sitting in the audience and ready to answer any questions you may have.

As, Dr. Bonaca, you pointed out, at the last subcommittee meeting we had about 11 open items, and since we have resolved all the open items, and Ms. Franovich will be briefing the committee on most of these open items.

I would also want to point out that in response to your comment in previous meetings on the commitment list, Duke has submitted a commitment list to the staff for review. The staff has since reviewed, verified, and included the list in the SER.

In the previous meetings I have also informed the committee that the staff was in the process of finalizing inspection procedure post renewal inspection procedure. That is IPE 71003.

We have since finalized the issue, dated December 9th, 2002. I believe you all have a copy in front of you.

With that, if you don't have any questions, I will turn the briefing over to Duke followed by the staff presentation.

CHAIRMAN BONACA: One thing I would like to just note, that in fact the commitment list attached to the SER, it's the first time we've seen that. That's extremely useful.

DR. KUO: Great.

CHAIRMAN BONACA: And I think it would be desirable to see that in every SER to follow.

DR. KUO: Thank you.

CHAIRMAN BONACA: Thank you.

MR. ROBISON: Good morning. Thank you, first, for the opportunity to come and speak this morning.

My name is Greg Robison. I'm the Project Manager for License Renewal at Duke Energy. With me today is Bob Gill, our licensing lead for license renewal. Bob and I have been doing this a long time, and we're very glad to get to this day and glad to be back with you again.

Later this morning, as Rani presents detailed technical information about several of the open items, we'll have a chance to dialogue on those items. What we thought we would do for the Duke presentation is do a small bit of background and then tell you where we're going in the future and give you a little bit of a feel for how we plan to manage the commitments you just spoke of into the future and how we're preparing for those things today so that we'll be ready for them tomorrow.

I begin with my typical pictures of our power plants. It's always good for visual folks to realize these are on beautiful lakes there in the Carolinas. On the left side is McGuire. It's north of Charlotte, North Carolina, on Lake Norman. Lake Catawba is on the right, and it's on Lake Wylie south Charlotte.

The next page for those who like details is a little bit of the stats of the plant. They are four sister units, four Westinghouse plants, construction finished in the '80s, employ about 2,200 people combined between the two sites. So we're real pleased with the plants. They're running very well, and I'm glad we can take them through license renewal.

Go on to five.

All right. I guess the first thing to point out on the application background, and Dr. Powers and I were talking about this just a moment ago, is we took the same team that we used out of Oconee and we continued them on into McGuire-Catawba. So we had a good, solid core of experience as we began the McGuire and Catawba license renewal process.

We did ask for and receive approval of an exemption request for the 20 year requirements because Catawba -- McGuire Unit 2 and Catawba 1 and 2 were younger than 20 years, and collectively, again, the four sister units, we felt like we had a good operating experience and could proceed with renewal.

We submitted the application June of 2001. The site supplemental environmental impact statements were issued December of 2002. SER, as was mentioned, was issued in January of 2003, and the safety and environmental reviews, the details of them in themselves covered a review period of 60 years.

Going forward, we had planned to go ahead and implement the UFSAR supplement at the next UFSAR update, go ahead an incorporate it. It is Chapter 18 of our UFSAR. We've trained the site, both sites completely on this. They're aware that it's there. They're aware of their responsibilities.

We wanted to make it as normal a part of the UFSAR, nothing extraordinary, nothing that would be out of the norm. So it's right there in the book or right there in the electronic file with the other parts of the UFSAR.

Currently we have completed our training. We're going through the process of marking up procedures and implementing things in the plant. We'll take a good portion of the remainder of this year post approval to complete those procedure updates, and then we will be up and running and be able to manage the commitments from there.

We have put in place plans to evaluate

plant changes as time goes on, and Bob is going to present the details of some of that.

And then as to the future, we'll maintain the records to support future assessments by our in-house team and also any further NRC inspections that may come along in order to validate the commitments that are being managed or the one-times that are being taken care of as we move into the renewal period.

So that's a little bit of background on where we are, how we got to today, and Bob is going to give you the next level of detail from here.

MEMBER LEITCH: Greg, you mentioned training. Could you say just a word about the scope of the training necessitated by this license renewal effort?

MR. ROBISON: Well, there are really two levels for the training. The first was to create an awareness that this new commitment set was there. We've spent about ten years at Duke creating an awareness that aging management is important. It's not just creating a program that a bunch of specialists run, but creating an understanding by the whole work force that as the plant ages we're all responsible for managing aging.

Well, the license renewal led to a set of specific commitments. So the training was to help them understand now we've gone publicly and committed to certain activities and details of those activities, and we wanted to train them on that.

In addition, we wanted to train them on the process that we had put in place or were putting in place to maintain those commitments.

So we packaged all of that in a -- how long was the training program, Bob?

MR. GILL: Several months last summer.

MR. ROBISON: Hours?

MR. GILL: A couple hours.

MR. ROBISON: And we took all of the key staff at both of the sites and our general office through this training.

MEMBER LEITCH: Okay. Thank you.

MR. GILL: Okay. I'm going to go into a little bit more detail on what Greg has mentioned.

Early this last month I, in fact, sent the FSAR supplements to each site so that we'd start getting in the process to make an amendment or an update to the FSAR. Each FSAR is updated periodically six months after the Unit 2 outage, not to exceed two years.

So within the next couple of years we'll have updates with Chapter 18 already in the SAR.

So the plants are going through their formal review process to assure that all of the owners of those sections are aware what the commitments are and start taking ownership of the programs we have.

We've created several documents, and I'm going to go through these to help implement the commitments in the plant. The first one is this plant specific turnover specification, or Spec 16, and that specifically identifies the detailed changes to each and every procedure that is needed to implement the commitments. These could be plant procedures, inspection modules, surveillance procedures, that type of things, maintenance work orders, work orders where a craftsperson would go down and perhaps look at a strainer or the inside of a pump or something along those lines.

Certain hardware, aging management programs, such as the flow accelerated corrosion program or the fluid leak management. Each one is going to be annotated to indicate that it is now a license renewal commitment to do that.

There's also other documents we had

called engineering support programs which will also indicate that this is a license renewal related item.

The Spec 16 also includes something that we call inspection monitoring plans for future inspection activities, and if you'll turn in your handouts, you'll see a copy of the page. I don't have it as an overhead, but this is a copy of the page that we have for the pressurizer spray head examination.

This is right out of Spec 16. This is the typical format for each and every one of the programs that we've credited, and it has a title. It lists all of the references that we have for it, including the FSAR section where it is further described in detail, and in this case it's 18.2.20. It refers to the SER section. It will refer to where it came from in the application, and in this case it was really a response to a request for additional information from the staff.

There's also a Spec 05 which has even more detail in programs and inspection activities. So we have a reference there, and then any other piece of correspondence that we might have. In this case it was response to a particular open item.

This is something that the plant --

CHAIRMAN BONACA: I thought you had that changed for VT-1 inspections.

MR. GILL: Yes, this was the one to go from VT-3 to VT-1. So that was an open item we had. So you're exactly right, Dr. Bonaca.

CHAIRMAN BONACA: Okay.

MR. GILL: So there's a brief description of what the program is, the activity, and then you see we have internal milestones.

Dr. Kress?

MEMBER KRESS: I didn't want to dwell on the details of this, but I was just reading it, and if you go in with a visual inspection, how do you find thermal embrittlement?

MR. GILL: You find the results of that which could be cracking, and that's why --

MEMBER KRESS: You're looking for cracks?

MR. GILL: You're looking for cracks really.

MEMBER SHACK: Well, why does it say initially VT-3 and then you do a VT-1?

MR. GILL: Well, a VT-3 is just a little further away. It should be a VT-1. I think if you go down further we've got a VT-1.

MEMBER SHACK: That's what caught my eye.

MR. GILL: Yeah. We'll fix that in the next revision.

CHAIRMAN BONACA: Originally it was VT-3.

MR. GILL: It was VT-3.

CHAIRMAN BONACA: -- to a VT-1 because of the --

MR. GILL: And this may be -- one of the reasons that is uncontrolled is it's still in review, and we'll make sure that change gets in before the next revision comes out.

The main point here is you see the milestones in the future, and we've incorporated the fact that we've committed to look at Unit 1 specifically, and then if necessary look at Unit 2, and then from there possibly Catawba, and Catawba would have a similar chart on that.

So there is a synergy between the two Westinghouse plants.

I also want to point out we've already committed to look at the Oconee pressurizer spray heads, which will occur much earlier than this, and so there may be some lessons learned as we have there. It's the same type of material, but it's a different design.

So we're not quite sure what we're going to find when we go in there, but I had --

CHAIRMAN BONACA: At Oconee you're looking only at Oconee 1 or all repressurized? I can't remember.

MR. GILL: I think it's just Oconee 1, and then from there we decide.

CHAIRMAN BONACA: Oconee 1, okay.

MR. GILL: It's a spray head design, and so it's got fine holes. It's spherical shape. I asked the question at McGuire when I was doing some management training, information exchange, and nobody at the site today has ever seen what the pressurizer spray head looks like. They've never looked into it.

MR. ROBISON: We actually talked to the manufacturer in the process of digging out this information. It's got an interesting design to it that's different than the Oconee design, and of course, this brings up a good point about the one time inspections.

They were never geared to go find aging

that we thought was occurring.

CHAIRMAN BONACA: Right.

MR. ROBISON: They were geared to deal with those doubts when we did not really feel like we had an aging problem. We just absolutely couldn't be sure. So we wanted to go look again. We want to be conservative as we look to run the units many more years.

So this was another one of those opportunities to take a look.

MR. GILL: But it is cast all in stainless steel and certainly thermal embrittlement with the temperatures and cycles and all of that.

So anyway, that's typically what a Spec 16 program description would be. They are signed off by all of the program owners and who created it. So there is some ownership that would occur there, and this is what we have in the interim used to get all of our plants' procedures going.

This one has no current plant procedures, but I'll get into what we do for preparing for long-term inspections in the next set of overheads.

Anymore questions on this phase?

CHAIRMAN BONACA: And the last

commitment --

MR. GILL: This is more sort term.

CHAIRMAN BONACA: The last commitment you have is develop dramatic oversight. So prior to entering the renewal period --

MR. GILL: That's correct.

CHAIRMAN BONACA: -- you will have it.

MR. GILL: If there's a need for periodic inspections --

CHAIRMAN BONACA: Exactly.

MR. GILL: -- or whatever, we would have that in place prior to entering the period of extended operation.

CHAIRMAN BONACA: Okay. Good.

MR. GILL: That's correct.

We feel that commitments made for license renewal must be maintained obviously, particularly pursuant to 5437(b), and that changes to the FSAR commitments are going to be made by the existing 5059 program.

The concern is how do you make sure that happens in the future when you have new people perhaps 15 or 20 years from now trying to manage these commitments that one has.

What we're created are we did a lot of

brainstorming over the past couple of years of how can you actually change the plant and perhaps impact a commitment you've made for license renewal, and through a lot of iterative processes we came down to you can physically modify the plant to add or delete something that might change the commitment. You can make operational changes to the plant that may change ambient conditions that are worked there. It may change a flow path, a few open valves that were isolated for some reason.

In fact, we had that at Oconee where some heat exchangers were valved in when we had them valved out when we did the initial review.

You can also have current licensing bases changed by bulletins, generic letters, regulations. Perhaps some more will come out on the control rod drive mechanisms that will supersede what we've already committed to.

So there are numerous ways you have to do that. So you have to look at your existing internal processes to see how best that can be accomplished and how do you make sure that if something does change you don't undo a commitment that we've already made for license renewal.

Site engineering is the key in these

areas, and they were heavily involved in the training that we did last summer at all three stations in this area, and what we've come up with is an engineering oversight document that's corporately owned, and it's a common process for all three sites.

I think Greg briefly alluded to this at our last meeting we had in October, and it's the process for maintaining the license renewal scope, an aging management of components within the license renewal scope. It's an overall. It's a very high level process document that actually has a flow chart in it, and I have copies of it.

I don't have an overhead I can show you, but it basically takes those three sources of changes that you could have, plant modifications, operational changes or CLB changes and works them through a process of will it do this, can it do this, do you have to make a change, are you within the bounds of what you've already analyzed.

If you're replacing a carbon steel component with another carbon steel component, perhaps there's no change at all. You know, these are one out of 1,000 items that get changed and they cause a change to the commitments one has made.

If you change your reactor vessel head, do you need to change now your CRDM nozzle inspection program? That would have to be looked at to see what would the appropriate change be. That would manifest itself in perhaps a change to the FSAR supplement.

It certainly defines the specific responsibilities in establishing the aging management SPOC. I think at the last meeting someone called it "Dr. SPOC."

Well, those are all three established now, one at each site. They're in training. They, in fact, meet periodically. There is a corporate sponsor that helps facilitate the communications amongst the three sites. They share lessons learned as they start doing some of these reviews, and it provides the method to make sure that we do the reviews when we need to have the reviews done and that we make the right decisions on what additional programs might be needed or changes to existing programs or whatever.

MEMBER KRESS: Is SPOC an acronym for something?

MR. GILL: Single point of contact.

MEMBER KRESS: Single?

MR. GILL: Site point of contact, and that person has been introduced to the site personnel at McGuire. She has a sponsor in the engineering area, and the engineering manager is a middle manager, and that person talks to everybody else.

So there's a lot of communication and dialogue to make sure that they know who the person is. There's a lot of responsibility on the front line. Modification engineers who are making plant mods to make decisions and only if they need to do they go to the SPOC.

Hopefully, there will be a self-sufficient, and when you go through a mod checklist to see what documents you need to change, you've answered the question of am I changing something with EQ, am I changing something with fire protection, am I making a new safety related system adding a new piece of paper or whatever.

That's covered in the mod process, and only if you really get something different like titanium versus stainless steel would you go to the SPOC to see what to do.

MEMBER KRESS: If I could have seen the slide, I would have known it was an acronym, but --

MR. GILL: We try to do that, Dr. Kress.

MEMBER KRESS: Yeah.

MR. GILL: Spell it out the first time.

MEMBER KRESS: What does that third bullet mean, specially the "should they be required" part?

MR. GILL: If you put in a new material and --

MEMBER KRESS: Oh, if you do something on this page that could impact your commitments?

MR. GILL: Yeah. Say you put Alloy 690 in instead of Alloy 600.

MEMBER KRESS: Yeah.

MR. GILL: Perhaps you'd have to do a new review for that because you hadn't completed it or titanium or some other material that may not have been used in that system before. You would do a review to make sure.

MR. ROBISON: We were concerned that we had the expertise, of course, to do the aging management reviews for renewal, but we needed to leave that process somewhere so that --

MEMBER KRESS: You need to pass it on as corporate memory.

MR. ROBISON: Right.

MR. GILL: That's right.

MR. ROBISON: And so what we've done is created this 229 document that sort of embodies all of that, gotten a number of people to own it, plugged it back into the site. So hopefully there will be enough people around as time moves on. There will be a general awareness of how to do this and at least know where the resources are should they want to do a new material selection and go through this review process.

MEMBER KRESS: About to have a loss of power accident.

MR. GILL: Active/passive component here.

CHAIRMAN BONACA: I hesitate to ask.

MEMBER POWERS: Where's the back-up generator?

MEMBER KRESS: Do you have a diesel for that?

MEMBER POWERS: Let me ask you this question. Who does the SPOC report to?

MR. ROBISON: The SPOC reports to the civil mechanical manager inside of the engineering department at each of the three sites.

MEMBER POWERS: Is that too far down the

line of management to be effective?

MR. ROBISON: I don't know.

MEMBER POWERS: I mean, how do you look at that?

MR. ROBISON: The civil mechanical managers supervise the majority of the program office.

MEMBER POWERS: I know they do, but the question is SPOC is in the business of making work for people. Most people kind of resent that.

MR. ROBISON: You're right. I haven't really given that a lot of thought.

MEMBER POWERS: I want to give some thought to it because both for optics and for the ability to impose new requirements on people that they're not going to like.

MR. ROBISON: It's a good suggestion. Thank you.

MR. GILL: A good point.

Anymore questions on the previous slide? We're up to Slide 11 now.

EDM 229 defines the aging management of SPOC duties. It's the site technical point of contact for this program. Again, there's one at each site plus a corporate sponsor. So they share the lessons learned amongst all three sites and are not on an island by themselves.

They can provide any guidance for the aging management reviews that are done by other engineers. They also are independent checkers of the Chapter 18 program changes that may occur so that again we don't undo something.

And I expect Greg and I will be in a role of consulting over the next year or two as people try to make even more changes that they want to now that they're finally reading the document in detail, and we've already had some of that.

MEMBER POWERS: Screech.

MR. GILL: Screech. We're committed to do what?

(Laughter.)

DR. LEITCH: Is operating experience at other plants fed into the SPOC somehow or how does that information get in?

MR. GILL: That would be under the CLB type changes that might occur, any operating experience that might occur that rises to the level of a notice or some other generic communication coming down.

MR. ROBISON: It really feeds in at two

places. It feeds into the program owners who are there and as part of their program keep up with industry operating experience, and it feeds to the SPOC, and that's where that sort of independent review role comes in for them.

At least that was what we envisioned. This has obviously not been up and running that long, but that would be our thought. It would create several people who would be interested in a topic and a good dialogue to start at their own site.

MR. GILL: Particularly the control rod drive, the head issue. Certainly the program owner of that is well versed in what's going on with the other units in the country, their inspection results and all of that, and that's the program owner. That's why on those program summaries we had them sign to make sure they knew what the commitments were, and they would maintain ownership as long as they had that position and for the duration.

An additional tool we have is the license renewal handbook, and this is Spec 017. This was developed as an aid to the aging management SPOCs in evaluating the impact of plant changes on license renewal programs and scope. It contains a lot of information, license renewal scope definitions, smart charts, the implementation plans we noted earlier.

In some cases it has drawings to help clarify when something is in scope, and it will be a living document to be updated as changes that might occur in the future.

The next slide in your handout, the next overhead page in your handout is a copy of the smart chart from Spec 17. This is McGuire, and this is the auxiliary feedwater system. And what we have done is collapsed all of the aging management reviews that we did for this system down onto one page. So instead of having multiple pages of tables like we had in the application, in fact, we have more information here because the mechanisms are listed.

But you can see for the aux. feedwater system -- and this is it for the aux. feedwater system, just this one page. You can have carbon steel and stainless steel. The external environments would be reactor building and sheltered and then treated water is the internal environment.

And then you see the programs that we actually credited for that, what the type of aging effects were, what the aging mechanisms were, and then a summary listing of the component types that are included in that part of the system and what the functions are.

So this allows engineers in the future to help decide if I'm making a plant change to the aux. feedwater system and I'm using carbon steel or stainless steel, I can see that all of these reviews have already been done, and I know that I don't have to go in and change any of these particular programs.

If I come in with some new material that's not covered here, then I would have to do the aging management review, and this has been repeated for every system at the site, and this is true at McGuire, Catawba, and Oconee, and it's what we call a smart chart. It's real simple to use.

MR. ROBISON: An example of how the operating experience may fit, for example, in the middle of the page where the words "lubricating oil" are mentioned, suppose an aging phenomenon for lubricating oil came via operating experience. This gives you very quick reference to say where have we credited lubricating oil and what did we do with it.

Well, there was no aging effects and no

program was required. Operating experience may change that in the future. This would then be a quick reminder of where that's supplied, and then we could proceed from there to make the changes.

CHAIRMAN BONACA: Now, for the auxiliary, for the other system you have made a commitment to internal inspection, one internal inspection, right?

MR. ROBISON: I'm sorry?

CHAIRMAN BONACA: As part of the -- as inclusion of an open item, I think you made a commitment to inspect the internals of this.

MR. GILL: Right.

MR. ROBISON: Yes.

CHAIRMAN BONACA: So that would be under one of these programs here, right?

MR. GILL: Well, it's a separate commitment that's contained separately. It's more to gain information to demonstrate that the chemistry program was okay.

CHAIRMAN BONACA: Okay.

MR. GILL: So that's a separate -- it's not --

CHAIRMAN BONACA: All right.

MR. GILL: It's a commitment to do

inspections. It's not really an aging management program.

MR. ROBISON: These are more the ongoing programmatic.

CHAIRMAN BONACA: Okay.

MR. ROBISON: The individual commitments that may have just a single action to be taken, we have a separate section in the UFSAR and track them separately.

MR. GILL: We have a separate appendix. It would be Appendix B that has all of those committed actions.

CHAIRMAN BONACA: Yeah, I understand that. I just was -- I thought that I would find it here under aging management even if it is one time inspection.

MR. GILL: Right.

CHAIRMAN BONACA: You wouldn't include it here.

MR. GILL: No.

The last slide I have is on our maintenance of records. Once we go through all of these review processes, we will document the answers by the 5059, by the mod process, by operating experience review determinations. All of this will effectively manage whatever the license renewal commitments are. So what we have today and any changes that might occur over the future, we should have the records available for whenever an assessment occurs internally, and we do plan to do those over the next several years, as well as the NRC inspection that Dr. Kuo mentioned, some time late in the initial 40 year license.

So we will have the records available. We may or may not have the same people available. People do change jobs and all of that, but we should have the records for all of the changes that have been made. We know where we started. We know what the changes are, and we should be in compliance through the 40 year period and the plus 20 years.

Any questions?

CHAIRMAN BONACA: I appreciate the presentation. I think it gives us a feeling for, you know, what you have to do to track it, and of course, it gives us also -- I mean, this is 20 years to go before you get into this license period. A lot of people will have retired by that time, and now we've got to see how the NRC is going to be able to track it.

But I guess if you have this kind of

structured program, it should be easier to verify the commitments.

MR. GILL: There should be more efficient inspection, we would think. I've been through those, and a lot of the preparation for team inspections is gathering up the records that have occurred.

CHAIRMAN BONACA: Sure.

MR. GILL: And if you've got, like you said, ten, 15, 20 years' worth of records, that's a lot of information to go back and track through.

Another point we were trying to make when I was talking to McGuire management was there may be opportunities over the next few years to go in and look at the pressurizer. If you're there for some other reason, you need to put that in the planning schedule, and if they have scaffolding built and they're already climbing all over the pressurizer for in-service inspection perhaps, maybe that's the time to go in and look at the pressurizer spray head and to start formulating the plans.

You don't have to wait until the last outage at year 39 to do these inspections. There may be more appropriate, opportune times over the next five or ten years perhaps that one can do those inspections.

CHAIRMAN BONACA: Now, as you explained before, you know, in 20 years the plant will look quite different from what it is today in materials, in changes. There will be a lot of things happening there.

You do have a process that you have established to track of those changes.

MR. GILL: To keep track of those, right.

CHAIRMAN BONACA: Now, I'm trying to understand how the NRC will come in with an inspection and interpret all the changes or verify commitments to all of those changes. It's going to be a challenging thing.

MR. GILL: I think it will be a challenge. I think if you break the inspection into two parts, one of have you completed your inspection commitments, the one time inspections, if you will, and how have you maintained the changes that might have occurred over time, and that will be a challenge because we're updating the FSAR every two years or so or in some plants maybe doing it annually.

That's a lot of changes, a lot of plant

mods to go through.

CHAIRMAN BONACA: If you change a component with a different material, the basis for the commitments that you have given the NRC will change.

MR. GILL: Right.

CHAIRMAN BONACA: You will make decisions on your own that say, well, now we change, you know, 600 to 690. Therefore, we don't have to do this anymore.

MR. GILL: Right.

CHAIRMAN BONACA: Now, you don't know if the NRC will agree with that assessment.

MR. GILL: That's correct.

CHAIRMAN BONACA: Is it going to be a surprise for the inspection team of the NRC to come in and find that you do not perform a certain committed function because you have replaced the material? But you haven't gone back to the NRC to see if it's okay with them.

MR. GILL: Right. It may be a challenge because of the time lag from the time you made that change until the inspection actually occurs. If it changes the FSAR summary description, that would be part of the update that's periodically sent into the staff and then reviewed by the staff.

It is a concern though, I think, if a lot of that occurs in trying to reconstruct history well down the pike when none of us are around.

CHAIRMAN BONACA: Well, this tells me that probably before you enter the renewal period and if you have an inspection, there may be another iteration of the SER with additional open items coming in and a debate on what else you need to do

MR. GILL: Yeah, I don't know that --

DR. KUO: Dr. Bonaca, if I may comment on these changes, generally when they make a change according to 5059, the changes will have to be subject to three tests, whether the changes will affect the previous calculation in terms of risk, in terms of mode of failure and all of that.

So if, say, for instance, you talk about the change of materials, certainly it will change the failure mode and all of that. So in that case, my thought is that it probably will have to submit it to the staff for review.

It's their determination whether it will change the accident sequence or not, but if you do have a material change, that's a major change in my view.

CHAIRMAN BONACA: Yeah. No, I recognize there are processes in place, including 5059 that would allow to track that. I'm thinking about there are probably 40 or 50 plants in the period of six or seven years will go into renewal, and that's going to be a heck of a challenge for the staff to track.

DR. KUO: It will be a challenge, yes.

CHAIRMAN BONACA: Because this is a major resource, the demand for the Commission.

DR. KUO: Yeah, it will be a challenge for sure, but the mechanism is there.

CHAIRMAN BONACA: Okay. Thank you.

DR. KUO: Rani Franovich will make the staff presentation.

MS. FRANOVICH: Good morning. I'm Rani Franovich. I was the Project Manager for the staff's safety review of the Catawba-McGuire license renewal application.

And to my right I have Jim Medoff, who is a reviewer in the Division of Engineering. He managed the contractor who performed the staff's review of the aging management of reactor coolant system and associated components.

To my left is Tanya Eaton, who performed the scoping and screening review for the staff of fire protection equipment.

Before I proceed with my presentation, I'd like to talk a little bit about my background. I've been with the NRC for about 12 years; spent eight years in Region II, where I certified as a reactor or resident inspector, and McGuire was my reference plant for certification; spent six years at Catawba as a resident inspector. So it was a good segue to come in and manage this license renewal project, and it has been a pleasure to manage.

MEMBER POWERS: So you know these plants.

MS. FRANOVICH: I know these plants.

So with that, I'll go on and get started.

When we last met, I think there may have actually been, Dr. Bonaca, 13 SER open items and then one extra one that we added that was not documented in the SER, and I'd like to go over the ones that I think are of most interest to the members.

When we last met, we were in a disagreement with Duke as to whether or not fan and damper housings met the scoping criteria for license renewal. The staff believed they did. Duke believed that they did not, but ultimately Duke did identify fan and damper housings associated with ventilation systems within the scope of license renewal, provided the aging management reviewers results for those components. The staff completed its review of the AMR results, and that resolved the open item.

In fact, there were two open items on these two issues.

Another issue had to do with building sealant, structural sealants, especially for those structures where ventilation systems either maintained a positive pressure or processed potentially radioactive gases from the buildings.

And Duke identified an aging management program that was satisfactory to the staff for these structural sealants. It involves a one time inspection of structure sealants to insure that there's no cracking or other degradation associated with aging, and the staff found that to be acceptable.

MEMBER WALLIS: Let's look at, say, damper housing. Damper housings apparently are in scope because they do not move, and the damper that moves is not in scope.

MS. FRANOVICH: Correct.

MEMBER WALLIS: It seems a little bit bizarre to make the distinction, but I realize this is the way it's done. It just seems rather strange.

MS. FRANOVICH: Yeah.

MEMBER WALLIS: The operation of the damper depends upon both of these things functioning right, and it doesn't move very often presumably.

MS. FRANOVICH: Right. If you look at it as kind of like pump casings or valve bodies, it's really a pressure boundary function that we're interested in.

MEMBER WALLIS: I see. That's what you're interested in.

MS. FRANOVICH: Exactly.

CHAIRMAN BONACA: And the interesting thing is that Duke took the position that the failure of these components would be identified by the functional failure of the component itself. I mean, if you have failure of pressure boundary, you would see it, the same way in which you would have a failure of the active component.

MS. FRANOVICH: Correct.

CHAIRMAN BONACA: But you took the more

strict consistency with award of the rule and the example of the pump casing. And during the subcommittee meeting we discussed this, but the feeling was that it doesn't harm to do a visual inspection of the passive component anyway, and so we felt that there was consistency with the letter of the law and also it was beneficial to have a walk-down and just look at these components for physical conditions.

MS. FRANOVICH: Correct, and the staff felt that a minor breach in the pressure boundary may not reveal itself in a fan surveillance test failure or a damper failure.

And when these systems conveyed potentially hazardous gases, that's important. So Duke brought them in scope. Duke disagreed with the staff, but brought them in scope nonetheless, and provided aging management results, and it resolved the open item.

MEMBER WALLIS: Well, presumably these dampers are in some sort of a pipe work or ducting and everything. That's in scope presumably.

MS. FRANOVICH: Correct. The ducting is in scope.

MEMBER WALLIS: So it would be rational

to have the whole encasement in scope, wouldn't it?

MS. FRANOVICH: That's the way the staff felt.

MEMBER SHACK: But, I mean, this is an issue that seems to come up quite frequently in license renewal space.

MS. FRANOVICH: Yeah.

MEMBER SHACK: You would think that we have, you know, provided guidance to sort of settle this issue by this time.

MS. FRANOVICH: Yes. We have issued an interim staff guidance document on this issue, and I believe that the status of the document is not yet final. So once it is final, then we will feed that guidance back into our GALL report and standard review plan.

PT, did you want to comment on that ISG?

DR. KUO: You are correct that we have issued a draft position to the industry. We have had meetings, but it hasn't been finalized yet, but as soon as it's finalized, we will incorporate that guidance into the GALL and SRP in the next revision.

MS. FRANOVICH: Any other questions on these open items?

Okay.

MEMBER WALLIS: Well, just that they seem so trivial compared with all of those other things that matter in the whole system.

MS. FRANOVICH: Okay. Thank you.

Another area where there was a lot of disagreement between the staff and the applicant had to do with scoping and screening of fire protection equipment.

When we last met, Duke had brought everything into the scope of license renewal that the staff took issue with, with the exception of jockey pumps, which maintain pressure of the fire water system, and manual suppression equipment for certain areas that the staff felt were potential fire exposure areas.

To resolve these two open items, Duke disagreed with the staff on both of them, but nonetheless brought into the scope of license renewal an entire pressure maintenance system for both McGuire and Catawba, which included not only the jockey pumps, but associated piping. There were some tanks; there were some strainers for the jockey pumps, and other miscellaneous equipment.

So they gave us a very full response to that SER open item to resolve it.

When it came to the manual suppression and potential fire exposure areas, the staff was interested in two areas, in particular. One area was in the yard, and the other areas was in the turbine building.

And the staff and applicant got together and discussed these two areas and the applicant was able to demonstrate that there weren't any fire exposure areas in the yard that required manual suppression to meet the requirements of 10 CFR 5048. So that was resolved, and the staff accepted their position.

However, with respect to the turbine building, the staff felt strongly that manual suppression capability was necessary to insure that you could mitigate the effects of a fire even though the applicant took credit for a three hour barrier in addition to that to prevent the spread of the fire.

The staff felt that the fire barrier really wasn't sufficient alone to meet the requirements of 5048, and they also needed to put the fire out. So Duke again disagreed with the staff, but identified those hose racks within the scope of license renewal, providing the aging management review results and an aging management program for those components, and that resolved that open item.

Any other questions on any of these open items?

MEMBER SHACK: The jockey pumps seem like another familiar topic in license renewal. Do we have an ISG for those?

MS. FRANOVICH: Well, actually I'm the lucky person to have written that ISG as a result of a request from our Region II license renewal inspector, Caudle Julian, who leads the license renewal inspection teams in Region II, indicated that this does come up often. It's not just jockey pumps, although that's a popular topic of debate, but a lot of other fire protection equipment as well.

So I've written an interim staff guidance document on that, with the help of Tanya and her group. It is out for comment, public comment, from stakeholders, NEI, Union of Concerned Scientists, and we haven't gotten those comments yet. So we're embarking upon dialogue with the industry on this ISG.

DR. KUO: In fact, this subject will be

the discussion of a meeting with the industry on February the 13th.

MEMBER SHACK: Just sort of a general, you know. How many ISGs are in play at the moment?

DR. KUO: We have a total of 14 ISG right now, but the four of them have already been finalized. So ten is in active discussion or development.

MR. ROSEN: And the fact of an ISG is ultimately to be incorporated into the GALL report --

DR. KUO: That is correct.

MR. ROSEN: -- and deleted.

MS. FRANOVICH: Correct.

MR. ROSEN: The ISG, once it is incorporated in the Gall report, goes away.

DR. KUO: That's correct.

MS. FRANOVICH: Okay. We had an open item on volumetric examination of Class 1 small bore pipe. Duke uses a risk informed approach to identifying the piping that they perform in-service inspection of.

The staff does not have a problem with the risk informed inspection approach. However, the staff felt that there was no guarantee that in their risk informed identification of piping, small bore piping would be included in the sample of the population for inspection.

So Duke has specifically committed to identifying a sample of small bore pipe based on the potential for degradation, considering a number of degradation mechanisms, and the staff found that to be satisfactory, and that resolved that open item.

CHAIRMAN BONACA: Is the one time inspection?

MS. FRANOVICH: That is -- I'm sorry. In the past the staff, I think, has found one time inspection acceptable, but Duke is actually doing this as part of their interim.

MR. ROBISON: We have already incorporated risk informed techniques, particularly in our McGuire ISI plant, and have already identified small bore locations and have that ongoing today.

CHAIRMAN BONACA: Okay.

MR. ROBISON: So it will be an ongoing part of our ISI plan in the future.

CHAIRMAN BONACA: Okay, and these are acceptable locations, not necessarily risk significant locations, but the most acceptable ones.

MR. ROBISON: Right, yes.

Greg Robison from Duke Energy.

MS. FRANOVICH: Thank you, Greg.

The other open item had to do with a rubber expansion joint in the circulating water system, the condenser circulating water system that was brought into scope by a request for additional information and response to that request, but no aging effects were identified for this component, this expansion joint.

The staff asked the applicant to consider the effects of ultraviolet radiation since the expansion joint is located in the yard outside the turbine building, and the applicant came back and indicated that there was no operating experience to indicate that -- I apologize. That's not really what they said.

They said that these expansion joints were located 30 feet down in a pit where the circulating water pumps are, and that they really didn't -- they weren't exposed to much UV radiation.

However, the staff felt that there were other aging effects that could cause degradation over time and it didn't seem like this expansion joint could last for 60 years without any degradation.

So the applicant identified aging effects for this component and proposed a one time visual inspection of the component to verify that aging effects are not causing degradation of the component, and that was acceptable to the staff and resolved the open item.

Any questions on this slide?

MEMBER WALLIS: This was a one time inspection?

MS. FRANOVICH: It's a one time inspection, and the reason --

MEMBER WALLIS: Just don't these things deteriorate over a period of five or ten years rather than --

MS. FRANOVICH: Well, there are two components that the staff looked at. One is the expansion joints in the condenser seals or the condenser seals themselves which are exposed to somewhat higher temperatures of condensed steam and circulating water.

But the expansion joints that were in question for this open item are actually just in the condenser circulating water system itself out in the yard.

MEMBER WALLIS: Cold.

MS. FRANOVICH: It can get cold, sure. Oh, I'm sorry. You're talking about the water itself. Right, it's temperature is typically below 100 degrees from what I understand.

MEMBER WALLIS: It doesn't fluctuate very much.

MS. FRANOVICH: Correct, correct. So there really isn't much experience, much operating experience to indicate that these things have failed, and without that operating experience we didn't feel like more than one time was warranted, but it will at least verify that there is no degradation that could be occurring.

MEMBER WALLIS: And presumably if it does degrade, it will leak and then this will be detected and it will be fixed. It's not as if it's --

MS. FRANOVICH: One would expect so, correct. It's not a very high pressure system, correct.

MEMBER SHACK: And, again, what's the timing of the one time inspection? It's before the end of the license, but obviously you'd sooner wait a reasonable amount of time to do it.

MS. FRANOVICH: I agree, and it's really up to Duke. The only thing they're required to do is have that inspection completed before the period of extended operation begins.

But you're absolutely correct. It would be more prudent to give it more opportunity to reveal itself before you inspect it.

So with that, I'll turn it over to Duke and you can indicate, Greg.

MR. ROBISON: This is Greg Robison, Duke Energy.

I think the example we used this morning, the pressurizer spray where the dates are included in your handout, is an example of the time frame we would do these inspections on.

As Bob Gill mentioned, we will find an appropriate point in time somewhere toward the end of the initial four year period. It could be two years short, five years short, just when we happen to be there, and we'll go in and do these types of things, but it will be toward the end of the initial --

PARTICIPANT: Twenty years.

MR. ROBISON: -- will not.

And one other point. I think this is

Catawba only, and these things are -- physically you're looking at a component that's about a foot in length, 42 inches in diameter. So it's not a huge mechanical component. It's a rather small component, very much in the bottom of a pump pit out in the yard.

So that was the basis of our it doesn't see a lot of sunlight, because it's hard to get the sun to shine that deep into the pump pit.

MR. ROSEN: As I recall, there has been a failure of those components in an operating nuclear plant, and the results are quite interesting. It's an amazing amount of water can come out of those things into the basement, turbine building basement.

MS. FRANOVICH: Then maybe we need to go back and look at that. Okay. Thank you.

Any other questions on this slide?

(No response.)

MS. FRANOVICH: Okay. We had a couple of other open items that are related. They had to do with aging effects and aging management of concrete structures and structural components that are not exposed to a harsh environment. Duke's position was that there are no aging effects, and the staff's position was that there are and that they need to be monitored.

So Duke ultimately disagreed with the staff. Nonetheless they specified an aging management program to monitor concrete structures that are not located in a harsh environment, and a couple of those concrete components involve accessible portions of concrete components in the ice condenser, which they also specified in the aging management program for. That resolved those open items.

MEMBER POWERS: Can you tell me more about that one?

MS. FRANOVICH: What would you like to know?

MEMBER POWERS: Where it is, how it's going to be managed, how it's going to be monitored.

MS. FRANOVICH: Sure. The aging management program that they specified is the civil structures inspection or -- I'm sorry -- the inspection program for civil structures and components, I believe. It's a visual inspection program.

MEMBER POWERS: -- accessible?

MS. FRANOVICH: For the accessible

concrete, yes.

MEMBER POWERS: When I look at the concrete, it's not the concrete we're interested in.

MS. FRANOVICH: Can you repeat your question?

MEMBER POWERS: Well, the issue is the inaccessible concrete structures.

MS. FRANOVICH: The inaccessible concrete structures. Are you talking about those that are below grade?

MEMBER POWERS: I'm talking about the ones that are in the bullet two on your slide.

CHAIRMAN BONACA: Yeah, you have inaccessible concrete.

MS. FRANOVICH: Right. The open item had to do with concrete components that the staff believed were inaccessible in the ice condenser. As it turned out in the RAI response, the applicant indicated that this concrete is accessible from other areas. I think one of the structures was the -- was it the structural wall that you could see form the other side? I'm not real familiar with the details, but --

MEMBER POWERS: Maybe Duke can help.

MS. FRANOVICH: Do you want to take it,

Greg?

MR. ROBISON: Greg Robison, Duke Energy.

You're correct. We can access several of the ice condenser structures from the other side to do an inspection there. One other point is the philosophy here for inaccessible concrete structural areas would be when we did our aging management evaluation, we looked for environments that were different from accessible areas, and if we found one, then we had to make provision to get to that inaccessible, unique environment somehow.

We didn't find any unique, inaccessible environments. We found out environments of our exposed concrete similar to our environments of our inaccessible concrete. So feel good that we can do our inspections and sampling over in the accessible area and apply that to all of the concrete.

MS. FRANOVICH: Right, but I think I understand Dr. --

MEMBER POWERS: The last time we got together we discussed a lot about water chemistry.

MS. FRANOVICH: Oh, yeah.

MEMBER POWERS: A little bit about water chemistry and the issue of whether you had sulfates and phosphates and the groundwater.

Here you had looked at, as I recall, the sulfate contents and concluded that they were low enough concentration they were benign. You had not looked at the phosphate contents.

MS. FRANOVICH: Let me see. The last time we met, we had looked at pH, chlorides, and sulfates. Phosphates were not included in that list. You're absolutely right.

I don't know if David Jeng would like to address this or if we may have addressed it in the last meeting, but we did not look at phosphates.

David.

MR. JENG: I'm David Jeng of the Division of Engineering.

During the last subcommittee meeting, questions were raised whether phosphate was a concern. The staff position, based on the expert, having the main concern are the sulfate, chlorides and the pH vary. So each of the three parameters we decided to measure with acceptance criteria, and phosphate was not particularly of concern based on our expert evaluation.

MEMBER POWERS: Oh, that's great. What was your expert valuation?

MR. JENG: It's --

MEMBER POWERS: Apatites don't form. I mean is that what you're telling me?

MR. JENG: I am not a chemical --

MEMBER POWERS: But you never get the chemical expert. We only get the reference that the chemical experts tell us that this is not important, but he never shows up. Where is this guy? I mean, he's the guy that believes that apatite doesn't form. He has no teeth. I know this. I will recognize this guy because he has no teeth.

MEMBER WALLIS: Excuse me. Appetite?

MEMBER POWERS: Yeah. It's calcium phosphate.

MEMBER WALLIS: But it's spelled like "appetite"??

MEMBER POWERS: And it's spelled like "apatite."

MEMBER WALLIS: Thank you.

MR. JENG: I would like to take back your very important question and come up with additional supplemental information.

MEMBER POWERS: That's what I heard last time. I'd like to see it some day.

MEMBER FORD: The question was also asked last time about corrosion of the rebar and whether that would necessarily be detected by a visual inspection of the outside of the concrete. Obviously the concrete spalls off and you see it, but the damage is done before that occurs.

What was the resolution of that?

MS. FRANOVICH: I seem to recall, and I could be wrong, and I may need to rely on my staff or Duke to chime in, that with the staff's feeling that the groundwater was not aggressive, that the concrete would be able to prevent the seepage of water into the rebar, but I'm not sure if that's the correct recollection or not.

If Duke or the staff wants to chime in. David?

DR. KUO: Let me just comment on that. A long time ago, about ten years ago the industry had submitted to the staff for review what's called an industry report, and that included the containment, office buildings, and all of that concrete, other Class 1 concrete structures.

During the review of these industry reports, we had a roomful of concrete experts together and discussed this subject, and that is how that limit that Rani just read to the committee -- you know, that limit was set during those meetings, and it really reflects the knowledge in this field.

I don't know if that satisfied Dr. Powers' question or not.

MEMBER POWERS: Dr. Powers will be satisfied when he sees solubility relations and concentrations and aqua solutions. I mean, having someone say, "Gee, I've never heard of calcium phosphate. Therefore it can't be important," is not a persuasive case.

DR. KUO: No. I think what we have concluded in those meetings, that we never saw an operating experience in that fashion. That is basically what the conclusion was from those meetings.

MEMBER POWERS: There are two reasons that one never sees something. It doesn't occur and you haven't looked. Okay?

Now, there has to be some basis for concluding that it's not important. That's what I want to see.

DR. KUO: Yes. Well, like Mr. Jeng said, we will come back to you on that.

MEMBER FORD: Could you call us or get back to us on the rebar corrosion aspect?

MS. FRANOVICH: Sure.

MEMBER FORD: In this industry rebar corrosion is a big item.

MS. FRANOVICH: Even if --

DR. KUO: I understand that, Dr. Ford. For that to happen, of course, the concrete has to crack, and we have several cases like that of, for instance --

MEMBER FORD: The concrete is really porous, and all you have to do is get water to the rebar.

MS. FRANOVICH: It does degrade.

MEMBER FORD: And it's not water any longer. It's a fairly complex environment once it hits the rebar.

MS. FRANOVICH: Okay. We have an action item to get back to you both on these two items, and I'll make sure that the staff gets something to you.

But, Dr. Powers, I understand your question on my slide because I did characterize it as inaccessible. It turns out that there are accessible portions of these components. So I apologize for that confusion.

Any other questions on this slide?

(No response.)

MS. FRANOVICH: We had an open item on

the aging management program proposed by the applicant to monitor insulation degradation of electrical cables, in particular neutron monitoring and radiation monitoring cables.

And the staff's feeling was that a visual inspection of the insulation looking for deterioration was really not sufficient to insure that there was no degradation of these cables before loop accuracy could be effected.

The staff has previously accepted a loop calibration procedure which is a common surveillance procedure that is already being performed at most of the nuclear power plants. It ultimately proposed a combination of surveillance requirements that would fulfill the loop calibration, aging management program, and that resolved the open item.

Any questions on this item?

(No response.)

MS. FRANOVICH: That concludes my presentation of the SER open items. If there are any other open items that I did not discuss that anyone has a question on, feel free to ask.

MEMBER RANSOM: I had a question on hydrogen mitigation and the power for those in the event of station blackout. It was mentioned in some of the discussion, but is any of that an issue with these plants?

MS. FRANOVICH: Well, it's a timely topic to bring up because we're involved in some legal proceedings where that is a concern of one of our petitioners, and the generic safety issue, I think it's 189, which involved combustible gas mitigation with igniters.

This is really a current operating issue of a current concern that the staff is addressing through the generic safety issue process. Nonetheless, we did have some contentions that were proffered by intervenor groups that were admitted into the proceeding for hearing.

The contentions have since been rendered moot by some staff RAIs, requests for additional information, and responses from the applicant that consider information in aa Sandia report on direct containment heating that touches on this very topic.

So the status of that legal proceeding is that the contention has been rendered moot. Nonetheless there are eight late filed contentions that are associated with that contention that we are going to engage in oral argument on in a couple of weeks here.

So the legal proceedings are still ongoing. When we first started out, there was also a contention on the potential use of MOX at Catawba-McGuire. That contention also was admitted by the ASLB, but subsequently appealed by Duke and the staff and reversed by the Commission.

There was another contention that was certified to the Commission on the potential for terrorism at these two plants, and the Commission advised the Board not to consider that contention for the license renewal proceeding.

So where we are right now is there are some eight late filed contentions that are related to that very issue, and we're still going through that process.

CHAIRMAN BONACA: My understanding, for example, for the severe accident mitigation analysis is that it's not that it's not an issue. It's an issue being dealt with under the current license basis.

So, therefore, it was taken out from the license renewal proceedings because it was an issue that affects actual operations right now in the covered licensing basis.

So it's not that it's not being dealt

with. It's begin dealt under a different kind of process.

MS. FRANOVICH: Correct.,

CHAIRMAN BONACA: Okay.

MS. FRANOVICH: Thank you, Mr. Bonaca.

MEMBER POWERS: Am I correct in my recollection that one of the plants -- I think it was Catawba -- had an important flooding hazard in its IPEEE.

MS. FRANOVICH: Yes.

MEMBER POWERS: And that it has agreed to mitigate that?

MS. FRANOVICH: Yes, sir, I think it agreed to build flood barriers for these auxiliary transformers located in the basement of its turbine buildings, correct.

MR. ROSEN: Where the condenser seals are.

MS. FRANOVICH: Pardon?

MR. ROSEN: Adjacent to the condenser seals like we talked about earlier.

MS. FRANOVICH: No. Actually those condenser seals are outside the turbine building.

MR. ROSEN: Oh, okay. I have one concern that comes up. It's really more generic, not specifically about Catawba or McGuire, and that isi that we talked to PT about 14 ISGs that are open that have come up as a result of this and prior license extension requests.

MS. FRANOVICH: Correct.

MR. ROSEN: And that those are moving it through a process to become aspects of the GALL report, and my question is given that we're learning things and putting them into ISGs and ultimately into the GALL, what about the plants that have previously had their licenses extended? Are they subject to these new or is there any process for going back and thinking about the plants that have previously had their license extended?

DR. KUO: Dr. Rosen, it's a real good question. Yes, we are thinking about it, and we are dealing with it. Actually for those plants to had renewal licenses we are considering whether we should backfit them or not.

This is really a -- now that once they got the renewal license, they are in the operating reactor space. We have to follow the backfitting rule. So we are in the process of developing a procedure to deal with that.

MS. FRANOVICH: In fact, I think that

when we develop new ISGs now, we consider the implications for backfit, and it's part of the process for developing the ISG.

MEMBER POWERS: Let me ask you about that. It seems like a real good route to assure there's no -- to inhibit the evolution of our understanding, you're saying, "Gee, before I develop an ISG, I have to think about everything that I've done before," and even though it's a good idea, it may not pass the backfit rule in those plants that have license extensions. It's still a good idea.

Are you really condemning yourself to mediocrity in everything that goes forward because you're wedded to your past sins?

DR. KUO: No, it is not. Yes, we will consider the backfit, but backfit, it doesn't necessarily mean that we have to ask those plants to do anything. This is going to become compliance backfit because of a Part 50 rule.

So in the space of a compliance backfit, there is some consideration as to whether this is, indeed warranted or not.

So in case like, Dr. Powers, you said, maybe it's a good idea to do it now and later maybe we really don't have to backfit all the others.

It's not an inhibitor for the staff to raise any ISGs because, you know, in this consideration of a compliance backfit we do have that -- what do we say? -- the consideration whether we need, we do need to backfit or not.

So if an issue is a really good idea for today, for the future applicants --

MR. ROSEN: Good enough to get into the GALL report.

DR. KUO: Right, but really it doesn't warrant any additional action for those plants who have renewed their license. We wouldn't do that, but the thing that we were talking about is at the time of identifying this ISC, must give consideration of whether there is the backfit needed or not.

For instance, we have four --

MEMBER POWERS: That's the part that I find really troubling. I'm sitting there, and I said, gee, this is a really good idea, but if I think about it a little bit, it will never pass the backfit on those other plants. So I'm not going to bring this thing up.

MS. FRANOVICH: Yeah. I think Bob mentioned that --

MEMBER POWERS: I think you've got to separate these things.

MS. FRANOVICH: Yeah, when I mentioned that we consider the implications for backfit, some of what we put into ISGs don't involve that potential at all, and so we indicate that when we issue the ISG, that we've reviewed it and there are no backfit implications.

For others we just indicate that there are, and that's the kind of review that we do. It's not a consideration as to whether or not we issue the ISG or develop the ISG. It's that we indicate up front whether or not it has those implications.

MR. ROSEN: Well, I think the ones that you say have backfit implications will ultimately fail the backfit test, substantial additional protection, 5109 cost-benefit test.

So I think Dr. Powers is exactly right. We are condemned to basically not being able to use new insights in plants that have previously licensed. As a process what that means is that we're not going to do a better and better and better job.

MEMBER POWERS: That's right.

MR. ROSEN: We're just kind of stuck

where we are. Whatever kind of insight right now when you're getting ready to relicense, for example, Catawba, that's all the benefit that the regulatory system is going to be able to give. Future understandings and insights, it will be up to Duke to decide whether they want to put them in or not because the regulatory system simply won't be able to pass the 5109 backfit test, unless -- unless the staff decides to take a harder line on compliance backfitting.

Now, there you'd have to make the case, I think that there's some compliance issue under the relicensing rule brought up by a given ISG. That's such a revelation that, gee, we wish we really had thought about it for all of those other plants, but you know, we're going to go back to the previous X number of plants that have previously had their license extended and order them to include it in their licenses.

MS. FRANOVICH: Right.

CHAIRMAN BONACA: One aspect is, however, that many of these issues are really border line. That's why they've been open until now. They've been debated, and this is not necessarily the one for which a hard decision was easy to reach because it was more like issues were there on the fence between, for example, the functionality test, that you have a passive component in a housing where, you know, the perspective of the licensee here, it's pretty valid, too. I mean, you could rely on the failure.

So I'm saying these are issues that have been debated for a long time, and I don't think they're so significant to the safety of those plants.

MR. ROSEN: I think you're right that a lot of them are borderline, but I think there are a number of them that are not, and I'll take the jockey pumps as one, speaking for the Fire Protection Subcommittee of the ACRS. You know, there are some issues that are very plain that ought to be, to me, that ought to be included in the scope and treated as with an aging management program properly, and that's something that I feel badly about, for the plants that have already had their licenses extended, have no requirement on their jockey pumps.

MS. FRANOVICH: Well, it's interesting that you bring up this particular ISG because this is one that we feel a backfit is not implicated. I think that the staff supplied the same review for all previous plants, applicants, and it's a battle every time, but the staff has gotten those things in scope that it felt should be in scope or applicants have already identified them.

This ISG was really written at the request of our inspector to preclude expenditure of tremendous resources during the inspections, fighting these issues out. We wanted to get our guidance out to future applicants to make sure that they understand that if they don't apply some of their current licensing basis documents in their review, there's going to be bumps in the road.

So this is one where I think we've always applied the same standards. We're just getting the ISG out to avoid unnecessary debate with future applicants.

CHAIRMAN BONACA: Yeah. We do have a commitment to the Commission to report to them in the springtime, spring to summer, on potential improvements to the license renewal process, and I think it will be interesting to hear from the staff at one of the upcoming meetings for license renewal what the issues are and the potential impact for those plants which have been licensed before, and they have a different position than those recommended now by the staff.

So that we can have a sense of whether or not we should have a recommendation for the Commission.

DR. KUO: If I may, Dr. Bonaca, I just want to make one additional comment. Out of the four IC I said that we have completed, only one that we are considering backfit. That's the station blackout. The other three are not being backfitted.

MEMBER SHACK: Yeah, but are you not considering a backfit because they've always been included? I mean the fan housings have always been, you know, a contentious thing. You've always insisted they go in. I just sort of figured by now people would stop fighting the battle.

I mean it seemed like a waste of resources. It didn't really change the requirements. They were always there.

DR. KUO: Correct.

MEMBER SHACK: And so are these like that? I mean, they're asking for things that have been asked in every license renewal. You're just codifying the guidance.

CHAIRMAN BONACA: By the way, jockey

pumps have been previously included even at Oconee.

MS. FRANOVICH: Right.

CHAIRMAN BONACA: That was a disputed issue, but I remember that you verified it, and then for Oconee they were put in the license renewal.

MS. FRANOVICH: Right.

CHAIRMAN BONACA: Anyway, I think we have an opportunity at one of the upcoming meetings to hear about what these issues are, what the exposure would be to the previous licensees for not doing that. In many cases it may not be exposure at all because they are already committed to, and so we have a sense as a committee if we should see this issue as a recommendation to the Commission.

MS. FRANOVICH: What can we do to help? I mean would you --

CHAIRMAN BONACA: Just simply bring a list of those --

MS. FRANOVICH: A list?

CHAIRMAN BONACA: -- how do you call it, ISGs?

MS. FRANOVICH: ISGs?

CHAIRMAN BONACA: And then, you know, maybe tell us if previous applications, in fact, did not have these commitments in.

MS. FRANOVICH: Okay.

MEMBER SHACK: Do 14 ISGs include the one that the industry submitted on environmental fatigue?

DR. KUO: That is correct. That is correct. The ROIC process actually made it very clear that anybody, including the public, can propose an IC. In this case the industry proposed an IC on the fatigue, involvement to assist fatigue.

And let me go back to also the 5109 process. There are two kinds of backfits. One kind is adequate protection, and Dr. Rosen was right. Some of these ISGs cannot really pass backfit test there, but there is also this compliance backfit just simply because the rule requires that. Okay?

That in some cases may be less of a requirement than adequate protection.

MR. ROSEN: Well, when you come back you can tell us the status of the 14 ISGs and the ones that you think need to be backfitted, whether they fit the 5109 test or whether they would rise to a compliance backfit as PT has suggested.

DR. KUO: Right. We will come back with that as a generic topic.

CHAIRMAN BONACA: Okay. Good.

MS. FRANOVICH: Okay. Any other questions on my presentation?

DR. KUO: Thank you, Rani.

And as a result of this presentation, I have two take-back actions. One is to provide the additional information to Dr. Powers on the inaccessible concrete, and the other is the --

CHAIRMAN BONACA: Specifically on the issue of phosphates?

DR. KUO: Yeah, and also the rebar corrosion.

CHAIRMAN BONACA: Oh, the rebar.

DR. KUO: And also, Dr. Rosen, you mentioned that there was some operating experience. I'm sorry. Dr. Rosen was talking about the operating experience related to the seal, the pump seal.

MR. ROSEN: I will talk to you off line about that.

DR. KUO: Okay, okay. And if you can just hold a moment and let me check, maybe Mr. Hans Asher here would say something about concrete.

Hans, the question is: how do you deal with the aging management of an inaccessible area concrete? The fact that we had some limit, but --

yeah. Go ahead.

MR. ASHER: Well, the way we approach in GALL, the issue of inaccessible area, for containment, for example, they are supposed to look at just by the rule, regulation requires them to -- applicant's licensees to look at the area, inaccessible area when there's some finding or there's some symptoms of degradation or corrosion in certain areas in containment surface. So they are to look into it. Regard the number of licensees have done that historically, and I get so many reports on this kind of a thing, like the junction of liner plate and the concrete interface. There's always corrosion there, and they are investigating throughout.

Now, for the other areas, for example, which are in the basement areas, which are normally emitted by soil, by another structure or something, and so in that area what we did in GALL was to establish some safe limits for certain contaminants which could degrade concrete competence.

There are three items that we felt and NEI, NUMARC at that time, agree with those three items and therefore limited the SEC (phonetic). Three items are the chlorides, the sulfates, and the pH level of the soil, water which is surrounding that particular concrete item.

For chloride I think we set 500 ppm as the limit. For sulfate, we set at 1,500 ppm, and for pH where we said anything lower than 5.5 pH level would be something that we would have to further evaluate and see what is the degradation or what they plan to monitor those areas.

This is what we have right now on the license renewal context.

MEMBER POWERS: Is there a hint of a reason for choosing 500 ppm for chloride instead of 650 ppm?

MR. ASHER: Please?

MEMBER POWERS: Why 500 ppm instead of 650?

MR. ASHER: Yeah, okay. That is a value that we picked up from American Concrete Institute's direct reports in American Concrete Institute. One is ACI 222, which is simply related to the corrosion related event for reinforcing bars mainly in concrete.

And secondly is ACI 318. After 1980, ACI 318 established certain requirements for chloride even in fresh concrete, not in the concrete which is hardened concrete, but in the fresh concrete also, and based on what we understood and what we knew about, I think we felt that 400 ppm is a safe limit.

Industry and we had dialogue of this particular item for a long time in the 1993 to 1995, 1996, before it became a part of NUMARC document. What is it technically we're using? Understanding industry report.

So that is where it was established for inaccessible areas.

MS. FRANOVICH: I just wanted to add to that that the last time we met the staff had a slide, and I still have it with me. I can put it up on the overhead projector, of the data that Duke had collected over the last 20-plus years. These are lake water data that indicate what the pH, chloride and sulfate levels have been.

And the staff's basis for determining that the groundwater was not aggressive is based on these data. So if you would like to see them, I can put them up. I have them right here.

MEMBER POWERS: Well, I mean, you did show them to us before.

MS. FRANOVICH: Yeah.

MEMBER POWERS: And they elicited exactly the same response. There's no phosphate indication there. It is not a useful thing to take lake water and then infer that is what groundwater is. The two are just not the same. Okay? Because if nothing else, the groundwater goes through the ground.

The acceptance of 500 ppm for chloride and 1,500 ppm is always referred to ACI 318. ACI 318 does not tell you why they took those values. So you haven't got a clue why the staff is doing things. Okay?

I give in on ACI 318. You're accepting an industry standard there, and the Commission says. It's not consistent with what we expect from the staff, which is a good science based understanding of what it's requiring, but okay. There's a point where you give up and say, "Okay. We'll take it."

But now we raise this issue of phosphate, and all we hear is the experts say it's not important. We know positively that appetites do form, that they're volumetrically large, that they cause spallation in the intragranular, interaggregate spaces, and for the same reason that gypsum formation causes concrete spallation. So why shouldn't they be considered?

I mean, I never get an answer to that, except the experts say it's not important. The experts could well be right. I just don't understand why.

MS. FRANOVICH: Perhaps what we need to do is take a look at the same references that you're familiar with and see if we can --

MEMBER POWERS: Well, you're looking at ACI 318. I mean, it's kind of a little button on concrete placement and maintenance. Okay?

DR. KUO: Dr. Powers, I guess, you know, this is really not the forum of the discussion, and I will take this back and come back to the committee.

MEMBER POWERS: Yeah. I'll just simply say I've heard that before.

DR. KUO: Okay. If there are no other questions, that concludes the staff's presentation on the SER for McGuire and Catawba license renewals.

Thank you.

DR. KUO: And, Dr. Bonaca, this concludes the staff's presentation.

CHAIRMAN BONACA: Thank you.

I would like to go around the table here and see if any of the members have additional questions for the staff or for the licensee.

Insofar as this information on having to look for additional information on the issue of concrete.

DR. KUO: Right.

CHAIRMAN BONACA: Okay, and --

DR. KUO: I will come back and arrange with the ACRS staff and see.

CHAIRMAN BONACA: Yeah. Please speak with me and se can set up a time.

DR. KUO: Certainly.

MEMBER APOSTOLAKIS: So can we write a letter then?

CHAIRMAN BONACA: Could you also include the rebar?

MEMBER APOSTOLAKIS: I think first we should write a letter.

CHAIRMAN BONACA: I'm sorry.

MEMBER APOSTOLAKIS: Aren't we supposed to write a letter this time?

CHAIRMAN BONACA: Yes, but hopefully we can hear something before.

MEMBER APOSTOLAKIS: Huh?

CHAIRMAN BONACA: We can hear maybe

something from the staff before we get to that.

MEMBER APOSTOLAKIS: Oh, before.

CHAIRMAN BONACA: And then we will look at that.

MR. ROSEN: And we have an issue that maybe we don't address in the McGuire and Catawba letter, but we address in our opportunity to talk to the Commission about improvements to the license renewal process about previously relicensed plants no being able to gain the benefit of new GALL provisions.

CHAIRMAN BONACA: That's right. So we will handle it that way under that umbrella.

Okay. If there are no further questions on this issue, I will thank the staff for the presentation. I think that the SER was, in general, a very quality document. So I commend you for that.

And with that we'll take a break. Since we're ahead of time, we'll start the meeting at 10:20.

(Whereupon, the foregoing matter went off the record at 10:04 a.m. and went back ion the record at 10:31 a.m.)

CHAIRMAN BONACA: Let's resume the meeting.

The next item on the agenda is the draft regulatory guide, the G-1107, "Water Sources for Long-Term Recirculation Cooling Following a Loss of Coolant Accident," and Draft Generic Letter 2003-XX, related to the resolution of GSI 191, "Assessment of Debris Accumulation on PWR Sump Performance."

And Dr. Wallis will guide us through this presentation.

MEMBER WALLIS: Thank you, Mr. Chairman.

We heard about this issue in 2001. It concerns the debris which is released into a containment building during a LOCA, for instance, and it falls or it is transported in the building. It may reach the region of the strainers for the pumps which are relied upon for long-term cooling by recirculation.

And the question is: what is the effect of this debris on the functioning of that system?

We wrote one of the shortest letters we've ever written in September, on September 14, 2001, where we said the NRC staff should expeditiously resolve GSI 191, and we stated if plant specific analyses are required, guidance for performing these analyses should be developed.

The staff has now prepared a generic

letter, which is their answer to resolving the issue, and they have, along with that generic letter, prepared a draft guide, a reg guide which will provide this guidance for performing the analysis which the licensees will be asked to do.

And so things are moving along. The Thermal Hydraulic Subcommittee heard about this a couple of days ago, and the staff is here today to present to the full committee. I think Gary Holahan is going to start us off.

Please do so, Gary.

MR. HOLAHAN: Thank you.

My name is Gary Holahan. I'm the Director of the Division of Systems Safety and Analysis at NRR.

The NRR and the research staff will go through and present you the details of the generic letter and where we're going on this issue. I just wanted to make a few introductory remarks to remind the committee that there was a research study that we're basing our actions on, and basically the conclusions of that research study was that PWR sump concerns were credible, but that we couldn't really address them without more plant specific information, and that's what led us to the path of going out and getting more information, involving licensees and also developing technical guidelines by which we can judge the status of individual plants and what sorts of corrective actions might be needed and whether those corrective actions were, in fact, sufficient. And you'll hear about that in our presentations today.

The reason we're here with the committee is because this activity involves both the resolution of a generic safety issue for which the ACRS' role is important, and it also involves generic communication for which both the CRGR and the ACRS have roles.

And I think although it is sort of voluntary for the ACRS to involve itself in a generic letter, I think it makes sense in this context since it's an important one and also because it really is the key resolution path to the generic safety issue itself.

May I have the second viewgraph?

One thing I wanted to make clear, and you won't hear this too much later on in the presentation because most of what we're talking about is forward looking in how we're going to resolve the issue, but to remember that we always ask ourselves the safety questions.

Why is it okay to continue operation, if that's appropriate?

How long would that be appropriate? We recognize there are a lot of issues that can't be resolved on a short term basis. It requires information.

So when a generic safety issue is first identified, we have to ask ourselves: why is it okay to allow plant operation while we're studying it?

We also have to ask that question on a sort of continuing basis. Whether a generic letter or a bulletin or an order or whatever action we take, there are some time frames involved and implied, and we have to ask ourselves, again, are we comfortable with the information and the state of the plants so that we can in this case take the time to develop guidance, to send out a generic letter, in this case even send it out in a draft form for public comment.

And so we're just going to remind the committee that we do such things, that we consider things such as the probability of meeting the sump, what compensatory actions are possible, the advantage one has from a leak-before-break point of view, the fact that there are some additional margins which because we didn't do plant specific analyses may be available as you'll hear in the discussions.

What we really looked at was areas and concerns about losing net positive suction head to the recirculation or containment spray pumps. But, in fact, there's some margin in that approach. There's more margin than just the design margins, and we don't give credit for containment over pressure and those sorts of issues.

We also are --

MEMBER POWERS: Gary, is that a universality? I think you do give credit for containment over pressure in some cases.

MR. HOLAHAN: For the boiling water reactors.

MR. ARCHITZEL: There are a couple PWRs where over pressure, very few, but as part of this process, we are recognizing that over pressure that we're carrying, and that's part of the regulatory guide changes. Our practices are incorporated into the reg guide that's in front of you, and it is the minimal possible. You do a different analysis.

There are very few PWRs, more BWRs, but there are some that have over credit pressure, not total, but partial.

MR. HOLAHAN: In addition to that, we are aware and have been working with the industry on some interim actions they're taking even before we issue the generic letter. They've been, I think, rather proactive in responding directly as a result of the research study before waiting for our generic letter to go out.

And so a number of plants have been following a guidance from generic program developed through NEI of looking at maybe not the issue in all of its ramifications, but at least looking at where they are with their particular sump; certainly doing walk-downs in containment and looking at cleanliness and related issues.

And there are at least two PWRs that have decided already to make improvements to their sumps. So the combination of these things together gives us enough comfort for moving ahead on a schedule that we've proposed. These considerations don't make the issue go away. They don't completely resolve the issue. We think it's still an important issue and it needs to be, you know, driven to an appropriate conclusion.

But at least there's a certain comfort level that we're going to maintain safety in the interim.

If I could have the fourth viewgraph.

MEMBER WALLIS: This is somewhat vague, the word "a certain comfort level." It would be nice if you had a more specific measure of this comfort about maintaining safety.

MR. HOLAHAN: Well, part of the difficulty is the nature of this issue. The fact that we have to go out and get plant specific information leaves us in a condition where we can't definitively say how much margin there is at any given plant. So part of the imperative for getting the generic letter out is so that we are more informed, but I think --

MEMBER WALLIS: So you don't know enough to make this assessment that I want more specific. The information isn't there.

MR. HOLAHAN: That's correct, and I think if it were, perhaps we'd be approaching the issue a little differently. So if we knew that there were three plants that had very little or no margin, then we'd deal with that differently.

MEMBER WALLIS: I think we determined at the subcommittee meeting this is what you are going to do. You're going to find out this information.

MR. HOLAHAN: that's right.

MEMBER WALLIS: Then it may be clear what specific actions you need to take.

MR. HOLAHAN: Yes, indeed.

And what information? I mean, we may very well accelerate our activities on a few plants that are problems and may be more tolerant of plants that have only minor issues.

MEMBER WALLIS: Okay.

MR. HOLAHAN: The three major activities that are going on really have to do with a draft regulatory guide, which is really a revision to Regulatory Guide 1.82.

An industry initiative activity, which is developing specific technical guidance that can be used by individual plants to test where they are with respect to this issue and what they need to do and the generic letter itself, which is our regulatory tool for kicking off that activity.

At the bottom of the viewgraph you see basically the closeout activities are after the generic letter goes out we'll get responses from each plant. We'll review those. Hopefully in a short order, because of the guidance available, we think maybe this can be an efficient review; come to closure on what actions we think need to be taken and on what time frame.

Where there are some difficult or technical issues, we may do sample audits or independent calculations as we did for the case of the BWR sump strainers, and in the normal course of action, we would issue a temporary instruction, which is an instruction to our resident inspectors to see that appropriate closeout activities are taken.

So that's a general overview of where we are and how the program works, and what we're going to do today is kind of walk you through the structure and the technical expectations in the generic letter.

John Lehning, are you going to do that for us? Ralph.

MR. ARCHITZEL: Well, I'll try and go through quickly. My name is Ralph Architzel. I'm with Plant Systems Branch at NRR. I'll try and quickly go through some of my slides from the other day.

Can I have the next slide, John?

First, I'd like to note that Generic Safety Issue 191 is related to the Regulation 5046 and Criterion 35 for long-term recirculation. It's sort of critical. We consider this a compliance issue in some instances, and those are the regulations involved.

As Gary has mentioned, the reblockage may prevent the injection of water into the reactor core or containment spray operation.

Of note, USI A-43 did examine this. It was principally focused on vortex formation, along with debris blockage by fibrous insulation. It was closed in 1985 with a recommendation going forward that mechanistic analyses be performed by licensees as they changed out insulation, et cetera.

A specific decision was made not to backfit at that that time as it wasn't cost beneficial, but forward looking plants had to do deterministic analyses, and the current fleet of plants should consider that when they changed out insulation because of the expenses involved.

So GSI-191 was opened in 1996 because of events that happened at the BWRs and also because of new information during the BWR resolution that was identified, such as the thin bed effect and other aspects of that. So we reexamined USI A-43 and resultant GSI-191 being initiated. Research completed their technical assessment, concluding that there was a sufficient basis to conclude it's a credible concern, and we're in the process of developing regulations.

The current generic letter you have in front of you today is based on a -- has actions that require us to consider this a compliance backfit. So now we're reversing that position at least in the draft staff position and considering this to be a compliance backfit issue associated with the generic letter.

We realize this is a pre-decisional document. We still have to go through the CRGR. At the moment it is a compliance backfit.

MEMBER APOSTOLAKIS: What is it that -- let's go back. What is it that USI A-43 missed when you closed it?

MR. ARCHITZEL: The principal concern was the new information. I mean it didn't miss that much. It did say we have a 50 percent criteria on blockage of some screen that we put out with not a good, sound basis way back in the beginning. It identified that as being faulted. It picked that up.

What it didn't pick up, the large blankets and the transport of large fiberglass break-up, and it finds that new transport, et cetera, generation should be considered mechanistically. It didn't have effects like the thin bed effect where you have a very fine fibrous in the suppression pool at the boilers that resulted in those events, and then you have the particulate debris that goes along with that and can result in some clogging at much different configurations that were assessed at the time of USI A-43, some of the paint chips, you know, different particulates.

There was more information that was identified after that point in time that would change the balance of a cost-benefit.

MEMBER APOSTOLAKIS: And this information came from where?

MR. ARCHITZEL: Well, the Barseback event, or a lot of research that has been done since then, the transport mechanisms, how the debris is -- I mean, we had a presentation the other day by Los Alamos about a lot of the testing they've done, and there is a lot more information today than there was then.

MEMBER POWERS: I have, quite frankly, lost track of the experimental bases for a lot of these discussions. I guess I'm familiar with some of the Los Alamos sponsored experiments on beds and things like that affecting the screen.

It seems to me that when Los Alamos was before us, there was quite a lot of discussion about uncertainties in the analyses of, one, what kind of debris was formed during a break, what range of it of area was affected, and the subsequent transport of that debris from whence it was formed to the sump itself.

Could you give us a thumbnail sketch of what the experimental support there is for those aspects of the analyses?

MR. ARCHITZEL: Are you talking about the uncertainties? I'm not -- I mean, if I went into the parametric and looked at how you took all of the parametric cases and --

MEMBER POWERS: I'm not so concerned about the analysis itself. I'm trying to recall what the experimental data base is.

MR. ARCHITZEL: It wasn't just the work Los Alamos did. It also was based on the work that was done for the boiling water reactors and the foreign experience in testing.

For the generation transport, like the steam air jet test, there is a tremendous history of testing associated with this issue, and still uncertainties, too, as you --

MEMBER POWERS: Oh, sure, and there always will be. I guess what I'm asking really is do we have reasonable qualitative understanding of the phenomena associated with first the formation of the debris and the subsequent transport of it.

I mean, you try to calculate transport of debris particles, and you're going to run into serious problems knowing what drag coefficients are used and flow pathways and things like that. I wonder do we have large scale tests that give us some confidence that these models that Los Alamos was using are roughly correct.

DR. WEERAKKODY: This is Sunil Weerakkody. I'm the Section Chief in the Plant Systems Branch.

I can try. I am not familiar about the historical aspects of this issue, but I have visited the experimental facilities both at LANL and also at University of New Mexico which were constructed just for this purpose.

MEMBER POWERS: Incidentally, the folks at University of New Mexico just before Christmas invited me down to visit their experimental facilities, and so I'm reasonably familiar with what they've done there, and quite frankly, their work puts a perspective on this that you might not derive from just looking at the raw paper work.

MR. ARCHITZEL: March 4th there's another meeting coming up at New Mexico, and the French are coming to that meeting also.

MEMBER POWERS: This committee is not.

DR. WEERAKKODY: Well, I can try to answer some of the parameters to the limited knowledge I have that Los Alamos did look at. One of the parameters they looked at in the University of New Mexico facility is how the velocity of -- I don't know the exact term -- the velocity of water that approaches the sump, how that affects the transport of different natures of debris because you have debris like RMI, and I'm sure you have seen, you know, that's metallic and what kind of velocities are necessary to transport that type of debris up to the screen where it is transporting things like fiber. What type of velocities are needed to transport that type?

So that was one parameter I know for a fact that they did look at. Then when I think of the facility at Los Alamos, you said you have seen that. In all of there they construct an apparatus where they have a pump and the screens, and then they introduce, you know, debris that they would think would be the type of debris that could be created during the loss of coolant accidents and missile delta Ps.

So there was real hard data that were generated to support this issue. I'm not sure I answered fully all of your questions, but --

MEMBER POWERS: Well, I'm sure that a fool can generate questions that a wise man would take a lifetime to answer, and so I'll play the fool here a little bit.

MR. ARCHITZEL: And let me just clarify one thing. If there's a lot of detailed information, and BP will talk about, second, there's some knowledge based documents and final preparation. It's a fairly thick document, but it's a track record back to the other experimental. You can go in there and you can go to the other NUREGs and the other historical aspects.

MEMBER POWERS: I think that's the news I wanted to hear.

MR. ARCHITZEL: And that document will be useful for industry in resolving this as well, and BP should be talking about this versus me, but that's the key document. We've been reviewing that.

MEMBER POWERS: So eventually we'll have a nice handbook that says here's all that we know about this issue from an experimental point of view.

DR. WEERAKKODY: Absolutely right.

MEMBER POWERS: I think that's a -- you guys deserve big credit for pulling that all together. I hope you do a great job on that because that would be of historical value. It will be of value to people designing new reactors. I mean, do a good job on that one. That's great.

MEMBER WALLIS: Dr. Powers, we had a presentation from Los Alamos at the subcommittee meeting, and there was quite an extensive give-and-take, and talked about their ways of approaching the generation of debris, the way in which they defined the area in which the insulation was destroyed and essentially broken up into small particles of various sizes and fibers and so on, and they essentially said that for a large LOCA, the material within that region was disbursed throughout containment and the velocities and so on.

MEMBER POWERS: Well, I know that's what they say. The question is is that true.

MEMBER WALLIS: Well, again, that is a question. I think one would have to -- someone has to peer review that and so on, but then that is to say that they were addressing the questions of transport in the water with CFD and all of that.

So we did have a look at that, and I guess you're right to say how far do you have to go to verify that the models are okay.

The way this is evolving is that the ball is very much in industry's court, that generic letter says you will analyze these things for your plant because each plant is different, and not only is it in industry's court, but NEI has promised to provide the guidance on the matters that you've been asking questions about.

So the success of this process depends very much on the response of industry and NEI, and I think the Los Alamos work has been very, very useful in establishing some of the things one needs to worry about. It's ongoing, and I hope it results in the document that you're suggesting, but the process here is to get the letter out and get information back from industry and get them to get NEI to develop this, industry to develop the methods for analyzing individual plants.

MEMBER POWERS: Well, I guess I agree with you that the strategy that the staff has approached here seems appropriate. They've done their analyses enough to see that they have a real issue here, and then they've said, well, but the issue really belongs to the industry and now they're turning it over.

I still think that this data document that you're putting together is just a great idea.

DR. WEERAKKODY: There is going to be a data document. I'd like to add one caveat to what Dr. Wallis said, which is we have made it clear to the industry that whenever they develop guidance, we review them, review our comments. We don't do safety value in some of them, but even in our generic letter, we make it clear in that that if we feel that they're not going in the right direction, then we would come back and say, 'No. That's not the first direction. So, you know, we try to the extent possible work with them, but at the same time, given the significance of this issue, we keep an eye on what, you know, is happening on all aspects.

MEMBER LEITCH: Ralph, a few minutes ago you used the term "compliance backfit." Could you explain the implications of that?

MR. ARCHITZEL: When you do a backfit like was done with -- the regulatory analysis guidelines have changed somewhat since '85. They allow now for compliance backfits. When you do a compliance backfit, a simplified cost-benefit, it still needs to be a significant issue, but you don't need to show a positive cost-benefit.

If we had to do a cost-benefit even today with an industry program and the way the regulatory analysis guidelines are set up, you have to factor in that program. You have to do best estimate with the program, without the program, and then you do the cost benefit, and that's a regulatory analysis without a compliance backfit basis.

It would be very hard probably even still to pass such a program with an industry program in place, but we can still, even if we didn't do compliance backfit, we can choose to do a backfit on that basis. We'd have to do that and then show a net benefit would go up. That's noncompliance backfit.

Okay. So we could still do that, but it's unlikely at this stage with an industry program to pass muster. A compliance backfit says that considering the way we've established the guidelines, we don't believe the ECCS system is in compliance with what we're looking for for long-term recirculation, those regulations I quoted. Therefore you need to change your analysis, mechanistically evaluate that phenomenon, and that's what we're imposing, is actions in the draft generic letter.

That is pre-decisional. We haven't gone through the CRGR yet. So we could come back with this, an information generic letter that wouldn't have any compliance aspects to it. It has the same impact, but it's not quite as hard an action as the compliance backfit generic letter.

MEMBER LEITCH: So the main difference is that a cost-benefit analysis does not have to be done or has that --

MR. ARCHITZEL: A simplified one has to be done for a compliance backfit, but not a rigorous one. We still need to do some type of -- and the one we're referring to now is the one that was done two years ago by research. You had it in the package, but it's not a rigorous regulatory analysis. It would be a different one if we had to do one today.

MEMBER WALLIS: This is really compliance. I mean, the LOCA system has to work, and if the debris prevents the system, the mitigated system, from working, then this is not mitigating the LOCA.

MR. ARCHITZEL: But from a compliance backfit standpoint, we're changing the way you say it works. We said 50 percent clean screens or 50 percent blocked is the guidance, and we agreed to that and we accepted that, and that's how these plants were designed and operated.

So they're in compliance today until we take an action to say different.

MEMBER LEITCH: Okay. Thank you.

MEMBER APOSTOLAKIS: So, I mean, this is telling us what Los Alamos did, but what did they find? I mean, address testing or knowledge based uncertainties. Can you tell us in one or two sentences what the conclusion there was?

MR. ARCHITZEL: I've got a back-up. Let

me just give you the typical numbers. Whether those are actually the numbers, we've had numbers portrayed, how many plants, good, bad, et cetera. The bottom line was there was a significant additional core damage frequency projected by the Los Alamos work.

MEMBER APOSTOLAKIS: Okay.

MR. ARCHITZEL: For the current condition it was less of a core damage frequency if you assume large break LOCA initiating events, and then if you factor in operator actions, one of the things in my slide here, to evaluate the potential recovery actions. We're finishing up with a report on that right now.

Then, for example, in a large break LOCA case, it might be an increase in CDF on the average of two, without operator action, it might be like 17. There's numbers like that out there.

MEMBER WALLIS: Would you tell him the number that Los Alamos gave us?

MR. ARCHITZEL: Yeah, these are -- I've got the studies.

MEMBER WALLIS: Well, we heard a number 170.

MR. ARCHITZEL: Well, that's without --

that number should have been 140.

MEMBER WALLIS: It's still a big number without these other operator actions and so on.

MR. ARCHITZEL: But whether that's a best estimate PRA, you know, there's some question. We've got -- that's what Los Alamos did for us to evaluate this associated with the --

MEMBER APOSTOLAKIS: And how were the operator recovery actions evaluated?

MR. ARCHITZEL: On the same basis of -- do you mean how many operator?

MEMBER APOSTOLAKIS: Presumably they put some probabilities there.

MR. ARCHITZEL: Oh, yes.

MEMBER APOSTOLAKIS: How?

MR. ARCHITZEL: Like the operator availability of taking the water storage tank and getting another source into the refueling water, to keep the ECS running and whether the operator turns off the pump and starts it again and can -- if that would be effective in clearing the insulation.

MEMBER APOSTOLAKIS: Do you happen to recall what model they used for these things?

MR. ARCHITZEL: Well, I've got it here if you're interested. I guess we could give it to you.

MEMBER APOSTOLAKIS: I am interested.

MR. ARCHITZEL: It's a draft though.

DR. WEERAKKODY: We can provide it to you later.

MR. ARCHITZEL: We can provide it to you.

DR. WEERAKKODY: I don't have the answer.

MEMBER APOSTOLAKIS: Are we writing a letter on this today? No.

MEMBER WALLIS: Do you want to talk about that now or do you wish to talk about it later?

MEMBER APOSTOLAKIS: Oh, it's up in the air.

DR. WEERAKKODY: But one thing I wanted to add to what Carl said, Dr. Apostolakis, is in terms of the knowledge base uncertainty, it's not just the core damage frequency numbers that the Los Alamos contributed. If you look at the history of this issue, for boilers the agency could take a much more rigorous approach because of events where the screen was blocked.

So in terms of uncertainty, there's

quite a bit of certainty that this is a problem, and the agency issued a bulletin, then a letter, and had the boilers -- initiate the boilers to address that.

When it came to pressurized water reactors, we have never had an actual case where sump recirc. was actually demanded. All of the small LOCA events we had in the industry were mitigated before proceeding with the sump. recirc. stage. So it was a case of zero demands and zero failures.

In a situation like that, now you need some original experimental data to establish the credibility of what you postulate, and I think the Los Alamos study significantly contributed to the issue so that we can engage the industry with strength in saying, "Look. We did the experiments. We think there's a potential issue here." So we all should pay attention and resolve this.

So I think if I summarize the knowledge base uncertainty that LANL contributed, that's that. In terms of the recovery actions, you know, we would provide you the numbers and the basis that they gave us, but I just want to tell you that the type of operator actions, the operators can take in situations like this, we don't normally assign. I don't think they can assign very high failure probabilities.

So whatever are the CDF numbers that we came with were not --

MEMBER APOSTOLAKIS: Now, why is that?

DR. WEERAKKODY: Because, again, you run into situation of limited demands and limited failures. If you look at the type of operator actions the operators must take in a scenario like this, one of the things you talk about is refilling the RWST, and this has to be done. First there should be a water source available. Cross-ties have to be made, and this kind of action has to be done within a short time frame under stressful conditions.

A second operator action, again --

MEMBER APOSTOLAKIS: So wait a minute.

DR. WEERAKKODY: Yeah.

MEMBER APOSTOLAKIS: Maybe I didn't understand what you said. You said you cannot assign verified probabilities of failure?

DR. WEERAKKODY: You cannot assign -- oh, well, maybe I used the wrong word.

MEMBER APOSTOLAKIS: Because your argument is you --

DR. WEERAKKODY: Yes, yes.

PARTICIPANT: Low probability.

MEMBER APOSTOLAKIS: A low probability, but what is a low probability of failure?

DR. WEERAKKODY: When you look at operator actions and the failure probabilities, you see numbers like .001, .5 and --

MEMBER APOSTOLAKIS: For failure?

DR. WEERAKKODY: For failure, yes. So you wouldn't see failure probabilities such as .001 in a situation like this. Again, what I would --

MEMBER WALLIS: I'm confused. You will see big numbers like .5. Is that what you're saying?

DR. WEERAKKODY: Yes.

MEMBER WALLIS: If it's .5, it doesn't matter whether it's failure or success, does it?

MEMBER APOSTOLAKIS: But didn't se just hear that without recovery actions the delta CDF was very high and then with recovery went down?

MR. ARCHITZEL: About an order of magnitude.

MEMBER APOSTOLAKIS: About an order of magnitude. How do you go down by an order of magnitude if the failure probability of the operators is .5?

DR. WEERAKKODY: Because it's a combination of operator actions. You know, again, what I would rather do is give you a copy of the report we have because right now I'm speaking from the overall knowledge I have rather than the specific numbers that are in this report.

But the short answer to your question would be it is not just one operator action. If you have a couple of operator actions, such as another action I know that the operators can take is stopping and restarting the pumps, and I don't know how that has been factored into the support because we just got the report a couple of days ago.

MEMBER APOSTOLAKIS: From where?

DR. WEERAKKODY: From Los Alamos.

MR. ARCHITZEL: But it's delayed recirculation by not having both trains working, you know, delayed if you can avoid the containment spray starting. There's different things that can be done, and they are factored in there, and they are analyzed on that analysis.

MEMBER APOSTOLAKIS: Yeah, I'd like to see that.

MEMBER LEITCH: Is it not also a factor

that even if the operator does all of the things that this procedure prescribes that it may not be successful?

MR. ARCHITZEL: Right.

MEMBER LEITCH: Is that factored into the issue? In other words --

MR. ARCHITZEL: Sure.

MEMBER LEITCH: -- I presume the procedures could prescribe some remedial operator actions, but they may not be successful at removing the debris from the --

MEMBER APOSTOLAKIS: That's right.

MEMBER LEITCH: So is that -- when you talk about the success of operator actions, are you talking about the faithfulness with which he does them versus whether those actions are successful or not? Are both of those factors included?

MR. ROSEN: You fraction for both. You have an event tree.

MEMBER LEITCH: Right.

MR. ROSEN: You fraction for both.

DR. WEERAKKODY: What you say is correct, yes.

MEMBER LEITCH: Okay.

MEMBER WALLIS: The probability of

clearing the screens by playing with the pumps is probably pretty small, but if you can actually cross-tie another source of water, then that may be that you can do that. You know the water is there and it will probably work. It all has to be worked out.

MR. ROSEN: Well, the first infraction says that the operator should violate basically his intuition, which it is not a big accident, and he is in recirculation, and he should stop recirculation.

So what is the likelihood of that? Well, if he has been trained, it is unlikely or maybe 50-50 that he will do it. And then the next is grandiose,a nd what Leitch just said, and that begs the question is even if he does it, will that unplug the sump.

Well, we don't have a lot of testing on that, and maybe it will and maybe it won't.

MEMBER APOSTOLAKIS: Maybe it depends on the context doesn't it?

MR. ROSEN: It depends on what?

MEMBER APOSTOLAKIS: On the context.

MR. ROSEN: Sure.

MR. ARCHITZEL: I had better move on.

MEMBER WALLIS: I think we should move

on, yes.

MR. ARCHITZEL: One thing I want to say for Los Alamos support, we did contract -- NRR contracted, and it does bring us the technical expertise that researchers had devoted to this topic.

I did want to mention that they are completing a set of calculations for the volunteer plant, and you did hear or the subcommittee did hear about some of the results of that the other day.

So we are actually going through and doing a set of calculations to give us a feel for when the licensees do it for us to be able to evaluate that.

So you heard some of the results of those calculations two days ago. And --

MEMBER WALLIS: Do you want to move to the next slide?

MR. ARCHITZEL: Yes. I would like to say that we have NEI perform. The Sump Performance Task Force that has been in place, and they have been holding regular meetings and interacting with us since --

MEMBER WALLIS: They have been there since 1997?

MR. ARCHITZEL: This issue started in 1996 as a GSI. So they did form in 1997, and they have been following the work that Research was doing during the technical assessment, and they were involved frequently, and going out and looking at the test facilities. So, yes, they have been around for a while.

MEMBER POWERS: The issue was introduced on my -- to this committee on my very first meeting as a member. It brings tears to my eyes.

MEMBER WALLIS: Well, you have struck a cord there, Dr. Powers.

CHAIRMAN BONACA: I don't have as much history on the committee, but why is the burden on the NRC to perform this research?

MEMBER WALLIS: It isn't.

CHAIRMAN BONACA: It isn't? Okay.

MEMBER WALLIS: I think we ought to move head. The subcommittee decided that there was quite enough evidence that this was an issue. And that it was appropriate that this letter be sent out so that information could be gathered to resolve it, and that it should be done expeditiously.

CHAIRMAN BONACA: Okay.

MR. ARCHITZEL: I would like to note on

the industry and in some of these meetings, I will try and go fairly quickly. On March 28th was the initial kick-off meeting with our generic resolution process, generic safety issue, and it does allow for industry initiatives, and you factor those in.

So they did offer one at the initial meeting, and it is a six-step program. One of the initial steps of that program was the condition configuration assessment, and that document was issued last fall.

A lot of utilities are going out there as we speak assessing the configuration, and gathering design-basis documents, and getting their hands together on this issue, so that when the guidance comes out that they are not starting from ground zero.

They are starting from a base of having looked at their containment, and assessed the configuration, and they know where they are starting from.

Additional meetings. I won't go over what we have done in all of those meetings. Gary has gone over some interoperability issues.

MEMBER WALLIS: All right. Go ahead.

MR. ARCHITZEL: We have been reviewing

the guidelines and the ground rules documents, and the actual guidelines by the industry won't be coming out until September of this year currently.

MEMBER APOSTOLAKIS: So you have a session at the ANS meeting?

MR. ARCHITZEL: We did have a session at ANS, but it was not well attended.

MEMBER APOSTOLAKIS: It was not?

MR. ARCHITZEL: Not compared to like the NEI industry workshop, where you had hundreds of -- maybe a hundred representatives of industry, and vice presidents, and it was an important issue. Gary went to that meeting, and so the PWR industry, the biggest meeting that we have had was that one, and it was not our meeting. It was NEI's workshop.

MEMBER WALLIS: Well, maybe it is appropriate for me to bring up the issue of how much one can rely on this NEI evaluation methodology. The NEI-02-01 is at a very low undergraduate level, and even less a high school level, where you walk around the containment and look to see if there might be some debris.

MEMBER APOSTOLAKIS: Junior high maybe.

MR. ROSEN: You are very pejorative.

MEMBER WALLIS: Well, I'm sorry.

MR. ROSEN: It is quite a bit higher than that.

MEMBER WALLIS: Okay. I'm sorry, but you get the idea. The main question is that when you have got this debris how does it come off, and how is it transported, and does it go to the sump and all of that.

And really we have seen -- the subcommittee was presented with no suggestion that these guys were on the way to providing any guidelines for those important mechanisms. And maybe it is there somewhere, but we just didn't see any manifestation of it.

MR. ARCHITZEL: Well, the guidelines that have been put out, the PWR URG guidance document, the staff did an evaluation for that when we resolved that issue. The PWR Owners Group has that document.

And to the extent that they follow that and follow those recommendations, and follow our SER--

MEMBER WALLIS: They are following the work that you did, rather than developing their own.

MR. ARCHITZEL: Well, no, what the BWRs did.

MEMBER WALLIS: Oh, the BWRs.

MR. ARCHITZEL: The BWR URG is a document that is pretty detailed guidance. They have not developed and published that yet, but that is certainly a strong base, and to have that on where to start them. So it may not be that difficult to come up with an acceptable guidance document.

But they do have that document, and we have reviewed and approved that.

MR. ROSEN: The BWR containments and PWR containments are quite a bit different.

MR. ARCHITZEL: Yes. I think -- I would like -- there was a question the other day has there been any foreign interest. Just yesterday, we did get an e-mail from two representatives of the French regulatory agency, and they are thinking about coming and visiting us next March in that meeting, and telling us some of their experience with testing.

So we want to brief you a little bit on a change from the other day. So that next meeting does have the potential for some international participation.

MEMBER WALLIS: I noticed that the

French were cooperating with NEI, but --

MR. ARCHITZEL: That is different.

MEMBER WALLIS: -- they seem to be cooperating with you.

MR. ARCHITZEL: The French have a representative -- the French industry have a representative on the NEI task force, but the regulator has been doing testing, and they have asked to come and meet with us, and the regulator is involved in this issue and trying to resolve it in France. We didn't know that the other day.

Currently, we are planning to issue a draft generic letter for public comment in the first quarter of 2003, and then as I mentioned before, it is pre-decisional.

You had mentioned, and we are prepared to come back and tell you what the results of those public comments are, and if they are not significant changes, if that is what I am hearing. It is your choice. I am hearing that again.

And then when the industry evaluation guidelines come out in September, or potentially maybe somewhat later than that, we are not positive, we will meet with you once we have reviewed and made our comments with that, and we will meet with you and go over that guidance.

We do require ACRS review of the final resolution of this generic issue, and I will turn it over to John Lehning for the details of the schedule.

MR. LEHNING: Again, my name is John Lehning, and I work in NRR, and I work with Ralph, and we are the technical leads on the GSI 191 issue, and I am going to go through the generic letter. And just again it is a proposed generic letter pending completion of management and CRGR review, and it is not publicly available right now.

MEMBER APOSTOLAKIS: Is there something that is in the books, or this is what you actually studied, "General Engineer."

MR. LEHNING: It is a title.

MEMBER APOSTOLAKIS: It is a title?

MR. LEHNING: Correct. Yes, nuclear engineering is my study.

MR. ARCHITZEL: I would like to mention that we provide you a draft of the generic letter. There have been changes. We have a redline strikeout version. If I could pass that out.

There aren't substantive -- there are some changes, but they are highlighted for you, and so we are dealing with the document that is in front of our management now.

MR. LEHNING: Going to the purposes of the generic letter, and I am going to move through the slides pretty rapidly. I mean, the subcommittee has heard it, and again just what the subcommittee's biggest interest is was the schedule, and that is the last slide, and I have a better viewgraph of that. So hopefully it will be more clear as it was too confusing before.

Again, the main purpose was to inform the PWR licensees that our research has identified a problem with the sump screen debris blockage, and that were culminated with a parametric study.

Then there were some additional issues that were identified in the other research and analysis that we did on the GSI, and I will identify what those are.

And then we request action as Ralph said with the compliance backfit, and we request action to address those with an evaluation and additional actions.

And then finally we ask for information so that we can identify whether plants are doing the actions that we request at the completion so that we can evaluate how well they performed those actions.

The phenomenology just really quickly. The debris generation and the kind of mechanisms that were are talking about is when the pipe breaks, and you have really rapid expansion of the pressurized fluid in there, and you have jet impingement upon non-robust materials that are in the path of that fluid.

You also have global containment conditions that can disbond coatings and the like. You have pre-existing debris sources, which may be like dust coating on surfaces and containment, and that that may contend fibrous materials.

So you could have for small sump screens, and that might be a concern, and you might have enough fiber to cause a thin bed effect, even with that coating of dust.

As far as debris transport, you can have gravitational settling or water entrainment and wash down can cause this debris to enter the pool on the floor of the containment, and then if you have enough turbulence, or velocity, within the pool that debris may transport to the sump screen.

And then if accumulation patterns are suspended in the pool, it may tend to accumulate uniformly. But if it is sliding on the floor, it may be able to crawl up on the screen as you accumulate debris.

Or if it is a horizonal screen, it may cover that type of screen. Next slide, please. The concerns that I have addressed in the generic letter have to do with sump screen debris blockage, and there are two issues there.

The first is what was examined in the parametric study, and it focused on the laws of NPSH margin for the emergency core cooling system pumps and the containment spray pumps.

But in addition to that there is also an issue with the structural reinforcement of those screens, and whether they can withstand the increased head loss that a complete coverage with a debris bed, as opposed to just a 50 percent blockage, is a lot greater head loss.

So there are concerns with the structural adequacy. There are also concerns with debris blocking drains that are in the containment, like in their fueling cavity, or containment compartments, where those would block the debris and you could hold up water there and reduced the net positive suction head available to pumps.

And then also if the sump screen is not adequately sized, there may be debris that is able to pass through it and block flow restrictions downstream of that location. The next slide, please.

MEMBER WALLIS: May I say that all these methods, all these mechanisms that you talked about here, Los Alamos has a handle on, and has ways of dealing with, and has looked at, and your presentation to the subcommittee gave us enough confidence that there was a problem, and that you could make various assumptions and so on.

But it is remarkable how little debris it takes to plug a screen, for instance.

MEMBER POWERS: As I indicated, I did have a chance to visit the University of New Mexico's test facility, and they showed me some of their thin beds that they create on the sump screens in their test facility.

And I have to admit that I was very, very impressed. My intuition was quite wrong about how little material it takes to cause a clogging, and it is unfortunate that we didn't bring an example of that for the members to see.

Not only that, things are time

dependent, and they get different behavior if they wait over the weekend and do things, and it is really quite interesting.

MR. LEHNING: That is all true, and just to give an example of what Dr. Wallis was talking about. Like for say a hundred square foot screen, if you assume a one-eighth inch thin bed of fiber, it would only take roughly a cubic foot of fiber to do that.

MEMBER WALLIS: A bucket full of fiber or a few bucks?

MR. LEHNING: Not very much.

MEMBER APOSTOLAKIS: Now the mechanistic evaluation of the susceptibility. What is that?

MR. LEHNING: What we are talking about there is the concerns that I identified before. Those are not addressed in most or current licensing bases because they assume that the screen would be half-blocked and half-open.

So the mechanistic part of that refers to where you have to phenomenology look at these processes, like the generation transport and accumulation.

MEMBER APOSTOLAKIS: So each licensee will do this?

MR. LEHNING: Each licensee would have to do an evaluation of their own plant using these mechanistic processes.

MEMBER APOSTOLAKIS: My understanding of the work at Los Alamos and other places is based on very large uncertainties here and it is very difficult to predict anything. So how can the licensee do a credible job here to convince you about that?

MR. LEHNING: There are uncertainties, but the way that -- traditionally uncertainties are addressed through conservatism. So if a licensee has an uncertainty, then they would have to address it that way.

MEMBER APOSTOLAKIS: Are you talking about he sensitivity analysis here, where you assume that a certain percentage of the screens is blocked, and then you try to find out what the impact of that is on the ACCS; or you actually want them to go into the transport mechanisms?

MR. LEHNING: We want them to go into the generation and the transport, and industry is developing methodology that all these plants can use for determining how much debris is generated, and transport guidance.

I mean, each plant has different conditions for transport and things like that, but there is going to be a general guidance, and the staff is going to look at that and comment on it.

So each licensee will have to go through for their plan and apply that guidance to that plan.

MEMBER APOSTOLAKIS: Are there any computer codes that would help you with this?

MR. ARCHITZEL: Yes. Los Alamos has some that industry may avail themselves or may not, and they did go into them a little bit yesterday. The BLOCKAGE code that actually accumulates on the screens, depending on the types of strainers and screens, and they also haver what is called a CASINOVA code that they went over that steps through the debris generation part of it from the line breaks.

So there are some codes that are available, but they may develop their own.

MEMBER POWERS: And there are engineering organizations, engineering consulting organizations that are actively pursuing this issue.

MEMBER WALLIS: George, we had a representative from NEI at the subcommittee meeting who stressed the need for plant specific evaluations, because the plants are very different.

MR. LEHNING: Okay. That kind of covered the evaluation part of it, but then the next step was to have licensees, PWR licensees to look at doing intern compensatory measures.

And in the version of the generic letter that was given to the ACRS ahead of time, the language on that particular issue did change just a little bit, and that is one of the changes that we highlighted for you.

And it is kind of worded the same way in the revised that is on the slide here now.

MEMBER WALLIS: That is on the slide now?

MR. LEHNING: And then it just says assess the necessity of them, and then if appropriate take these actions, rather than requesting them directly. There is no substantial change. It's just that a matter of emphasis as far as that change goes.

MEMBER APOSTOLAKIS: So the language is a little strange?

MR. LEHNING: The language is a little bit more relaxed I guess, but there is no change in meaning.

MEMBER APOSTOLAKIS: Is it possible that there will be a necessity, but it will be found inappropriate in implementing measures?

MR. LEHNING: That is a language issue, and I guess we could try to address that.

MEMBER APOSTOLAKIS: But that is not what you mean?

MR. LEHNING: Right. I guess appropriate there means that if it is necessary to meet requirements.

MEMBER WALLIS: They have to report to you, and you are going to assess or evaluate this response?

MR. LEHNING: That's correct. They will report what interim compensatory measures they take in response to the generic letter. So we will be able to look at that.

And then the last bullet there was just to do plant modifications if you need to comply with the regulations. The next slide, please. Moving on to the information request.

The generic letter does require a response as per the regulations. There is a two-part response, and the first part basically asks for the plans for doing the walkdown and for doing the evaluation, and also the plan in term compensatory measures, but the measures that will be taken.

The second part -- well, the first response is requested 90 days after the letter is received, and I will have a viewgraph on that schedule.

MEMBER WALLIS: I noticed that your schedule seems to emphasize the walk down, and I was a bit pejorative before, but the walk down is simply inventorying the fact that you do have an insulation here, and which they probably know already.

But there may be some dust and all of that. That is the easiest part of the whole thing, and that doesn't solve the problem at all.

MR. LEHNING: That's right.

MEMBER WALLIS: They have to figure out does it come off and does it go to the sump, or does it block the sump, and how big is the strainer, and everything.

And that is the part that really has to be done. And you don't want to let them say, oh, we have done a walk down and we don't have to do anything for another year or something like that.

MR. LEHNING: Well, the evaluation, as I will show on the slide, but the two inputs to the evaluation are the NEI test, which has to provide that guidance to the industry, and the licensee has to walk down the containment and get an understanding of what insulation they have and confirm that.

So those are the kinds of two inputs. And once both those two inputs are satisfied, then the evaluation can proceed at that point. And I will show that on a future slide.

And then the second information request was basically asking licensees what methodology they used, and what was the result of the evaluation was, and whether compensatory measures needed to continue, and plant modification schedules. If we could go to the next slide, Ralph.

This slide discusses the coordination with the industry as has been mentioned, and the industry is working to develop technical guidance to solve the technical issues at stake.

The first part of that was the walk down guidance that licensees would use to perform the containment surveillance to look at what debris sources they had in the containment. And the second part is the actual evaluation methodology guidance as to what you do with that information that you have in your plan.

The walk down guidance was published last September, and the revision that incorporated NRC comments. And the methodology guidance is scheduled for this coming September 2003.

The generic letter tentatively endorses the NEI program, but we also say that we can issue a supplemental generic communication if it is not appropriate in our opinion, and if we have some exceptions to it. Go to the next slide, please, Ralph.

This slide shows the schedule and a little bit easier way to understand than before. On the left column of this graph, we just have the actions that we are requesting in the generic letter, and the bars represent the time period over which those actions will take or is expected to take.

MEMBER WALLIS: Now, this is what I found surprising and we didn't see this in the subcommittee meeting.

MR. LEHNING: That is correct.

MEMBER WALLIS: And you wrote a letter and it talks about within 90 days of getting the generic letter, you have to present your plans for containment, and you have to present your plans to perform the evaluation of the susceptibility of the recirculation functions, and ECCS, and CSS.

So within 90 days, they have to not only do these containment walkdowns, but they have to develop their sort of plans for analysis of all these other things, like transport, and blockage, and all that kind of stuff.

And then there is another within 90 days of doing that, and they have to actually describe the actions taken. So the impression given from the generic letter is that things are proceeding pretty rapidly with these 90 day periods.

Here we look at this time schedule, and it may be that they don't even do the debris blockage evaluations until 2006, which is amazing.

MR. LEHNING: Well, the language in the letter is meant to convey the same information as is up here, and I will just explain why. The first response is asking for when you plan to do the walk down and when you plan to perform the evaluations, and what interim compensatory measures that you are looking at.

So a lot of the reasons why these bars are long is because of the refueling cycle, and that's how we made the assumption that licensees would do the containment walkdown in a non-power condition.

So that kind of drives the schedule a little bit, and just if I explain -- well, like if the licensees had begun last September, these bars show that. There is a navy blue part of the bar on the screen, and there is a green part.

If they had begun right when they issued -- when NEI issued their guidance for the walkdown, basically the activity would complete at the termination of the navy blue part of that line.

However, if the licensee was not proactive and waited until the generic letter was issued to start the walkdown, the green part, they would not complete that until the green bar.

MEMBER WALLIS: But it is conceivable that a proactive licensee, given the NEI guidance comes out and is adequate, could actually mitigate and solve the problem with that plant by part of this year in the front of that blue part there.

And if they were really proactive and didn't delay, they could by January of '04 there have solved the problem and everything.

MR. ARCHITZEL: Well, as Gary mentioned,

some have already done it, at least one.

MEMBER WALLIS: So we are just looking at the laggards who might be waiting until '06.

DR. WEERAKKODY: For example, Davis-Besse has already -- or has installed or is installing a new screen.

MEMBER WALLIS: Well, the fact that they might, there is no problem with that plant.

CHAIRMAN BONACA: Well, in fact, this agency seems to be relying on the comfort that was talked about before, that it would be for plants that have susceptibility to CRMD cracking, and you would have some additional expectation of more promptly looking at the sumps? I mean, that seems to be the logic.

If you are looking for comfort, maybe that is where you have less comfort.

DR. WEERAKKODY: I may not directly answer the question that you raised, but one of the things to put this picture in context, this is for plants which conclude degraded, but operable. In other words, it is difficult, if not impossible, for us to say that your plant needs some screening which is not operable.

But when we get the generic letter out

there may be some plants which concluded for themselves that it is inoperable and then replace it. But there would be a number of plants which would say we are in good condition, and something relevant to what you said in terms of the CRDM cracking and then that relates to this issue.

It did come up for Davis-Besse, and in fact this question came up yesterday regarding the type of debris that is near the CRDM, and that is specific to transport, for example, for that area. And if you have mostly (inaudible), then that is what you would generate.

And then looking at the (inaudible) velocities, and given injection and by the time that you reach the recirculation state, you don't have much turbulence in the sump, that type of debris would most likely be deposited wherever they are rather than transported into the screen.

MR. HOLAHAN: I think I agree with Sunil's summary. I am not particularly concerned about control rod drive mechanisms, because certainly from Davis-Bessie there was I think no fibrous material in that area.

And it is not such a direct path for producing that debris and getting it to the sump. I think there are probably a number of factors that might make you more concerned. Things like the size of the screen, or in fact whether there are pipes width, and fibrous insulation within the vicinity of the sump are probably more important considerations to driving a licensee for the need to do early implementation.

MEMBER WALLIS: So when you get the responses, the first response to the generic letter, you are going to do some assessment of susceptibility of these plants, and there may be some that you need to encourage to move up their response to the second part?

MR. LEHNING: At that point, we will make a judgment. I mean, they will tell us what their schedules are, and we will have to look at the information that we have, and make a determination on whether that is acceptable and satisfactory in conjunction with that information.

MEMBER WALLIS: Well, I would hate to have things still going on to resolve this issue when Dr. Powers is no longer a member, since he came on when it started, and that was -- it is going to be a period of 10 or 12 years since he came on by the time we finish.

CHAIRMAN BONACA: There is a finite chance that some of these plants may prove to have had an inoperable recirculation system for 10 years.

DR. WEERAKKODY: Yes, you can't rule that out. I think the short answer to Dr. Wallis' question is, yes, one of the things that we have going for us is the significant amount of information that the Office of Research has generated for us as a knowledge base.

For example, even though there are a number of parameters that are uncertain, we can (inaudible) determine what are the critical parameters are. For example, if a plant, a particular plant has a horizontal, as opposed to vertical, screen that is of a very small size, we would definitely look at the response from that plant very closely, compared to a different plant.

So even though we don't have answers to every question or every uncertainty, we do have enough information to engage the licensees effectively.

MR. ROSEN: No licensee should be surprised by this when the generic letter comes out in August.

MR. ARCHITZEL: Well, they have public

comment as a minimum version.

MR. ROSEN: So the licensees should be on notice now that something is in the works.

MR. ARCHITZEL: They have been on notice for over a year. All these groups have been brought in and so all the utilities -- NEI has done things like sending out letters that say be careful when you change insulation for this issue, and that has gone to all of the utilities. So they are informed of this issue.

MR. HOLAHAN: It is important to remember that these time frames don't supersede the licensees ongoing responsibilities to have operable systems based on their tech specs to deal with degraded and non-conforming equipment according to Appendix B and the time frame for corrective action based on the safety significance.

So those are all folded together. So my expectation is that if a licensee has through this information makes a determination that they have an inoperable ECCS, they know what to do. And we are not talking about years. We are talking about hours.

And if they have a degraded condition that is too significant to allow two cycles, or for corrective action, I expect them to be implementing their normal programs in dealing with that issue.

MEMBER WALLIS: When will you have this document that Dr. Powers is asking for that puts together the work from Las Alamos and says here are the problems and here are the methods?

MR. JAIN: We plan to issue this month. It is scheduled to be issued this month.

MEMBER WALLIS: This month?

MR. JAIN: Yes.

MEMBER WALLIS: So it will be ahead of the NEI document?

MR. JAIN: It will be definitely. We will have it available to them the first week of March.

MEMBER POWERS: You know, we ought to make time on the schedule for these guys to come down and describe that to us, because I think that it is a great idea.

MR. JAIN: I will try to summarize a few things that it has, and we are not prepared to go over the details of that at this time.

MEMBER POWERS: Well, once we have it and we have had a chance to look it over and try to understand the experimental basis here, if you can come down and give us a little half-an-hour pitch.

MR. JAIN: Sure.

MEMBER POWERS: So we can say nice things about you.

MEMBER WALLIS: I am more concerned about the NEI document, because I know that Los Alamos put a lot of effort into this. They did experiments and did a lot of analysis, and I just don't know what NEI is doing about it.

MR. JAIN: And finally to add the comfort level that we have been seeking with this particular knowledge-based document, it has been peer-reviewed by an international group of people.

MEMBER POWERS: This just gets better, and better, and better all the time doesn't it?

MR. ROSEN: This still don't resolve Dr. Wallis' concern that all this good work that has been peer reviewed is being picked up by the NEI document that will ultimately determine the way that he licensees do the analysis. How do we get comfortable with that?

I know that I heard Ralph say that the BWR groups did a very good job, but now I have to go through the inductive leap of faith that says that therefore the PWR groups will do a good job, too.

MR. HOLAHAN: I don't think it is a leap of faith. I think it is our job to do that, and to make sure that they do a credible job, and making information available to them seems to me that it only helps them do that.

And perhaps they might actually want to read this transcript to read the expectations. But I think that this is a normal part of our job, and when we come back, we will need to explain either how the industry has done a good job in meeting our expectations or what we insist upon to supplement that.

MEMBER WALLIS: In this schedule that is up on the screen, when do you expect to come back to us?

MR. HOLAHAN: For the purpose of the NEI guidance?

MEMBER WALLIS: For whatever purpose.

MR. ARCHITZEL: At this stage, what we plan now is at the stage where we have evaluated that guidance, and accept or don't accept it, shortly thereafter. So it would be probably -- right now it might be November or December of this year.

MEMBER WALLIS: So towards the end of

this year?

MR. ARCHITZEL: That is when we are planning it. It is not specific on the schedule. It is sort of on my side, but it would be after hat.

MEMBER WALLIS: Well, would you have the responses to the first part of the generic letter, and you would have the NEI guidance. So you would have a lot more information, and then you could tell us whether you were on track, or needed to revise your strategy, or needed to lean on certain plants, or --

MR. ARCHITZEL: or reissue another version of the generic letter or something.

MR. ROSEN: Now, what happens if they do their analysis and develop their evaluation methods, and you read them and don't like them? What happens?

MR. ARCHITZEL: Well, we have one example of that right now, but we have to make our case, and we have to -- it is a little difficult to push, let's say, the leak before break issue, with a program if it takes most of the risk away.

And we do fall into a more difficult situation with an industry program. If that takes the majority of the leak -- and if there are still residual issues there, with latent fiber and things like that, but that is an example.

We have to make a decision, and come forward, and do battle on that issue.

MR. ROSEN: Okay. So a leak before break is clearly one big issue, but what if you get past that somehow, and now you know before you do these kinds of calculations that Dr. Wallis will help you understand if you don't already, that there is lots of ways to come up with answers.

MR. ARCHITZEL: I guess the best way to characterize that is if you would see -- we did have comments that they incorporated on the NEI-02-01, and they were responsive.

And if we have difficulties, your question is how do we --

MR. ROSEN: Well, I am told that if they have high school issues that they were responsive on; is that right? We are now into graduate school in the evaluations of thermal hydraulics.

MEMBER WALLIS: Well, I guess that is looking up in the insulation, and it looked to me like something that didn't require any engineering knowledge and was not the difficult part.

MR. ROSEN: And what Ralph said was that

they were able to reach an agreement with NEI on those issues. Now, I am less sanguine about the ability to reach agreement with the industry on the more difficult technical issues, and asking what will you do about it then? Are we going to be stuck with NEI's guidance?

MR. ARCHITZEL: No. No, we are prepared to not agree with NEI. I mean, there is only one regulator, and its name is not NEI.

MEMBER WALLIS: Right. Put that on the record.

MR. ARCHITZEL: And a typical example is that if you look at the BWR URG document that I had mentioned, there is probably 8 or 9 issues where we wrote our SER and we disagreed with URG.

MEMBER WALLIS: Right.

MR. ARCHITZEL: When the audit teams went out and inspected, they verified that the utilities did it in accordance with our SER, or the RG plus. So that is the situation. We would have to supplement if there was that disagreement with this generic letter, but that would be the process.

MEMBER WALLIS: Ralph, we need to finish by noon, and I think we expected that we might take less time than we have taken already, but that is always our expectation perhaps.

MR. LEHNING: Well, if there are no more questions, that was my last slide, and we can move to BP Jain to talk about the reg guide.

MEMBER WALLIS: thank you.

MR. JAIN: I am going to be talking about the reg guide which we are here to seek your comments for releasing the draft for public comment.

MEMBER WALLIS: This reg guide by the way is in our folder for this meeting.

MR. JAIN: In this presentation, I will describe the process that we used in issuing the guidance, and the summary of the revision to the reg guides.

We will also talk about our plans and schedules to each of the reg guides. The process includes a briefing of the draft guide to ACRS on what we did the day before yesterday, and finally in the contents we will issue the draft for public comments.

And we will address all of the public comments to it and brief the CRGR and ACRS again. And after observing all the comments, we will issue a final reg guide.

MEMBER WALLIS: Do you have an expected

date of arrival of this final guide?

MR. JAIN: Well, it is September of 2003.

MEMBER WALLIS: So it is pretty soon?

MR. JAIN: Right, and we will come back to you in July to the ACRS. That is what we have planned. And with respect to this reg guide, we have basically enhanced the guidance on debris blockage evaluation for PWR sections, and the guidance, what we have is consistent with the BWR guidance, and insights that we have gained from the research program on 191.

And that includes issues such as debris source and generation that we talked about last time, and debris transportation, and accumulation and head loss. Now, the draft guide provides a unique approach which are acceptable to the staff. However, the licensee can always propose alternate approaches for the staff's review. We are also making available to the --

MEMBER APOSTOLAKIS: I gave a talk to the Northeast Section of the American Nuclear Society last Tuesday, and I mentioned what you just said, and those people laughed. Can you tell me why they laughed?

MR. ROSEN: I don't understand the circumstances of their laughter and so I get the joke.

MEMBER APOSTOLAKIS: I said that the regulatory guide is an acceptable method to the NRC and --

MR. ROSEN: Oh, that. Now I understand the question.

MEMBER APOSTOLAKIS: And they said about industry proposing an alternative and they laughed.

MR. HOLAHAN: Yes. There is a widely held view in the industry that it is extremely difficult to take a path different from the regulatory guide. I think that there is a certain truth to that, in the sense that the burden of proof shifts. If you follow the regulatory guide the expectation is that whatever you are proposing ought to be approved.

And if you are not following what is on the regulatory guide, then I think that the burden of proof is on that individual applicant to show why everything back to the original research data, and whatever else we know supports their position.

Frankly, I think that the industry is sometimes too reluctant to deviate from a guide, because there are obviously -- I mean, the whole meaning has to do with the fact that every plant is a little different.

And I think that there is room for deviating from guides, but I think individual licensees find that that is a path that is not very appealing for them. It means that not the industry, but individual utilities, need to become experts on a whole set of technical issues that otherwise they don't need to take on.

MEMBER WALLIS: Well, Gary, in this case if the technical solution to the problem turns out to be remarkably difficult for a licensee, then there is a real motivation to come up with alternative approaches.

MR. HOLAHAN: Yes, there could be.

MEMBER POWERS: But do not underestimate the value of having a regulatory guide that articulates what is acceptable to the staff. There is alternate regulatory structures that lack those things that become chaotic.

And you can come into this country and I can point to you other government agencies that lack that particular feature of their regulatory system and you get chaos.

MR. HOLAHAN: Yes.

MEMBER WALLIS: This is where the NEI guidance is helpful.

MEMBER APOSTOLAKIS: Yes, the intent was never to put down regulatory guides. I mean, I think that Gary described it very well. There is a feeling out there that if we should do it that it takes forever.

MEMBER POWERS: Well, it is also true, because I think that you can look at anybody coming in under a regulatory guide and you will find subtleties, plant specifics, where they have taken deviation and checked the plant, and the staff has been very good about understanding their positions.

MEMBER WALLIS: I can't evaluate our evidence, George, until I know who was laughing. I mean, was it graduate students that were laughing, or was it the --

MEMBER APOSTOLAKIS: No, no, industry people. Graduate students would not dare laugh. Only when I tell them that it is a joke will they laugh.

MR. ROSEN: George, I can remember some utility meetings with the staff when the staff was advocating a position in the reg guide hard to the utility representatives present, and the utility managers present said let me read you something from the front of this reg guide.

And then they read the lines that say that reg guides are not required and additional alternates to this position can in fact be proposed, and the staff went along.

And as soon as I heard those words, that we are proposing an alternate to this reg guide, they said, oh, we understand that. You are not trying to comply. You are proposing an alternate. Well, okay, you can do that.

MEMBER APOSTOLAKIS: I did not intend my remark to be commented upon for 10 minutes.

MR. ROSEN: I think that is what happens at the ANS section meetings, and what happens in real regulatory guides.

MEMBER WALLIS: Well, we need to move on because we do have a deadline here, and we are almost to the end.

MR. JAIN: We are also putting together a knowledge based document and making it available to industry and this document pulls together all of the work done so far in the BWR arena and PWR arena, international or domestic.

And it is a good source for -- and including ourselves -- to review individual licensees on what they have done, and for the licensee to (inaudible). And I think that is a very valuable document which has also been peer reviewed by international investigators, and it is due soon.

MEMBER WALLIS: And you are going to send copies to the ACRS?

MR. JAIN: Yes. I think they are on the distribution list, but I will make sure.

MEMBER SHACK: You are going to have a CD, right?

MEMBER WALLIS: Twelve Cds.

MEMBER POWERS: In contrast to my high technology friend, I like paper.

MR. JAIN: I will talk about current plans and schedules. We plan to issue this reg guide for public comments in February once we hear from you, and NRR is going to issue a generic letter in the summer of this year.

We will come back to the ACRS for final reg guide in July, and reissue it in September. Hopefully by then the NEI will have their guidance around the same time.

MR. ROSEN: You say hopefully. If they

don't, then you will issue guidance yourself, right, to keep the ball moving. We are not just going to wait for NEI.

MEMBER WALLIS: They will have to respond to the schedule.

MR. ARCHITZEL: We are not prepared to issue guidance at that time if they have not issued it. We have the guidance in the reg guide, but we are not going to turn around --

MR. ROSEN: Well, what happens if NEI fails to open in the fall of 2003 and they are just not ready, and they have internal problems, or whatever, and there is nothing forthcoming?

MR. HOLAHAN: It seems to me that depends on whether they are going to be a month late, or they dropped out completely on the issue. I think we are going to have to deal with it when we see the circumstances.

If we think that there is a useful product, and we are a little bit more patient, then we might decide to accommodate that. If we see this as no longer a likely success path, then I think we are in a position of having to issue our own guidance. I don't see another choice.

MEMBER LEITCH: And this is John

Lehning. We are meeting with NEI regularly and getting updates on their status, and so if we feel down the road that we have indications that they will not meet it, we will have more information to make a decision.

MR. ROSEN: When you say updates on the status, do they just give you a schedule and say here is where we are, or are they giving you a draft?

MEMBER LEITCH: No, they have given us a draft like the ground rules that you got, and we have gotten that, and as they have gotten more detail guidance, we will get that information, and we will be able to see how far they are coming along and evaluate it.

MR. ROSEN: Well, what if the ACRS said we would like to see this issue resolved expeditiously, and I would be uncomfortable, and not speaking for the ACRS, but speaking for myself, and I would be uncomfortable if it came to the fall of 2003 and NEI had a longer or much longer schedule than that, and the staff was not ready to go along with it.

MR. ARCHITZEL: Let me just be fair to NEI. When this issue was agreed to and this approach was agreed to in March, the first time that we had the meeting, in September of 2003 was the date of the guidelines, and it has not changed since then. So they have not slipped on that guideline since we agreed to this program.

MR. ROSEN: The staff is confident that they will continue to stay on schedule and I am happy.

MR. ARCHITZEL: We have not heard of a slip. Maybe a month or two like Gary said is possible, but they have not told us of one yet.

MR. HOLAHAN: Nothing that we have said could encourage them not to meet September 30th.

MEMBER WALLIS: Yes. I think that the one concern that the subcommittee had was the chaos phenomenon that Dr. Powers referred to; is that if you don't have proper guidelines for this, which is a difficult problem, you may get a whole host of different approaches from different utilities, and then there is going to be a difficulty in evaluating all of those different methods.

And the last thing that ACRS wants to do is to have to be in the loop to evaluate all of those different methods.

But that is good enough. This letter

and the issuing of the letter and the regulatory guide for public comment is an essential step to get the ball rolling, and that is the real key thing. That is really what we are here for today. Any comments from my colleagues or questions?

MEMBER POWERS: Well, I would just comment that it is true that the resolution of this issue has been a slow process, but I have to say that I am very enthused about the approach that has been taken here on the BWR, where I think the staff has done a responsible job in assuring itself that there is a technical issue here.

And enough to say, gee, we can't go any further without having plant specific information and then turning the ball over to those that have the problem at the plants.

And I think that this really is kind of an example piece of how to attack these touch technical issues that come up every once in a while for the existing plants, and I think they have done -- I mean, I like the style.

I like your style on this, and this summarization that you are planning with all of your work in a trackable document, I hope that you do a good job on that, because I think that is a real contribution to inform the licensees and those that have concerns about your licensees. And doing a good job on that will serve your style even better.

MEMBER WALLIS: Dr. Powers, I just wanted to make clear that you said that you said that BWR and I think you meant to say PWR.

MEMBER POWERS: PWR, yes. I think I did a pretty good job on the BWR, too.

MEMBER WALLIS: But your comments were about the PWR and the record ought to show that. Any other comments or questions before we wrap up?

MEMBER LEITCH: I guess my concern is just with the speed with which this was done, or the lack of speed, and I just wonder. We can't go back and do anything about the time that has passed, but I wonder if you do any kind of a self-assessment?

Is there a different strategy we could have taken on this issue from the get go that would have led to a quicker resolution, or are we just tied up by the regulatory process in such a way that this is the best that we could have done?

Do you get a chance to -- in other words, my impression is that from crude inspection, it would become real obvious that there is probably 6, 8, or 10 plants that have a real serious problem with this, and we have been sitting here for 7 years and two more to go before it gets fixed.

Is there no way that we could have required improvements at those plants that had a real obvious problem prior to doing all this research work, which I admit is admirable, but it is time consuming, and we are thinking about plants where perhaps this is a serious problem, and one-quarter of the life of the plant has gone by while we have been wrestling with this issue.

I mean, is there a better and more expeditious way that we could have dealt with this problem at the get go?

MR. HOLAHAN: I guess I feel responsible for getting these things done, and it seems to me that the process that we used -- that is, you know, generating scientific data and saying that we really have a basis for understanding that there is an issue, I wouldn't want to skip those parts in order to expedite the process.

When I look at this, and when I look at other generic issues that we still have on our plate, and I ask myself are we doing these things as well as we could and as quickly as we could, I think there is room for improvement.

There is room for acceleration, but I wouldn't want to change the process. I think we have touched the right basis. If anything, I think we need to just be more dedicated to getting the work that needs to be done as quickly as possible.

There are technical steps and there are process steps, and there is the ACRS and the CRGR, and there is public comment, and all of those are valuable things that I wouldn't want to lose.

I think the challenge for those of us who are managing this program is to find the resources and the people who can do those right steps as quickly as possible.

And it is kind of hard to argue in this case whether it couldn't have been done any faster. Probably it could, and we just need to continue to look at that.

MEMBER WALLIS: Anything else? Then thank you very much for your presentation, and I will hand this back to the Chairman.

CHAIRMAN BONACA: Thank you. Before we break or take a recess for lunch, I would just like to thank you. This meeting is done.

(Whereupon, a luncheon recess was taken at 11:57 a.m.)

CHAIRMAN BONACA: We are back in session, and we have now a presentation on the PTS and evaluation project, technical basis for potential revision to PTS clinical materials, and Dr. Kress will take us through that presentation.

MEMBER KRESS: No, Dr. Shack will.

CHAIRMAN BONACA: Dr. Shack. Okay. I guess your initials have been changed.

MEMBER SHACK: They have been changed, right. We had a presentation to the subcommittee on --

MEMBER WALLIS: Are these your regulatory initials, or your real initials?

MEMBER SHACK: Add 60 degrees to --

CHAIRMAN BONACA: Well, that is the reason for the change. Okay.

MEMBER SHACK: We had a subcommittee meeting where we went over this in some detail, and the staff will now have the difficult task of distilling a days worth of discussion down to their allotted time, whatever that is. Nathan, are you going to lead off, or Mark?

MR. CUNNINGHAM: Good afternoon. Mark Cunningham from the Office of Research, and Ed Hackett and Nathan Sunil from the Office as well here, as well as Alan Kolaczkowski, and David Bessette will be making the presentation in some sort of fashion this afternoon.

First off, Mark Kirk was here yesterday making a lot of the presentations, and something came up today and he couldn't be here, and so Ed is -- just think of Ed as Mark today.

MEMBER KRESS: Is that his regulatory name, or is that --

MEMBER SHACK: And will he mess up the power point?

MR. HACKETT: We have already done that. We have already taken care of that one.

MR. CUNNINGHAM: Just by way of a short introduction --

MEMBER WALLIS: This sounds a little bit since he couldn't be here like the Politburo, where one of our members isn't here today, and you wonder what has happened.

MR. CUNNINGHAM: After the savage beating that Mike Mayfield administered --

MEMBER ROSEN: They beamed him up.

MR. CUNNINGHAM: Something like that. Not quite though. By way of introduction the committee has been involved with listening to us and talking with us over several years now on the PTS work that we have had underway.

We are kind of in an transition period right now, where we are moving from a state of having a technical basis for possible rule changes, and making a transition into considerations by our colleagues at NRR about real rule changes.

What you will hear today is kind of a summary of where we are with respect to the technical basis. You have been provided a document or two and those are summaries of where we are so far. So you are getting in a sense a summary of a summary today.

Again, the big point is that we are in a transition, and NRR will be coming back, I'm sure, and have lots of opportunities to talk to you or with you as well about the proposed rule as they get into that.

We will be back with them to help them discuss technical issues associated with it, and so --

MEMBER APOSTOLAKIS: Is there a request for a letter today?

MR. HACKETT: There is a request. Thanks, Mark.

MR. CUNNINGHAM: Go ahead. Mark will continue from here.

MR. HACKETT: A couple of other items here. There are also with us Roy Woods, and Roy, if you want to raise your hand; and Donnie Whitehead is over on the wall there, too. Matt Mitchell, representing NRR, in the back, and so if there are any hard questions on the regulatory aspects, we will go to Matt.

And Terry Dickson is here also from the Oak Ridge National Laboratory. And James Chang from Maryland is here, too. Sorry about that. Mark emphasized the fact that this is not our final product, and I think that is where we didn't quite lead off the day real well yesterday.

So this will not be the committee's final crack at this. There is quite a road ahead of us ultimately.

MEMBER APOSTOLAKIS: It this is not the final product, then what kind of letter are we supposed to write?

MR. HACKETT: Where we are, and I will try and set the stage for that, as Mark indicated, what we have right now is a draft technical basis that the team here feels supports a revision to the

PTS rule. But it is exactly that.

It is a draft and there is some more work to be done. We took some very good comments yesterday on the report itself and the structure, and the content, and some things that we need to address there.

So really what we are looking for from the committee at this point is a thumbs up that the committee feels that they are on the same page, and that this is something that at least merits going ahead and considering rule making at some point.

And that is not to say that that is even going to get engaged this year or even next. I mean, that is a decision for NRR, and we are here just to discuss the technical basis. That said, I guess I will go to the next slide if I can do that without Mark.

I think I basically already said most of what is on here. We did spend a full day yesterday, where we went through a lot of this in detail, and we can go through as much or as little of that as the committee needs hopefully, but we do have obviously reduced time.

We have only about a 16 or 17 slide presentation today, compared to probably about 50 or

60 yesterday. And we plan on going through all the things that you see here.

MEMBER WALLIS: You said 50 or 60? There was 150.

MR. HACKETT: That was Mark's presentation, that's right. And unfortunately Mark could not be with us today as Mark Cunningham pointed out, and that is certainly a deficiency for us in several respects.

And also most notably with respect to power point, and I don't think that any of us here at the table is equivalent in that regard. With regard to the rule, and maybe this is one that I could stand up for if you guys can still hear me, the basis was documented for the rule a long time ago now, in 1982 SECY-82-465.

What you are really looking at is a methodology construct to protect the reactor vessel in the event of an over cooling event, and it really boils down to as simple as two things; having a materials metric, which is here on the X-axis, and which was the subject of much debate yesterday in the way of RTNDTs, versus a screening criterion, or rather an acceptability when run through a wall cracking.

When that was all put together, basically you ended up with a criterion, acceptability criterion for through wall cracking frequency 5 times 10 to the 6th, minus 6.

And then a metric and RTNDT space at either 270 or 300, depending on the exact material consideration that you were looking at. And that just sets the construct for 10 CFR 50.61, which is the upper bullet that you see there.

If necessary, people could employe flux reduction measures to keep the flux down, and keep the embrittlement down for the plant in particular for the future.

And then if necessary perform plant specific analyses for Reg Guide 1.154 to justify continued operation if that particular trip wire was lauNched, and that happened --

MEMBER WALLIS: Wait a minute now. Is this your old basis?

MR. HACKETT: This is the old basis. All I was doing here was just revisiting what is currently today.

MEMBER WALLIS: So this is the current basis?

MEMBER APOSTOLAKIS: Yes. So it is 210

from there, plus 60.

MR. HACKETT: That was the fix that we put on, and the other part that we covered yesterday, and I know that Professor Apostolakis wasn't here. We did receive some feedback from Dr. Shack and Dr. Wallis about the incorrectness of this, and the way that it is shown in your draft report is not correct.

It was really keyed to 210, and the margins were -- I don't know if we want to get into all of that.

MEMBER APOSTOLAKIS: Now, wait a minute. Wait a minute. The current screening criteria is 270?

MR. HACKETT: That's correct.

MEMBER APOSTOLAKIS: This is consistent with that?

MR. HACKETT: Yes, it is.

MEMBER APOSTOLAKIS: So it is wrong.

MR. HACKETT: I am trying to think of the right --

MEMBER APOSTOLAKIS: It is not the figure that is wrong. It is the criterion that is wrong, because if you move to the right, you are increasing the frequency.

MEMBER SHACK: The number that they report, the 270, is this number to which they have sort of been told to add 60 degrees. So they correspond. The 210 is sort of the real embrittlement, and the 270 is the regulatory embrittlement.

MEMBER APOSTOLAKIS: But I don't understand that. Why do you add 60 degrees?

MEMBER SHACK: Because the reg guide tells you to do that.

MEMBER KRESS: Because that is more conservative when it comes down to trying to decide --

MEMBER APOSTOLAKIS: Well, that is what I am saying, these are more conservative.

MEMBER APOSTOLAKIS: Well, you move to the right and so you go up and the frequency is now less and the failure is higher, right?

MEMBER SHACK: The average value of an RTNDT is still 210. Whether the number that they report, because of the way that they are told to compute it, corresponds to an average of 210.

They report the average, plus the 60 degrees, the 270, but they are equivalent in terms of this plot.

MEMBER APOSTOLAKIS: This screening criterion is 270?

MEMBER SHACK: Yes.

MEMBER APOSTOLAKIS: So 60 degrees have been added to this number here from the curve to produce a screening --

MEMBER SHACK: No, to get this number from the reported number, you subject 60 degrees.

MR. HACKETT: Right.

MEMBER SHACK: The reported number computed according to Reg Guide 199, Rev. 2.

MEMBER APOSTOLAKIS: Okay. So the utility calculates

MEMBER SHACK: 270, and that really corresponds to 210 on this plot.

MEMBER WALLIS: Why does it really correspond?

MEMBER APOSTOLAKIS: I don't understand that. How does it do that?

MR. HACKETT: There is probably no better way to explain that than the way that Bill just did.

MEMBER APOSTOLAKIS: When you develop screening criteria don't you try to be conservative?

MR. HACKETT: Absolutely.

MEMBER APOSTOLAKIS: Right. And so here the conservative thing to do would be to say 210 from the curve, minus 60.

MEMBER SHACK: No, the 210 is conservative here because of all of the conservatisms in the analysis. In 1982, and I am not sure that I can reconstruct the argument, but I would guess that they said, Jesus, we did all sorts of conservative things to get to this 210, and we are not going to then add 60 more degrees of margin to cover it.

Everything else that we did to get to the 210 number was already conservative.

MEMBER WALLIS: So what is the 210 now? I mean --

MEMBER SHACK: Because for other reasons, you report a number from Reg Guide 1.99, Rev. 2, that is told to compute it. So you don't want to have two numbers around it.

MEMBER WALLIS: Well, why not --

MEMBER APOSTOLAKIS: What does a utility do?

MR. HACKETT: They do just what Bill said. They do the regulatory thing, which is --

MEMBER APOSTOLAKIS: They follow the regulatory guide ?

MR. HACKETT: They follow 1.99, and they compare it to the 270.

MEMBER APOSTOLAKIS: So the number is 280 that they calculate?

MEMBER SHACK: Let's not.

MEMBER APOSTOLAKIS: Let's say it is, and then what happens?

MR. HACKETT: Well, then actually you would have gone to that second bullet well before then, and if necessary, you would have gone down here.

MEMBER APOSTOLAKIS: But wouldn't it be more logical to say that you calculate your number to 80, and then subtract 60? Wouldn't that be the logical thing to do?

MR. HACKETT: You could say it that way, too.

MEMBER WALLIS: So why didn't you do that?

MEMBER APOSTOLAKIS: So under 60 degrees, the subjective estimate is -- well, I am trying to give you a way out.

MEMBER WALLIS: There is no way out.

MEMBER APOSTOLAKIS: There is no easy way out, but our judgment is that this low curve is too conservative, and so the screening criterion is moving up.

MEMBER KRESS: You guys are arguing about (inaudible) and the Rule is in the new one.

MR. HACKETT: That is what we are hoping.

MEMBER APOSTOLAKIS: It is important to understand where the --

MEMBER SHACK: The important thing to understand is that the current is not unconservative.

MR. HACKETT: It is actually very conservative, at least that is what we think. Anyway, maybe we will see if we --

MEMBER WALLIS: You are sort of lucky that by you understanding it in terms of that it is very conservative. If you try to argue with George on the basis of this figure, you will probably be in deep water for a long time.

MEMBER APOSTOLAKIS: Well, tell me why not? I mean, we need to learn.

MEMBER SHACK: Because they have always used -- if you computed the number the way they computed this number, they have always used 210. The number that they happen to report is computed slightly differently, but it is equivalent to the 210 number.

MR. HACKETT: I think that Matt Mitchell is here from the NRR, and Matt has got some comments.

MR. MITCHELL: Yes, I am Matt Mitchell, from NRR, and we are the folks that are responsible for this on the NRR side of the house. I will try to sort of repeat Bill's explanation as to how this figure fits together with what is in 50.61.

There could be a limit in 50.61 that says or would set a screening criteria of 210 degrees based Upon this nominal mean RTNDT value. What has been done, and what was done in SECY.82.465.

To the best of my understanding is that there were 60 degrees added to the 210 value, and in recognition of uncertainties which were involved in the probablistic calculations which were used to develop the screening criteria.

And that same 60 degrees in effect was added to the other side of the equation when a licensee calculates the RTPTS value. If you were comparing to 210 and you looked at Reg. Guide 1.99 methodology, you would take the initial RTNDT value and you would add the shift.

And you would stop at that point. To compare to 270, you would take the methodology which is the initial property, the shift, plus the margin turn from Reg Guide 1.99 Rev. 2.

So what in effect has been done is that 60 degrees has been added to each side of the equation. I agree completely that it is confusing and is not clear. But if you look at it as sort of a balancing of the scales, you have essentially put 60 degrees on both sides.

MEMBER APOSTOLAKIS: So you need at least 210.

MEMBER WALLIS: No.

MEMBER KRESS: If you use this mean --

MR. MITCHELL: The number is 270 in regulation.

MEMBER APOSTOLAKIS: Sure, but that has already been --

MR. SIU: And it is related to a mean of 210.

MEMBER SHACK: The criterion it consistent with this graph.

MEMBER APOSTOLAKIS: But is it also consistent with 1.1?

MEMBER SHACK: No, 1.1 is wrong.

MR. MITCHELL: 1.1 is wrong.

MEMBER APOSTOLAKIS: And then why is 1.1 wrong?

MEMBER SHACK: Because they pretend that the 60 degrees is margin. If we could get margin that way, we would just add 120 degrees, and we could walk out of here real fast. It would be more conservative and everybody could meet it. It is just wrong, and just forget it.

MEMBER WALLIS: The 60 degrees cannot be justified, but the 56 degrees, which is the margin in 1.99, is put on because of uncertainties. So you calculate your RTNDT and then you add 56 degrees for uncertainties.

MEMBER APOSTOLAKIS: In your calculation, or in your --

MEMBER WALLIS: In the calculation, and then it is all taken away again by the 60 degrees.

MEMBER APOSTOLAKIS: Right.

MR. MITCHELL: In the calculation of RTPTS, the actual material property value for a licensee's vessel, Dr. Wallis is correct that nominally it is about 56. There are some nuances in the reg guide which allow margin terms to be -- the so-called margin term to be modified, but nominally correct.

And it was believed that was sufficiently close to the 60 that was added to the other side of the equation, the 210 plus 60 to arrive at 270, and that it was essentially equivalent.

MEMBER APOSTOLAKIS: Do you at least agree that this is an odd way of doing business?

MR. MITCHELL: Absolutely. Without doubt, and we would certainly hope that as a result of any changes to the regulations which might result from the work that the Office of Research has done that we can clarify it and make it much more simpler, and much more straightforward.

CHAIRMAN BONACA: I hope that the licensee will who submit this data for license renewal will understand the nuances of all this, and do the proper numbers compared to the right numbers.

MR. HACKETT: I think they are painfully aware of that and have been for a long time, as I completely concur with Matt, and it is confusing, and it is a construct that we are hoping to be able to improve upon.

However, as we go through, we see that we have some more complexity to add before we get there. At any rate the first one out of the box that got tested for this -- and of course the committee probably remembers this, or maybe certain members maybe do with Yankee Rowe, which tripped the screening criteria and got into the Reg Guide 1.154 analysis --

MEMBER APOSTOLAKIS: I can't wait to make a copy of this and give it to Andy Kadac at MIT.

MR. HACKETT: The plant attempted to make this case with the NRC and one of their problems in doing that is that they felt that the guidance was not clear is probably an understatement in 1.154 and it led to a fairly protracted debate with the NRC staff which ultimately ended up in the shut down of Yankee Rowe.

They decided that they were not going to be able to prosecute that case effectively because of the lack of clarify of the guidance. The upshot for this presentation is that because of that, as part of the NRC's lessons learned activities, the Commission directed the staff to address this in

1991.

Here we are over 12 years later trying to still do that effectively, but sometimes these things take that long. In terms of other motivations, that is one primary motivation. Other motivations are listed here in terms of technical improvements that have been made over many years.

This is a slide that I know that we shared with the committee, and we spent a lot of time on this yesterday. We have been asked about the magnitude of these arrows.

The green arrows are indicating where you might expect improvement, and the red arrows are cases where we might have actually seen things that have acted in a non-conservative manner.

With the ultimate or the bottom line here being that we are looking at something that is pointing towards burden reduction and an extension of the screening criteria.

But in terms of that magnitude, a couple of things on here I think -- and the team can correct me if I am wrong here, but I think we are seeing a fairly large down arrow on more refined binning in the use of the probabilistic risk assessment methodology.

And in particular in probabilistic fracture mechanics, we have a significant conservative bias that has been eliminated in the model, and which I will talk a bit more about later, because it unfortunately gets back to RTNDT and a new version of RTNDT.

MEMBER WALLIS: Yes, but it is a bias of -- well, it is something like a hundred degrees, compared with all the arguments that we have had previously about maybe 60 degrees. So it overwhelms that 60 degrees right there.

MR. HACKETT: It does. It does. There is also spatial variations in the fluence, and maybe somewhere between these two the flaw distribution is a major element for the material aspects of this task, in that when it was done previously in 82.465, it was a Marshall distribution that was used, which came from the U.K., and wa the best that folks could do at that time, but it didn't actually involve looking at flaws from reactor vessels for the most part.

We have been able to do a lot of work in that area since most of it has been sponsored by the NRC, and it has really shown as a bottom line that we see flaws in vessel welds, but they are very small and largely do not participate as being problematic in a PTS transient.

MR. KOLACZKOWSKI: And if I highlight the bottom red arrow, because that changes the whole reason why meeting a large break LOCA is considered, because that changes the whole reason why certain sequences are important, the fact that we have added that.

Whereas, the original analysis back in the '80s did not include medium and large LOCAs, and we talked to the subcommittee at length about that.

MEMBER APOSTOLAKIS: They ignored them or they lumped them?

MR. KOLACZKOWSKI: Basically, they ignored them.

MEMBER ROSEN: I thought what you told us was that you thought this was an undercooling transient driven process, and undercooling because of what happened in the secondary side, and is not a primary side issue.

MEMBER WALLIS: They thought that the pressure vessel needs to be the pressure from a PTS event, rather than just pure thermal shock, and then they realized that the pure thermal shock could be significant and so LOCAs had to be considered.

Once the vessel is depressurized it is no longer under stress from the pressure, but you can still have thermal shock.

MEMBER ROSEN: All right. So at the end of the day what you find out is that this pressurized thermal shock problem is really a little pea-big pea shock problem. Little pressure, large thermal stresses, and that is what you worry about.

MR. HACKETT: That is what we are seeing now, and indeed Terry Dickson went back and ran an older version of the code that was applicable at around the time of Yankee Row, and it was exactly that. These just were not addressed previously, and when you do address them, even with the older version of the code, it looks like that has always been the case. That it is much more of a thermal driven --

MEMBER ROSEN: With that understanding, George says that is why large LOCAs are important, because those are depressurized events.

MEMBER APOSTOLAKIS: Yes.

MEMBER ROSEN: And before we didn't think that was important to this problem.

MEMBER APOSTOLAKIS: Okay.

MEMBER ROSEN: Because they were not

pressurized, and as it turns out it is the thermal shock that is important.

MEMBER APOSTOLAKIS: Are you going to discuss the acts of commission that are considered? I mean, did you quantify those things?

MEMBER ROSEN: We are prepared to discuss that, and we could do that now, or we could wait until the appropriate point. But Alan is available to do that.

MR. KOLACZKOWSKI: Yes, George, in this shortened version, we don't have any specific slides on that. But I guess at the appropriate point that we could certainly address whatever --

MEMBER APOSTOLAKIS: What method should you use to quantify those?

MR. KOLACZKOWSKI: Well, as was explained in previous presentations, the use of the ATHEANA at least qualitatively was sort of the basis behind all of the human errors that we analyzed, whether they were errors of omission or errors of co-mission.

And in terms of coming up with the probabilities, again as we have explained before, that was an expert elicitation process, and a very systematic process, where we tried to figure out what are the issues that could effect this particular error.

And through the expert elicitation process, using people both at the utilities either in a review role, or actually in a participation role and in a collaborative arrangement as we did with Palisades, we had trainers, EOP writers, actual crew members, along with the NRC contractors, essentially putting the HRA numbers --

MEMBER ROSEN: With due consideration of the works of Apostolakis, et al?

MR. KOLACZKOWSKI: Yes, absolutely.

MEMBER APOSTOLAKIS: I mean, it is a side remark, but this morning also we had a presentation on the accumulation of debris in the sump, and they also considered human errors, and they took upper bounds and the probabilities, and in fact pretty high numbers.

And which now raises the question is there really a need for the agency to develop a model for human reliability performance, or human reliability? I mean, people seem to be happy that they are using what is available.

And in the power uprates, it is also where people put numbers there, you know, and some of us objected, but I wonder whether it is worth pursuing this anymore. If we manage to get an upper bound, that is good enough. Maybe an expert opinion elicitation is the answer.

MR. CUNNINGHAM: It may be, and I guess I am not quite sure where you are going.

MEMBER APOSTOLAKIS: Where I am going is that we don't have a model, but yet people are coming in here for important issues and nobody says I cannot do this because there is no model. Everybody does something and people seem to say okay, that is reasonable.

MR. CUNNINGHAM: Well, we do have models, and part of what we are doing now is trying to be -- as Alan was talking about, in terms of the quantification process, I am not sure you would say that we have a model there.

But we are trying to take something and make it more systematic if you will, and so you can in a sense call it a model.

MEMBER ROSEN: I don't know if it is called a model really. It is a method.

MR. CUNNINGHAM: It is a method.

MEMBER ROSEN: And Alan described it in some detail for the subcommittee.

MEMBER APOSTOLAKIS: But basically the way that I understand it is that people are happy that they have a description of the context, and then you have a number of experts, and they tell you what the number is.

MEMBER ROSEN: It is more complicated than that, but yes.

MEMBER APOSTOLAKIS: It is always more complicated.

MR. SIU: If I may, you know, clearly in this project we tried to exercise with the tools that we had, and we have some belief that the results that we are getting are reasonable and useful for the decision at hand.

It is not to say that improvements in these tools won't lead to better decisions later on. We just don't have such better tools at this point. So I guess I would argue that we are not necessarily at a state where we should be freezing development on these methods and tools.

We always learn, and the project that you see in front of you now, where HRA is just a part, we have done a lot of work on fracture mechanics, and we have done work on thermal-hydraulics, and have done work on PRA and a culmination of all of that is for example, this particular -- this is one product of such an integrated process.

If we had said back in the '80s, well, we can make decisions, and you have seen the tools that we have now, and that is the current rule. So now we are in a position to better that.

MEMBER APOSTOLAKIS: Well, it is hard to generalize. A lot of things were done conservatively and so on, but it is a real issue, and a major intellectual challenge to develop a model that will give you the probability of time-dependent human actions. So let's recognize that.

MR. SIU: Yes.

MEMBER APOSTOLAKIS: I mean, ATHEANA tried, and it really didn't lead anywhere. I mean, it did a lot of qualitative work, but not the quantitative. And then at the same time we see the staff coming here, and both of them do research at NRR, and they seem to find reasonable things like asking experts, and looking at upper-bounds, and so on.

So it really makes you wonder whether it is worth pursuing an HRA effort now. Maybe 10 years from now, after again we find that a lot of things were wrong and very conservative, because I don't know whether if we lead anywhere, and people do things, but don't make them unhappy.

They don't make them happy, but they don't make them unhappy.

MR. CUNNINGHAM: If we could go back to the HRA program that we have got planned over the next couple of years. I think we have talked to the committee that one element of the expert elicitation process is what kind of experimental information could you provide on human performance insert context.

And I think that is a big element of what the staff is proposing, in terms of research, and getting back to trying to collect more, if you will, empirical evidence or experimental evidence, to support an exert elicitation process.

MEMBER SHACK: We are sort of a quarter of the way through, and so I think we had better move on.

MR. HACKETT: I think I will just add one final comment specific to this project in HRA. One of the slides that we will come to is showing that a lot of the risk is dominated by LOCA and then the HRA is not a huge contributor in that regard.

We can get into that further.

MEMBER APOSTOLAKIS: Which LOCA is that?

MR. HACKETT: LOCAs in general.

MEMBER APOSTOLAKIS: Really.

MR. HACKETT: We have got a slide on that. Another motivation was the fact that to quantify some plants are predicted to be close to the screening criteria at EOL, and so sort of this red band that Mark Kirk had here on the slide.

And, you know, starting out towards the end of this decade that you are starting to see some plants that are beginning to impact this criterion. And so their interest level -- and our industry colleagues are not here today by and large, but that gets their interest level up pretty quickly when they are starting to look at making cases for license renewal man, many years in advance.

So that is another major motivator, and also another major motivator --

MEMBER APOSTOLAKIS: Let me understand. Some plants close to the screening criterion?

MR. HACKETT: Right.

MEMBER APOSTOLAKIS: And which ones are these?

MR. HACKETT: Arbitrarily, what Mark did

on this slide is that he is showing a band that is within about 50 degrees of, say, the 270 or the 300 criterion.

And then basically what you are getting towards are --

MEMBER APOSTOLAKIS: Oh, this is from --

MR. HACKETT: Right, exactly. Exactly. So the bottom line is that we are trying to show the interest level, and I think we skipped over one. No, not yet.

MEMBER POWERS: The more I think about this, I didn't understand it at all. Could you focus us here on at least that first one?

MR. HACKETT: Sure.

MEMBER APOSTOLAKIS: The previous one you mean?

MEMBER POWERS: Yes.

MEMBER WALLIS: That is the simplest slide he has got I think, is that one.

MR. HACKETT: Yes, really this is just in simplicity, these are the number of degrees that you are from the screening, and it should say criterion. But from the 270 or the 300, and so it is just showing you that there is a grouping of plants here, especially when you are getting out towards where folks are considering license renewal, where we are starting to get into increasing numbers.

And not that anybody is in any particular difficulty when they are 50 degrees away from the limit. But it certainly is going to make --

MEMBER POWERS: But a lot of them are at zero.

MEMBER WALLIS: Not at the end of the license period or that time.

MR. HACKETT: At the end of the license. There actually should be two.

MEMBER APOSTOLAKIS: What is the point of showing the years there?

MEMBER WALLIS: That's when they get there.

MR. HACKETT: That's just when they get there. That is when they are predicted to get there. This in particular would be Palisades, and I believe that would likely to be Beaver Valley. I can't say for sure, but this one is certainly Palisades. They hit their criterion in 2011.

MEMBER POWERS: Who is the guy at 2035? Is that --

MR. CUNNINGHAM: At 2012, they would be at -- they could not operate beyond --

MEMBER POWERS: He is in a world of hurt.

MR. CUNNINGHAM: They could not operate beyond 2012 because of the embrittlement of the vessel under the current rules.

MR. HACKETT: That was another primary motivation. And in terms of the scope of the analysis --

MEMBER APOSTOLAKIS: That sounds kind of funny to me, but why are you doing the work and not them?

MR. HACKETT: Well, in the next slide, we will come to that. They are indeed doing a lot of work, and working with us on this. In terms of the scope of the analysis, we have analyzed three plans which would be Palisades, Beaver Valley, and Oconee.

Two of those are among the most embrittled at EOL,which would be Palisades and Beaver Valley, and they are both in about a degree of the screening limit at EOL.

We have all the PWR manufacturers represented in two plants from the original study, and which would be Oconee and Beaver Valley, or Oconee and Calvert Cliffs. I'm sorry.

And two plants close to the screening criterion which I mentioned, and caveat this, you know, as Mark has done before, and we said -- these are all that we are aware of, when all significant and potential initiating event sequences are considered.

That is not to imply that there aren't some that could be out there that we missed.

MEMBER ROSEN: We have spent a lot of time talking about model uncertainty yesterday.

MR. HACKETT: Yes.

MEMBER APOSTOLAKIS: And you will again.

MR. HACKETT: This is just to get to Professor Apostolakis' point. The conduct of the project has --

MEMBER APOSTOLAKIS: And you will gather facts and conclusions to report to the full committee?

MEMBER WALLIS: We gathered estimates and --

MEMBER POWERS: And idle speculation.

MEMBER APOSTOLAKIS: It seems to me that if you want to form a peer review group, you are going to have a hell of a problem.

MR. HACKETT: We are working on that. I agree, and we are working on that right now. That is one of the slides that you will see that we will get to, in terms of things that still need to be done.

MEMBER POWERS: Let me assure the committee that I have no idea what Sandia is doing on this.

MEMBER APOSTOLAKIS: Yes, I mean, you are creating --

MEMBER POWERS: I have no idea what they are doing.

MEMBER SHACK: I mean, who is the cognizant Federal employee here?

DR. LARKINS: I guess I am.

CHAIRMAN BONACA: Yes, John Larkins is the Cognizant Federal Employee.

MEMBER APOSTOLAKIS: Well, maybe I should -- can I talk to you?

DR. LARKINS: Sure.

MEMBER APOSTOLAKIS: Not on the transcript.

CHAIRMAN BONACA: Can we proceed.

MR. HACKETT: In addition, I will

mention that this also does not indicate public participation, but we have had some significant participation from the public. At least not a lot lately, but definitely some since then.

In terms of how the analysis is conducted, there are two main components. There is the estimation of the plant, which TWC stands for is through wall cracking.

And then you compare that to an acceptable frequency of through wall cracking, which is what we spent one of the previous slides talking about.

And this is how you get there, going through the three major disciplines, from PRA event sequence analysis, to combinations of those running through the thermal hydraulics, and getting the inputs from thermal hydraulics feeding into a probablistic fraction mechanics assessment.

And that addresses the materials aspects and things like flaw distribution. And what you get coming out of all of this is a conditional probability or yearly frequency of through wall cracking. And that then you are going to compare with the limit.

MEMBER APOSTOLAKIS: And when you

quantify uncertainties, don't you address them? I mean, can you quantify uncertainties without addressing them? Why do you say address, then quantify?

MR. HACKETT: Okay. Address, then quantify. No, in fact, maybe it should be written that in a lot of cases that you can't get there. The acceptance criterion, bottom line, is that we feel, or at least the team feels, that we are consistent with the Commission's safety goal policy statement, the SRM that was issued after Yankee Rowe, and in general the principles of Reg Guide 1.174.

And then the way that this thing pans out for you is --

MEMBER WALLIS: Excuse me, but when you say through wall cracking and vessel failure, that means the same thing?

MR. HACKETT: That means the same thing, reactor vessel failure frequency, or frequency of through wall cracking, and that is going to get you to the establishment of a limit and the comparison with the curve for the material behavior.

MEMBER APOSTOLAKIS: Without adding anything to it?

MR. HACKETT: Without adding anything in. This part at least is just schematic, and so we are not even going to get into whether degrees F, or C, or RTNDT.

MEMBER WALLIS: But you are going to define it in your report?

MR. HACKETT: It is defined in the report, and obviously I think that is an area where we are going to need to have some clarify.

MEMBER APOSTOLAKIS: When you say in your report that your results indicate that you may increase the screening limit by 80 --

MR. HACKETT: By 80 to 110 degrees.

MEMBER APOSTOLAKIS: You are referring to the 270?

MR. HACKETT: That's right.

MEMBER APOSTOLAKIS: So that becomes 350?

MR. HACKETT: 350 to 380 or so.

MEMBER APOSTOLAKIS: And calculated the way the regulatory guide says?

MEMBER WALLIS: I don't think that is true. No, that is not true.

MEMBER APOSTOLAKIS: So you have a new method for the screening criterion, but the old method for developing your --

MR. HACKETT: Let me see if I can take a crack at that, and we may be back in the same place we were for --

MEMBER APOSTOLAKIS: It not a simple deal.

MEMBER SHACK: Sure it is.

MR. HACKETT: All we are doing there is that you will see a new metric for RTNDT, which we will call an RTNDT star, and I will try to explain that a little bit later how that compares with the current criterion.

And so we are trying to compare apples to apples and you are exactly right. We should try 80 to 110 degrees fahrenheit, and you are adding that on to the screening criterion. So what was 270 becomes nominally 350 to 380.

MEMBER APOSTOLAKIS: Okay. That is one issue. But the other issue is that you are using a more sophisticated methodology now to come up with a screening criterion. Yet the licensee would be using the old approach to come up with the RTNDT?

MR. HACKETT: i see your point.

MEMBER APOSTOLAKIS: And compared to the new screening criterion?

MR. HACKETT: That was one of the things that we addressed. The answer to that is really no. They will be using an RTNDT based approach, and the only thing they will have to adjust for is basically going to be the weighting of this RTNDT for weld type, and weld length, and fluence.

I will try and explain that a little bit better. In practice, they won't have to do anything. If we set the criterion out, all they need to demonstrate is that they are that far back from it, and there won't be any need for any plant specific analysis.

MEMBER APOSTOLAKIS: Yes, but the question is how do you demonstrate?

MR. HACKETT: Well, the only change in --

MEMBER APOSTOLAKIS: Is it from the old approach?

MR. HACKETT: The only change in regulatory space that they would need -- for instance, here are a few things that they would need to know. They would need to know details of the fluence analysis for their vessel, and they will need to know weld type and length that are limiting, and they have that information now.

So we are not imposing anything new in regulatory space.

MEMBER ROSEN: They won't have to worry about it until they are running out about 200 years anyways.

MEMBER WALLIS: Well, that assumes that all the statistical stuff that you are doing is typical of all plants.

MR. HACKETT: Right. It is assuming a generalization. That's right.

MEMBER APOSTOLAKIS: But the earlier argument that it doesn't really matter that we honor the 60 degrees, because there is a compensating addition on the calculational side.

Now you are changing the screening criteria and making it more realistic.

MR. HACKETT: No.

MEMBER APOSTOLAKIS: Aren't you going to touch the other one?

MEMBER SHACK: The screening limit before and we will now make it 290, and we added 60 degrees to the 210 to get 270, and we will add 60 degrees to the 290 to get 350.

So you do the two exactly the same way, just so you don't change anything that the licensee does. He will compute the number and exact --

MEMBER APOSTOLAKIS: So we are doing a good analysis here, and then we will make it bad based on the calculations?

MEMBER SHACK: No. Let's move on.

MEMBER WALLIS: This is all going to be clear when they rewrite the report so that it is clear. It all will be clear when they rewrite the report so that these 6 or 7 RTNDTs are all very clearly defined, and we know what is going on.

MEMBER APOSTOLAKIS: And also when they do page numbers. I was so scared on the plane yesterday.

MR. CUNNINGHAM: If I can go back just a second.

MEMBER APOSTOLAKIS: Yes.

MR. CUNNINGHAM: We are proposing a technical basis for a rule change.

MEMBER APOSTOLAKIS: Yes.

MR. CUNNINGHAM: And the folks at NRR will be looking at rule, as well as reg guide changes, possible reg guide changes.

MEMBER APOSTOLAKIS: Okay. All right. That is a better answer.

MR. CUNNINGHAM: I don't want to commit

Matt to saying that absolutely he is going to do this or that, or whatever.

MEMBER APOSTOLAKIS: Yes, sir?

MR. MITCHELL: Again, Matt Mitchell, NRR. The only thing I would say is we will ensure as we go forward with any proposed rule change that the way that licensees would analyze the actual material properties or vessel is completely consistent with the basis upon which the screening criteria is established.

I mean, that is incumbent in the way that we would modify the rule. So weighted average used -- and which I Ed is going to get to -- to try to enumerate a screening criteria, weighted average, for evaluating the vessel.

MR. HACKETT: What we are hoping is that as a resource that a --

MEMBER WALLIS: Wait a minute. I'm sorry. The present RTNDT is not a weighted average. It is a bounding curve. So you are changing the definition if you go to a weighted average. You won't just be using the --

MEMBER SHACK: But that is only proposed.

MR. HACKETT: That is proposed right

now, and it would be changing it in a way that they would be able --

MEMBER WALLIS: And all of this will be clear when you rewrite it to make it clearer?

MR. HACKETT: That would be our goal.

MEMBER WALLIS: All right. Thank you.

MR. HACKETT: Let's move on to some results. The bottom line is that over the realistic operational time frames, and we tried to show that, and some of this is really extending out too far, but that is just the way that the mathematics went.

But over realistic operational lifetime, the through wall cracking frequency that we are finding coming out of the FAVOR code is very small, and by that we mean somewhere between E minus 8, E minus 9, range.

And you can see that on the slide here, and at the current screening criteria the yearly through wall cracking frequency in a generalized sense is on the order of 1 times 10 to the minus 8.

And then it is important to note here that two of the plants that we use to try and set this up are among the most embrittled that have been evaluated. So we feel we are well below.

MEMBER APOSTOLAKIS: Well, that is

confusing, and so let's talk about this figure. When you say the mean of the 95th person, I was looking for those. Where do I find them?

The only difference in the product is the plants.

MEMBER SHACK: They are the same.

MR. HACKETT: Those are the same basically. they are skewed.

MR. CUNNINGHAM: The calculation results, as they are essentially -- the mean is at the 95th percentile.

MEMBER APOSTOLAKIS: And that is mentioned somewhere in here?

MR. CUNNINGHAM: I am sure it is.

MEMBER APOSTOLAKIS: It is? Well, I missed it. Not hear the figure.

MEMBER SHACK: In some of the figures you can almost see a shadow of your --

MR. HACKETT: The second major result is looking at what are the dominant contributors to risk and what the team has found is that its LOCAs are the dominant contributor to risk, as opposed to stuck-open safety valves, which are actually a contributor as you can see here for Oconee, and for the B&W type design.

But an important feature is that secondary side breaks in general are not contributing the way that they were during the original study. There are a couple of reasons for that, and a lot of it goes to the severity in binning, and again the team can correct me if I am wrong on any of this.

But in terms of the binning on the secondary side previously it used to be that everything was binned with the severity of the main steam line break is my understanding.

Also, they are just not as severe a challenge as are the LOCAs, in terms of the thermal transient, and then of course you have the piece that we talked about previously, and some credit applied now for operator action that was not applied previously, or the three main elements don't affect the --

MEMBER WALLIS: So if we actually took the importance of the things which are thought to be important 20 years ago, they seem to be like 1 or 2 percent of the thing now?

MR. HACKETT: Very small.

MEMBER WALLIS: And so in fact you have not only gained a factor of 10 to the 4th, you have gained a factor of 10 to the 6th, because the things that you thought were important have now decreased to 1 percent of what matters. This is even more remarkable.

MR. HACKETT: I think it is remarkable.

MEMBER ROSEN: And things that you have ignored.

MEMBER WALLIS: The things that you have ignored have come up to be important, but they went down. They really were important before because you had the factor of 10 to the whatever.

MR. SIU: Or perhaps even a different way of looking at it is that the things that we ignored are still unimportant in an absolute sense. The numbers are small.

MEMBER WALLIS: But for different reasons.

MR. SIU: But they are high in proportion to what you have got left.

MEMBER WALLIS: But if you had not considered the LOCAs and just used the same basis 20 years ago, you would have been picking up another factor of 10 squared.

MR. HACKETT: And the purpose of the following slide here is to show that we are trying -

- we tried to, and we think that we have achieved balance in the project, and in the execution of the project, and that the contribution of the initiating event frequency, and the conditional probability of failure is somewhat balanced.

And the analogy here is, you know, the idea that the initiating event frequency were so, so low that maybe you could operate a plant with a glass reactor vessel.

MEMBER APOSTOLAKIS: Let me understand. What is that figure showing?

MR. HACKETT: What it is really showing here, which is the X-factor, which is the initiating event frequency. The Y-axis is the conditional probability of failure given that event.

MEMBER APOSTOLAKIS: Failure of what, the vessel?

MR. HACKETT: Of the vessel, and that you would not want to see this laying over too much either way, and it is especially skewed to me towards the initiating event frequency side.

MEMBER APOSTOLAKIS: Well, is the initiating event frequency goes to 10 to the minus 2, and the condition probability goes also to 10 to the minus 2?

MEMBER WALLIS: No, no, the other event doesn't mean anything really.

MR. SIU: The question is whether the small numbers that I showed you on the previous slide are coming solely from, let's say, small initiating event frequencies, or solely from the condition of probability of vessel failure.

And what the slide is showing is that by and large for most important sequences there is a roughly equal contribution.

MR. HACKETT: In terms of the materials aspects on the slide that you are seeing here, what we have seen, which is not at all surprising to those of us who have been associated with this for a while, axial welds tracks way dominate the through wall cracking frequency on the order of over 90 percent.

And in this case it is the axial weld, RTNDT, or the adjacent plate RTNDT that is governing. The circumferential weld cracks play a minor role, and in a lot of cases we have seen significantly less than 10 percent.

And in that case you are looking at the circ weld RTNDT, or the plate, or the forging situation governing. Cracking plates and forgings by and large are too small to play a role.

What you are really seeing -- and Terry can give you the details on this, but you have to have cracks that are probably more than a quarter of an inch or so, or I think what I remember from runs that I have done in the past were things on the order of a quarter-of-an-inch to three-quarters-of-an-inch to really be contributors.

And what you see from our flaw density and distribution that was developed is that you see a lot of flaws on the weld fusion lines, but they are a lot on the order of these two millimeter characteristic flaws. They are very small.

So when you hit those with a PTS transient, by and large they don't participate in contributing to --

MEMBER WALLIS: When you calculate your RTNDT star, you had a weighting factor for axial welds.

MR. HACKETT: Right.

MEMBER WALLIS: Now, I don't really remember, but I think it was independent of plant, and it looks as if the weighting factor here should not be independent of the plant.

It is very different for the Palisades

than it is for Oconee.

MR. HACKETT: Yes. In fact, if you look at Beaver Valley, is a plate-dominated plant and so this actually is probably a pretty good place to take that kind of question as a lead-in to the weighted RTNDT.

The reason that -- and Mark Kirk developed that, and again at this point it is a proposal, as a way that you could proceed to recognize exactly this piece here.

That there is not an equivalence in how these things are initiating, and so it was a good idea to try and bring that data scatter today to try and weight these.

MEMBER WALLIS: But that is for different plants, and that is the thing that I wasn't sure about.

MR. HACKETT: It will be different depending on the material condition.

MEMBER WALLIS: So you calculate your weighting factor .

MR. HACKETT: Correct.

MR. SIU: That's right. I think you could view what he has as a curve fit for the three plants, and now we are doing Calvert and there will obviously be a check on that.

MEMBER WALLIS: So since you had three weighting factors at three plants, and that seems to be --

MEMBER SIEBER: Could you tell me why Beaver Valley is different than the others in that it is plate dominated?

MR. HACKETT: It really comes down to being as simple as their welds are in good shape. So they don't have --

MEMBER SIEBER: That is a high copper plant.

MR. HACKETT: They don't have high copper welds. They have a plate in this case that -- and I may have to turn to Matt for the exact reason. I don't know the exact answer to your question.

MEMBER FORD: Wasn't one of the reasons is that the axial welds were not at peak flux azimuth of the core?

MR. HACKETT: Matt, is that the correct answer?

MR. MITCHELL: Yes, what it comes down to is that the plates at Beaver Valley are -- one might consider them atypically high in copper when compared to other plates around the industry.

And the way that the core management scheme has been conducted at Beaver Valley has tended to put the flux peaks on the plates rather than on the axial welds.

MEMBER SIEBER: I did that, too.

MEMBER WALLIS: It is not just core management. It is design. You have got a core which is square inches, and you have got a round vessel and where the square points come close to the vessel is where you have a high fluence, and put their welds on the flat part.

MR. HACKETT: That is also true.

MEMBER SIEBER: Well, it was done intentionally at that plant.

MEMBER WALLIS: Well, you don't -- it is inherent in the design, and you don't manage anything after that.

MR. HACKETT: There would be certain limitations as to how much you could change it with the core design versus inherent construction.

MEMBER SIEBER: Well, that plant always had a low-leakage core and the idea wa to keep the fluence to the welds down, and we did that by zoning fuel. So that is how --

MR. HACKETT: Prior -- and that is a good question, but prior to the conduct of this project, I think there was a concern that with the plate being the embrittlement concern, and the material concern, you now have this very large surface area, and then if you were to sum up all the flaws that you might expect over that surface area, you might back yourself into a problem.

Instead, what you find is you find again that the flaws are focused on the weld fusion line, and the plates by and large aren't defective.

MEMBER SIEBER: Yes, I would suspect that most of the flaws are initiated in the welds.

MR. HACKETT: Right.

MEMBER SIEBER: And the density of the flaw initiators in the plates should be very low by orders of magnitude.

MR. HACKETT: That's exactly what we are finding.

MEMBER SIEBER: Okay.

MR. HACKETT: This next slide gets into basically -- well, it does not get into much. Mark Kirk is supposed to be here for that, and we had some -- we even had some audio for that. But the bottom line of this is looking at the containment as a system and its performance in terms of PTS and PTS impact on containment performance, is that the system energy for these types of situations are lower at the time of RPV failure, and so you have a limited mechanical impulse, and you have a limit to the containment pressurization.

And I think we have another graphic here. There it is. I think that Dave and Nathan can help me through this if I don't get it quite right. But I think what David did here was put a line on showing basically water at 212 degrees as a base line for energy, and then showing that particularly in the case of LOCAs, and this is a 16 inch LOCA here.

But the LOCAs drop very quickly and then the energy that you are at is much lower. So the whole bottom line is that the design bounds this type of -- the design being basically to take the double-ended guillotine break from LOCA for containment performance is something that initially in this type of scenario should not present any extra challenge to the containment.

And with some dependency if you are looking at containment sprays, and we are looking at a situation where we have done at least a qualitative analysis and there is not a missile threat or other threat that would hopefully in a dependent way take out containment sprays.

Another element would be the fuel cooling, depending on the reactor cavity design. Some of the cavities are designed and would be flooded in the event of a significant LOCA.

And then obviously that goes towards your fuel performance or any core melt characteristics. This one I know the committee heard this morning about GSI-191, and there is obviously some dependence in here with regard to 191 and some strainer blockage.

MEMBER POWERS: Are you arguing that if you flood the cavity that the core won't melt?

MR. SIU: We are arguing that the probability of core damage is significantly less if the cavity is flooded, yes. We are not saying -- we just have not carried the analysis all the way through, but you are in a situation where you have got lots of cold water.

You have dumped the RWST, and in some of these plants the water level will rise above the top of the active fuel. In other plants, it won't.

MEMBER KRESS: There is a whole there to

get the water into it?

MR. SIU: Yes, it is pouring out of the reactor pressure vessel. This is after the reactor pressure vessel has failed.

MEMBER POWERS: But you are not circulating it.

MR. SIU: It will heat up, but --

MEMBER WALLIS: Even if it doesn't completely cover the core as a pool, you will get two-way effects from spitting and steam cooling, and all that kind of thing.

MR. SIU: Yes.

MR. HACKETT: I guess I hesitate to go back to this type of slide, but -- well, there is one more piece here and this is basically Nathan's point here, is that this is addressed in the sequence analysis in detail for going through this type of scenario for the tree.

This was the one that I was hesitating to get back into, because this tries to resummarize sort of everywhere where we have been. But just going through the bullets, you know, and we have said this before, but very low predicted through wall cracking frequency values, and this is our bottom line, is suggesting that a revision of these criteria is warranted.

Basically this reactor vessel failure frequency set at 1 times 10 to the minus 6, will correspond to this weighted RTNDT value of 290 fahrenheit. Now, again we are back into this where it does not compare directly to the ASME or the regulatory RTNDT.

This is a weighted RTNDT, and it was described in your report, and unfortunately I don't have -- we have some backup slides that get into that with a lot of algebra on i showing that it is weighted basically by weld type in the case of axial circumferential weld length. And also the fluence specifics, and the --

MEMBER WALLIS: For the benefit if Professor Apostolakis, you should point out that it takes account of the epistemic and aleatory uncertainties in RTNDT.

MEMBER APOSTOLAKIS: Yes, we will come to that.

MEMBER WALLIS: Oh, you will come to that, but this RTNDT star is supposed to take account of that or not.

MR. HACKETT: We feel that it does.

MEMBER WALLIS: Well, maybe not. It

doesn't. I'm sorry, I'm wrong. It is in evaluating the mean of the TWCF that you take account of that.

MR. HACKETT: Yes, that is correct. In this case, we --

MEMBER APOSTOLAKIS: This is weighted over what again?

MR. HACKETT: This is basically to try and do like the layman's view of this thing. This is taking the RTNDT and going back to that slide that I had showed you that breaks down where the -- I think like Marsh liked to put it yesterday, where do you assign the blame.

And where you assign the blame for failure of these things is failure of axial welds for the most part. So it is trying to weight it where the meat is. So largely weighted towards axial welds, but it will be weighted both in terms of the type of weld, axial versus circumferential, and the weld length.

MR. CUNNINGHAM: So it is the weld length.

MR. HACKETT: And the way the fluence is delineated. So it is a function of those things.

MEMBER APOSTOLAKIS: There was an argument made, which I can't find now, is on page X, and that if a particular utility does not necessarily know what kinds of axial rods it has,a nd that is what it says here, and that is why you are taking the weighted average.

And you have a generic average of 10 percent of them, and what is that called, heating, or heat something?

MR. HACKETT: A heat analysis?

MEMBER APOSTOLAKIS: Yes.

MR. HACKETT: There are obvious different heats of weld material.

MEMBER APOSTOLAKIS: Yes, and they don't know, right?

MR. HACKETT: Actually, they have everything, and this gets back to the discussion that we had earlier. They would have everything. If you were to get into the plant specifics, they have everything that they need to address the weighted value also.

MEMBER APOSTOLAKIS: So if they haver everything, they will not need to use a weighted value, and that is where I am going. Why would they need a weighted value?

MEMBER WALLIS: No, no, a weighted value takes account of the composition.

MR. CUNNINGHAM: The variability of materials and welds within a given plant. The weighting is all for one plant.

MEMBER APOSTOLAKIS: Within a plant.

MR. CUNNINGHAM: Within a plant.

MR. HACKETT: Now, if you were to get to -- and Professor Apostolakis may be going beyond to -- if you were to get to a plant specific analysis, and if your question is can they make this case, and can they calculate this parameter, again it is just a proposal at this point, but yes, they could, because the know the weld types that are limiting, and they know the weld lengths, and the geometry.

And they have the detailed fluence map of their vessel. So they could argue on that basis if they needed to. And the chances are that if this project is successful, they won't need to. Hopefully you won't ever need to.

But that is there if it had to come out. The last point really goes to this issue here, this RTNDT star that we have been talking about, and we have RTPTS,, which is RTNDT, but that is the way that it is calculated currently.

There is a difference of on the order of 80 to 110 degrees F. to compare apples to apples.

So like what we were talking about before, what this means in the end is that a 290 F. screening limit on RTNDT star corresponds to the current regulatory limit moving out to 350 or more, depending on exactly where we end up.

And then that then has the effect of pushing out the operation for -- and I think that is my next slide in fact.

MEMBER APOSTOLAKIS: Yes.

MR. HACKETT: Well, maybe not, but the bottom line is that the plants are grouped here and it takes them for even coming close to impacting this revised screening criteria for many years.

At least it looks like for the license renewal period, and probably beyond, and Mark has the graphic down here saying 60 to 80 years potentially.

It may be getting to the point of eliminating this as a real regulatory concern.

MEMBER WALLIS: Mark also pointed out that the highest value you have for Beaver was something like a thousand years or something like that.

MR. HACKETT: They ran the analysis out pretty far I think.

MEMBER WALLIS: So for 60 to 80 in the yellow region, but if you start and kind of go up to the 10 to the minus 6, you have got to go out for hundreds or thousands of years.

MR. HACKETT: We did get into some discussion yesterday, and again --

MEMBER POWERS: We will never get out of the license renewal business.

MEMBER SIEBER: By then it will have corroded through.

MR. HACKETT: So I think our conclusions we have pretty much been through most of that. I think we have covered most of this. There is a question that Mark Cunningham raised about the reg guide.

Certainly we feel that we have a tech basis to go forward with the rule revision. Whether or not we engage in revision of the reg guide is probably going to be a resource issue largely. Nathan mentioned and talked about the reactor vessel failure frequency.

And the metric that we are talking about that is proposed here is that that is equivalent to the through all cracking frequency, and other options were evaluated.

And that that failure frequency would be set at 1 times 10 to the minus 6 per reactor year, and we think that is consistent with the guidance that we received from the committee, and previous foundation for the PTS rule, and also the quantitative health objectives.

The analysis supports this revised screening limit, and in this case the 290 on the weighted basis, which is equivalent to this 350 plus number. in terms of what we are used to thinking about.

MEMBER WALLIS: Well, I am just wondering about you screening them, which is such that they will never reach it. So there ought to be some regulatory check on what is going on with embrittlement.

MR. HACKETT: Before then.

MEMBER WALLIS: Before that, and how are you going to do that?

MR. HACKETT: A couple of things that I could comment on, and I am glad that you brought that up because we have gone through this so fast that we didn't bring up some of the other issues.

One effect that this will have is that we have to now go back and look at the companion in

Appendix G for the operational limits. I know that we talked about that yesterday, but we should get into that here, too.

So we have an activity that is looking into the effects on Appendix G for heat up and cool down curves,a nd that is probably more likely to be where we will shift some of the limiting concerns here.

MEMBER WALLIS: But maybe this should also be an ongoing effort to evaluate some of the key assumptions that got you to this wonderful immortal vessel as you go along.

So that you say, oh, well, yeah, we made these big changes in what was assumed about flaws on the basis of the knowledge that we gained. And as we gain more knowledge, do we have to go back on that because of the extra knowledge that we are getting, and say maybe we were too optimistic about flaws or something.

MR. HACKETT: Yes, absolutely. That one is a key one that Dr. Ford mentioned yesterday. The potential or at least we have looked at for fairly near term, and any possibility for any active advancement of these fabrication flaws.

We think the answer is no, and we have

data that says that it should be no, but that is not to say that is true for all time.

MEMBER WALLIS: And how about this noble chem thing? Suppose they come up with some new kind of chemical treatment for the water, and is this going to do anything about the surface flaws and all of that? Are we going to have to revisit this?

MR. HACKETT: We are going to have to continue to monitor those types of developments, and then maybe we will finish up and take any other questions with where we are going.

MEMBER APOSTOLAKIS: Oh, I thought you were finished.

MR. HACKETT: As I said, maybe to revisit where Mark started us off, and we feel that we have this interim product that we have shared here with the committee that has been forwarded to the NRR for detailed comments.

And that describes a lot of activities in the Office of Research from all three of the divisions. There is also that NRR has been involved while we have been doing this.

But in terms of the things that we still need to do, the Calvert Cliffs analysis, or the analysis of the Calvert Cliffs plan is not complete, and we should complete that in 2003, and that is a big aid in helping us with number two, in terms of the generalization of what we have done here to other plants, and to all plants.

We do have some sensitivity studies to work on, and one of them involves the flaw density and distribution. We have been challenged with some what if's there.

We feel that we have a pretty solid basis for that, but you can always second-guess what we have done so far, because there is a limited amount of data there like in a lot of cases.

There is verification and validation of the FAVOR code, which has been ongoing, and a lot of which has been completed. A lot of interaction with the industry on that.

Professor Apostolakis mentioned the peer review, and it is a challenge to get people, and it is almost like an O.J. Simpson jury. You know, you are looking at trying to find people who have not been involved in this thing in the United States, and it is not easy.

So we do have that as a take away, and that we have got an external peer review, and I think in Mr. Mr. Thadani's letter, he had indicated that the ACRS was sort of subbing for -- and I don't know if that is the right word, but there was some discussion yesterday about ACRS substituting for an external peer review, and that is not the case.

As always, we have gotten many useful comments from the committee, and we think that we have addressed a lot of them. We have more to detail with, but it is not substituting for an external peer review, and so we will have that going.

The implications of the operational limits, we talked just briefly about that here. That is something that we still need to address. We have a user request from NRR to get into that area, and we are budgeted to do work in that area in 2004, I believe.

And Matt can get into any other details on the NRR activities, but just briefly here this was sent on -- we actually made a New Year's Eve deadline, which is maybe the first time in my career that we actually did that.

But Shipp (phonetic) was here, and he signed it out, and it went over to NRR on New Year's Eve. We have to have our comments back by the end of March, and then looking at decision to proceed with rule making, which is -- we talked a lot about that yesterday, too.

We feel that it is warranted technically and there are obviously a lot of other concerns at NRR that we will have to consider with regard to engaging rule making activities. So that will be their decision.

Preliminary indications from discussions with the EDO and NRR are that they feel pretty strongly about this, and so that is likely to go forward hopefully in the near term here.

And that is pretty much the end of our prepared remarks, and we are happy to take any questions.

MEMBER APOSTOLAKIS: Okay. I have a few questions on the uncertainly analysis that is described in Chapter 2 of this report. In Section 2.1.6.1, it says that -- it describes how aleatory uncertainties are handled, and I understand the aleatory problem.

But then much to my surprise, it says that model uncertainties are aleatory, and also uncertainties due to incompleteness are also aleatory. So 2.1.6.1.

And I have always believed or thought

that model uncertainties were part of the epistemic uncertainties. Now, you might say all you have to do is take these two paragraphs and move them to the other section that talks about epistemic uncertainties.

But actually there is more to it than that, because somewhere else it says that in 2.26, I believe, it says that parameter uncertainties which are classified as epistemic the only epistemic uncertainty in the report is the parameter uncertainties.

Now, propagated using Monte Carlo and Latin Hypercubes. The other, the aleatory, are handled by considering a best estimate, lower and upper bound, and you put some subjective probabilities.

And then there is Table 2.3 that lists some of these aleatory uncertainties. For example, the break location. We don't know what it is. The season. It says there is one-quarter probability of it being winter, and .5 being spring or fall; and .2 5 being the summer, which I think I know where it comes from.

So these are aleatory and they are random, and you can't do anything about them. But the same table is the RELAP-5 code model uncertainty is an aleatory uncertainty.

So that tells me now that if I run the code a thousand times I will get random results because it is a random code, and then if I go to what Nathan wrote in Appendix B, which was written some time ago, the interpretation that Nathan used for aleatory and epistemic, which I agree with, is inconsistent with this, because I can't believe that the code is --

MR. SIU: George, if I made, I will give my interpretation of what I see written here. And then, James, I don't know if you want to add anything to that.

I think they were referring to model uncertainty in a very limited sense, and in models in a very limited sense. They were talking about the input parameters, such as the valve area.

And when you say the valve has failed, what does that mean? So you look at different openings. That is an aleatory --

MEMBER APOSTOLAKIS: So it is the event that is --

MR. SIU: It is a boundary condition. So you could say that is part of the model.

MEMBER APOSTOLAKIS: But that's not aleatory. I mean, that is not model uncertainty.

MR. SIU: Well, that is what I am saying, is how I was reading that particular model uncertainty, as opposed to saying RELAP is off by -- you know, let's pick an arbitrary number, which may not be real at all, and let's say 10 degrees, plus or minus, standard deviation. That is differently than what this is trying to reflect.

MEMBER APOSTOLAKIS:

MEMBER APOSTOLAKIS: What is says, for example -- are you there, Vic? Table 2.3. I need you guys to look at it. For 2.3, there is no page.

MEMBER RANSOM: It must be missing.

MEMBER APOSTOLAKIS: If it is messed up, you will never fix it. Does anyone on the table have 2.3? Okay. So that I can understand the valve state, now where it says component heat transfer rate, can that be an aleatory variable?

I mean, the heat transfer rate, what does that mean, the heat transfer coefficient? Yes, sir, what is it?

DR. CHANG: This is James Chang from the University of Maryland. When we modeled this, we considered that there is the uncertainty in the measurement of the heat transfer rate. So in our --

MEMBER APOSTOLAKIS: What heat transfer rate is that? Where?

DR. CHANG: It is the heat transfer -- well --

MEMBER ROSEN: From the fluid to the wall.

MEMBER APOSTOLAKIS: Okay.

DR. CHANG: Yes, but in doing so, we are not able to change the unified equation. Instead, we changed the heat transfer area by --

MEMBER APOSTOLAKIS: And what equation is that? You said that you cannot change the equation. What equation is that? Is it the heat equation in the code?

DR. CHANG: Yes.

MEMBER APOSTOLAKIS: Okay. So that will give you the nominal value, right?

DR. CHANG: Yes.

MEMBER APOSTOLAKIS: And you say that I believe that equation that the code uses only .9 percent of the time, but 10 percent or .8 percent of the time. And 10 percent of the time, I believe it is 30 percent less, and 10 percent of the time I believe it is 30 percent more. That is what the table says.

So there are two questions now. The first is what is the basis for these assessments, and second is that aleatory. In other words, for the same sequence and for the phenomena, 10 percent of the time it would be underestimated, and 10 percent of the time it would be overestimated? That doesn't make sense.

It is always the same value, but you just don't know what it is. So it is a mistake. It shouldn't be the same table as the others,a nd again if it is a matter of removing it from the table, I wouldn't mind that much, but you used it in your calculations.

You combined it with an aleatory, and now I don't know what happened to all of this.

MEMBER WALLIS: This concerned me, too, and when you do this, and when you make a calculation with RELAP, you get the temperature going down like this on a curve.

If you use the aleatory, it jumps around as it comes down the curve and that changes the thermal testing. Well, it doesn't jump around as it comes down.

MEMBER SHACK: Well, no, it predicts a

heat transfer coefficient which you are going to use in favor.

MEMBER WALLIS: And then do you stick to that, or as it randomly changes as --

MEMBER SHACK: No, in some codes or in some cases they use the predicted value, and they say there is some uncertainty in that value, and so sometimes they use a higher value, and sometimes they use a lower value.

MEMBER WALLIS: But they use it throughout all the time, this correction?

MEMBER SHACK: No, but --

MEMBER WALLIS: Oh, you don't change it from time to time?

MR. BESSETTE: No, and so let's say we have a heat transfer coefficient for a convection model and so we put a multiplier on that of 1.3 or .7.

MEMBER WALLIS: So it is always off in the same direction? The thing that we are looking for --

MEMBER APOSTOLAKIS: No, no, and if you go to Appendix B, Nathan has a very nice figure of how aleatory uncertainties is handled. It is inside in a loop, and then the epistemic are on top.

This cannot be part of the loop, period. It is epistemic.

MR. BESSETTE: This particular table is everything that we varied, and so it is not intended to be an aleatory table.

MEMBER APOSTOLAKIS: It is not in terms of what?

MEMBER SHACK: Separate the table in two if it makes you happier, George.

MEMBER APOSTOLAKIS: Yes, but the calculation --

MEMBER SHACK: Split the table.

MEMBER APOSTOLAKIS: No, because the text says that all of these are aleatory and they are treated as such, because the epistemic are treated via the Monte Carlo. It is not just a table. The text says this is what we do.

MR. BESSETTE: Yes, and so none of these things are treated in a Monte Carlo sense. These are all treated as --

MEMBER APOSTOLAKIS: It is random, and we are taking -- right? What else?

MEMBER RANSOM: I think they made sensitivity studies, and so they made parametric studies, although I don't understand why 9/10ths of the time that --

MEMBER APOSTOLAKIS: Well, that is another issue, but the other issue is the process issue. I mean, to put in a table things like I don't know what season of the year it will be, right, and so it is that one-quarter of it is winter. I understand that.

And then to say that the coefficient will be treated the same way, that just does not make sense to me.

MEMBER WALLIS: Well, there is a bigger question than that, is that if you are going to make this correction to the heat transfer coefficient throughout the whole transient, then you simply displace everything.

But in reality RELAP could be critically too high a heat transfer coefficient at the beginning, and to low a coefficient at the end. And that is where you get a transient with a steeper time variation of temperature.

MEMBER APOSTOLAKIS: Right.

MR. BESSETTE: Well, you know, we deal with this single -- let's say convective model. I mean, so RELAP can be wrong im the sense that it is calculating the wrong fluid velocity, which gives you -- maybe you say how can RELAP be wrong in different directions at different times in a different transient, and it is.

MEMBER WALLIS: It is wrong.

MR. BESSETTE: The way that you would obtain that in practice is somehow if RELAP is sometimes toggling too high a fluid velocity,a nd sometimes too low.

MEMBER WALLIS: Well, what I was looking for is that you said you drew these curves for RELAP predictions versus the data, which is fine. And then you have to say intellectually how am I going to represent this difference between the two.

How am I going to do that given that it has certain features, and some of it is above and some of it is below, and with time the deviation goes plus or minus. How am I going to represent that?

How do I go from that to whether it is epistemic or aleatory, and how do I treat it? And all that logic could somehow come out in the report.

MEMBER APOSTOLAKIS: And aren't you actually -- well, admittedly you are doing sensitivity analyses?

MR. BESSETTE: Yes.

MEMBER APOSTOLAKIS: How do you do that? Do you do it one parameter at a time? How do you conclude that the LOCA between 1-1/2 inch and 4 inches is a dominant scenario?

I mean, you have some something, and all you are saying in the report is that for each key PTS contributing parameter, typically three representative values are presented lower, nominal, and upper bound with corresponding predetermined probabilities are used for the assessment of their (inaudible) sensitivity indicator.

But it does not tell me how. So are you taking all the possible combinations of this table and run the code and see what happens, or are you doing one parameter at a time?

DR. CHANG: We do think one parameter at a time. So we fix -- at first we fix the break size and we select l.5 inches, and 2 inches, and 2.8 inches, and 4 inches, and 5.7 inches, and 8 inches.

So for each break size, I varied the parameter, and at that time we changed a few other EOC water temperature, from the spring time temperature to the winter time, and then see the difference.

MEMBER APOSTOLAKIS: So when you change

the component heat transfer rate, you assume that there is perennial summer, because you don't change that. If you are unlucky to have a different heat transfer rate, and it happens in the winter, then you are in trouble, because you are using nominal values for the other parameters, which really goes against this aleatory business.

Aleatory means that things are random and all sort of combinations.

MEMBER WALLIS: And you need 59 combinations.

MEMBER APOSTOLAKIS: Well, whatever it is, yes. We were all very happy when we saw what is now Appendix B that Nathan wrote 3 years ago, or 4 years ago, because that was logical, and explained how things were going to happen. But now they didn't happen that way.

MR. CUNNINGHAM: It is clear, Dr. Apostolakis, that we need to go back and look at this, and either clarify --

MEMBER APOSTOLAKIS: I thought you said Appendix B was clear, yes.

MR. CUNNINGHAM: If Appendix B was clear, yes.

MEMBER APOSTOLAKIS: I was completely

confused by this discussion here, and I thought again, thinking of my colleagues' shock, that maybe I was overreacting and that this was academic, and that you actually did things like that. So it matters this time.

MEMBER SHACK: They have the main sequence, and at least as I understand it, the thermal-hydraulics, they have been in the PRA, and that is how they get those sequences that they considered.

Then they want to consider the uncertainty associated with each of those main sequences. So they take the one-inch break, and --

MEMBER APOSTOLAKIS: No, that is not what it says. They want to characterize the variables.

MEMBER SHACK: But you do that because you are representing this whole set of scenarios by a thermal hydraulic sequence, but that one thermal-hydraulic sequence doesn't account for all the uncertainty that you have in it.

So you account for that uncertainty by considering the range of variables over which that scenario really covers for you representing 15,000 thermal-hydraulic sequences by one, but that really corresponds to a range of variables.

There is the aleatory representation that you have, because the break could occur anywhere. It could occur in winter and in the summer, and there is also the epistemic problem that RELAP may not be calculating the heat transfer coefficient properly.

MEMBER APOSTOLAKIS: Right.

MEMBER SHACK: So you include an uncertainty for that. In that sense that you have included when you do the hydraulics for that bin, you have included the thermal-hydraulic uncertainties covering the fact that you are representing 15,000 sequences by one thermal-hydraulic sequence.

And that there are things that you don't know about the -- and even if you had all 15,000 sequences, there is still things that you don't know about the sequence, like when it is going to happen in the year. And the fact that RELAP could be wrong.

MEMBER APOSTOLAKIS: I understand all of this. The question is what do you do about it? And that is not what is --

MEMBER SHACK: Well, today you have to

look that it favors --

MEMBER APOSTOLAKIS: No, no, no. I am looking at 2.6.

MEMBER SHACK: Well, it is a question of how he does it in the calculation.

MEMBER APOSTOLAKIS: Yes.

MEMBER SHACK: Is he picking it randomly within -- I mean, what Monte Carlo loop is he within, and I believe that he does it so that he treats the RELAP uncertainties as epistemic, and the other uncertainties as Aleatory.

MEMBER APOSTOLAKIS: All the indications --

MEMBER SHACK: But he is probably the best --

MEMBER APOSTOLAKIS: Why do you believe that when the author says that they treat them as aleatory? I mean, why do you believe that?

MEMBER SHACK: Well, personally I don't believe when I read that report the figure of 1.1.

MEMBER WALLIS: But, George, there is another point that needs clarification. Is that when the thermal hydraulics result goes to the next step, it is treated as being a deterministic result, and it is one curve. It is not a curve, plus uncertainties.

So I am not quite sure then how the thermal hydraulic uncertainties propagate through to influence the final answer.

MEMBER APOSTOLAKIS: Okay. So there are several issues here. One is the issue of how did you come up with the 30 percent more or 30 percent less with the probability of .1.

MEMBER SHACK: Well, that is a judgment.

MEMBER APOSTOLAKIS: Right, but it can be questioned by experts in that field. Secondly, why do mix aleatory and epistemic; and why do you do a sensitivity analysis one variable at a time?

MEMBER POWERS: Because you are an idiot. It is the wrong way to do it. No, it is easy to do.

MEMBER APOSTOLAKIS: It is easy to do.

MEMBER SHACK: Sure. It is easier to do it at multi-variables at a time than it is one variable at a time.

MEMBER APOSTOLAKIS: So they chose the hard way?

MEMBER SHACK: I bet that they did.

DR. CHANG: Well, I say it is the Table 2.3 here where we changed one variable at a time,a nd then we used the first 10,000 seconds, the downcomer average as a sensitivity indictor, and from here we used a single probe to mix all of them.

MEMBER APOSTOLAKIS: You mixed them? When? I thought you said you do it one at a time.

DR. CHANG: Yes, one at a time, and that is the first set, doing the sensitivity of one parameter uncertainty, and how it could affect the PTS, yes.

And then the second step is that now we have the sensitivity of one parameter, and then all the associate probabilities, and that probability is assigned here.

And then through the all the parameters combined --

MEMBER APOSTOLAKIS: So you are going by the probability?

DR. CHANG: Yes.

MEMBER APOSTOLAKIS: But them that assumes that the dependence of the 30 models in the code is linear, because if it is not linear, then you can't do that.

DR. CHANG: Yes.

MEMBER APOSTOLAKIS: Are they linear?

DR. CHANG: Because the sensitivity

would be indicated, we choose for the first and second parameter checks an average of --

MEMBER APOSTOLAKIS: Well, there again you have a problem again because you are saying now that I will take the weighted average.

So I will take 70 percent of the nominal heat transfer coefficient with a probability of .1, and multiply that by .1, and take the results for winter and multiply them by five and add the two. Well, winter is aleatory, and it is really --

MEMBER WALLIS: It is average behavior through the year.

MEMBER APOSTOLAKIS: Average is everything. Anyway, I think Mark is right.

MR. CUNNINGHAM: We need to go back and look at this, and look at it further.

MR. ROSENTHAL: This is Jack Rosenthal, Safety Systems Analysis Branch. I agree with Mark that we have to go back and regroup on this issue. Nevertheless, in preparation for this, I asked Dave please help me as we continue on.

And he pointed out to me that if you take the water from the refueling water storage tank, and you pump it through the system, and you throw it against the wall. And in the winter it is

40 F., and in the summer it is 80 F.

So that delta-40 ends up with almost the delta 40 on the wall. So we take these values, and the delta 40 F. is long compared to at least on an RMS basis how we did between RELAP and the developmental assessment calcs, and we run it through FAVOR.

And what you get is a low number in favor either way. So I acknowledge that there is some real methodology things that we have to straighten out with the report, and I think we can do it right, but my basic understanding is that we have done enough variation of parameters, and done enough FAVOR runs that the basic conclusion that we have that the PTS risk is small is robust.

MEMBER WALLIS: Jack, that's why we need some numbers of these green and red arrows, and my impression is that the effect of this thermal-hydraulics is probably a 10 or 20 percent effect.

And the effect of what you assume about the flaws is a factor of 20 to 70, and so one overwhelms the other completely. If we make that clearer, we might have more perspective on what we ought to concentrate on.

MR. ROSENTHAL: Fair enough.

CHAIRMAN BONACA: I think so.

MR. ROSENTHAL: I figured that the probablistic fracture mechanics is maybe three, or what is the magnitude on the thermal-hydraulics, and yes, we will acknowledge that we need to go back and rewrite the document better.

MEMBER WALLIS: You really need this overview document which puts the whole thing in perspective, all these things in perspective.

CHAIRMAN BONACA: I wanted to ask another question. Just because it is a rather significant contributor that has been eliminated, and we discussed this before, but I did not attend the whole meeting yesterday.

You concluded secondary side breaks are not important. So now I remember one of the dominant breaks assumed for a B&W plant in the previous analysis, and that was a steamline break, and we had run out of feedwater, and tried to isolate the primary system pressure drops.

And you had this ECCS injection, and further cooldown, and repressurization, and now you have this very severe condition. Now, I grant that there is no operator actions being assumed there, and failure of the (inaudible) isolation, and so that is understandable in that scenario, for example.

But how do you eliminate that being any contributor? Just because of operator actions in the procedures? Yesterday, you pointed out that it was not only operator actions.

MR. KOLACZKOWSKI: There are three reasons which Ed mentioned, and we will go over that again, I guess. Hopefully it will be clearer. As we pointed out in the early work, and of course the Oconee analysis that was done in '81 or '82, or whenever it was, the early '80s, that was the one that really showed the main steamline break was important.

If you go in and look at that analysis, you find that because we are dealing today in doing a 150 thermal-hydraulic bins, or as back then it was more like about a dozen, as Ed pointed out, that if you go look at the analysis, you find that essentially they took all the frequencies of things like main steamline break, and maybe a couple of multiples,a nd stuck-open turbine bypass valves, and small steamline break,a nd treated all of those events as if it was a main steamline break.

MEMBER APOSTOLAKIS: Okay.

MR. KOLACZKOWSKI: So from a thermal-hydraulics standpoint, we get this very rapid cooldown, so on and so forth, and they are dumping all these frequencies into that bin, and then obviously applying a very high, or relatively high, CPF.

That is, a conditional probability of vessel failure, because they were treating it like it was all a main steamline break. So first of all, we come along and we say we are not going to treat it that way. We are going to take a main steamline break, and we are going to put it in its bin, and have its frequency.

And that will still give us a high, or relatively high, CPF, but the frequency if we had not dumped in all these other things as if they are all main steamline breaks.

And then we have a multiple turbine bypass valve bin, and we say, okay, we are going to get its frequency, but you know what? That is a much smaller break, and so even though the frequency is higher, the CPF is a lot lower because we don't get much cooldown.

So first of all the binning, and the fact that we are not using as gross bins, everything else equal, you have already lowered it a lot because we are not treating all these frequencies like they are all a main steamline

MEMBER APOSTOLAKIS: I understand.

MR. KOLACZKOWSKI: And so that is reason number one.

MEMBER ROSEN: You're not treating all of them with the steamline breaks degree of overcooling?

MR. KOLACZKOWSKI: That's right.

MEMBER APOSTOLAKIS: So the frequency of that particular event is much lower now because of --

MR. KOLACZKOWSKI: Yes, that is reason number one. The bining itself, and the process itself, changed the numbers.

The second thing is if you just look at -- and now with all the changes that have occurred in FAVOR code and so on, and so forth, removing all these conservatisms, et cetera, if you were to take the same main steamline break back in 1980 with today's code, and now do the analysis with today's code, what you would find is that the CPFs were grossly over-estimated because of the old -- well, whatever was the precursor to the current FAVOR code.

In other words the CPF that was being predicted back in 1984 for a main steamline break, are higher than the CPF we would predict today with today's version of the FAVOR code, just because of the fact that we have removed a lot of those conservatisms in the fracture mechanics part of the analysis.

So that has lowered the main steamline break. And then finally the third thing is as you have already pointed out, Dr. Bonaca, is that the early analysis gave little to no credit for isolating, let's say, a faulty steam generator because they didn't want this to rely on necessarily human action or whatever.

And we said, okay, but we are trying to do a best estimate with uncertainty bounds on things. So as a result, we want to acknowledge that operators just aren't going to watch a steam generator blowdown and continue to feed for 30 minutes and not do anything about it.

And so we said, okay, let's give -- well, whatever we felt was the appropriate credit, and it went through the systematic process, ATHEANA, and expert elicitation, to try to put some, we hope, realistic values on what is the chance that operators would not isolate a steam generator by 30 minutes into this event.

And we all believe that probability of failure is not 1.0 based on the simulations that we have seen, and based on EOPS today, based on where EOPs were back in 1970, late, when those early analyses were done. and based on current training today, et cetera.

And that there are real reasons to provide some credit for operator error.

MEMBER ROSEN: The big change is in systematic procedures, right?

MR. KOLACZKOWSKI: Sure.

MEMBER ROSEN: Since 1970.

MR. KOLACZKOWSKI: Clearly. I mean, the systematic procedures, and so on and so forth of the higher sensitivity to PTS that we have today than we had back in 1981 when this was first all coming up, et cetera.

MEMBER ROSEN: The operators don't have to diagnose what it is. They just look at symptoms.

CHAIRMAN BONACA: And I thank you very much for bringing that out.

MR. KOLACZKOWSKI: And I don't want to

over-emphasize the --

CHAIRMAN BONACA: No, no, let me just say that for the purpose or the point that Dr. Wallis was making before, these are pluses and minuses contributors. This was a very important presentation to me, because it tells me that we are not just relying on operator action judgments, and there are other factors.

And again in the context of a report, it would be valuable to understand roughly what kind of contribution we had from these considerations. And that would take the issue off the table and convincing say, yes, let's just forget about the secondary side and cooldown, because even if what was said about human reliability is wrong, still it is a small contributor, or a smaller contributor than we thought.

MEMBER APOSTOLAKIS: I think in that context, you know, I think we were promised more than a year ago a walk through calculation. I don't think we ever saw that or I ever saw that.

So I have two comments here. One is that Mark Cunningham said earlier that this is a summary report, and so there will be a bigger report somewhere else?

MR. CUNNINGHAM: There will be supporting reports behind this, yes.

MEMBER APOSTOLAKIS: But still though I think it would be useful for the summary report to be a little more explicit.

MR. CUNNINGHAM: Yes.

MEMBER APOSTOLAKIS: Now, in addition to what I said earlier, in 2.3, it just says that we formed a team, a party, a working party, that was able to distinguish between aleatory and epistemic, period. Thank you very much.

Well, give me something, you know. And also the emphasis is too heavy on the process. We formed the party and the party did this or the party did that. I don't care what the party did. What is the method.

Second, I really would like to see a chapter or a presentation on how figure B.4 in Nathan's appendix was actually used. If you do that, I think it would go a long way towards explaining everything that was done. B.4.

MEMBER WALLIS: Well, George, there has to be a much more extensive summary of what were the procedures, and how it all hangs together, and what thermal shock is, and the fact that you have to calculate wall temperatures and so on.

And a lot of the stuff which is very good, you don't get until you get to the appendix. It has got to be right up front, and this is how we did it.

MEMBER APOSTOLAKIS: I think that figure is great. It tells how we did this, and how we did that. Let's make a sequence or something, whatever is convenient, and demonstrate how that figure was implemented, and then show the susceptibility results and the whole works.

Don't just tell me that the working party went and ate dinner last night. I mean, that is what it says in Chapter 3. Not dinner, but we formed a party to understand the physics, because this is important.

Well, you know, I never knew that the physics was important. But this is full of that.

MR. CUNNINGHAM: Between yesterday and today, we have gotten a lot of constructive comments on ways to improve the report, and we appreciate that, and we will take it to heart.

MEMBER POWERS: Let me ask a question. I hope that I don't get over-interpreted, as it is not intended as a criticism. It is curiosity on my part. At constructing this undertaking, you did a lot of calculations on binned interim results, and then you did subsequent calculations. Why did you bin interim results?

MR. KOLACZKOWSKI: Resources. Learning as we go, and recognition that if it was pretty clear to us that some things were going to be not important at one stage, then we could begin to screen out certain portions of things that we had to model in more detail.

And/or perhaps we learned that the binning was too crude in some places, and more than what we needed in other places, and so therefore we could redo or reshuffle some of the binning, et cetera.

But clearly at the beginning, Oconee had 181,000 over-cooling sequences in the PRA model

MEMBER POWERS: Right.

MR. KOLACZKOWSKI: We could not do 181,000 thermal-hydraulic calculations and avoid binning.

MEMBER POWERS: Why couldn't you do 181,000 thermal-hydraulic calculations?

MR. ROSENTHAL: I think surely you can, and I just got new linux clusters up today, and so we can or must pull the rip cord and let it run. But would it be meaningful?

You know, I am starting out with a -- well, I don't know what, maybe 530 or 550 F. And I am not bringing it in any lower than 212 F, and so about 300 degrees, and I am doing this over a period of two hours or so.

And by the time that I have calculated a hundred ways of going from stake point A to stake point B, and I don't know if it is winter or summertime anyway outside, I would say this would be overkill on just running RELAP.

MEMBER POWERS: I said don't over-interpret my question.

MEMBER WALLIS: But there must be a systematic way of calculating 180,000 sequences to find out the reasons where --

MR. ROSENTHAL: Right.

DR. KORSAH: And to find out a grid.

MR. ROSENTHAL: Right. And I will stop after this, but in fact we did that. And the reality was that we guessed some sequences, and we were off building decks and writing models.

Then we had some PRA input, and then based on that we ran some more cases, and then as a function of time, we started getting fracture mechanics results back.

And then we had already done a fair amount of arithmetic, and we then had an integral finally closed system,a nd this was a function of time.

And at that point the PRA guys started refining their models, because now they had the fracture mechanics, and the end answer, and asking us to do more thermal-hydraulics. And that is what happened with --

MR. BESSETTE: Our first consideration at Oconee, for example, we had 20 bins, 20 RELAP bins, and this process of refinement and deciding how many we needed, we went from 20 to ultimately to about 200.

MEMBER WALLIS: Do these bins take care of the uncertainties in RELAP?

MR. BESSETTE: Well --

MEMBER WALLIS: Do the bins somehow take account of the uncertainties? The next step is a deterministic calculation.

MR. KOLACZKOWSKI: The bins really representing the uncertainty in the event, because there is randomness in the event, and we don't know if the break is really going to be 1.8 inches or 1.9 inches.

MEMBER WALLIS: I know that, but there is a whole chapter in this report which claims that you have taken account of the RELAP uncertainties.

MEMBER APOSTOLAKIS: And that should be on top of these uncertainties, and what Alan is talking about is the aleatory, and you don't know the size and you don't know the place.

MR. KOLACZKOWSKI: Yes.

MR. BESSETTE: So we had all these bins, and what we did is that we picked the let dominant bins in which to do further uncertainty analysis with RELAP,

MEMBER POWERS: Let me just ask another question again. This is not a criticism of this particular study, but you did a lot of calculations for Oconee, and that means that you had to set up an Oconee deck. If I asked you to do a lot of calculations on Commanche Peak, how long does it take to set up the deck?

MR. BESSETTE: Well, to set up a deck, or to set up a new deck from scratch is about -- I would say two man years of work.

MEMBER POWERS: Two man years of work?

MR. BESSETTE: Yes.

MEMBER WALLIS: Doesn't the Commanche people already have a RELAP deck?

MR. BESSETTE: No.

MEMBER WALLIS: But they have a deck of some sort.

MR. BESSETTE: We don't, no. They don't have a deck.

MEMBER WALLIS: They don't have it?

MR. BESSETTE: No.

MEMBER SHACK: So even after you get TRAC-M, you still have to wait years to point out decks to --

MR. BESSETTE: Well, we don't come anywhere close to having a deck for each plant. We have decks for perhaps 10 plants or so.

MEMBER SIEBER: Even that is a lot.

MR. KOLACZKOWSKI: Let me make a comment about this and why we make the statement that the T-H uncertainties are covered, and I agree that we have not probably proved the point.

But let me just say that I think we believe that the uncertainties in RELAP and its ability to really match experiments, we believe that uncertainty is small, and I grant you that we absolutely have not proved that point sufficiently.

But we believe it is small compared to these things like is the break really 2 inches or 4 inches. That is going to so swamp we believe the uncertainties of the T-H calculation of what a 2 inch response should be, or what a 4 inch response should be, that from that sense, that is why we are qualitatively saying in the report that we believe that the T-H uncertainties have already been enveloped by the ones that we have looked at, because we believe those are larger, and have a greater effect.

MEMBER WALLIS: It is just a question of shielding?

MR. KOLACZKOWSKI: I understand that, and that's why I am saying that I think that we have not proved the point, but I think that is why the statement is there, is that we believe that the T-H uncertainties, in terms of the code uncertainties, are small relative to this randomness of is the peak really going to be six inches or three inches.

MEMBER APOSTOLAKIS: Does this apply also to the probablistic fracture mechanics uncertainties? Are there any uncertainties there? I mean, I appreciate the Marshall distribution, the flaw distribution, but are there any model uncertainties?

MEMBER WALLIS: If you look at the RELAP clause, and any other data --

MEMBER APOSTOLAKIS: What kind of model of uncertainties would you have?

MR. HACKETT: I would take a crack at that. The model uncertainty there is several sources, One, of course, is the one that has been referred to most often here today, would be the flaw density and distribution, and we do have a model there that does explicitly address uncertainties.

And as well as we could do it weighted on the data that we had, as opposed to extrapolations with expert codes, or expect elicitation. That is one. The other model is of course the one that we have spent a lot of time debating here today, and that is on the toughness model and that we did not get into that today, as opposed to what is the measure of truth in this situation.

And the bottom line there is that we did go into this in a fair bit of detail yesterday and you are trying to get an estimate of the fractured toughness of this material, for which RTNDT is but a

-- I have to admit is a bad surrogate for that here.

It is what you are stuck with by the historical way this thing played out. So you are trying to get to fracture toughness with this RTNDT, and the imperfections that lie therein.

And there is a model that goes with that, which ultimately traces back to the development of the master curve approach for fracture toughness. And we could spend a lot of time on that,

but there is a model there, and epistemic and aleatory uncertainties that go along with that. The last major piece would be --

MEMBER APOSTOLAKIS: And these are represented somewhere?

MR. HACKETT: Yes, they are in Appendix A.

MEMBER APOSTOLAKIS: Appendix A?

MR. HACKETT: That's right. The last major piece I will just mention is the embrittlement model. which we have spent more time than anything else on between us and the industry.

And in terms of how do you get from throwing neutrons at a vessel of certain composition and how embrittled it ends up and we have that covered in there, too.

MEMBER SHACK: However, they do believe that fracture mechanics is written in stone. That when Kmaterial equals Kapplied, things break.

MR. HACKETT: Correct.

MEMBER APOSTOLAKIS: And these uncertainties are evaluated?

MEMBER SHACK: When you look at the uncertainties in the embrittlement model, and the uncertainties in the material toughness model, you can make Alan's argument that they ought to swamp any other model.

MEMBER WALLIS: Just look at some of the parts, George. I mean, you have a curve and you have the data, and just take a look at those.

MEMBER APOSTOLAKIS: Yes, but I thought that what Alan and others were saying was that the aleatory uncertainties are overwhelming here. But there is epistemic and aleatory?

MEMBER SHACK: There is aleatory and epistemic.

MEMBER APOSTOLAKIS: But the epistemic I would suspect would be more significant there.

MEMBER POWERS: To be precise, there are aleatory uncertainties in the material properties, and there are epistemic uncertainties in fracture mechanics models.

MEMBER APOSTOLAKIS: yes, yes.

MEMBER WALLIS: And most of the RTNDTs are a very weak surrogate for toughness, but it is the thing that is being used.

MEMBER APOSTOLAKIS: Yes, but what I am asking is the argument that was made that the thermal-hydraulic uncertainties are overwhelmed by the uncertainties in the LOCA size and so on, right?

MR. KOLACZKOWSKI: And perhaps other things in the fracture mechanics.

MEMBER APOSTOLAKIS: So the fracture mechanics are up there? Okay.

MR. HACKETT: In that case the modeling for the flaw density and distribution, and the toughness, I think overwhelm that, too. And we do -- and Dr. Shack raises a good point, in terms of in the fracture mechanics, you are assuming that the fracture mechanics truth in this thing is still a Kapplied versus a Klc type of thing, which takes you back 20 or 30 years in fracture mechanics technology.

And Professor Apostolakis asked a good question there, too, that in terms of -- well, does that work pretty well for this case, and we feel that it does, because you have got a big thick vessel that is about the best way of coming at that type of fracture mechanics that you are going to get, a big thick vessel with a thermal shock.

And that is not to say that you couldn't apply elastic plastic fracture mechanics as a refinement to this thing. And we do in fact do that when we look at low upper shelf welds, for instance.

And that is a whole different problem, but when you are looking at cleavage fracture in a big thick steel component, that is probably still pretty good.

MEMBER POWERS: When are we going to be able to do elastic plastic fracture mechanics routinely?

MR. HACKETT: We do it now. I think we are back to the same kind of point that Jack was making on the binning. It is really a resources issue more than anything.

And Terry Dickson is at the microphone, and I think I can say that by adding elastic plastic fracture mechanics into FAVOR would -- and I will let Terry comment, but it would greatly complicate the computational aspects of the analysis. Terry, did you have some comments?

MR. DICKSON: Yes, but to my knowledge that is on the agenda to do. That is where we kind of go from here. Everything that has been discussed here is based on a linear elastic plastic fracture mechanics model.

And I was going to address the question by Dr. Apostolakis --

MEMBER POWERS: Before you go on to that, do you have some sort of -- is there somewhere a strategy written down on how to evolve our fracture mechanics?

MR. DICKSON: We are working on that right now. But the expectation is that by including the higher constraint plasticity models is that that will be a removal of conservatisms,a nd that these numbers will go down. That is the expectation going in.

MR. HACKETT: Let me come to a little bit more background on that, because the elastic plastic fracture mechanics has also been around for 20 plus years at least, and there are some major analyses that the NRC and the industry have done in terms of qualifying low upper shelf welds for operational performance that is governed by 10 CFR

50, Appendix G, that are indeed based on elastic plastic fracture mechanics.

And with this case there just was not a need to go there as Terry is indicating, but that is future work.

MEMBER POWERS: That's fine. What I am really asking about is what is the Agency's plan to develop its fracture mechanics technology, and whether or not it is applicable to this problem.

MR. HACKETT: Correct. Yes.

MR. DICKSON: I can't speak for the NRC, as I work at Oak Ridge National Laboratories, and we are a contractor, but I know that our plan, and I believe it has been coordinated with the NRC, is that we will be developing a version of FAVOR that includes elastic plastic fracture.

MEMBER POWERS: If there is some sort of a plan on this, it would just be interesting for me to see.

MR. HACKETT: We will make note of that and we will -- Mark Kirk in fact has the lead for developing that right now, and we will make sure that we bring that forward.

MEMBER POWERS: I mean, it is one of those areas that if we are to be supportive, it would be nice to know what the plan is. And it may not be this year, or next year, or five years, but if we have a plan, then we can do things that are supported.

MEMBER WALLIS: Plastic is fine, but then you will get down to the business of what is a flaw, and you said you were using the worst flaw, which is this sort of a razor-like atomic sized flaw that cuts its way through in the worst possible way.

MR. HACKETT: That's correct.

MEMBER WALLIS: And that must be a very conservative assumption.

MR. HACKETT: It is certainly a conservative assumption. Even elastic plastic fracture mechanics does not address that. You are still assuming these atomistically sharp flaws. So that is probably there for the foreseeable future.

MEMBER WALLIS: But that is a conservative assumption?

MR. HACKETT: Yes.

MEMBER WALLIS: George seems to be satisfied, and I would only add to your statement, George, that you need to be shown the thermal-hydraulic uncertainties are swamped by these other ones. But it has to be shown though. It can't just be stated. There has to be a rationale.

MEMBER APOSTOLAKIS: I would like to see though a sequence of calculations all the way through the beginning to the end.

MR. HACKETT: And just as a comment, I have the same recollection as Dr. Apostolakis, and I have been off on another rotation loop here at the NRC, and I have been out of the loop in this project for a while, but I do recall a commitment that we had to do that with the Committee.

And I don't believe for some variety of reasons that never happened.

MEMBER APOSTOLAKIS: It never happened. I am not chairing.

MEMBER WALLIS: How far along are we in this presentation?>

MR. CUNNINGHAM: I guess we are -- I guess if I could wrap up again. We talked earlier that we were interested in a letter from the committee, and we are at the point where we think we have a reasonable technical basis to recommend to NRR that they proceed to rule making to make some changes to the pressurized thermal shock rule to reflect over what we have learned over the last X years in terms of the frequencies of PTS types of events.

So we would be interested in a letter from the committee either endorsing this research idea, and that it is a good idea to proceed to rule making, or some such thing. And again any other comments that you have in that regard, we would be happy to get them.

I am sure that we will be back talking to you, and perhaps Matt and the NRR folks will be the lead the next time we are here.

MEMBER WALLIS: Well, when we were waiting for the train last night, we said what you really need is sort of an external writing committee, which is not so tied up with the work, and just see the details of what you have been doing, and they can present the whole thing in a way that is sort of a half-inch report that tells the whole story.

MR. CUNNINGHAM: Okay. We will look into it.

MEMBER WALLIS: And if you want to know the details, you look somewhere else.

MR. CUNNINGHAM: Okay. We are going to look into that.

MEMBER POWERS: Mark, one of the

hallmarks of this PTS work has been bringing together experts in PRA fracture mechanics, human factors, thermal-hydraulics, people that ordinarily don't speak even similar languages, and producing a product.

And I guess I have been unabashed in my admiration about the way that that was done. Have you had a chance, or will you take the time to go back and assess how easy that is, and what would facilitate those things, and the multidisciplinary activities?

I think you have done this one extraordinarily well, and it sets a high standard for subsequent people coming along, and it might well be useful to set down for people who subsequently try to organize these efforts things that make this an attractable approach

MR. CUNNINGHAM: I think that is a great idea. I think we obviously -- or maybe you didn't see it, but there was some rocky times in this project trying to interweave different disciplines. Many people speaking many languages if you will, and I think we can learn from that.

MEMBER POWERS: I think it is one of the few instances where I have seen matrixing actually work, and that comes from a laboratory that prides itself on doing that, and I don't think we did it as well as you guys did for this particular study.

MEMBER WALLIS: Well, I take a bit of issue with you. Almost all engineering is interdisciplinary in some degree, and you can over-estimate or over-state this division between disciplines, and the different languages.

And in fact it is possible for someone knowing a PRA to have some idea on what is going on in thermal-hydraulics and so on. There are lots of common approaches in all engineering.

MEMBER POWERS: Well, as I said, I spent most of my working career at a laboratory where we try to do a lot of that, and I am always stunned at how difficult it seems to be to do these multidisciplinary things, and I think this team has really done an outstanding job on this.

I attribute it a lot to the personalities involved, and Ashok, I think you are to be congratulated for a heck of a good undertaking here.

MR. THADANI: Thank you.

MEMBER POWERS: Thank you.

MR. HACKETT: I think a comment that I

would add, because I see that Dr. Powers' comment is going towards sort of a managerial issue, too, and this in my opinion has been one of the better efforts, if not the best effort that I have seen managed from within the Office of Research.

And in that regard a lot of credit does go to Ashok Thadani's management team, in terms of providing the resources and lining things up so that other things got out of the way when it came time --

MEMBER POWERS: We would never say something like that. It would go to their head, and they would be insufferable.

MEMBER WALLIS: I am astonished by you are saying that this is one of the difficult interdisciplinary projects, and that it is managed better than one of the purely disciplinary ones. I don't think you mean that.

MEMBER APOSTOLAKIS: Say thank you very much.

MR. HACKETT: I will say thank you.

MEMBER SHACK: We are ready to wrap it up.

MEMBER ROSEN: Are we going to have a committee discussion?

MEMBER SHACK: We will have it later on

today as we get ready to consider the letter, and we will have a discussion.

CHAIRMAN BONACA: So at this time we will just recess for 15 minutes until 3:15.

(Whereupon, at 2:59 p.m., the meeting was recessed and resumed at 3:17 p.m.)

CHAIRMAN BONACA: Okay. The meeting will come back to order. And we have now a review of the draft final version of Regulatory Guide DG-1077, Guidelines for Environmental Qualification of Microprocessor-Based Equipment Important to Safety in Nuclear Power Plants, and I believe that John Sieber is going to walk us through.

MEMBER SIEBER: Okay. Thank you, Mr. Chairman. As Mario said, we are going to consider draft Regulatory Guides DG-1077, and the title is, "Guidelines for Environmental Qualification of Microprocessor-Based Equipment Important to Safety in Nuclear Power Plants.

This draft reg guide builds on the environmental qualification guidelines and the rule to which it all refers is 10 CFR 50.49, and Reg Guides 1.89, and 1.180, and IEEE Standard 323-1983, and the International Electrotechnical Commission Standard 60780, all apply.

And the foundation work is contained in two Oak Ridge studies, NEUREG CR 6741, and 6479. The staff provided the ACRS a copy of the draft regulatory guide on June 8th, 2001 prior to publishing for public comments.

At that time the ACRS declined to review it, deciding instead to wait until the comments were received and incorporated. And so now we have come to that point in time.

So the ACRS, other than through mailings has really not had a chance to review the draft regulatory guide that is the basis of these documents except for what we will have this afternoon.

There actually were a significant number of comments received by the staff from 11 commenters, and there is a staff analysis which is proprietary and therefore not a public document, which includes the technical analysis of the comments, and a description of changes that were made to the draft reg guide to bring it to its final form as it is today.

Among those 11 commenters, one that had a particular large number was Winston & Strawn, which is a Washington law firm that represents the

Nuclear Utility Group on Environmental Qualification.

And there were a number of comments which the staff's resolution and technical analysis took about 29 single-spaced typed pages. And so those are listed there.

Winston & Strawn has asked for time to make a statement during this meeting, and I think I will call upon them right now to make that statement.

MR. HORIN: Good afternoon. I appreciate the opportunity to provide a brief statement with respect to our comments on this draft guide. As mentioned, Winston & Strawn represents the Nuclear Utility Group on Equipment Qualification.

We are a group of utilities that are comprised of over 90 of the operating power reactors in the United States.

We are supported by a technical consultant who has been involved in environmental qualification of electrical equipment for over decades, and is the author of a number of papers, the EQ Reference Manual, published by EPRI.

We submitted comments as mentioned, and

we have not had the opportunity to see the resolution of those comments. So I want to keep my statement brief here, and hopefully we will have an opportunity to look at the resolution of the comments prior to any finalization of this draft reg guide.

Unfortunately, our technical consultant is out of the country and cannot be here, and so I am standing in as a lawyer, and so I will limit my brief comments to a couple of regulatory points.

We have provided copies of our comments to the committee, and as mentioned, they were rather extensive and dealt with a number of technical issues, and a number of regulatory questions.

I wanted to make a couple of key points, and then I will sit back and listen to see where the reg guide has gone in a revised state. I think most fundamental to our comments is a concern that there has been an approach taken in the draft guide which would confuse the overall regulatory scheme with respect to the environmental qualification of electrical equipment under 10 CFR 50.49.

And again I am referring to the draft guide that was issued for public comment. Principally among those concerns have to do with the confusion of the applicability of 50.49 to equipment that is in mild environments, versus equipment that is in harsh environments.

50.49 applies to electrical equipment that is in harsh environments, which is specifically defined in that guide regulation as environments which are significantly more severe following a design basis event than during normal operation of, and we are not talking about environments or conditions which are slightly different, or not any different at all.

They are -- 50.49 is geared towards the harsh environment qualification. Secondly, with respect to mild environment qualification, there is guidance, and there is a clear direction within the current regulatory scheme with respect to mild environment qualification.

That guidance is contained in the Standard Review Plan, and that guidance is part and parcel of an overall scheme that would apply to quality assurance criteria, design control criteria under Appendix B, coupled with design analyses for particular applications that are already within the regulatory scheme.

So we had some fundamental problems with the way that the draft guide characterized certain effects as being either aging effects, or effects that would be seen that would create a harsh environment, because they are effects which are not necessarily more severe following a design basis event.

So those type of clarifications are important, because we think that if they are not clarified, and if there is not a clear distinction maintained between harsh and mild equipment, this draft guide, again as we saw it, would be wholly inconsistent with 50.49.

And to the extent that there was an attempt to proceed along those lines would direct or practically necessitate that there would be a whole rule change under 50.49.

So we don't see that as drafted that this was consistent with the existing regulatory scheme. We have some comments with respect to backfit issues, and we will make sure that those are addressed in the context of CRGR, and fundamentally our recommendation here was that certainly as drafted this guide should be withdrawn as a reg guide.

It just simply did not provide a clarity of direction or consistency with the existing regulatory scheme necessary to on its own address these issues.

Alternatives may be whether it is issued as a separate NEUREG document, or perhaps an RIS to address some of these questions, but nonetheless, we felt that this was not an appropriate mechanism to apply these particular considerations.

And we also -- and I don't want to go through all of it this afternoon, but there is an extensive number of comments that sounds as though there has been an extensive resolution, or at least an effort to address those, but again we have not seen that.

So we don't know whether it ends us. But I appreciate the opportunity just to point this out to the committee. Hopefully we will have an opportunity to take a look at how these comments have been addressed in the past. Thank you very much.

MEMBER SIEBER: Okay.

MEMBER WALLIS: I am wondering if you planned that this whole thing is unnecessary and unwarranted, it would seem that no change to the draft would satisfy you.

MR. HORIN: We think that the use of this as a regulatory guide without significant modifications to make it consistent with the existing regulatory scheme would make it unwarranted.

MEMBER WALLIS: You see to claim that the resisting scheme is so good that we don't need to do anything.

MR. HORIN: I think if you read our comments that there are a few elements that really establish matters that cannot already be addressed under the existing design processes for nuclear power plants.

MEMBER SIEBER: I perhaps should not give advice here, but we are going to give advice anyway later on, is that it is either come out with a new guide or modify the existing guides, because there are some differences.

And I think that is pretty well established through the work, and so what I would like to do is to introduce our speakers, and after I give your names, please correct me after I am done, and except for Mr. Wood, where I think I am on safe ground. But Christina Antonescu; is that correct?

MS. ANTONESCU: That's right.

MEMBER SIEBER: And you are from NRR.

MS. ANTONESCU: No, from Research.

MEMBER SIEBER: Okay. And Kori Korsah; is that correct?

DR. KORSAH: Yes.

MEMBER SIEBER: I got it right. How about that, and they will be our speakers this afternoon. One of the things that I would like to ask you to do is that the significant part of what we are about this afternoon will be to address these comments, and so to the extent that you can do that.

And there are too many of them to do them all, and that you may want to choose some of the more important points that have been made by the public to actually explain what it is that you did, and what the staffs position is on that, and why you think that we ought to agree with you.

So with that, Christina, I would like for you to begin.

MS. ANTONESCU: Before I introduce myself, I would just like to let you know that the presentations were organized such that we address the resolution of the public comments, and the subsequent viewgraph presentations will actually address most of these questions.

And if you will allow us, then we can proceed with an overview of the reg guide, and most of your questions will be answered as well.

MEMBER SIEBER: I think that would be helpful

MS. ANTONESCU: Good afternoon. My name is Christina Antonescu, and I am in the Engineering Research Application Branch in the Division of Engineering within the Office of Research.

My background is in electrical engineering, and I have worked at NRC as a project manager in the field of instrumentation and control for the past 11 years.

I am here today to present to you DG-1077, and DG-1077 describes an acceptable method for environmental qualification for microprocessor-based systems.

The draft guide was released for public comments on October 14th, 2001, and we received 11 submissions from the public. After interaction among the staff, the technical support contractors at Oak Ridge National Lab, and industry stakeholders, the draft was revised to reflect resolution of the public comments.

So the purpose here today is to present

to you the guidance contained with this DG-1077, which describes the need and the benefits of the guide. And at the end of our presentation, we would like to request a letter from the Committee endorsing publication of the final effective guide.

Before I proceed, I would like to introduce other branch members in attendance. Mr. Steven Arndt, who is the team leader in the I&C Group, and our branch chief, Mr. Dan Dorman.

And our counterparts in NRR I think is represented by Mr. Paul Loeser today. And again I would like to briefly introduce our supporting contractors, Dr. Richard Wood and Dr. Korsah Kofi, from Oak Ridge National Lab.

Dr. Wood is the project manager for the I&C projects that we sponsor at Oak Ridge. He has a Ph.D. degree in nuclear engineering from the University of Tennessee, and has 20 years of experience with instrumentation and control technology.

Dr. Wood is currently contributing to an advisory committee of I&C experts that is providing research recommendations to the Office of Nuclear Energy in the Department of Energy.

And Dr. Korsah is an investigator for

the I&C Qualification Project at Oak Ridge National Lab. He received his Ph.D. in nuclear engineering from the University of Missouri, and has 30 years experience in the I&C Research and Applications.

In additional, Dr. Korsah has served as a member of IEEE working groups on criteria for computers and safety systems IEEE 7.4.3.2, and for environmental qualification IEEE 323-1983.

Following these remarks, I will present an overview of the draft reg guide, and Dr. Wood will describe the technical basis supporting this guidance.

We do appreciate the opportunity to appear before you today, and we look forward receiving the benefit of your insight. So if there are no other questions, I would like to give you a brief presentation or highlights of DG-1077.

The first part of this high level introduction is the overall of the reg guide and follow-up by the technical basis for environmental qualification that Dr. Wood will present. And then Dr. Korsah will summarize th value of DG-1077 and its benefits.

Let me give you a high level on what BG does, and the main scope and what it applies to. It endorses current consensus of environmental qualification standards for safety related microprocessors of these systems.

And the main regulatory position in endorsing the guidance in IEEE 323-1983 for qualification of safety related microprocessor basic equipment for service in nuclear power plants that are subject to conditions and clarification.

And it also endorses the guidance of IEC 60780, and so DG-1077 applies to new or modified safety related systems in existing or future nuclear power plants that employ microprocessors equipment, or not already applied to installed equipment.

MEMBER WALLIS: Could you explain -- one of the criticisms of the previous speaker was that this was unnecessary ,and that you already had sufficient rules and guidance, and so why is it that this is necessary in view of what the present system is, and what are the inadequacies in the present system?

MS. ANTONESCU: If you look at the subsequent view graph presentations, they will clarify your question.

MEMBER WALLIS: You will clarify that question later on.

MS. ANTONESCU: So if we can proceed, then we can systematically go.

MEMBER WALLIS: That seems to me to be the main thing on whether or not it endorses, and what problem does it solve is the real question.

MS. ANTONESCU: Right, and we are going to answer all your questions.

MEMBER SIEBER: There is an interesting aspect to this. Right now in U.S. nuclear power plants, there is not to my knowledge any safety related microprocessor based equipment and harsh environments. Is that correct?

MEMBER WALLIS: That's true.

MEMBER SIEBER: So this really applies to modifications, upgrades, and totally new construction of advanced reactors, and I think that one of the reasons here that you endorsed an IEC 60780, which is a European standard, and I think based mainly on the fact that suppliers may be of European heritage.

And therefore equipment that is built in Europe to satisfy European requirements can't be used in the U.S. unless we endorse the standard, or they change their standards.

So this is the use of an international

consensus standard as a way to allow for a greater degree of competition, and choice among licensees. And lacking that, I think that the only thing that would apply is 323, which may require some changes or upgrades in that equipment. Is that correct?

MS. ANTONESCU: Well, I just want to reiterate that if you allow us to go through that you will understand the reason why we find it necessary to also present to you for our endorsement or to provide you the technical basis for endorsement of IEC 60780.

DR. WOOD: I think your comment about the European suppliers is valid, and that was one of the motivations as to why we needed to or we felt the need to also look at the European standards.

There is also a move within the entire U.S. Government to look at more than just national standards, and I wanted to take this opportunity to point out that this is not specifically to satisfy the Code of Federal Regulations 50.49, because the environmental qualification is not limited to the rules and regulations within 50.49.

So that is why we have this and we will talk about that later.

MEMBER SIEBER: There is a general

design criteria that says that this stuff has to work during an accident, and so that is really what the basis is in my view.

DR. WOOD: And there is even more than that, and we will talk about that in the presentation.

MEMBER SIEBER: All right. Go ahead.

MS. ANTONESCU: So why do we need to review DG-1077? We will talk about these things in more detail in our presentation, but I wanted to let you know up front what DG-1077 can address. It is a response to a user need request and --

MEMBER WALLIS: But your response could have been that you don't need a new reg guide.

DR. WOOD: had that proven to be the case, that would have been the response.

MS. ANTONESCU: Yes. It addresses unique characteristics of microprocessor-based equipment that we think should be addressed, and it endorses consensus of national and international standards, and existing reg guides limit the scope to harsh environments, but we want to include all environments.

And also potentially regulatory burden arises from case by case treatment of qualifications from the environments. A recent review of topical reports continue on a case by case qualification from environments, and vendor qualification programs were accepted under three separate SERs; from Tricon, Common Q, and Teleperm.

So instead of having one process, at this point we are reviewing it case by case. The resolution of public comments, we had again 11 public comments submitting comments on DG-1077, and the public comments can be grouped into a group of categories, and we tried to group them into four categories.

And these will be addressed in subsequent slides. The need for guidance, and whether the existing guidance is sufficient, and the application of location categories, and how location categories tend to be applied.

And the scope of qualification, and that is the full scope of environment conditions, mild and harsh. And the backfit analysis. The staff's position is that there are no backfit associated with this guide, and as described in 10 CFR 50.109, because there is no change in licensing basis for existing equipment.

And it only applies to new equipment,

and voluntary modifications. And now I would like to turn the next presentation to Dr. Wood.

DR. WOOD: Thank you. I think that the comment that we received prior to these presentations highlighted perhaps one of the most frequent comment that were received in the public comment and that deals with the need for guidance.

So I thought for the technical basis that we would start with the basis for qualification, and walk through that, and then hopefully illustrate why the staff believes that this guide is both necessary and useful.

So to begin with the Code of Federal Regulations, Title 10, Part 50, requires environmental qualifications of safety related systems.

Specifically, structures, systems, and components important to safety must be designed to accommodate the effects of and be compatible with the environmental conditions which they will face.

And design control measures such as testing and other quality control activities should be used to verify the use of that design. The primary -- I'm sorry, that would make it a little easier to follow me. The other way. Sorry.

In any event the discussion in the regulatory guide was modified from the version that was released for public comment to try to more systematically step through the current regulatory requirements and the guidance that is given for those, and then highlight the need for this particular guide.

Part 50.55(a) dealing with protection systems provides embedded requirements for environmental qualification of all systems important to safety, and all protection systems.

And in that it by reference includes the requirements of IEEE 603, which specifically states that environmental qualifications shall be performed to confirm the conservative nature of the design and that it can accommodate the environmental conditions.

Then the specific rule that was mentioned in the comments prior to these presentations, Part 50.49, deals with environmental qualifications of electric equipment important to safety that are to be implemented in harsh environments.

And we will talk a little later about the scope of 50.49, and we are not intending to expand the scope of 50.49. Our purpose is to address the full scope of all of the regulations that are --

MEMBER POWERS: As I understand it, there are no microprocessor-based systems in harsh environments now; is that correct?

MEMBER SIEBER: yes, but it is just a matter of time.

MEMBER POWERS: So that means that arguments that the current regulatory process is stable is not applicable here; is that correct?

DR. WOOD: That is I guess part of our belief.

MEMBER WALLIS: Are these harsh environments under normal operations or under accident conditions, or what?

DR. WOOD: Harsh environments that are addressed under 10 CFR 50.49 are severe environments that are subject to design basis accidents.

MEMBER WALLIS: So something like a LOCA break?

DR. WOOD: Yes. Things that are characterized as mild environments, some of them we would consider severe environments.

MEMBER WALLIS: Temperature and

humidity, and things like that.

DR. WOOD: Well, mild covers a big range, and that is one of the areas that we will talk about a little later.

MEMBER SIEBER: I guess to my mind that is why you ended up with three different categorizations.

DR. WOOD: Exactly.

MEMBER SIEBER: As opposed to two, which is what, 323.

DR. WOOD: That's right, and I will talk a little later about how the intent of that is to provide some --

MS. ANTONESCU: Relaxation of 323 for mild environments.

DR. WOOD: Exactly.

MEMBER POWERS: When I search out to apply 50.49 and to understand what a harsh environment is, I should take into account LOCA kinds of accidents and what not. Do I also take into account anticipated fires?

DR. WOOD: That I would have to defer to some of our colleagues. It is not specifically identified, and there is no definition within the Code of Federal Regulations of a harsh environment.

There is a definition of a mild environment, and fires are mentioned.

MEMBER SIEBER: In your report, you mentioned the effects of smoke.

DR. WOOD: Yes.

MEMBER SIEBER: On the other hand, you don't qualify to a fire environment as I read it.

MEMBER POWERS: That is what I was going to get out. Your report is remarkable to me, in that you come along and say, gee, smoke can affect these things, and we know that, but we don't know how to test for that.

You know, we don't have a standardized test for that, and so we are going to ignore the issue, and have you punted on the most important issue here?

MS. ANTONESCU: We are going to minimize it and treat it under design, minimize the susceptibility, and treat it as a design issue.

DR. KORSAH: Also, the other thing is that qualification against fire and so forth, but fire basis is under Appendix R of the Code. So that is --

MEMBER POWERS: Appendix R does not address smoke issues outside the immediate fire zone. And one of the things that this committee has kept asking about repeatedly is that if we have a fire and we disperse smoke beyond the fire zone into the regions where you have digital electronic equipment, do you have a long term problem.

And do the components of the smoke cause a long term degradation of these low voltage systems such that we encounter a difficulty not at the time of the fire, but 6 months later.

DR. WOOD: I think that -- of course, we address how we had originally intended to deal with smoke in a position that was subsequently deleted, because in response to public comments, and that dealt with multi-tiered protection.

Design and implementation approaches that could be utilized to minimize the potential susceptibility of equipment to things like smoke.

MS. ANTONESCU: The intent was to take credit for the specific design approaches that can mitigate the susceptibility to environmental effects.

DR. WOOD: The difficulty that we faced in taking the research information, the findings, and converting that into relevant guidance for the industry is that as you mentioned.

There is no means right now to test whether or not a piece of equipment or in its installed configuration is or is not susceptible to smoke, because there is so many variables that can't be controlled.

However, the other difficulty that was presented is that while the research indicated that certain implementation techniques would be of benefit, there hasn't been a full-scale investigation of all of the possible ramifications of certain things, such as conformal coding, and what might that do to temperature susceptibility.

So it is difficult to recommend implementation guidelines.

MEMBER POWERS: I think I am very sympathetic with the challenge it had there, because as I look at the experimental database that is available, it looks at a very acute smoke exposure, and my reaction to it is fine.

You know, I am glad that you found this stuff out, but when I read Appendix R, I have wiped that equipment out anyway. It doesn't seem to address this long term chronic problem where I have smoke constituents degrading contacts, et cetera, with these materials and what not.

And so I think I must appreciate our argument that says we just have not found the information that is of the breadth that we need for this kind of guidance. I think I am much more sympathetic with that than the apparent wording that says we are going to punt on this, okay?

On the other hand, I say, gee, I have people from the Navy and people from the Army telling me that we don't want smoke to affect our systems, and I see novel designs, especially for surface naval vessels now, where they are confronting this issue in novel ways that I won't go into here on the public record.

But I see other people confronting it, and it might be something that you can put on your to do list, and not for this regulatory guide, but maybe for the next one and what not, because it looks like people are trying to confront this issue.

MEMBER SIEBER: Well, maybe I could give my thought here a little bit. It seems to me that long term failures due to smoke would be very random in nature, you know.

A piece of the equipment would fail today and another piece two weeks from now and so forth, and the single failure criteria would seem to me to provide a sufficient degree of defense in depth.

DR. WOOD: I can give an example of how that very point was considered. In the research, different fire scenarios were investigated to determine which were the most credible, and then assessed to determine which would provide the most harsh smoke environment.

And a small in-cabinet fire provided the most severe conditions.

MEMBER SIEBER: That's right.

DR. WOOD: And that would be localized.

MEMBER POWERS: Ask the people at Oconee.

DR. WOOD: Yes, I know. Exactly.

MEMBER SIEBER: The density is --

DR. WOOD: Yes, I know, and for reactor protection systems that would affect one channel, and the general fires, because of the fire protection that is engaged, would be detected early. There would at least be knowledge that they had occurred, and then maintenance practices could assess whether or not any of the electronics had been affected by smoke.

The one where you might not know it had

happened, and it might not detect it until something failed, would be int eh in-cabinet fire, but that would be in most instances, unless you have an extreme coincidence, localized to the one cabinet.

MEMBER POWERS: Yes, but is a localized one cabinet, and if you produce a lot of smoke and it gets distributed by the HVAC system either during the event or in the subsequent recovery, then is it a more broad issue then?

DR. WOOD: There you run into the separation of the air supplies among different cabinets. You might affect two cabinets, but not all four, but certainly we recognize that there are still a lot of questions that could be asked in investigations that could be conducted.

MEMBER SIEBER: It seems to me --

MEMBER WALLIS: Tell me about the smoke, and what was referred to as specific components in the smoke, and presumably there are aerosols that have water and carbon particles, and so forth. Will they cause effects of electrical coactivity on this rather small space component, and parts of these components?

Do they penetrate and cause local corrosion of structural circuits?

DR. WOOD: Yes, it is conceivable that those things could happen. What we found int he actual physical tests of equipment exposed to smoke is that high density particles or high density of particles of where the effects occurred, and very low density tended -- the equipment tended to be fairly robust.

MEMBER WALLIS: But density you mean the number of particles per cubic meter in the smoke or something like that?

DR. WOOD: Yes.

MEMBER WALLIS: And does size matter?

DR. WOOD: I can't say based on my recollection whether there was any investigation on the size of the particles themselves. Different materials were burned and so there were different sized chemicals and particles released.

MEMBER WALLIS: There was a scientific basis for evaluating these effects then?

DR. WOOD: The telecommunications industry does a lot of research about the susceptibility of equipment and corrosion effects that would occur in the long term.

DR. KORSAH: And also typically during the measurement of doing the scientific measurement is try to make a second -- you know, leakage currents and so forth, and so forth and so on. The other effect is the smoke in conjunction with the humidity and the environment would form some kind of acid, and corrode the metal interconnections and so forth. So that is another effect of the smoke.

MEMBER SIEBER: On the other hand, most of these components -- computer chips, for example, are coded to avoid contact between the smokey atmosphere and the metallic portion of the circuit.

And they also try it seems to me to make more low impedance of the circuits than low impedance circuits so that leakage of currents don't have the impact that they would if you were involved in all high resistance circuits.

DR. WOOD: And I think that highlights some of the implementation of things that can be done, and that was the motivation for that position that I mentioned that was deleted in this version.

MEMBER SIEBER: It would be difficult to test for, because there are so many variables, and there are different kinds of smoke, and different humidity conditions, and different air flows, and so it would be a complex test.

MS. ANTONESCU: Exactly.

MEMBER POWERS: All you are telling me is don't use microprocessor systems.

MEMBER SIEBER: Right now they aren't.

DR. WOOD: I think what we should highlight is that we didn't investigate as a purpose the susceptibility of analog components, but by no means are we saying that digital or microprocessor-based components are more susceptible by definition.

MEMBER WALLIS: Is there a short statement that you have about the need for this new guide?

DR. WOOD: A short statement?

MEMBER WALLIS: To impress upon us quickly about the need for this new guide?

DR. WOOD: Let's see. I have a tendency to be long-winded, and so it is very difficult for me.

MEMBER POWERS: I think -- I'm operating from my recollection, but I think if we look at the Digital Electronics Research Plan that they had a nice piffy paragraph that explained why this work was being done, and maybe Steve could recall that from memory.

DR. WOOD: I can give you our short statement here that Ms. Antonescu went over. First off, we feel that the unique characteristics of microprocessor-based systems need to be addressed, and I have a subsequent slide that talks about those unique characteristics.

So one thing that this guide does is provide that specific guidance in one location. Some of that guidance is scattered among various guidance documents.

We feel like that leads to a case by case basis as everybody discovers in each application what it is that I need to do. Instead of being able to go to a specific guide. There is no existing endorsement of the current national or international consensus standards. That is one thing that this guide provides.

MEMBER WALLIS: And these are specific standards for microprocessor equipment.

DR. WOOD: These are specific standards for qualification of equipment.

MEMBER WALLIS: Microprocessor.

DR. WOOD: Of equipment.

MR. DORMAN: Just to clarify. This is Dan Dorman, Research. It is no endorsement of those consensus standards for microprocessor-based equipment for the range of environments that are considered in this guide.

DR. WOOD: Yes. If you take all of these together, you get the bigger picture, and I will show you the bigger picture is a few words as soon as I finish this discussion.

The comprehensive regulatory guide as Dan mentioned dealing with all environments, there is that comprehensive guide dealing with harsh environments, Reg Guide 1.89.

But as it was mentioned applications currently today of microprocessor-based equipment are in what are called model environments. We visited Taiwan last fall, and they are working on a microprocessor-based system for containment environments.

It is not in the far-distant future when microprocessors will move into containment, and then the other issue was the case by case basis. But these last four bullets are the reasons that motivated the development of this guide.

And so rather than going through all of these in detail, these next two viewgraphs basically highlight the distribution of guidance among different documents, and I won't go through this in detail, but I would like to point out the last bullet on this slide.

The DG-1077 is intended to provide a road map for existing guidance that is applicable to microprocessor-based equipment. So you go to one source, and there it is. You don't have to decide should I infer from the guidance to the reviewer in the standard review plan some things that I needed to do.

Do I have to go to the staff position in NEUREG-0588 and derive some additional information; and then do I go to IEEE323, and then what do I do for model environments. Chapter 3 and Chapter 7 have some differences in what they do, because they apply to different kinds of equipment, and that is in the standard review plan.

CHAIRMAN BONACA: Now, the letter from (inaudible) does not object to having a regulatory guide as an umbrella. The next two specific objections says that new regulatory positions contained in the draft guide include expanding the scope of 10 CFR 50.49 to apply to (inaudible) model environments.

And concluding that EMI/RFI is both an environmental condition and a significant aging mechanism. Those are two specific objections.

DR. WOOD: Those two specific objections, the objection about the expansion of the scope of 10 CFR 50.49 resulted from a result of a lack of clarify in what the guidance that went out for public comment, and the public comment highlighted to us the need the make it more systematic in the presentation of what is the purpose.

CHAIRMAN BONACA: So your intent is one of expounding it?

DR. WOOD: That's right.

CHAIRMAN BONACA: So you don't have an issue there.

DR. WOOD: Exactly. And regarding EMI/RFI, there was no intent to identify EMI/RFI in general as an aging stressor. But EMI/RFI, and all the electromagnetic conditions in a plant, are part of the environment of the plant, and this is a position that is consistent with the IEC standard, and it is treated as a condition.

It is also a position that is being adopted by the United States because the revision of IEEE 323 includes EMI/RFI as a listed service condition.

MEMBER SIEBER: Well, there is a reg

guide for that already.

DR. WOOD: That's right.

MEMBER SIEBER: 1.180.

DR. WOOD: It's inclusion in this reg guide is to reflect consistency between the IEC and the IEEE standard, and to remind people not to forget EMI/RFI, and not to provide full guidance on EMI/RFI.

The position provides a pointer to Reg Guide 1.180, and also a pointer to EPRI 102323, as both providing guidance on how to address this specific issue.

CHAIRMAN BONACA: So you don't feel that even on this issue that you do have a conflict?

DR. WOOD: That's true.

MEMBER WALLIS: If this is a harsh environment, it seems to me that harsh is defined, or a harsh environment is defined by what it does to a particular thing and in a particular context.

And if you simply look at an environment which has a significant effect on the behavior of a microprocessor, that by definition is a harsh environment for a microprocessor.

It may not be harsh for other things, but I don't see why you need to make this distinction.

If it affects the function of that device, then it is a harsh environment.

CHAIRMAN BONACA: I think it is more than that. It is the practice of how the harsh environment is (inaudible) --

DR. WOOD: Yes, there is a lot of semantics involved in it, and part of the fuzziness of the semantics is the semantics are the reasons that we went to the location categories.

MEMBER SIEBER: Right.

DR. WOOD: And I think the public comments illustrated that we were not effective in conveying that. So hence the revision with additional information.

MEMBER SIEBER: Well, you defined Category A and Category C, and Category B as everything else.

DR. WOOD: Everything in between. Now, to be fair to the commenters, there was much more conservatism in the boundaries between the representative conditions in the version that went out, and there was great value in the public comments and highlighting that we needed to give consideration to what would make this practical to implement without adding a burden, rather than reducing a burden.

So we tried to do that. This is an illustration of environmental qualifications. Some of the comments, or many of the comments that we received dealing with the need for guidance illustrated a great deal of diversity in understanding what environment qualification is, and when does it apply. When do you have to do it, and what do you have to do.

These are two views of environmental qualification. One is looking at the environment in the plant, and so you have all environments, and the rule that requires environmental qualification are given in 10 CFR 50-55(a)(h), and then demonstrating that you have accomplished the design criterion in GDC04, General Design Criterion-4, and that you accommodate the effects of, and are compatible with, the environment.

Normal operation all the way through. Harsh environments are a subset of that, and as I said earlier, there is not an explicit definition of harsh environments in the Code of Federal Regulations. There is a definition of mild environments.

MEMBER WALLIS: Well, you could expand to fill the whole space available.

DR. WOOD: That's right. But 10 CFR 50.49 specifically addresses harsh environments. It notes that mild environments, qualification for mild environments are beyond its scope, and it doesn't say that you have to qualify for mild environments. It says that it is beyond its scope.

So that is the plant environment viewpoint. Now, where do microprocessors fit into this right now? They are in that larger bubble outside the harsh environments, but they are moving toward the inner-bubble, and part of the vision for this guide is to anticipate that, and have the guidance in place, rather than reacting.

MEMBER WALLIS: Is there likely to be an environment that will affect their performance?

DR. WOOD: Yes.

MEMBER WALLIS: I'm really just playing with words about whether it is harsh or not.

DR. WOOD: That's right.

MEMBER WALLIS: As they are not very important to me.

DR. WOOD: The harsh and mild really are in sort of standard and regulatory space. If it has an effect, it is a significant environment.

MEMBER WALLIS: Right.

DR. WOOD: And then looking at it from the equipment point of view, the Class 1E equipment point of view, you have got all the electrical equipment which are within the scope of 10 CFR 50.49, and then you have got microprocessor-based equipment which are a subset of that.

But all electrical equipment -- I'm sorry, the all electrical equipment expand beyond the scope of 50.49, because there are Class 1E electrical equipment that are not implemented in harsh environments.

So the next viewgraph is intended to sort of illustrate what is the role of DG-1077. You have the electrical equipment and harsh environments, which is the regime of Reg Guide 1.189, and you have the microprocessor-based equipment in all environments, which is the regime of BG-1077.

And then you have got this small overlap that right now is almost non-existent, but eventually it will become populated, where you have microprocessor-based equipment in harsh environments.

And then in that case you have DG-1077 and you have the conditions in Reg Guide 1.189. If you don't have DG-1077, you don't have explicit guidance about all of the blue part of the small bubble.

And also you don't have added to Reg Guide 1.189 the specific considerations for microprocessor-based equipment.

MEMBER WALLIS: So Reg Guide 1.189 wouldn't really handle this cross-hatched region is what you are saying?

DR. WOOD: Not absolutely. We think that there are some considerations that need to be addressed that are in the various sources of guidance, but you have to go ferret them out.

MEMBER WALLIS: And so it is a question of difficult to find rather than they aren't there?

DR. WOOD: I think that the reviews of the vendor topical reports on the various systems indicate that the major vendors know where those things are, but the concern is there are some subtleties, and you want to make sure that all vendors can be aware of what they need to do.

MEMBER WALLIS: Wasn't it the claim of the previous speaker that really this blue thing is inside the red, and it is all taken care of, and that we don't need to do anything?

DR. WOOD: And that is not the case. I think that the understanding, partially motivated by the need for additional clarity in the guide, may have left an uncertainty about whether or not this was solely to address the 10 CFR 50.49 kind of application, and that was not the intent of the guide.

And I think if it is interpreted that way, then some of the claims of the speaker makes sense. But we think that it was just a matter of a lack of clarity, and we hope that this revision has addressed that.

One of the other issues that was brought up in the public comments was what was in the version of the draft guide that went out for public comment did not make a very effective case for why are these things different.

Part of that is because those of us who understand the technology and have been dealing with it a long time just simply accept that fact, and I will have to admit that we were not very rigorous in trying to identify all the different differences.

MEMBER WALLIS: But what is the hang-up?

I mean, if you put a computer in smoke, it is going to be a different problem than putting some switch gear in smoke.

DR. WOOD: Right.

MEMBER WALLIS: What is the hang-up about saying you have a new problem?

DR. WOOD: Well, you would have to ask the commenters, but what we did is try to expand the discussion so that we were much more precise in what the differences were. And these are some of the differences, some functional, and some hardware.

And if you are talking about an analog piece or analog module that is performing one function, its loss is not the same as the loss of a microprocessor performing many functions.

And then there is the issue of digitizing what had been a continuous application of function in a distributed or let's say in a channel. There is the sequential execution of function, and then as far as hardware goes, there is some differences; more susceptibility for the current integrated circuit technology for radiation tolerance than most of the analog components.

There is also an increasing level of complexity in higher circuit density, which could have some effect on environmental susceptibility, and higher clock speeds and lower voltages could increase or do increase the potential susceptibility to electrical and EMI kind of events.

MEMBER WALLIS: Isn't the difference -- and this is sort of an aging system, which is different from the old systems, and it is processing information, and therefore has a way of distorting the information and confusing in a way that was not there before?

DR. WOOD: I think the main difference has to do with the level of understanding of what is going on under the surface. I think people have a pretty clear understanding of the physics behind some of the analog modules and how is it going to respond to different environmental conditions.

But when you are talking about a microprocessor, and you can talk to our colleagues that also deal with software V&V, understanding how that microprocessor is going to respond with all of those number of transistors is maybe a little more complex and are harder to deal with.

The applications of microprocessor-based systems for reactor protection systems tend to be functionally the same. That is what the analog components are, although we have an example in one of our background viewgraphs.

MS. ANTONESCU: It is an illustration of an analog channel and a digital channel, and you can see how several of the instruments are being replaced by a microprocessor.

MEMBER SIEBER: Is that in our package?

MS. ANTONESCU: No it is a back-up slide.

DR. WOOD: We can provide this.

MEMBER SIEBER: Yes, any slide that you use --

DR. WOOD: Any slide that we use, we will provide to you later. This one in particular is just illustrating a simple instrument string within an analog reactor protection system, versus what is basically the full reactor protection system for the advanced boiling water reactor.

And one way to look at it is that all of these functions are performed right there. So everything that you do here can be done right there, with the exception of that some of the calibration is probably distributed into the remote multiplexing unit.

Now, that is not on one microprocessor.

They tend to break it up so that there is some functional diversity, so that if you lose one microprocessor, you still have functional diverse trip signals within that channel.

The other thing that the advanced boiling water reactor protection system adds is inner-channel communication. Whereas before all of the trip logic voting occurred in the relays, this duplicates it. It performs it twice in the trip microprocessor-based unit.

And then in your solid state relays, and so it just performs it twice, but there is inner-channel communication through optical isolation, and optically isolated links.

But that just illustrates a current version, and it is implemented in Japan, and it is being implemented in Taiwan, and if the ABWR is chosen for the MP 2010 program, it will be implemented here.

This design has been reviewed by the NRC staff for the design certification of the ABWR.

MEMBER SIEBER: let me ask a question to demonstrate my ignorance. I am aware of a situation where a microprocessor-based instrument had a counter in it, which was basically a timer, and because of spikes on the emergency buses that were caused by relays closing, it would cause that timer to reset.

Now what regulatory guide covers that? Is that 1.180, or is it covered at all?

DR. WOOD: It is covered through the provisions of 1.180 dealing with surge, surge withstand testing, and also through conducted EMI.

MEMBER SIEBER: Yeah, and on the other hand if it doesn't fail, and it just becomes confused for a second and fails to perform the function.

DR. WOOD: Right.

CHAIRMAN BONACA: Right.

MEMBER WALLIS: So the electromagnetic environment is part of your environment?

DR. WOOD: It is part of the environment, and the way that this guide handles it, this proposed guide handles it, is to identify it and make sure that it is considered, and then point to the appropriate guidance for how to address it.

And in that guidance, Reg Guide 1.180, it addressed electromagnetic compatibility more than just qualification. It addresses design and implementation practices, as well as essentially susceptibility practices, and it also addresses how that system may affect that environment through emissions testing.

One of the reasons that there were several comments dealing with some positions that have been subsequently deleted is we took a similar approach in the first version of this guide, and dealt with environmental compatibility, rather than just strictly environmental qualification.

And so there were things about implementation and design, and looking at lower levels within the system at the components that were indeed expanding the scope of if you called it environmental qualification. It was really environmental compatibility.

They weren't presented as required things to do. They were instead presented as information that can supplement the evidence, but because the comments illustrated that they were being understood as requirements, those positions were deleted.

So that information, which is useful information, is maintained in the associated NEUREGs. I realize that we are a little limited on time.

MEMBER SIEBER: Right.

DR. WOOD: So I will just skip through each of the positions within the guide and talk about the technical basis for those provisions. The main thing is the endorsement of the current national and international standards for environmental qualification, as being appropriate for application for microprocessor-based --

MEMBER WALLIS: And the industry objects to it?

DR. WOOD: No.

MEMBER WALLIS: If that is not a bone of contention, then focus on what the bones of contention are, and maybe we could help.

DR. WOOD: Okay. Well, actually we hope to have to have addressed all the bones of contention.

MEMBER WALLIS: And so they have accepted them then?

DR. WOOD: Well, no.

MS. ANTONESCU: They have never seen one resolution once they are implemented.

DR. WOOD: I discussed these things at a working group meeting of our EEE323 for the revision of EEE323, and I have discussed these things at conferences, but we have not had until today a public meeting addressing this guide. So the position here on --

MEMBER LEITCH: As I understand it, you can use either one of these standards, but not cherry-pick.

DR. WOOD: That's right.

MEMBER LEITCH: And you use one in its entirety.

DR. WOOD: That's right. I didn't put the words on this viewgraph that said no mixing and matching. You can't just say that I want this out of IEC and I want this out of IEEE.

MR LEITCH: We were -- can you say without taking a whole lot of time just what are the major differences between the U.S. and the European standard?

DR. WOOD: The European standard provides a lot more detailed guidance, and it breaks the test sequence up into three major categories, and it allows the user to use different specimens in each of those categories as long as there is no demonstrated relationship.

So that you don't have to have the same specimen going through every test. The European standard has some references to other European guides on specific ways to conduct tests. So it gives more detailed information there, but for the most part the two standards, we did a detailed comparison of the two standards. They are very much equivalent.

MEMBER LEITCH: I tried to do that, but the version that we got, we only got every other page.

MR. DICKSON: That's because the pages that you didn't get, they were in French.

MEMBER LEITCH: Oh, okay.

DR. WOOD: So if you could read French, then it might have helped you. So anyway the detailed comparison of the standards is the basis for this position.

And there was also a comparison of the 323- 1983, the current version with the 323-1974 version, which is what the staff had endorsed in the past. Then the environmental qualification of this is the unique characteristics, two points were addressed.

One is that the equipment should be functioning, and performing its operational activities while being performed, and that is directly out of IEEE 7-4.3.2, which is also endorsed by the staff.

And then the dynamic response of a distributive system under environmental stress should be considered during qualification testing that is consistent with what is in Appendix B and Appendix C of Chapter 7, Chapter 1, in the standard review plan.

MEMBER POWERS: Are you making the point of the previous speaker that this stuff is all covered elsewhere?

DR. WOOD: These things, these two particular things are stated, but maybe not as directly. The standard review plan, while it provides good guidance, is not intended to be guidance to the industry, but guidance to the reviewer.

MEMBER POWERS: It is guidance to the staff and we understand that.

MEMBER WALLIS: I thought you were going to try to cover the unique characteristics of microprocessors?

DR. WOOD: I will tell you how these two cover those. The first one is that the equipment should be functioning during the tests, which is not stated in IEEE 323, and it covers the functional density because of the complexity of the function that can be performed.

MEMBER POWERS: That is an interesting one. I mean, I like your slide where you pointed out the functional density of microprocessor systems. That is something that I tend to overlook, but then when you say it is functioning during the test, there are so many potential functions of even a simple computer code that you can argue that some of those functions are not being performed in any particular test.

DR. WOOD: Well, I will agree that it is not the same as software verification and validation where you try to perform and see that all of the operational codes execute.

But you can perform the trip comparison where you have trip conditions that would indicate a trip and you have non-trip conditions. You can perform those kinds of functions.

MEMBER POWERS: Sure. I can pick out some particular high level functions, but all the low level ones I can -- I mean, it would be physically impossible to say every single function of this thing has operated in this test.

DR. KORSAH: I think we should make a qualification that this is a hardware situation and not software where V&V. Before you come to this level, you must have done a lot of V&V which incorporates all the different types of testing that you can have, and a 99 percent confidence that this is going to work and those kinds of things.

DR. WOOD: And when you are dealing with a software system, you are dealing with software operating on hardware under whichever environment it is in, and there is an infinite range of combinations that could occur.

But the point here is that this is not a survivability test and demonstrating that it can perform its function. And not to demonstrate that it can perform absolutely every function. And then the dynamic response of a distributed system deals with the sequential execution of function.

If you have information that has to go from this microprocessor across a network to that microprocessor, depending on what kind of handshaking you have in that communication, the effect of the environment on those communication interfaces can affect the overall system response.

And it is not a new requirement, because there is a lot of information about you need to look at the dynamic response of your system, and this is just making sure that you don't forget it.

Just because you can't test a distributed system like the ABWR system as a whole and all in one chamber, doesn't mean that you shouldn't do an analysis accompanying that system.

The environmental effects here, coupled with the environmental effects here, don't add up to a cumulative delay that affect the system response. These are not earth-shaking requirements, if you want to call them requirements. Guidance.

They are just intended to make sure that the users of the guidance is aware that these are two particular issues.

MEMBER WALLIS: What are you thinking of here? I mean, that there is a computer here and a computer there and talking through some kind of a line, and someone comes and operates a welder, and the electromagnetic thing coming out from the weld sends false signals along the line. Is that the kind of thing that you are thinking of?

DR. WOOD: Well, that is one thing that could happen. The ABWR example that I used, the remote multiplexing units to be in the reactor building, because they are there multiplexing data and sending it then to the location of the control room for the trip calculations.

There is a distributive system, and you can't put it all in one chamber.

MEMBER WALLIS: I have no idea what the test sequence might be for something like that. Maybe we should move on.

DR. WOOD: Okay. The other one which was mentioned was electromagnetic compatibility testing, and the susceptibility of surge to withstand, and this is the worldwide practice, the international practice.

So our position is that it belongs here, and it is being put there in IEEE 323 in the next revision.

MS. ANTONESCU: And the EPRI document 107330.

DR. WOOD: That's true, the EPRI guidance on qualification of PLCs.

MS. ANTONESCU: And it also mentioned in IEEE 7.4.3.2., too.

DR. WOOD: The application locations were simply intended to streamline the initial determination of do you need to address aging and if you do type testing. And it is not a radical departure, and we tried to look at the information that was being provided by public comments and adjust things that it is much more practical to implement and avoid some of the potential for burden that were illustrated in the public comments.

But basically Location A categories correspond to 10 CFR 50.49 locations. Traditional aging factors must be accounted for in qualification, and that is what Reg Guide 1.189 says. It is consistent with that.

Category C locations are really the new thing, and it is intended to RELAP the position that is in the standard. Category C locations are areas that employ environmental control and it is generally acknowledged that there are not traditional aging factors in those areas.

And so aging is not a necessary step in qualification, nor is the determination of do you have significant aging mechanisms. And then Category B is everything else.

The only thing this does is take the model environments that exist in IEEE 323-1983, and set aside a small subset of locations which correspond to environmentally controlled locations, and says you don't have the burden of trying to determine do I have to address aging. That is the purpose of --

MEMBER POWERS: When you are discussing aging here, are you discussing aging over the course of an event, or over the course of a lifetime of a plant?

DR. WOOD: Over the installed life of the piece of equipment.

MEMBER SIEBER: The difficulty with that is that it is pretty subjective as to how much ventilation you have and so forth. It seems to me that your model environments in Category C are pretty mild.

DR. WOOD: They are.

MS. ANTONESCU: It is a controlled environment.

DR. WOOD: We floated the term benign.

MEMBER SIEBER: On the other hand, it is usually cold in this room, but if I run this computer all day, it is hot.

DR. WOOD: Oh, yes.

MEMBER SIEBER: So it depends on how we put it into place.

DR. WOOD: That is exactly right. And

the purpose of qualification is to verify that the design accommodates the environment and the conditions or the practices are to test your equipment in its installed condition, and to have all the connections that it would have in its installed location.

MEMBER LEITCH: So can you help me here a little bit with EMI and RFI? We have another document which I believe is presently out for public comment, and in fact maybe the public comment period is closed, and I guess within the next month or two we are going to be seeing that here.

Does that intermesh with what you are speaking about here, with the microprocessors?

DR. WOOD: Yes.

MEMBER LEITCH: In other words, is that being revised also primarily to --

MS. ANTONESCU: We are in the process of revising Reg Guide 1.180 regarding EMI/RFI, and I believe that were scheduled to appear in front of you next month to give a presentation.

MEMBER LEITCH: Those modifications are to address microprocessors?

MS. ANTONESCU: No, no.

DR. WOOD: No, because the original

version covered analog and digital, and the modifications deal with basically some issues that could not be addressed in the first version because there weren't mature standards that could do that.

There is a more full compliment and the other thing is trying to provide an endorsement of the international, of the IEC standards.

MEMBER LEITCH: Okay. Thanks.

MEMBER WALLIS: Has this been through a subcommittee?

MEMBER SIEBER: No.

MEMBER WALLIS: That is why we are getting all this --

MEMBER SIEBER: yes this is cold.

MEMBER WALLIS: EMI is electromagnetic interference?

DR. WOOD: Yes.

MEMBER WALLIS: So it is a separate guide from this one?

DR. WOOD: yes.

MEMBER POWERS: It has been before the committee since you have been on the committee.

DR. KORSAH: That Reg Guide 1.180 deals specifically with EMI. This reg guide deals with all aspects of the environment; high temperature, humidity, EMI, and those kinds of things.

MEMBER WALLIS: So it deals with all of them?

DR. KORSAH: All of them, yes.

MEMBER POWERS: It was in fact one of our complaints about the EMI/RFI was that the reg guide didn't address all of the stressors.

DR. WOOD: We tried to listen.

MEMBER POWERS: Darn it. You are not supposed to do that.

DR. WOOD: I apologize. How do those location categories show up as positions and there were a lot of comments because it was I think not well presented in the original version, and we think that it is now.

And to make it clearer what is the intent, and the intent is not to go out and map every plant. The intent is to identify some locations that everyone can agree are harsh, and everyone can agree don't have aging mechanisms.

So that you don't have to go through an assessment. So Category A, which are the 10 CFR 50.49 kind of categories, the so-called harsh environments subject to design-basis accidents, aging must be addressed, and the conditions and clarifications, and exceptions, however you want to call them, that are in Reg Guide 1.189, are incorporated within DG-1077 by reference.

For a microprocessor-based system, you can use IEEE 323, or you can use IEC 6780. That is for Category A. For Category C, and I will jump down a little bit, aging does not need to be addressed and so it can be omitted from the test sequence if type testing is used, and there does not have to be any documentation of the age conditioning or the assessment of age conditioning.

Category B, which of course is equivalent to what had to be done for model environments in any event, you have to assess whether there is a significant aging mechanism.

You either include your aging condition if there are as part of your documentation, or you can include the findings of your assessment, saying that there aren't significant aging mechanisms. So I think it is pretty clear, I hope.

And then the final -- I will get this right probably after the presentation is over, and I apologize. The final position deals with margin, and the purpose for this position being there is that there is one suggested margin factor in IEEE

323 that is not included in IEC 6780, and so it is just identified that if you are using IEC 6780, consider this as one of the suggested margin factors.

So that is basically the position, and now to try to be brief about it, four positions were deleted from what went out for public comment, because we agreed with the substance of the comment. Maybe not the details, but certainly that this could constitute an expansion of what has traditionally be called environmental qualification.

One dealt with standards and test practices used by the integrated circuit manufacturers can be identified and listed for each supplier to ensure the use of quality components.

And that is basically to say that it is fine to say that this type is representative of this entire product line, but what if there is a change in the supplier of this integrated circuit.

How do you know that is the same quality as the one that you tested. In Japan, Hitachi performs these kinds of tests on every chip that is sent to them that is going into their nuclear power plant product line.

But still an electromigration issue

occurred at Akashiwasaki wae-ri wae (phonetic), but that was from a much earlier version. This was Position 8 in what was released for public comment. The intention was not that the licensee perform these tests, or that the vendor perform these tests.

The intention was that you just document that these kinds of tests were performed for every component product line that you use.

MEMBER FORD: But you do know how to relate those standardized tests to the variation in all the temperatures, and radiation, and sulfide, and all those wonderful range of things that you could have in a reactor.

These are good for, as you said, for Hitachi to come out and say hey, and put a stamp on it, but it has not relation at all, risk-based, or-risk informed, or otherwise, for how long it is going to last in the reactor.

DR. WOOD: The only relation that we were intending to promote is that this indicates that you are using a qualify product, and that it has been demonstrated to be capable of surviving in the kinds of =-=

MEMBER FORD: Yes, but you can say a Rolls Royce is a great product, but it won't last in the Sahara.

DR. WOOD: Your arguments and the arguments of the public comments were well taken, and that is why this position was taken.

MEMBER FORD: So why is it taken out? I thought that this document that you formulated is an umbrella document?

DR. WOOD: It is.

MEMBER FORD: So why then take out the most important part?

DR. WOOD: Well, what we have taken out here is the umbrella information for environmental compatibility. We have the road map for -- what remains is the road map for environmental qualification. The things that were taken out dealt with quality, and design, and implementation, which are not direct elements of environmental qualification.

Environmental qualification by definition is verification of your design, that your design can accommodate its environment. So these other things dealt with building quality in and using designs that minimize the -- I guess what kinds of environments it might be exposed to.

MEMBER FORD: So how would you deal

with, for instance, an ACR-700? It would seem to be certified and you are judging whether that should be used, qualified, and do you just go on to Hitachi microprocessors and say, hey, pass their rests, and therefore it is okay?

DR. WOOD: No, this was not intended to be I guess a free pass beyond the qualification process of your system, or your piece of equipment. This was just some supplemental information that could confirm that if you have done type testing that that type is in fact representative of every incarnation of that system that is going to be placed in your plant.

If you buy a replacement, an exact replacement two years from now, and you have gotten that from a different vendor.

MEMBER FORD: Then how do you relate that entire past design to how it will behave in the reactor specifically then?

DR. WOOD: You do it through environmental qualification, and subjecting it to the kinds of environments that are --

MEMBER FORD: Okay. Then this is just to make sure that every item that you get is the same?

DR. WOOD: Right.

MEMBER SIEBER: Well, one of the problems there is that a lot of this stuff I think ius going to be commercial off-the-shelf, which means that the manufacturer and the chip maker, which is usually two different folks, can change whatever they want at any time that they want and call it an improved model, or don't call it anything, and you don't know whether that device is qualified or not, except for the piece of paper that you get with it.

DR. WOOD: That is going to happen, and at least looking at it, the way to address it is part of quality control, but you are right. Two years from now the next commercial product, or the next instance of that commercial product may not be the same as the one that was dedicated.

So those are tricky things that are additional burdens for the staff.

MEMBER SIEBER: Well, I think that the standard is weak when addressing that, you know. You don't have requirements that say, well, you had better analyze to make sure that the chips are the same, and the motherboards are the same, and the cabinet is the same, and the connections are the same. The other components that fit in there are the same.

DR. WOOD: It says those things except for make sure that the chips are the same.

DR. KORSAH: And I think in addition to that, and to be fair, most IC manufacturers actually do have a lot of stress screening tests for quality control.

MEMBER SIEBER: That's true, but those tests are not specifically designed for harsh environments. They are designed to make sure that they can product a high quality chip or the $200 or $300 that they charge for them.

DR. KORSAH: But one of the reasons why we listen to the public comments in this particular issue is that in fact when we looked at the actual stress screening test that they do, and many of the temperatures and humidities are compatible with the design of the design basis accidents that you might see. So that is why we listen to the public comments also.

MEMBER WALLIS: I think the interesting thing here is that you have got an industry which is mature and has regulations, and is an industry developed very slowly, and there have been very significant changes in the design of a PWR/BWR regulations, and it doesn't matter if they have a response time of 5 or 10 years.

Now you have got an industry with microprocessors and chips which is developing all the time, and things change year, by year, by year., by year. And it is just interesting to see if this agency can respond to that kind of technology predicted into this very slow moving technology.

DR. WOOD: Those of us in the instrumentation and control field have always chuckled a little bit whenever obsolescence is brought up because obsolescence in the digital world takes on a completely different meaning and pace.

But we felt like there was value to this position,b ut we agreed with the public comments that this position complicated this guidance, and so it was deleted. The information still exists.

And basically the same thing here for multi-tiered protection. The motivation behind putting it there to begin with was to address things like smoke.

This was really the only way that we could take the findings of the research project, and have an impact. And it was not a requirement that you do things in a particular way. It was a suggestion that you document the different things that you do that can minimize your potential vulnerability to environmental conditions.

But again it was perceived an additional burden, and we acknowledge that this deals with the bigger score of environmental compatibility, versus environmental qualification.

So this was deleted in the revised draft guide, but the information still is maintained in the accompanying NEUREGs. And then the final two, and basically the first one about identifying life-limited components.

It was a bit of, well, if we are not doing a qualified life, how do you know that you can't leave it, and how do you realize that they can't leave it there for 60 years.

But then the public comments caused us to think about it a little bit, and we looked in a little more detail at the standard, and that is explicitly stated as one of the bits of information that you collate about your product.

So it was in this case redundant with what was being endorsed, and so it was deleted.

MEMBER WALLIS: The problem with rapidly

developing technology like this is that by the time that you have done enough to find out what the operational life of something is, you can't even buy it anymore because it has developed into several others.

DR. WOOD: Well, you would like for your I&C system to be good for about 15 years, and then the last one had to do with on-line surveillance, and there are surveillance -- some surveillance guidance in Reg Guide 1.189 for harsh environments, where you can't access your equipment, and we agreed with the public comments that this was not necessary in this guide, because it also addressed some issues that dealt with design.

So that position was deleted. So what we feel is that we have got a fairly straightforward reg guide, and that is perfectly consistent with the practices, but it can eliminate the need for each vendor submitting their program and an individual evaluation of that program.

And now I will rest my voice and also your ears and let the lovely Ms. Antonescu serenade you with the conclusions.

MEMBER SIEBER: I have a question to ask before you jump ahead.

DR. WOOD: Okay.

MEMBER SIEBER: I presume that things like fiberoptics are not covered under any of these standards because they are not electric other than the sending and receiving end of it.

So what do you do about qualification, environmental qualification and things like fiberoptics?

DR. WOOD: There is a reg guide and there is a standard, IEEE Standard 383, that addresses cables and there is a significant research program looking at --

MEMBER SIEBER: I am aware of the research program.

DR. WOOD: Exactly.

MEMBER SIEBER: But the standard I thought addressed metallic?

DR. WOOD: It does. It does not address optical cables.

MS. ANTONESCU: But I think in one of the future revisions it will address fiberoptic cable.

DR. WOOD: For what is going to be balloted this year throughout IEEE, it will not, but for the next revision, I think they have plans to take that up.

But you are talking about maybe 5 years before that happens, and one of the public comments suggested somebody needs to look at optic cables.

MEMBER SIEBER: It seems that somebody could jump in right now and decide to install it, and the staff would be running around like chickens with their heads cut off trying to figure out what do I do now, because it doesn't fit anything.

DR. WOOD: Right. The design that I showed of the ABWR uses optical fiber networks.

DR. WOOD: And military applications are strong on that, too, because it eliminates the radio frequency interference, and all that kind of stuff.

DR. WOOD: But the cables themselves are covered in another reg guide, and are beyond the scope of both Reg Guide 1.189, I believe, and I can't say that for sure, but definitely DG-1077.

MEMBER SIEBER: They aren't in here, and they are not in any other place that I am aware of.

DR. WOOD: Okay.

MR. BESSETTE: Just additional knowledge, but you are aware of the aging research programs, and things like that. But there is also a small research program done about 5 years ago for looking at qualification issues associated with fiberoptics.

MEMBER SIEBER: I am aware of that.

MR. BESSETTE: Okay.

MEMBER SIEBER: But that is not a regulation.

MR. BESSETTE: No, it is not, but we have some information that if we chose to do a fast track regulatory position.

MEMBER SIEBER: Well, I could see this becoming an issue, because maybe you don't have fiberoptics thrown all over containment, but you have got optical isolators, and things like that which are just little tiny sections of fiber that are embedded in a chip, and so the issues are there.

And it seems to me that they are affected by radiation in a more significant way than metallic conductors are.

DR. WOOD: I know that there has been a lot of research that has been conducted, and I recall from some discussions at one of those DOE meetings that we had trying to bring I&C experts together. And a particular individual telling me that the optical cables susceptibility to radiation was perhaps misstated.

Yes, it does have an effect in the visible frequency ranges, but it is perfectly okay in some of the other frequency ranges.

MEMBER SIEBER: And it become opaque and it also become brittle.

DR. WOOD: Yes, that's true.

CHAIRMAN BONACA: We are running out of time.

DR. WOOD: Okay.

MS. ANTONESCU: So I would like to wrap up by going over again the benefits of this reg guide. It does give explicit guidance on acceptable methods for environmental qualification of safety related microprocessor-based equipment.

It provides a comprehensive guidance since the guidance that we have right now is distributed all over several sources as Mr. Wood said on Reg Guide 1.189, and NEUREG 0588, and (inaudible) Chapter 7 and Chapter 3.

And also it provides endorsement of the current national and international standards, consensus standards. And it does include specific guidance to address unique characteristics of microprocessor-based technology.

And finally to it supports a streamlined approach to the initial determination of whether aging is necessary. And specifically by designating plant location that clearly do not require aging, and you have seen Dr. Wood's presentation and that category.

So your public comments provide clarify and a sharper focus on this reg guide, and in particular the public comment showed widespread support for endorsement of the current standards, and many of the comments were a result of a misunderstanding of the intent and application of the reg guide, and so we improved it.

The regulatory discussion and position were expanded and we improved on them. So this provided more clarity.

MEMBER FORD: What is your basis for saying that? Do you have widespread agreement with this? Have they come back for a second time around to look at your revised documents? What is your basis for saying --

DR. WOOD: What she is saying is support for the endorsement of the current standards, and that is not the same as support for the draft guide.

MS. ANTONESCU: For the consensus standards.

DR. WOOD: They recommended that other venues be used to endorse the standards.

MS. ANTONESCU: And so we have public comment open for revision, and scope and purpose, and we did clarify those, and finally we found some positions that Dr. Wood mentioned that were completely deleted because there was supplemental information supporting the environmental compatibility, but not directly to an environmental qualification.

And those were -- some of them were like the I&C manufacturing and testing. And overall it supports the NRC mission, and it contributes to achieving NRC goals, and helps maintain safety by providing an approach for verifying the environmental stress, and it does not hinder performance.

It gives a definitive explicit guide on acceptable practices, and it reduces its regulatory burden by minimizing potential regulatory uncertainty, and streamlining the determination of necessary qualification steps, and that is the example of when aging is necessary.

And it improves the regulatory effectiveness by giving explicit guidance on acceptable practices, for environmental qualification, and addresses unique characteristics.

So we do thank you for the opportunity to present this guide to you today, and we look forward to a letter with your comments on this draft reg guide.

MEMBER WALLIS: If I go back and read the Winston and Strawn comments, they are exactly the opposite of yours. They are saying that it is unnecessary and unwarranted, and have no effect on safety, and it doesn't part from minimizing the uncertainty, and it creates confusion and instability in the process.

MS. ANTONESCU: I'm sorry, which --

MEMBER WALLIS: I am reading their letter here I don't understand how to reconcile these positions.

MS. ANTONESCU: Well, we have a viewgraph on --

MEMBER WALLIS: Have you established that there is a reconciliation of their views in some way?

MS. ANTONESCU: We have reconciled, yes.

MEMBER WALLIS: You have reconciled? With these extremely different views, you have reconciled? You think you have reconciled?

DR. WOOD: What we believe is that the disagreements over the need for this guidance were based on a misunderstanding of the guidance, and we went through great pains to try to be much more systematic in the discussion that led into the regulatory position, and we deleted positions within the regulatory position that we agree could have led to complications and uncertainty, and additional burden.

MEMBER WALLIS: Maybe it would be appropriate to ask the representative from Winston & Strawn saying that now that I have heard this, do they agree.

MEMBER SIEBER: Well, whether they have heard it or not, to be able to give an opinion one way or the other, because they have not given them word by word changes.

CHAIRMAN BONACA: yes.

MEMBER SIEBER: And had they given them the justification for the comments, as they had about --

MEMBER WALLIS: What are we supposed to do? We are not going to write a letter are we? I don't have a basis for deciding either. This has not been seen by the people who were very critical of the previous views, and so I really don't know what to say.

MEMBER SIEBER: Perhaps we can provide the members with a copy of the public comments and resolution that you gave me.

MR. HORIN: If I may, I might suggest that I think consistent with previous practice and first off, I do want to express appreciation for your efforts to address the comments, and I recognize that there has been a lot of effort and thought in that respect.

But again the devil is in the details as they say, and we have not seen what the end result is. So we would appreciate an opportunity to be able to review what the proposed changes are, and have an opportunity to interact in some fashion in that regard.

It may even be appropriate at some point whether the subcommittee or this committee might want an opportunity to look at that next generation with an opportunity already having been provided for additional review.

MEMBER SIEBER: Well, that goes beyond what the regulations require for the issuance of a regulatory guide. You know, you don't keep on going, and going, and going.

DR. WOOD: I will note that I did have or I did attend the working group meeting, and I am now a member of the working group for the IEEE on IEEE 323, the revision of IEEE 323.

And I did engage in discussions with the group that is writing the revision of that standard, and I have had a lot of discussions with our international colleagues as well, and I have had discussions with a variety of members of the industry stakeholders.

I think that the guidance itself, the major objections as you indicated, had to do with whether or not this was expanding the scope of 10 CFR 50.49. I hope that we have illustrated that that is not the case.

The other had to do with defining the EMI/RFI as an aging stressor.

CHAIRMAN BONACA: Right.

DR. WOOD: And I hope that we have also indicated that we didn't do that, but we are moving into agreement with the international position that it is an environmental condition.

While that large document that you have

with the response to the public comments, there were 115 comments, and a little less than half of those were just repetitive. The majority of them dealt with the need for this guide.

And is the existing guidance sufficient, and is this guide consistent, and is this guide confusing, and is there a need for something for a microprocessor-based versus analog.

We think that we have addressed those things by clarifying the discussion. The issue of the location categories, we think we also addressed by clarifying how do you use them, and trying to make their application a lot more practical.

The issue of the scope of qualification is a matter of understanding what qualification is, and I could give you another two hours on qualifications, but I won't do that.

CHAIRMAN BONACA: The only concern that I have about writing a report on this at this stage is that in part it is true that the devil is in the details, and you are still in the process of communicating with industry.

And we intentionally waited until the comments were resolved. I mean, I think --

MEMBER SIEBER: Well, maybe I could

address that. One of the problems that I think we had in our procedure was that there was no subcommittee meeting. In fact, there is no I&C subcommittee that I am aware of.

And so we came into this cold and the documents that I now have, or the ones that or some of which I had to ask for, because I knew they were generally produced during the course of staff's doing their business.

And I have had the opportunity now to ask for them, and received them, and study them, which gives me an advantage over everybody else, and that's probably why I tend to be a little flip with my responses, for which I apologize.

On the other hand, if I were in other committee members' shoes, I would say I certainly have not been provided with enough information to make this decision.

And I don't know that we can provide the documents, and I think in the aggregate that the documents do answer the questions. On the other hand, it is a pretty good sized stack for overnight reading.

MEMBER SIEBER: Well, I think we should end the meeting, and then when we talk about the reports, then we will discuss it at that time and see what -- because I mean that there are things that can be said, and so why don't we do that.

MEMBER SIEBER: I think that would be a good idea. So I will turn it back to you.

CHAIRMAN BONACA: Okay.

MEMBER SIEBER: But I would like to thank our speakers today for good presentations, and good preparation for the discussion, and representatives from Winston & Strawn for coming here and giving us the views of the Nuclear Utility Group on Equipment Qualification. So with that, I will turn it back to you, Mr. Chairman.

CHAIRMAN BONACA: Thank you. With that, I thank you very much, and we will take a recess until 5:15, and at this point, we will not need the recorder anymore. So, at 5:15, we will just talk about these reports and see what we have, and what our plans are.

(Whereupon, the hearing was concluded at approximately 5:01 p.m.)