MEMBER POWERS: Yes, I hope.

MEMBER WALLIS: What are the other nozzles on the right there?

MR. MATTHEWS: The ones on the right are the instrument nozzles. There is some small instrument nozzles.

MEMBER WALLIS: A J-groove or something like that?

MR. MATTHEWS: Yes, the instrument nozzles, and if you recall in Oconee-1, I believe it was, had eight instrument nozzles around the periphery, and they are out on the edge, and they are smaller. They are like one inch diameter nozzles, as opposed to the four inch diameter nozzles.

MR. WOOD: There is a second red bar on the far right --

MR. MATTHEWS: I believe it is TMI model one.

MR. WOOD: So it has got a whole lot of leaks at those nozzles?

MR. MATTHEWS: Yes, essentially all of those nozzles have been -- there is only two plants that had the nozzles, two B&W plants that had those kinds of nozzles, and I am trying to figure out what all these others down here are.

I guess there are other nozzles, similar type smaller nozzles at some of the CE plants also if I am reading this right. There is just not enough light up here with my trifocals to read my own chart.

MEMBER FORD: This is the smallest print that we have ever had to read, but however it is amazingly precise. I mean, it is not smeared, and it is not double printed. It is actually legible. It is incredible.

MR. MATTHEWS: Yes, you just need a magnifying glass.

MEMBER FORD: It is a very good quality reproduction.

MEMBER POWERS: If you get the PDF file and you set it at 400 mg, it works real well.

MR. MATTHEWS: Yes, you can blow this thing up, and I really did intend to bring a big one, but I left it in Denver. And the point is that most of the plants -- and I will get into -- well, why don't we go to the next slide, so that I can talk about what is on there.

It shows graphically the extent that we have inspected the plants to date, and it shows where the cracking has occurred, and the leakage, and any wastage that has occurred only at Davis-Besse.

And where those cracks were occurring on the head, and there is other columns there with key operating parameters, like head temperature,and that sort of thing.

Also, if you look closely, and it would have to be closely, there is a refueling outage schedule, and current outage plans at the time that we put the charts together.

MEMBER WALLIS: Can I ask you about the leakers now? Now, this was visual inspection, and they looked for popcorn; is that what they did?

MR. MATTHEWS: Yes.

MEMBER WALLIS: So that there is no distinction made between the very small leak with a little bubble of popcorn, and the big leak with a mountain of popcorn. There is no distinction made there.

MR. MATTHEWS: Right.

MEMBER WALLIS: There is nothing about the extent of the leakage.

MR. MATTHEWS: Well, almost all of the leakage, except for perhaps what was occurring at Davis-Besse, has been extremely small.

MEMBER WALLIS: It has all been very small. There has been very small amounts of popcorn?

MR. MATTHEWS: Yes. Some of them, you know -- and I don't know that I have seen any golf balls if you will.

MEMBER WALLIS: So there is no indication of liquid. There is no indication of rust flowing, or anything like that?

MR. MATTHEWS: There has been some of the nozzles that had the small amounts of popcorn, when they did the inspections, it would look like there was a little trail of boric acid.

MEMBER WALLIS: Well, I am trying to make the distinction between dry popcorn and something wet under the popcorn, which actually dissolves the steel, and you might see some rust streaks or something?

MR. MATTHEWS: There have been small amounts of rust, I believe, on some of these. I couldn't recall off the top of my head which nozzles or which plants.

MEMBER WALLIS: That is an important transition from a dry leak to a wet one isn't it?

MR. MATTHEWS: Yes, it is, and the important thing there I believe, and according to our model anyway early on was that the leak rate. If the leak rate gets to be sufficient, you can get enough evaporative cooling taking place even with a 600 degree head that it can cool down to a local area and maintain a liquid state.

Also, it is not really clear what happens when you have, as you say, a mountain of boric acid. Do things get trapped underneath it? Do they maintain humidity in the area that causes other problems, and that is some of the stuff that we want to try and look into.

MR. ROSEN: Larry, you say that it shows, that the table graphically shows the extent to which the fleet has been inspected, but I can't see it well enough. So if you will go back to the previous slide and tell me what the colors mean, I might even know what it says.

MR. MATTHEWS: Okay.

MR. ROSEN: There is yellow, and green, but I can't read --

MR. MATTHEWS: The white re the nozzles that have not been inspected.

MR. ROSEN: Okay.

MR. MATTHEWS: And the green are the nozzles that have received at least the top of the head, bare metal visual. The yellow nozzles have received some type of under-head NDE.

If it has a "W" stamped in the middle of the block, it also means that the weld was examined either by PT or (inaudible).

MEMBER WALLIS: I'm beginning to see this clearer every moment. I am getting used to it.

MR. ROSEN: And the gray means what again?

MR. MATTHEWS: The dark gray to the right means that there is no nozzle there. It is -- you know, we just numbered the nozzles sequentially.

MR. ROSEN: There is a gray over there under South Texas, for instance, all the way over on the left. What does that mean?

MR. MATTHEWS: I think that means that those four locations, number wise in their numbering sequence, don't have nozzles there. Whereas, a similar plant did have nozzles there.

MEMBER SIEBER: They broke off.

MR. MATTHEWS: No, they didn't break off. Not yet. They were never installed. Let me see if there are other things. The kind of yellow orange, and it does not show up very well at all on this, are flaws that were left in service. They were flaws that were detected and left in service.

And the main ones were Millstone-2, which is about the fifth plant down in the middle box; and Cook. Well, Cook might show a repair. Yes, Cook-2, it shows that it was left in service and then it was repaired later, but it never made a through wall.

That is the third plant up from the bottom of the top box. There were also a few nozzles with cracks that were left in service at North Anna-1, and one thing that is not on here is that I just heard yesterday that nozzle 50 at North Anna was determined to be leaking after running for one cycle.

It was questionable the previous cycle, and they determined that it wasn't leaking, or that was the call at the time, and then they went back when they just had the refueling outage, or they are in the middle of it now. And when they relooked at it that nozzle was leaking.

MEMBER FORD: Is that the one that was repaired?

MR. MATTHEWS: No.

MEMBER FORD: At North Anna?

MR. MATTHEWS: North Anna-2 had some leaking nozzles, and repaired those that were leaking. I am talking about North Anna-1.

MEMBER FORD: Wasn't there a nozzle at North Anna that was repaired?

MR. MATTHEWS: Yes, North Anna-2 had at least one nozzle that was repaired previously. It was leaking in a previous cycle in the fall of '01, and then they repaired that nozzle.

Then when they shut down in the fall of '02 to examine it, that nozzle was again leaking.

MEMBER FORD: And what was it repaired with?

MR. MATTHEWS: it was repaired with an overlay technique, where they welded six 152 or 52 over the weld itself.

MEMBER FORD: Well, isn't that 152 or 52 weld supposed to be the replacement, non-cracking resistant weld?

MR. MATTHEWS: Right. One of the things that we don't know on that nozzle is what the leak path was, and when they went back and redid some very thorough looking at the nozzle, it was determined that the overlay that they put on the weld itself in all of '01 did not actually cover all of the 82-182 material that was there.

And so the hypothesis is that the crack came up through the part that was not covered by the overlay.

MEMBER FORD: So you are relying on the butter to be the barrier?

MR. MATTHEWS: Well, I think that was

probably what happened with that overlay that they did at North Anna. But another part of our research is the North Anna-2 head now is sitting on the ground in Utah, and we are evaluating proposals today.

MEMBER FORD: Well, what concerns me, Larry, is that we have been told that Alloy-690, 52, and 152, the replacement alloys of construction, are immune to stress corrosion cracking.

And immune has got a whole range of definitions, but it doesn't crack, and it especially does not crack in the fair condition in one fuel cycle.

MR. MATTHEWS: And the belief is that that overlay itself did not crack, and that the crack that did occur was in the part of the 82 or 182 butter that was not overlaid, because they did not completely understand how far out when they did the overlay design and did the overlay application, the overlay did not go all the way to the stainless steel clad, and so there was still some exposed (inaudible) type material.

MEMBER FORD: When will the inspection be done?

MR. MATTHEWS: We are evaluating bids this week for removing the sample from the head, and then we also will shortly be out for proposals for the DE NDE on those heads. And that particular nozzle is one of the nozzles that we are going after.

They did a BOAT sample on that nozzle anyway, and the BOAT sample was limited and did not determine what the actual leak path was. We intend to try and find that leak path.

MEMBER FORD: Okay.

MEMBER SHACK: Larry, on that nozzle 50 that you said is now leaking, was there a UT call that there was a crack there that was not through wall?

MR. MATTHEWS: It's probably, and I don't know if I ought to be speculating in this environment, but it is probably a similar situation to what they had on North Anna-2 on the one that was repaired and then leaked, and that when they did the exam, the visual exam -- and I don't know if you have seen the pictures, and I don't have one with me.

But they had just a little white boric acid. It wasn't even popcorn at that point, right around the intersection of the nozzle. They did a UT on the tube, and as I recall there were no flaws on the tube. In fact, they went and cut the thermal sleeve out so that they could do a thorough UT.

And they did (inaudible) on the nozzle,

and the only thing they found were some indications which at that point in time they believed were far enough away that they were in the stainless steel cladding of the vessel and not in the alloy-82 or 182.

And based on the results from the North Anna-2 repair that was subsequently leaking, I think there is a strong possibility that those indications that they thought were in the cladding were actually in the butter itself.

And it is speculation, you know, but it would be consistent with the results from the North Anna-2 repair.

MEMBER SHACK: I had one more question. Have any through-wall cracks been found by the volumetric that were not detected by the bare metal visual?

MEMBER SIEBER: Through-wall.

MR. MATTHEWS: Through-wall? There were certainly flaws of concern that were detected by the volumetric, and in particular North Anna-2, the NDE indicated there were some nozzles that had circumferential cracking at or near the root of the weld, but not above the root of the weld.

And again this is something that we are going after those nozzles to try and nail down, but the initial speculation is that it was a weld flaw that prorogated up through the weld, and when it encountered the edge of the nozzle below the root of the weld, it turned circumferentially into the nozzle and was in the process of growing in the nozzle.

And which is a significant finding, because that could eventually have led to a circumferential flaw that would have been of great concern and that would not have necessarily been leaking had it not been --

MEMBER WALLIS: You might have lost a control rod before it leaked.

MR. MATTHEWS: Yes. I mean, that is the concern.

MEMBER WALLIS: This is the sneaky stealth crack, which is a real problem, but doesn't show up as a leak.

MR. MATTHEWS: Right. That is the one, and that is the concern. And that is part of the reason or one of the main reasons that we pulled back the MRP 75 inspection plan, which was based primarily on visual examination as the recommended exams.

And when we saw the North Anna-2 results, we said, okay, that is a surprise, and we should not be basing it a hundred percent on visual exams. So now we are going back and regrouping, and trying to put together another inspection plan, not unlike the staff's, but different in significant ways.

And that we will then be working with the staff to try and convince them, the staff, that ours is adequate. We revise this table periodically. It is in electronic format, and so you can blow it up as big as you need to.

MR. ROSEN: Where is it? I mean, on the web, on the MRP website?

MS. WESTON: I will get a copy and provide it to you.

MR. ROSEN: Electronically so that we can have --

MS. WESTON: I will get a copy and provide it to you, a large copy.

MR. MATTHEWS: Right.

MR. ROSEN: A large copy.

MS. WESTON: Yes.

MR. MATTHEWS: Well, electronically, you can make it as big as you need.

MR. ROSEN: Well, if I don't know what URL it is --

MR. MATTHEWS: Right, we will send it to you.

MS. WESTON: I will send it to you.

MR. MATTHEWS: And as detailed as this is, this is not all the information that we have. I mean, we have all the information and we have access to all the information in even more detail.

So we are going to use that information as we try and work on things like what is the probability of leakage, et cetera.

MEMBER FORD: Larry, somewhere on that graft there is denoted Davis-Besse wastage, and there are two other instances we understand of wastage, minor, which was reported to us I think at the end of last year. Where are they on that graft?

MR. MATTHEWS: I guess they are probably not on here, because they were so minor, and one of them was at Oconee, one of the Oconee units as I recall.

MEMBER FORD: I can't remember.

MR. MATTHEWS: And it was a very minor little bit right at the top of the head, and I don't believe that is marked.

MEMBER WALLIS: Well, there is minor, and then there is minor compared with the size of the Davis-Besse crater.

MR. MATTHEWS: Right.

MEMBER WALLIS: And there is minor compared with the thickness of the clearance, which is not so minor, and that is a very small thing, but it is still significant because it opened up a hole.

MR. MATTHEWS: Yes.

MEMBER WALLIS: So I don't know what you mean by minor.

MR. MATTHEWS: And I guess we don't have the details on that wastage. We know that what was measured on the top surface, which was as I recall a very minor or a half-an-inch.

MR. ROSEN: Yes, minor from the standpoint of depth, but I am not sure that the world minor applies from a phenomenological point of view, because if you tell me a quarter-of-an-inch of the head was wasted away, I want to know how did that happen.

And what was the mechanism, because I thought with boric acid coming out on the surface of a hot head would flash and have a little bit of popcorn, and so I don't get it.

MR. MATTHEWS: Well, when it does flash, the first thing that happens is that half of it goes to steam, and half of it goes to water, and saturation conditions. Then you have to boil that water off.

And if your leak rate is sufficient, that evaporative cooling of the half of the water that is left behind is enough to cool the head temperature locally down to the point that you can --

MR. ROSEN: I can't believe it. I mean, maybe -- well, I just have to look at the thermal calculations, but the head is six inches thick, and with all that residual energy in the head, do you really think that --

MR. MATTHEWS: Yes.

MEMBER KRESS: I think you can probably neglect that evaporative cooling. What you have got is a temper distribution through the head, and it is hot at the bottom, and colder at the top.

MR. MATTHEWS: Well, it is pretty hot.

MEMBER KRESS: It is pretty hot all the way, but what you have to do is you have to concentrate the boric acid and for the liquid to waste away that head.

So what you are doing is you are putting in a low concentration, and it is steaming off the top, and as it steams, it concentrates the stuff behind. And if you have a way to keep that liquid in there and only let steam escape, that will go on concentrating over time and time.

MR. ROSEN: The big if is if you have

something to keep it there.

MEMBER KRESS: Yes.

MR. ROSEN: But if you don't --

MEMBER KRESS: And I suspect that may have to do with that ton of stuff on top.

MEMBER WALLIS: With the forms of boric acid and the boiling point elevation, and all that.

MEMBER KRESS: And then you have the solution dissolution of the metal into the concentrated boric acid, and then either way that depends on temperature and concentration.

So I could see how they could develop a fully mechanical model, and you could probably use it as a parameter the way it which it steams out the top of the --

MR. ROSEN: Well, we have evidence that my intuition is wrong. I mean, it did dig away some in the plate.

MR. MATTHEWS: Well, at Davis-Besse.

MR. ROSEN: Well, not just Davis-Besse. I am talking about these other small ones.

MR. MATTHEWS: Well, we did some heat transfer calculations as a function of the leak rate, and in the range of .1 to .2 GPM, we were showing that you could if it is coming from that annulus that .1 to

.2 GPM was enough to cool the area right there on the OD surface of the head down to saturation temperature.

MEMBER FORD: And was that a calculation, or was that an experiment?

MR. MATTHEWS: That was a calculation. It was a 3-D finite element model of the head with the heat transfer, and the cooling from the flashing.

MEMBER FORD: I suspect that at the subcommittee meeting in April that you will get a lot of questions on not only the calculations, but also the qualifying data to support that.

I have seen a lot of suppositions, both in the June meeting from Dominion, and in the various documents since, relating the idea of wastage to leak rates, and I have yet to see any supporting data.

MEMBER WALLIS: Well, what we are looking for is theory of an experiment, which is put together with high academic quality.

MEMBER FORD: But you guys have got those people at EPRI, and John, and other people can do it.

MR. MATTHEWS: Yes, John is involved. John Hinkley is involved.

MEMBER FORD: So we would like to see that.

MR. MATTHEWS: We don't have the

experiment, but we do have --

MEMBER KRESS: Basically, you don't really need an experiment. You have got all the data that you need put together. You have got to have a boric acid concentration in liquid to have the steam, as opposed to if it is pressure.

And you have got the relationship between how boric acid, at a given concentration level, dissolves steel. Now, those are the two things that you need, and you have to put it together with a model of temperature distributions, and flow rates, and --

MEMBER FORD: I am just surprised that in the year since we have had this that this has been not even attempted, because I am awake at night thinking that tomorrow we might find another Davis-Besse.

MEMBER KRESS: Well, we suggested that that model be put together at our very first meeting I think.

MEMBER FORD: Yes, sure.

MEMBER KRESS: And I applaud them for doing it, because it is likely to tell you things about whether there is some potential for it happening in some of the others.

MEMBER FORD: Exactly. I want to know what the margin is.

MEMBER KRESS: Well, it is a good thing for them to be doing.

MEMBER POWERS: You indicated that you calculated the dissolution rate?

MR. MATTHEWS: Yes.

MEMBER POWERS: And has the stability constance for ferric borate been measured?

MEMBER KRESS: There is data, and I have seen a lot of data for the -- well, the data that I have seen is concentrated boric acid dissolving without the ferric included in it. I don't know how much of the -- you know, it is the pure boric acid on pure metal, and that is the way that I have seen it.

You are right though, that it may change that when you put enough of the iron into it.

MEMBER POWERS: As soon as you corrode it a little bit, you are saturated in that kind of a model if you don't put the ferric borate in.

MEMBER KRESS: Yes, I think that is correct.

MR. MATTHEWS: You are just flushing it away.

MEMBER FORD: I think you will have trouble, Tom, doing more --

(Simultaneous conversations.)

MEMBER FORD: And watching steam coming through this stuff, and it is quite a complicated process going on in there, and it is not just --

MEMBER FORD: I get your message, Larry, and in April, we would like the hypothesis and supporting data.

MR. MATTHEWS: We had a model, and it was kind of a phenomenological model.

MEMBER FORD: That's right.

MR. MATTHEWS: And we were told that we need data to back up certain parts of it, and we are in the process now of going to get that data, lab data.

We already have a lot of data on boric acid corrosion rates, and some of them are quite high in the boric acid corrosion guideline. But we are going after specifically what is happening in the crevice type environment.

MEMBER WALLIS: You are going to simulate the pressures and the flashing, and all that stuff?

MR. MATTHEWS: Yes. This is just a bigger chart to read, and it is all the nozzles that have had cracks. So if you are interested in nozzles that have cracks, then the next one is a further and bigger still of all of the nozzles that have had circumferential cracking at or above the degenerative weld.

And there is a limited number of plants that have had circumferential cracking, and so I can get bigger type on a small sheet of paper.

MEMBER SHACK: So on North Anna-2, you inspected 65 and 42 were cracked?

MR. MATTHEWS: North Anna-2?

MEMBER POWERS: I am looking for 42. Where is that?

MR. ROSEN: Number 9.

MEMBER WALLIS: Number 9.

MR. MATTHEWS: Oh, this is on the big chart.

MEMBER WALLIS: It is in the welds.

MR. MATTHEWS: Yes. The cracks are in the welds. Most of the welds in North Anna-2 had cracks in the welds of one size or another.

MEMBER WALLIS: Well, that stands out as being so much bigger than all the others.

MR. MATTHEWS: Yes. It is a different manufactured head, and we don't know if we can attribute it to that or not. It was made by Rotterdam, and there is only like 7 or 8, or maybe 9, heads in the U.S. that were made by Rotterdam.

And all of the welds, or not all of them, but there were a couple of welds that had no indications, but most of the welds at North'Anna-2 had some type of early indication in them.

MR. BATEMAN: This is Bill Bateman from the staff. I would like to clarify that an indication is not necessarily a crack. Those indications were not explored to determine whether or not they were cracks.

So I think it is unfair to say that 42 at North Anna had cracks in them. We can say that they had indications, but that is all that we can say.

MEMBER WALLIS: Well, in the column, it says number with weld metal cracks, and you are saying that is wrong?

MR. BATEMAN: Well, that is a misnomer. That is wrong. It should be indications and not cracks.

MEMBER WALLIS: So something was there that looked like a crack, but you don't know that it was a crack?

MR. BATEMAN: In order to determine if an NDE indication is a crack, you have to explore it. And North Anna opted not to explore 42 different penetrations that would take a lot of time and radiation exposure, and they opted to just replace the head once they found that one was available.

MR. MATTHEWS: We are going after some of those nozzles in particular to look at those weld indications and try and quantify what the NDE is telling us relative to are those --

MEMBER SHACK: Is there any current technique that other people have used without producing --

MR. MATTHEWS: Very similar to a current technique to what Robinson used on all of their welds and got no indications.

MEMBER FORD: Larry, can you give us some idea of what the leak rates are from these nozzles? Leak rates in terms of gallons per minute?

MR. MATTHEWS: I think all of these leak rates are very, very low, except possible the Davis-Besse leak rate.

MEMBER FORD: An order of magnitude value.

MR. MATTHEWS: A millionth of a gallon per hour, or something like that.

MEMBER FORD: Okay.

MR. MATTHEWS: A very low leak rate. Very low leak rates.

MEMBER FORD: The reason that I am asking the question is that our disposition curves for circumferential cracking, you have quoted that it would be less than .004 gallons per minute.

Therefore, those disposition curves to be applicable --

MR. MATTHEWS: To use that factor, too, on the crack growth rate, yes.

MEMBER FORD: And so all of these leaking situations here are well below that limit that you put on those disposition curves?

MR. MATTHEWS: I am not sure about Davis-Besse. The ones that developed wastage, wherever they are, were probably leaking at a sufficient rate to have cooled the area enough to maintain a liquid to concentrate and waste the head.

But those are very, very few. If you had any kind of significant leak rates going on, you would not have popcorn. You would have mounds of boric acid.

MEMBER FORD: Right.

MEMBER SHACK: So a thousandth of a GPM gives you 15 pounds of boric acid per year. So it piles up.

MEMBER WALLIS: It does pile up.

MR. MATTHEWS: It piles up.

MEMBER FORD: Okay. Larry.

MR. MATTHEWS: Okay. Slide Number 6 has the nozzles that had the circ loss in the base metal of the nozzles, and all of these, except North Anna, were in the B&W plants.

Slide 7 kind of covers some of the overall statistics, and in the U.S. we have 3,871 CRDM nozzles, and 1,090 CEDM nozzles, which are the same thing for CE plants.

And 94 in-core instrument nozzles, and in 69 units. Bare metal visual and/or non-visual inspections have now been performed on approximately 81 percent of those nozzles, or the other type exam, or both. And about 47 have been found to be leaking.

Almost 8 percent of the nozzles in the B&W plants have leaked, but leakage in the non-B&W plants have been North Anna-2, and Surry-1, and now it looks like North Anna-1 also has it.

MEMBER WALLIS: You said that North Anna-2 was a Rotterdam fabrication?

MR. MATTHEWS: Right.

MEMBER WALLIS: And are there other Rotterdam fabrications which are in the lower categories of susceptibility?

MR. MATTHEWS: Yes, there are.

MEMBER WALLIS: So maybe they should be looked at more carefully?

MR. MATTHEWS: And I think that those plants are taking that into account.

MEMBER WALLIS: All right. But is the staff taking that into account?

MR. MATTHEWS: You would have to ask the staff.

MR. BATEMAN: I think if you look at our orders that dictated the inspection requirements the answer would be yes.

MEMBER WALLIS: But I don't have to look at them for the answer to be yes. If the answer is yes, it does not imply that I have to look at them. The answer is yes, right?

MR. BATEMAN: Yes, and not specifically because they were Rotterdam heads, no.

MR. MATTHEWS: And we have not yet said that these weld flaws are a Rotterdam problem.

MEMBER WALLIS: But obviously you look for any kind of a clue that something is different.

MR. BATEMAN: Yes.

MR. MATTHEWS: Yes. And that is the difference that all of the welds flaw -- well, they had a preponderance of weld logs.

MEMBER WALLIS: It is such a huge number, and you can't ignore it.

MR. MATTHEWS: Yes.

MEMBER WALLIS: This is Rotterdam, Holland?

MR. MATTHEWS: The stockyards in Holland, yes.

MEMBER WALLIS: Do they build French heads?

MR. MATTHEWS: I don't believe they did, no. And the French have gone back and looked at several of their decommissioned plants and they have not seen the kind of weld flaws that the B&W plants in North Anna, or at least that is the last that I heard from the French, that they had not seen any, or at most one, weld flaw.

MEMBER POWERS: When you think about the chemistry at the top of the head, and there is boric acid, and you have liquid up there, what kind of rates do those boric acid experience on the top of the head during normal operation?

MR. MATTHEWS: Dose rates, gamma neutron?

MEMBER POWERS: Yes.

MR. MATTHEWS: The neutron is going to be very low, and it is so far away from the fuel. Gamma would be the contamination that you have got in the coolant, and in 16, and in 13.

MEMBER POWERS: In the crud.

MR. MATTHEWS: And in the crud, and all of that stuff. If you crawl under the head, it can be a thousand mR per hour under the head in gamma.

MEMBER KRESS: That can be part of the chemistry --

MR. MATTHEWS: A thousand mR per hour, but that is at shutdown and after it is has taken off, and it is probably quite a bit more than that with the other stuff going on during operations with the gamma dose rate.

MEMBER KRESS: That can strongly affect your chemistry.

MR. MATTHEWS: Yes.

MEMBER POWERS: When you look at the chemistry of boric acid do you take into account radioloysis?

MR. MATTHEWS: I am not sure that we had.

MEMBER POWERS: There is an awful strong oxidates to it.

MR. MATTHEWS: Yes.

MR. ROSEN: I couldn't understand what you said, Dana.

MEMBER POWERS: I said awful strong oxidates.

MEMBER SIEBER: Our transcriber is having trouble hearing you.

MR. MATTHEWS: I will get back to our folks on that.

MEMBER POWERS: Sure.

MR. ROSEN: So, you said a thousand mR per hour if you craw under and remove the head, or 1r per hour?

MR. MATTHEWS: Yes, or more than that.

MR. ROSEN: How much more, 10?

MEMBER SIEBER: I remember numbers like five several days after --

MR. ROSEN: 5r per hour.

MR. MATTHEWS: And it is mostly combination. There is not a lot of activation of the steel that distance from the core, and --

MR. ROSEN: There is a shield between it and the core.

MEMBER POWERS: Very persistent combination though on the handle and nozzle.

MEMBER SIEBER: You have to sandblast it to get it off.

MR. MATTHEWS: Continuing?

MEMBER FORD: Yes.

MR. MATTHEWS: It looks like about half of the plants in the category that the NRC would call high susceptibility in a third of the nozzles that are in the moderate will have received or have had non-visual examinations performed on them.

And about two-thirds of the nozzles in the B&W plants, and 25 percent in the non-B&W plants, and that is going up rapidly as we enter another outage season and more plants are doing examinations.

MEMBER POWERS: Is this -- I mean, suppose you examine them and it says they are fine. How long do they stay fine?

MR. MATTHEWS: They don't stay fine forever. We certainly don't assume that. And we will be determining -- we had recommended a reinspection on some periodic basis, and the NRC staff for the high category in the orders had said every refueling outage.

We think cracks don't grow that fast or to be that significant, and so we are going to be looking to how fast you would need to come back in. It could be on the order of every other refueling outage or something like that for those plants.

MEMBER POWERS: It's a chore.

MR. MATTHEWS: It's a chore, and it is expensive, and so people are replacing heads in plants right away. I mean, there are plants that are replacing heads that have found no flaws, just to avoid the expense of having to go in every cycle, or every other cycle, or whatever due to those experiences, and do the examinations.

MEMBER POWERS: I believe it.

MEMBER WALLIS: Do they assume what they put in now, is that susceptible to flaw than the one that was there before?

MR. MATTHEWS: Yes. It's 690, and the staff does not assume that, except for Davis-Besse, who has replaced with another Alloy 600 penetration head.

And the staff has not given us any credit, and I think that they believe that the material is less susceptible, but we have to gather the worldwide data and make the case, and we are in the process of doing that right now.

Plus, we will probably be doing other types of testing to further bolster the case that 690 is a better material. I mean, clearly it has performed better I think in steam generators, and the hypothesis would be that it would be better also in these, but these are thick wall applications.

MEMBER WALLIS: And all these new heads have stainless steel alignments?

MR. MATTHEWS: Yes, they do.

MEMBER WALLIS: And about the same thickness as Davis-Besse?

MR. MATTHEWS: I think they are, yes.

MEMBER POWERS: That's good.

MEMBER FORD: Your data collection for 690 will also include alloys?

MR. MATTHEWS: Yes. Further on, what has been done, about 19 percent of the inspected B&W plant nozzles have shown some kind of base metal cracking, either OD or ID, and we are not trying to pin it on B&W, because the B&W plants, if you look at the chart, were all the ones that had the high time at temperature, and so you may have both going on there. And I don't think we have enough data to try and say, well, it is their problem. And I don't want to go there anyway.

The base metal cracking in the non-B&W plants. I guess we may have trouble showing this, but I will lay it up here. It has got more information that you want to get, and here is a big copy of that chart and you can come up and look at it.

MR. ROSEN: Pass it around.

MR. MATTHEWS: It has to be that big, and we print them out and plot them out that big so that we can look at it. It says that base metal cracking was in the Millstone and Cook-2, and I thought I remembered another novel. Maybe not.

North Anna-1 and 2 have experienced some cracking in the base metal. North Anna-1 had some shallow cracks that were left in service. North Anna-2 had cracks that were coming in from the OD.

I think they may have also had some shallow cracks on the ID. Currently scheduled for the spring, we have got 20 units having outages, and three of those units will replace their heads this spring.

North Anna-1, Surry-1, and Aconee-3 intend to replace their heads this spring using Alloy 690 nozzle material and weld metal. The other 17 units are performing either the bare metal visual or under the head non-visual, depending on their susceptibility category, and how much degradation years they have.

All the plants greater than 12 will have performed a non-visual baseline examination by the end of the spring outage season. And I believe what we are going to get through in the spring is going to be most of the commitments that people made in 2001-01.

There is only two units that will have done at least the bare metal visual, or I mean will have not done.

There are only two that will not have done some type of examination, and I believe those plants were on two year cycles, and they just have not gotten back around to their outages.

And 20 out of the 28 are in the NRC's high susceptibility category, and there may be 29 or 30 now as time has progressed, and will have done the baseline non-visual, or replaced their heads.

After the fall, all 69 units will have done some type of head examination, and 27 of the 28 units with greater than 12 EDYs will have completed baseline non-visual by the spring '04 outage.

MEMBER POWERS: When you go about replacing a head, how do you inspect? I mean, you just take on faith that 690 is better, right, no matter how it is fabricated?

MR. MATTHEWS: Yes. We watch how they do it, and 690 is the better material.

MEMBER POWERS: Yes, but you don't know what you are looking for. So, I mean, you can watch until the cows come home.

MR. MATTHEWS: That's true. Pretty much. I don't know that plants are putting any kind of particular specs on Alloy 690 other than they use Alloy 690.

MEMBER FORD: How about specs on the welding procedure and the effect that has on the residual stress --

MR. MATTHEWS: I am not sure of the details of the specs.

MR. BATEMAN: Bill Bateman from the staff again. I can only speak from the observations of the trip that myself and several other staff made up to B&W Canada, where they are fabricating these new heads using Alloy 690.

And they are taking much more care in designing the process for applying the welds.

MR. ROSEN: And including such things as shrink fitting the tubes?

MR. MATTHEWS: The whole process is much more controlled, but in particular the welding. I actually saw them where they are running experiments by machine welding and applying the beads, and taking stress measurements and that kind of thing.

So I know that they are being a lot more careful in developing the -- that is B&W Canada, and I have not been to Framatone and maybe I can get a trip over there, Peter.

MR. HEISER: This is Alan Heiser of the staff. The design of some of the joints has been improved to reduce stresses, and reduction of weld volume, and trying to make the welds more symmetric to reduce stresses. Some surface conditioning, and those are some of the things that Oconee had pointed out to us almost two years ago when they first initiated their head replacements.

Now, we have some indications from one vendor regarding advanced reactors is that they are using the same designs for advanced reactor heads, and they are just changing the material out. And that may not provide as good a performance hopefully as we will get from the plants that utilize all this experience that we have had over the last few years.

MEMBER SHACK: Are these thermally treated? Do they dump carbites on the grain boundary, the nozzles? I mean, is it Alloy 600TT as we would say in the steam generator tube?

MR. MATTHEWS: I don't know.

MEMBER WALLIS: What is the weld material?

MR. MATTHEWS: It is 152 or 52, depending on whether it is automated or --

MEMBER WALLIS: Same as the weld material before?

MR. MATTHEWS: No, it is alloy to be consistent with the Alloy 690 base metal.

MEMBER FORD: I would like to follow up on Dana's comment, which was a good one. And that is what sort of control do we have over the fabrication process?

When you said you looked at it and it looks good, and your processes lower the stress, those are all engineering judgments?

MR. MATTHEWS: Yes.

MEMBER FORD: Has there been any work done for BWR heads or TWR heads, sorry, in which there is a correlation between the observed residual stresses and fabrication parameters, such as weld heat input, and speed, and geometry, shrink fit, all this business?

MR. MATTHEWS: I am not sure of the details of what the fabricators are doing in their set-ups and all. I am just not that close to that right now.

MEMBER FORD: The fabricators are the controllers, and not the buyers, in terms of setting up the specifications?

MR. MATTHEWS: Again, I think each buyer would have its own spec, and what he is writing into it, and I am not that familiar with what --

MEMBER FORD: Well, with Dana's comment, are we not just heading into -- we might come up with bad material, and we don't know what we are looking for in the material specifications, and we know what to look for in terms of microstructure, but not in terms of detailed specification composition.

And 690 looks as though it might be better, and what is the factor improvement by going to these controlled welding procedures, and we don't know. So how do we know that we are any better off?

It seems to me that we are not controlling the process. We are going by engineering judgment.

MEMBER SHACK: You are not going to wait to replace your head and solve all these problems.

MR. MATTHEWS: No.

MEMBER FORD: No, of course not, and I can't believe that the PWR world have not done some residual stress measurements to calibrate their finite element analysis.

MR. MATTHEWS: I think they have.

MEMBER FORD: Okay, then, great.

MR. MATTHEWS: On 600.

MEMBER FORD: So that is the answer.

MR. MATTHEWS: I think they mocked up the

690 to big mock-ups to do that. There may be some with the fabricators that I am not familiar with.

CHAIRMAN BONACA: I have a question regarding -- you said before that 19 percent of the B&W plant nozzles show metal, base metal cracking, and for this you have a significant debate, because they did a UT of all of them.

But then you say that for the others, there is very few that had base metal cracking. But for the others, we had much more visual inspections, right?

MR. MATTHEWS: Well, there has been quite a bit of volumetric examination that has been done, and --

CHAIRMAN BONACA: Well, wouldn't it be true that as they do more and more volumetric that we are going to find that it is more than just a few?

MR. MATTHEWS: Well, there may be other flaws out there, or we may find other flaws in the future inspections. I am not saying that we won't. And we are not trying to draw a conclusion from this that there won't be any problems.

CHAIRMAN BONACA: Well, it sounds like the problems would only be in B&W plants.

MR. MATTHEWS: No, we are not trying to

draw that conclusion. There have been other plants that have done the inspections and have not seen them. Several plants have done volumetric examinations, and so of them are almost to the same EDY as the Oconee units, and have seen no problems in their baselines, or in the welds either.

I would like to move on to the process that we are going through.

MR. GILLESPIE: I was about to point out that we are halfway through, and you are about a third of your way through, if that, through your total stack. So maybe --

MR. MATTHEWS: I will try to speed it up.

MEMBER FORD: Well, actually, to help you in areas that you think you might need some help from us, and suggestions that you could cover in more detail in April?

MR. MATTHEWS: Yes.

MEMBER FORD: Would that help you?

MR. MATTHEWS: Yes.

MEMBER POWERS: I hate to slow it down, but is it true that Farley-2 has the same bad heat that we have for the famous five nozzles at DB?

MR. MATTHEWS: Farley-2, or 4 of the 5 nozzles at DB as I recall, and most of the nozzles at

Oconee-3, were all from the same heat. It is also true that Farley-2 had almost all of the nozzles from that heat.

Farley-2 did a volumetric examination and found no flaws, and there were quite a -- they are not as high in EDY.

MEMBER SIEBER: But they are still around 19 though, right?

MR. MATTHEWS: Well, they are more like 18 or 17.

MEMBER SIEBER: I was close.

MR. MATTHEWS: No, actually, maybe more like 16, but they are in the high to moderate, or up in that range, and they found no flaws. In Robinson-2, it is not the same heat, but they are way up there, and they found no flaws.

MEMBER FORD: Before you get to the next subject, too, you mentioned that quite a few of the stations were replacing the heads. At the same time, some of them were repairing the heads; is that correct?

MR. MATTHEWS: Yes. I mean, a few --

MEMBER FORD: Are there any code restrictions on the size of these repair welds that are being proposed, and is there any control over the welding process?

For instance, if for instance the cracking at North Anna turns out to be a hot short cracks, there aren't just corrosion cracks. Are there any welding process specifications being imposed on the repairers, and what are they?

MR. MATTHEWS: I don't know the details of them, but yes, those processes and those welding or repair processes are controlled quite closely.

MEMBER FORD: Have there been mock-up tests done prior to North Anna?

MR. MATTHEWS: On the weld overlay?

MEMBER FORD: Yes.

MR. MATTHEWS: I believe that Westinghouse had demonstrated that weld overlay process on a spare head, and I believe they had. I am not absolutely certain, but I believe they had just in the process of tooling development.

MEMBER FORD: Will this be covered in April?

MR. MATTHEWS: On the controls for the repair?

MEMBER FORD: Yes. Again, it is going back to the same thing. Are we just working our selves into another problem?

MR. MATTHEWS: Well, most of the plants that have done a repair have immediately instituted plans to do a replacement.

MEMBER FORD: Well, maybe it would be a good idea to do a destructive examination of those to see if there is a hot short crack?

MR. MATTHEWS: Well, on the North Anna repair, we are going after that nozzle in particular, and that is one of the ones that we will be doing DE on.

I want to talk a little bit about the process that we are going to use to revise our proposed inspection plan, and cover the overall safety assessment process, and this transitioned from where we originally were recommending visual exams to a combination baseline inspection, and covered a little bit about the (inaudible) and inspection analysis, and we are trying to avoid surprises in the future in the schedule for issuing revised inspection plans and safety assessments.

This is again hard to read, but it is kind of a new process that we are going through here, and we are going to start on the left with the failure modes and effect analysis and try to determine every possible failure mode.

And then through evaluations then go into determining what the appropriate inspections are, and that would all be part of our safety assessment, and put out inspection guidance, and then the plants would perform inspections.

And if we are bounded by our safety analysis, okay, and if we are not, then we have got to feed back in to our revised inspection plan and guidance. Hopefully we won't be revising it much in the future.

MEMBER FORD: But this essentially apart from the head wastage evaluations, this is essentially what you proposed in June of last year; is that correct?

MR. MATTHEWS: We were not proposing a failure mode effects analysis and starting over. In June of last year, I think we were still to the point that we were recommending as our base inspection a bare metal visual inspection on top of the head, and that is what was in the RPM 75.

North Anna-2 made us question that presumption if you will, and so we are going back to do a complete failure modes inspection analysis, and what can fail, and how can it fail, and what are the consequences.

And where can you draw the appropriate inspection lines to cut it off before you get to anything significant.

MEMBER SIEBER: Doesn't the existence of the order change your plans?

MR. MATTHEWS: Well, the existence of the order clearly changes what individual plants are having to do as they go into their outages.

MEMBER SIEBER: Right, and how often they do it.

MR. MATTHEWS: And how often they do it. If we come up with a plan that is less -- I will use Brian Sheren's word -- onerous for the high susceptibility plants, and yet a completely acceptable plant, we would be presenting that to the staff and working with the staff to convince them that it would be appropriate to change that order, or as we work into the code to work and get a set of inspection criteria in plans that would be more appropriate for those plants.

Our new approach recommends a combination of baseline inspections. We pulled MRP75 from review by the staff, but then in December, we sent a letter -- the MRP sent a letter to all the plants recommending a series of baseline inspections.

And even though the low susceptibility plants should do baseline volumetric inspections, and the timing of those inspections and the reinspections as we move forward will be based on technical evaluations that we put together, and it will be in combination with more frequent bare metal visuals.

In fact, our bare metal visuals were not every cycle even for high susceptibility and MRP75. Looking at the wastage issue, et cetera, I believe we are going to be changing those recommendations for the high susceptibility plants to go even more frequent on the bare metal visuals.

The safety assessment that we are putting together starts like I said with a failure mode effects analysis and it will include many of the tools, and analysis tools that we already have done analysis, and we are working on as the technical basis for MRP75, but we need to step back based on recent inspection results and see if those inspection results have impact on our previous analysis.

MEMBER WALLIS: Now, this safety assessment is not a risk assessment?

MR. MATTHEWS: Risk is part of that assessment.

MEMBER FORD: Since you brought this

subject up, in April, will we be reviewing again the utilities view on calculation of delta-CDFs? You heard it for the Oconee and for Davis -- well, we have not heard it from Davis-Besse, but we have been given to understand that it is very similar to the Oconee justification, in terms of small delta-CDFs.

MR. MATTHEWS: Yes.

MEMBER FORD: Are we going to hear a reevaluation of that approach?

MR. MATTHEWS: Well, it is certainly part of the plan. We won't be through with the reinspection plan by that point in time.

MEMBER FORD: No, but in April will you be reviewing again the rationale for your delta-CDF calculations?

MR. MATTHEWS: I don't believe it was in what we were going to present. I think we already went over part of that at one point in time.

MEMBER FORD: Well, in June when we brought this question up, in June of last year, when we brought this question up, you said, oh, we are working on it, and we will get back to you, or we will be getting back to you.

MR. MATTHEWS: Oh, okay, and we did not discuss it in detail back then?

MEMBER FORD: No, you said we don't have much to report and it was in June, and you said that we don't have much to report. But I guess you have more to report now.

MR. MATTHEWS: Well, we had more when we submitted MRP75, but like I said, we have to go back to --

MEMBER FORD: Well, it has not been given to us. We have not seen it.

MR. MATTHEWS: And we are going back and we are going to reassess what that really meant, and what the inspection results might do. And the main driver for those would be -- well, it show you model the crack propagation for one thing.

MEMBER FORD: Correct.

MR. MATTHEWS: And then also what is the probability of leakage, which was one of the input parameters to that. And those things are going to be in and are being reassessed to assess what impact that would have on the core damage frequency.

MEMBER FORD: Okay.

MR. MATTHEWS: We are going to use the results of the FMEA to help us establish the required technical evaluations that we need to do, and ultimately the inspection detectability requirements.

We believe that our current calculations that we have been doing show that the non-visual inspections do not have to be performed every refueling outage to ensure safety.

But we have to put together the story for the staff in an manner that they can review and --

CHAIRMAN BONACA: For all plants, irrespective of the susceptibility?

MR. MATTHEWS: Yes. We don't believe that even the high susceptibility plants need to do a hundred percent NDE on the nozzles every cycle to assure a lot probability of nozzle rejection.

CHAIRMAN BONACA: You would have to convince yourself that wastage cannot --

MR. MATTHEWS: Well, part and parcel with that is coupled with bare metal visuals every refueling outage to make sure that you don't have wastage going on, along with the technical arguments that you cannot develop safety significant wastage conditions in one cycle.

If you can, then we have got to reassess that, too.

CHAIRMAN BONACA: So you expect then a visual inspection every cycle?

MR. MATTHEWS: Yes, that is our current or that is going to be our recommendation. I am pretty sure of that, and I am pretty sure that is where we are going for the high susceptibility plant.

MEMBER FORD: So, in April, you are going to go through and give some examples of this and this data, et cetera?

MR. MATTHEWS: Examples of?

MEMBER FORD: Well, you are saying existing calculations show --

MR. MATTHEWS: Yes.

MEMBER FORD: I mean, it is a bullet sized statement.

MR. MATTHEWS: Yes. If we are through to the point that we can review it with the staff, et cetera. I said that we need to back off and make sure that what we put together on this crack growth, and the reinspection interval, is rigorous, very rigorous.

And so we are going all the way back and looking at all of the assumptions that we are putting into it, and I don't know if we will be through with it by April.

MEMBER WALLIS: When you say it is a significant wastage, you mean making a hole that compromises the integrity of the head, or one that compromises the ability to hold on to the control rod?

It seems to me that is a different thing.

MR. MATTHEWS: Either one.

MEMBER WALLIS: Davis-Besse compromised both, but it is not clear that you have to have a big hole in the head in order to compromise the integrity of holding on to the guide to, because you could waste the welds, or the waste around the weld in some way that would --

MR. MATTHEWS: Well, I think we could easily show that it wouldn't launch without a fairly decent -- I think we could show that even if you had an interference fit of minus a half-an-inch, or more, that covered the whole weld, it still would not launch from a structural standpoint.

CHAIRMAN BONACA: And the other concern that I have is not -- we used to say that wastage cannot happen. So therefore we excluded it, and we were all worried about cracks and accidents, and we said, oh, a system operational crack can happen. So we worried about those.

And we find wastage now and we say, okay, now we understand it all. So we have to demonstrate that if a leak starts the day after you start the plant, and over a two year period, which is until the next shutdown, nothing will happen of risk significance here.

Well, I am not sure that we understand all the aspects of this process by which we have cracking, and leakage, and wastage.

MR. MATTHEWS: Well, that is the point, and that's why we have said that we are not going to base our future inspection recommendations if you will on what has happened.

We are gong to go and do a rigorous failure modes and effect analysis on what can happen, and what should we inspect to make sure that the safety issues don't happen.

MEMBER WALLIS: Well, we do know where the wastage starts, and does the wastage start on the top, or does it start at the bottom, and there is a cavity and there is a cave. Does it start at the bottom of the cave, or does it start at the top? Do you know that yet?

MR. MATTHEWS: No.

MEMBER WALLIS: So you may have difficulty understanding how much wastage you can tolerate if you have enough down there then it might weaken the weld wouldn't it?

MR. MATTHEWS: Well, you can't have a significant volume of wastage without something being there on top of the head. The stuff is bigger than steel, and it is not going back through the crack.

MEMBER WALLIS: Well, you are saying that you don't know how the wastage proceeds.

MR. MATTHEWS: Right.

MEMBER WALLIS: So how much wastage could occur between cycles.

MR. MATTHEWS: That is the point of the boric acid corrosion testing that we are going to be doing in the modeling, et cetera.

MEMBER WALLIS: Well, since we don't know how wastage develops, we can't quite tell how much and where and how significant the wastage could be between cycles.

MR. MATTHEWS: Well, that is what we are going to try to quantify in the lab and through this model.

MEMBER WALLIS: Well, it would be important that you do it pretty rapidly, right?

MR. MATTHEWS: Yes.

MEMBER FORD: Could you put 15 up again, please.

MR. MATTHEWS: If I can find it.

MEMBER WALLIS: Because I think what is throwing everybody at this point here is if you look at the second bullet, the first subbullet, you say that calculations show a extremely low probability of nozzle ejection and significant wastage.

And I think what people are questioning right now is right now, you don't know how you can substantiate that conclusion and get wastage.

MR. MATTHEWS: Well, we are going to have to, and number one, it is based partly on the fact that we are going to be recommending a visual exam every cycle.

But I recognize that we have to be able to demonstrate that you cannot get safety significant wastage in that one cycle of operation, even if the leak started when you first started up.

MEMBER WALLIS: Okay.

MEMBER KRESS: But those probabilities come out of your FMEA?

MR. MATTHEWS: No, they would be coming out of our probablistic fracture mechanics, parts of it, and also we had a probablistic model for wastage which requires tuning, we understand.

MEMBER KRESS: Well, FEMAs generally quantify probabilities by expert opinion and I just wondered if that is how you arrived at these particular bullets.

MR. MATTHEWS: No. No, in fact some of these are deterministic conservative, deterministic calculations, which will show that the crack growth is going to be significant, you know.

And I don't have the calculations. We are not through with them. But we feel pretty confident based on crack growth rates that we believe should be used that we can reach these kinds of conclusions. We have not documented it yet. We haven't done it yet.

MEMBER WALLIS: I just really wonder if you know. If you have got a very small leak squirting out a jet of boric acid which is concentrating as it comes out, there is all kinds of things going on there that can cause pretty rapid wastage locally.

And I am not sure that you have much of a handle on those things.

MR. MATTHEWS: Well, there have already been quite a bit of experiments done on various wastage mechanisms from hot streams impinging on hot steel, or cold streams on hot steel and that sort of thing have already been done.

And you can get significant wastage rates under certain conditions. And we have used that information to build this phenomenologic model last summer that was in our basis for MRP75.

Our experts have told us though that we need more data to back that up in certain areas, and that is what we are going after in our lab tests. Am I half through? The letter that we had sent out is basically as far as the types of inspections that we are recommending under the heading in DE.

We are pretty consistent I believe with what was in the orders and the Bulletin 2002-02. And the timing is not terribly inconsistent either. We may be a few months off, but the letter that we sent out in December is pretty much saying when low, and medium and high plants ought to be doing these types of inspections.

We are still looking at time and temperature to form the basis for the susceptibility groups. We still don't think we have enough information to conclusively start to subcategorize plants.

What we have recommended and I think the order is putting it in place that it is not expected any more and that it will happen, and the high susceptibility plants will perform some kind of volumetric exam by the next outage. Moderates around 2005 at the latest, and the lows around 2007 at the latest.

MR. ROSEN: And TQM.

MR. MATTHEWS: Well, I didn't make this slide, but I think that is where FMEA supposedly started. We built these tables of all the possible failure mechanisms and track them through to the ultimate consequence, and look at relationships.

I think that there is a chart in here, and I think we put it in, yes, later. There are three basic failure mechanisms that they postulated at this point, although they are not ignoring anything else that could happen. Nozzle ejection due to the circumferential flaw that leads to ejection. Cladding blowout due to wastage, and --

MEMBER WALLIS: Well, what is that?

MR. MATTHEWS: It is a rupture of the cladding surface area because you have wasted down on top of the head. Davis-Besse's is only a little bigger and so that it erupts.

MEMBER WALLIS: You mean the stainless steel?

MR. MATTHEWS: Yes.

MEMBER WALLIS: And the liner is the cladding?

MR. MATTHEWS: Yes, the stainless steel cladding. And then another possible safety significant issue is some RCS damage due to lose parts generation if the bottom part of the nozzle gets in enough pieces and goes in the wrong places, and all of that is going to be included.

There is lots of different failure mechanisms, or levels, and if you will look at the next chart, if you can read it, and I realize that it is pretty small, too. But across the bottom is the initiation type of events, and how they progress as you go up, ultimately leading to core damage as the high level.

At various points in this progression, you can insert inspections, and some of the things that you can't do anything about because there is no way to know that it is happening. Others you can do an inspection to stop that pathway if you will.

And this is kind of the framework in which we are trying to assess the overall thing of what inspections, and what timing, et cetera, we ought to be putting out.

MEMBER FORD: And this is conceptual, and how close is it to reality?

MR. MATTHEWS: Well, some of these things have happened.

MEMBER FORD: Does failure to SCRAM come

into this thing? Have you launched a control rod into other controls?

MR. MATTHEWS: Yes, that would come under the consequential damage up in the --

MEMBER FORD: So there is a SCRAM somewhere in there?

MR. MATTHEWS: Well, that would be up under the consequential damage evaluation, the second line from the top.

MEMBER FORD: The reactivity transient, is that what you are saying, that it would be under that?

MR. ROSEN: Or damage to other mechanisms.

MR. MATTHEWS: Damage to other mechanisms would be --

MEMBER FORD: I just wondered if it was not worth a box by itself.

MR. MATTHEWS: Well, all of those consequential damage things would have to be evaluated. Each of the conditions would be classes and not credible, and not actionable or actionable, and you need a very strong case to say something is not credible.

MEMBER WALLIS: Well, if it has been used before.

MR. MATTHEWS: Not credible?

MEMBER WALLIS: Yes. Credible has been used before.

MR. MATTHEWS: Well, you need a very strong case.

MEMBER POWERS: You are just overly credulous.

MR. MATTHEWS: That's why it has to be a very strong technical argue to say that anything on this chart would be not credible.

MEMBER WALLIS: The other thing is a finite probability of occurrence, and I think we know that.

MR. MATTHEWS: Well, credible has a definition that is not zero, I think, and so --

MEMBER WALLIS: Is the point of all of this just formalizing a life management or degradation management technology?

MR. MATTHEWS: It really is. What we have been doing in the past was what have we seen, and how can we show the plants are safe based on what we have seen, and I think I said here, and I know that I have said it in other forums, every outage season we were surprised by a new inspection plan.

MEMBER WALLIS: And so as more things become credible?

MR. MATTHEWS: Yes, or things become thought of anyway.

MEMBER FORD: So would this be used in some sort of proactive way that --

MR. MATTHEWS: That is the intent, is to say we are not just going to look at what has happened. We are going to look at everything that can happen, and trying to assess its likelihood, and trying to assess what inspections we might be able to do if we need to do it to prevent it, and to interrupt that chain to core damage if you will.

MEMBER FORD: And what would the role of the NRC be in this? Would you have to approve this, or is this purely a -- I am asking you for more information.

MR. MATTHEWS: Well, this would be part of our technical basis for an inspection plan that we might put together or will put together that might differ from the orders, and would be the basis hopefully of what goes in ultimately into the ASME code as the long term inspection program.

And the NRC would certainly have to buy off on anything like this, and the overall process, and the overall plan, to modify the orders --

MEMBER FORD: So this would be the basis

of the relief from the order?

MR. BATEMAN: The staff's long term plan, given that we can reach agreement with industry within a reasonable amount of time on this, is just as Larry has said. In fact, we have representatives on the co-committees that are working to get this in the code.

Once it gets in the code, and we are all in agreement with that, then of course we indorse that through 55A, and in that way get it into the regulations, and it becomes a regulatory requirement. That is our goal at this point.

MR. MATTHEWS: And right now we have the orders in place, and people are going to have to live with those orders, unless and until they can provide the technical justification for any kind of relaxation that they might be going after individually.

Or we as an industry can put together the arguments and convince the staff before the code has codified the new rules that the order merits relaxation in certain areas.

There is a list of other factors that will be considered in the overall process that we are going to go through. And then proceeding along with part of the overall process, we will be assessing the frequency of occurrence, and that will be based primarily on the inspection results to date.

And we will also be using crack growth rates from MRP 55, and addressing all the small and medium break LOCA analysis, and consequential damage assessments, and then also loose parts damage, and that is all part of that whole process.

And we intend to put together this comprehensive safety assessment, and it will be the basis for our revised inspection plan. It will reference other documents that have been put together. We still need to do and revise some of our calculations, and some of the models that we used in MRP 75, but much of that work is pretty good the way that it stands, maybe with minor revisions.

MEMBER WALLIS: And this medium break LOCA analysis, do we have a medium break LOCA analysis that includes the fact of this high velocity stuff on the control rod drive mechanisms, and the various other things up there which are above the head?

MR. MATTHEWS: It would be coupled with the consequential damage assessment, which I believe is the next line on the slide.

MEMBER WALLIS: So that is part of that?

MR. MATTHEWS: Yes. And we will couple all of that together to try and figure out what it does to the core damage frequency.

MEMBER WALLIS: And has that been done yet or is that to be done? Do we have a handle on it yet?

MR. MATTHEWS: We have done some looks at what the consequential damages are, and it doesn't look like there is a lot of consequential damages that lead to an increase in contributions to the core damage frequency.

You could cut a lot of cables, but that is not going to hurt you because the rods are going to go in, and that sort of thing.

CHAIRMAN BONACA: Going back to the fact that you are going to recommend that not in every outage that you have to have a visual inspection, wouldn't you want to have a baseline inspection for each plant?

MR. MATTHEWS: We have recommended that every plant do that.

CHAIRMAN BONACA: But the baseline inspection is not necessarily really --

MR. MATTHEWS: No, it is. It is. We have recommended that every plant do an under the head NDE inspection, and some of those are on a time schedule comparable to what the staff has recommended, and so the low susceptibility plants may be a few years away, but we have recommended that everybody do at least a baseline.

CHAIRMAN BONACA: Because, I mean, if you have that, and then you detect some perceived cracks, but no leakage, you can refer to some kind of growth rate over a cycle, and then support a strategy of just visual inspections or periodical. Otherwise, I don't see how you can do that.

MR. MATTHEWS: Well, we have recommended a baseline volumetric exam or NDE exam, and it could be any current full weighted surface for everybody.

MEMBER WALLIS: Well, if you have done such a wonderful job, I wonder what the staff has to do?

MR. MATTHEWS: Well, they do one and we do one, and then they do one, you know. So we are kind of hand-in-hand if you will, although they have not approved ours, and we don't have any choice on theirs.

MEMBER WALLIS: Well, this is an interesting example, and if you guys did a really fantastic job on this, they wouldn't have to do much would they?

MR. MATTHEWS: Exactly, and if we had done some of this stuff much earlier, or recognized that we needed to do some of this stuff much earlier.

MEMBER WALLIS: If you had done your homework right at the beginning, the professor would not have had to intervene.

MR. MATTHEWS: Some people would say that, yeah.

MEMBER FORD: In the second to last bullet, you say prepared to discuss the contents. Is that discuss with the ACRS?

MR. MATTHEWS: It was with the staff, but certainly whatever we have discussed with the staff at the appropriate time we can come back to the subcommittee.

MR. ROSEN: First the staff and then the ACRS, please.

MR. MATTHEWS: Yes. That is kind of what I was trying to say,

MEMBER FORD: I see that you are saying to have a revised inspection plan by the summer of 2003. And steps to that time line are presumably your boric acid prediction work.

MR. MATTHEWS: That certainly is going to factor into it. I am not sure that it is the -- if we are going to be doing experiments, we probably won't even be through with those experiments in time for that, but I think the main driver here is going to be the calculations on crack growth rate and that sort of thing.

MEMBER FORD: You checked the boric acid corrosion as the one that has given us the biggest pain.

MR. MATTHEWS: Well, it has all been a pain to me. One of the things that you had asked about, or I believe you had asked about, was the status of our inspection demonstration activities. And Tom Alley from Duke is the Chairman of the Inspection Working Group within the Alloy 600 ITG.

And he was going to make the presentation at the subcommittee meeting, but I have got a subset of his slides. What he was going to cover is a little bit of background, and the top of the head visual examination guidance that we issued, although I don't think that wound up in the summary in any detail.

MRP approach to NDE demonstration for these penetrations, and then the process we had in '01 for demonstrating the techniques and the results from that, and then the '02 demonstration process, and then what is planned for the future.

The original 97-01 demonstration, we have had a demonstration program operated by the EPRE NDE center on head penetrations all the way back to the mid-'90s as a result of the Bougeis crack.

At that point in time, everybody was concentrating on ID axial flaws, or ID flaws, and the techniques that were in use were current for the detection of the ID of the tube only, and UT for sizing if something was detected.

And there were programs put together back then to bring the vendors in to qualify them to do -- well, qualify may not be the right word. But to have them come in and demonstrate their techniques for doing those exams.

The OD tube cracking and the weld cracking showed up and we needed to modify those techniques. The visual evidence of leakage on top of the head wound up being vastly different than what people had thought we would see as a result of a through wall flaw.

And so our visual examination recommendation need to be change changed, and the first phase of the MRP demonstrations subsequent to the OD cracking were available to support the fall '01 outages, which was -- how long ago was that? A year-and-a-half ago.

And it was aimed at detecting safety significant flaws in the tube material, and the second phase was put together and performed during the summer of last year to support those fall inspections, and in that demonstration process we had J-groove weld flaws so that vendors could demonstrate techniques for inspecting the J-groove welds, and we had more base metal flaws for evaluation and the capability of depth sizing them than we had originally had in our program.

MEMBER FORD: I seem to remember in the original FEN work that you are talking about in June, that you had probability of detection figures in that. Is that correct?

MR. MATTHEWS: Yes, they were estimates.

MEMBER FORD: Well, so they didn't come out of this study?

MR. MATTHEWS: No, we don't have enough flaws and enough samples to really come up with a rigorous probability of detection, and so those were based on estimates at that point in time.

MEMBER FORD: So they are conservative estimates?

MR. MATTHEWS: I am not even sure. That is part of the other thing that we have got to evaluate. I am not sure how conservative those estimates were. For the visual, I think they were quite conservative.

You know, it is like 60 percent detection of a leak on top of the head, and if you missed it the first time, you are like down to 12 percent the next time. So those were pretty conservative for visual, but then the volumetric, I think that the folks had just pulled some curve from other types of UT data inspections.

MEMBER FORD: So they were not specific to this geometry or necessarily fit --

MR. MATTHEWS: No, I don't think they were at that point in time. One of the other parts of the demonstration program back in '01 was that we had cutoff nozzle segments from the bottom of the Oconee nozzles, which had actually PWSCC flaws in those nozzles.

The original demonstration blocks used these type of flaws, and used these actual flaws, for vendors to demonstrate their capability to detect.

MEMBER WALLIS: This is a real nozzle?

MR. MATTHEWS: Yes.

MEMBER WALLIS: And are those veins or flaws?

MR. MATTHEWS: Yes.

MEMBER WALLIS: If I had anything in my house that looked like that in my piping system, I would get pretty nervous.

MR. MATTHEWS: Well, they cut it off and repaired it, yes.

MEMBER WALLIS: There were things that were very difficult to see, and there were only a few of them, and --

MR. MATTHEWS: Well, you are probably looking at PT bleed out here, and you are probably not looking at a visual of the flaw. This is probably a PT bleed out.

MEMBER WALLIS: Well, it is highlighted by the --

MR. MATTHEWS: Yes, highlighted by dipenetrative tests.

MEMBER WALLIS: It must be.

MR. MATTHEWS: And I am pretty sure, or I am almost positive that the bottom one is.

MEMBER SIEBER: Varicose veins.

MR. MATTHEWS: Yes.

MEMBER WALLIS: And even so, it is riddled with flaws one could say.

MR. MATTHEWS: Well, a lot of these were shallow, although there is one there on the bottom that was certainly ID connected. But these were used to demonstrate the capability to detect the tips on actual PWSCC flaws, and then the mockups were built.

And at that point in time, we were not implanting flaws. We were using notches, and the mockups were more to demonstrate the capability of the tooling to deliver the sound to the geometry.

And the flaws weren't used to demonstrate the capability to detect the flaw. In the 2002 mockups that we put together, we called in a Tiger team of people to come up with let's build a nice mockup for a blind test.

It was going to be blind, and it would demonstrate the sizing capabilities, full-scale, and establish what kind of thresholds that we could and could not see.

We didn't have enough to determine the probability of detection. We just don't have enough flaws and samples. But we were also working to get practice blocks so that the vendors could come in and practice and not just hit them cold with a blind thing that they had never run on a real flaw.

And then we included the effects of the ID crazed cracking that had been seen before, and how that might mask the ability of the detection to see the significant flaw underneath it.

All the demos that had been performed had to fall in characteristics that were blind, and the vendors did not know where the flaws were, and how big they were, and what their orientation was.

The team put together the flaw design, the mockup design, and it has been held pretty close so that the vendors couldn't do it. It was a procedure demonstration though. It was not a test of -- like PDI, where you are qualifying an individual to do it.

It was a procedure demonstration, and so it didn't have acceptance criteria, and it was to show what you could do, and demonstrate what the best techniques were able to do, and measure the limits on what they could detect.

MEMBER WALLIS: What techniques were used? UT?

MR. MATTHEWS: A wide variety; mostly UT and EDY current in various transducer sizes, shapes, angles, beam paths, et cetera.. The demonstration protocol was that a vendor would collect the data on the mockup without knowing what was there, and produce findings.

And then it would be evaluated, versus what we knew was in the mockup, and its ability to detect, and figured out his ability to locate with respect to the pressure boundary in the weld. And sizing results were documented, and false call performance was documented.

And also in the process the evaluation process that the vendor was going to use on the UT or any current data had to be documented in the procedure, and it was captured by the process.

So that then we could go back and make sure that it is the same process that is being used when they are in the field. And then the results of all of those demos have been provided to the utilities as they are going into doing demonstrations or examinations.

This is a complicated examination volume to try and do, and the vendor UT inspection procedures include many techniques in probe combinations. There is an open tube probe that can be used if there is no thermal sleeve or dry shaft in the tube, and you have the whole open ID to put a round probe up in it.

You can mount a good number of transducers and EDY current coils on, and where you have thermal sleeves, the blade probes are used, and many of those are designed to accomplish a specific purpose, like query the OD region for axial flaws, or the OD region for circumferential flaws. They are focused at different bits, et cetera.

MEMBER SIEBER: You can't do the root with the blade type probe though, right?

MR. MATTHEWS: I believe one vendor has demonstrated some capability in that arena.

MEMBER SIEBER: Because that is where the stress concentrations are going to be.

MR. MATTHEWS: The root of the weld?

MEMBER SIEBER: Yes. Well, the root -- you are going down an annulus with a blade, right?

MR. MATTHEWS: No, we are coming up from the bottom with the blade and in contact with the ID of the tube, and looking into the tube.

MEMBER SIEBER: Right.

MEMBER FORD: So when you made up this experimental matrix, what input did you have from the vendors in deciding on that experimental matrix, and was there any lessons learned from the French experience by Framatome?

MR. MATTHEWS: Oh, you mean the matrix of where the flaws would be located?

MEMBER FORD: Well, the matrix of the whole procedure, and how you went through this demonstration process, and the procedure, and the experimental matrix, and what input did the vendors have, and into that input was there any experience gained from that from France?

MR. MATTHEWS: Well, the overall protocol from doing the demonstration, the basic protocol was established even back in the '90s when we did the ID axial flaw demonstration. That it is going to be blind, and you are going to record in your least sensitive mode first.

Like you are going to have two different scan rafters, and one is five and one is three, and you have got to record the five first, and report the results, and then record the three.

Those kinds of processes. I believe that basically the NDE folks at the utilities and at EPRE put that process together for how to demonstrate.

MEMBER FORD: And did it draw on experience from France?

MR. MATTHEWS: I am sure that as the original protocol was put together that there was lots of communication with the French people. The French really have not done a whole lot on UT qualification I don't believe. Theirs has been mostly ID.

But they do a lot of inspections in the process, and those processes were very similar to the process that was used in the U.S. for doing the examinations, and I guess they have never seen any OD axial or OD flaws and that sort of thing.

So I guess I am not sure where you are trying to go with your question.

MEMBER FORD: Well, I just wanted to make sure that -- well, this is a critical area, and I just wanted to make sure that all information available world-wide was being used in both the definition of the experimental matrix that was used for this demonstration.

MR. MATTHEWS: Well, as far as the techniques, the UT probes, and the UT probe angles, and the scan patterns, et cetera, we did not dictate those. Those were developed by the vendors, and it was the vendor procedure and the vendor process that was brought in to demonstrate.

We were more of a demonstration source, and we have a mockup and come show us what you can do. We know what is in there and you don't. Tell us what you can find, and they come in and use their best processes.

And over time their processes have been modified and enhanced to make them better as a result of the initial demonstrations a little later. Some results. The blade probe UT. And the results from the vendors are quite similar from the ones that have done the demonstrations. Flaws ranging from about 15 percent to a hundred percent through wall, and equivalents have detected when the flaws were oriented perpendicular.

MEMBER WALLIS: You mean some flaws, or all flaws?

MR. MATTHEWS: It means that it is almost all flaws, I believe. There were flaws missed, and we have all the detail on every flaw and every mockup, and on every technique, and what the vendors did and how well they did it. This is just kind of a high level --

MEMBER WALLIS: I think the measure of success would be so that, let's say, that 95 percent of the flaws, or 99 percent, or something, were detected. The fact that some were detected doesn't tell us very much.

MR. MATTHEWS: Okay. We have the details.

MEMBER WALLIS: I noticed that it is later on.

MR. MATTHEWS: Yes.

MEMBER WALLIS: First of all, I thought you were detecting only 15 to a hundred percent of the flaws, and that is --

MR. MATTHEWS: No, no, 15 to a hundred

percent through wall, and on the blade probe, you will notice that it is about the same -- whether it is oriented perpendicular to the beam angle, or horizonal to the beam angle, and that is because it is a tip diffraction technique, and the defracted pattern comes back in all directions.

And so it should really -- both patterns were fairly good at detecting these things. The open tube rotating probe is essentially the same kind of capability. It is just tabled to deliver more probes faster because they are all on one mechanism.

MEMBER WALLIS: A flaw and crack are synonymous here?

MR. MATTHEWS: Yes, except that the flaws here were probably squeezed notches and other things that we have worked with the NRC on in demonstration processes.

MEMBER WALLIS: These flaws are typical or are they representative of the real cracks and the real thing?

MR. MATTHEWS: They are not the real thing, but they are mocked up to give very, very similar UT responses by the way they are put together, very tight cracks that are then hip-squeezed and demonstrated that the signals are very similar to the type that you would see from a real flaw.

MEMBER LEITCH: Are false positives an issue with this type of process?

MR. MATTHEWS: Pardon?

MEMBER LEITCH: Are false positives an issue? Do they identify flaws where there are none?

MR. MATTHEWS: Yes, we track that on their demonstration, and that is one of the things that we did, and we would call it a false negative.

MEMBER LEITCH: You would find a flaw that is not there?

MR. MATTHEWS: Exactly and we track that, too, as part of their demonstration process and that is reported, too.

MEMBER LEITCH: Is there a great deal of that?

MR. MATTHEWS: No, I don't think there was a great deal. There was some. There was some, but especially for reporting small flaws that weren't there. I am trying to remember. There is one -- if you look on the next slide -- well, let me finish this one.

The open tube root rotating probe, one of the vendors tried to demonstrate his ability to see beyond the tube OD into the weld, and he could, and that vendor was at least able to demonstrate that for the law flaws that went all the way through to the annulus, to the triple point, and he was able to detect those.

But if they are any significant distance into the weld, and not up next to the tube --

MEMBER POWERS: Well, forgive me, but a triple point to me where they dissolve the liquid and the gas are in equilibrium.

MR. MATTHEWS: It is at the triple point where three different kinds of metal are coming together, and air, and it is the root of the J-groove weld.

The next slide is just an example of the kinds of information that was recorded from each one of the vendors as they went through, and the different techniques are down to the left, and the different flaws are across the top. And then how well they did on each particular one.

MEMBER WALLIS: I think it would help if you said something about the information included the numbers of flaws, or the size distribution, or something, because simply saying that they were detected doesn't tell me whether there were a sample of 4 or 5, or a sample of 400, or what it was.

MR. MATTHEWS: Well, it certainly was not 400. We only had a very few mockups, but each mockup had a great number of flaws.

MEMBER WALLIS: So, what, hundreds of flaws, or --

MR. MATTHEWS: No, it wasn't hundreds. There were probably 10s of flaws in each one, and oriented in each kinds of different --

MEMBER WALLIS: And they were all detected?

MR. MATTHEWS: No.

MEMBER WALLIS: Almost all?

MR. MATTHEWS: Most of them were in the base metal certainly. They were in the weld metal, and UT was not seen into the weld, and so it is not an effective technique for querying the weld metal from the ID of the tube.

MEMBER WALLIS: So again you say that three flaws were missed, and that does not tell me much unless I now that 97 were detected, and if it is 3 out of 3, that is very different from 3 out of 10, or 3 out of a hundred.

MR. MATTHEWS: It would likely be most -- well, where are you looking?

MEMBER WALLIS: It says four flaws less

than 24 percent were totally missed. Now, does that mean that those were all the flaws less than that size, or --

MR. MATTHEWS: It was probably. It might have been all of them. I would have to go and get information on that.

MEMBER WALLIS: Well, that information needs to be represented somehow here.

MR. MATTHEWS: And that information is available as we get ready to do an examination. As far as the weld metal or the weld surface exams, especially in the EDY current arena, you can imagine that the detection is very sensitive to the surface condition.

For welds that were ground smooth, they detected very short flaws and fairly tight flaws, and those were pretty effective in detecting those things. But if you get on to the unground condition, they were able to detect one flaw that was half-an-inch long and they then missed one that was 1.42 inches long.

MEMBER WALLIS: The width is an average width or something?

MR. MATTHEWS: Yes, I think so.

MEMBER WALLIS: I mean, they are not a constant width?

MR. MATTHEWS: No, it is probably an average or a max, but I am not exactly sure how that was reported. I must say that this unground mockup in the demo was -- it was a rough, rough weld. I am not sure there are any in the field that were as rough as that one.

But it was kind of bounding, and if you got a smooth one, they were really good, and if it was really rough, there was the potential of missing some stuff.

MEMBER WALLIS: This is the bigger one, and there was more than one, but they did miss that big one. And it was parallel to the weld beads, and you have got dips in the weld, and it might have lifted off. I am not exactly sure. Or it could have been that their analysis procedure was calling it a bead interface, as opposed to a crack, and it was really a crack.

MEMBER FORD: Are these surfaces normally ground?

MR. MATTHEWS: In some plants they are ground, and in some plants they are as welded.

MEMBER FORD: And corroded.

MR. MATTHEWS: Well, they are all corroded probably, too.

MEMBER FORD: I guess my question is whether this is a pristine surface, which is then ground, or have these surfaces been corroded beforehand?

MR. MATTHEWS: I don't think so. I think the unground samples were probably as welded and cleaned up as you would clean up a weld. I don't think that these have been operated in any kind of environment. They were not field samples actually.

We have future demos going on and planned, and Tecnatom from France, or I guess Spain, I guess it is, is planning to come in this year and demonstrate their capability on the attachment welds.

Framatome was supposed to do a demonstration of ET on the attachment weld this last month, but I think that has been delayed a little bit.

WesDyne is doing or coming back for more demonstrations on UT of the tube weld interface, and ET attachment weld, and they are also looking at a technique for the welds of some sort of thermal imaging.

And I am not sure exactly what that process is, and maybe they are going to flash an infrared scan or something. I am not sure. And Framatome has another process for weld surface areas that they are wanting to look at.

MEMBER SIEBER: Do you know who did the past demos?

MR. MATTHEWS: WesDyne and Framatome had been the two that have come in and demonstrated various parts of their technique for various things.

MEMBER SIEBER: Thank you.

MR. MATTHEWS: B&W Canada also plans to come in this quarter and do some demos. They are being asked to bid on pre-service on some of the heads that they are manufacturing, and they have been asked to demon their capabilities, too.

In the future, we are building new mockups still, and the existing mockups will hopefully be made available to the vendors for practice. We will tell them what is in there and let them practice, and improve their techniques.

We are also looking at what the inspection requirements might be for new heads, and are they different. One of the things that we are looking at is the metal equivalent studies, and does sound behave the same at 690 as 600.

If it does, then the demonstrations that have been done on 600 would be appropriate for 690. If it doesn't, then we may have to go build mockups.

MEMBER WALLIS: How can it be different?

MR. MATTHEWS: Well, it is a different crystal. It is a different alloy, and we are talking how noisy it is. Every type of metal has got a different sonic characteristic.

MEMBER SHACK: Grain sizes change.

MR. MATTHEWS: Yes.

MEMBER WALLIS: I thought the speed of sound in steel was about the same in all steels, but maybe you need to --

MR. MATTHEWS: No, it's not.

MEMBER POWERS: Speed is.

MR. MATTHEWS: Yes, but you have to put that into account, and is it simulated, attenuated, and how much backscatter you get off of grain interface, and that sort of stuff.

MEMBER SIEBER: Sometimes it is swamps out what you are looking for.

MR. MATTHEWS: Yes, like cast dust in stainless steel is very difficult to examine. We are also planning very shortly to put out -- it says requirement, but it would certainly be a recommendation on what pre-service everybody ought to do on their heads before they put new heads into service.

And as a baseline before they go into operation to get ready for future exams, and now what is there. We are also at this point taking a look at the bottom mounted instruments and those nozzles on the bottom head of the vessel.

At this point it is taking a look and seeing what has been done. We know that the French have done some examinations, and we want to figure out what tooling they have, and what the capabilities are that currently exist for looking at those, besides just visual on the bottom.

Lots of people are doing visuals on the bottom head now, but if you had to go in and do a volumetric on it, we want to find out what is out there, and that is something that we are looking at right now.

MEMBER SIEBER: Let me ask a question. When a licensee buys a head, and even if it is 690, you are going to be under the same inspection program because there is no 690 danger or not enough to say that it should be any different than 600.

So do they do anything like electropolishing the clad and so forth so that they can decontaminate the head surface, and have a better interface with the --

MR. MATTHEWS: I know that Oconee is talking about electropolishing the whole clad, or some people are anyway the whole underhead clad surface --

MEMBER SIEBER: That is what I am talking about.

MR. MATTHEWS: -- and that kind of thing. I know that people have done it to their steam generator channel heads.

MEMBER SIEBER: Well, it made a big difference as far as radiation is concerned, and it is not that expensive when it is clean than when it is new.

MR. MATTHEWS: I am not exactly sure. Some people have jumped through hoops to get heads and have gone at a more leisurely pace to replace their heads. So whether the guy is doing in '07 or '08 might be a little different than what Oconee or North Anna is doing.

MEMBER SIEBER: Right.

MR. MATTHEWS: One more slide, and it looks like I might be finished.

MEMBER WALLIS: On the first bullet here, it seems to me that you have done a lot of work, and I am very impressed by all these activities, but I do not see the intellectual backbone that says how much do I need to do, and what does it mean, and how do I interpret it, or is there an analysis that backs it up and all that kind of stuff.

So I am looking for a more academic intellectual backbone of this really good experimentation and investigation of things. I don't know how many of these tests you need, for instance, to reach a conclusion and that sort of thing.

MR. MATTHEWS: And we have expertise at EPRE,a nd we have expert panels that we have called on and Mr. Shack participated in some of the crack growth expert panels.

MEMBER FORD: But, Larry, I understand that in April that you will be getting all this academic background stuff to support these conclusions. That was the understanding, I think, and I look forward to that.

I thank you very much indeed for coming, and look forward to seeing you in April, along with your colleagues. Thank you.

MR. MATTHEWS: I will bring some help next time.

CHAIRMAN BONACA: Thank you very much for the presentation, and at this point we will take a break, and let's get back again at 10 of 4:00.

(Whereupon, at 3:32 p.m., the meeting was recessed and resumed at 3:55 p.m.)

CHAIRMAN BONACA: Okay. We are back in session, and we are going to review the draft final revision-1 to Regulatory Guide 1.180, DG-1119, Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems.

And Jack Sieber will take us through this presentation.

MEMBER SIEBER: Thank you, Mr. Chairman. I would point out that if you look in your notebooks that it is Tab 5 and is the information that has been made available to us, and represents the foundation, mainly the Oak Ridge reports, and the draft reg guide, that we are going to discuss this afternoon.

If you thought that the last one, which was the environmental qualification for microprocessor-based equipment was difficult, this one is about an order of magnitude or more difficult I think, or in my opinion.

MS. ANTONESCU: I don't think so.

MEMBER SIEBER: It is complicated because you have to go to metal standard.

MS. ANTONESCU: We just have to remind

everybody that this reg guide was already issued in January of 2000, and we are just having some revisions done on it.

MEMBER SIEBER: Yes, I understand that. In fact, at the last subcommittee meeting I could find on this issue was back in 1992, and so everything has been basically done by the paperwork group.

And so without further ado, I think I would introduce to you Christina E. Antonescu, who is from the Research, and in charge of this project. Christina.

MS. ANTONESCU: Good afternoon. My name is Christina Antonescu, and I work in the Engineering Research Applications Branch in the Division of Engineering, within the Office of Research.

And I have worked at the NRC for the last 11 years in the I&C area. And I am here today to present to you DG-1119. Also, I would like to introduce to you some other division members in attendance. Steve Arndt is our I&C section leader, and Mr. M. Soske (phonetic), who is the acting deputy director in the Division of Engineering.

And also two representatives from supporting contractors are here to participate in the presentations. They are Dr. Richard Wood and Dr. Paul

Ewing of Oak Ridge National Lab.

Dr. Wood is the project manager for the IEC projects that we sponsored at Oak Ridge National Lab, and he has his Ph.D. in nuclear engineering from the University of Tennessee and has 20 years of experience with IEC technology.

Dr. Wood is an internationally recognized expert in the application of digital IEC for nuclear power and he is currently contributing to an advisory committee of IEC micro studies providing research recommendations to the Office of Nuclear Energy in the Department of Energy.

And Dr. Paul Ewing is the principal investigator for the MRFI and power search guidance projects, and he has an MS degree in electrical engineering from the University of Tennessee and has over 20 years of experience working with electrokinetic phenomena.

Mr. Ewing is presently the leader of the MRFI microwave system both in Oak Ridge National Laboratory, and some of their activities include characterization of electromagnetic effects, developing robust wireless communications for harsh environments, and developing mobile ad hoc wireless sensors and RF tagging, and tracking systems.

He has served on the IEEE EMC Society, PC-4 committee, and the ANC standards committee. I will present an overview of this draft guide, and Dr. Wood will describe the technical basis supporting this guide.

And we do appreciate the opportunity to appear before you today, and we look forward to receiving the benefit of your insights, and if there are no questions, we would like to proceed with the presentation.

And before then, I would like to remind you that this draft guide describes an acceptable method for electromagnetic compatibility at nuclear power plants, and it was released for public comment on November 8th, 2002 and received four submissions from the public.

After interaction among the staff, the technical support contractor, and industry stakeholder, and the draft was revised to reflect resolution of the public comments.

So our purpose here today is to present you the guidance contained within DG-1119, and that is updating Reg Guide 1.180; and to request a letter from the committee endorsing publication of the final guide.

And also I would like to mention that the NRC and industry stakeholders have interacted on this IEC guidance, and at the close of the public meeting period, the NRC staff and the NRC contractors briefed the EPRI working group on this guidance.

So the outline of our presentation, again I am going to provide you with an overview of DG-1119, followed by the technical basis for electromagnetic capability, and a presentation by Mr. Richard Wood; and a third part summarizing the value and the benefits of DG-1119.

So what is DG-1119? It describes the design installation and implementation practices to evaluate and minimize the impact of EM/RFI, and power surges on I&C systems.

And the scope covers analog, digital,a nd hybrid equipment, and in all locations within the plant. It addresses emissions, susceptibility, and surge withstand testing, and describes grounding and shielding practices.

MEMBER WALLIS: So compatibility means it is robust when subjected to these surges or radio frequencies, and that is what compatibility means?

DR. WOOD: It also means that it does not adversely --

MEMBER WALLIS: There is no loss of function or bogus signal release, or anything like that?

MS. ANTONESCU: Yes.

MEMBER SIEBER: And it is also not fitted to microprocessor face.

MS. ANTONESCU: For all equipment.

MEMBER SIEBER: Yes, digital and analog on IEC, because the other electrical equipment is not covered under this.

MS. ANTONESCU: That's right.

DR. WOOD: That's right.

MEMBER WALLIS: When you say EMI/RFI, does that mean EM and RF, or is RF a subgroup of EM, or RF is a subgroup of EM, or what?

DR. WOOD: RF is a subset of EM.

MEMBER WALLIS: So you mean all EM really.

DR. WOOD: Yes.

MEMBER KRESS: Is there a lot of sources of EM in a power plant?

MEMBER SIEBER: Yes, there is.

MS. ANTONESCU: Yes, there are.

MEMBER WALLIS: People walking about are sources.

DR. WOOD: There is detailed communication devices, and there is --

MEMBER KRESS: And there is just EM in --

DR. WOOD: Right.

MEMBER KRESS: And t.v. stations and stuff.

DR. WOOD: And lighting in the area.

MEMBER SIEBER: But the more important thing is the opening and closing of breakers.

MS. ANTONESCU: Right. Switching.

MEMBER SIEBER: Because that gets reflected through the system, the power supply system, and if it is at least digital equipment, it can really reek some havoc if it is not taken into account in the design.

MEMBER LEITCH: Welding machines can also be a source, a transient source as well. I mean, it is here today and gone tomorrow, and it is sometimes hard to figure out exactly what occurred.

MEMBER RANSOM: I assume these do not include electromagnetic pulses, like from nuclear weapons, or that science?

DR. WOOD: That is not specifically accommodated within or was not a specific target within the guidance, although some of the effects that might result from an EMP, such as the surges that would occur, could be addressed through the surge withstand testing. It is a question of level.

MS. ANTONESCU: Very high EMP.

MEMBER LEITCH: And what about solar flares?

DR. WOOD: We did not specifically cover solar flares. We did not go through and try to write the guidance to address individual sources of emissions or the potential interference, but the phenomena would be addressed, the eradicated susceptibility or if you conducted susceptibility or surge withstand.

MEMBER SHACK: Is there corresponding industry guidance, EPRI?

MS. ANTONESCU: There is (inaudible) that was endorsed from an FTR by NRR.

MEMBER SHACK: Sot he reg guide then is an alternate to that, or --

MS. ANTONESCU: It is an acceptable method, just like ESE. Also the draft guide applies for new safety related IEC equipment, either existing or in future nuclear power plants, and applies to voluntary modified systems and existing power plants.

Also, DG-1119 endorses the testing guidance in IEC 6100, and the technical basis is well documented in the enhanced basis, which is the updated NEUREG CRs 5609, which covers signal lines, and 6782, which shows the comparison between the military standard and IEC 6100.

MEMBER WALLIS: Excuse me, but this also covers electrostatics, or a buildup of sparks resulting?

DR. WOOD: No.

MEMBER WALLIS: It doesn't cover that? A spark is a source of EMR. A spark would be, but just the electrostatic itself is not covered?

DR. WOOD: Right. The specific electrostatic event is not covered. Any secondary effects would be covered.

MEMBER SIEBER: In our references, NEUREG CR XXXX is 6782.

MS. ANTONESCU: Right. And existing guidance that that provide already given technical basis in the past are three NUREG CRs, 5941, which is an earlier version of the technical basis endorsing IEEE 1050, and also Military Standard 641C and D, which are earlier versions.

And 6431, which is endorsing the operating envelopes and 6436, are documenting the plan data there that we took.

MEMBER WALLIS: I'm sorry, but minimizing the impact doesn't mean anything to me. Do you mean to make the impact tolerable, or allowable, or prevent the --

DR. WOOD: You cannot absolutely guarantee that there will never be an event that can occur.

MEMBER WALLIS: But presumably this level of minimization has to be calibrated against the kind of events that you expect or something?

DR. WOOD: Exactly. And that was the purpose of the measurements.

MS. ANTONESCU: To validate.

MEMBER WALLIS: So there must be some sort of standard event here protecting against, and not above that, is that what it is?

DR. WOOD: There are certain levels that you have to demonstrate the robustness of your equipment. If events occur above those levels, then you don't have any evidence that your equipment won't have enough --

MEMBER WALLIS: What you mean by minimize impact means no detectable effects on performance?

DR. WOOD: There is reasonable assurance that upsets will not occur.

MEMBER WALLIS: And will not affect the

performance?

DR. WOOD: That's right.

MEMBER SIEBER: Now --

DR. WOOD: We can't give an absolute guarantee.

MEMBER SIEBER: -- existing equipment is not affected by this Reg Guide.

MS. ANTONESCU: It is not --

MEMBER SIEBER: And it seems to me that EMI/RFI tolerance in existing equipment is sort of trial by test more or less, and each item was licensed on an individual basis, and that is why in the older power plants there is a lot of restrictions on whether you can use cell phones, and walkie-talkies, and things like that.

MS. ANTONESCU: Right.

MEMBER SIEBER: And I also take it that it is not acceptable to attack the problem of spikes and surges on the power system by conditioning the power system, and you really want the instrument itself conditioned for surge withstand and so forth. There is two ways to look at the problem.

DR. WOOD: Actually, there is a lot of benefit to power quality control.

MEMBER SIEBER: Absolutely. It is

cheaper.

DR. WOOD: Exactly. This Reg Guide does not address that, though when we talk about the technical positions, I will mention how you can take credit for your power --

MEMBER SIEBER: Oh, you can? Okay. Thank you.

MS. ANTONESCU: So what is our motivation for DG-1119? The purpose of it is to update Reg Guide 1.180, and to respond to a user need and also to endorse the test methods from most recent military standards, like 461E.

And also comparable EMC standards that are available in IEC 61000. And also to address those issues that were not covered by previous guidance, and specifically conducted susceptibility for signal lines, and susceptibility in emission testing for frequency ranges above 1 gigahertz.

And also to provide some relief concerning operating envelopes as warranted by enhanced technical basis.

MEMBER LEITCH: Just so that I understand, what is the age of Reg Guide 1.180? In other words, is this 20 years old?

MS. ANTONESCU: It was released in the

year 2000.

MEMBER LEITCH: So that is quite new.

MS. ANTONESCU: Yes, January of 2000.

MEMBER LEITCH: Okay. So it is quite new and we are revising it based on these criteria.

MS. ANTONESCU: Yes, it was pre-existing, and it was accepted.

MEMBER LEITCH: So it is not reflecting digital instrumentation particularly. In other words, that must have been already included in he IEC 61000.

MS. ANTONESCU: Yes.

MEMBER LEITCH: Okay. Very good. So I understand.

MEMBER WALLIS: So what triggered the new for revision?

MS. ANTONESCU: That is what we will be showing in our presentation.

MEMBER WALLIS: Okay.

MS. ANTONESCU: And these were some of them that I responded to; updates in military standards, and which is in 461E, and that is the latest revision.

And we wanted to provide an alternate testing practice and we included IEC 61000, and also some additional issues that were not included in the previous revision of 1.180, and we are covering now susceptibility for signal lines, and also we are trying to cover susceptibility in emission testing for frequency ranges above 1 gigahertz, because of the use of cells phones and wireless communications.

And also we are trying to relax some of the test limits. So we received four sets of comments, and --

MEMBER KRESS: We are always interested in who you receive comments from, and are these all just from industry reps?

MS. ANTONESCU: There were four sets, and one of them was from I believe Jim Shank, and ES&G, and EPRI, and TVA, and STARS. And we grouped the public comments into general categories that you see listed here; in operating envelopes, and testing 1 gigahertz, and providing surge testing for signal lines, and some relation with previous guidance, the ones that you just mentioned, EPRI's 1022 and 1023; and test methods and exemptions.

So Rev-1 of DG-1119 reflects the resolution of these comments. And now Mr. Wood will provide you with the technical basis for electromagnetic compatibility guidance.

MEMBER KRESS: Just one question on your

last bullet.

MS. ANTONESCU: Yes.

MEMBER KRESS: Do you always feel constrained to -- well, is the resolution of a comment, is it an acceptable resolution to say that that we don't agree with you?

MS. ANTONESCU: Yes.

MEMBER KRESS: So you don't have to do something with the comments?

MS. ANTONESCU: Well, we like to --

MEMBER KRESS: And explain maybe why you don't agree?

MR. ROSEN: At a minimum, you have to say why.

MS. ANTONESCU: We explain why.

DR. WOOD: Frequently what you will see is either them interpreting it in a way that we didn't intend them to interpret it, which frequently results in adding clarifying language, or saying use it this way and don't use it this way, as opposed to simply saying use it this way.

But sometimes you are right. They will have a technical issue that we just don't agree with, and then we will say --

MS. ANTONESCU: But we will provide an

explanation.

MR. ROSEN: But why we don't agree with it and cite either our technical basis in the NEUREGs or specific data, or whatever.

DR. WOOD: I will try to mention some examples.

MS. ANTONESCU: And for this presentation, Dr. Wood is going to let you know what changes were done. Some of the positions were not changed from the previous revision.

DR. WOOD: So I will begin by giving just a quick overview of electromagnetic compatibility and then track that a little bit with environmental qualifications, which we talked about last month.

Electromagnetic compatibility is establishing the compatibility of your equipment with the environment, and making it able to accommodate the environment, and minimizing its effect on the environment.

So you have design and implementation approaches that are intended as minimization practices to enhance the immunity of your equipment, and also minimize its effect.

And then you have emissions testing which are intended to control the environment so that you don't inadvertently create adverse conditions. And then you have two kinds of basically susceptibility testing.

There is EMI susceptibility testing, and then there is surge withstand capability susceptibility testing, and those are intended to ensure the robustness of your equipment, and its ability to withstand the expected environment in which it will be implemented.

And that is sort of the element of EMC that that is equivalent to qualification, and that's why that was mentioned in DG-1077 last month and this guide was referenced.

But has a larger scope and qualification. The guidance that is in DG-1119 deals with analog, digital and hybrid versus simply microprocessor-based as in the case of last month, and it applies for the entire plant and does not make a distinction between harsh and mild environments, and try to separate the guidance into those kinds of categories.

The basis for DG-1119 and the basis for Reg Guide 1.180 are the U.S. industrial experiences, and that was used to adopt and enhance a systematic approach to EMC.

And then it also in DG-1119 also offers an international standard option that can be employed to increase the flexibility of the guidance. It endorses commercial standards for design and installation practices, and the IEEE standard 1050.

And it endorses well-established testing standards; IEEE standards, and IEC standards, and the latest version of the MIL standards.

MEMBER WALLIS: MIL standards that did not exist at the time of the previous reg guide?

DR. WOOD: The IEC standards had just been released in a complete form, and so there had not been time to review them and evaluate them, and the purpose for getting Reg Guide 1.180 out on the street is that it contained some benefits, although what was in EPRI's 1023.23, and there was some motivation to have that alternative out on the street, and then revise it and add the IEC standards at a later date.

MEMBER SIEBER: Question. The electrotechnical standard is obviously different than the U.S. standards. How do you reconcile the differences? One has to be in some respects easier than the other.

And so if you adopt -- let's say, for example, that the U.S. standard, if you adopt that and it is tougher than the electrotechnical standard, have you taken steps to allow flexibility in the use of the more difficult standard to relax the requirements?

DR. WOOD: That's why it has been a 3 year period before we submitted this revision, because we went to great pains to try to identify what are the differences, and is there just a general value judgment that you can make that IEC might be easier or more severe than MIL standards.

And you can't make an across the board type of assessment like that. And what we did is that we tried to -- we did some conformity research, where we developed a (inaudible) artifact and tried to demonstrate that you got comparable results given the differences in the test methods.

And we looked at what the test limits were for the MIL standard and tried to identify comparable test limits on a sound technical basis for the IEC.

MEMBER SIEBER: And I talk it that it is the test methods is where the differences occur for the most part?

DR. WOOD: Yes, and it is not in every case. There are a few cases where there are some significant differences in the way that the tests are implemented, and in many cases the tests are varied somewhat.

MS. ANTONESCU: And this comparison is shown in your Reg Guide CR 6782.

MEMBER SIEBER: Okay.

DR. WOOD: So the other thing that this guide has, which also Reg Guide 1.180 had, were tailored test limits or we call them operating envelopes, that are adjusted to reflect what you might expect to see in a nuclear power plant.

There were some modifications in this version of the guide and I will talk about the changes that were made. And then there were also some exemptions of some of the tests, depending on certain conditions, technical conditions that might be met.

These are the major differences between DG-1119 and Reg Guide 1.180. There is enough data for the endorsement of the no-standard test methods so that it endorses the current version of the MIL standard, the E version as Ms. Antonescu mentioned.

It provides the alternate testing options using the IEC 6100 test method. Another thing that it provides and makes more explicit is that it was possible under the previous guidance, but not explicitly identified, is that there are certain conditions under which the FCC will assist for certification for emissions and satisfy the requirements.

And then one thing that it clearly adds, although Reg Guide 1.180, is the signal line conducted susceptibility test methods, and also extending the frequency range for radiated emissions and susceptibility testing above 1 gigahertz.

MEMBER WALLIS: Up to what?

DR. WOOD: For susceptibility up to 10 gigahertz for --

MEMBER WALLIS: So a big change?

DR. WOOD: A big change.

MEMBER WALLIS: Why is this? Is it because this is a range that you are expecting it in a power plant?

DR. WOOD: Because of cells phones.

MEMBER WALLIS: Okay.

MEMBER SIEBER: Or any kind of portable. The frequencies keep going up, and up, and up.

DR. WOOD: Yes. And then there is some enhanced guidance on the surge withstand capability operating envelopes, and that I will describe in a little more detail.

Now, why did we need to address these two additional issues; the signal line conductive susceptibility test methods, is because the MIL standard at the time that the technical basis was developed for Reg Guide 1.180 did not address signal line susceptibility.

MS. ANTONESCU: The earlier revisions of the MIL did.

DR. WOOD: So it is these updated versions that now address signal line susceptibility, and then the technical need for EMI or EMC above one gigahertz is increased in these recent years.

So what I will do is step through the various positions, and tell you whether or not there was a change between Reg Guide 1.180 and DG-1119, and then tell you what kind of comments were received on that position, and what was the resolution.

And by position what we mean are the conditions, clarifications, or exceptions that are applied to establishing an electromagnetic compatibility program.

And position one basically is unchanged from Reg Guide 1.180, and it identifies what could be characterized as a road map for electromagnetic compatibility. But the changes that did occur were just updating that road map to include the new guidance.

There were very few public comments and

they mostly related to editorial changes. Position 2 deals with the design and installation practices that are covered in IEEE Standard 1150-1996, and there were no changes between Reg Guide 1.180 and DG-1119, and thee were no public comments.

The one thing that I will note is that there is one exception taken to the guidance that is in IEEE 1050, and that exception has been submitted to the IEEE committee that is considering the revision of that standard, so that perhaps could be addressed.

During the development of Reg Guide 1.180, there were four exceptions. The 1996 version which occurred addressed three of those exceptions, and the fourth one still remains and we are hoping that that will be addressed in the pending revision of the standard.

MEMBER KRESS: And the continuation of (inaudible) --

DR. EWING: It actually varies and if you have a magnetic field, a magnetic field source, and you are very close to it, it falls off as 1 over R-cubed, and if you have an electric field source, and you are very close to it, it falls off as 1 over R-squared.

But in the far field, the magnetic field and the electric fields both fall off at 1 over R. And then in the standard it did not make that that clear, and so we actually took exception to it.

DR. WOOD: And Position 3 changed considerably from Reg Guide 1.180 to DG-1119, mainly because of the addition of the alternate test options that were included in it.

The things that changed were the option for the IEC test, and also the option for making use of the FCC Part 15 Class A certification. So those were intended to add more flexibility in the implementation of the guidance.

The left-hand side, which shows the MIL standard and with the box with four test methods, that is the baseline method. It is identical to the previous version of the guide.

The only difference, or the only significant difference is that it updates the reference standard from the previous versions of the MIL standard to the E-version.

And also these exemptions that you see at the bottom. You can exempt the CE101 test if power quality is employed, power quality control, and you can exempt the RE101 test if your equipment is not going to be installed in the proximity of a magnetic field emitters.

The options. We looked to see if there could be an equivalent set that could be just generally applied from the IEC. Unfortunately, they don't have test methods that correspond to the low frequency tests that the MIL standard has.

So these options are only applicable if the exemptions apply. So if the exemptions apply, then you can either perform a reduced set of tests from the MIL standard, which eliminates two test methods, and also reduces the frequency ring coverage of CE102, because you can exempt the low frequency portion of it.

Or you can do the IEC61000-6-4, which is essentially the CISPR 11 Class A emissions test; or you can use the FCC Part 15 Class A certification. So there is a great deal of flexibility if the exemptions apply.

And those exemptions are identical to the exemptions that existed in Reg Guide 1.180. The public comments that were received, many of them on this position dealt with the operating envelopes for the emissions tests, and they were basically a carry over from the previous set of public comments on what became Reg Guide 1.180, and there still was not a technical basis for changing those emissions envelopes, but we did try to clarify those envelopes.

And then in the IEC limits, there were some comments about those because there was an impression that we were developing customized limits for IEC, which is not typically the way that the IEC test methods and criteria are applied, when in fact we were actually endorsing standard test limits out of the IEC that were comparable to the limits that were tailored for nuclear power plants for the MIL standard.

And so we clarified the designation of those limits, and so it was clear that those are standard test levels from the IEC. The major changes that we made from the version that went out for public comment to the version that you see before me, is that this figure was added to try to clarify what is equivalent, and when you can use those alternate options.

Position 4 deals with the EMI/RFI susceptibility tests from the MIL standard and the IEC, and it presents the associated operating envelopes.

And it also changed from Reg Guide 1.180 to DG-1119. It is more comprehensive, in that it addresses signal line susceptibility, and it has got some added flexibility, and that it has the option, the alternative, of the IEC test methods, and also there are some enhanced operating envelopes that resulted from the public comments.

MEMBER WALLIS: Can you assure us that the alternative method measures just as well what you want to measure as the baseline method?

DR. WOOD: We feel that there is a strong technical basis that says that.

MEMBER WALLIS: It is essentially equivalent?

DR. WOOD: It is essentially equivalent, and you won't get exactly the same. But it is not a general, across the board, one is stronger than the other.

What existed in this and Reg Guide 1.180 are the two tests under the power line, or the baseline set under MIL standard on the left-hand side, and the two tests under the radiated box.

Those methods are unchanged, and what has changed is the reference standard has been updated to a new version of the MIL standard, and the other change that was made is that the operating envelope for CS114 was relaxed because we were able to develop a technical basis that would justify that.

So it is less restrictive. What has been added are the signal line test methods which were not in Reg Guide 1.180, and then the alternate IEC option, and there is no restriction on which of the two options you use. You just pick one and use all IEC, or pick the other and use all MIL standard.

You have a mix between the two, because this is a consistent phenomena that depends on the complimentary nature of the different sets of tests within it.

MEMBER KRESS: Things that are bold are things that were existing before? What is the difference between bold and not bold?

DR. EWING: That is just an artifact of --

DR. WOOD: This is part of the figure. That is an understandable inference. Maybe it is an EMI effect. I don't know. Okay. The public comments dealt with three technical areas.

One was the necessity of certain test methods, and one was a repeat from the comments on what became Reg Guide 1.180, and one was a new one dealing with the IEC. But there were technical reasons for having those tests there, and those are covered in the response to public comments.

Other questions dealt with the operating envelopes, and we received a set of comments that said the test limits that were being identified for signal lines were too lax in certain situations.

And upon reflection, we agreed with that, and we updated those operating envelopes so that there was a general limit that is applied under conditions where you have got signal lines that are interior and short runs, and then there is another set of operating envelopes that you apply if your signal lines are of great length or connected to external power lines, or your system is connected to an external power source.

All of the triggers are covered in the language of the guidance. The other question still has to do with CS114, wanting some further relaxation, and then also there were questions about the IEC limits.

Again, this issue of customized versus standardized limits, and so we clarified the designation of the limits to make it clear that they were the standard IEC limits.

And then there was the question on whether or not surge testing was necessary on signal lines, and what we did is that we looked at the technical basis and found phenomena where a surge could be induced on a signal line even if it is not a long signal line that you can buy a strong emitter, like switch gear or something like that.

But the operating envelopes are basically half of what the operating envelopes are for power lines. The changes that we made in response to public comments is that we added this figure to try to illustrate what are the two alternate fits, and then we enhanced the signal line limits to address the comments that under certain conditions they might be too lax.

Position 5 deals with surge withstand capability testing, and it also has changed in the transition from 1.180 to DG-1119, and it has added flexibility through the addition of the IEC test option, and also enhanced operating envelopes.

Previously in Reg Guide 1.180, we had tried to develop operating envelopes that would cover the vast majority of situations in the nuclear power plant, and what we have done now is relaxed that envelope for most locations, but there is a slightly stronger envelope for locations in medium surge exposure areas.

And the standard has a definition of what constitutes those kind of exposure areas. The IEEE standards, the IEC C62.41 ring wave or combination wave, and EFT, are the baseline case, and they are identical to what was in Reg Guide 1.180.

What are added are the IEC options, and the test methods are identical to the IEEE test methods. The public comments dealt with the surge operating envelopes, and it was pointed out that in relaxing the envelope we had failed to cover some of the few locations where there is a high surge activity or medium surge activity.

And so we added the discriminate, and I will show it on the next side what the difference is. And then there was a question about the necessity of one of the wave forms, and that was a repeat from comments that had been received from what became 1.180.

The change that was made in response to the public comments were enhanced operating envelopes for surge, and if we look at the next view graph, what went out for public comment was basically two kilovolts as your operating envelope.

And because of the comments noting that there are some locations in some situations where that is not likely to be sufficient, and we had discussed that with our colleagues in NRR, and had intended to make that change anyway after the public comment period, but we were heartened that our commenters also made that point, and weren't just as would be human nature to expect asking for relief.

Here in this case, and in the case that I mentioned about signal line limits, they were pointing out that there needs to be strengthened guidance. So in cases where there is a medium exposure, then 4 kilovolts would apply.

And then in any I&C system that is placed out in the switch yard or an external area, then 6 kilovolts would apply. And the definitions of those exposure levels are in the standard.

MEMBER LEITCH: How does the standard deal with what I would call transient situations? In other words, the upgrading envelope in a normal situation is one thing, but particularly of portable welding equipment, and like a welder comes and fires up his welding machine and goes to work, is that just prohibited?

DR. WOOD: In Position 1, not getting into the details on that view graph, but there is a formula that can be applied to determine an exclusion zone around safety related equipment that would guide so that there would be administrative controls about where the welder could be located and under what conditions.

MEMBER LEITCH: So the I&C equipment is not hardened against that, and the solution to that problem is an administrative control.

DR. WOOD: It is hard enough to assert a level, and that is what the exclusion zone is intended to maintain, that you don't exceed that level by putting your portable source too close to it.

MEMBER LEITCH: Okay. Thanks.

MEMBER WALLIS: The six kilovolts is what, a peak or something?

DR. WOOD: Yes, that is the peak.

MEMBER WALLIS: And it says nothing about the length of the pulse or anything?

DR. EWING: It varies with the ring wave and the combination wave, and the EFTs. All of them have different pulse shapes.

DR. WOOD: The pulse shape is included in the guide as part of the standard.

MEMBER WALLIS: My sheep fence has six kilovolts, and if I put my sheep fence selector on here is it going to damage something?

DR. WOOD: For those categories, the combination wave form is intended to represent direct lighting discharges, or --

MEMBER WALLIS: Well, that is a much bigger energy than my sheep fence.

DR. WOOD: Right. Exactly. So the change in response to public comments was that enhanced guidance was given for the operating envelope. Position 6 is a position that didn't exist in Reg Guide 1.180 and that is intended to account for electromagnetic compatibility in the frequency range above one gigahertz.

So it is a new element that is intended to address new technologies that are being introduced into the plant. The emissions tests is applicable above one gigahertz, for up to 10 times the highest intentionally generated frequency within the equipment under test.

It is not intended to test intentional transmitters. It is intended to test things like high frequency digital devices that might have a very fast clock speed and emit about one gigahertz.

I should note that in the survey of the events of Y2K a lot of embedded microprocessors were discovered, and those potentially could become sources of emissions.

MEMBER KRESS: You don't have to answer

this unless you want to, but our wanting to impart damage to a plant by a saboteur, would this be a good way to do it, with artificial EMI sources?

DR. WOOD: Yes, let's just not answer that.

MEMBER SIEBER: It is hard to set up.

DR. EWING: It is actually hard to do. It depends on what side of the main transformer you are on.

MEMBER SIEBER: You can't send it in.

DR. EWING: Right. It is actually harder sending it in because the level on the pulse itself will also drop with the voltage levels.

MEMBER KRESS: Are you guys thinking about that when you are in this program?

MS. ANTONESCU: We started this program a long time ago, and that was not --

DR. WOOD: EMP at the time or during the primary technical phase of the project was excluded as a research focus, because it was primarily related to certain devices. But as a secondary effect to things like lighting strikes, those kinds of things are addressed.

MEMBER SIEBER: This is sort of a general question, and I don't recall exactly who all the commenters were, but did I&C companies comment?

MS. ANTONESCU: There were four commenters.

DR. WOOD: There weren't any comments from any system suppliers.

MEMBER SIEBER: I would think that those would be the folks that would comment, because they have to meet the standard unless they sell you anything, and force you to meet the standard by exception.

And if that is the case, that is not a real good deal from an equipment procurement standpoint.

DR. WOOD: They just did not reply whether that was -- whether they were comfortable with what was in it, or whether that was because --

MEMBER SIEBER: Maybe they don't read the Federal Register.

DR. WOOD: That may be. But we have on other guidance received things from the system suppliers, and so at least in some cases they read it.

MEMBER WALLIS: Do they explicitly have to meet these standards or does it require a lot of redesign?

DR. WOOD: You don't have to redesign

anything because they don't apply to existing systems.

MEMBER WALLIS: No, but I mean if I were t now get some new system like the existing system, would it have to be substantially redesigned to meet these standards, or is this essentially describing essentially what is already there?

DR. WOOD: There might be some -- if you were to try to purchase some of a Legacy system, there might have to be some modifications in the implementation to enhance its immunity.

But model systems might already be designed for this kind of environment.

MEMBER WALLIS: Well, that doesn't tell me anything.

DR. WOOD: I know. I can't give you any antidotal evidence of difficulty. I know that when I visited Korea and talked with Ken and also talked with Cary, we had a great deal of interaction on EMC, and they have shared with me some of their experiences.

They have had to make some modifications to certain systems, and mainly their own signal lines to pass some of the tests. But I don't have any antidotes about systems that went in and passed every test and never had to have a change made.

That doesn't mean that it doesn't exist, but it just means that I am not aware of it, but this is also relatively new.

MEMBER SIEBER: Well, you test based on a systems approach, as opposed to a component?

DR. WOOD: Yes. You are essentially testing a card, and you are not taking into account the shielding that might be provided.

MEMBER SIEBER: By the case, or you may substitute shielded cable.

DR. WOOD: Exactly. And there are commercial systems that can satisfy the MIL standard. So it is not like it is an impossible feat. The other thing is susceptibility testing, and that has to do mainly with high frequency communications protecting against those.

The public comments, the only substantial public comment had to do with -- and what was issued had only susceptibility testing, and they noted that there should be some testing for emissions because of the higher speed digital devices.

So that was the change that was made after th response to public comments, is emissions testing guidance was added. And then finally Position 7, which deals with documentation. There was no change.

MEMBER WALLIS: I really am intrigued what administrative emissions are. Are those the things that come from John Larkin?

DR. WOOD: No, administrative emission control, which would be the enforcement of the exclusion zones for portable sources and things like that.

MEMBER SIEBER: That's why you never find a cigarette butt inside containment.

DR. WOOD: That's right. And now we will return to Ms. Antonescu and she can describe to you some of the benefits and the value of DG-1119.

MS. ANTONESCU: To summarize what we believe the benefits of DG-1119 are is that it provides a comprehensive guidance on acceptable methods for electromagnetic compatibility of safety-related I&C systems.

And it provides endorsement of current national and international EMC standards, and Military Standard 461E, and IEC61000. It gives some specific guidance to address previously unresolved issues, such as the issue on susceptibility for signal lines, and emission susceptibility testing above 1 gigahertz.

It provides some additional relaxation if test criteria in Reg Guide 1.180, where technically justified, like in operating envelopes and finally under some conditions licensees can take credit for FCC or CISPR emissions certification.

What did we do about the public comments? We addressed them in the revised draft reg guide DG-1119, and specifically the IEC test limits were being endorsed. The illustration of alternate test options were added.

We added some figures to improve the clarity, the ones that you saw that were presented under Positions 3 and 4. We enhanced the operating envelope guidance for surge to address additional location environments, and we addressed emissions testing above 1 gigahertz for addressing high frequency for digital equipment.

And in conclusion we believe that the revision of 1.180 will contribute to achieving NRC goals, and for maintaining safety by providing an enhanced approach for establishing electromagnetic compatibility for safety-related I&C systems in nuclear power plants.

And reducing regulatory burden by providing alternate testing suites and relaxing selected test criteria where technically justified; and for improving regulatory effectiveness. We made the guidance more comprehensive by addressing the issues on signal lines and the emission testing above one gigahertz.

CHAIRMAN BONACA: And did NRR review this document?

MS. ANTONESCU: NRR has reviewed it.

CHAIRMAN BONACA: And do they agree with the recommendations?

MS. ANTONESCU: They have.

DR. WOOD: They also attended the EPRI/EMR working group meeting.

MS. ANTONESCU: Last December of 2002.

CHAIRMAN BONACA: Okay.

MEMBER WALLIS: Did you show them the portion of the document that we have to look at?

DR. WOOD: No.

MEMBER WALLIS: There are pages that are completely garbled.

MEMBER SIEBER: It goes and up and down, and around.

MEMBER WALLIS: And figures are missing.

MS. ANTONESCU: I sent them an electronic version and so I am not sure what happened.

MEMBER SIEBER: And that is what we got.

MEMBER WALLIS: I think it was subject to some sort of EMI.

DR. WOOD: We don't have a guide on printer drivers yet. If you would like to put that in your letter.

MEMBER SIEBER: This, I presume, was a figure?

MS. ANTONESCU: Yes.

MEMBER SIEBER: I would sort of like to understand better what the process is for this and what in the NRC is research that does the reg guide updates and revisions. Research usually doesn't do anything unless it has a user need. Is that correct?

MS. ANTONESCU: No, in some cases we can do --

MEMBER SIEBER: So who decides, well, I think we ought to update this reg guide? Is that Research or NRR?

MS. ARNDT: The process is the following in general. As industry standards get revised, or if there is a new technical issue, and in this case above 1 gigahertz, or any other things, the idea is to maintain our regulatory guidance up to date with the current regulatory standards.

We actually have a directive from the President to try and do that whenever possible. So as things change, a decision gets made usually by the program office that updated guidance is necessary, and then they will put forth a user need.

There can of course be a lot of consultation, and hey, this has been changed twice and isn't it time to renew it and those kinds of things. Or if through operational experience, say LERs or some major event or something, it becomes obvious that the guidance is not current based on some new experience that we found or some new emerging technology or something, that can also trigger an update.

And in this case, as was mentioned, there was new guidance that was provided, as well as a new technical issue. We had a user need and we did the research to support the technical position.

We evaluated the changes in the guidance things, and we wrote it and we put it forward.

MEMBER SIEBER: And it is Research that does this for reg guides I take it?

MR. ARNDT: For reg guides, it is research's responsibility that if you are going to change a CFR, the actual CFR, it is NRR's responsibility. But we work together on both of them.

MEMBER SIEBER: And either by yourself or with the contractor develop a draft guide which you send out for public comment?

MR. ARNDT: Right, but we send out for public comments.

MEMBER SIEBER: And you get the comments back and you prepare a document that resolves those comments, which sooner or later becomes a public document.

MS. ANTONESCU: Right.

MR. ARNDT: It becomes the effective guidance when it gets published in the --

MEMBER SIEBER: So when you publish it, the resolution, the comments go with it?

MR. ARNDT: Right

MEMBER SIEBER: And on the other hand the implementer, that goes into the standard review plan typically?

MS. ANTONESCU: Right.

MR. ARNDT: Right.

MEMBER SIEBER: Or it can be called out by licensees and applications and so forth, and whether it is being properly used or not is NRR?

MR. ARNDT: Correct.

MEMBER SIEBER: Somehow or another there has got to be an agreement?

MR. ARNDT: Right.

MEMBER SIEBER: And how does that happen?

Do you have a memorandum of understanding or --

MS. ANTONESCU: We send a package to NRR.

MEMBER SIEBER: And could they turn around and say don't issue it?

MR. ARNDT: yes, and they frequently say we are uncomfortable with the issue, and then we have to sit down and have a discussion, either at the staff or management level.

MEMBER SIEBER: Okay. So you can work it out if that occurs?

MR. ARNDT: That is the idea, yes.

MS. ANTONESCU: In this case, the NRR has already approved the Reg Guide 1.180.

MEMBER SIEBER: And so you are hoping that they will approve this?

MS. ANTONESCU: They have already reviewed it already, and they agreed with the changes.

DR. WOOD: We don't come to you until our counterparts in NRR have given some kind of an agreement.

MEMBER SIEBER: Well, the question --

MS. ANTONESCU: And in this case we are providing more flexibility by providing alternate options for test methods presented in IEC standard and international standards, and updated revisions of existing current standards.

MEMBER SIEBER: How do you deal with comments that are internal to the staff? For example, you may have a staff person that says that I don't really care too much for this, and I would like to comment. Do you treat it and process it like you would a public comment?

MR. ARNDT: It depends on when it comes in the process, and what the comment is, and how contentious it is.

MEMBER SIEBER: Well, it could end up as a EPV.

MR. ARNDT: Well, there is nothing wrong with EPVs and that is part of the process.

MEMBER SIEBER: But on the other hand it would be better to deal with it than let it emerge out of the woodwork.

MR. ARNDT: Exactly, and like anything else, if someone brings up an issue, a technical issue or an implementation issue, or whatever, we will deal with it internally within the process, either between NRR and whichever staff or whatever.

MEMBER SIEBER: And that would all take place before it comes to us?

MR. ARNDT: Generally.

DR. WOOD: I can state that on this one and the one from last month that we gave several technical briefings to NRR on each of these.

MEMBER SIEBER: Yes, I understand. I actually know what has happened. But I wanted to clarify the fact that I think that for us to be able to give an opinion on all these issues have to be out in the open for us.

MR. ARNDT: Right.

MEMBER SIEBER: So when you send us a document package, which really ought to come 30 days in advance of the meeting, as opposed to Federal Express 3 days before he meeting, that would help me.

MR. ARNDT: Yes, we understand.

MEMBER SIEBER: With these issues at least exposed, and then I would be in a better position to deal with them and if that could happen in the future, that would be great.

MR. ARNDT: We do our best, and we will continue to try and improve on our performance in that area.

MEMBER KRESS: And I could see how you could get the military standards and these other alternative standards and study them, and see how they compare, and make some judgments as to equivalents, but do you have test apparatus where you actually subject these devices to these things?

MR. ARNDT: Yes.

MEMBER KRESS: And does that show up in these reports?

DR. WOOD: Yes, it is in the reports.

DR. EWING: It is in NEUREG 5609. There is also NEUREG 6406 that describes an experimental digital safety channel that was developed and put through not just EMI/RFI testing, but also other environmental testing to determine the kinds of failure mechanisms that might be --

MEMBER KRESS: Is that the one that you are going to use to test the effects of smoke?

DR. EWING: We did that.

MEMBER SIEBER: But the standard itself really describes the test methods and criteria, as opposed to being application oriented. Before I open it and start to read it, I expect that we would be designing airplane parts or radar systems, but that is not the way that those standards are written.

So it is generally applicable to any kind of instrument and control system and describes the box that it has to fit in is my way of thinking of it.

DR. WOOD: Yes.

MEMBER WALLIS: I have a question. I am now reading the reg guide here and I see various codes which I suppose are the various pulses and combination waves, and so on, and I see a curve. Now, is this the curve that they are supposed to use and is there an equation that goes with this curve? Are they somehow supposed to copy the curve?

MS. ANTONESCU: Which curve are you on?

DR. WOOD: That is a standard wave form from --

MEMBER WALLIS: Why isn't there an equation or something that describes it? It is just a figure here.

MS. ANTONESCU: What page are you on?

MEMBER WALLIS: I am on page 33, and then there is a figure, and there is something called duration, 20 microseconds, and the other durations are the width of the half-peak, but this duration doesn't make any sense to me.

DR. EWING: It actually has equations with it, but it must be part of the standard.

MEMBER WALLIS: I hope so, and there is something called a front time of 8 microseconds, and it seems that has nothing to do with the actual shape of the curve as far as I can tell. So all of this is somehow unequivocal in the real world?

DR. WOOD: This is the standards wave form.

MEMBER WALLIS: You must choose this wave form and it has an equation?

DR. WOOD: Yes. It just didn't repeat all the details.

MEMBER KRESS: Well, when is it that you impose all these things on your equipment? Is there also a standard input that you are dealing with, and you are looking at the effect on the output? Is that part of this thing?

DR. EWING: Yes, it is. It is a coupling device which is described in the standard for certain test methods.

DR. WOOD: For susceptibility testing. If it is a pass or fail criteria, it depends on the functional specification of the equipment under test, but it has to be able to perform its function.

MEMBER KRESS: So there is a number of inputs that you would use in that and check it out?

MEMBER SIEBER: If I recall properly the test equipment that you use generates these standard curves?

DR. WOOD: Yes.

MEMBER SIEBER: So it is not like you have to figure anything out. You just dial it in and put the parameters on it, and hook it up and press the button.

DR. WOOD: These things are not rocket science, though they might be used for such.

MEMBER SIEBER: But they are.

MEMBER WALLIS: Why do you need to define things like waste time and front time, and duration if you have an equation?

DR. WOOD: Whose are the things that are defined in the standard as characteristic of the curves.

MEMBER WALLIS: But the curve is the standard and so the fact that it has a duration of 20 microseconds doesn't mean very much. That is the curve. You can't use anything with a duration of 20 microseconds.

DR. WOOD: I believe that some of those parameters have variability.

MEMBER WALLIS: Well, the way they are defined depends on the curve as far as I can see. I am just trying to see what the real standard is. So they have to use the curve for some specified equation?

DR. EWING: Yes, into some specified load.

MEMBER WALLIS: So these words about front time is just descriptive, and they don't define anything.

MEMBER SIEBER: There is some protective device that trigger on rise time.

DR. EWING: Yes, and the test apparatus has to be able to generate a pulse with a certain rise time and a certain fall time.

MEMBER WALLIS: But there are all kinds of shapes that have those characteristics.

MEMBER SIEBER: I thought they were standardized.

DR. WOOD: There is some standard test equipment.

MEMBER WALLIS: Well, how close do you have to be to this curve is what I am trying to understand. When you have a curve like this, you are not going to get exactly the same curve out of some test equipment. How close do they have to be?

DR. EWING: And if you took the test apparatus into a known load, it should about that same shape. When you plug it into the equipment under test, the shape varies somewhat though.

DR. WOOD: But this is what the pulse is

supposed to look at into a known load.

MEMBER WALLIS: Look like. Isn't it supposed to follow --

DR. WOOD: This is what the pulse is supposed to be into a known load.

MEMBER WALLIS: Well, that is not very clear to me and if you have a standard, what type of standard is it if it allows flexibility in the shape of a pulse?

MR. ARNDT: It doesn't.

MEMBER WALLIS: Is it exactly on the curve?

MEMBER KRESS: For applying it to a known load.

DR. EWING: And in the standard it has a little tolerance in there as well, plus or minus 5 percent.

MEMBER SIEBER: And the ring wave is just a resident circuit. It is an LC circuit which comes out the same wave each time.

MEMBER RANSOM: How does the current equipment in nuclear power plants or existing nuclear power plants -- would it satisfy the standard?

DR. WOOD: Some of the equipment has been tested to the MIL standard test methods, and some to the previous version of the IEC, which was never fully completed.

Those things were done on a case by case basis, and based on a site measurement at that specific location, which developed the test limits and then an application of the test method on the equipment.

So in some nuclear power plants, these tests have already been employed and for the systems that were addressed in the review of the Tricon system and the Common Q system, those systems, they have an EMI program included in their qualification package as well. So they have been demonstrated to pass these kinds of tests.

MEMBER RANSOM: Is there any thought that this might be applied retroactively to existing plants?

DR. WOOD: No.

MEMBER RANSOM: What about replacement equipment or upgrading?

DR. WOOD: Upgraded equipment that are voluntarily initiated by the licensee, this would apply.

MEMBER SIEBER: A modification.

DR. WOOD: A modification, right, a

modification of the equipment, this guidance could apply.

MEMBER SIEBER: If it comes out as a design change, then the new standard applies, whether you purchase something new or change something old.

MEMBER POWERS: So in other words, we are going to inhibit anybody from upgrading their equipment to comply with a new standard?

MEMBER SIEBER: Actually, meeting these standards is not a bad idea. There was a time when we didn't have sufficient surge protection and it prevented our diesels from starting up, and that was an extremely bad situation.

DR. WOOD: Well, what you had before, if there was anything done, would be that an upset would occur, and there would be an investigation of the cause of the upset, and then some of the minimalization practices were employed to address that.

MEMBER SIEBER: And that is what we ended up doing.

DR. WOOD: This is just intended to take care of that up front, rather than having you go through the upset.

MR. ARNDT: And also, Dana, the ability to use the FCC and the CISPR certifications will give particularly our European counterparts a more expeditious way to qualify than was previously available.

MEMBER WALLIS: So you are saying go ahead and do this?

MR. ARNDT: Yes, we would.

MEMBER WALLIS: Now has any one of my colleagues read this guide so that I can be assured that it meets some sort of basic quality standards and makes sense?

MEMBER SIEBER: Well, I can't read figures.

MEMBER WALLIS: So how do you know?

MEMBER SIEBER: Well, some of these figures you don't know, because they didn't come out right.

MEMBER WALLIS: So we are endorsing something that we really don't quite know what it is.

DR. WOOD: In our public meetings, we found that a lot of the utility practitioners didn't quite know what 1023-23 was, and I remember one coming up to me and saying thank you for your presentation. Now I understand how I am supposed to use this kind of stuff, because it is an incredibly complex set of things that you must do. But it has a definite payoff.

MEMBER SIEBER: This is one of the -- even though no one believes me, this is one of the more complex fields that I think in instrument control.

DR. WOOD: As opposed to the other environmental stressors, where the physics are well understood, and the causes of changes in that environment are well understood. This is essentially -- it has a natural element and a man-made element, and it has a lot of transient or random characteristics.

So this kind of an approach has a long history with the military.

MEMBER SIEBER: In the practical application in the power plant, it is unusual because, for example, combinations of circuit breakers opening and closing will generate different surges, depending on what is on the bus at the time.

Or how dirty the contacts are in the circuit breakers, and most of those are ring waves because it is conducted.

DR. WOOD: In assessing your opinion on this guide, I would like to point out that those figures that you can't see, that in the vast majority of cases are identical to the figures that are in Reg Guide 1.180.

The changes were made in adding test methods to cover a phenomena that weren't covered before and making some adjustments.

MEMBER WALLIS: I think what will also be the case is that if these figures are identical to what is in some of these standards, and the figures have been pulled right out of a standard and written down. So it is not your words.

DR. WOOD: In the surge testing, that is exactly the case.

MS. ANTONESCU: And also they are identical to DG-1110,. Rev. 0.

MEMBER SIEBER: But the difficulty is that they don't copy the standard, because if somebody changes the standard the reg guide is incorrect. What they do instead is endorse it, and then you go and buy your own copy and get the figures from the standard prepared.

DR. WOOD: I can give you a quick synopsis of the basis for those operating envelopes. The operating envelopes are tailored for nuclear power plants per the MIL standard application.

For the IEC application, they are the

standard test levels and there were no changes made to those test levels. You go to the standard and look at class or whatever, level or whatever, and that is what you find.

The MIL standard tends to have a more customized approach, depending on the application, because they have full ground facilities for submarines, for aircraft, a variety of conditions.

What we did is that we sent to the military standards and looked at the different categories, and military ground facilities were the most common and had the most in common with nuclear power plants.

And then we looked at the technical basis, the rationale for those operating envelopes, and where there was a basis that clearly didn't apply for nuclear power plants, like it was intended to protect sensitive receivers, or it is intended to account for radar, or things like that, then we looked for other bases to adjust those envelopes, and that is where the measurements came in, and that is where looking at commercial limits came in. So these envelopes have a very strong pedigree.

MEMBER WALLIS: But the reason that we don't need to proofread this very much is that it looks to me that a great deal of this is simply pulled out of these standards.

DR. WOOD: Yes.

MEMBER WALLIS: And just were written down again. So we don't have to worry about them.

DR. WOOD: Right. We tried to pull out the things that we thought could help the user find what they need, because some of those are very complex and there are a lot of options, and so tell them which option is the one that is appropriate for nuclear power plants.

MEMBER SIEBER: All right. Any additional comments that you would like to make?

MS. ANTONESCU: No, that's all. We just would like to thank you for the opportunity to present this presentation, and if possible we would like to receive a letter from you with your comments and endorsement of this revision of 1.180.

MEMBER SIEBER: I just happen to have one, and all I need is votes.

DR. WOOD: Well, anytime you are lonely and want an interesting technical discussion, feel free to let us know.

MEMBER SIEBER: We appreciate the discussion and the information you provided. I did mention a couple of things in the process of doing this, and if we could fix that a little, it would make it easier for us.

MEMBER KRESS: I have one parting comment though. Go Big Orange.

MEMBER SIEBER: Mr. Chairman, unless anybody has any questions or comments, I think we are finished.

CHAIRMAN BONACA: Are there any questions or comments? Thank you for your presentation, and I think we can go off the record now.

(Whereupon, at 5:12 p.m., the hearing was recessed.)

CERTIFICATE

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

Name of Proceeding: Advisory Committee on Reactor Safeguards 500th Meeting

Docket Number: n/a

Location: Rockville, MD

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Matt Needham
Official Reporter
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