

1 significantly? How much?

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

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

13 It turns out this plant doesn't have a
14 high embrittlement rate. It has a very low
15 embrittlement rate. Its RT^{PTS} value after uprate is
16 only like 130 or 125 versus the screening criteria of
17 275 to 300. So this is not going to -- This uprate is
18 not going to impact -- No matter how much fluence we
19 increase it, it is not going to affect that.

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

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

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1 those --

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

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

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

16 (Slide change)

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

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

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1 structural integrity.

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

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

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

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

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

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

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

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

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

15 We are in the process of obtaining some
16 more detailed information as part of our review of NEI
17 97-06 on foreign operating experience, for example, to
18 get information on whether or not there's been stress
19 corrosion cracking and under what conditions it may
20 have been observed in other plants. But domestic
21 operating experience has been favorable.

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

24 MR. KARWOSKY: Research has plants to
25 conduct some testing with some of these advanced

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1 materials to determine under what conditions they
2 would crack, initiation times, crack growth rates.
3 There is a long term research program.

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

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

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

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

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

22 MR. KARWOSKY: Yes.

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

25 MR. KARWOSKY: I would have to -- I'm not

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1 sure. I'm not sure. These are some of the larger
2 steam generators.

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

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

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

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

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

24 MR. KARWOSKY: Right. I think some of
25 that would definitely be planned as part of our review

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1 of NEI 97-06, I believe. We have discussed with the
2 Committee before with respect to, you know, we will
3 provide that operating experience in support of longer
4 inspection intervals.

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

10 MR. KARWOSKY: Sure.

11 CHAIRMAN WALLIS: Is it time to move on?

12 MR. ELLIOT: Okay.

13 CHAIRMAN WALLIS: Thanks very much.
14 Thanks, Barry.

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

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

19 MR. ALEXION: Okay.

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

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

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

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

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

10 MEMBER POWERS: And because of the review?

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

13 (Slide change)

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

19 (Slide change)

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

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

4 (Slide change)

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

10 (Slide change)

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

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

25 MR. POWERS; I mean, they found a terribly

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1 high in-leakage relative to what they had assumed in
2 the past, and so they fixed a bunch of things. But
3 their in-leakage is still six times what they assumed
4 in the past.

5 MS. HART: That's correct.

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

9 MS. HART: Not exactly.

10 MEMBER POWERS: Ah. Why not exactly?

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

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

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

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

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

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

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

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

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

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

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

6 MR. CARUSSO: Yes.

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

10 MR. CARUSSO: Go ahead, Michelle.

11 (Slide change)

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

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

22 (Slide change)

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

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

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

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

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

22 MR. CARUSSO: Not at all.

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

25 MR. CARUSSO: Not a power uprate issue.

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

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

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

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

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

22 MS. HART: Right.

23 CHAIRMAN WALLIS: So it's really not much
24 of a physical model about what happened. So let's
25 assume that it's sort of equally distributed between

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1 this and that, and let's assume there's --

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

9 CHAIRMAN WALLIS: Like it was liberal arts
10 engineering.

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

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

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

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

22 MS. HART: Not really important for power
23 uprate.

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

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

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

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

13 So that's why he dug into this. It's not
14 a power uprate issue. HE just said, gee, you know,
15 this sounds convenient. You know, it comes in at
16 22/68, and it mixes perfectly, and that helps their
17 dose, looks convenient, how did you do it. He asked
18 them the question.

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

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

25 MR. CARUSSO: Yes. So he looked at what

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

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

6 MS. HART: That's correct.

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

9 MR. CARUSSO: No.

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

15 (Slide change)

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

18 Are there anymore questions?

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

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

23 MR. ALEXION: I hope so.

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

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

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

7 CHAIRMAN WALLIS: Please go on.

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

13 (Slide change)

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

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

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

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

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

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

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

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

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

20 MEMBER POWERS: If you come in and say I'm
21 going to run my motors faster, but it's tough to get -
22 - to understand how the change in failure frequencies
23 are there, and so I'm going to leave it out, and then
24 you find there's no change in the PRA, there's no
25 change in the risk significance of the items. These

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1 are not insightful conclusions, it strikes me.

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

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

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

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

22 If you are, though, within the operating
23 design limits of that piece of equipment, the data is
24 not going to support, because it's done for pumps, not
25 pumps that are outside its design. So that you've

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1 got, if you will, a philosophical problem with that.
2 It's a --

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

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

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

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

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

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1 They don't. It was 30 percent. It stays
2 35 percent.

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

10 MR. HARRISON: Right.

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

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

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

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

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

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1 MR. HARRISON: Yes.

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

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

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

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

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

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

25 MEMBER SIEBER: And it might be, what,

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1 three years old?

2 MR. HARRISON: Yes, '97 time frame.

3 MEMBER SIEBER: Five years old.

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

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

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

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

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

25 MR. HARRISON: Yes, I do that with every

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1 one of them.

2 MEMBER SIEBER: Did you find anything
3 outstanding?

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

10 MEMBER SIEBER: Thank you very much.

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

15 MR. HARRISON: Right.

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

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

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1 using maybe the EPRI risk assessment guidelines.

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

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

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

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

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

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

3 (Slide change)

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

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

14 MEMBER SIEBER: Good. Thank you.

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

17 MR. ALEXION: Okay.

18 CHAIRMAN WALLIS: It looked like the
19 standard list.

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

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

24 MR. ALEXION: Okay. The staff feels like
25 we've done an extensive review. We have no open

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1 items, and we feel that the application meets the
2 regulations, and staff recommends approval of the
3 uprate.

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

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

13 CHAIRMAN WALLIS: Thank you.

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

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

25 MR. RICHARDS: We have tried to learn from

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1 some of your feedback that you provided in past
2 presentations. So we appreciate getting that positive
3 feedback, and we will build on what we heard today.

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

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

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

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

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

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

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

14 MR. MARSH: Okay.

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

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

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1 preparation for the meeting or in the preamble for the
2 meeting.

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

5 MR. MARSH: Okay.

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

8 MR. MARSH: Right.

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

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

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

22 MR. MARSH: Right.

23 CHAIRMAN WALLIS: And I just don't want --
24 You want us to write a letter at the next meeting,
25 whenever it is, this March or April meeting. I just

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1 hope that what goes into that letter doesn't suffer
2 because we just didn't schedule enough time to go into
3 everything.

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

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

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

25 CHAIRMAN WALLIS: I think where we

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

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

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

17 MR. MARSH: Okay.

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

23 CHAIRMAN WALLIS: In fact, it's obvious.
24 Just look at the SER. There's a tremendous number of
25 items in there which are covered. So I'm very

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1 impressed with the breadth. There's no need to defend
2 that.

3 MR. MARSH; Okay.

4 CHAIRMAN WALLIS: Are we ready to break?

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

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

13 MR. BOEHNERT: That's right.

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

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

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

25 CHAIRMAN WALLIS: But it was too much

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1 brevity, too.

2 MR. MARSH: Right.

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

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

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

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

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1 MR. MARSH: Okay.

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

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

17 MR. MARSH: We'll do that.

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

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

24 MR. MARSH: Understand.

25 CHAIRMAN WALLIS: And someone who just

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

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

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

9 MR. MARSH; I understand.

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

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

16 MEMBER SIEBER: Please.

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

19 MR. MARSH: Thank you very much.

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

22 MR. BOEHNERT: 3:30.

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

25 CHAIRMAN WALLIS: Please come back into

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

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

14 We do have a continuation of this meeting
15 tomorrow.

16 MR. WILLIAMS: Yes.

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

24 MR. WILLIAMS: Yes.

25 CHAIRMAN WALLIS: So let's see how far we

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1 can get then with this plan, and see if we can get out
2 at a reasonable time today.

3 MR. WILLIAMS: All right, Dr. Wallis.

4 CHAIRMAN WALLIS: Please go ahead.

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

9 (Slide change)

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

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

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

22 (Slide change)

23 MR. WILLIAMS: We have submitted a license
24 amendment request to increase the thermal power output
25 of Clinton station by 20 percent over our original

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1 licensed thermal power. We have used accepted G.E.
2 methodology to leverage industry experience and Exelon
3 Nuclear experience.

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

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

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

15 (Slide change)

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

20 (Slide change)

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

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1 modifications and analyses we've performed.

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

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

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

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

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

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

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1 Yes.

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

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

9 MR. WILLIAMS: That is correct.

10 CHAIRMAN WALLIS: Yes.

11 (Slide change)

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

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

24 Sargent and Lundy, as the balance of plant
25 architect/engineer, has served similar roles in

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1 several previous power uprates throughout the country
2 and is also the original architect/engineer for the
3 Clinton Power Station.

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

8 (Slide change)

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

17 (Slide change)

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

22 For clarity, the EPU region has been
23 highlighted in the upper righthand corner of the map.
24 One note: Other recent plants have implemented MELLLA
25 as part of the EPU license submittal. At Clinton, we

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1 have previously been licensed to MELLLA and, thus, the
2 EPU will be realized by increasing power along the
3 previously licensed MELLLA boundary.

4 (Slide change)

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

9 (Slide change)

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

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

23 (Slide change)

24 MR. SPENCER: At this time I want to
25 proceed to a discussion of the mods we will be

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1 performing to the balance of plant systems.

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

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

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

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

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

25 CHAIRMAN WALLIS: It's the same feedwater

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1 pump?

2 MR. SPENCER: Yes, sir.

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

5 MR. SPENCER: Yes, they are.

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

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

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

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

15 MR. SPENCER: No, sir.

16 MEMBER KRESS: They are okay?

17 MR. SPENCER: Yes, they are.

18 CHAIRMAN WALLIS: It's the same core flow.

19 MR. WILLIAMS: There is the same core
20 flow.

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

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

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1 CHAIRMAN WALLIS: This is a flow induced
2 vibration question?

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

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

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

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

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

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

25 (Slide change)

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

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

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

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

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

25 MEMBER SHACK: Dale, are you going to go

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

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

5 MEMBER SHACK: So at the upcoming outage?

6 MR. WILLIAMS: Yes. That is correct.

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

11 MR. WILLIAMS: That is correct.

12 MR. SPENCER: That is correct.

13 MEMBER SCHROCK: What are the condenser
14 improvements?

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

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

25 MR. WILLIAMS: The original condenser was

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1 designed with large operating margins. We are
2 utilizing those margins.

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

7 MR. WILLIAMS: That is correct.

8 (Slide change)

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

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

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

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

25 (Slide change)

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

6 (Slide change)

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

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

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

22 (Slide change)

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

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

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

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

14 (Slide change)

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

17 All safety related pipe stress and pipe
18 loading levels are within code allowable limits, and
19 no modifications are necessary. Our analysis showed
20 that we have five nonsafety related supports which
21 require modifications prior to start-up from our April
22 2002 outage. These supports are located in our
23 feedwater system outside containment.

24 All other piping and supports were
25 acceptable without any changes, and no new pipe break

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1 locations were identified during our analyses.

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

6 (Slide change)

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

12 (Slide change)

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

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

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

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

10 MEMBER POWERS: They do.

11 CHAIRMAN WALLIS: It all goes away so
12 quickly.

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

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

21 MEMBER SIEBER: It will run a couple of
22 years.

23 CHAIRMAN WALLIS: A couple of years,
24 right.

25 MEMBER SIEBER: Take a number.

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

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

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

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

16 MR. CROCKET: Yes, sir.

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

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

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

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

5 CHAIRMAN WALLIS: Where does it go?

6 MR. CROCKET: Excuse me?

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

9 MR. CROCKET: In the demineralizers
10 ultimately.

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

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

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

24 CHAIRMAN WALLIS: Does it wear in a sort
25 of straightforward way or does it begin to wear and

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1 get sort of -- I don't know what the wear pattern
2 looks like. If it's got ripples, I could see the
3 ripples actually increasing the wear rate, because
4 they stir things up.

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

6 CHAIRMAN WALLIS: Is it ripply wear?

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

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

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

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

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

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

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

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

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

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

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

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

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

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1 observed the thinnest?

2 MR. WILLIAMS: Describe our gridding.

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

8 MEMBER SCHROCK: Thank you.

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

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

16 (Slide change)

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

20 (Slide change)

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

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1 Mechanical Engineers Section III allowable criteria of
2 1.0.

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

5 MR. WILLIAMS: Forty years.

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

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

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

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

20 (Slide change)

21 MR. KERESTES: This ultimate analysis
22 approach consisted of two areas. We used more refined
23 methods of analysis as allowed by the Code. These
24 include applying the scaling factors to the applicable
25 thermal stress terms, removing conservatism from the

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1 flow scaling factor, and establishing pre-EPU and
2 post-EPU usage contributions.

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

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

11 In conclusion --

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

14 MEMBER SIEBER: Thermal.

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

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

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

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

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

4 MR. WILLIAMS: That is correct.

5 MEMBER SIEBER: Hopefully.

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

11 MR. WILLIAMS: That is correct.

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

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

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

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

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

24 MEMBER SHACK: Section III or Section --

25 MR. RANGANATH: Section III fatigue

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

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

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

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

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

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

24 So I think we probably have more than
25 enough conservatism to account for even any postulated

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1 environmental effects.

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

4 MR. KERESTES: Right now that number is
5 .873.

6 MEMBER SHACK: Not a lot of margin left
7 there.

8 MEMBER POWERS: Approximately, right?

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

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

16 MR. RANGANATH: Actually --

17 MEMBER SHACK: It's still .873.

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

23 The triple sleeves farger has pretty much
24 caused out the high cycle fatigue aspect of it. So we
25 are tinkering with probably a very conservative

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1 analysis for the low cycle fatigue, and wherever we
2 have seen actual fatigue monitoring, we find that the
3 step changes are not anywhere near what we have
4 assumed in the analysis.

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

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

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

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

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

23 MR. RANGANATH: Yes. That has happened,
24 and the triple sleeves farger was intended to
25 eliminate the leakage that you get, and that's why the

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1 high cycle or rapid cycling that caused the original
2 fatigue cracks in the feedwater nozzle is pretty much
3 eliminated, and it's been a very successful
4 modification.

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

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

16 I would now like to --

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

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

25 CHAIRMAN WALLIS: So the analysis has been

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1 done, and it does show this?

2 MR. KERESTES: Yes, it does show this.

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

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

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

11 (Slide change)

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

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

23 We've got the low carbon stainless steel,
24 and when we walk through all the different components,
25 you know, you basically get to the same place we were

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1 with Dresden and Quad. There's two issues that you
2 are really thinking about.

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

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

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

20 The next thing that we are looking at is
21 we are going to be doing the shroud inspections. The
22 shroud inspections are coming up this spring. What we
23 are doing is we are doing a fluence profile, again
24 with the same neutron transport calculation, making
25 sure that we account for where we have high fluence

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1 welds, what the fluence profile is through-wall and
2 azimuthally.

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

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

10 (Slide change)

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

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

23 When you do that, you know, essentially
24 what we've concluded is that our reactor internal
25 systems and our pressure vessel -- we've pretty much

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1 conservatively bounded all the effects that power
2 uprate are going to have, and believe that they are
3 acceptable for EPU conditions.

4 Are there any questions?

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

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

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

21 MEMBER SHACK: Are these stainless steel
22 components?

23 MR. MOSER: Yes, absolutely.

24 MEMBER SHACK: Is your shroud 304L?

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

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

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

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

9 MEMBER SHACK: Slightly above it?

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

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

21 Any other questions?

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

24 MR. MOSER: Yes, sir.

25 MR. SCHROCK; It seems almost generic, in

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1 some sense.

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

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

10 (Slide change)

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

15 (Slide change)

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

23 Recently, we have also completed the
24 reload analysis for the next cycle 9 core which is
25 implementing EPU, and I would like to show some of the

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1 details of the cycle 9 core. Next slide, please.

2 (Slide change)

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

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

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

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

24 CHAIRMAN WALLIS: This is an eighth of a
25 core?

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1 MR. BOLGER: It's a quarter core.

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

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

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

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

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

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

24 So there's a natural tendency to shift
25 the power away from octein symmetry, and then what you

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1 will do later in the cycle is set another pattern that
2 will shift it back. So it will tend to achieve octein
3 symmetry throughout, although there will be a small
4 amount of variability.

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

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

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

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

25 The next column is the MLHGR ratio, which

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1 is the ratio of the calculated LHGR to the LHGR limit.
2 In the case of the LHGR, this was designed to a design
3 target of .91, and you can see that the actual design
4 had about two percent margin to the design target.

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

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

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

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

21 (Slide change)

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

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1 of the EPU power. Next slide, please.

2 (Slide change)

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

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

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

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

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

16 MEMBER SIEBER: Okay.

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

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

23 MR. BOEHNERT: Well, then we need to ask
24 people who are not approved to hear G.E. proprietary
25 material to leave the room. How long do you think the

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1 session is going to take?

2 MR. BYAM: Approximately 30 minutes maybe.

3 MR. BOEHNERT: Thirty minutes? Okay.

4 Well, if you gentlemen want to go over into the next
5 room and then come back in about 30 minutes, we would
6 let you back in the room.

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

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

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

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1 CHAIRMAN WALLIS: Are we going to keep
2 going?

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

6 (Slide change)

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

13 (Slide change)

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

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

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

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

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

13 (Slide change)

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

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

21 MR. SCHWEITZER: Correct.

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

25 MR. SCHWEITZER: And this is a temperature

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1 spike.

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

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

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

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

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

24 If we looked at the actual temperatures
25 that the structure would see and the equipment in

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1 there would see, there's a time lag, and they wouldn't
2 be coming up near the 330.

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

8 MR. PAPPONE: That's right.

9 MEMBER POWERS: I guess I'm missing
10 something. My intuition is bad here. You increase
11 the amount of energy that you are putting into the
12 drywell and eventually into the containment by roughly
13 20 percent. Well, where does it go? I mean, all
14 these numbers go down or marginally move up. Where's
15 the energy go?

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

25 The short term part as far as peak

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

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

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

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

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

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

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

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1 This has a much smaller one.

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

5 MR. PAPPONE: That's right.

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

8 MR. PAPPONE: That's right.

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

12 MEMBER KRESS: It's a big pool.

13 CHAIRMAN WALLIS: It's a big pool.

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

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

19 MR. PAPPONE: Do we have one?

20 CHAIRMAN WALLIS: I'm just trying to
21 remember.

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

24 MR. SCHWEITZER: Would you like a sketch?

25 CHAIRMAN WALLIS: Well, maybe you can make

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1 a sketch. We can go on. You can hand it to me in ten
2 minutes or something. Are we done for the day now?

3 MR. WILLIAMS: Dr. Wallis.

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

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

9 CHAIRMAN WALLIS: Yes.

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

12 CHAIRMAN WALLIS: Sure.

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

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

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

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1 CHAIRMAN WALLIS: That's what we see here.

2 MR. BOEHNERT: Right.

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

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

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

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

20 MR. WILLIAMS: Thank you.

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

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

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

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

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

6 MR. BOEHNERT: There it is.

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

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

16 Now where do we want to go with this?

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

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

23 CHAIRMAN WALLIS: Drywell and wetwells are
24 --

25 MR. PAPPONE: This is the drywell region

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1 in here.

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

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

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

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

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

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

24 MR. PAPPONE: Right. The structural limit
25 here is a 15 psi compared to the 60-ish. The

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1 structure here is still the same 60-ish psi.

2 MEMBER SIEBER: But you never achieved
3 the--

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

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

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

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

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

20 MR. BOEHNERT: So the wetwell air space
21 load is for controlling over the hydraulic loading at
22 185?

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

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1 MR. BOEHNERT: That was controlling?

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

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

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

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

13 MR. BYAM: No. I think that --

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

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

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

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

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

25 CHAIRMAN WALLIS: Any volunteers?

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

3 CHAIRMAN WALLIS: That's right.

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

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

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

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

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

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

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

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

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

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

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

12 MEMBER POWERS: As we found out.

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

15 MEMBER POWERS: I don't think so.

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

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

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

23 MEMBER POWERS: I think we've got one.

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

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

3 MR. BYAM: Thank you.

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

7 MR. BOEHNERT: Recess.

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

13 MR. BYAM: Thank you.

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

16 Thank you all very much for your
17 presentations.

18 (Whereupon, the foregoing matter went off
19 the record at 5:18 p.m.)
20
21
22
23
24
25

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This is to certify that the attached proceedings
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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
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Pippa Antonio
Official Reporter
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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 uprate 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

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

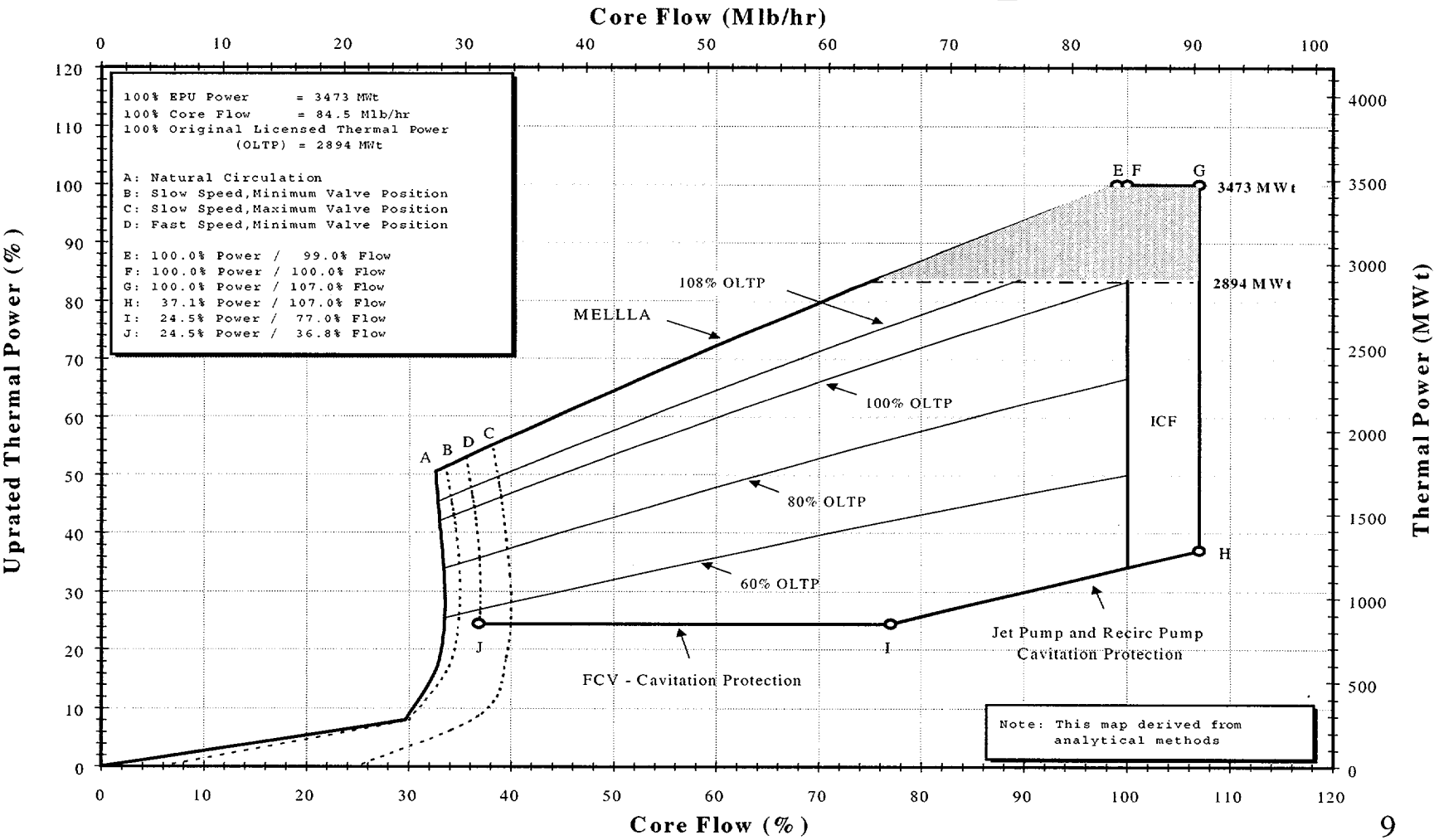
Project Summary

- 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

<u>Parameter</u>	<u>Current Rated Power Value</u>	<u>EPU Value</u>
Thermal Power (MWt)	2894	3473
Vessel Steam Flow (Mlb/hr)	12.4	15.1
Full Power Core Flow Range Mlb/hr % Rated	63.4 to 90.4 75 to 107	83.7 to 90.4 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) Temperature Range (°F)	12.4 370 to 420	15.1 380 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

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

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

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

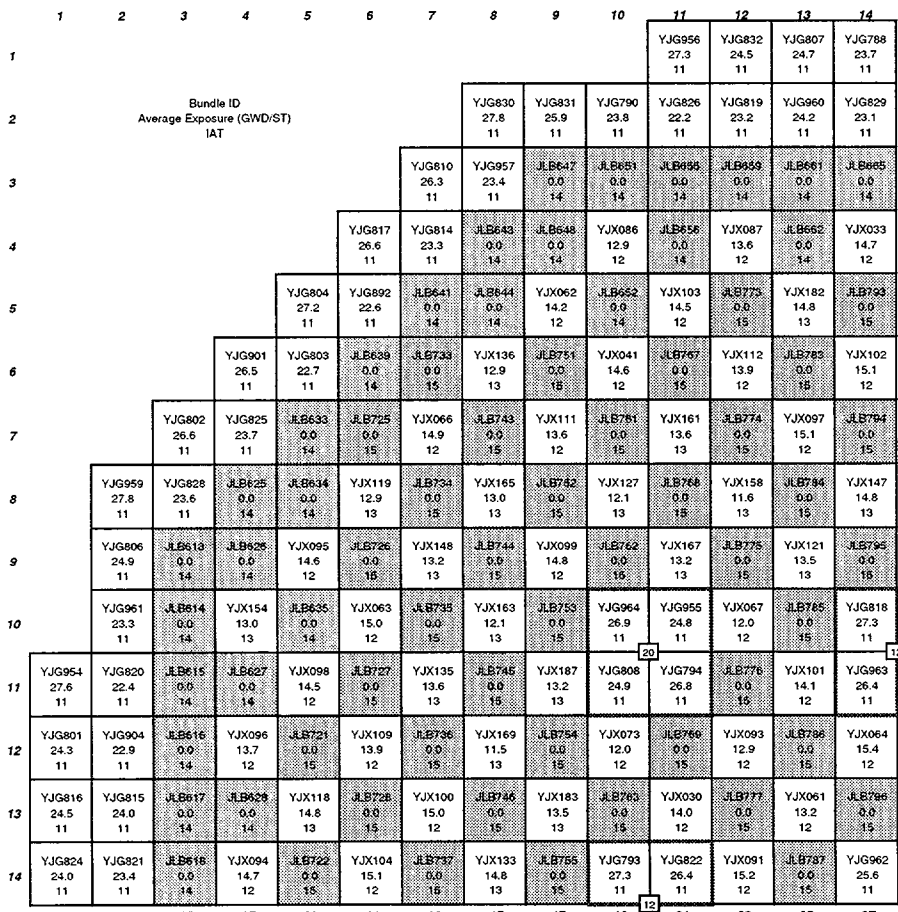
Fran Bolger, GE

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



CYCLE							AXIAL POWER
EXP	K-EFF	FLOW-%	MFLCPR	MFLPD	MAPRAT	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..

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

Low average
radial peaking

Bundle Name	IAT	# In Core	# Fresh	AvgWt KG	AvgExp GWD/S T	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

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

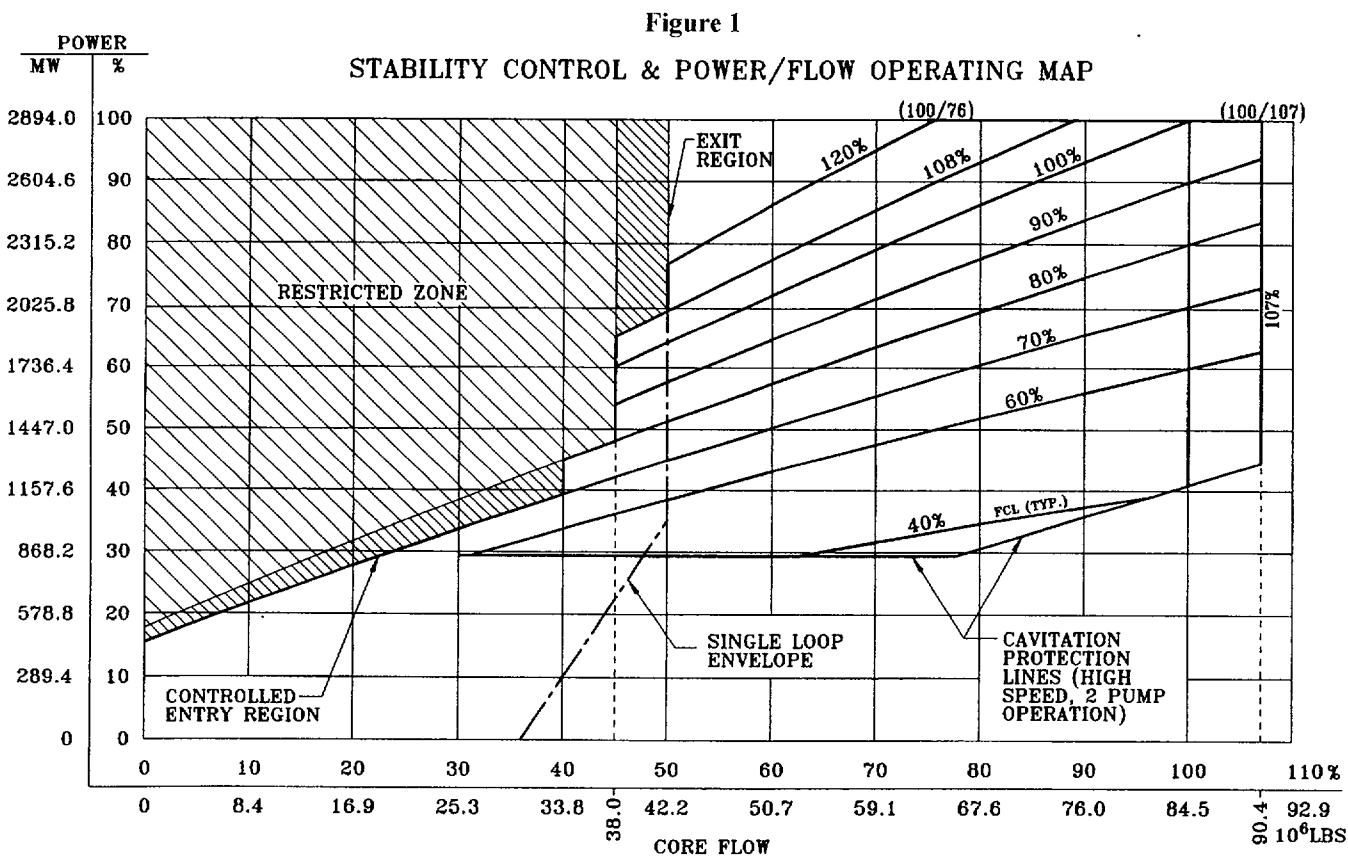
Stability

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

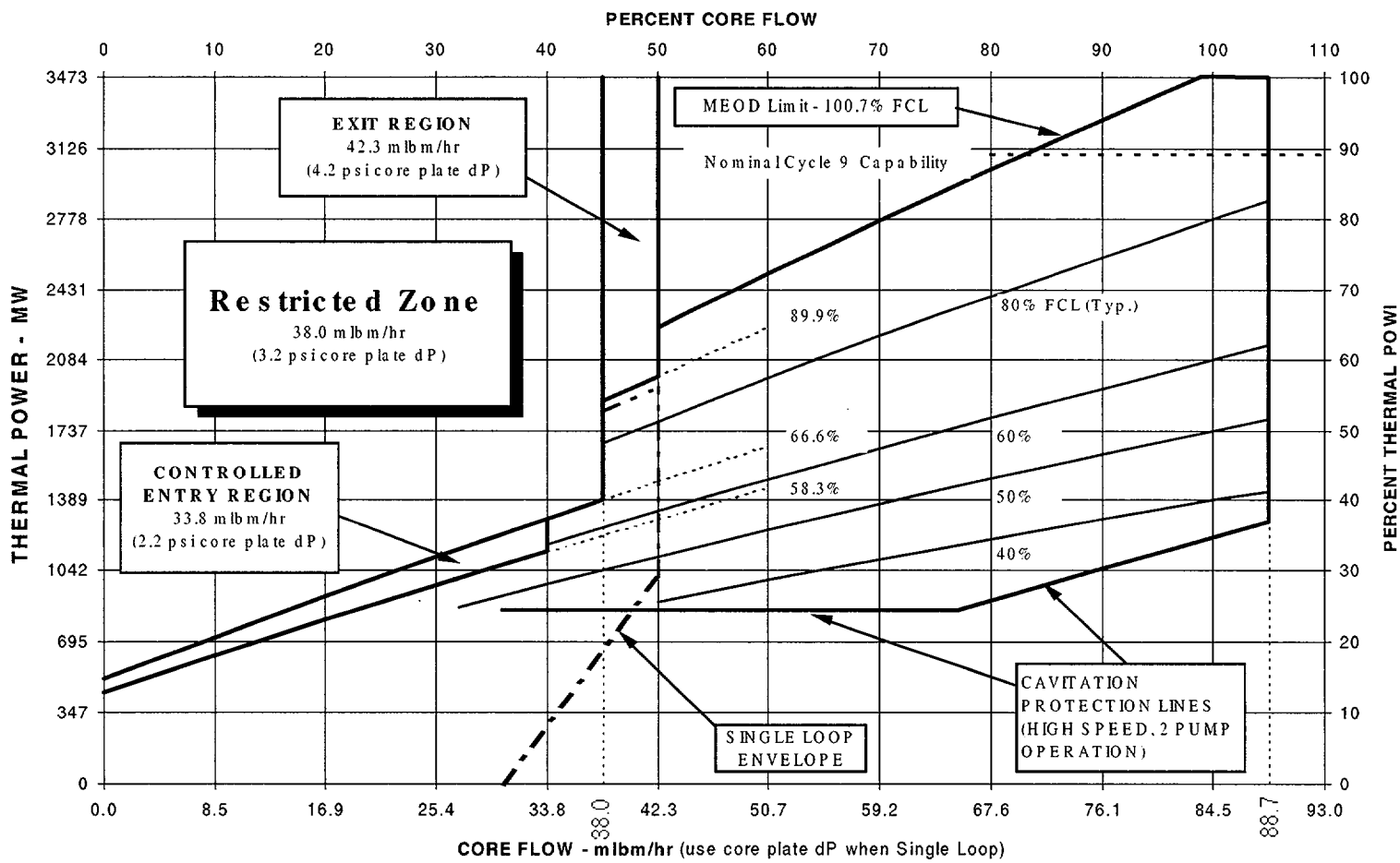
Current ICA Power/Flow Map



Stability

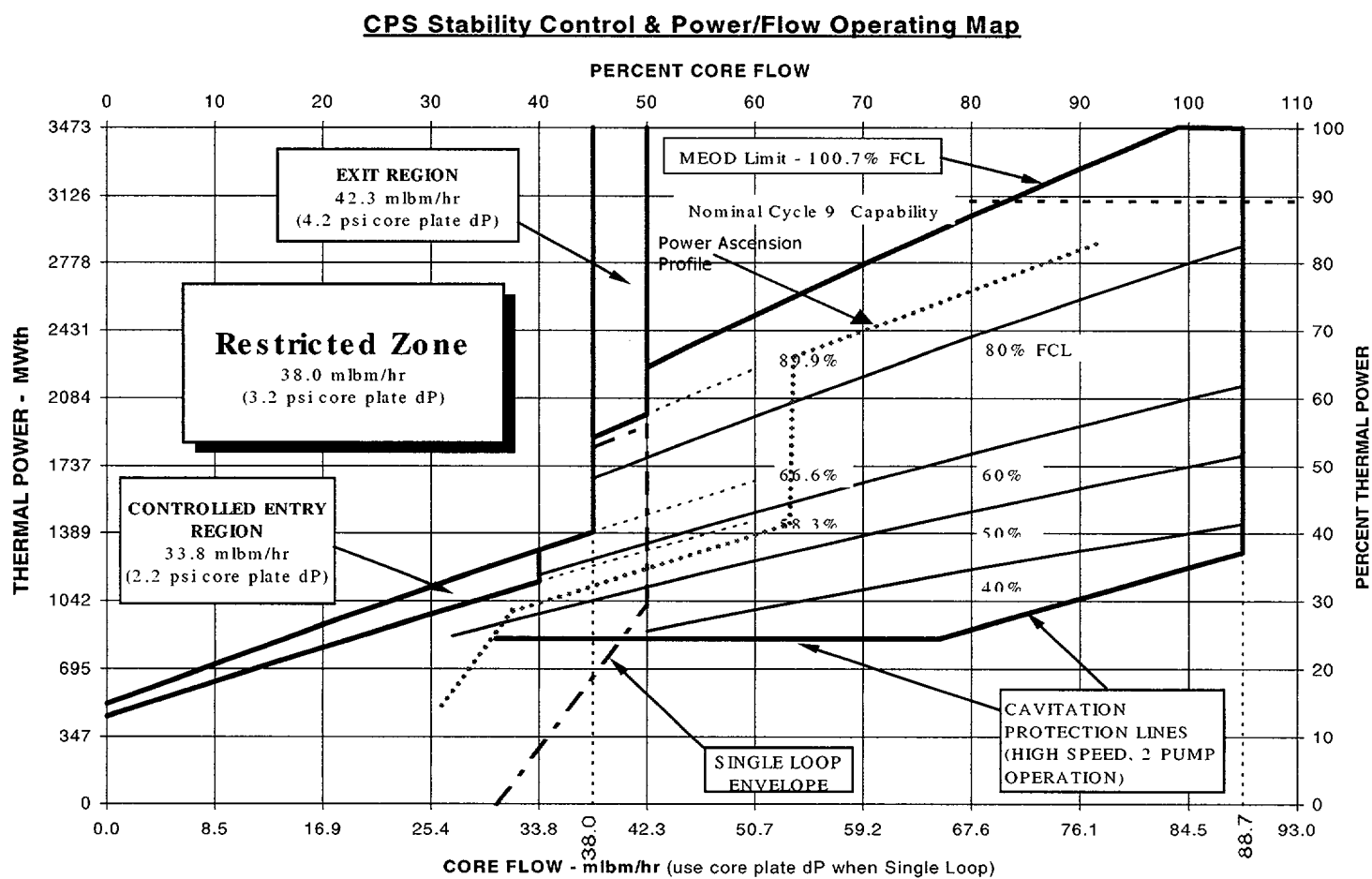
EPU ICA Power/Flow Map

CPS Stability Control & Power/Flow Operating Map



Stability

Operational Aspects - ICA power/Flow Map



Stability
Methodology

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

<u>Parameter</u> Method	<u>USAR</u> SAFER/GESTR	<u>EPU</u> SAFER/GESTR	<u>Limit</u> 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

<u>Limiting Event</u>	<u>Cycle 8</u>	<u>Cycle 9</u>	<u>Limit</u>
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	

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

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
 - Success criteria
 - Systems
 - Data
 - Operator responses
 - Structural analysis
 - Quantification
 - 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%

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

FPIE Risk Evaluation

Results

- Pre-EPU PRA results

<u>CDF (yr⁻¹)</u>	<u>LERF (yr⁻¹)</u>
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 Δ CDF 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
- Δ CDF is a very small risk change per Regulatory Guide 1.174
- Δ LERF 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

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		SU	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