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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

THERMAL-HYDRAULIC PHENOMENA SUBCOMMITTEE

+ + + + +

WEDNESDAY

JANUARY 16, 2002

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ROCKVILLE, MARYLAND

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

COMMITTEE MEMBERS:

GRAHAM WALLIS, Chairman

PETER FORD, Member

MARIO BONACA, Member

THOMAS KRESS, Member

WILLIAM SHACK, Member

ACRS CONSULTANT PRESENT:

VIRGIL SCHROCK

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STAFF PRESENT:

PAUL BOEHNERT

ALSO PRESENT:

FRAN BOLGER

JASON POST

DAN PAPPONE

RON ENGEL

ISRAEL NIR

GEORGE STRAMBACK

JIM KLAPPROTH

JOE DONOGHUE

SIGH BAJWA

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

(1:02 p.m.)

CHAIRMAN WALLIS: The meeting will now come to order.

This is a meeting of the ACRS Subcommittee on Thermal Hydraulic Phenomena. I am Graham Wallis, the Chairman of the Subcommittee.

Other ACRS members in attendance are Peter Ford, Thomas Kress, and I think William Shack, but not Mario Bonaca. The ACRS Consultant in attendance is Virgil Schrock.

The purpose of this meeting is for the Subcommittee to discuss the GE Nuclear Energy Licensing Topical Report NEDC-33004-P, "Constant Pressure Power Uprate," and to begin review of the Framatome ANP-Richland S-RELAP5 realistic thermal-hydraulic code version and its application to large-break LOCA analyses. 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

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1 this meeting previously published in The Federal
2 Register on December 20, 2001.

3 Portions of the meeting will be closed to
4 the public, as necessary, to discuss information
5 considered proprietary to General Electric Nuclear
6 Energy and Framatome ANP-Richland.

7 A transcript is being kept, and the open
8 portions of this transcript will be made available as
9 stated in The Federal Register notice. It is
10 requested that speakers first identify themselves and
11 speak with sufficient clarity and volume so that they
12 can be readily heard.

13 We have received no written comments nor
14 requests for time to make oral statements from members
15 of the public.

16 We would now like to proceed with the
17 meeting. I will call upon Mr. Israel Nir of GE
18 Nuclear Energy to begin after my colleague, Dr. Ford,
19 makes a statement.

20 MEMBER FORD: I have a conflict of
21 interest on this afternoon's discussion since I am a
22 General Electric retiree.

23 CHAIRMAN WALLIS: Thank you.

24 MR. NIR: My name is Israel Nir,
25 representing General Electric, who will be presenting

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1 today the GE BWR Constant Pressure Power Uprate
2 Program.

3 Earlier last year we submitted the
4 Constant Pressure Power Uprate Licensing Topical
5 Report for NRC review. We anticipate shortly that the
6 Draft Safety Evaluation will be issued, and we would
7 like to take this opportunity to provide you some
8 background information and facilitate your upcoming
9 review of this LTR.

10 Let's start with a short open session,
11 review briefly some of the past EPU briefing to the
12 ACRS, go over the key elements of the GE Power Uprate
13 Program, and provide you an update on the GE BWR Power
14 Upgrading Implementation status.

15 The closed session will consist mainly of
16 fairly brief BWR overview, a brief discussion on the
17 CPPU/LTR approach, and then we are going to review
18 selected topics associated with the submittal.

19 GE, as of now, has extensive experience
20 with EPUs. EPUs are being implemented at --

21 CHAIRMAN WALLIS: You don't really have
22 experience with implementing, do you? You have
23 experience with preparing for and justifying?

24 MR. NIR: GE has extensive analysis
25 experience with EPU--

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1 CHAIRMAN WALLIS: That's different from
2 real experience.

3 MR. NIR: -- and growing experience with
4 implementation. However, EPU's are now being
5 implemented in 10 different BWRs, and that is now a
6 pretty significant number, and NRC review is ongoing
7 on an additional three plants.

8 For all these EPU's, plant safety margins
9 are maintained. We anticipate high volume of power
10 uprate requests in the coming years up to--

11 CHAIRMAN WALLIS: Do you expect that to
12 happen with almost every BWR?

13 MR. NIR: I'm sorry?

14 CHAIRMAN WALLIS: Do you think that will
15 happen with almost every BWR?

16 MR. NIR: Almost all, yes. It may not be
17 necessarily to the maximum of 120 percent of the
18 regional license, but to some extent, and most of them
19 a very large extent.

20 We anticipate approximately four BWR
21 requests per year. In anticipation of this load and
22 to facilitate NRC review and ACRS reviews, we propose
23 a streamlined approach --

24 CHAIRMAN WALLIS: Well, GE's approach is
25 always streamlined.

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1 (Laughter.)

2 MR. NIR: I will not dispute that.

3 (Laughter.)

4 It is experience-based. It is focused on
5 the potential impacts to power uprate, maintain safety
6 margins, and facilitate regulatory review.

7 We've met with you back in June 1998.
8 This was to describe the EPU approach as it was
9 evolving from the 5 percent Stretch Power Uprate
10 Program. There was no change to the licensing basis
11 plan. NSSS expected to be capable for EPU even though
12 there was a potential for operating pressure increase.
13 We anticipated that there will be some modification
14 needed for the balance of plant. which we identified
15 in a feasibility study initiated prior to the effort.

16 We limited operating domain to the maximum
17 extended load line limit analysis boundary, the
18 MELLLA. The plant-specific submittal was supposed to
19 be based on the generic LTR approved by the NRC in a
20 plant-specific submittal.

21 We discussed with you the ELTR-1, the
22 guidelines, and, two, the generic evaluations. That
23 was coordinated in conjunction, although in parallel
24 to, the Monticello EPU effort, and after Hatch Unit 1
25 and 2 pursued the same approach, we concluded that the

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1 EPU approach is effective and acceptable, as a result
2 of the NRC and ACRS reviews.

3 We also met with you in June of 2001 to
4 initially describe to you the CPPU approach, and it
5 facilitates BWR power uprate application. We
6 introduced a simplification. We indicated it utilizes
7 established proven process, provides insurance that
8 all safety aspects are addressed, and we also
9 indicated effects and aspects that are not related to
10 power increase or separated from the power uprate.

11 We submitted the LTR initially in March of
12 2001. We received significant feedback from the NRC.
13 Subsequent to that, we revised the submittal and
14 resubmitted it in July of 2001.

15 The LTR version that we will review is
16 based on the July 2001 version, plus additional
17 changes as a result of subsequent RAIs from the NRC.

18 CHAIRMAN WALLIS: Are you going to tell us
19 what some of those significant changes were, or
20 somebody will?

21 MR. NIR: The significant changes from
22 REV-0 to REV-1?

23 CHAIRMAN WALLIS: Right.

24 MR. NIR: It was not included in the
25 presentation, but I can tell you now that most of it

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1 had to do with the level of detail of the submittal,
2 the plant-specific submittal. What we proposed
3 initially was to reduce the level of detail. That was
4 not acceptable in certain areas, and we've corrected
5 that. The level of detail will be comparable to the
6 most recent EPU's.

7 CHAIRMAN WALLIS: Okay. So it's sort of
8 asking for more detail from the specific applicant in
9 the specific applications?

10 MR. NIR: Yes, that's right.

11 Also, I will talk about the different
12 dispositions of the various topics that are addressing
13 the CLTR, and the initial approach was somewhat
14 involved, and we simplified the disposition process.
15 These were the main two areas.

16 MR. SCHROCK: As I've read it, you've also
17 deleted the requirement for testing? Have I got that
18 right?

19 MR. NIR: What I suggest is that we'll
20 wait until the closed session to discuss that.

21 MR. SCHROCK: That's okay, not appropriate
22 for open sessions.

23 MR. NIR: Yes.

24 MR. SCHROCK: Okay.

25 MR. BOEHNERT: I have a question. On this

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1 key elements slide, how is the MELLLA Plus going to
2 impact this, if at all?

3 MR. NIR: Okay, let me defer that question
4 to the closed session.

5 MR. BOEHNERT: Okay.

6 MR. NIR: I will address that.

7 MR. BOEHNERT: Okay.

8 CHAIRMAN WALLIS: While we're on this
9 general area here, you folks tend to emphasize what
10 you're not changing: You're not changing the call
11 flow rate; we're not changing the pressure, and so on.
12 So the question always arises, how do you do it?

13 I think we have been convinced or
14 persuaded that this has something to do with clever
15 design of fuel and management of the fuel, and that's
16 really the key thing that you've brought technically
17 to this power management or power uprate, which makes
18 it possible. Is that a true statement? Am I wrong in
19 saying that it's the way in which you manage the fuel
20 which is sort of the key to making this happen?

21 MR. NIR: I don't think that this full
22 answer. I think it's part of it. It's only part of
23 it. I think part of it is just the BWR design and its
24 capability.

25 CHAIRMAN WALLIS: But you couldn't take

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1 the BWR without doing something and just jack up the
2 power by 20 percent?

3 MR. NIR: You absolutely have to adjust
4 the core and fuel design, absolutely, and that is a
5 very challenging part of the design.

6 CHAIRMAN WALLIS: I know fuel is very
7 complicated and custom-built, and there's all kinds of
8 different areas and different enrichments.

9 MR. NIR: It's evolving. The pressure to
10 improve the fuel and core design was there prior to
11 EPU, just because of the economical pressure to
12 produce more energy --

13 CHAIRMAN WALLIS: I also think
14 computationally, when you have a very complicated
15 fuel, you've got to get your neutronics down right.

16 MR. NIR: Yes.

17 CHAIRMAN WALLIS: Really different bits of
18 fuel in different parts of the core behaving
19 differently with different histories and all that, but
20 an awful lot of things to keep track of. So maybe
21 modern computers make it possible to manage this
22 tremendously varied population of fuel elements.

23 MR. NIR: And we believe we are doing it
24 pretty well. Actually, one of the topics that we'll
25 discuss in the closed session will be the fuel and

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1 core design. If needed, we can get into a little bit
2 more discussion on this. Actually, you get, I think,
3 a flavor of some of the design fuels that are being
4 used.

5 CHAIRMAN WALLIS: Okay.

6 MR. NIR: I listed here actually the
7 evolution of the Power Uprate Core Program. We
8 started with 5 percent. It evolved to the EPU, 120
9 percent. That's actually 20 percent increase over the
10 original licensed thermal power.

11 The TPO, the thermal power optimization,
12 which is based on pool feedwater flow measurement
13 uncertainty, that's about a percent and a half or so.
14 And, finally, the constant pressure power uprate,
15 which we will discuss today.

16 I wanted just to add one more element and
17 ask to do actually to implementation. This is the
18 concept of online implementation, and I'm doing that
19 just to provide maybe the concept or the timeline so
20 that you can tie actually the SCR and your function in
21 this timeline to the power uprate process.

22 CHAIRMAN WALLIS: Now just to clarify
23 this, you're talking here about thermal power, 20
24 percent.

25 MR. NIR: Yes.

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1 CHAIRMAN WALLIS: And the efficiency
2 actually goes down a little bit, doesn't it? Or
3 what's the effect on mechanical power?

4 MR. NIR: It depends. Efficiency may or
5 may not go down. Typically, when you uprate by 20
6 percent or so, you replace the high-pressure turbine.

7 CHAIRMAN WALLIS: But you take more
8 pressure drop in the steamline and things like that.

9 MR. NIR: That's true, but typically the
10 designs are much more advanced, and on balance, we
11 actually see potentially improving in efficiency just
12 because the technology on the balance of plant is
13 improved.

14 CHAIRMAN WALLIS: So have we concluded
15 that it is still 20 percent electrical? That would be
16 a good conclusion to make with that?

17 MR. NIR: Yes, it's --

18 CHAIRMAN WALLIS: Close enough?

19 MR. NIR: Close enough. You know,
20 actually, the efficiency depends, as you know, on the
21 environment. It can vary, but, yes, to your point, if
22 you perform the power uprate with constant pressure,
23 you do not change the turbine; you do not change the
24 system; efficiency will go down, I agree.

25 The vertical bars on this slide represent

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1 the refueling outages. They are spaced typically
2 uniformly every 18 months or 24 months, and the
3 timeline represents the EPU process. We start with
4 the evaluation and then, following the NRC submittal,
5 NRC review, and the vertical line, indicated by SER,
6 is basically the combination of NRC review and ACRS
7 review.

8 At that point the license is issued, and
9 with constant pressure power uprate, almost
10 immediately, without any power reduction, the power
11 can be increased.

12 Following this online implementation,
13 well, at that point the power may be limited by core
14 design or BOP limitations. Following the subsequent
15 refueling outage, these limitations can be addressed,
16 some modifications in fuel design and appropriate core
17 design, and then full power, EPU power can be
18 achieved.

19 Let me just tell you that this approach
20 was successfully demonstrated both for Duane Arnold
21 and Dresden 2.

22 CHAIRMAN WALLIS: So how far along is
23 Duane Arnold?

24 MR. NIR: Duane Arnold is right now at
25 about 113 percent of original thermal power, and I

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1 believe that Dresden 2 is actually at the generator
2 limit. So they reached the maximum electric
3 production or their target, I would say. The thermal
4 power is lower. It's about 95 percent, I believe, of
5 the new rate of --

6 CHAIRMAN WALLIS: Anything unexpected
7 which happened would have been reported then? The
8 agency would know about it at this point?

9 MR. NIR: That's true. I believe that
10 both power increase ascensions were very successful
11 and uneventful.

12 This is a summary of GE BWR power uprate
13 experience. On the left you can see most of the
14 initial power uprates were associated with power
15 increase. On the right the recent applications is
16 with dome pressure remaining constant, and as I
17 indicated, there are three applications, three
18 projects in progress: Clinton, Brunswick, and the two
19 Browns Ferry units.

20 Finally, this is actually a slide that we
21 showed you about six or seven months ago. Since then,
22 it changed actually pretty significantly. This shows
23 the addition to the U.S. electrical grid as a result
24 of GE BWR power uprates, and you can see that to date
25 we added 750 megawatts. That's a combination of the

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1 5 percent uprate and the EPU. In progress is an
2 additional 800, and that will cover slightly above 50
3 percent of what we believe the potential for power
4 increase in the BWR fleet.

5 CHAIRMAN WALLIS: Explain this a little
6 bit. On the left it says, "Completed," and it starts
7 at 1,000 and it goes up to 1750? It looks like a 75
8 percent increase? I don't understand that.

9 MR. NIR: This is 750-megawatt electric.

10 CHAIRMAN WALLIS: So it's increased by 25
11 percent?

12 MR. NIR: I'm not following your question.
13 I'm sorry.

14 CHAIRMAN WALLIS: Well, there is sort of
15 a grayish shaded thing and then there's a blackish
16 shaded charcoal thing on top of it --

17 MR. NIR: Oh, yes. The charcoal is the
18 TPO. There you see the light is the 5 percent power
19 uprate. The darker gray is the EPU, and the dark
20 is --

21 CHAIRMAN WALLIS: Oh, I see the light is
22 what you've already gained?

23 MR. NIR: Right, yes.

24 CHAIRMAN WALLIS: Okay. So it's not the
25 base. The base is zero.

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1 MR. NIR: Absolutely. Yes, this is the
2 addition. I'm sorry.

3 MR. BOEHNERT: Yes, it's all addition.

4 MR. NIR: These are all additions due to
5 the different programs.

6 CHAIRMAN WALLIS: These are the total
7 megawatts added to the grid by these various
8 processes?

9 MR. BOEHNERT: Yes.

10 MR. NIR: Yes. So it's actually, as you
11 can see, a very significant contribution. The
12 potential there is equivalent of five units of 940-
13 megawatt electric and more than two of them are
14 already effectively online.

15 CHAIRMAN WALLIS: Does this include Ramone
16 Yankee? You say "Forecast," so I guess you're looking
17 into the future.

18 MR. NIR: The forecast -- well, the two
19 columns represent the potential that exists. The
20 actual will depend on the --

21 CHAIRMAN WALLIS: It is not going to be
22 specific about plants?

23 MR. NIR: That's right.

24 That is the conclusion of the open
25 session.

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1 CHAIRMAN WALLIS: Okay, thank you.

2 MR. BOEHNERT: We will go to closed
3 session now. So the transcriber will go to a closed
4 session transcript.

5 (Whereupon, at 1:25 p.m., the proceedings
6 continued in closed session. The open session resumed
7 at 5:25 p.m.)
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1 CHAIRMAN WALLIS: Thank you.

2 MR. DONOGHUE: Good afternoon. My name is
3 Joe Donoghue, and I'm here for a very brief discussion
4 on where the staff review stands.

5 When this meeting was originally
6 conceived, the staff anticipated being at the stage
7 where we would be giving you, basically today, giving
8 you the draft SER, but we're a couple of weeks away
9 from that. I will give you that schedule in a little
10 while.

11 First, I wanted to thank GE. The staff
12 really appreciates the effort that General Electric
13 put into this presentation. It is always good to hear
14 the overview and the material and meet people face to
15 face.

16 I think you have heard a little bit about
17 this earlier in Dr. Nir's discussion. I will just
18 point out that the staff's got very recent experience
19 with extended power uprates, and I think you heard
20 earlier, there was a remark made that there are
21 reviews ongoing with the staff. I think Brunswick was
22 one of them, where the CPPU process is at least in
23 part being applied.

24 There are some common technical issues,
25 the ones we just talked about, just heard about, that

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1 came up in some of these other reviews, this large
2 transient testing issue, and it is going to be covered
3 in the staff review on CPPU.

4 My final slide, the draft SER is coming
5 together as we speak. Large portions of it are
6 prepared by the staff, still under review by some
7 management. I think some of these parallel efforts --
8 I bring up one here, the Brunswick review, where the
9 staff actually did a lot of review at GE on some of
10 the analysis work, is benefitting the CPPU effort.

11 There is a balance we have to play because
12 a lot of the same people are involved in plant-
13 specific work that are doing the generic topical
14 report review here. But I think in total it is
15 probably a benefit. They probably learned enough to
16 actually help speed up the review process for this
17 topical report.

18 As I mentioned, the draft SER we expect to
19 have delivered to the ACRS early February. That's
20 really all I had to say today.

21 CHAIRMAN WALLIS: Now we had some comments
22 on your previous SERs on power uprates which your
23 management assured us were being taken to heart.

24 MR. DONOGHUE: Yes.

25 CHAIRMAN WALLIS: There wasn't much

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1 change, however, in the SER, the last one we saw. I
2 wonder if you are making more effort this time?

3 MR. DONOGHUE: Well, I know that the
4 reviewers are using information and comments that they
5 got from meetings on the other uprates.

6 CHAIRMAN WALLIS: I think we are not
7 concerned about the quality of the review. I think
8 our main concern is that it be properly reflected in
9 the SER itself, so that the written document properly
10 reflects all the work and consideration that the staff
11 put into the review of it.

12 Anyway, we have said this in letters, but
13 I just wanted to bring it up again because this was an
14 important point among my colleagues, that the SER
15 should reflect the quality of the technical review
16 perhaps more than some of the SERs tended to in the
17 past.

18 MR. DONOGHUE: Well, our remark about the
19 plan for this SER is, and this is part of the process,
20 is seeing what questions the Subcommittee is going to
21 have, and we definitely are going to meet in the near
22 future, I believe, on the topical report itself.
23 Those comments will be factored into the SER. The
24 reviewers are prepared to use that. Because what we
25 are delivering to you is a draft SER with the intent

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1 of factoring in any additional information that might
2 come up that we need to think about.

3 MR. BAJWA: Dr. Wallis, I can address --

4 MR. BOEHNERT: Identify yourself, Singh.

5 MR. BAJWA: This is Singh Bajwa, the NRR
6 Project Director for Project Directorate 3.

7 We are in finalizing the response to your
8 comments for the previous two applications which you
9 have reviewed. It is with the senior managers, and
10 there are a couple of issues which are in the final
11 stages. One is the SRP development for the power
12 uprate which is one of your recommendations, and the
13 second one, which you have just stated in reference to
14 the documentation of the reviews.

15 The present situation which we are facing
16 is that the two applications which you are receiving
17 this month, 95 percent of the work was completed prior
18 to receiving your comments. Staff is doing the best
19 to their ability with the time allowed and the
20 schedules.

21 At the same time we are also seeing that
22 there will be a change in the SE development in light
23 of the CPPU if the topical report is approved. So we
24 have to keep that in mind, that the guidance which we
25 develop for our technical reviewers will be in light

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1 of the new methodology to be used in developing the
2 SEs.

3 So we are doing the best we know at this
4 point under given circumstances, but the staff has
5 definitely taken a very serious look to your comments
6 and the management was very mindful of that. At least
7 we believe that the Dresden/Quad City was a little bit
8 notch better than the first one, and I think hopefully
9 you will see the next will have an improvement over
10 the previous ones.

11 CHAIRMAN WALLIS: Yes, I think our
12 comments were rather independent of the actual
13 methodology. It was rather more a question of making
14 your technical case clearer to whoever read the SER.
15 That was a very general comment, but still I think
16 applies.

17 MR. BAJWA: I understand.

18 CHAIRMAN WALLIS: We are looking forward
19 to your next effort.

20 MR. BAJWA: All right, thank you.

21 CHAIRMAN WALLIS: Thank you.

22 Anything else we need to do now?

23 MEMBER KRESS: I take it you don't have
24 any real showstoppers at this time in your SER or
25 draft?

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1 MR. DONOGHUE: None that I'm aware of.
2 I'm the Project Manager, not the Technical Reviewer,
3 but right now the inputs I have seen -- we have gone
4 through the RAI process on this. We have responses,
5 and reviewers are writing the SER input. So the
6 answer is, no, none that I am aware of.

7 CHAIRMAN WALLIS: So maybe with our
8 previous experience this will go quicker next time.

9 MR. DONOGHUE: That's the intent.

10 CHAIRMAN WALLIS: More streamlined, right?

11 (Laughter.)

12 MR. DONOGHUE: I didn't use that word.

13 (Laughter.)

14 I think process improvement is what
15 management just said.

16 CHAIRMAN WALLIS: Do my colleagues have
17 anything else to add?

18 (No response.)

19 I would appreciate your input to me in
20 terms of what we should say to the full Committee; by
21 email would be great from each one of you.

22 MR. BOEHNERT: You'll make your report to
23 the full Committee?

24 CHAIRMAN WALLIS: And I think we will make
25 a report, an oral report. I don't think there's any

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1 letter involved this time around.

2 MR. BOEHNERT: No

3 CHAIRMAN WALLIS: Just what I would like
4 to be a consensus or at least a combination of views
5 that I have to put before the full Committee, I think
6 pretty briefly, at our next meeting.

7 Thank you very much.

8 Is there anything else we need to do, my
9 conscience over here?

10 MR. BOEHNERT: Not until tomorrow.

11 CHAIRMAN WALLIS: Okay, then I think we're
12 ready to -- what do we do?

13 MR. BOEHNERT: Recess.

14 CHAIRMAN WALLIS: We recess?

15 MR. BOEHNERT: Recess.

16 CHAIRMAN WALLIS: Recess until 8:30
17 tomorrow morning, when the topic will be entirely
18 different.

19 MR. BOEHNERT: Yes.

20 CHAIRMAN WALLIS: Thank you very much.
21 Everybody who has been here contributed to our meeting
22 today.

23 (Whereupon, at 5:33 p.m. the Subcommittee
24 recessed, to reconvene the following day, Thursday,
25 January 17, 2002, on a different matter.)

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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 Subcommittee

Docket Number: (Not Applicable)

Location: Rockville, Maryland

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Official Reporter
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