significantly? How much?

MR. ELLIOT: I don't know how much it goes up, but let me explain it to you. We don't -- I don't know if Lambrose can talk to fluence, but I would let him talk if you want to talk about it. But I want to give you my answer first.

We take the fluence evaluation, our group, and we take the results of the fluence evaluation and we see whether or not it meets the screening -- how much it affects the screening criteria for the upper shelf energy and the RT^{PTS}, and we've done that. We do that ourselves, in addition to the applicant.

It turns out this plant doesn't have a high embrittlement rate. It has a very low embrittlement rate. Its RT^{PTS} value after uprate is only like 130 or 125 versus the screening criteria of 275 to 300. So this is not going to -- This uprate is not going to impact -- No matter how much fluence we increase it, it is not going to affect that.

The upper shelf energy, even after the uprate, are in the Sixties. We've checked that, and we have plants that are in the Forties, you know, and are operating.

Again, how we change the fluence here, ten percent, 20 percent, is not going to really impact those --

CHAIRMAN WALLIS: None of this is a problem. Can we move on then? I don't think we need to go on.

MR. ELLIOT: Okay. The pressure temperature limits are being reviewed by the staff, and they are for 32 effective full power years, and it's under a separate application.

It won't limit the plant's life. We just -- If we find that they did something wrong, they have to recalculate the curves or they have to bring back the curves to a different effective full power years, and they are a long way from 32 effective full power years. Therefore, reactor vessel integrity is assured.

(Slide change)

MR. ELLIOT: As far as steam generator integrity is concerned, this plant has Alloy 690 tubes which are more resistant to stress corrosion cracking than the Alloy 600 tubes.

Degradation of tubes resulting from deposition of copper was eliminated by removing copper from the secondary side. Redundancy and analysis of vibrational frequency responses of anti-vibration bars minimizes wear, and the RG 1.121 analysis ensures structural integrity.

Therefore, there is no -- As a result of the uprate, there is no change in the tube inspection program.

MEMBER SHACK: Oh, as a result -- They are not going to continue doing 100 percent inspections, which is presumably what they were doing with the old generator.

MR. ELLIOT: I don't know what their program is. Ken will tell you the details of their program.

MR. KARWOSKY: Ken Karwosky from the NRC staff. As you may be aware, they would still have to comply with their current tech specs, which specifies the minimum three percent. Many utilities with these newer types of steam generators do not perform as many inspections as utilities with mill annealed Alloy 600. But, you know, the criteria that they would still need to meet at this point would be the tech specs.

It is possible that they would reduce potentially the frequency of inspection, also the number of tubes inspected as a result of --

MEMBER SHACK: I thought the industry group was proposing a 20 percent instead of a three percent.

MR. KARWOSKY: That's correct. The industry committed to NEI 97-06, which are the steam generator program guidelines, and that has different criteria. I was speaking to the technical specification requirements.

MEMBER POWERS: Ken, as long as you are there, what do we know about these thinner tubes, experience-wise?

MR. KARWOSKY: Experience-wise, we are -- With respect to the resistance to stress corrosion cracking, not just 690 but thermal treated 600 tends to be much more resistant to stress corrosion cracking than mill annealed Alloy 600. So the operating experience has been better.

We are in the process of obtaining some more detailed information as part of our review of NEI 97-06 on foreign operating experience, for example, to get information on whether or not there's been stress corrosion cracking and under what conditions it may have been observed in other plants. But domestic operating experience has been favorable.

MEMBER POWERS: Are we running any experimental programs with these materials?

MR. KARWOSKY: Research has plants to conduct some testing with some of these advanced materials to determine under what conditions they would crack, initiation times, crack growth rates. There is a long term research program.

MEMBER POWERS: How about correlations between voltage signals and leakages and things like that?

MR. KARWOSKY: There's also research in that area, but in the case of 690 a lot of those correlations that exist for 600 would not necessarily apply. So for the 690 tubes at Arkansas, those correlations wouldn't apply. I don't believe there is any testing with respect to voltage versus crack severity in that program as of yet, just because of the lack of operating experience.

MEMBER POWERS: Well, if they don't crack, it's going to be hard to get anything.

MR. KARWOSKY: But nobody is going to say they won't crack.

MR. POWERS; I got confidence in the corrosion guys. They can make anything crack, if they put their minds to it.

MR. KARWOSKY: Yes.

MEMBER SHACK: Is this a unique generator with this diameter tube?

MR. KARWOSKY: I would have to -- I'm not sure. I'm not sure. These are some of the larger steam generators.

MEMBER SHACK: Have we got any -- Do we have other CE plants that now have Westinghouse steam generators?

MR. KARWOSKY: We have other CE plants that have, like B&W Canada replacement steam generators.

MEMBER SHACK: Those look a lot more like a CE steam generator, don't they? I mean, they've got egg crates and all that sort of stuff.

MR. KARWOSKY: Right. As far as I'm aware, this is the first Westinghouse replacement steam generator in a CE plant.

MEMBER POWERS: I get the feeling that at sometime it might really be worthwhile to have our Materials and Metallurgy Subcommittee host a presentation of the full Committee on these new materials and what you know and things like that, just for educational purposes. I mean, they are coming about. People have great faith in them. It would be nice to know what we know and don't know and what we ought to know.

MR. KARWOSKY: Right. I think some of that would definitely be planned as part of our review of NEI 97-06, I believe. We have discussed with the Committee before with respect to, you know, we will provide that operating experience in support of longer inspection intervals.

MEMBER POWERS: I was thinking of maybe having somebody with -- one of the corrosion guys, specialists, come talk and say what do we know from the science on this material, and what kinds of things could we -- should we be worrying about and what-not.

MR. KARWOSKY: Sure.

CHAIRMAN WALLIS: Is it time to move on?

MR. ELLIOT: Okay.

CHAIRMAN WALLIS: Thanks very much. Thanks, Barry.

MR. ALEXION: Next we will hear from Dose assessment.

CHAIRMAN WALLIS: I wondered if the dose assessment we might just go to the open items.

MR. ALEXION: Okay.

CHAIRMAN WALLIS: It might gain us a little time, and the resolution of the open items. Is that okay with the presenter? Would you agree to do that?

MEMBER POWERS: You are no fun. You can argue with him. So you prepared, by gosh.

MS. HART: Actually, that is the way I prepared.

CHAIRMAN WALLIS: Tell me what you're not prepared about, and we'll ask questions on it.

MS. HART: My name is Michelle Hart. I'm with the Probabilistic Safety Assessment Branch. I feel duty bound to tell you I did not do the review for this. The person who did that is unavailable today.

MEMBER POWERS: And because of the review?

MS. HART: Perhaps. I'm unaware of what his --

(Slide change)

MS. HART: As you can see, the regulatory requirements we review against are 10 CFR Part 100 for offsite doses and GDS 19 for in the control room, and all the reviews were conducted in accordance with the particular applicable SRP Section 15 sections.

(Slide change)

MR. HART: Analyzed: The accidents we analyzed for the power uprate were the maximum hypothetical accident, which is the LOCA; the control assembly -- element assembly ejection; the steam generator tube rupture; and the fuel handling accident.

The seized rotor, main steamline break and feedwater line break were previously reviewed for the steam generator replacement.

(Slide change)

MS. HART: In the draft SE there were three open items. One was the control room habitability review, the steam generator tube rupture, and the reactor building mixing for the maximum hypothetical accident.

(Slide change)

MS. HART: In the control room habitability assessment, there was concern with unfiltered in-leakage, and the licensee had done that testing that they had discussed this morning and had come up with an action plan to address our concerns and also, I am sure, their concerns with this control room envelop unfiltered in-leakage uncertainty and these modifications, which are a procedural change and sealing which will be completed before they start up.

They have a new licensing basis in-leakage value based on their tracer gas testing, and we have confirmed acceptability through doing a confirmatory analyses of all the accidents for this uprate review.

MR. POWERS; I mean, they found a terribly high in-leakage relative to what they had assumed in the past, and so they fixed a bunch of things. But their in-leakage is still six times what they assumed in the past.

MS. HART: That's correct.

MEMBER POWERS: So I assume that you found that the dose to the operators was six times what they found in the past.

MS. HART: Not exactly.

MEMBER POWERS: Ah. Why not exactly?

MS. HART: Unfortunately, I can't speak exactly to that. There were other changes that are made in the analysis and things like that. Like I said, I didn't do the review. So I can't speak exactly.

CHAIRMAN WALLIS: This isn't a power uprate dependent issue, is it?

MS. HART: Not really, no. It is something we look at for the larger uprates --

CHAIRMAN WALLIS: And it would be an issue whether or not they were uprating the power.

MS. HART: That is correct. And as you all know, we are working on a generic solution for this issue with our Reg Guides and a possible Generic Letter. We're not sure about that.

CHAIRMAN WALLIS: Assessement -- must be French or something, up at the top there.

MR. CARUSSO: This is Mark Carusso. I might just add a comment here in response to your question. I am in the same branch with Michelle, and I am her Acting boss today. That means I'm not the guy who reviewed the work she didn't do, but anyway I'll try to help you, although I can't provide anymore detail either. I'm not familiar with the details of Arkansas' analysis and our review.

I think typically licensees that are doing these tests and are finding these flow rates higher than what they assumed before, when they do come in with their new package, they are modifying their methods. They are using better meteorological calculations.

This is generally. I'm not saying Arkansas did this. I don't know exactly what they did, but you know, they are sharpening their pencil and their methods, and so they come in with a package that, well, I've got more, you know, in-leakage flow rate, but I've sharpened my pencil over here. And so you get a new number and it's pretty hard to say, well, you know, in answer to your question, shouldn't it be six times higher, you can't sometimes tell that;

because there's been a number of changes in the analysis, assumptions and methods.

CHAIRMAN WALLIS: I think we should move on. I know that the control room habitability is another issue entirely.

MR. CARUSSO: Yes.

CHAIRMAN WALLIS: It's before the ACRS in another context. It's not related to power uprate. So maybe we should move on.

MR. CARUSSO: Go ahead, Michelle.

(Slide change)

MS. HART: Okay. The next one was the steam generator tube rupture. The open item was because this analysis was unavailable for review before the draft SE was put out.

When we did finally get the review, we did have some concerns with the distribution of iodine isotopes within the RCS for analysis. The licensee did provide a revised distribution, and we came to an agreement on acceptability of use of this distribution for this uprate.

(Slide change)

CHAIRMAN WALLIS: Does the uprate make a big difference? Why does the uprate affect the iodine isotopes?

MS. HART: The uprate doesn't affect it much, if at all. It was just that they had used the core distribution instead of a RCS distribution to do their analysis for like the steam generator tube rupture, main steamline break, things like that. They didn't do main steamline break in this, though.

MR. CARUSSO: This is mark Carusso again. Normally we expect to see -- In these analyses we expect to see the concentration in the reactor coolant system, the distribution in the coolant system, not what's in the fuel.

They came in with what was in the fuel, and the reviewers said that doesn't match with what we normally see; show it to me with the coolant. He came back and said, okay, I agree, it's inappropriate; I did it with the fuel, and I actually got a worse answer with the fuel, slightly worse, but I'll do it again for you with the distribution in the reactor coolant system. We said fine.

CHAIRMAN WALLIS: It doesn't sounds like that's a key issue for the power uprate.

MR. CARUSSO: Not at all.

MS. HART: Not because of the power uprate, no.

MR. CARUSSO: Not a power uprate issue.

MS. HART: The next issue is the reactor building mixing issue. The concern the staff had is that in determining -- well, in using that mixing they had all of the return air to the unsprayed region was all from the sprayed region, which we thought was perhaps a bit nonconservative.

The licensee did provide clarifying details of their mixing model, which is in that RAI that was discussed earlier, and through much discussion and also some confirmatory independent, back of the envelope kind of calculations, we determined that the mixing -- although they said it was 100 percent, we came to around 97 percent or so we thought would be coming from the sprayed region to the unsprayed region.

CHAIRMAN WALLIS: Is your confirmatory analysis any less hand waving than their responsive to the RAI?

MS. HART: I can't speak to the exact --

CHAIRMAN WALLIS: It is. It's very qualitative.

MS. HART: Right.

CHAIRMAN WALLIS: So it's really not much of a physical model about what happened. So let's assume that it's sort of equally distributed between this and that, and let's assume there's --

MS. HART: Right. The original assumption the reviewer thought might be more applicable is you have -- I can't remember the exact amounts, but let's say 76 percent of the containment is sprayed and the rest is unsprayed. So it should be that same ratio coming back to the unsprayed, and they said it was 100 percent on the sprayed.

CHAIRMAN WALLIS: Like it was liberal arts engineering.

MS. HART: Right. Right. So he did some more calculations based on the concentration in the containment and determined that, well, 100 is maybe not so far off that we need to argue it at this time.

CHAIRMAN WALLIS: Why is this an issue for power uprate?

MS. HART: This is not a power -- particularly for power uprate, no.

CHAIRMAN WALLIS: So it may be something that we might well question in terms of model, but apparently it's not really important for power uprate?

MS. HART: Not really important for power uprate.

CHAIRMAN WALLIS: We should just forget it, because it's not important?

MS. HART: Well, I wouldn't say that, no. It's not important when the --

CHAIRMAN WALLIS: If all issues were treated this way, I think we might be a little concerned.

MR. MR. CARUSSO: Can I interject for a moment here. I think in talking with the reviewer, he looked at this in terms of what doses were they getting and saying, well, you know, if it is, you know, a 78/22 split versus up to 100, that could -- and looking at what margin they had in the doses, that could be a problem.

So that's why he dug into this. It's not a power uprate issue. HE just said, gee, you know, this sounds convenient. You know, it comes in at 22/68, and it mixes perfectly, and that helps their dose, looks convenient, how did you do it. He asked them the question.

They came back with, you know, I'd say -- I wouldn't call it purely qualitative. I would say it's certainly quantitative in terms of how they broke up the containment.

CHAIRMAN WALLIS: There are also numbers in it. That's true.

MR. CARUSSO: Yes. So he looked at what

they sent in and said this is a reasonable assessment of mixing, reasonable enough to support the assumption that I'm within seven or eight percent.

CHAIRMAN WALLIS: Okay. Effects on dose are relative small anyway.

MS. HART: That's correct.

CHAIRMAN WALLIS: It doesn't seem to be a critical issue for power uprate anyway.

MR. CARUSSO: No.

MS. HART: Right. And as a result of our reviews, all of the different accidents we did do confirmatory analyses using mainly the same assumptions that the licensee had used. We did check into those assumptions.

(Slide change)

MS. HART: Their dose results: They meet Part 100, and they also meet GDC 19.

Are there anymore questions?

MR. ALEXION: Okay. We will move on then to the risk assessment.

CHAIRMAN WALLIS: This is the dessert this time, isn't it?

MR. ALEXION: I hope so.

MEMBER POWERS: I think desert is the word you were looking for. Desert.

CHAIRMAN WALLIS: It becomes the oasis of rationality, isn't it?

MEMBER POWERS: I think we're seeing where the limitations of risk really come to the fore, and maybe some of the capacity for looking at bottom lines without looking at the intervening materials.

CHAIRMAN WALLIS: Please go on.

MR. HARRISON: Good afternoon. My name is Danny Harrison. I'm with the PRA Branch. I'm in the Safety Program Section, and I'm here to just give you what we've done on the risk assessment review part of the power uprate.

(Slide change)

MEMBER POWERS: Do you have a SPAR model for this plant?

MR. HARRISON: I believe there's a SPAR model. I didn't manipulate a SPAR model on this.

This slide just shows the fact that, even though it's not risk informed, the license, he did provide risk information either through a supplemental submittal that he made or in response to specific questions the staff asked.

The areas covered are the four listed here: Internal events; external events; shutdown operations; and the quality of their PRAR.

CHAIRMAN WALLIS: I think this is what we should see in the perspective. When we look at these PRAs and there's all kind of things to question or we're a little unsure about, but the purpose of using it in this context is to see if you learn something from it that says now we had better go back and dig into that. You're looking for insights.

You're not really taking seriously the numbers for the point of making a decision, because it's not risk informed. It's does something come up here which says we'd better go back and think about that some more.

MR. RUBIN: That's absolutely correct. Mark Rubin from the PRA Branch.

Essentially, what you are doing here is reconfirming the original IPE now there have been some changes.

MR. HARRISON: And to make sure there's no new vulnerabilities.

MEMBER POWERS: If you come in and say I'm going to run my motors faster, but it's tough to get -- to understand how the change in failure frequencies are there, and so I'm going to leave it out, and then you find there's no change in the PRA, there's no change in the risk significance of the items. These are not insightful conclusions, it strikes me.

MR. HARRISON: Well, certainly, a thing like that would not be an insightful conclusion, but you could get some insights on changes, success criteria, timing changes, some HRA insights. The types of issues you mentioned, of course, they are very difficult to deal with.

That's one of the reasons why we and the licensees look at monitoring system performance to try to pick up insights on performance degradation from operating experience data.

MEMBER POWERS: I mean, what you are doing there is you are getting -- You have insights despite the PRA there. I mean, this is risk and informed safety analysis here.

MR. HARRISON: Well, you can gain some insights. What you can look at is, if I know I am going to overload a motor, you can then postulate that that motor is going to -- or main transformer that's being overloaded, you might postulate I'm going to get a failure of that transformer more frequently.

If you are, though, within the operating design limits of that piece of equipment, the data is not going to support, because it's done for pumps, not pumps that are outside its design. So that you've got, if you will, a philosophical problem with that. It's a --

MEMBER POWERS: That brings me to another philosophical issue. Here we have this interesting situation. We got a plant with a operating event PRA, core damage frequency -- what? -- 10^{-5} roughly, and you got an IPEEEE submittal that says 9×10^{-5}.

If I'm risk informed, don't I spend all my attention looking to see how power uprate affects fire frequency?

MR. HARRISON: Well, I would say on that is you would definitely look into it, and that's what the staff has done. We saw that the fire analysis results were high. They used the five methodology with not a whole lot of manipulation.

If you look at other five methodology plants out there, they are all probably pretty close to 10^{-4}. So can you gain insights from that? Yes, you can gain insights.

You can look at it and say what's the criteria for accepting that level? The licensee used NUMARC 91-04 as a way to close out each zone. So in closing it out, you can say, if any zone contributes more than 50 percent to the CDF for fires, I have to do something else, supposedly by the NUMARC criteria.

They don't. It was 30 percent. It stays 35 percent.

MEMBER POWERS: That's going through the NUMARC criteria. Here we're looking at a power uprate, and it seems to me that you ask the question: I've got a methodology that is probably conservative, certainly round number-ish kind. Is there anything in the power uprate that is going to change anything with respect to fire?

MR. HARRISON: Right.

MEMBER POWERS: And I mean, things cross your mind, but I mean, I don't have a smoking gun here. I mean, have you guys looked to see if there is anything here?

MR. HARRISON: The main impact that we saw would be in the operator response times, and that's what the licensee manipulated in their model.

MEMBER POWERS: There is no -- You don't have increased frequencies of fires just due to current loads or things like that?

MR. HARRISON: We didn't postulate any, no.

CHAIRMAN WALLIS: The changes in the fire CDF are about the same proportionally as the internal events changes.

MR. HARRISON: Yes.

CHAIRMAN WALLIS: And they are mostly attributable to operator response?

MR. HARRISON: Almost 100 percent of it is operator response time.

MEMBER SIEBER: I have a question on the last slide, but don't go back to it, because it's a simple question.

One of the sub-bullets was PRA quality. My overall impression was that this was maybe not an outstanding PRA. How did the staff judge the quality of this PRA, being as it didn't meet the standard, wasn't peer reviewed?

MR. HARRISON: I wouldn't say that it hasn't met the standard, and I wouldn't call it a bad PRA either. It hasn't been through the peer review process of NEI. However, back in the IPE, I believe there was an engineering team review. In the IPEEE they did a review, outsider review.

If you look at the SEs on those, they will make mention of different reviewers doing reviews. So I wouldn't say that this is a sub-par PRA at all. It just hasn't been through the peer review process, and that's just to be recognized. That's where they are.

MEMBER SIEBER: And it might be, what,

three years old?

MR. HARRISON: Yes, '97 time frame.

MEMBER SIEBER: Five years old.

MR. HARRISON: They added in -- Some of the things from the steam generator replacement project got added into the power uprate model so that they could compare that back to where the base model was. So actually, they took a hit there for something they have already done.

MEMBER SIEBER: I'm just trying to get a feeling as to where to place this in the overall list of PRAs that are out there, to know whether it's really giving us insights or not.

MR. HARRISON: Yes. One of the things that I do when I do these reviews, I go back to the SEs that were written on the IPEs and the IPEEEs, and I look to see do they have any particular heartburn.

They may have bought off eventually on something, sensitivity calcs or whatever, but where were the issues - they thought the issues were coming out, and then a lot of times I'll pursue those further with the licensee.

MEMBER SIEBER: And did you do that with this particular one?

MR. HARRISON: Yes, I do that with every

one of them.

MEMBER SIEBER: Did you find anything outstanding?

MR. HARRISON: Nothing came outstanding. The question that you get here would be -- I think the IPE had a couple of questions on the containment analysis, but on the PRA part of -- the IPE part of it, I don't recall any chillers in the review that was done.

MEMBER SIEBER: Thank you very much.

MEMBER POWERS: When the reviews were done on the IPE submittals, my recollection was, as they came in, some large fraction of them had questions about the human reliability analysis.

MR. HARRISON: Right.

MEMBER POWERS: Here we've got changes in the CDF and everything else in these is associated with human reliability analysis. Did you look at what they did?

MR. HARRISON: Yes. Because of the fire numbers being so high and because the operator actions are typically where you get the hit on power uprates, we took a visit to the site, took a look at both their fire analysis to see how closely do they follow the five methodology, where did they take liberties by using maybe the EPRI risk assessment guidelines.

We also looked at how closely they followed the methodology for doing the human reliability analysis. Arkansas has a spreadsheet on a computer that they use to manipulate the curves that they use, if you will.

We walked through a number of operator actions, actually went in and said, well, what if I change this number to this, what if you have an extra crew or not, and looked to see what the impact was, to see if it would match up with the numbers that are in the EPRI guide.

In fact, I think the Arkansas documentation -- If you were to look at it and then set the EPRI guidance on how to do it next to it, they are nearly identical, page for page. I mean, you can -- It's a cut and paste job, and the methodology picks that right up.

So we walked through that. We asked a couple of questions about why did this operator action not show up that we expected to show up. We found it was an oversight. They did model it. It's just that they missed it when they made their list of impacts.

So there's that part of it that we actually look at in depth.

MEMBER SIEBER: So your final slide is everything is okay?

(Slide change)

MR. HARRISON: The bottom line is you have to answer that last bullet, which is: Is there anything that shows up that would say that this plant -- you would question adequate protection?

They have a high fire number based on the five methodology, but it's no higher than what you will see for other plants that use that methodology. Nothing triggers you to question adequate protection, and at that point then we end our review. We don't pursue it further.

MEMBER SIEBER: Good. Thank you.

CHAIRMAN WALLIS: Thank you. I think we are ready to move on to the other bottom line items.

MR. ALEXION: Okay.

CHAIRMAN WALLIS: It looked like the standard list.

MR. ALEXION: Good. Just a very short conclusion. Just a second here.

CHAIRMAN WALLIS: Tom, we may have all read it by the time you get it up there.

MR. ALEXION: Okay. The staff feels like we've done an extensive review. We have no open items, and we feel that the application meets the regulations, and staff recommends approval of the uprate.

MR. RICHARDS: I'm Stu Richards. I'm the Projects Branch Chief for Arkansas, and we would just like to thank the Committee for the opportunity to present our review of ANO today. As Tom already mentioned, we think that we did an extensive review.

It is the first extended power uprate for a PWR, but I'm sure there's more to follow. This concludes our presentation. We would be happy to try and address any other questions you have.

CHAIRMAN WALLIS: Thank you.

MEMBER POWERS: I have just a comment from my perspective. We've offered several suggestions on how the presentation could be improved, but quite frankly, this was orders of magnitude better staff presentation than we've had in the past for the BWR presentations.

I found it -- I mean, maybe because you were misled a little bit on guidance coming in, it's still a little summary in nature, but it's certainly articulate, and I found the responses to our questions to be forthcoming.

MR. RICHARDS: We have tried to learn from some of your feedback that you provided in past presentations. So we appreciate getting that positive feedback, and we will build on what we heard today.

I think one thing we need to work with the ACRS staff on is the timing. We looked at having 90 minutes with six branches, and when you do the math, that doesn't come out to a very extensive presentation. But then, of course, the Committee, I think, desires to get into some detail in particular areas. So we need to figure out how we can make those competing demands match up.

MR. BOEHNERT: Well, if we didn't have two uprates back to back, we might have been in a little better shape.

MEMBER POWERS: You just understand our position. Sooner or later we have to go attest to the Commission that we have --

MR. RICHARDS: We understand that, but you know, I personally told the staff to cut back on their presentation, because I figured about seven minutes per branch and then another seven minutes for questions when you get 90 minutes. So when people get up there and say, hey, we don't have enough detail, that was a conscious decision, at least on my part.

MR. MARSH: Mr. Chairman, we want to be

responsive to your needs. If you need more detail on anything, whether it comes up in the meeting or in advance of the meeting, we want to provide that to you. We don't want to leave the impression with you in some areas that we haven't gone into some detail. So we want to fill that need of yours.

MEMBER SIEBER: I think it would be a good idea that, when you are all done with the SER, that you would look at it and say here are three or four of the important issues we dealt with, particularly where the analysis was concerned, confirmatory analysis, and then give us a little picture of what was done for those three of four.

MR. MARSH: Okay.

MEMBER SIEBER: And that then helps to establish some confidence that, yeah, there was depth in the review as opposed to, you know, 60 bullets that say everything worked out okay.

MR. MARSH: So let me play that back. Maybe in preparation for further presentations, if you get either an advance or maybe in an introduction about some of the key areas that we went into more detail, because we were concerned about them or because we want to demonstrate to you some of the depth of issues that we may have, as either preparation for the meeting or in the preamble for the meeting.

MEMBER SIEBER: I think that would help me to get an appreciation for what all you did. Okay?

MR. MARSH: Okay.

MEMBER SIEBER: And to what extent did you do it.

MR. MARSH: Right.

MR. RICHARDS: We have also made notes of some questions that you've asked today that were unable to answer. I think we've made commitments that we will get back to you with that information. So we'll do that.

CHAIRMAN WALLIS: Bill, do you want make any comments? Tom?

Well, my colleague, Dana Powers, was remarkably complimentary. I felt we didn't have very much time today, and I'm not quite sure why it was so short, since this is the first time we are seeing such a big uprate for a PWR. I think it's important that we get it right.

MR. MARSH: Right.

CHAIRMAN WALLIS: And I just don't want -- You want us to write a letter at the next meeting, whenever it is, this March or April meeting. I just hope that what goes into that letter doesn't suffer because we just didn't schedule enough time to go into everything.

I agree with my colleagues here. We know we are going to see in the SER that they met all the requirements, and if they didn't, they wouldn't write an SER. So we're not really interested, I think, in all that.

We read it. We see it, and we don't need to see it again on the transparency. What we have to do is, as my colleague, Jack, says here, we need to get some confidence that when there was an issue that you had to dig into, that you dug into it in appropriate depth, that you did your own thinking and maybe you brought in a consultant or somebody if you had to, and that then -- so we have confidence that you reached the right conclusion. That's the sort of thing we need.

MR. MARSH: I think you are picking up on what we were trying to say. We have 90 minutes in which to present to you a range of issues, a range of branches and a range of issues, to demonstrate to you the breadth of issues that we go into -- the breadth as opposed to the depth.

CHAIRMAN WALLIS: I think where we

learned more was when we asked you questions on things you weren't prepared about. The same thing that you get with a sort of student thesis. When you ask them questions that they didn't prepare for, you often learn far more than when you get this sort of thing which is all prepared, because it looks --

MR. MARSH: Perhaps then you don't want a breadth presentation. You want a depth presentation. You don't want to know the range of issues that we look at. You would like us to pick out a few issues and demonstrate depth.

CHAIRMAN WALLIS: Well, I think you need to talk about perhaps briefly but then to get confidence, I think it would help if you pick a few examples and say this is an example of how went in in depth into something.

MR. MARSH: Okay.

MEMBER SIEBER: I think that, to get a picture of the breadth of issues, you could almost give us a list: These are the things that we reviewed; in general they all come out okay, but here are the concerns we had, and here's how we --

CHAIRMAN WALLIS: In fact, it's obvious. Just look at the SER. There's a tremendous number of items in there which are covered. So I'm very impressed with the breadth. There's no need to defend that.

MR. MARSH; Okay.

CHAIRMAN WALLIS: Are we ready to break?

MR. BOEHNERT: Well, since this ANO will be moving on, you need to let them know that we have this scheduled for the March meeting. It's going to be on the seventh of March. I think it's right after lunch in the afternoon, two hour presentation time. Total time is two hours that's been scheduled.

CHAIRMAN WALLIS: The knowns are the seventh. That's okay. The Ides are the 15th.

MR. BOEHNERT: That's right.

CHAIRMAN WALLIS: That's not the Ides of March.

MR. MARSH: Back to your issue of a letter, if you feel -- the Committee feels like you are unfulfilled in a particular area, that we haven't demonstrated to your satisfaction a thoroughness of review, allow us to answer any questions that you may have or to come back to you with concerns.

I wouldn't want the brevity of the meeting to result in a letter that may demonstrate something we don't want to.

CHAIRMAN WALLIS: But it was too much

brevity, too.

MR. MARSH: Right.

CHAIRMAN WALLIS: I think it's not just a matter of the Committee being satisfied. I think, when you've got this down in the record, it's a public document. The more satisfied we are, the more we can say that in a letter. So it's not just a question of interactions within this community. It goes out into the world.

MEMBER POWERS: I think we owe Tad some guidance on what he could present to the full Committee and what-not. I think your slides that your presenters had that had the list of all the things that were in there could certainly be included in the package, but say most -- I'm not sure 100 percent, but most of the members can read -- and say here are the ones that I think are most important.

I think one of your speakers did that. He said here's five things, I want to concentrate on the last three, and of these last three here, I want to show you what I had to do here to satisfy myself,that kind of a trend.

You may want to cut down on the number, because there are clearly some that are of higher importance and greater interest.

MR. MARSH: Okay.

MEMBER POWERS: Myself, I think that, if I were designing it, I would have worried like the plague going into the PRA region, just knowing the Committee and knowing how unimportant the PRRA aspect is to this particular uprate, just because I don't think you will ever get out. Schedule that one just before the end of time or something like that.

Yes, I thought some of the speakers -- they had very effective slides in showing breadth, and they don't need to go through it, and then highlighting perspective by showing that they could pick out of all that breadth things that were most important, and then all they needed to add in there is -- and it doesn't have to be everyone, but occasional ones to say "and here's an illustration of the depth."

MR. MARSH: We'll do that.

MEMBER POWERS: And I think that would go a long ways to present.

CHAIRMAN WALLIS: What you want to avoid is having slides where you had this long list of things we looked at, all terminating with that the regulations were satisfied, whatever.

MR. MARSH: Understand.

CHAIRMAN WALLIS: And someone who just

sort of reads that, one suspects, well, if that's all he's got to show, maybe there isn't much behind it. But if he could say but this is one where we really got into it in depth.

MR. MARSH: Where we plumbed the issue and here's how we plumbed it, and this is what we found.

CHAIRMAN WALLIS: And so departing from the text helps a great deal to give confidence.

MR. MARSH; I understand.

MEMBER POWERS: Showing a perspective -- showing breadth but then perspective, I thought, was very effective on one of the presentations, particularly.

CHAIRMAN WALLIS: Yes. Okay, are we though now? Can we take a break?

MEMBER SIEBER: Please.

CHAIRMAN WALLIS: We have to move on to another one of these.

MR. MARSH: Thank you very much.

CHAIRMAN WALLIS: So we'll take a break. Thank you all. Until half past three.

MR. BOEHNERT: 3:30.

(Whereupon, the foregoing matter went off the record at 3:19 p.m. and reconvened at 3:34 p.m.)

CHAIRMAN WALLIS: Please come back into

session. We have a new topic, Clinton Power Station, Unit 1 Extended Power Uprate. We ought to be able to make good progress, because this follows the pattern that we've seen before for other stations.

I'll say up front that some of the information that will be given is proprietary. Some of the questions the Committee asks will be answered by reference to proprietary matters. What we would like to do is save the proprietary issues for the end of the day and, if we ask questions which have an impact on proprietary matters, they will be stored. Then we'll come back to the answers at the end of the day.

We do have a continuation of this meeting tomorrow.

MR. WILLIAMS: Yes.

CHAIRMAN WALLIS: We will need to break for dinner and sleep and all that at an appropriate time, but we don't want to shortchange you. If we need the time, we will take it. But I think we have -- I have an agenda here which says you are going to break before you discuss ECCS analyses. Is that okay with you?

MR. WILLIAMS: Yes.

CHAIRMAN WALLIS: So let's see how far we can get then with this plan, and see if we can get out at a reasonable time today.

MR. WILLIAMS: All right, Dr. Wallis.

CHAIRMAN WALLIS: Please go ahead.

MR. WILLIAMS: Good afternoon. My name is Joe Williams, Exelon Nuclear. I am the Clinton Senior Management Sponsor for the extended power uprate project.

(Slide change)

MR. WILLIAMS: I would like to thank the ACRS in advance for their time. We have brought in a number of our technical specialists and senior reactor operators to present the aspects of our power uprate project.

We will present a summary of the project. We will discuss plant modifications. We will present the results of selected analyses and the power uprate risk evaluations. We will discuss the project implementation plan.

Before we begin the presentations, I would like to make just a few points.

(Slide change)

MR. WILLIAMS: We have submitted a license amendment request to increase the thermal power output of Clinton station by 20 percent over our original licensed thermal power. We have used accepted G.E. methodology to leverage industry experience and Exelon Nuclear experience.

Exelon Nuclear has previously uprated seven G.E. boiling water reactor units. Our analyses demonstrate that our plant will operate in accordance with all applicable regulations after uprate, that our plant operates safely now and will operate safely in the future.

In conjunction with a thermal power increase, we will also perform plant modifications and increase the electrical output of Clinton Station.

I would now like to introduce Dale Spencer who will summarize the uprate project.

(Slide change)

MR. SPENCER: Thank you, Joe. Good afternoon. My name is Dale Spencer, Exelon Nuclear. I'm the Project Manager for the Clinton Station extended power uprate.

(Slide change)

MR. SPENCER: As an introduction to the material which we will be presenting to you over the next few hours, I want to spend just a few minutes and provide you with a summary of the overall extended power uprate project, followed by an overview of the modifications and analyses we've performed.

As Mr. Williams discussed, we are requesting a license for a 20 percent increase in reactor power. Our plans are to implement the power ascension in two steps.

The first step will take place upon start-up from our eighth refueling outage which is scheduled to finish in May of this year. The second step of the power ascension will take place after our ninth refueling outage.

We will be performing modifications to the plant to facilitate this power ascension, and I'll cover these in more detail later. These modifications will be installed between now and early 2004 to support our schedule for power ascension.

Of the modifications I will describe, we will show you that we are making relatively few changes to the operations of safety systems, and that upon implementation of our uprate, Clinton Power Station will be limited by balance of plant components.

CHAIRMAN WALLIS: Which indicates that, if you change the balance of plant components some more, you could get even more power out of this reactor?

MR. WILLIAMS: Yes, sir, up to 20 percent.

Yes.

CHAIRMAN WALLIS: Well, it says following the uprate it will be balance of plant limited. It indicates to me you could go for 25 percent, you know, if you change the balance of plant.

MR. SPENCER: The analyses that we are limited by now is we performed the analyses to the G.E. topical, which is a 20 percent plant uprate.

MR. WILLIAMS: That is correct.

CHAIRMAN WALLIS: Yes.

(Slide change)

MR. SPENCER: The team we are using to perform the analysis, preparations and implementation of this extended power uprate has a wide range of experience and knowledge. Our on-site core team is made up of personnel with a broad range of experience at Clinton, other Exelon and AmerGen plants, as well as the industry.

We have used the G.E. standard EPU process as our guide for our analyses and schedule. The G.E. processes have been used for the performance of numerous stretch and extended power uprates at boiling water reactors.

Sargent and Lundy, as the balance of plant architect/engineer, has served similar roles in several previous power uprates throughout the country and is also the original architect/engineer for the Clinton Power Station.

In addition to the knowledge of the team, we maintain both a base of lessons learned from the industry as well as routine contact with other plants performing uprates.

(Slide change)

MR. SPENCER: The slide on the screen now provides a listing of the change in the plant conditions. In a short summary, our increase in licensed thermal power will allow us to increase steam flow to the turbine. The increase in steam flow is being precipitated by replacement of the high pressure turbine. Thus, no changes in reactor steam dome pressure is required for this uprate.

(Slide change)

MR. SPENCER: The next slide I would like to show is the power to flow map at EPU conditions. This map graphically shows the approved operating region for the Clinton Power Station post-uprate.

For clarity, the EPU region has been highlighted in the upper righthand corner of the map. One note: Other recent plants have implemented MELLLA as part of the EPU license submittal. At Clinton, we have previously been licensed to MELLLA and, thus, the EPU will be realized by increasing power along the previously licensed MELLLA boundary.

(Slide change)

MR. SPENCER: At this time I would like to spend a few minutes to review the plant modifications we will be making, followed by a brief description of the analyses performed.

(Slide change)

MR. SPENCER: As stated in our power uprate safety analysis report,no safety related hardware changes will be required to implement the extended power uprate at Clinton.

Upon issuance of the revised operating license, we will perform changes to nuclear instrumentation. This will allow us to increase our output. These set point changes include the APRM flow biased Scram and rod blocks, the main steamline high flow Group 1 isolation, the turbine control valve and stop valve Scram, and the reset trip bypass, and the control rod block pattern controller, lower power setpoints and high power setpoints.

(Slide change)

MR. SPENCER: At this time I want to proceed to a discussion of the mods we will be performing to the balance of plant systems.

As I stated previously, we will be implementing our power ascension in two steps. During the upcoming refueling outage, we will be replacing the high pressure turbine with a unit capable of passing higher steam flow.

The main power transformers will be replaced with units capable of handling the increased MVA that the power increase will generate. Associated with the main power transformer replacements are changes to the isophase bus duct configuration and cooling.

The main generator hydrogen coolers will be replaced, and the hydrogen pressure will be increased from the current 60 pounds to 75 pounds. This is to handle the increased heat load in the generator.

The exciter ANO transformer will be replaced to allow the increased excitation load on the exciter at uprated conditions, and we will be upgrading five piping supports on the feedwater system.

These changes will allow us to achieve the additional megawatts for the next operating cycle.

CHAIRMAN WALLIS: It's the same feedwater pump?

MR. SPENCER: Yes, sir.

CHAIRMAN WALLIS: But they are pumping more water, so that --

MR. SPENCER: Yes, they are.

CHAIRMAN WALLIS: -- they run faster or something? What?

MR. SPENCER: We have two turbine driven feed pumps and a motor driven feed pump.

MR. WILLIAMS: The turbine drivers will run faster. If the motor driven is being used, its regulating valve will be further open.

MEMBER KRESS: Did you have to do anything to the recirculation pumps?

MR. SPENCER: No, sir.

MEMBER KRESS: They are okay?

MR. SPENCER: Yes, they are.

CHAIRMAN WALLIS: It's the same core flow.

MR. WILLIAMS: There is the same core flow.

MEMBER SHACK: And why did you add -- or upgrade the supports on the feedwater piping?

MR. SPENCER: The increases in flow that we do see are on the feedwater flow and the steam flow sites.

CHAIRMAN WALLIS: This is a flow induced vibration question?

MEMBER SHACK: The energy in the -- the higher energy in the line?

MR. WILLIAMS: The higher energy in the thrust for the faulted conditions, that's correct, not flow induced vibration.

CHAIRMAN WALLIS: Not flow induced vibration. Just bigger forces of reaction because of the higher flow rate? Is that it?

MR. WILLIAMS: Yes, sir, that is correct.

MR. BLANTNER: I'll give you a little bit more -- My name is Jerry Blantner with Sargent & Lundy. For the piping analysis, there were five supports that changed. They were all in the non-safety, non-seismic portion, and what that was associated with was there is a feedwater pump trip which has accelerated.

It came up with larger loads, and this is associated with the check valve closing. These are -- The support changes are very minor. They were a baseplate -- Two baseplates had to increase with stiffeners. Two snubbers went up one size each, and one piece of auk steel had to change.

(Slide change)

MR. SPENCER: To ensure we realize the full potential from our uprate, we will be performing additional modifications in the future. These mods are currently targeted to be installed either online or during the ninth refueling outage to facilitate future power increases.

As these mods are only in the conceptual scoping stage at this time, I just provide an overview right now.

Improvements will be made to allow the condenser to perform at higher efficiencies. Improvements will be made to allow the condensate polishers to operate in a balanced configuration at the high condensate flows we expect.

Moisture separator reheater chevrons will be replaced in order to improve the MSR and, thus, the plant efficiency. Changes will be made to breakers, conductors and relay schemes associated with the switchyard to allow the increased megawatts electric and MBA output of the plant.

Improvements to the exciter are planned which will allow the plant to run at full capability of the generator. Also, further improvements in the cooling capability of the bus ducts are foreseen.

MEMBER SHACK: Dale, are you going to go

to noble metal additions in this cycle or has that already happened?

MR. WILLIAMS: We plan to inject noble metals in the upcoming refueling outage.

MEMBER SHACK: So at the upcoming outage?

MR. WILLIAMS: Yes. That is correct.

MEMBER SHACK: But you don't count that as a balance of plant, because you would have done that -- I mean, you don't count that as an uprate mod, because you would do that anyway?

MR. WILLIAMS: That is correct.

MR. SPENCER: That is correct.

MEMBER SCHROCK: What are the condenser improvements?

MR. SPENCER: They are currently targeted for our next refueling outage a year and a half or so down the road. The most likely changes are going to be a continuous online cleaning system or a means of continuous vacuum improvement for the upper tubes of the condenser, and these are only in conceptual stages right now.

MEMBER SCHROCK: How do you get 20 percent more power out of the plant with the existing main condensers?

MR. WILLIAMS: The original condenser was designed with large operating margins. We are utilizing those margins.

MEMBER SCHROCK: I guess somebody has told us that before, but I didn't remember it. It was sufficient to give 20 percent higher power and still operate efficiently?

MR. WILLIAMS: That is correct.

(Slide change)

MR. SPENCER: I would like to now change the focus of our presentation to concentration on several of the analyses and evaluations which have been performed in support of the EPU.

Listed on the slide are the specific areas we will present. We will go over each of these right now, but these areas have been chosen based on requests from the ACRS as well as select areas covered in requests for additional information responses to the staff.

We have prepared presentation material on each of these areas, and our experts will be presenting our findings in each area.

At this time, I'd like to introduce Bob Kerestes who will discuss piping analyses used in support of the EPU.

(Slide change)

MR. KERESTES: Good afternoon. Thank you, Dale. My name is Bob Kerestes. I work for the AmerGen Corporation, and I'm the Project Engineer for the extended power uprate project at Clinton Power Station.

(Slide change)

MR. KERESTES: I'm here today to present a number of technical subjects to you. The first of these will be the piping analysis which we performed at the Clinton Power Station as part of the extended power uprate project.

First I would like to point out that the safety related pipe stress evaluations were performed in accordance with ELTR1 and ELTR2. The result of these evaluations are that all safety related pipe stress levels are within code allowables, and no plant changes are required.

Secondly, I would like to note that the safety related pipe support loading evaluations were performed in accordance with ELTR1 and ELTR2 or it was qualified based upon more detailed analysis.

(Slide change)

MR. KERESTES: On the next slide, please let me explain further as it relates to the more detailed analysis.

The detailed pipe support loading analyses consisted of the following approach. We applied the load factors to the individual load components that were affected by the extended power uprate, i.e., the thermal and the transient loads.

We also applied the extended power uprate conditions and performed detailed analysis to update the plant specific turbine stop valve closure transient, and also we updated the plant specific feedwater pump trip transient.

The results of these evaluations is that all safety related pipe support loadings are within code allowables, and no plant changes are required.

(Slide change)

MR. KERESTES: On the next slide, I would like to present our conclusions.

All safety related pipe stress and pipe loading levels are within code allowable limits, and no modifications are necessary. Our analysis showed that we have five nonsafety related supports which require modifications prior to start-up from our April 2002 outage. These supports are located in our feedwater system outside containment.

All other piping and supports were acceptable without any changes, and no new pipe break locations were identified during our analyses.

In conclusion, with the completion of the modifications planned during our April 2002 refueling outage, all of our piping systems are acceptable to support EPU conditions at the Clinton Power Station.

(Slide change)

MR. KERESTES: The next subject which I am going to present to you is the results of the evaluation we performed on the flow accelerated corrosion program at the Clinton Power Station as part of the extended power uprate project.

(Slide change)

MR. KERESTES: The provisions of Generic Letter 89-08, Erosion/Corrosion in Piping, are implemented at the Clinton Power Station by using the Electric Power Research Institute generic program CHECKWORKS. Clinton Power Station's specific parameters are entered into this program to develop requirements for monitoring and maintenance of specific system components.

These requirements are then implemented through plant procedures. In accordance with the requirements, the Clinton Power Station flow accelerated corrosion program was updated for operation at the extended power uprate conditions.

This update identified several changes to the predicted wear rates under its complements. We have incorporated these changes into our program, and have found that the most significant change is in the predicted wall thinning rate to the main steamlines carrying scavenging steam to the high pressure feedwater heaters.

CHAIRMAN WALLIS: Those wear rates sound pretty high to me.

MEMBER POWERS: They do.

CHAIRMAN WALLIS: It all goes away so quickly.

MR. KERESTES: The wear rate went from 38 mils to 70 mils, which is about 80 percent. This piping in this area, sir, is about a half-inch thick. We will certainly continue to monitor this, and if we find any areas that need replacement, we will take action and replacement them.

CHAIRMAN WALLIS: Well, half an inch thick isn't much at 70 mils.

MEMBER SIEBER: It will run a couple of years.

CHAIRMAN WALLIS: A couple of years, right.

MEMBER SIEBER: Take a number.

CHAIRMAN WALLIS: Seven years it's gone. It's gone before then, because it's burst.

MR. CROCKET: Excuse me. I'm Harold Crocket, and the analysis is made with some conservative assumptions, and this was a bounding limitation of this. We recognize that that is probably a much higher wear rate than we would see, but we would rather be anticipating wear rates of that nature rather than go with the easy out.

This way we can monitor it, do our exams, and feed in the actual measured wear, merge it with the predicted wear, and get our line correction factors, and this will refine the analysis.

MEMBER POWERS: You have been doing that now. Right?

MR. CROCKET: Yes, sir.

MEMBER POWERS: And so -- I mean this can't be enormously conservative, because it is taking into account observational data that you have had in the past.

MR. CROCKET: Well, this particular 70 mils is purely predictive. This has not been merged in with a measured wear at the uprate conditions.

MEMBER POWERS: What's been the measured wear rate at the un-updated?

MR. CROCKET: Oh, the actual measured wear rate is much lower, and these particular lines, I'm going to say, are on the order of 20 mils per year. But I would have to look at it. It's closer to that.

CHAIRMAN WALLIS: Where does it go?

MR. CROCKET: Excuse me?

CHAIRMAN WALLIS: Where does it go? There's a sludge somewhere?

MR. CROCKET: In the demineralizers ultimately.

CHAIRMAN WALLIS: It gets filtered out. So you can do a kind of conservation measurement in the seal?

MR. CROCKET: The other side is, as we see systems that have significant wear, we upgrade it with chrome alloy in order to eliminate damage from FAC, and that's probably what is going to happen, because we are not going to continue to monitor if we see that it's apparent that the line needs to be upgraded. That's ongoing in our long term strategy.

MR. WILLIAMS: We will obtain the actual measured wear rates on this piping, and we can communicate those in the morning when we reconvene.

CHAIRMAN WALLIS: Does it wear in a sort of straightforward way or does it begin to wear and get sort of -- I don't know what the wear pattern looks like. If it's got ripples, I could see the ripples actually increasing the wear rate, because they stir things up.

MR. CROCKET: Yes, sir. That is correct.

CHAIRMAN WALLIS: Is it ripply wear?

MEMBER SHACK: It varies. There's the tiger striping, and then there's more -- There's more exotic patterns.

CHAIRMAN WALLIS: But it's not just a smooth wearing. It's --

MR. CROCKET: Sometimes it is smooth. Sometimes it is the tiger striping.

CHAIRMAN WALLIS: It's the wear which itself could affect the wear rate, because it affects the turbulence and so on.

MEMBER POWERS: It should be near and dear to your heart, because chemistry and turbulence are intimately connected here.

CHAIRMAN WALLIS: I'm just trying to get the idea, how rapidly it develops once it begins to get significant geometrical changes. Does it start to wear more rapidly when it gets these significant geometrical changes?

MR. CROCKET: You know, if we're looking

at, for example, a 16 inch diameter pipe, it's got maybe a half-inch of wall, and we see at our exam at R-4 that it's lost 50 mils and then we come back four cycles later and it's lost another 60 or 80 mils, then we're going to make a conservative assumption at that point and probably replace it and upgrade the material anyway.

The systems that have significant wear, we have a population expansion program. So if we see degraded conditions, we continue to do examinations to make sure that it has not gotten worse at other similar trains or upstream/downstream locations.

It's not in our best interest to leave pipe in place that continues to wear. When we see it wearing, our first response is to try and upgrade the material.

MEMBER SCHROCK: Does your inspection technique allow you to pretty much map the corrosion pattern?

MR. CROCKET: When you say map, are you speaking along the run of the piping system or very localized mapping?

MEMBER SCHROCK: You were talking about it being nonuniform, and you're concerned, I suppose, with the thinnest place. How do you know that you observed the thinnest?

MR. WILLIAMS: Describe our gridding.

MR. CROCKET: Yes, exactly. The gridding -- we use EPRI recommended grid spacing, and at the point we see low readings, we refine the grid and go to a smaller mesh until we have ascertained where the wear is going on.

MEMBER SCHROCK: Thank you.

MR. KERESTES: We will continue to monitor and inspect our piping systems, again in accordance with this latest update, to ensure plant and personnel safety.

So in conclusion, flow accelerated corrosion effects are acceptable at the extended uprate conditions.

(Slide change)

MR. KERESTES: The next subject I would like to present to you is the feedwater nozzle fatigue usage.

(Slide change)

MR. KERESTES: First I would like to provide you with some background. In our extended power uprate submittal, we noted that the analyzed fatigue usage factors for all components except the feedwater nozzle were within the American Society of

Mechanical Engineers Section III allowable criteria of 1.0.

CHAIRMAN WALLIS: They are within for how long? For a long time in the future?

MR. WILLIAMS: Forty years.

CHAIRMAN WALLIS: Forty years? For the life of the plant?

MR. WILLIAMS: That is correct, Dr. Wallis. We analyzed for 40 years, including pre-uprate and post-uprate operating conditions.

MR. KERESTES: Specifically, we noted that the safe end on the feedwater nozzle exceeded the fatigue usage factor of 1.0 and we would perform evaluations in accordance with the American Society of Mechanical Engineers code Section XI, Appendix L.

Further review indicated an alternate analysis approach to attempting to lower the fatigue usage factor. I would like to present to you that ultimate analysis approach.

(Slide change)

MR. KERESTES: This ultimate analysis approach consisted of two areas. We used more refined methods of analysis as allowed by the Code. These include applying the scaling factors to the applicable thermal stress terms, removing conservatism from the flow scaling factor, and establishing pre-EPU and post-EPU usage contributions.

We also utilized more accurate estimates of plant operational cycles. These cycles are verified by an ongoing fatigue monitoring program at the Clinton Power Station which monitors the usage of the feedwater nozzle during the life of the plant.

If we find ourselves getting close to 1.0, we can perform fracture mechanics and additional inspections.

In conclusion --

CHAIRMAN WALLIS: Why is there fatigue in the feedwater nozzle?

MEMBER SIEBER: Thermal.

CHAIRMAN WALLIS: Is there a lot of fluctuation in temperature?

MR. WILLIAMS: Yes, as a result of transients.

CHAIRMAN WALLIS: It's transients, but you don't have many transients.

MR. WILLIAMS: Included in the plant analysis are -- and contributions toward the analyzed fatigue are thermal transients which the feedwater nozzles are sensitive to. For example, loss of feedwater heaters or other components of --

CHAIRMAN WALLIS: But these are sort of a few dozen in the lifetime of the plant or something, aren't they?

MR. WILLIAMS: That is correct.

MEMBER SIEBER: Hopefully.

CHAIRMAN WALLIS: It's not as if there's some kind of a fluctuation in temperature which is beating this thing all the time, is it? Very unusual -- relatively unusual event, but you still have to take account of it.

MR. WILLIAMS: That is correct.

CHAIRMAN WALLIS: Heat it up and cool down, heat it up and cool down.

MEMBER SHACK: So this is basically a Section III analysis with a fatigue curve that has no environmental contribution versus a Section XI where you would have had a K environment term.

MR. WILLIAMS: Sam, can you get to the microphone?

MR. RANGANATH: My name is Sam Ranganath. I'm with G.E. Nuclear Energy.

The fatigue analysis is that using the Section XI fatigue curves.

MEMBER SHACK: Section III or Section --

MR. RANGANATH: Section III fatigue

curves. There is some debate on how much environmental effects are included in these fatigue curves, and that's going on with the ASME code, but at this point the --

MEMBER SHACK: Did you do an alternate analysis with Section XI, Appendix L, to see what difference it made?

MR. RANGANATH: One can do -- postulate a crack and do a crack growth analysis to --

MEMBER SHACK: Appendix L wouldn't postulate a crack, right? That would just be a smooth -- with a K effective.

MR. RANGANATH: There are several ways -- options that are available to do the Appendix L analysis. One is to include an environmental correction factor, but I believe that much of the conservatism in the correct analysis comes from we assume step changes, for example.

This is an idealized thermal cycle diagram that was developed when the plant was designed, and we have found over time through fatigue monitoring that these step changes and so on are extremely conservative.

So I think we probably have more than enough conservatism to account for even any postulated environmental effects.

MEMBER SHACK: What is your usage factor now with the new analysis?

MR. KERESTES: Right now that number is .873.

MEMBER SHACK: Not a lot of margin left there.

MEMBER POWERS: Approximately, right?

MR. RANGANATH: The feedwater nozzle with the double -- triple sleeve has been a very effective system, and we have not -- in the last 15 years there's been no issues relative to fatigue.

MEMBER SHACK: I mean a design to reduce thermal stresses, you would think, would show up in your analysis.

MR. RANGANATH: Actually --

MEMBER SHACK: It's still .873.

MR. RANGANATH: -- the bulk of the fatigue contribution comes from what's known as the low cycle end of it. The high cycle end of it is the one that gives you the rapid cycling, which has been the focus of interest.

The triple sleeves farger has pretty much caused out the high cycle fatigue aspect of it. So we are tinkering with probably a very conservative analysis for the low cycle fatigue, and wherever we have seen actual fatigue monitoring, we find that the step changes are not anywhere near what we have assumed in the analysis.

So I really believe that this is over many plants when we looked at actual fatigue monitoring. The thermal cycles are a lot less severe than what we assume.

MEMBER SHACK: What did your more refined method of analysis do for you here?

MR. RANGANATH: What we have done is we have done scaling factors of the original assumptions. So the thermal -- for example, the flow rate are higher. So you account for the heat transfer effect.

We also look at actual number of cycles versus postulated numbers. So that's what was done to refine the fatigue analysis. But the fact remains that the original fatigue analysis probably was very conservative.

CHAIRMAN WALLIS: This is irrelevant, because thermal fatigue has caused pipe failures, I believe. It's not something unheard of.

MR. RANGANATH: Yes. That has happened, and the triple sleeves farger was intended to eliminate the leakage that you get, and that's why the high cycle or rapid cycling that caused the original fatigue cracks in the feedwater nozzle is pretty much eliminated, and it's been a very successful modification.

MR. WILLIAMS: Dr. Wallis, I should supplement the discussion we had on operational transient contributions. In addition to operational transients due to equipment problems, the normal start-up and cool-down cycle of the reactor also contributes.

MR. KERESTES: So in conclusion, in the analysis we are now completing we will demonstrate that the feedwater nozzle safe end cumulative usage factor will remain less than 1.0 over the 40 year life of the Clinton Power Station.

I would now like to --

CHAIRMAN WALLIS: You will demonstrate, as far as that it's a "will"? You will do an analysis. It says "will demonstrate." That's a statement of faith?

MR. KERESTES: No. As I noted, right now we have the final draft report form General Electric. We are reviewing that report on site, and going to approve it shortly.

CHAIRMAN WALLIS: So the analysis has been done, and it does show this?

MR. KERESTES: Yes, it does show this.

CHAIRMAN WALLIS: It's just a question of recording it and mailing it?

MR. KERESTES: Thank you. We do have the report. It does show this, and we are in the process of approval on site right now.

Any further question? I would now like to introduce Mr. Keith Moser of Exelon Corporation, who will present the topic of reactor and internals.

(Slide change)

MR. MOSER: I'm Keith Moser. I'm the Reactor Internals Program Manager, and I've got Sam Ranganath. He's my counterpart with G.E. Nuclear.

You know, a couple of months ago we were here talking about Dresden and Quad power uprate and how we do an asset management strategy, go component by component. One of the nice things about a BWR-6 of Clinton's vintage is you don't have a lot of the material issues, that we've got the improved heat treat beams for the X750. We've got low carbon -- Yes, we replaced those out in 1994.

We've got the low carbon stainless steel, and when we walk through all the different components, you know, you basically get to the same place we were with Dresden and Quad. There's two issues that you are really thinking about.

You have, obviously, accounted for the delta P, increased delta P in your fall handbook. So that's covered. But the two areas that you are thinking about is what am I going to do with the additional fluence?

Now for the pressure vessel, what we did back in the summer of 2000, we wanted to incorporate the two code cases so we would get some benefit from lower hydrostatic test pressures. When we did that, we said we know we are going to power uprate. So let's see what we can do with the fluence estimations at that time, and we scaled it up so we wouldn't have to repeat the calculation.

Well, in hindsight that wouldn't have been necessary, because the improved methodology that just got NRC topical approval essentially says we were already conservative, even with EPU conditions.

The next thing that we are looking at is we are going to be doing the shroud inspections. The shroud inspections are coming up this spring. What we are doing is we are doing a fluence profile, again with the same neutron transport calculation, making sure that we account for where we have high fluence welds, what the fluence profile is through-wall and azimuthally.

Then when we get the inspection results, hopefully, we won't have anything but we will be able to better characterize how to do the flaw evaluations.

That kind of takes care of where we're at on the increased fluence that you would expect with the power uprate. The other area is also the increased steam flow that you are going to get.

(Slide change)

MR. MOSER: Most of the places that would show up with would be your dryer. For this dryer, you know, we've done the analysis. It says that we won't have any problems, but just like at Dresden and Quad, we've gone back and said historically have we seen -- Just the last outage we went and looked at some of the dryer components and the separate components.

Then this cycle when we come down in the spring, we are going to again look at the dryer so we get a real good benchmark. Then after power uprate, we are going to go back and look again, just to make sure we didn't miss anything.

When you do that, you know, essentially what we've concluded is that our reactor internal systems and our pressure vessel -- we've pretty much conservatively bounded all the effects that power uprate are going to have, and believe that they are acceptable for EPU conditions.

Are there any questions?

CHAIRMAN WALLIS: These fatigue cracks in the steam dryer, they were actually observed at Clinton or somewhere else?

MR. MOSER: You know, we have some small amount of cracking at Clinton. We're not sure if it's IGSEC or not, because it's pretty much stopped. The place, if you remember, is Peach Bottom. We had some fatigue cracks there.

What we are doing is we're coming up and getting the metallurgical samples done to see if we can't see the beach marks and striations. Again, Sam Ranganath and his team are taking some of the information we've got from other places and seeing if we can't refine our finite element model to better predict when you may run into these things for our fleet.

MEMBER SHACK: Are these stainless steel components?

MR. MOSER: Yes, absolutely.

MEMBER SHACK: Is your shroud 304L?

MR. MOSER: It's an L grade, yes. But

again, 218 vessel, a little more compact than the Dresden models we talked about before. Therefore, you are going to get to those fluence levels a little bit earlier in life.

MEMBER SHACK: What is your fluence level in your shroud welds now?

MR. MOSER: You know, it's above 5 x 10^{20}, slightly above that right now.

MEMBER SHACK: Slightly above it?

MR. MOSER: It's about 80, if I remember right, and we've just gotten a neutron transport calculation. Before we go in the outage, we are going to do a full blown fluence profile, like I said. So I could better answer that question a little bit later. But as you know, that's only for certain areas.

Then we will be factoring in the new VIP documents, VIP 99, I believe, and VIP 100 on fracture toughness and crack growth rates, if there is any cracking to be observed.

Any other questions?

MEMBER SCHROCK: I guess these things are all plant specific that you are talking about here?

MR. MOSER: Yes, sir.

MR. SCHROCK; It seems almost generic, in some sense.

MR. MOSER: Well, the concepts, the approach is fairly generic, how we go through each one of these different asset management strategies or component by component look. But we always use the plant specific values. Thank you.

MR. WILLIAMS: We would now like to discuss core and fuel with Fran Bolger of General Electric.

(Slide change)

MR. BOLGER: I'm Fran Bolger from General Electric. I'm going to discuss the core and fuel design that was done for the power uprate. Next slide, please.

(Slide change)

MR. BOLGER: As part of the power uprate process, an equilibrium core was developed. The equilibrium core was 18 month cycle design with GE 14 fuel. In this equilibrium core design it was demonstrated that the core had sufficient shutdown margin, MCPR margin and LHGR margin, if operated at full EPU.

Recently, we have also completed the reload analysis for the next cycle 9 core which is implementing EPU, and I would like to show some of the details of the cycle 9 core. Next slide, please.

(Slide change)

MR. BOLGER: This slide is a summary of the cycle 9 core. IF you look over on the left side, there is a core map picture. The color bundles, the shaded green and the gray bundles are the fresh fuel to be loaded in cycle 9.

If you look in the slide, you will notice in the center of the box there's a value. In some cases you see a zero. That's indicating it's at zero exposures. Some of the other bundles -- for example, you will see the bundles out on the periphery are at a higher exposure, on the order of 30,000.

The lower value on the box is the bundle type. The bundle type corresponds to the column labeled IAT on the bottom of the chart. This chart shows the fuel which will be resident in cycle 9. There is a two times operated batch of GE 10 fuel. There's a once burned batch of GE 14 fuel and a large fresh batch of GS 14 fuel. The batch is 268 bundles.

I'd like to describe some of the margins that were calculated for cycle 9. Let me say first that this core was designed for not -- Yes, question?

CHAIRMAN WALLIS: This is an eighth of a core?

MR. BOLGER: It's a quarter core.

CHAIRMAN WALLIS: You would think an eighth of a core would be good enough. But then it's not quite -- I notice the numbers aren't quite symmetrical, I notice.

MR. BOLGER: It's close to octein symmetry.

CHAIRMAN WALLIS: Pretty close, but you would expect them to be.

MR. BOLGER: There is some small variation in there. If yo look at the reflected quadrants, you will see some small differences as well.

CHAIRMAN WALLIS: Is that because of the way in which the calculation was run, so that if you saw them one way and you run across something --

MR. BOLGER: Well, one of the main reasons is when the rod patterns change throughout the cycle, they are varied as a function of the cycle, and different rods are inserted. For example, you see this group of rods inserted. This happens to be a symmetric pattern, but later in the cycle you do a sequence exchange, and you may insert this rod here in another group.

So there's a natural tendency to shift the power away from octein symmetry, and then what you will do later in the cycle is set another pattern that will shift it back. So it will tend to achieve octein symmetry throughout, although there will be a small amount of variability.

These columns are some of the margins for the cycle 9 design. This lefthand column is the cycle exposure in megawatt days per short ton.

The next column is the Eigen value. The predicted Eigen value for this cycle -- This was predicted based on a previous cycle operation in the expected performance of the GE 14 reload.

You will notice the core flow goes below the minimum on the power flow map, which was 99 percent. This is because this core and these results are shown at about 90 percent EPU power, because it's a transition to the next cycle, which will be at full EPU.

This next column is the ratio of the MCPR operating limit to the calculated MCPR. In the case of the MCPR, the core was designed for a maximum ratio of MCPR of .93. So you will see in this example that the maximum through the cycle MCPR ratio is only .88. So it had about five percent margin to the design target.

The next column is the MLHGR ratio, which is the ratio of the calculated LHGR to the LHGR limit. In the case of the LHGR, this was designed to a design target of .91, and you can see that the actual design had about two percent margin to the design target.

The last column is -- The second to last column is a ratio of the average planar LHGR to the average planar LHGR limit, and it's similar to the LHGR, had about a .9 relative to the design target of .91.

The last column shows the axial power shape through the cycle. This is a core average axial power shape. The value is presented, and then in parentheses is the axial node.

So you notice that the core tends to burn toward the bottom as you operate through the cycle. Then as you get toward the end of the cycle, the power shape will move toward the middle of the core.

In summary, the core provides the desired energy, has adequate MCPR margin and LHGR margin, as required by the reload process. Next slide, please.

(Slide change)

MR. BOLGER: As is done for full power uprates, the thermal limits monitoring power level is scaled down. In the case of Clinton, it is scaled from a value of 25 percent to a value of 21.6 percent of the EPU power. Next slide, please.

(Slide change)

MR. BOLGER: A conclusion: Adequate margins have been demonstrated in equilibrium design as well in the cycle 9 core design.

CHAIRMAN WALLIS: Are you putting in any kind of new fuel? I forget now.

MR. BOLGER: No. This is the same fuel type that was loaded in the previous cycle.

MEMBER SIEBER: I presume that you believe that future cycles will also be able to take full advantage of the EPU rating?

MR. BOLGER: Yes. There was a equilibrium core analysis that was performed which did show adequate margins in a "when operated at full EPU."

MEMBER SIEBER: Okay.

MR. BOLGER: The next presenter is Kent Scott from AmerGen.

MR. BYAM: My name is Tim Byam. I'm with AmerGen. Dr. Wallis, we have reached the portion of our presentation which is proprietary. It contains General Electric proprietary information.

MR. BOEHNERT: Well, then we need to ask people who are not approved to hear G.E. proprietary material to leave the room. How long do you think the session is going to take?

MR. BYAM: Approximately 30 minutes maybe.

MR. BOEHNERT: Thirty minutes? Okay. Well, if you gentlemen want to go over into the next room and then come back in about 30 minutes, we would let you back in the room.

So we don't have any problem with anybody here? Okay, continue.

Transcriber, we will go into closed session, closed session transcript.

(Whereupon, the foregoing open session went off the record for closed session at 4:19 p.m. and went back on the record at 5:02 p.m.)

CHAIRMAN WALLIS: Are we going to keep going?

MR. SCHWEITZER: Keep going. Next I would like to present the Clinton Mark III containment analysis.

(Slide change)

MR. SCHWEITZER: To evaluate the containment for EPU, we followed the established method for the containment analysis in ELTR1. The limiting events that were analyzed were the main steamline break, the recirculation suction line break, and the alternate shutdown cooling.

(Slide change)

MR. SCHWEITZER: The next slide shows a summary of the results. This table shows the drywell and containment pressures and temperatures and the suppression pool temperature following the analyzed events.

The first column of values on the left are the original analysis in the Clinton updated safety analysis report. The second column of values are the comparison benchmark cases which use the EPU methods with the original licensed power.

The third column of values are the EPU results, and the last column shows the design basis.

Comparing the first and second columns shows the change in methodology. Comparing the second and third column shows the effective of EPU, which is relatively minor with a no vessel pressure change. And comparing the third and fourth column shows the margins to the limits.

I'd like to point out that all remain below the design limit with the exception of the drywell temperature. This value is above the design temperature of 330 degrees for less than .5 seconds. This has been evaluated as acceptable, because there is insufficient time to heat up the structure.

(Slide change)

MR. SCHWEITZER: The conclusion of these results is that Clinton performance of the containment is acceptable at EPU conditions.

CHAIRMAN WALLIS: The peak temperature doesn't really impose some load by itself, does it? It has to heat something else up. Peak pressure would immediately stress whatever is around it.

MR. SCHWEITZER: Correct.

CHAIRMAN WALLIS: The temperature takes some time, particularly with all these masses of metal.

MR. SCHWEITZER: And this is a temperature spike.

MEMBER KRESS: And time is a relevant parameter to have in your limit? Why do they have -- They don't specify a time for it. Why do you feel that time is an appropriate way to accommodate being above the limit?

MR. SCHWEITZER: Well, the temperature is a structural design limit, and with the atmosphere changing for such a short spike, the structures don't change in temperature.

CHAIRMAN WALLIS: So it really should be a design -- a structural limit on temperature, not a atmospheric temperature.

MR. PAPPONE: This is Dan Pappone. It's showing the 330 degree temperature limit. It really is a structural limit. It also factors into the equipment environmental qualifications, and both of those do have a time element in them.

So in this case, we are talking about a very brief transient right at the beginning. We are picking up a little bit of the compressive heating effect as we are squeezing it before we clear the vents, and it drops right down.

If we looked at the actual temperatures that the structure would see and the equipment in there would see, there's a time lag, and they wouldn't be coming up near the 330.

CHAIRMAN WALLIS: I think all you need to do is show by back of envelope or something that the time concept of these things is much longer than the actual time for which it's subjected to this temperature.

MR. PAPPONE: That's right.

MEMBER POWERS: I guess I'm missing something. My intuition is bad here. You increase the amount of energy that you are putting into the drywell and eventually into the containment by roughly 20 percent. Well, where does it go? I mean, all these numbers go down or marginally move up. Where's the energy go?

MR. PAPPONE: The energy is really showing up in the peak suppression pool temperature, and that's the long term part. That's where you are going to see the higher decay heat from the core showing up in the pool, and you've got to get up to a higher delta T across the higher temperature difference across the heat exchangers in order to be able to remove that energy with the fixed service water side conditions that you have.

The short term part as far as peak

temperatures and peak pressures, those are driven almost exclusively by the pressure in the vessel. We are keeping that constant, so when we break the pipe and it comes rushing out, we've got the same driving function --

MEMBER POWERS: So if looked at a time plot on these things, I would find that if I integrated that, I would get my 20 percent back?

MR. PAPPONE: Yes. The 20 percent would show up in the pool temperature, and I believe that is what the results are showing.

MR. SCHWEITZER: You can see that between the comparison of column 2 and 3.

MR. PAPPONE: Right. The ten degree increase in the pool temperature due to the power uprate is that piece that's due to the core power change.

CHAIRMAN WALLIS: Why is it limited to 185 degrees Fahrenheit? What are you concerned about, if it goes above 185?

MR. PAPPONE: The concern there is the partial pressure in the air space in the containment part. Well, the containment is a large structure. So it's not like the earlier containment, Mark1/Mark2 containments that had a 56 to 62 psi design pressure.

This has a much smaller one.

CHAIRMAN WALLIS: So it's the effects of this temperature on the pressure that you are concerned about?

MR. PAPPONE: That's right.

CHAIRMAN WALLIS: Really, the bottom lien is the pressure, isn't it?

MR. PAPPONE: That's right.

CHAIRMAN WALLIS: And you are not taking this water and pumping it somewhere else. It's not a question of --

MEMBER KRESS: It's a big pool.

CHAIRMAN WALLIS: It's a big pool.

MR. PAPPONE: They've got the big pool in there, and we're cooling that pool remote, if you will.

CHAIRMAN WALLIS: Do you have a picture of this containment somewhere?

MR. PAPPONE: Do we have one?

CHAIRMAN WALLIS: I'm just trying to remember.

MR. PAPPONE: I could draw a sketch for you real quick, if you like.

MR. SCHWEITZER: Would you like a sketch?

CHAIRMAN WALLIS: Well, maybe you can make a sketch. We can go on. You can hand it to me in ten minutes or something. Are we done for the day now?

MR. WILLIAMS: Dr. Wallis.

CHAIRMAN WALLIS: Okay, make the sketch. Please make the sketch then.

MR. WILLIAMS: Dr. Wallis, while he's making the sketch, we are prepared to clarify the issue on the core flow.

CHAIRMAN WALLIS: Yes.

MR. WILLIAMS: If you would give us a few minutes.

CHAIRMAN WALLIS: Sure.

MR. WILLIAMS: We would like to reintroduce Kent Scott to discuss it.

MR. SCOTT: Thanks, Joe. Again I'm Kent Scott from AmerGen. Did a little bit of research with respect to the differences between the core flows on the two power to flow maps, the existing one and the new power to flow map, the 105 percent vice 107 percent.

What I found was that the -- So the licensed value for core flow is 107 percent of the original rating or 90.4 millions pound mass per hour. That's what is shown on the original power to flow map.

CHAIRMAN WALLIS: That's what we see here.

MR. BOEHNERT: Right.

CHAIRMAN WALLIS: It's not quite the same as the one that we saw on the handout.

MR. SCOTT: That's right. Well, a little bit of history. After implementation of the increased core flow licensing change, we found that the plant was only able to achieve 102.5 percent core flow.

With this in mind, the cycle 9 reload design used a limiting value of 105 percent for core flow. This was done to provide additional operating margin from thermal limits. So when they did the reload design for cycle 9, they looked at it and said, well, we're not going to be able to get to the 107 percent licensed limit; let's use 105 percent, and that will give us additional operating margin to thermal limits.

So that was the basis for the difference between the two. Thanks.

MR. WILLIAMS: Thank you.

MR. BYAM: I believe we've reached --

CHAIRMAN WALLIS: We're just waiting for Dan to draw us a sketch to go home.

MR. BYAM: We're waiting for our artist to finish here.

MEMBER SIEBER: It looks a lot like the Ramada Inn.

CHAIRMAN WALLIS: Do the Subcommittee have any other questions to raise while we are waiting for the picture? Any observations?

MR. BOEHNERT: There it is.

MR. PAPPONE: This is a quick sketch of the Mark 3 containment where we've got the reactor vessel sitting inside of a cylindrical concrete shell. We've got a large, large steel building, another cylinder outside.

All of the refueling stuff is inside of the containment up here above the drywell, and got the suppression pool in here. We've got a weir wall with a set of three horizontal vents.

Now where do we want to go with this?

MR. SCOTT: Talk about the various design pressures and temperatures?

MR. PAPPONE: Right. I guess the biggest difference when you are looking back at the -- comparing this to the earlier containments is you've got this big, big containment air space volume.

CHAIRMAN WALLIS: Drywell and wetwells are --

MR. PAPPONE: This is the drywell region

in here.

CHAIRMAN WALLIS: I could never figure out why it was dry, but I guess that's the drywell.

MR. PAPPONE: Because we've got the big pool of water here, and that's the wetwell. In the earlier containments, the Mark 1, the Mark 2 containments, the drywell volume and the wetwell volume were about the same.

CHAIRMAN WALLIS: This is the one where you have the vent clearing of the three, and you have a big bubble that comes through and all that stuff.

MR. PAPPONE: All of them have some form of vent clearing. All of them have some form of big bubble. But in here, the key difference is that we've got this big, big full reactor building structure and, because that structure is so big, it's not designed for the 60 psi loads, pressure loads, inside.

That's where the concern was. We heat this up to 185 degrees. We get a partial pressure of water up here that gets close to that design pressure limit.

CHAIRMAN WALLIS: This is still very low compared with the design structural limit of 15 psi.

MR. PAPPONE: Right. The structural limit here is a 15 psi compared to the 60-ish. The structure here is still the same 60-ish psi.

MEMBER SIEBER: But you never achieved the--

MR. BOEHNERT: Jack, we can't hear you.

MEMBER SIEBER: Oh. You never get close to 60 psi in the drywell in any accident. Is that not true?

MR. PAPPONE: For those other -- For any of these, no. The earlier containments, we get fairly close to it. The Mark 1s we get up there, not all the way. The 62 psi, as I say, is a transient overpressure limit.

MEMBER SIEBER: Then you have automatic relief through the suppression.

MR. PAPPONE: Right. The whole suppression -- pressure suppression containment relieves that pressure through here with the idea that we are going to condense that steam here and not subject the rest of the building to that pressure.

MR. BOEHNERT: So the wetwell air space load is for controlling over the hydraulic loading at 185?

MR. PAPPONE: At 185 that's where we're looking at the pressure loading across this part of the structure.

MR. BOEHNERT: That was controlling?

MR. PAPPONE: The structural load here is feeding back into the air space pressure here that then feeds back into the pool temperature limit.

CHAIRMAN WALLIS: Okay. thank you. Do we look ahead to tomorrow or have we got something else to do today?

MR. BYAM: We are prepared to continue, if you would like, or we can break at this point.

CHAIRMAN WALLIS: No, I think you can break at this point. We don't seem to have that much to do tomorrow.

MR. BYAM: No. I think that --

CHAIRMAN WALLIS: The bulk of it concerns Bill Burchill's risk analysis. Is that the bulk of tomorrow?

MR. BYAM: Yes, as well as project implementation.

CHAIRMAN WALLIS: And we should be able to do that, say, in about an hour?

MR. BYAM: I would say an hour and a half, max.

MEMBER POWERS: Do we have somebody on the committee to play Steve Rosen?

CHAIRMAN WALLIS: Any volunteers?

MEMBER POWERS: Well, I am noticing that they are going to discuss large transient testing.

CHAIRMAN WALLIS: That's right.

MEMBER POWERS: And I peeked ahead, perhaps illegitimately. I noticed that they are not in favor of large transient testing. I was shocked to see that.

CHAIRMAN WALLIS: It's the same arguments we had before.

MEMBER POWERS: And as you will recall, the bulk of the ACRS thought that was fine, but we had one strong dissenting opinion. Are we going to be able to reproduce his arguments? I can't.

MEMBER KRESS: No, but we can give him a chance during the full Committee meeting.

MEMBER POWERS: Well, I was hoping we could avoid that.

CHAIRMAN WALLIS: He essentially takes the view that, no matter how much you believe that you've got it all under control and you can calculate things, you never really know until you test it.

MEMBER SHACK: He's a structuralist, despite being a PRA man.

CHAIRMAN WALLIS: Yes. He's a doubter. I guess he has enough experience behind him.

MEMBER POWERS: Why don't you just put that on your Vu-Graph, that only a structuralist would endorse doing these tests.

CHAIRMAN WALLIS: Well, I wish we would get away from this labeling people as one thing or another, as if there were some sort of religion involved here. We can all be rational without being called rationalists, I hope.

MEMBER SHACK: I would hope that I didn't -- Scratch a rationalist hard enough, and he becomes a structuralist.

MEMBER POWERS: As we found out.

CHAIRMAN WALLIS: We could turn you into a conservative, too.

MEMBER POWERS: I don't think so.

CHAIRMAN WALLIS: I think we're through for today.

MR. BYAM: Would the committee like a more formal drawing of the containment? Would that be beneficial?

CHAIRMAN WALLIS: Sure. It would be very nice to have a picture in the morning.

MEMBER POWERS: I think we've got one.

CHAIRMAN WALLIS: I remember this sort of thing. Yes, that's fine.

MEMBER POWERS: I don't think I would knock myself out on that. I'm sure we can find one.

MR. BYAM: Thank you.

CHAIRMAN WALLIS: Anything else the committee would like before we break? We are going to recess. Is that the word?

MR. BOEHNERT: Recess.

CHAIRMAN WALLIS: Recess until tomorrow morning at 8:30, and then we will finish your presentations in a little over an hour, we hope, and then we need to hear from the staff. That should take us until lunchtime tomorrow.

MR. BYAM: Thank you.

CHAIRMAN WALLIS: And if there is no impediment to that, I will close the meeting today.

Thank you all very much for your presentations.

(Whereupon, the foregoing matter went off the record at 5:18 p.m.)

CERTIFICATE

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

Name of Proceeding: ACRS Thermal-Hydraulic Phenomena and Future Plant Designs Subcommittee Meeting

Docket Number: (Not Applicable)

Location: Rockville, Maryland

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Pippa Antonio

Pippa Antonio
Official Reporter
Neal R. Gross & Co., Inc.

INTRODUCTORY STATEMENT BY THE CHAIRMAN OF THE
SUBCOMMITTEE ON THERMAL-HYDRAULIC PHENOMENA
11545 ROCKVILLE PIKE, ROOM T-2B3
ROCKVILLE, MARYLAND
FEBRUARY 13-15, 2002

The meeting will now come to order. This is a meeting of the ACRS Combined Subcommittee on Thermal-Hydraulic Phenomena and Future Plant Designs. I am Graham Wallis, Chairman of the Subcommittee on Thermal-Hydraulic Phenomena. Tom Kress, Chairman of the Future Plant Designs Subcommittee, will chair the meeting session beginning at 1:00 p.m. on February 14, 2002.

Other ACRS Members in attendance are: Dana Powers, Bill Shack, and Jack Sieber. The ACRS Consultant in attendance is Virgil Schrock.

The Combined Subcommittee will (1) begin review of the license amendment request of Entergy Operations, Incorporated for a core power urpate for the Arkansas Nuclear One, Unit 2 plant, (2) begin review of the license amendment request of the AmerGen Energy Company for a core power uprate for the Clinton Nuclear Power Plant, Unit 1, and (3) continue review of the Phase 2 pre-application review of the Westinghouse Electric Company's AP1000 passive plant design. The Subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate, for deliberation by the full Committee. Mr. Paul Boehnert is the Cognizant ACRS Staff Engineer for this meeting.

The rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the *Federal Register* on January 29, 2002.

Portions of the meeting may be closed to the public, as necessary, to discuss information considered proprietary to General Electric Nuclear Energy and the Westinghouse Electric Company.

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

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

(Chairman's Comments-if any)

We will now proceed with the meeting and I call upon Mr. Rick Lane of Entergy Operations Incorporated to begin.

OPEN SESSION

OPEN SESSION

AmerGen
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Extended Power Uprate

Clinton Power Station, Unit 1

AmerGen Energy Company, LLC
presentation to
Subcommittee on Thermal-Hydraulic Phenomena
Advisory Committee on Reactor Safeguards

February 13 & 14, 2002

Introduction

Joe Williams, Exelon Nuclear

Site Engineering Director

Agenda

- Introduction
- Project Summary
- Modifications
- Selected Analyses
- EPU Risk Evaluation
- Project Implementation
- Conclusion

Introduction

- Safely increase licensed thermal power by 20%
- Use accepted methodology to leverage industry experience
- Perform plant modifications to improve performance
- Increase the electrical output of CPS

Project Summary

Dale Spencer, Exelon Nuclear
CPS EPU Project Manager

Project Summary

- Two step phased implementation
  - C1R08 (May 2002)
  - C1R09
- Modifications phased in over same time period
- Few changes to safety-related structures, systems, and components
- Plant will be balance of plant (BOP) limited following uprate

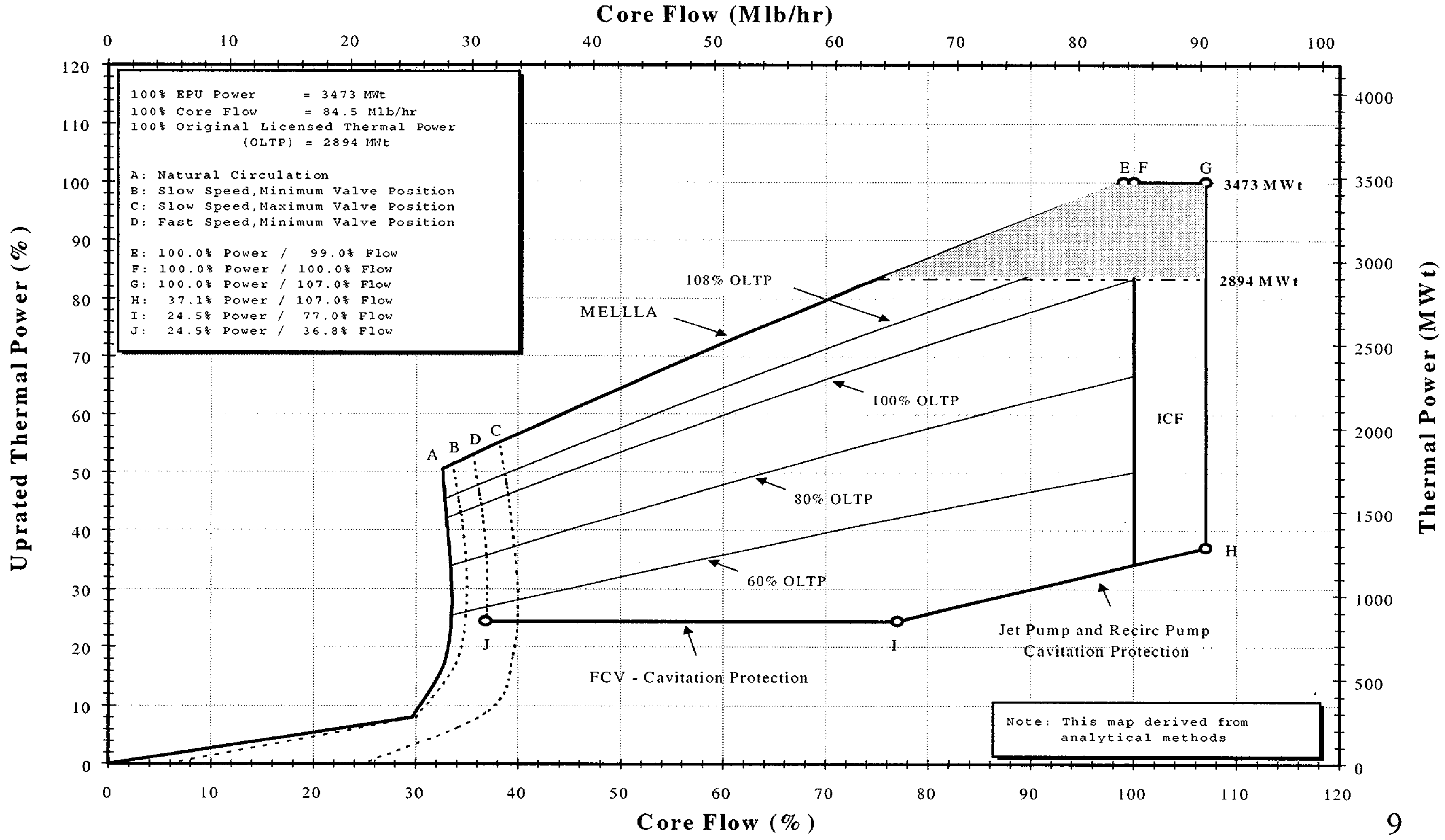
Project Summary

- Integrated Project Team with extensive plant and industry experience
  - Exelon/AmerGen
  - GE (NSSS A/E)
  - Sargent and Lundy (original BOP A/E)
- Use of industry contacts and lessons learned
- Analyses based on GE standard processes

Current and EPU Operating Conditions

Parameter	Current Rated Power Value	EPU Value
Thermal Power (MWt)	2894	3473
Vessel Steam Flow (Mlb/hr)	12.4	15.1
Full Power Core Flow Range		
Mlb/hr	63.4 to 90.4	83.7 to 90.4
% Rated	75 to 107	99 to 107
Dome Pressure (psig)	1025	No change
Dome Temperature (°F)	549.4	No change
Turbine Inlet Pressure (psia)	982	954
Full Power Feedwater		
Flow (Mlb/hr)	12.4	15.1
Temperature Range (°F)	370 to 420	380 to 430
Core Inlet Enthalpy (BTU/lb)	527.8	525.5

Power/Flow Operating Map for EPU



Plant Modifications & Analyses

Dale Spencer, Exelon Nuclear
CPS EPU Project Manager

Plant Modifications

- Phase 1, C1R08 safety-related changes
  - Nuclear Instrumentation
  - No safety-related hardware changes required

Plant Modifications

- Phase 1, C1R08 BOP Modifications
  - High Pressure Turbine Replacement
  - Main Power Transformer Replacement
  - Isolated Phase Bus Duct Cooling Improvements
  - Replace Generator Hydrogen Coolers
  - Increase Generator Hydrogen Pressure
  - Replace Generator Excitation Anode Transformer
  - Upgrade five Feedwater Piping Supports

Plant Modifications

- Phase 2 - Proposed BOP Efficiency Improvements
  - Main Condenser Improvements
  - Condensate Polisher Flow Balancing
  - Moisture Separator Reheater Chevron Replacement
  - Switchyard and Relaying Upgrades
  - Generator Excitation System Upgrade
  - Bus Duct Cooling and Configuration Upgrades

Selected Analyses and Evaluations

- Piping
- Flow accelerated corrosion
- Feedwater nozzle fatigue
- Reactor and internals
- Core and fuel
- Thermal-hydraulic stability
- ECCS performance
- Transient events
- Containment
- Large transient testing
- ATWS event response

Piping Analysis

Bob Kerestes, AmerGen
Paul Olson, S&L

Piping Analysis

- Safety-related pipe stress evaluations were performed in accordance with ELTR1 and ELTR2
- Safety-related pipe support loading evaluations were performed in accordance with ELTR1 and ELTR2 or were qualified based on more detailed analysis

Piping Analysis

- Detailed pipe support loading analyses included
  - Application of load factors to the individual load components affected by EPU (i.e. thermal and transient loads)
  - Updated plant specific turbine stop valve closure transient
  - Updated plant specific feedwater pump trip transient

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Piping Analysis

Conclusion

- All safety-related pipe stress levels are within Code allowable limits
- Five nonsafety-related support modifications will be required to feedwater system outside containment
- All other piping and supports acceptable
- No new pipe break locations were identified

Piping systems are acceptable at EPU conditions

Flow Accelerated Corrosion

Bob Kerestes, AmerGen
Harold Crockett, Exelon Nuclear

Flow Accelerated Corrosion

- Updated existing FAC program for EPU parameters
- FAC program identified inspection points
- Incorporated into plant monitoring program

Flow Accelerated Corrosion effects are acceptable at EPU conditions

Feedwater Nozzle Fatigue Usage

Bob Kerestes, AmerGen
Sam Ranganath, GE

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Feedwater Nozzle Fatigue Usage

Background

- In EPU submittal, fatigue usage factors for all components except feedwater nozzle safe end within ASME Section III allowable criterion of 1.0
- Feedwater nozzle safe end exceeded fatigue usage of 1.0 and would be evaluated in accordance with ASME code Section XI, Appendix L

Feedwater Nozzle Fatigue Usage

Methodology/Conclusion

- More refined methods of analysis used as allowed by Code
- More accurate estimates of plant operational cycles

Feedwater nozzle safe end cumulative usage factor will remain less than 1.0 over 40 year plant life

Reactor and Internals

Keith Moser, Exelon Nuclear
Sam Ranganath, GE

Reactor and Internals
Scope and Methods

- Exelon reactor internals asset management strategy involves a systematic review of components
  - Inspection, evaluation, mitigation and selective repair
  - Degradation modes – SCC and Fatigue addressed
- Component by component review for EPU effects
  - Current P-T curves conservative for operation at EPU conditions
  - All reactor internals evaluated for Flow Induced Vibration (FIV) due to increased steam flow
    - All components have required FIV margins for EPU flow

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Reactor and Internals

Steam Dryer Experience

- Fatigue cracking has been observed in steam dryer drain channel and tie bar
- Not a safety concern; can be managed by inspections
  - Dryer cracking consequences addressed in BWRVIP-06
  - Steam dryer is not a safety related component
  - Lost part consequences shown to be acceptable
    - Loose parts expected to be large
    - Core shroud, shroud head form protective boundary
    - Lost dryer parts pose no threat to core and fuel integrity
    - MSIV closure is assured even with lost dryer parts
  - Pre- and post-EPU inspection to be performed on dryer

Reactor and Internals
Conclusion

- Comprehensive evaluation of reactor and internals using approved methods
- Used recent industry experience

Reactor and internals *are acceptable at EPU conditions*

Core and Fuel

Fran Bolger, GE

John Freeman, Exelon Nuclear

Core and Fuel

Methodology

- Equilibrium core analyzed to demonstrate reactivity margin and thermal margin capability
- Reload core analysis performed for Reload 8 / Cycle 9

Clinton Cycle 9 Core Design

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Bundle ID
Average Exposure (GWD/ST)
IAT

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
1											YJG956 27.3 11	YJG832 24.5 11	YJG807 24.7 11	YJG788 23.7 11	56
2								YJG830 27.8 11	YJG831 25.9 11	YJG790 23.8 11	YJG826 22.2 11	YJG819 23.2 11	YJG960 24.2 11	YJG829 23.1 11	54
3							YJG810 26.3 11	YJG957 23.4 11	JLB647 0.0 14	JLB651 0.0 14	JLB655 0.0 14	JLB659 0.0 14	JLB661 0.0 14	JLB665 0.0 14	52
4						YJG817 26.6 11	YJG814 23.3 11	JLB643 0.0 14	JLB648 0.0 14	YJX086 12.9 12	JLB656 0.0 14	YJX087 13.6 12	JLB662 0.0 14	YJX033 14.7 12	50
5					YJG804 27.2 11	YJG892 22.6 11	JLB641 0.0 14	JLB644 0.0 14	YJX062 14.2 12	JLB652 0.0 14	YJX103 14.5 12	JLB773 0.0 15	YJX182 14.8 13	JLB793 0.0 15	48
6				YJG901 26.5 11	YJG803 22.7 11	JLB639 0.0 14	JLB733 0.0 15	YJX136 12.9 13	JLB751 0.0 15	YJX041 14.6 12	JLB767 0.0 15	YJX112 13.9 12	JLB783 0.0 15	YJX102 15.1 12	46
7			YJG802 26.6 11	YJG825 23.7 11	JLB633 0.0 14	JLB725 0.0 15	YJX066 14.9 12	JLB743 0.0 15	YJX111 13.6 12	JLB781 0.0 15	YJX161 13.6 13	JLB774 0.0 15	YJX097 15.1 12	JLB794 0.0 15	44
8		YJG959 27.8 11	YJG828 23.6 11	JLB625 0.0 14	JLB634 0.0 14	YJX119 12.9 13	JLB734 0.0 15	YJX165 13.0 13	JLB742 0.0 15	YJX127 12.1 13	JLB768 0.0 15	YJX158 11.6 13	JLB784 0.0 15	YJX147 14.8 13	42
9		YJG806 24.9 11	JLB613 0.0 14	JLB626 0.0 14	YJX095 14.6 12	JLB726 0.0 15	YJX148 13.2 13	JLB744 0.0 15	YJX099 14.8 12	JLB762 0.0 15	YJX167 13.2 13	JLB775 0.0 15	YJX121 13.5 13	JLB795 0.0 15	40
10		YJG961 23.3 11	JLB614 0.0 14	YJX154 13.0 13	JLB635 0.0 14	YJX063 15.0 12	JLB735 0.0 15	YJX163 12.1 13	JLB753 0.0 15	YJG964 26.9 11 [20]	YJG955 24.8 11	YJX067 12.0 12	JLB785 0.0 15	YJG818 27.3 11 [12]	38
11	YJG954 27.6 11	YJG820 22.4 11	JLB615 0.0 14	JLB627 0.0 14	YJX098 14.5 12	JLB727 0.0 15	YJX135 13.6 13	JLB745 0.0 15	YJX187 13.2 13	YJG808 24.9 11	YJG794 26.8 11	JLB776 0.0 15	YJX101 14.1 12	YJG963 26.4 11	36
12	YJG801 24.3 11	YJG904 22.9 11	JLB616 0.0 14	YJX096 13.7 12	JLB721 0.0 15	YJX109 13.9 12	JLB736 0.0 15	YJX169 11.5 13	JLB754 0.0 15	YJX073 12.0 12	JLB769 0.0 15	YJX093 12.9 12	JLB786 0.0 15	YJX064 15.4 12	34
13	YJG816 24.5 11	YJG815 24.0 11	JLB617 0.0 14	JLB628 0.0 14	YJX118 14.8 13	JLB728 0.0 15	YJX100 15.0 12	JLB746 0.0 15	YJX183 13.5 13	JLB763 0.0 15	YJX030 14.0 12	JLB777 0.0 15	YJX061 13.2 12	JLB796 0.0 15	32
14	YJG824 24.0 11	YJG821 23.4 11	JLB618 0.0 14	YJX094 14.7 12	JLB722 0.0 15	YJX104 15.1 12	JLB737 0.0 15	YJX133 14.8 13	JLB755 0.0 15	YJG793 27.3 11 [12]	YJG822 26.4 11	YJX091 15.2 12	JLB787 0.0 15	YJG962 25.6 11	30
	01	03	05	07	09	11	13	15	17	19	21	23	25	27	

Bundle Name	IAT	# in Core	# Fresh	AvgWt KG	AvgExp GWD/ST	AvgRea	Avg Power
GE10-P8SXB353-12GZ-120T-150-T	11	168	0	177.93	25.0	1.010	0.590
GE14-P10SNAB353-13GZ-120T-150-T-2412	12	112	0	180.17	14.2	1.106	1.210
GE14-P10SNAB354-15GZ-120T-150-T-2413	13	76	0	179.83	13.3	1.106	1.270
GE14-P10SNAB395-16GZ-120T-150-T-2519	14	108	108	179.23	0.0	0.971	0.900
GE14-P10SNAB385-16GZ-120T-150-T-2520	15	160	160	179.18	0.0	0.960	1.220
	Total	624	268	179.11	10.9	1.019	1.00

Low average radial peaking

CYCLE EXP	K-EFF	FLOW-%	MFLCPR	MFLPD	MAPRAT	AXIAL POWER PEAK
200	1.0017	100.0	.840(12, 7)	.854(10,11,16)	.886(10,11,16)	1.349(10)
1400	1.0018	97.2	.848(12, 7)	.809(12, 7, 4)	.839(7,12, 4)	1.361(5)
2800	1.0018	91.6	.860(7,12)	.828(12, 7, 4)	.862(7,12, 4)	1.406(5)

Etc..

CYCLE EXP	K-EFF	FLOW-%	MFLCPR	MFLPD	MAPRAT	AXIAL POWER PEAK
9600	0.9968	95.7	.881(13,14)*	.808(14,14, 4)	.845(9, 6, 4)	1.358(4)
12000A	0.9946	90.0	.859(11, 6)	.886(3,13, 4)*	.898(5,12, 3)	1.539(4)
15550	0.9928	100.0	.841(14, 7)	.854(10,10,11)	.840(10,10,10)	1.352(10)

Etc..

Provides the desired energy

Has adequate MCPR margin

Has adequate LHGR and MAPLHGR margin

Reload design process ensures margins are adequate

Core and Fuel

Results

- Thermal limits monitoring power threshold changed from 25% pre-EPU CTP to 21.6% EPU CTP

Core and Fuel

Conclusion

Adequate margins demonstrated in equilibrium design and in cycle 9 core design

Thermal-Hydraulic Stability

Kent Scott, AmerGen
CPS Operations Services Manager
Jason Post, GE

Stability

Background

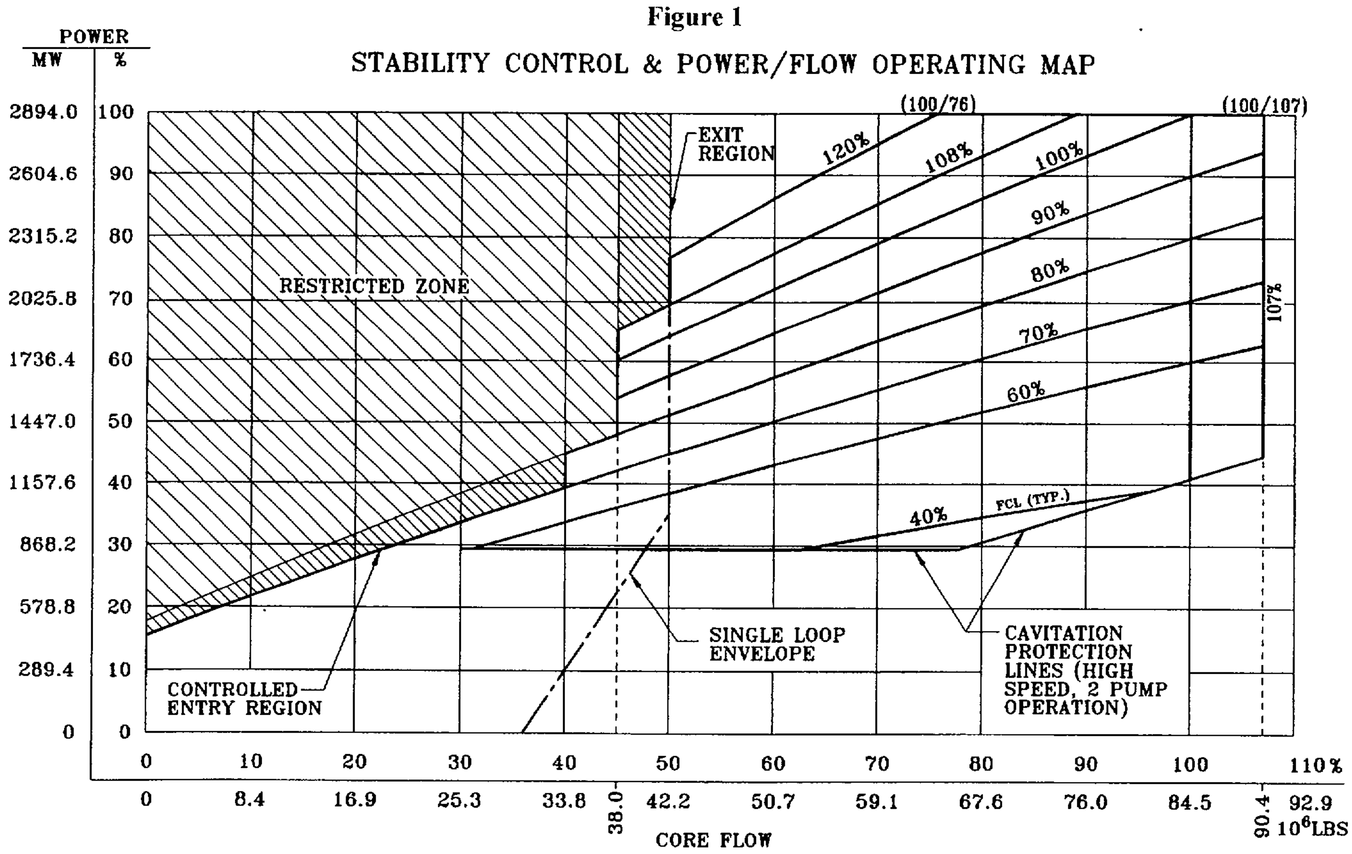
- CPS is currently operating under interim corrective actions (ICAs)
  - ICAs provide manual prevention and suppression
- CPS implementing stability solution Option III
  - Automatic "detect and suppress" solution
  - Detection algorithm implemented with new hardware: Oscillation Power Range Monitor (OPRM)
  - OPRM initiates reactor scram in the trip enabled region if oscillations reach OPRM count and amplitude setpoints
  - Implementation on hold pending 10 CFR 21 resolution

Stability

Current ICA Power/Flow Map

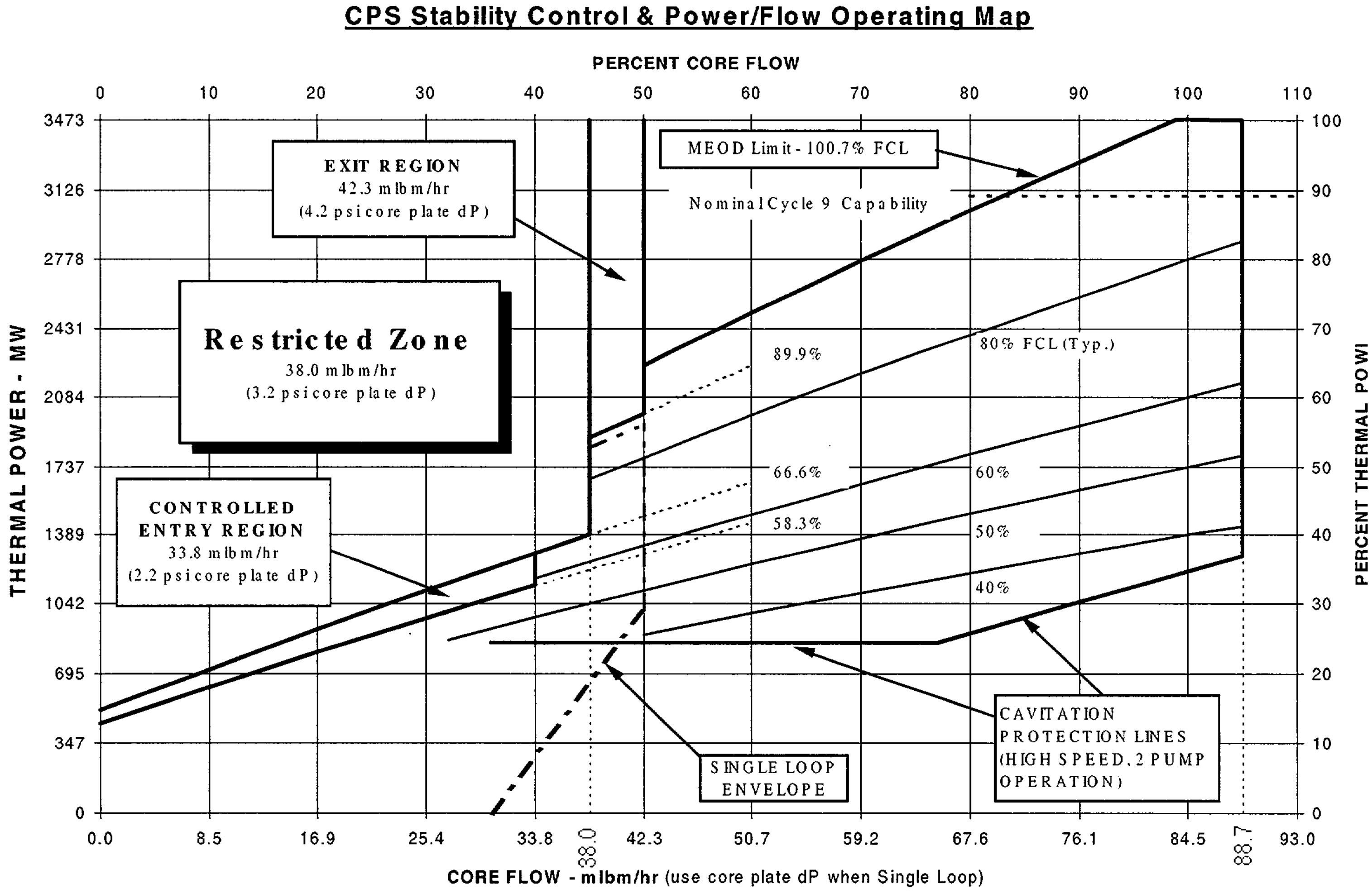
Figure 1

STABILITY CONTROL & POWER/FLOW OPERATING MAP



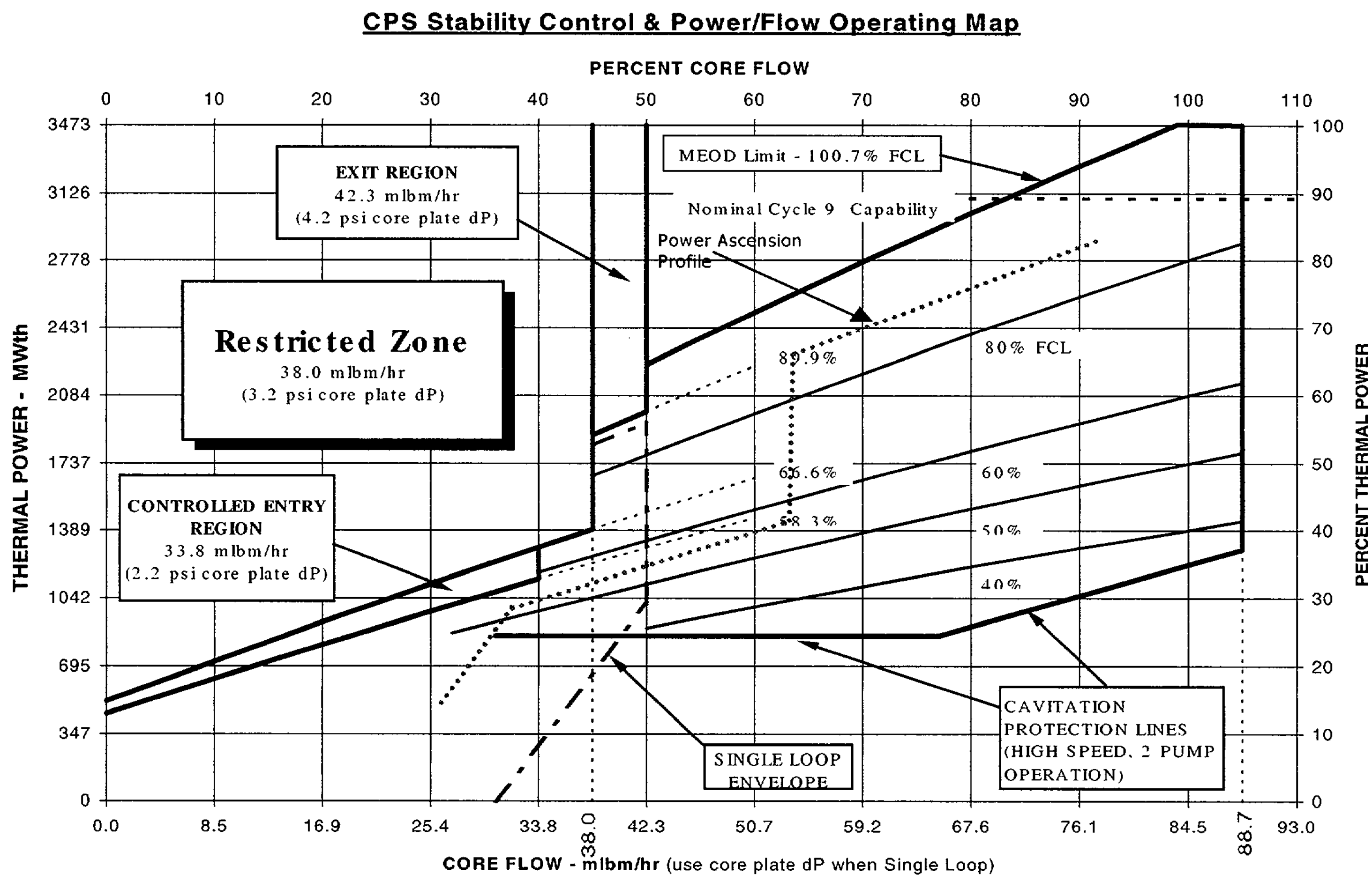
Stability

EPU ICA Power/Flow Map



Stability

Operational Aspects - ICA power/Flow Map



Stability

Methodology

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Stability
Conclusion

- CPS EPU startup under ICAs
  - Re-scaled to maintain absolute power and flow conditions
  - Provide protection to prevent and suppress oscillations
  - Operator actions remain unchanged
- CPS will perform OPRM setpoint cycle specific stability analyses

Thermal-hydraulic stability is acceptable at EPU conditions

ECCS Performance

Eric Schweitzer, AmerGen
Dan Pappone, GE

ECCS Performance

Background

ECCS Performance

Results

Parameter	USAR	EPU	Limit
Method	SAFER/GESTR	SAFER/GESTR	NA
Power (MWt)	3015	3543	NA
Licensing Basis Peak Clad Temperature (PCT), °F	< 1550	< 1570	≤ 2200
Cladding Oxidation, % Original Clad Thickness	< 1.0	< 1.0	≤ 17
Hydrogen Generation (Corewide Metal-Water Reaction), %	< 0.1	< 0.1	≤ 1.0

ECCS Performance

Conclusion

- Methodology has conservative basis
- Results indicate that all 10 CFR 50.46 criteria met

ECCS performance is acceptable at EPU conditions

Transient Events

Eric Schweitzer, AmerGen
Fran Bolger, GE

Transient Events

Methodology

Transient Events

Results

Limiting Event	Cycle 8	Cycle 9	Limit
Overpressurization (Vessel Pressure)	1288 psig	1314 psig	1375 psig
Turbine Trip without Bypass (OLMCPR)	1.34	1.31	NA

Transient Events

Conclusion

- Operating limit MCPR remains acceptable under EPU conditions
- Vessel overpressure protection remains within ASME limits under EPU conditions
- Loss of feedwater event reactor water level remains above the top of active fuel

CPS transient analysis results acceptable for EPU conditions

Containment Analysis

Eric Schweitzer, AmerGen
Dan Pappone, GE

Containment Analysis

- Followed the established method for containment analysis in ELTR1
- Limiting events analyzed
  - Main steam line break (MSLB)
  - Recirculation suction line break (RSLB)
  - Alternate shutdown cooling (ASDC)

Containment Analysis

Containment Performance Results

Parameter	USAR Methods (102% of OLTP)	Current Methods (102% of OLTP)	Current Methods 102% of EPU	Design Structural Limit
Peak Drywell Pressure (psig)				
MSLB	18.9	23.1	23.2	30
RSLB	19.7		21.3	
Peak Drywell Atmos Temp. (°F)				
MSLB	330	339.9	340.0	330
RSLB	246.6		248.6	
Peak Containment Pressure (psig)				
MSLB	8.7		7.0	15
RSLB	8.7	3.2	3.9	
ASDC			6.1	
Peak Containment Temp. (°F)				
MSLB	180.3		158.8	185
RSLB	180.3	149.2	149.3	
Peak Suppression Pool Bulk Temp. (°F)				
MSLB	180.3		177.1	185
RSLB	180.3	167.5	177.2	
ASDC	175.5		182.6	

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Containment Analysis

Conclusion

Containment performance is acceptable at EPU conditions

Large Transient Testing

Larry Westbrook, AmerGen
CPS SRO - Operations

Large Transient Testing
Background

- ELTR1 specified large transient tests
  - MSIV closure of all valves at 110 % Original Licensed Thermal Power (OLTP)
  - Generator load rejection at 115 % OLTP
- AmerGen has taken exception to these tests as an unnecessary challenge to the plant
- GE has concluded these tests are no longer necessary when reactor dome pressure is unchanged
  - EPU reactor dome pressure remains the same for CPS
  - Tests will not provide new significant information
  - Existing modeling code adequately predicts plant response

Large Transient Testing

Methodology

- Power uprate industry experience
  - KKL performed transient testing at uprated conditions with acceptable results
  - Unplanned transient at Hatch at uprated conditions showed parameters were acceptably predicted
- Performance of plant structures, systems and components has been evaluated at EPU conditions
- Surveillance testing will confirm that these components maintain required performance capability

Large Transient Testing

Conclusion

- No new significant information will be gained by performing these tests
  - Transient modeling code shown to be acceptable
  - Plant response to these transients as a result of EPU will not change significantly
  - There is operating experience on uprated plants
  - Plant components will perform as designed

Large transient testing is not required to be performed at CPS

ATWS Event Response

Larry Westbrook, AmerGen
Jason Post, GE

ATWS Event Response

- EPU ATWS event response operator actions unchanged from pre-EPU conditions
  - Following reactor recirculation pump trip the reactor power and flow is unchanged
  - Symptomatic conditions for ATWS remain unchanged for EPU
  - Mitigating operator actions remain unchanged for control of reactor power, water level, and pressure

ATWS Event Response

- Raised minimum SLC boron concentration to increase the rate of negative reactivity addition
- Analytical results for EPU ATWS

	Pre-EPU	EPU	Limit
Peak Reactor Pressure (psig)	1264	1336	1500
Peak Suppression Pool Temperature (°F)	160	165	185
Peak Containment Pressure (psig)	5.6	6.3	15
Peak Clad Temperature (°F)	1440	1477	2200

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ATWS Event Response
Conclusion

- CPS has implemented an ATWS mitigation strategy consistent with BWROG EPGs

EOP operator actions remain unchanged for EPU

EPU Risk Evaluation

Bill Burchill, Exelon Nuclear

Purpose of EPU Risk Evaluation

- Estimate change in full power internal events (FPIE) core damage frequency (CDF) produced by EPU
- Estimate change in FPIE large early release frequency (LERF) produced by EPU
- Identify qualitatively changes in risk from other sources, e.g., external events or shutdown state, produced by EPU
- Identify PRA revisions required to represent plants following EPU

EPU Risk Presentation Subjects

- FPIE quantitative risk evaluation
  - Evaluation methods
  - Dominant effects of EPU
  - Quantitative results
  - Uncertainties
  - Includes internal flooding risk
- Qualitative risk evaluation
  - Fire risk
  - Seismic risk
  - Shutdown risk
- Summary of EPU risk impacts

FPIE Risk Evaluation
Methods

- Identify plant configuration changes due to EPU
- Use recently-updated PRA models
- Identify those PRA elements affected by plant configuration changes
- Use realistic models
- Compare with realistic success criteria and limits
- Model hardware and procedure changes using sensitivity cases with PRA model
- Compare results with Regulatory Guide 1.174 Guidelines

FPIE Risk Evaluation

Methods

- Reviewed PRA technical elements

-Initiating events	-Operator responses
-Success criteria	-Structural analysis
-Systems	-Quantification
-Data	-Event tree sequences

- Evaluated the impact on thermal-hydraulic parameters (e.g., time to boildown, core damage)

FPIE Risk Evaluation

EPU Effects - Operating Conditions

- Increased decay heat load reduces times to boiling in core, pool temperature limits, and core damage
  - Reduced time for equipment response and operator actions
- Increased ATWS power levels and peak pressure
  - Reduced time for equipment response and operator actions
- Increased feedwater flow but no change in the number of normally operating feedwater and condensate pumps

FPIE Risk Evaluation

EPU Effects - Systems

- No changes in systemic PRA success criteria
- Setpoint changes produce negligible risk impact
- BOP changes (e.g., replacement of high pressure turbine rotor) result in an estimated negligible risk impact
- AC switchyard changes (e.g., replacement of main power transformer) result in an estimated negligible risk impact

FPIE Risk Evaluation

Dominant PRA Model Changes to Represent EPU

PRA Technical Element	PRA Model Change	Contribution to CDF Increase
Op. Fails to Initiate ADS	Time available decreases 13%	3%
Op. Fails to Restart FW Given Op Fails to Initiate RPV Depressurization	Dependent HEP increases based on change in RPV Depressurization HEP	1.6%
Op. Fails to Initiate SLC Injection (early) During ATWS (2 SLC pumps)	Time available decreases 25%	1.1%
Op. Fails to Initiate SLC Injection (early) During ATWS (1 SLC pump)	Time available decreases 33%	0.4%
Op. Fails to Manually Start an EDG if Auto Start Fails	Time available decreases 13%	<0.1%
Op. Fails to Bypass MSIV Isolation to Maintain Steam Path	Time available decrease 13%	<0.1%

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FPIE Risk Evaluation
Internal Flooding Risk

- EPU effects
  - Dominant FPIE PRA model changes apply
  - No new initiating events or increased initiating event frequencies (IEFs)
- EPU has negligible impact on internal flooding risk
  - Pre-EPU flooding contribution to CDF (4.7%)
  - Post-EPU flooding contribution to CDF (4.8%)

FPIE Risk Evaluation

Level 2 Risk

- EPU effects
  - LERF is calculated using standard methodology
    - Level 1 end state bins are transferred to Level 2 containment event trees (CETs)
    - Level 2 release category binning is unaffected by EPU
    - Level 2 release frequency in each bin is proportional to Level 1 result
  - Minor changes in Level 2 human error probabilities (HEPs)
  - Negligible change due to timing of containment failure
- EPU has minor impact on Level 2 CETs
- EPU impact on LERF is similar to Level 1 impact

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FPIE Risk Evaluation
Results

- Pre-EPU PRA results

CDF (yr^{-1})	LERF (yr^{-1})
1.4E-5	1.4E-7

- EPU has small impact on CDF and LERF
  - CDF (+6%)
  - LERF (+6%)
- Risk changes conform to Regulatory Guide 1.174 Guidelines
  - ΔCDF is in Region III (very small risk change)
  - ΔLERF is in Region III (very small risk change)

FPIE Risk Evaluation

Uncertainties

- Uncertainty in FPIE PRAs was examined using
  - Risk importance measures
  - Sensitivity studies
  - Comparison to NUREG-1150 uncertainty results
- No uncertainty sources beyond those identified by NUREG-1150 were found
- An uncertainty in EPU risk evaluation in the range estimated by NUREG-1150 would only change the ΔCDF results from "very small risk" to "small risk" (per RG 1.174)

Qualitative Risk Evaluation

Fire Risk

- EPU effects
  - Dominant FPIE PRA model changes apply
    - Examined critical fire scenarios from CPS IPEEE
    - Loss of inventory control (70%) and loss of decay heat removal (30%) dominate fire risk profile
    - Minor impact on decay heat removal scenario HEPs because of long times available for response/recovery actions
  - No new fire initiating events or increased fire IEFs
- EPU has negligible impact on fire risk

Qualitative Risk Evaluation

Seismic Risk

- EPU effects
  - No change in Seismic Margins Analysis (SMA)
    - Little or no impact on seismic qualifications of SSCs
    - Negligible impact of increased stored energy on blowdown loads on reactor vessel or containment
- EPU has negligible impact on seismic risk

Qualitative Risk Evaluation

Shutdown Risk

- EPU effects
  - Dominant FPIE PRA model changes do not apply
  - No new initiating events or increased IEFs
  - Time to boiling and boildown times decrease
    - Shortens times available for response/recovery actions
    - Delays time when alternate, low capacity systems can be used
  - EPU risk impact is minimized using configuration risk management tool (ORAM, Outage Risk Assessment & Management)
- EPU has negligible impact on shutdown risk

Summary of EPU Risk Impact

- Risk impact was evaluated using standard PRA methods (quantitative and qualitative)
- Quantified risk impact is a small percentage of current plant risk
- ΔCDF is a very small risk change per Regulatory Guide 1.174
- ΔLERF is a very small risk change per Regulatory Guide 1.174
- Risk impacts from external events and shutdown conditions are negligible

The EPU risk impact is acceptable

Project Implementation

Larry Westbrook, AmerGen
CPS SRO - Operations

Project Implementation

Classroom Training

- Classroom material
  - Technical Specifications and Updated Safety Analysis Report changes
  - Plant limits and operating condition changes
  - Design changes for EPU
  - New power/flow map
  - Operating procedure revisions
  - Uprate operating experience

Project Implementation

Simulator Training

- EPU full power conditions
- Normal operations scenarios
- Dynamic transients and accidents scenarios selected to highlight both similarities and differences in plant response at EPU and current power levels

Project Implementation

Simulator Training

- Operator re-qualification training covered two cycles of classroom and simulator training
- "Just-in-time" training is planned prior to power ascension

Project Implementation

Start-up Test Overview

- Careful and deliberate approach to uprated power levels
- Incorporate Exelon uprate testing experience
- Steady state data collection and testing beginning at 90% of OLTP
- 2% incremental power test program
- Power increases along constant rod line to maximum achievable power level

Project Implementation

Start-up Test Overview

- Dynamic testing begins at approximately 70% OLTP
  - Pressure control system
  - Feedwater level control system
  - Turbine valve surveillances

AmerGen
An Exelon/British Energy Company

Project Implementation

Test Matrix

Original Licensed Power Level, %					48.0%	72.0%	90.0%	100%	102.0%	104.4%	106.8%	109.3%	...	120.0%
Reactor Thermal Power, MWth		**S\U**	**Sync**	**868**	**1389**	**2084**	**2605**	**2894**	**2952**	**3022**	**3091**	**3160**	**...**	**3473**
Licensed Power Uprate, %				25%	40%	60%	75%	83.3%	85%	87%	89%	91%	...	100%
EPU Start-up Tests														
Chemistry Samples								X	X	X	X	X	X	X
Radiation Surveys & Posting								X	X	X	X	X	X	X
Core Performance							X	X	X	X	X	X	X	X
APRM Cal's /Gain Adjust. - per TS			X	X			X	X	X	X	X	X	X	X
IRM Performance (Overlap Check)		X												
Piping Vibration Data					X	X		X	X	X	X	X	X	X
FW Flow Calibration (AMAG)						X	X	X	X	X	X	X	X	X
Max FW Runout Capability						X	X	X	X	X	X	X	X	X
FWLC Incremental Regulation						X	X	X	X	X	X	X	X	X
Turbine Valve Surveillance						X	X	X	X	X	X	X	X	X
Pressure Control Incremental Reg			X			X	X	X	X	X	X	X	X	X
Incremental Regulation Data Collection					Required <3% increments from generator synch to max power									
Pressure Setpoint Step changes		X				X	X	X	X	X	X	X	X	X
Pressure Regulator Fail-Over						X		X						
MSIV Functional Test						X	X	X						
System/Equip Performance Data							X	X	X	X	X	X	X	X

Project Implementation

Conclusion

- Operator training is extensive
- Testing plan is incremental and comprehensive
- Careful and deliberate approach to uprated power levels

Project implementation will ensure that EPU is implemented as designed and plant response is as expected

Conclusion

Keith Jury, Exelon Nuclear
Licensing Director

Conclusion

- Extensive analyses using accepted methodology
- No significant impacts on plant response or system integrity
- Minimal changes in plant risk
- Plant operation is acceptable at EPU conditions