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For your information, I have enclosed the pdf of the transcript of the ACRS meeting that was held on the MOX Construction Authorization in 2005. The MOX discussion starts on page 184.

Hearing Identifier: MixedOxideFuelFabricationFacility_Public
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From: Tiktinsky, David

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Recipients:

"MFFFHearingFile Resource" <MFFFHearingFile.Resource@nrc.gov>

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"Oesterle, Eric" <Eric.Oesterle@nrc.gov>

Tracking Status: None

"Morrissey, Kevin" <Kevin.Morrissey@nrc.gov>

Tracking Status: None

"Roman, Cinthya" <Cinthya.Roman@nrc.gov>

Tracking Status: None

"Wescott, Rex" <Rex.Wescott@nrc.gov>

Tracking Status: None

"DeJesus, Jonathan" <Jonathan.Dejesus@nrc.gov>

Tracking Status: None

"Rahn, David" <David.Rahn@nrc.gov>

Tracking Status: None

"Norato, Michael" <Michael.Norato@nrc.gov>

Tracking Status: None

"Gwyn, Dealis W." <DWGwyn@moxproject.com>

Tracking Status: None

"Benson, Michael" <Michael.Benson@nrc.gov>

Tracking Status: None

"Tripp, Christopher" <Christopher.Tripp@nrc.gov>

Tracking Status: None

"Asadul Chowdhury" <asadul.chowdhury@swri.org>

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519th Meeting

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Pages 1-328

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

519TH MEETING

+ + + + +

THURSDAY,

FEBRUARY 10, 2005

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ROCKVILLE, MARYLAND

The Committee met at the Nuclear
Regulatory Commission, Two White Flint North, Room T-
2B3, 11545 Rockville Pike, at 8:30 a.m., Dr. Mario V.
Bonaca, Chairman, Presiding.

COMMITTEE MEMBERS:

- MARIO V. BONACA, Chairman
- WILLIAM J. SHACK, Vice Chairman
- JOHN D. SIEBER, Member-at-Large
- GEORGE E. APOSTOLAKIS, Member
- RICHARD S. DENNING, Member
- F. PETER FORD, Member
- DANA A. POWERS, Member
- VICTOR H. RANSOM, Member
- STEPHEN L. ROSEN, Member
- GRAHAM B. WALLIS, Member

1 ACNW COMMITTEE MEMBER:

2 MICHAEL T. RYAN, Member

3

4 ACRS STAFF PRESENT:

5 JOHN T. LARKINS, Director

6 SAM DURAISWAMY, Designated Federal Official

7

8 NRC STAFF PRESENT:

9 FRANK ASKTULEWICZ

10 JOE GITTER, NMSS, FLSS, SPB

11 MIKE JOHNSON

12 STEVEN JONES, NRR, DSSA, SPLB

13 N. KALYANAM, NRR, DLPM, PDIV-1

14 STEWART MAGRUDER, NMSS, FCSS, SPB

15 TAD MARSH, NRR, DLPM

16 ALEX MURRAY, NMSS, FCSS, SPB

17 JAMES TATUM, NRR, DASSA, SPLB

18 LEN WARD, NRR, DSSA, SRXB

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ALSO PRESENT:

KEN ASHE DCS

WILLIAM L. BROWN

Westinghouse

JOE CLEARY Westinghouse

DAVID CONSTANCE Entergy

BOB HAMMERSLEY Westinghouse

JERRY HOLMAN Entergy

ED LYMAN Union of Concerned Scientists

TIM MITCHELL Entergy

DON P. SISKI Westinghouse

SHARON STEELE DCS

JOSEPH VENABLE Entergy

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A G E N D A

OPENING REMARKS BY ACRS CHAIRMAN 5

POWER UPRATE FOR WATERFORD NUCLEAR PLANT 6

BREAK 104

TECHNICAL BASIS FOR POTENTIAL REVISION
OF THE PRESSURIZED THERMAL SHOCK (PTS)
SCREENING CRITERIA IN THE PTS RULE 177

LUNCH 182

MIXED OXIDE (MOX) FUEL FABRICATION FACILITY . . 182

P R O C E E D I N G S

(8:31:38 a.m.)

1
2
3 DR. WALLIS: This is the first day of the
4 519th Meeting of the Advisory Committee on Reactor
5 Safeguards. During today's meeting, the committee
6 will consider the following: power uprate for
7 Waterford Nuclear Plant, mixed oxide fuel fabrication
8 facility, and the preparation of ACRS reports.

9 This meeting is being conducted in
10 accordance with the provisions of the Federal Advisory
11 Committee Act. Dr. John T. Larkins is the Designated
12 Federal Official for the initial portion of the
13 meeting.

14 We have received no written comments from
15 members of the public regarding today's sessions. We
16 have received a request from Mr. Lyman, Union of
17 Concerned Scientists, for time to make oral statements
18 regarding MOX fuel fabrication facility. That will be
19 this afternoon.

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

25 I have a few items of current interest.

1 I'm very happy to announce that Erik Thornsby has
2 been selected as a Senior Staff Engineer for the ACRS,
3 and he will be joining us soon. Since October, he's
4 been assigned to the EDO's Nuclear Security Special
5 Projects Team, and we've heard some of his
6 presentations.

7 Prior to that, Erik spent eight years as
8 a Reliability and Risk Engineer in the Office of
9 Research. His recent activities have been focused on
10 the assessment of potential vulnerabilities and
11 mitigation strategies for nuclear power plants for
12 security events. Erik also has significant risk
13 assessment experience in pressurized thermal shock,
14 digital instrumentation and control, and reliability
15 analysis. Erik has a B.S. in mathematics and physics
16 from Cumberland College, Kentucky; an M.S. in nuclear
17 engineering from the Ohio State University, and is
18 currently working toward a Ph.D. in reliability
19 engineering at the University of Maryland, so please
20 welcome Erik.

21 A few items of interest have been handed
22 out. Notice that there are a few SRMs, press releases
23 on the new commissioners, and you may have an interest
24 in the draft program for the regulatory information
25 conference.

1 I'd like to proceed with the meeting.

2 MR. DURAISWAMY: May I?

3 DR. WALLIS: Yes.

4 MR. DURAISWAMY: The proposed schedule for
5 the Quadripartite Meeting, take a look at it.

6 DR. WALLIS: Oh, we have a handout.
7 Please look at the schedule for Quadripartite Meeting
8 suggested here. We will discuss that later today.
9 Anything else, Sam?

10 MR. DURAISWAMY: That's it.

11 DR. WALLIS: Okay. Tad Marsh, would you
12 get us going, please.

13 MR. MARSH: Yes. Good morning, Mr.
14 Chairman. Thank you. My name is Tad Marsh, and I'm
15 the Director of the Division of Licensing Project
16 Management in the Office of Nuclear Reactor
17 Regulation.

18 As you'll see, behind you we have a large
19 contingent of staff and management here to support
20 this meeting, and we are ready to discuss any issue
21 that you'd so choose, but it's a full audience on this
22 side.

23 The purpose of our briefing today is to
24 present to you our review of Entergy's application for
25 an extended power uprate for Waterford Unit 3. If the

1 8 percent uprate is approved, it will be the largest
2 power uprate, although not the only power uprate for
3 a PWR in the United States. Waterford 3 will be
4 operating at a core power level of 3,716 megawatts
5 thermal.

6 Our review of the proposed EPU for
7 Waterford is the first one to be completed using the
8 new review standard, RS-001. We have presented this
9 to you several times in the last year, including the
10 Standard Review Plan Section 14.2.1, which is a new
11 Standard Review Plan Section associated with large
12 transient testing.

13 The Staff's review of Waterford uprate
14 application was challenging, and the Staff required a
15 substantial amount of additional information from the
16 licensee to complete its review. Even up to the last
17 few days, we've been dialoguing with the licensee and
18 the vendor on issues associated with this review.

19 Now this was the first review associated
20 with large transient testing for a Pressurized Water
21 Reactor, and the Staff set the standard high, and
22 followed the SRP associated with this issue. You will
23 hear more about that as we present to you the results
24 of our review.

25 The review was thorough, and it followed

1 Waterford's application, and took a substantial amount
2 of Staff resources and licensee's resources. We have
3 come to resolution on the open issues which we
4 described to you at the subcommittee. However, the
5 licensee will need to supplement its application, and
6 the Staff will need to amend its Draft Safety
7 Evaluation to address these issues. You will hear
8 today the information that will be contained in the
9 amendment and the supplement safety evaluation itself.

10 Stepping back a little bit from Waterford
11 EPU in particular, going to power uprate in general;
12 as I said, this is the first application of the Review
13 Standard, and we believe that the Review Standard is
14 a very thorough, very complete document which helped
15 us in our technical reviews. However, we did notice,
16 and we discussed this at the subcommittee, that it
17 required more Staff hours, and more interactions than
18 we have seen before in past uprates. And this
19 experience is borne out not just by Waterford, but by
20 the other ongoing EPU applications which we are
21 reviewing.

22 We believe this more than anticipated
23 Staff hours was caused by a couple of things. First,
24 this is a new Review Standard, and this is the first
25 application or the first time the Staff has used the

1 Review Standard, so it's a thorough document, and it
2 has guided us appropriately, and it has led us to more
3 thorough, more complete documentation, so we believe
4 that's an element.

5 We also believe that the industry is being
6 guided by this first application of the Review
7 Standard; that is, its thoroughness, and its
8 completeness has led to more interactions needed with
9 licensees. We are seeing that. We also have ongoing,
10 stepping back even one step further, concerns
11 expressed by the industry in general, not associated
12 with power uprate, about RAIs, Request for Additional
13 Information, and the extent to which maybe the
14 licensing process needs to be looked at in terms of
15 RAIs. That's another backdrop to this increased
16 interactions.

17 We do believe that is a very thorough
18 review, and it was complete, and we are satisfied with
19 the extent that this Review Standard was developed and
20 used. We intend on issuing, though, a Regulatory
21 Issues Summary later this year to address thoroughness
22 and completeness in applications associated with the
23 Review Standard, so we could end up with a more
24 efficient process.

25 Thank you very much for the attention and

1 the introduction, and I'd like to turn the
2 presentation over to the Project Manager for Review
3 Standard, Kaly, who will be doing an introduction and
4 also leading us in the presentation; unless there's
5 any questions, sir.

6 MR. KALYANAM: Good morning. My name is
7 Kaly Kalyanam. I'm the Project Manager for Waterford
8 3, and I'm going to make a brief presentation on the
9 background and some of the open items we have from our
10 last meeting.

11 Okay. The plant was originally licensed
12 in 1985 for a reactor core power of 3390 megawatt
13 thermal. And back in 2002, we granted a recapture
14 uprate up 1-1/2 percent increase, not to exceed 3441
15 megawatt thermal. Now this current extended power
16 uprate requests an increase of 8 percent power level,
17 the core power now takes it 3716 megawatt thermal.

18 As Tad pointed out, this is the largest
19 PWR increase to-date. And some of the major plant
20 modifications that are planned are the high pressure
21 turbine is being upgraded, and the main generator is
22 being rewound and provided with the associated
23 auxiliaries, install higher capacity circuit breakers,
24 disconnect switches and press work, main transformer
25 modifications are being done, and the control rods for

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1 the heater drain system and the reheat system safety
2 valves have been done, and the condenser tubes are
3 being stayed.

4 DR. WALLIS: You also have slightly more
5 enriched fuel. Is that right?

6 MR. KALYANAM: No, I don't believe so.

7 DR. WALLIS: It's the same fuel?

8 MR. KALYANAM: Same fuel.

9 DR. WALLIS: And the same steam
10 generators.

11 MR. KALYANAM: Yes, sir.

12 The EPU Implementation Schedule is as
13 follows; plants implement this in one increment, and
14 completion of plant modifications necessary to
15 implement the EPU are planned prior to the end of the
16 refueling outage 13 in the spring of 2005, another
17 couple of months. With the approval of this license
18 amendment request, the plant will be operated at the
19 higher power level of 3716 megawatt thermal starting
20 in Cycle 14.

21 We briefly discussed the Staff review
22 approach. The first PWR EPU to follow the Review
23 Standard 001, we replaced the Standard Review Plans
24 and used acceptable codes and methodologies. There
25 were requests for additional information. We received

1 a total of 32 supplements, and we did perform audits
2 and independent calculations in selected areas.

3 Now in the subcommittee briefing, we
4 talked about four issues that were on consensus path
5 and close to resolution, and let me briefly touch
6 them. The first one is the alternate source term
7 amendment, and the reviewer gave the presentation on
8 that. And to summarize that, the review is proceeding
9 on schedule, and we do not anticipate any surprises.
10 And the AST amendment will be issued by mid-March,
11 2005. And it will be a prerequisite for EPU amendment
12 issuance, and the EPU Safety Evaluation would reflect
13 this, so we consider that this is no longer an open
14 issue and it is closed.

15 The other three issues that were items
16 referred as open last time were the three-second time
17 delay between the steam generator tube rupture and the
18 loss-of-offsite power, and potential aging effects on
19 reactor vessel internals, the EPRI, MRP report and
20 accounting for instrument uncertainty.

21 These three issues have been resolved and
22 closed with either a commitment or condition in the
23 amendment from the licensee which is on the docket.
24 The staff essay will reflect this.

25 Now finally, as the agenda would indicate,

1 we have the boron precipitation issue and the large
2 transient testing issue which will be presented before
3 the committee by the licensee, followed by the Staff
4 review. Also, we have the licensee present the
5 comparison between the Waterford 3 and Palo Verdi
6 steam dryers. I believe this was an item of interest
7 in the last subcommittee briefing.

8 With this, I hand it over to --

9 MR. MARSH: Mr. Mitchell.

10 MR. KALYANAM: Yes.

11 MR. MARSH: Okay. Thank you, Mr.
12 Chairman.

13 DR. WALLIS: Thank you. Please go ahead
14 when you're ready.

15 MR. VENABLE: Yes, sir. Thank you. Good
16 morning, Mr. Chairman and Committee Members. My name
17 is Joe Venable. Tim Mitchell will be following me. I
18 am the Site Vice President at Waterford 3. I'll just
19 take a minute to communicate my views on Waterford 3's
20 power uprate, and then we'll get right into it with
21 Mr. Mitchell.

22 First, I really appreciate the review
23 process for this power uprate that we're undergoing.
24 It has been, as Mr. Marsh said, challenging,
25 systematic, and very thorough. We've incorporated

1 industry lessons-learned, extended our Entergy and NRC
2 reviews, and explored new areas affected by this power
3 uprate. We have also addressed some longstanding
4 issues, reactor-type specific, while doing this power
5 uprate evaluation. We'll discuss some of those again
6 today.

7 Waterford has performed focused reviews of
8 this uprate with independent both internal and
9 external assessments during the engineering evaluation
10 and the design process. I am personally satisfied
11 that this is a safe uprate for Waterford 3, and
12 appropriate. This is important for Entergy Louisiana,
13 and a benefit for our customers. It is a key part of
14 the stabilization of the rates paid by our customers
15 in our area, and as such it has key interest from our
16 Public Service Commission.

17 Thank you for your attention, and I'll
18 turn it over to Mr. Tim Mitchell, and we can discuss
19 the issues at hand. Thank you.

20 MR. MITCHELL: Good morning. I'm Tim
21 Mitchell. I'm Engineering Director at Waterford 3.
22 I've been with Entergy about 15 years in various
23 capacities, or a little over 15 years. I do have a
24 previous SRO on a CE unit, and of significance, I was
25 the Ops Manager during the ANO2 power uprate.

1 I'm going to provide a brief overview.
2 Some of this will be redundant with what we provided
3 in the subcommittee meeting, so I'll keep it at high
4 level. We have a number of people here to support our
5 presentation and answer questions, and I will go
6 through and introduce the primary presenters. The
7 introduction was provided by Joe Venable, and as I
8 stated, I am providing the overview. Boron
9 Precipitation, Mr. Jerry Holman will provide that
10 presentation; Large Transient Testing will be then
11 provided by David Constance; Steam Generator Dryers
12 will be Don Siska. I'd also like to note as part of
13 this introduction that we've had an extensive Staff
14 review. I'd like to concur that that Staff review has
15 been challenging and thorough, and I believe it has
16 resulted in a better product as a result of that
17 review.

18 A little bit on overview. This project
19 has been a significant project for us. We've had the
20 large resource commitment, and more than three years
21 of commitment to this project has had a significant
22 fleet involvement from Entergy, as well, so it is not
23 just a single unit. We've got a lot of expertise
24 within the fleet that we called in to support this
25 project.

1 A significant benefit from this for us has
2 been the improvement in our design basis, not only in
3 understanding of the design basis, but also
4 improvements in design basis, bringing it up to
5 today's standards. We have focused a lot on oversight
6 and rigor, we have a Director level, Project Manager
7 or Project Lead for this, Mr. Ted Leonard. And we've
8 had multiple corporate-led assessments to make sure
9 that we were doing the right things. We kicked it off
10 with what was called the Red Team Assessment to make
11 sure that we started off with Lessons Learned from
12 the ANO-2 power uprate.

13 Last October we had a large assessment to
14 review our readiness, as well. It warrants noting.
15 It was a 12-member team, 11 of which had previous
16 uprate experience, and four were from outside Entergy.
17 And we continued to monitor engineering product
18 quality through this, and had several individual
19 assessments on that product quality.

20 We have considered industry operating
21 experience as part of this effort, and have gotten a
22 lot of information through a number of sources,
23 including INPO. And as I mentioned previously, we
24 also learned from the Staff review. As Kaly noted,
25 this submittal was per the Draft Review Standard, RS-

1 001, for extended power uprates.

2 Now I was going to cover a high-level
3 description of the plant. Kaly has already pretty
4 well hit this, but we are a combustion engineering
5 plant, and we will be going to 3716 megawatts thermal
6 with this project.

7 The project team included Entergy, and as
8 I mentioned both Waterford people and fleet people,
9 Westinghouse, Enercon, and then Siemens-Westinghouse
10 for the turbine.

11 This is a repeat list of what Kaly went
12 over of significant modifications associated with this
13 effort; replacing the high pressure turbine steam path
14 is the most significant of the modifications here.
15 The rest of them, including the generator rewind, will
16 address some issues with the plant and make the plant
17 more reliable after a power uprate.

18 From engineering plant impacts, safety
19 systems, you can see that we did not require changes
20 to these systems. I do want to talk briefly about the
21 fuel minimum requirement. We did need to raise the
22 level in fuel oil tanks. As part of that, we have
23 created an operator burden for the operators refueling
24 the tanks, and we have made a commitment by December
25 of 2006 to provide additional storage capacity.

1 From a safety analysis standpoint, we have
2 globally revised the safety analysis for this effort
3 for extended power uprate, and we have rewritten the
4 safety analysis report. It was an extensive scope,
5 and we've had intrusive reviews by the vendors.

6 DR. BONACA: Did you have to adjust your
7 set points in the reactor protection system?

8 MR. MITCHELL: We had one set point in the
9 reactor protection system, the steam generator low
10 pressure, that was adjusted, and we have a tech spec
11 change that has gone through on that.

12 DR. BONACA: Okay.

13 MR. MITCHELL: But only the one.

14 DR. BONACA: You have now less DNBR
15 margin, a margin for loss of flow?

16 MR. MITCHELL: I'm sorry?

17 DR. BONACA: You have lower DNBR margin
18 for loss of flow now?

19 MR. MITCHELL: Actually, I believe it
20 stays relatively constant. Jerry Holman, can you
21 answer that?

22 MR. HOLMAN: I'm Jerry Holman with
23 Waterford 3. The DNBR margin for the loss of flow
24 stays relatively constant. We did analyze that event
25 explicitly, and it shows acceptable results.

1 MR. MITCHELL: Okay. Now a little bit
2 about control room habitability. As previously
3 mentioned, we are going to alternate source term. We
4 did do the tracer gas test back in April of 2004.
5 That submittal has been submitted, and is in review,
6 and it does meet 10 CFR 50.67 and general design
7 criteria, 19 acceptance criteria.

8 From a PRA standpoint, our conclusions
9 from that PRA is the model elements reviewed for
10 impact, we have a minor reduction in operator recovery
11 times. From an external event standpoint, a slight
12 increase in core damage frequency, but it did not
13 change our operator response time.

14 DR. APOSTOLAKIS: Which times are you
15 referring to; the reduction in operator recovery
16 times?

17 MR. MITCHELL: Jerry, do you want to cover
18 that.

19 MR. HOLMAN: Okay. I'm Jerry Holman from
20 Waterford. The reduction in time is a function of the
21 higher decay heat. It's really looking at a time to
22 reach core uncover following let's say a loss of all
23 feedwater, so we changed -- as a result of the higher
24 decay heat, that time changed roughly from 83 minutes,
25 I believe, to 68 minutes for power uprate.

1 DR. APOSTOLAKIS: For which action, for
2 which sequence?

3 MR. HOLMAN: That would be for the time to
4 recover off-site power or --

5 DR. APOSTOLAKIS: Off-site power.

6 MR. HOLMAN: That is the time for core
7 uncovering that's used in that recovery time for off-
8 site power.

9 MR. MITCHELL: Okay. A little bit I want
10 to talk about from conclusions. We worked through the
11 issues, as Kaly talked about --

12 DR. APOSTOLAKIS: Excuse me. Back to 12;
13 so you're showing the Delta CDF and Delta LERF. What
14 is the baseline CDF?

15 MR. MITCHELL: Baseline CDF, I'll let
16 Jerry cover that also.

17 MR. HOLMAN: Baseline CDF for power uprate
18 was 6 times 10 to the minus 6.

19 DR. APOSTOLAKIS: What do you mean "for
20 power uprate"? That was before the uprate, right?

21 MR. MITCHELL: The question is before the
22 uprate; what is it before the uprate?

23 MR. HOLMAN: I don't have that number off
24 the top of my head, but I can get it for you.

25 DR. DENNING: You can see from that it

1 doesn't change.

2 DR. APOSTOLAKIS: I know.

3 MR. ROSEN: Can you talk about this slight
4 increase in the fire CDF, as well?

5 MR. MITCHELL: Yes, sir.

6 MR. ROSEN: What is that?

7 MR. HOLMAN: The increase in the fire CDF
8 was also driven by the very small changes in operator
9 action times, and the change in time for core
10 uncovering.

11 DR. POWERS: I guess what we're struggling
12 a little bit with is if 3.5 times 10 to the minus 7
13 gets put on the slide, how small is a slight increase?

14 DR. KRESS: For the --

15 DR. POWERS: It must be less than that.

16 DR. KRESS: Yes. It was on the order of
17 10 to the minus 9, was the slight increase for fire
18 CDF.

19 DR. POWERS: You have an extraordinarily
20 precise fire analysis, obviously.

21 DR. KRESS: Do you ever do a level 3 PRA
22 for this site?

23 MR. HOLMAN: No, we have not done a level
24 3 PRA.

25 DR. APOSTOLAKIS: Now your PRA has been

1 reviewed by the industry that went through the NEI --

2 MR. HOLMAN: Yes, we have gone through a
3 certification review with the Owners Group.

4 MR. MITCHELL: Okay. Any other questions
5 on PRA?

6 DR. BONACA: Well, I wasn't on the
7 subcommittee. I wonder if you explored -- I mean, how
8 complete is the PRA in addressing the effects of the
9 power uprate? There are certain issues to do with the
10 dryers and things which are discussed later. Possible
11 frequency of failures of those components, or impact
12 of those margins are not really included in this PRA.
13 Right?

14 MR. HOLMAN: We looked at all of the major
15 events for the PRA, including initiating events,
16 failure rates of equipment. We looked at success
17 criteria. We also did some more specific and detailed
18 thermal hydraulic analyses to determine operator
19 action times. So we've looked at all of those
20 elements and folded those changes into the revised PRA
21 model. As I mentioned before, the only changes were
22 to the operator recovery time based on shorter time to
23 core uncover as a result of the higher decay heat.

24 MR. MITCHELL: And as an extension beyond
25 the PRA, we've gone through and looked on a component

1 level at various components throughout the plant to
2 look at where their new operating ranges were, where
3 valves would be opening or cycling at different
4 positions, looked at maintenance histories, looked at
5 what we need to do in this upcoming refueling outage
6 to ensure their reliability, as well, so that's beyond
7 the PRA.

8 DR. KRESS: Well, what would be a good
9 number for an average population density around the
10 site?

11 MR. MITCHELL: Within a five-mile radius,
12 there's roughly 13,000 people. Within ten miles, it's
13 a little larger. I don't have that exact number - we
14 can get it. We have information.

15 DR. KRESS: How far away is New Orleans?

16 MR. MITCHELL: New Orleans - I think we
17 discussed that in the subcommittee - it's roughly 30
18 miles away.

19 DR. BONACA: You gave us here a CDF
20 increase, LERF increase. Is also late releases pretty
21 much the same for the plant uprated, or is there an
22 effect on that?

23 MR. MITCHELL: Do you understand the
24 question, Jerry?

25 MR. HOLMAN: Yes. We concentrated our

1 evaluation on the large early release. We did not
2 explicitly look at late releases. I would not expect
3 to see much of a change there.

4 DR. BONACA: Yes. My line of questioning
5 really is going in the direction of understanding to
6 what extent the model truly represents a risk increase
7 level in absolute, and whether or not there are
8 elements that really are not modeled here. And I
9 would daresay that there are some that are not modeled
10 because some we don't have experience about operation
11 of some components in this kind of regimes.

12 DR. DENNING: Let me make a comment. I
13 think that you're absolutely right, Mario, that some
14 of the things that concern us about the uprates that
15 could lead to vibrations of components and things like
16 that, they would not have been included in the initial
17 PRA, and they're not included in the modified PRA.

18 DR. BONACA: Okay.

19 DR. DENNING: We've got latents I think
20 that core damage frequency is a pretty good surrogate
21 here for how big is the total impact.

22 DR. BONACA: Yes, and I agree with that.

23 MR. HOLMAN: We'll also be performing
24 monitoring programs, so we'll be able to detect any
25 changes as we update our PRA model, fold that into the

1 updates.

2 MR. MITCHELL: And I think you'll see when
3 we provide the presentation on the dryers, that we've
4 looked at dryers, in particular, as well as a number
5 of other components, but we will -- I think the dryers
6 will be representative of what we looked at overall.

7 DR. WALLIS: Okay. Thank you.

8 MR. MITCHELL: Okay.

9 DR. RANSOM: I had asked a question last
10 time about the pumps. You know, the pumps and motors
11 are operating at about a 5 percent increase in power,
12 and I'm wondering what effect does that have on the
13 overall accident frequency?

14 MR. MITCHELL: You're talking reactor
15 coolant pumps. Correct?

16 DR. RANSOM: Right.

17 MR. MITCHELL: Okay. Reactor coolant
18 pumps, essentially their most severe load is in mode-5
19 operation when the density of the fluid in the reactor
20 coolant system is cold, which is not affected by power
21 uprates.

22 DR. RANSOM: That's where their maximum
23 load is seen.

24 MR. MITCHELL: Right. So at full power,
25 there's not a significant different in the motors, the

1 loading on the motors or the pumps. There's only --

2 DR. RANSOM: About 5 percent, actually,
3 just due to the density increase of the fluid.

4 MR. MITCHELL: There is a minimum RCS
5 change, a flow number that we expect to change, or a
6 number that we expect to change. Actually, the actual
7 number we expect to change smaller than that 5
8 percent, so the change in reactor coolant pump
9 performance is negligible. We will not see a
10 significant difference from the old 100 percent to the
11 new 100 percent.

12 DR. RANSOM: is there a basis for that, or
13 experience, or what?

14 MR. MITCHELL: Predominantly, it's that
15 the severest load is, like I said, under cold
16 conditions when you're starting the pumps for the
17 first time. Once they're up and running, and at full
18 power densities, the Delta between those two is very
19 small.

20 DR. RANSOM: Okay.

21 MR. MITCHELL: Ten-mile cumulative
22 population is 91,116, so that's help with local
23 population.

24 From a conclusion standpoint, we have
25 worked through a number of issues. As stated, even up

1 through yesterday, we've continued to have dialogue.
2 We have commitments in place to address each. AST,
3 Alternate Source Term, does remain on track for
4 completion of Staff review on schedule, so with this
5 presentation, we will show you that the uprate will be
6 a benefit to the plant, and is safe to go forward.

7 Now I'm going to turn over the
8 presentation to Mr. Jerry Holman for discussion of
9 boric acid precipitation, consideration of voiding in
10 this topic is not a new issue. It actually dates back
11 some number of years. It's not really an error, but
12 it was a conscious decision in that time frame to
13 simplify the model. Jerry is going to talk through
14 some additional work that we've shown to show the
15 conservatism in the long-term cooling capabilities,
16 and all this information has been submitted and
17 docketed, and challenged by the Staff. Even though
18 this information is on the docket, we will provide
19 further clarification as an update to our licensing
20 basis, our design basis. And Jerry is going to
21 provide more details on that, so I'll turn it over to
22 Jerry.

23 MR. MARSH: Jerry, this is Tad Marsh.
24 Good morning. I just want to verify that there is no
25 proprietary information that's being discussed here.

1 Is that right?

2 MR. HOLMAN: We have no proprietary
3 information in the slides that we're going to present.

4 MR. MARSH: Thanks, Jerry.

5 MR. HOLMAN: Okay. Good morning. I'm
6 Jerry Holman. I've been working at Waterford for 22
7 years. I'm going to talk about the boric acid
8 precipitation issue. The long-term cooling analysis
9 is done to determine the potential for boric acid
10 precipitation after a large break LOCA. Boiling in
11 the core leaves boron behind, causing the
12 concentration of boric acid to increase in the core.
13 The post-LOCA long-term cooling analysis is done to
14 determine the time for operator actions in order to
15 prevent boron precipitation.

16 DR. WALLIS: I have a question about this.
17 When you say it's for the large-break LOCA only, you
18 are concerned about this?

19 MR. HOLMAN: For the small breaks, you
20 refill the RCS and distribute the boron to the core
21 throughout the RCS.

22 DR. WALLIS: But during the small break,
23 the core is uncovered for half an hour or something
24 like that, and it seems to me that the liquid is
25 splashing up onto these tubes. And presumably, when

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1 the steam goes off the liquid, what's left behind is
2 boron, so the tubes return the region of both the
3 pool, presumably gets spattered with boron over quite
4 a period of time, don't they?

5 MR. HOLMAN: Joe, could you address that?

6 MR. CLEARY: My name is Joe Cleary, from
7 Westinghouse. Yes, the observation is correct that
8 that would be a phenomenon that would occurring during
9 a small break LOCA, and that phenomenon, the general
10 evaluation of boric acid precipitation for such small
11 break LOCAs is not explicitly done. One of the major
12 reasons for that is the high pressure associated with
13 a small break LOCA is at the point where the boric
14 acid solubility in the water would be essentially 100
15 percent, so within the two phase region there is no
16 potential for boric acid precipitation prior to the
17 reflood of the core. However, there has been, to my
18 knowledge, no assessment of the amount of boric acid
19 build-up on the fuel rods during the period of time
20 for limiting small break LOCAs --

21 DR. WALLIS: Well, solubility doesn't
22 really matter because if you're going to evaporate
23 all the water, then what's left behind has to be the
24 boric acid.

25 MR. CLEARY: I understand your --

1 DR. WALLIS: You have no concerns with
2 this? You say it's not really considered, but this is
3 something which happens. But has it not been a
4 concern in the past? Does the Staff have any reaction
5 to that?

6 MR. WARD: This is Len Ward from the
7 Staff. The evaluation model, CENPD-254 that
8 Westinghouse has developed addresses small breaks and
9 large break LOCA. To give you some perspective,
10 simultaneous injection is a mechanism that is designed
11 to control a large break LOCA. That's where you split
12 the high pressure safety injection between the hot
13 side and the cold side, and it flushes it out for
14 large breaks.

15 For small breaks, because you're at
16 elevated pressures, when you switch to simultaneous
17 injection, there isn't enough flow either into the hot
18 side or the cold side to flush the core, so you have
19 to do something else. So what you do is you do an
20 analysis for a whole spectrum of breaks, and these --
21 this is from a break size - the smallest break size
22 where charging just is -- where the break flow is just
23 in excess of charging. That defines a really tiny
24 break. WE analyze all the way up to a double-ended
25 break.

1 Now like I said before, because small
2 breaks remain at elevated pressures and we switch to
3 simultaneous injection, simultaneous injection will
4 not flush the core. So what you have to do is an
5 analysis of system response, and what you can show is
6 for the small breaks, and you run them out - these
7 analyses are run out to six, seven, eight hours. The
8 system will refill. For those breaks which cannot be
9 flushed, they will refill, and you will re-establish
10 single-phase natural circulation. That will mix the
11 boric acid throughout the primary system, so you don't
12 have to rely on simultaneous injection.

13 Now during these small breaks, 05 square
14 feet and the range that's uncovering, you're not
15 concentrating a lot. The injection into the system is
16 from one high-pressure pump. The boil-off is really
17 low. You are concentrating, and even if you do
18 concentrate some fairly high values, because you're up
19 at two and three hundred pounds, the saturation
20 temperature is huge. You don't even get anywhere near
21 the precipitation limit. And because the system
22 refills and re-establishes single-phase natural
23 circulation, it disburse the boron.

24 That analysis is key ingredient into this
25 evaluation model. They have addressed small breaks.

1 The real issue is the large breaks where you're trying
2 to define a time to simultaneous injection, and that's
3 what we're focusing on here, is large break LOCA.

4 DR. WALLIS: I understand all of that, but
5 you didn't answer my question about the spattering of
6 borated water onto these rods, and the drying out of
7 that, same things happen in the superheated tubes in
8 the boiler, any kind of non-soluble material is left
9 behind when you dry out this liquid which is deposited
10 on the tubes. This, apparently, hasn't been a concern
11 from NRC side or from vendors' side. Is that true?

12 MR. WARD: That's true.

13 DR. WALLIS: Is it something which should
14 be looked at? I'd like to know how much of this boron
15 is deposited during this period when -- a rather long
16 period where the tubes are steam cooled. It's not
17 really steam because it has liquid in it.

18 MR. WARD: Well, it's about a 45-minute
19 period where the core is uncovered.

20 DR. WALLIS: That's right.

21 MR. WARD: That's the period where you're
22 concerned with?

23 DR. WALLIS: That's right. And suppose
24 that you plug up those tubes with boron deposits
25 during that period, what happens when you then reflood

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1 then?

2 MR. WARD: Well, I guess I would ask -- we
3 would need to ask ourselves how much boric acid do you
4 need to plug the core.

5 DR. WALLIS: Yes, you would.

6 MR. WARD: And I don't think you're going
7 to -- my initial reaction to that is there's not
8 enough boron produced in 45-minutes to do that. If
9 you look at the slides I'm going to show you on how
10 much boron builds up in 45-minutes from the initial
11 concentration, it's not very much.

12 MR. MARSH: Mr. Chairman, why don't --

13 DR. WALLIS: Yes.

14 MR. MARSH: This is Tad Marsh from the
15 Staff. We understand this question. Why don't we
16 table this for the moment, if we can.

17 DR. WALLIS: You'll give us an answer
18 today?

19 MR. MARSH: Excuse me?

20 DR. WALLIS: Will you give us an answer
21 today?

22 MR. MARSH: No, we won't give you an
23 answer today.

24 DR. WALLIS: When will we get the answer?

25 MR. MARSH: What I'd like to do is table

1 this, if we can, until you hear his presentation.

2 DR. WALLIS: Okay.

3 MR. MARSH: And then we will discuss how
4 to go forward generically.

5 DR. WALLIS: Sure.

6 MR. MARSH: Okay? Because this is not a
7 plant-specific issue.

8 DR. WALLIS: I agree, it's a generic one.

9 MR. MARSH: Good. If we can do that, that
10 would be great.

11 DR. WALLIS: Yes. Sure, that's fine.

12 Let's move on then.

13 MR. HOLMAN: Okay. The Waterford 3 long-
14 term cooling analysis currently uses a collapsed water
15 volume from the bottom of the --

16 DR. WALLIS: I want to ask you about that,
17 too. I'm sorry. I'm trying to understand. Does that
18 mean that you include the fluid in the upper plenum?
19 It all collapses down into the core?

20 MR. HOLMAN: That effectively is what it
21 means, that we --

22 DR. WALLIS: The difference is that the
23 NRC says you don't count the stuff in the upper
24 plenum, you just count the liquid in the core. And
25 you mix in that volume. Is that what the difference

1 is?

2 MR. HOLMAN: That's correct. The NRC
3 Staff Review focused on voiding in the core, and that
4 assumption of the collapsed liquid volume.

5 DR. WALLIS: Why is it expected that the
6 mixture on the upper plenum doesn't get involved in
7 the mixing?

8 MR. HOLMAN: Well, I guess the assumption
9 of the collapsed liquid volume was a simplification
10 when the models were developed, and it was evaluated
11 that that assumption was bounded by additional
12 conservatisms. And in my presentation here today,
13 we're going to quantify and show those conservatisms
14 and demonstrate that --

15 DR. WALLIS: Actually, your case is going
16 to be rested on the answer with lots of conservatism.
17 You're not going to take credit for the conservatism.
18 You're going to say everything is okay, and it's
19 really better because.

20 MR. HOLMAN: That's correct. We intend to
21 show that there remains conservatisms in the analysis.

22 DR. WALLIS: So you're going to throw away
23 the mix, the fluid in the upper plenum. It's not
24 going to take part in the mixing. Is that right?

25 MR. HOLMAN: The upper plenum will have

1 some of that boric acid, and it will contribute to the
2 mixing volume.

3 DR. WALLIS: In your conservative
4 analysis, you don't consider it.

5 MR. HOLMAN: In the conservative analysis,
6 we do assume the mixing volume up to the top of the
7 hot leg within the upper plenum.

8 DR. WALLIS: That's all. That's the only
9 stuff which mixes.

10 MR. HOLMAN: We're including, obviously,
11 the volume in the core, and we're going to talk about
12 the volume in the lower plenum.

13 DR. WALLIS: The top of the hot leg.

14 MR. HOLMAN: Up to the top of the hot leg
15 in the additional calculations that I'm going to
16 describe today. The current existing licensing basis
17 calculation assumes a collapsed liquid volume from the
18 bottom of the core to the bottom of the hot leg.

19 DR. WALLIS: So you have to change your
20 licensing basis somehow.

21 MR. HOLMAN: And we'll discuss that.

22 DR. WALLIS: Yes.

23 MR. HOLMAN: We performed some additional
24 supplemental calculations and discussed that with the
25 staff. These additional calculations explicitly

1 account for voiding in the core. We account for
2 mixing in the lower plenum, which we'll discuss some
3 more in just a moment. We assume mixing of the boric
4 acid makeup tank and the refueling water storage cool
5 water before it reaches the core. We're using a best
6 estimate 1979 ANS Decay Heat Values. We're also
7 crediting containment pressure of 20 psi in order to
8 elevate the -- precipitate the solubility limit, and
9 we're also accounting for the effect of trisodium
10 phosphate in increasing the solubility limit.

11 DR. WALLIS: Now the container pressure
12 effect is on temperature, presumably; a saturation
13 temperature. Is that its effect?

14 MR. HOLMAN: Yes.

15 DR. WALLIS: Only changes the solubility
16 limit. It doesn't change the actual concentrating
17 process.

18 MR. HOLMAN: There is a small secondary
19 effect on the --

20 DR. WALLIS: But it's a small --

21 MR. HOLMAN: -- boil-off, but it is a very
22 small effect. The primary effect of containment
23 pressure is on the solubility limit.

24 Okay. With those assumptions, our
25 supplemental calculations show that we reached a boric

1 acid concentration of 17.2 wt% at three hours. Three
2 hours is the longest time that the operator would have
3 to take his actions to prevent boron precipitation.
4 That 17.2 wt% compares to solubility limit of 40 wt%,
5 so there's a large margin to the precipitation.

6 DR. WALLIS: The CE plan is equipped with
7 injection in both hot and cold legs?

8 MR. HOLMAN: That is correct. Waterford
9 has the capability to inject in both legs
10 simultaneously.

11 DR. WALLIS: So it's up to the operator to
12 manipulate this injection?

13 MR. HOLMAN: Yes.

14 DR. WALLIS: But he doesn't know what the
15 boron concentration is. He just has to follow some
16 procedures.

17 MR. HOLMAN: That's correct. He follows
18 the time after a LOCA.

19 DR. POWERS: Where you have cited the
20 solubility limit, did you know what the source of that
21 is?

22 MR. HOLMAN: I'm sorry. Say again.

23 DR. POWERS: Do you know what the source
24 on your solubility limit is?

25 MR. HOLMAN: Joe or Bob Hammersley.

1 MR. HAMMERSLEY: Bob Hammersley from
2 Westinghouse. I think the question was what was the
3 source of the solubility limit? The solubility limit
4 was determined from experiments that we were doing to
5 investigate the impact of TSP in solution with the
6 boric acid.

7 MR. HOLMAN: We'll talk about how we
8 determined the 40 wt% solubility limit in just a
9 moment.

10 DR. SHACK: You're taking credit for those
11 TSP.

12 MR. HAMMERSLEY: The basis is experiment.

13 DR. POWERS: I guess I was looking for a
14 little more. It's an experiment I can examine, or is
15 it one that was done in-house?

16 MR. HAMMERSLEY: It was an experiment that
17 was done following the subcommittee meeting, when
18 those questions were asked, so it's been done and
19 documented since that meeting to before this meeting.

20 MR. HOLMAN: We'll provide a little more
21 discussion of how we came up with that --

22 DR. WALLIS: So it's been done in the last
23 couple of weeks?

24 MR. HOLMAN: The effect of the TSP has
25 been --

1 DR. WALLIS: Determining the solubility
2 limit? So you've been boiling boric acid mixtures?

3 MR. HOLMAN: That's correct.

4 DR. WALLIS: And did you also look at the
5 effect of the concentration on the drift flux and the
6 formability of this stuff as it gets concentrated?

7 MR. HOLMAN: Let me get to that part of
8 the presentation, and we'll go over those questions.

9 DR. WALLIS: Okay. Thank you.

10 MR. ROSEN: Could I hold you here? It's
11 instructive to me to look at your left diagram in
12 relation to the discussion we had before about what
13 you include are the upper plenum. In the upper plenum
14 you said it's included up to the top of the hot leg,
15 if I'm correct; which means it's included basically.
16 Is that correct?

17 MR. HOLMAN: In the supplemental
18 calculations, yes.

19 MR. ROSEN: Because the top of the hot leg
20 is up at the top of the upper plenum almost.

21 MR. HOLMAN: That's correct.

22 MR. ROSEN: Okay.

23 MR. HOLMAN: Okay. As I mentioned, in our
24 supplemental calculations we took credit for mixing in
25 the lower plenum. That result comes primarily from

1 the BACCHUS test results. Bill Brown from
2 Westinghouse is here to talk a little bit more detail
3 of the BACCHUS test results.

4 MR. BROWN: Bill Brown from Westinghouse.

5 DR. WALLIS: Welcome back, Bill. We've
6 seen you before.

7 MR. BROWN: Hi guys. I'm a thermal
8 engineer with Westinghouse. I've had about roughly 25
9 years of experience in testing design thermal
10 hydraulics. Early years spent primarily with the
11 Seawolf and Trident class submarine designs and
12 testing, and Japanese PWRs, thereafter; most recently
13 with this illustrious group with AP600 and AP1000 for
14 the last 10 or 15 years.

15 I want to talk a little bit about the
16 BACCHUS test facility, which was a test facility which
17 was designed by Mitsubishi. They had interest in
18 studying mixing within the reactor vessel, a PWR.
19 They were looking primarily at the mixing between the
20 core region relative to the lower plenum that was of
21 specific interest, so what they did was they
22 essentially have a slab-type geometry, which really
23 represents a vertical slice through the reactor. It's
24 full-scale, full-height. It's roughly 9 meters tall.
25 The slices may be roughly a half a meter wide,

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1 represents roughly a fuel assembly. The fuel
2 assemblies are fairly prototypic in their modeling,
3 and as you notice in the diagram, we have a full
4 simulation also of guide tubes and structures within
5 the upper plenum, as well as within the lower plenum
6 and the core. There is a downcomer. The hot leg off
7 to one side with a separator to separate the phases,
8 and there is instrumentation located in 24 locations
9 throughout the facility to measure both temperature
10 and boron.

11 DR. WALLIS: To understand, Bill, if you
12 took the BACCHUS facility and put it in the core it
13 would look like that little rectangle.

14 MR. BROWN: Yes. Right. Basically, this
15 slice right here is what you're seeing. So
16 essentially in this facility, you're not looking at
17 measuring the circumferential effects. Primarily
18 you're looking at the lateral or the radial, and
19 primarily the vertical effects.

20 The anticipation was, which also the data
21 indicates, that the primary mechanism being that it's
22 really a density-driven, it's a really-type
23 instability, so they were really concerned to make
24 sure that they had everything in the vertical axial
25 direction scaled as well as they possibly could.

1 DR. WALLIS: Why would mixing in a little
2 thin slice like that be the same as mixing in a big
3 vessel?

4 MR. BROWN: In the vertical region, in the
5 axial plain, I guess, since it's essentially a
6 density-driven phenomenon, I mean the only thing
7 you're really missing here is anything that's
8 primarily a circumferential mode, which I would not
9 expect to be very large at all, and probably might
10 even help. But, essentially, you're really talking
11 about sort of a 2-D type of effect, and it's primarily
12 driven by density.

13 Basically, the core boils off enough
14 concentration of boron to the point where you offset
15 the Delta T, and when you get to that balance where
16 you overcome the density effect of the concentration,
17 the boron starts to fall into the lower plenum.

18 DR. DENNING: And what do you think that
19 cell size looks like? I mean, if it falls -- it's a
20 critical question, I think, as to what do you really
21 picture in your mind as to what that cell size looks
22 like over which the circulation occurs, because if
23 it's going down one area, it's going up some other
24 area. Right?

25 MR. BROWN: Yes. I mean, if you certainly

1 picture this - I mean, it's similar to thinking what
2 happens in ocean circulation, essentially replace the
3 sun warming the surface of the water and evaporation
4 with the core heat boiling that away, and replacing
5 salt with boron. And in those situations, and
6 certainly at moderate really numbers you would expect
7 to see sulfinger type of patterns. But I think at the
8 velocities and the high raily numbers, if you use the
9 -- if you were to imagine the full length of the upper
10 and lower plenum as a cell, you end up with some
11 pretty high raily numbers, so I would expect at that
12 point that it probably would actually transition into
13 something that's certainly more turbulent than just
14 sulfingers. It probably would get into another
15 instability which would start to mix those, as well.

16 DR. WALLIS: I should point out to the
17 full committee that we didn't see any of this at the
18 subcommittee meeting. The reason we have such a long
19 meeting this morning is that we're being presented
20 with material which normally we would first see at the
21 subcommittee meeting, but since we have the time,
22 we're having it presented this morning.

23 DR. KRESS: Speaking as a member of the
24 Thermal Hydraulics Subcommittee, I think you can be
25 sure that a two-dimensional mockup of a three-

1 dimensional phenomena for mixing can be shown to be
2 conservative.

3 MR. BROWN: Conservative, yes.

4 DR. KRESS: And I think that's the key
5 part of what you said.

6 MR. BROWN: Right.

7 DR. KRESS: It actually might help if you
8 had the three-dimensionals, but I think you haven't
9 shown that. You're just setting that. I think I
10 would like to see some analysis somehow. I think in
11 a relatively simple analysis you can show that.

12 MR. BROWN: Yes. In thinking back, some
13 of the AP presentations when we were looking at the
14 containment, and we started off with the 2-D slices,
15 and we went to the 3-D slices at the behest of Dr.
16 Wallis, we showed that the mixing was, in fact,
17 improved in additional modes where --

18 DR. KRESS: I recall that. That's why I
19 said that, yes.

20 MR. BROWN: Yes. And I guess that's why
21 I'm using that experience, as well, to --

22 DR. WALLIS: Are you going to take credit
23 for this mixing process, or are you just going to say
24 that it's an additional conservatism, and if we did
25 take credit for it, things would be better? You're

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1 actually going to try to take credit for it.

2 MR. BROWN: The calculation is taking
3 credit for --

4 DR. WALLIS: Is taking credit for --

5 MR. BROWN: Fifty percent of the lower
6 plenum volume, not the entire lower plenum volume.

7 DR. WALLIS: And you need that in order to
8 meet your solubility limit?

9 MR. BROWN: I'll let Jerry answer that
10 question.

11 MR. HOLMAN: Crediting the volume in the
12 lower plenum certainly increases the margin to the
13 precipitation. If we were to not credit any of the
14 lower plenum volume, it would still be less than
15 precipitation --

16 DR. WALLIS: I thought that was your
17 conclusion. Right. So you don't have to take credit
18 for it. It's just reassuring that you've got a margin
19 there.

20 MR. HOLMAN: Supplemental calculations
21 that we present do take credit for 50 percent of the
22 lower plenum --

23 DR. WALLIS: Okay. Well, we'll see those
24 in a while, I guess.

25 MR. HOLMAN: Yes.

1 DR. WALLIS: But you don't have to take
2 this credit.

3 MR. HOLMAN: Obviously, the margin is much
4 reduced without credit for lower plenum mixing.

5 DR. WALLIS: But you still meet the
6 requirements.

7 MR. HOLMAN: But it would still be below
8 the precipitation level.

9 DR. RANSOM: In the test facility, where
10 is the fluid injected?

11 MR. BROWN: Essentially, they start off
12 filling the system from the top and filling the
13 downcomer, and the lower plenum volumes.

14 DR. RANSOM: You continue to inject in the
15 downcomer and then boil-off through the --

16 MR. BROWN: Yes, yes, yes. MHI ran
17 actually two tests, primarily. One started off at a
18 base condition of about 3000 PPM, and then they ran
19 another test that was started off at around 9000 PPM,
20 and both tests showed that when the Delta
21 concentration - you can go to the next slide - in both
22 the tests, when you hit about 8-1/2 percent weight,
23 the balance, the critical density inversion point was
24 reached, and you get to see both the thermal couples
25 and all the thermal couples all the way through the

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1 entire lower plenum all the way to the bottom begin to
2 mix, as well as the boric acid --

3 DR. WALLIS: Now they say that mixing
4 occurs at some point. There's no criterion or
5 something for that?

6 MR. BROWN: Well, if you really knew the
7 link scale very well you could probably -- at MHI, we
8 have tried to capture that with the raily number, and
9 looking at cell size. Unfortunately, we do not
10 actually have enough probably visual --

11 DR. WALLIS: So we don't know where to put
12 these curves for a real reactor. We don't know where
13 the same -- where to put this mixing initiates in a
14 real reactor. We assume something similar happens,
15 but we don't really know when mixing initiates,
16 because we don't have a criterion.

17 MR. BROWN: Essentially, I'm saying this
18 is the criteria. It's really --

19 DR. WALLIS: At a certain density
20 difference will produce mixing?

21 MR. BROWN: Yes. And, in fact, I feel
22 even stronger about this because when I've also looked
23 previously at the Finn's that ran a VEERA facility,
24 which is essentially a VDER-type scale, full-height,
25 full-pressure, full-temperature-type facility;

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1 interesting that the density difference when it
2 reached I believe about 7-1/2 percent is what I see in
3 that data - again, the same phenomena occurs that the
4 entire lower plenum begins to mix. So again, it was
5 primarily independent of the time in which you get
6 there. You could take 100 hours to get there. It's
7 really dependent on when you reach the critical
8 concentration --

9 DR. WALLIS: It's not just the
10 concentration, it's temperature, too. The temperature
11 is different in the lower plenum than in the core.

12 MR. BROWN: Yes, it is.

13 DR. WALLIS: So that affects the density,
14 as well.

15 MR. BROWN: Yes, it is, and you have
16 offsetting -- right. What you have to do is you have
17 to get that point where you balance the --

18 DR. WALLIS: You have to overcome the
19 temperature difference.

20 MR. BROWN: Right. That's right.

21 DR. WALLIS: Which is why it doesn't start
22 at the beginning.

23 MR. BROWN: That's exactly right. That's
24 where it is.

25 DR. WALLIS: So you think there would be

1 a criterion which says that Delta T, Delta Rho due to
2 temperature, and Delta Rho due to Delta C have to
3 somehow be in balance.

4 MR. BROWN: Yes, I have that on this slide
5 that I pulled in here for just brevity of the
6 presentation. Essentially, that's what I've got. So
7 in the delta fluid due to the concentration
8 differences is offset by that due to the temperature.

9 DR. WALLIS: Does that explain when mixing
10 initiates?

11 MR. BROWN: Yes. Yes.

12 DR. WALLIS: Now you're giving us a
13 physical argument.

14 MR. BROWN: Yes. Yes.

15 DR. WALLIS: Are you going to actually
16 show us those numbers?

17 MR. BROWN: No, I'm not going to show you
18 MHI's proprietary data. That's why I've drawn this
19 nice little cartoon today. However, it is in the
20 BACCHUS report, which the Staff has, if you're
21 interested in looking at the actual data.

22 DR. WALLIS: So the number that says that
23 the density difference due to temperature change is
24 balanced by density difference due to --

25 MR. BROWN: Concentration, yes.

1 DR. WALLIS: It's in the report that we
2 have here?

3 MR. BROWN: There is a summary of that in
4 --

5 DR. WALLIS: It seemed to be all
6 discussion. I didn't see numbers like that.

7 MR. BROWN: I don't know if you have the
8 BACCHUS report there or not, but we've given that to
9 the Staff.

10 DR. WALLIS: If we do, maybe you can point
11 to it at the break.

12 MR. BROWN: Again, that document was
13 primarily intended as a summary document to
14 demonstrate to the Westinghouse Owners Group.

15 MR. MARSH: Mr. Chairman, this is Tad
16 Marsh. I'm being told that we have provided that
17 report to you.

18 DR. WALLIS: You have?

19 MR. MARSH: I'm being told that we have
20 provided that to you. Is that right? Ralph is
21 shaking his head yes.

22 DR. WALLIS: Okay. So when Ben gets up
23 and presents he can cite a page which we can look at
24 or something. Okay. We need to move on, but I think
25 it would be very useful if there is some kind of

1 quantitative criterion which is believable.

2 DR. DENNING: Can I ask another question,
3 Graham?

4 DR. WALLIS: Yes.

5 DR. DENNING: The bypass region, based
6 upon what you're saying here, your feeling is that
7 that has no real significance towards this effect?
8 What do you think is happening in that bypass region,
9 and are you telling us that it's your belief that that
10 really doesn't affect this mixing behavior?

11 MR. BROWN: I think that it has a second
12 order effect compared to this mixing mechanism, and as
13 well as any perhaps potential entrainment - while they
14 may exist, I don't think they're the primary
15 mechanisms. And again, looking at these different
16 tests at different scales, there seem to be a fair
17 amount of consistency with looking at the
18 concentration density effect between the upper plenum
19 core region relative --

20 DR. DENNING: Won't that bypass region be
21 prototypic of Waterford? Does it look basically the
22 same as it does in the MHI --

23 MR. BROWN: No. In this facility, I would
24 say that the hot leg region does not reflect that.
25 The focus was primarily on the core upper plenum with

1 the guide tubes and the lower plenum, and the
2 downcomer. That was the primary emphasis. It was not
3 trying to demonstrate hot leg gap or entrainment,
4 which certainly are present, but this mechanism seems
5 to explain quite well both the BACCHUS test and the
6 Finnish VEERA test.

7 DR. KRESS: This cartoon indicates to me
8 that you have some sort of initial concentration in
9 the lower plenum.

10 MR. BROWN: Yes, you have whatever the --

11 DR. WALLIS: Whatever the cold leg feeds
12 into it.

13 MR. BROWN: That's right.

14 DR. WALLIS: That's where you get that.

15 MR. BROWN: That's right. And I said, in
16 the one BACCHUS test, it was initially 3000 PPM, and
17 then when they ran another one, it was 10,000 PPM.

18 DR. WALLIS: Okay.

19 MR. BROWN: They had very long switch-over
20 times in Japan, so they were interested what happened
21 very far out in a post LOCA environment.

22 DR. RANSOM: These experiments have a
23 radial power distribution, I assume, similar to the --

24 MR. BROWN: Yes, they do have some.

25 DR. RANSOM: And boiling is going on, so

1 you think the boiling would be the major density
2 difference in the system that would cause
3 recirculation. I know you're assuming a collapsed
4 level, but --

5 MR. BROWN: Well, within the core region,
6 yes - but not necessarily the lower plenum. This is
7 the mechanism that -- I mean, you could boil all day
8 long and it isn't going to affect the lower plenum.

9 DR. RANSOM: The point is really you up-
10 flow through some parts, and down-flow through other
11 parts.

12 MR. BROWN: Yes.

13 DR. RANSOM: And that's what leads to the
14 mixing in the lower plenum.

15 MR. BROWN: Once it gets started, I'm
16 saying this is the initiating mechanism. Once that's
17 started, this certainly enhances it, but this is what
18 gets the ball rolling.

19 DR. WALLIS: Your slide is hibernating.
20 Does it hibernate in the summer, too?

21 MR. ROSEN: There's a natural length of
22 time that we can dwell on any subject.

23 DR. WALLIS: Are you going to proceed?

24 MR. BROWN: I think I've made my case, and
25 I welcome any more questions.

1 DR. WALLIS: Are you going to talk about
2 this TSP and the basis for your solubility limit?

3 MR. BROWN: No. My primary purpose is to
4 discuss the BACCHUS test. Jerry will pick up the ret
5 of the presentation after this.

6 DR. WALLIS: So we're supposed to believe
7 that you have some criterion for the lower plenum to
8 get involved in the mixing?

9 MR. BROWN: Yes.

10 DR. WALLIS: And we're not going to see
11 any numbers?

12 MR. BROWN: Well, what you can do when you
13 see the report is, for interest, MHI has actually
14 tried to use this facility to benchmark a computer
15 code they call EXLOBOCON, and they have used the raily
16 number criteria and played with the length scale to
17 try to match the data. And there is some plots within
18 the BACCHUS test report that --

19 DR. WALLIS: Yes, I saw that. It's just
20 that this is not a code which is approved by the NRC
21 or anything?

22 MR. BROWN: No, right. This is purely
23 MHI's code. You've never seen this before.

24 DR. WALLIS: Right. Could you explain to
25 me what is going on technically now? The computer is

1 being sabotaged by some software of some sort?

2 (Simultaneous speech.)

3 DR. DENNING: Could you restate basically
4 your premise? I think your premise is that normal
5 density in core region exceeds the density in the
6 lower plenum that you mix. Is it that simple?

7 MR. BROWN: Well, it's really when the
8 density effect due to the concentration of boron
9 within the core region exceeds the temperature
10 difference in that region relative to the lower
11 plenum. The difference in density due to the
12 temperature difference. When you hit that point, then
13 you basically have a hot or cold situation. I mean,
14 you could look at it in a crude sense as even when you
15 have a situation that raily originally looked at when
16 you had essentially a cold surface over a hot surface,
17 and you initiate rule cells, for example, in that type
18 evaluation like that. And what's happening here is it
19 takes some time to get enough boil-off to increase the
20 density due to the concentration of boron acid
21 solution with the water to get to that point where you
22 actually are unstable, and you get that disability
23 mechanism.

24 DR. DENNING: Well, I think what you just
25 said is there are two components to the density; one

1 is temperature, and the other is --

2 MR. BROWN: Yes, and the other is
3 concentration. That's correct.

4 DR. DENNING: But you say taking those
5 into account, when the density is greater in the core
6 than it is in the lower plenum, then you mix.

7 MR. BROWN: Yes, absolutely.

8 DR. DENNING: But you do that for
9 collapsed water level. Is that a true statement, as
10 opposed to accounting for some boil-up frothing --

11 MR. BROWN: You're referring to the
12 calculation.

13 DR. DENNING: Yes, the calculation. When
14 you determine the density in the core region --

15 MR. BROWN: Well, I would say at this
16 point in time, we're probably - keep in mind, we're in
17 a large break LOCA. Our pressures are rather low, and
18 our pressure differences going out the vessel are
19 relatively small, so we're almost to the point of a
20 static balance, and so whatever void fraction that you
21 have, whatever water level you have above the core
22 essentially is going to be dominated by what's in the
23 lower plenum, so there's not a big impact as far as
24 the gravity head is concerned. It certainly will
25 affect the mixture level that you have, which I'm sure

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1 is --

2 DR. WALLIS: I think what you really are
3 saying is that they're above the holes in the plate
4 there, and there's liquid. It's not totally a
5 mixture.

6 MR. BROWN: That's right.

7 DR. WALLIS: So if that's heavier than the
8 liquid below, it's going to go down.

9 MR. BROWN: It drops. That's right.

10 DR. KRESS: When you make this NITSDI
11 calculation in the upper plenum, do you assume any of
12 the boric acid goes with the steam as it goes out, or
13 do you just leave it all behind?

14 MR. BROWN: Well, I didn't make that
15 calculation, but I think in the calculations, I
16 believe you probably assume that the --

17 MR. HOLMAN: The calculations do not
18 credit any boron acid removal --

19 MR. BROWN: Right, with the steam. Right.
20 So it's basically steam.

21 DR. KRESS: I'm worried about that because
22 it's not a credit, it's a debit, because it affects
23 this density calculation you're making in the upper
24 plenum.

25 MR. BROWN: I would say in the case of

1 BACCHUS, we certainly got the real fluid --

2 DR. KRESS: Oh, I'm sorry. I was thinking
3 about the calculation.

4 MR. BROWN: Yes, I'm saying --

5 DR. KRESS: You did add the energy.

6 MR. BROWN: Right. And I'm saying, with
7 respect to --

8 DR. KRESS: So did the BACCHUS experiment
9 properly do it at the right pressure?

10 MR. BROWN: Yes. What I'm saying, this is
11 a full-height, full-temperature, full-pressure boric
12 acid solution test.

13 DR. KRESS: Okay.

14 MR. BROWN: Yes. That's why I'm saying
15 that the real stuff is in there --

16 DR. KRESS: It would show up in the --

17 MR. BROWN: Yes. And I would say the same
18 thing about any drift flux questions that may come
19 about, as well, possibly from some --

20 DR. WALLIS: Oh, yes. We're going to ask
21 that question, too. Now do we have to move on before
22 the computer gremlin decided to hibernate things
23 again?

24 MR. BROWN: Do you have any more
25 questions?

1 DR. WALLIS: We may come back to you.
2 Let's move on for now.

3 MR. BROWN: Okay. Thank you.

4 MR. HOLMAN: All right. Let's move on and
5 talk about the solubility limit. Trisodium phosphate
6 is used in the Waterford 3 containment in the sump
7 water to control pH post LOCA to a value near 7. It's
8 stored in granular form in baskets in the floor of the
9 containment in the Waterford 3 containment.

10 We performed tests with a TSP
11 concentration that's representative of what would
12 exist at Waterford 3. We added boric acid and brought
13 the solution to a boiling temperature, continued to
14 add boric acid until we reached the solubility limit,
15 and determined that that limit was at a concentration
16 of 36 wt%. That's at atmospheric pressure.

17 DR. POWERS: Let me ask a question. It's
18 my experience extraordinarily difficult to tell when
19 you've saturated when you have a concatenating NI and
20 a liquid that roughly 11 molal, and they're two
21 difficulties that you encounter; one is that the
22 solution can superheat if you have it in glass vessels
23 when you're doing this kind of experiment, glass or
24 silici, either one. And the second is that you can't
25 visually tell that you've formed colloids before you

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1 think precipitation has occurred. So when you say you
2 went up to saturation, how did you determine what
3 saturation was?

4 MR. HOLMAN: Bob Hammersley, can you
5 answer that?

6 MR. HAMMERSLEY: The experiment was
7 performed by starting with a mass of boric acid that
8 corresponded to the solubility limit in water at 100
9 degrees C, say a standard reference. So we started by
10 putting that in the flash in the water, put it on a
11 heat plate and brought it up to temperature of 100
12 degrees C. During that time, we had a stirrer,
13 stirring or agitating the solution until we could get
14 all the boric acid crystals dissolved, so it took some
15 time, of course, one - to heat the fluid, and two, to
16 get all the crystals dissolved.

17 At that point, we added the amount of
18 Trisodium phosphate, the solution was crystal clear.
19 The Trisodium phosphate went immediately into
20 solution. We continued to heat the solution until we
21 get to the normal boiling point. This was all done at
22 atmospheric pressure.

23 DR. POWERS: When you say it was crystal
24 clear, was that based just on visual observation, or
25 did you do a Tyndall effect on it?

1 MR. HAMMERSLEY: We did that by visual
2 observation.

3 DR. POWERS: So you couldn't tell if there
4 were colloidal suspensions in there.

5 MR. HAMMERSLEY: Not with my eyes, no.
6 We did take Tyndall measurements during the entire
7 testing sequence. Once we had the TSP in solution, we
8 now started to add additional boric acid in controlled
9 amounts of mass.

10 DR. WALLIS: Why did you keep adding boric
11 acid? Why didn't you add more TSP?

12 MR. HAMMERSLEY: Because we wanted to see
13 the increase in the solubility limit of boric acid in
14 the presence of TSP at the normal boiling point. We
15 were able to add additional boric acid that --

16 DR. WALLIS: So you used a round of
17 initial TSP as a variable in this, several
18 experiments?

19 MR. HAMMERSLEY: We did repeatability
20 tests. We did two tests at the TSP concentrations
21 that would be expected in containment. We did one at
22 a reduced concentration of TSP.

23 DR. WALLIS: The TSP and the boric acid
24 are all mixed up together in the containment, aren't
25 they?

1 MR. HAMMERSLEY: Yes.

2 DR. WALLIS: Then you just keep putting in
3 a bit more of each and boiling off. Isn't that what
4 happens in the reactor?

5 MR. HAMMERSLEY: No, the TSP, there's a
6 fixed amount that's in containment that goes into
7 solution.

8 DR. WALLIS: Yes.

9 MR. HAMMERSLEY: That's all that's
10 available during the entire transient. Likewise, the
11 boron, once the primary system and the water storage
12 tank and the accumulators have all exhausted, then
13 there's no addition of the chemical species.

14 DR. WALLIS: So you just put this in a
15 beaker and keep boiling it until it changes color. Is
16 that what happened?

17 MR. HAMMERSLEY: That's right.

18 DR. WALLIS: Is that what you do? Just
19 put it in a beaker and boil it until it changes color?

20 MR. HAMMERSLEY: Well, we put more and
21 more boric acid until it would go into solution.

22 DR. WALLIS: You kept trying to dissolve
23 more solid boric acid in it?

24 MR. HAMMERSLEY: Yes.

25 DR. WALLIS: So you did a reversal. You

1 didn't boil it down until it precipitated, you kept
2 building it up until it wouldn't dissolve any more.

3 MR. HAMMERSLEY: That's correct.

4 DR. WALLIS: Is that the same experiment?

5 MR. HAMMERSLEY: That's the experiment we
6 ran.

7 MR. HOLMAN: That should show the same
8 behavior.

9 MR. HAMMERSLEY: Right.

10 MR. HOLMAN: We're not modeling the actual
11 behavior in the core in this test. We're just trying
12 to determine the solubility limit in the presence of
13 TSP. And you can see from this picture --

14 DR. WALLIS: So you dissolved it. Did you
15 boil it while you were dissolving it, or you just had
16 some hot water, and you put crystals in and stirred
17 until they dissolved?

18 MR. HAMMERSLEY: We boiled it as we added
19 more crystals.

20 DR. WALLIS: You boiled it as you were
21 adding.

22 MR. HAMMERSLEY: This is a photograph that
23 actually the surface that that beaker is sitting on is
24 the hot plate. There is a magnetic stirrer bar in the
25 bottom there. Of course, we turned it off to try to

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1 get a picture. Boiling is actually going on there.
2 It's hard to see some of the bubbles that are rising
3 up along that, but this is the solution near the
4 solubility limit with the additional boric acid beyond
5 the normal concentration that you would expect, that
6 has now been concentrated to the solubility limit in
7 the core and we've added additional boric acid beyond
8 that and TSP. So this is a mixture of the boric acid
9 and the TSP at boiling near the solubility point.

10 DR. WALLIS: So you're doing an experiment
11 that I was tempted to do in my kitchen.

12 DR. POWERS: Well, hopefully you wouldn't
13 spill so much as is spilled here. I presume that's
14 what they are.

15 DR. WALLIS: So you're boiling, you're
16 heating this thing from the bottom.

17 MR. HAMMERSLEY: Right. During that
18 process we have the stirrer bar mixing it. And we've
19 monitored the temperature, of course, as we go along.
20 And the other thing that we wanted to observe from
21 this is that there's no -- we didn't observe any
22 foaming tendency of this solution.

23 DR. RANSOM: What was the solubility noted
24 at zero TSP?

25 MR. HAMMERSLEY: The solubility when we

1 started out is like 27.5 wt% boric acid.

2 DR. DENNING: If you continue to add TSP,
3 does the solubility improve? Because as Graham was
4 pointing out, in a real system you not only
5 concentrate boric acid, you also concentrate TSP.

6 MR. HAMMERSLEY: In this experiment, we've
7 concentrated TSP the same amount that the boric acid
8 would have been concentrated in the boil-off process
9 in the core.

10 DR. WALLIS: And you said something about
11 foaming, it didn't foam?

12 MR. HAMMERSLEY: This actually undergoing
13 boiling in this photograph. There's no tendency for
14 it to foam.

15 MR. HOLMAN: This is near the
16 precipitation limit.

17 MR. HAMMERSLEY: Yes.

18 DR. WALLIS: So you don't know what
19 happens when you boil it to the point where it begins
20 to precipitate.

21 MR. HAMMERSLEY: We do. We continued to
22 add boric acid until we got to that point. When it
23 simply wouldn't dissolve all the crystals, the
24 solution would get cloudy, and you would actually
25 start to form some crystals or -- especially on the

1 surface where probably the temperature grading was
2 such that it would tend to do that.

3 DR. WALLIS: You built up a skin on the
4 surface?

5 MR. HAMMERSLEY: Yes, we called it a scum.
6 Yes.

7 DR. KRESS: This is an atmospheric
8 pressure test?

9 MR. HAMMERSLEY: That's correct.

10 MR. ROSEN: That's a question I was going
11 to ask. On your slide 20, you talk about a minimum
12 containment pressure of 20 psia. That's five-pounds
13 gauge. That has the effect of increasing the
14 solubility by 4wt%.

15 MR. HAMMERSLEY: Correct.

16 MR. ROSEN: Now is this the only place
17 where you take credit for containment over-pressure,
18 or in your LOCA analysis?

19 MR. HOLMAN: In the supplemental
20 calculations, the primary effect is to elevate the
21 solubility limit. There is a secondary impact on the
22 calculation of the scheming rate and the voids.

23 MR. ROSEN: No, but I was talking more
24 generally, globally. Is the degree to which you take
25 credit for containment over-pressure limited to this

1 analysis, or is it typically taken in other parts of
2 the --

3 MR. HOLMAN: In other analyses?

4 MR. ROSEN: -- plant's analysis, yes.

5 MR. HOLMAN: Specifically, we do not
6 credit over-pressure for net positive suction. There
7 is a pressure that's calculated for ECCS performance
8 peak clad temperature in accordance with the approved
9 models.

10 MR. ROSEN: Though in the peak clad
11 temperature calculations, but not MPSH calculations
12 for the sump.

13 MR. HOLMAN: That's correct.

14 MR. ROSEN: So there's some precedent here
15 at Waterford for taking credit for over-pressure. And
16 here's another case where you have to do it to get the
17 solubility limits high enough, not to have this --

18 MR. HOLMAN: In our supplemental
19 calculations only we're showing that margin. In the
20 licensing basis analyses, we do not credit that over-
21 pressure.

22 DR. WALLIS: How is this heated? What is
23 the source of heat?

24 MR. HOLMAN: There's a hot plate.

25 DR. WALLIS: It's a hot plate. And it's

1 a glass beaker, so there are very few nucleation
2 sites. You probably get large bubbles from one or two
3 nucleation sites. It doesn't seem to me this is
4 typical of boiling on a host of fuel rods.

5 MR. HOLMAN: Again, what we were trying --

6 DR. WALLIS: Were you asked to extrapolate
7 t his experiment to what happens in boiling?

8 MR. HOLMAN: What we're trying to do here
9 is determine the solubility limit --

10 DR. WALLIS: So you're saying here there
11 was no foaming, and there was no -- you don't think
12 there was a change in the drift flux, and so on.

13 MR. HOLMAN: That's correct.

14 DR. WALLIS: You've got a very special
15 case. You're boiling in a glass beaker with very few
16 nucleation sites. You don't have a possibility to
17 make a lot of small bubbles.

18 MR. HOLMAN: We don't see that behavior in
19 this result. We would not expect that behavior.

20 DR. WALLIS: You didn't boil it in an
21 aluminum pan or something, or some sort of material
22 with lots of nucleation sites. It's an interesting
23 experiment. It just seems to be an extraordinarily
24 crude one on which to hang a licensing decision.

25 MR. ROSEN: And as you say, it's inverted.

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1 It's not the situation we're really dealing with.

2 DR. WALLIS: Okay. Well, maybe you should
3 move on. Are you going to show us a picture of it?

4 MR. HOLMAN: Okay. Let me talk a little
5 about our calculations. Our calculations that were
6 done to address the margins that are available assume
7 50 percent of the lower plenum in the mixing volume as
8 supported by the BACCHUS test. We calculated an upper
9 plenum level, two-phase level that existed up to the
10 top of the hot leg at three-hours. Our calculated
11 average void fraction in the core was 0.66, and we're
12 using a 1979 Best Estimate ANS Decay Heat values.

13 With those assumptions, we calculated a
14 boric acid concentration --

15 DR. WALLIS: Well, the void fraction in
16 your little beaker was nothing like 66 percent.

17 MR. HOLMAN: That's correct. With those
18 assumptions, we calculated a boric acid concentration
19 of 17.2 wt% at three-hours. That compares --

20 DR. WALLIS: I thought you were going to
21 tell us that you didn't need to assume this 50 percent
22 involvement of the lower plenum.

23 MR. HOLMAN: If we were to assume no
24 credit for lower plenum mixing, we would still come in
25 below the 40 wt% --

1 DR. WALLIS: What is the number you get
2 with no lower plenum mixing?

3 MR. HOLMAN: Joe, do you have that number?

4 MR. CLEARY: This is Joe Cleary from
5 Westinghouse. At three-hours post LOCA with zero
6 credit for mixing in the lower plenum, the
7 concentration in the mixing volume was approximately
8 32 wt% with the Appendix K Decay Heat curve. With the
9 Best Estimate Decay Heat curve, it was approximately
10 27 wt%.

11 DR. WALLIS: Are you going to show us some
12 graphs or something which gives us all these
13 comparisons so we can see these results?

14 MR. HOLMAN: I don't have those graphs
15 with me in this presentation. However, they were in
16 the report that we've docketed with NRC.

17 DR. WALLIS: So should we have them
18 somewhere?

19 MR. HOLMAN: I believe the ACRS does have
20 that information.

21 DR. WALLIS: Because I think we might be
22 interested in looking at sort of the worst case
23 assumptions or something else, so we're not just
24 looking at your number of 17.2.

25 MR. HOLMAN: What we're trying to show

1 here is that there exists on a Best Estimate basis,
2 significant margin between the calculated boron
3 concentration at the time the operator would take
4 action and the precipitation limit. There's a large
5 margin there, and that's the point of these
6 calculations.

7 DR. DENNING: And again, three hours is
8 the point in time in the emergency procedures in which
9 it switches over. Is that --

10 MR. HOLMAN: Yes. The emergency
11 procedures require the operator to switch-over
12 anywhere between two and three hours, so three hours
13 is the latest time.

14 Okay. We've submitted to the NRC and
15 docketed these supplemental calculations that we've
16 discussed. We intend to clarify that the Waterford 3
17 updated licensing basis long-term cooling analysis
18 will be based on these supplemental calculations. The
19 updated licensing basis analysis will include these
20 assumptions; will include explicitly voiding the core.
21 We used 50 percent of the lower plenum mixing volume
22 for mixing the boric acid makeup tank with the
23 refueling water storage pool water. Also taking
24 credit for the effect of TSP on the solubility limit.
25 That concludes the presentation. Are there any other

1 questions?

2 DR. DENNING: Question about range of LOCA
3 sizes, and is it clear that the specific conditions
4 over which -- I mean, there's a large LOCA and then
5 there are intermediate LOCAs. Is it clear that you
6 really have the most limiting case with regards to
7 when you'd switch over to sump recirculation, all
8 those things? Have you looked in some sense at that?

9 MR. HOLMAN: The long-term cooling
10 analysis does look at the whole spectrum of break
11 sizes.

12 DR. WALLIS: So the only thing you have on
13 effects of concentration on when you're boiling, on
14 drift flux and so on is this little beaker experiment?

15 MR. HOLMAN: We did some additional
16 sensitivity calculations on the effect of drift flux
17 and --

18 DR. WALLIS: You also submitted, I think,
19 a Fauske report, Fauske bubbled air through boric
20 acid. Those were very dilute mixtures, only 3000 PPM.

21 MR. HOLMAN: That's correct.

22 DR. WALLIS: That doesn't tell us anything
23 about what happens at 30,000 PPM.

24 MR. HOLMAN: That's correct.

25 DR. WALLIS: And so the suspicion -- if I

1 boil a surface solution or something down, I would
2 eventually get to boil over, because it would simply
3 froth up. But boric acid boils differently?

4 MR. HOLMAN: We did not see any evidence
5 of frothing from the tests that we did. It was a
6 clear mixture right up the solubility limit.

7 DR. WALLIS: I think it depends on the
8 rate of boiling and the nucleation characteristics,
9 and all sorts of stuff.

10 DR. RANSOM: Also, the amount of embedded
11 structure, too. I mean, it's different in a rod than
12 in a beaker.

13 DR. WALLIS: So we still don't have a very
14 good answer to what happens in terms of drift flux, as
15 you boil the concentration of this material on the
16 surface of the bubbles, because as water evaporates,
17 it leaves behind the skin.

18 MR. HOLMAN: Joe, could you describe the
19 sensitivity calculations that we did with varying
20 drift velocity?

21 MR. CLEARY: Yes. This does get to the
22 heart of the question about what the effect of
23 increasing concentrations are on the drift velocity,
24 but it may shed some light on the situation. What I
25 did was perform some sensitivity studies to determine

1 what the effect of a change in the drift velocity is
2 on the calculated concentration. And in a sense, this
3 could be looked at as the effect of change in any
4 parameter that affects the void fraction within the
5 mixing volume. It was convenient to do it in terms of
6 a multiplier on the drift velocity. And the
7 conclusion of the study was that any reasonable change
8 in drift velocity has an affect on the maximum boric
9 acid concentration at three-hours. That's small in
10 comparison to the margin that the supplemental
11 calculation is showing to the solubility limit.

12 With that very qualitative statement, let
13 me give you a specific example. And I could pull off
14 more from the curves I have if you would like.

15 DR. WALLIS: When you boil up a sugar
16 solution and reach a point where it froths up with
17 very small bubbles. If it's maple syrup, the sugar is
18 all brown and you get frothy stuff, and if you don't
19 do something pretty darned quickly, you lose the whole
20 thing because it boils over, and it doesn't detach,
21 and the bubbles don't burst, and the whole thing just
22 froths up and is gone. Now if this happened in the
23 core, presumably you'd be carrying over large
24 quantities of liquid. It wouldn't just be a drift
25 flux phenomenon, it would be a foaming-type

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1 phenomenon.

2 MR. HOLMAN: From the tests and the
3 calculations that we've done, we state that the
4 operator action would be well in advance of reaching
5 the precipitation limit, and would prevent any of
6 those types of behaviors.

7 DR. WALLIS: Well, I know with my
8 experience with boiling over the maple syrup, that if
9 you boil more rapidly, it's more likely to boil over.
10 If you boil very gently you just get a few bubbles,
11 then you could be okay. So it's not independent of
12 how rapidly you're boiling. I hate to say this stuff
13 is like maple syrup. I don't know that it is. It's
14 just that I don't think you've really done very
15 convincing tests.

16 MR. HOLMAN: From the tests that we did,
17 we did not see that type of change in viscosity. It
18 would look very much like just boiling water, so we
19 would not expect to see those types of behaviors. The
20 calculations that we've done show a large amount of
21 margin.

22 DR. WALLIS: Now there is no experimental
23 basis, and there's nowhere in the literature or NRC
24 that someone has actually boiled concentrated boric
25 acid solutions at different rates and observed what

1 happens?

2 MR. HOLMAN: Not that I'm aware of.

3 DR. DENNING: I think, Graham, we are
4 wandering into a generic issue area that's not their
5 responsibility to meet.

6 DR. WALLIS: Yes, I think that it may be
7 appropriate for the committee to draw attention to
8 this as a generic problem. That's my feeling, too.
9 I think we may have identified something generic, but
10 I just don't know what we do about its implications
11 for this particular application.

12 MR. HOLMAN: For Waterford, we believe
13 we've shown significant margins to the solubility
14 limit. We have operator actions that will occur well
15 in advance of the time that we would approach the
16 solubility limit --

17 DR. WALLIS: You obey the regulations
18 using the methods which have been used up to now.

19 MR. HOLMAN: Well, further than that, we
20 have quantified the conservatisms and demonstrated the
21 margins that do exist, so we believe our actions will
22 absolutely prevent boron precipitation.

23 DR. WALLIS: Will absolutely prevent, so
24 do you want to take a bet on what happens if you do
25 the right experiment? Can we move on to the Staff

1 conclusion here?

2 MR. HOLMAN: Okay.

3 DR. WALLIS: Thank you very much.

4 MR. HOLMAN: Okay. Len Ward is going to
5 be discussing the Staff Review.

6 MR. WARD: If it's okay with the Chairman,
7 I would prefer to use the overhead, because if I need
8 to jump around with slides --

9 DR. WALLIS: You can use whatever visual
10 aide, just as long as we can read it.

11 MR. WARD: I remembered you asked for
12 bigger letters, so I did that.

13 DR. WALLIS: Which is why we have a
14 complete blank in terms of our handout from you, or is
15 it somewhere else?

16 MR. WARD: It will follow. It's in this.

17 DR. WALLIS: So we also have the benefit
18 of the hard copy version we can look at.

19 DR. KRESS: Page 7.

20 DR. WALLIS: You're on page 7. That's not
21 very good. Can we turn off the computer so we don't
22 get that big shadow on there. Now when you presented
23 to the subcommittee, we asked you to increase your
24 font size. Did you get that message?

25 MR. WARD: That's not big enough?

1 DR. WALLIS: Well, it's better.

2 MR. WARD: I'm starting off on the wrong
3 foot already. Well, my name is Len Ward. I'm with
4 Reactor Systems Branch. What I want to do is show you
5 some calculations that we did to give us a feeling for
6 what the difference between a licensing calculation is
7 and where we think this situation really is.

8 DR. WALLIS: But you base your licensing
9 decisions on licensing calculations, presumably.

10 MR. WARD: Yes. That's right. I'll get
11 to that. In the subcommittee meeting, I talked about
12 feed line break calculations and small break LOCA, but
13 because questions were on boric acid precipitation,
14 I'm just going to focus on that one. So we're just
15 going to talk about boric acid precip.

16 Now as Jerry mentioned, post LOCA long-
17 term cooling, the purpose of that is to identify when
18 you would precipitate. And I'm just talking about
19 large break LOCA here. This is the double-ended
20 break. This is the one that's going to boil the
21 fastest because you get to the Decay Heat curve
22 earliest.

23 DR. WALLIS: The criterion is initiation,
24 it's not how much precipitation. It's initiation of
25 precipitation.

1 MR. WARD: Right. It's -- yes.

2 DR. WALLIS: Whereas, in the small break
3 LOCA when you've got deposits of boric acid on the
4 tubes due to splashing and drying out, that has
5 already initiated, and your argument was well, there
6 isn't going to be much of it.

7 MR. WARD: Well, if you remember that core
8 uncover transient, it was uncovered for 45-minutes.
9 I mean, that's alarming. But remember, that's an
10 Appendix K calculation. If I get rid of the 20
11 percent Decay Heat, the two-phase level is up near the
12 top of the core. It's only uncovered for maybe 15-
13 minutes. If I have two HPSI pumps on, which is
14 probably what's going to happen, there's no uncover
15 at all. You don't see it, it goes away. So I mean,
16 maybe I could help you with a little perspective on
17 that.

18 DR. WALLIS: I don't know. If I'm using
19 the regulations, I should probably use Appendix K.
20 That's what's being used. And the fact that the
21 reality is different and the regulatory world is
22 irrelevant.

23 MR. WARD: Well, the way to look at these
24 calculations is the Appendix K analysis is -- what
25 it's really going to do, it's going to allow you to

1 identify the earliest time you can switch to
2 simultaneous injection. And from a safety standpoint
3 that's really good, because what happens, the
4 concentrations are really low. And I'm going to show
5 you some curves. I mean, we've talked about mixing
6 volumes and Decay Heat, and all these different
7 various plenums that can contribute. I'm going to
8 show you what effect they have on the calculations
9 just so you can get an idea of -- when you're up here
10 in licensing - well, you're really down here in the
11 best judgment world. And that's what I hope to show
12 you. I want to show you that. We're pretty far away
13 still. Even though there was a non-conservative
14 input, it can be compensated for other items, and I
15 can show you what they're worth. And that's what I
16 hope to accomplish.

17 Now what happened was, I was doing a
18 calculation to try to predict the boron concentration
19 in the Westinghouse licensing calculation, and they
20 were showing a precipitation time of about four-hours
21 in the licensing calculation. In order to predict
22 that, I had to steadily increase the amount of liquid
23 in the core until I assumed zero liquid, and then I
24 predicted their calculation. But when I put in the
25 void fraction that's consistent with the amount of

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1 steam in the core at three-hours, there's about 35
2 percent liquid in the core, it shifts the
3 precipitation time to one-hour. Now this is a
4 licensing calculation, and it's alarming but bear with
5 me. Let me get through this to get to the meat,
6 because I know I alarmed you last time, and this is
7 alarming.

8 Let me show you what I just said, what it
9 looks like. This is the licensing calculation with
10 zero liquid fraction. And, basically, what I did is
11 I used their licensing --

12 DR. WALLIS: Zero void fraction.

13 MR. WARD: I mean, I'm sorry. It's pure
14 liquid. Pure liquid.

15 DR. WALLIS: At the collapsed level?

16 MR. WARD: Well, the whole mixing volume
17 is full of liquid, and that included --

18 DR. WALLIS: All full of liquid.

19 MR. WARD: That's what they assume.

20 DR. WALLIS: No bubbles in there at all?

21 MR. WARD: No bubbles. I mean, that's --

22 DR. WALLIS: A very strange assumption.

23 Just look at it.

24 MR. ROSEN: If it looks right to you,
25 it'll be right.

1 MR. WARD: Okay. There we go. What they
2 assumed, the mixing volume consisted of the core and
3 the upper plenum below the bottom of the hot leg, so
4 just mixing it -- we're just mixing in this region.

5 DR. WALLIS: And it was all solid liquid?

6 MR. WARD: And it was all pure liquid.
7 Okay.

8 DR. WALLIS: How did they ever get away
9 with that?

10 MR. WARD: Well, it was a non-conservative
11 input. We found it. Let's wait until we get to
12 the --

13 DR. WALLIS: I'm not sure they did that.
14 I thought they used the collapse level.

15 MR. WARD: Well, that's the way they
16 characterized it. I mean, the mixing volume was full
17 of liquid. I mean, I can't control what they're
18 calling it.

19 DR. WALLIS: Okay.

20 MR. WARD: So now when you put the correct
21 void fraction in, it shifts us back to here. And this
22 is precipitating in an hour. Now this is a licensing
23 calculation.

24 DR. WALLIS: Simply because there's less
25 liquid.

1 MR. WARD: Yes, that's right. That's
2 right. So it's going to shift it to the earlier time.

3 DR. WALLIS: No core flushing means that
4 whatever comes in, evaporates and doesn't flow out.

5 MR. WARD: That's right. Everything is
6 concentrated in there. Now Westinghouse has shown
7 margins in their calculations, and what they did is
8 they took credit for additional mixing volumes to show
9 that there's still a lot of margin there. And
10 basically, if I can list what they did, this is
11 consistent with Jerry Holman's slide. They took
12 credit for lower plenum mixing, half of it, the core
13 includes the upper plenum up to the top of the hot
14 leg, near the top of the hot leg. Okay. They're
15 raising the containment pressure to 20 pounds and that
16 is based on a GOTHIC calculation, that's their license
17 containment calculation. They ran it in a minimum
18 pressure mode. And when you do that, and if I look at
19 their results in that report that you have - I
20 extrapolated it to include the entire lower plenum,
21 and that's what I have in one of my slides. And I'm
22 only mentioning this because I want to show that what
23 they would calculate is consistent with what I --
24 we're in the same ballpark on that curve, and I'll
25 show you that curve in a minute. But it's just for a

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1 reference point to show consistency between our
2 margins.

3 Now the calculations that I'm going to
4 show you --

5 DR. WALLIS: In the licensing world,
6 aren't there specific rules about what you're allowed
7 to consider to be mixed here?

8 MR. WARD: It's not specific.

9 DR. WALLIS: No specific --

10 MR. WARD: What you justify --

11 DR. WALLIS: -- regulation that says you
12 should not consider the lower plenum or anything like
13 that?

14 MR. WARD: Nothing says that.

15 DR. WALLIS: Okay.

16 MR. WARD: I mean, it hasn't been --
17 vendors do different things. It's a generic issue
18 that we want to settle, but everybody makes different
19 assumptions based on what they justify.

20 MR. MARSH: Just a little clarification.
21 This is Tad Marsh. There's a topical report that's
22 approved. That gives an approved methodology.

23 MR. WARD: That's correct. This is based
24 on CENPD-254, which was approved.

25 MR. MARSH: So licensees follow that

1 topical report and the guidelines thereof.

2 MR. WARD: That's right.

3 MR. MARSH: They can take exception to
4 what's in the topical report, as long as they justify
5 it.

6 MR. WARD: That's right. That's right.

7 MR. CLEARY: This is Joe Cleary from
8 Westinghouse. I'd like to expand upon the procedure
9 we used in applying our CENPD-254 methodology. The
10 topical report in question is not explicit in what
11 physical volume constitutes the mixing volume. It
12 merely states that a conservative value is used. In
13 recent years, that conservative value has come into
14 question with the NRC Staff during previous reviews.
15 And questioned specifically was the fact that we
16 historically had credited 100 percent participation of
17 the lower plenum in the mixing volume.

18 For Waterford, we did not do that, but
19 rather taking a cue from an NRC evaluation of another
20 power uprate, which explicitly allowed crediting of
21 the collapsed liquid level in the core and upper
22 plenum to the bottom of the hot leg, we used the same
23 definition of the mixing volume in the Waterford
24 calculation, i.e., a collapsed liquid volume from the
25 bottom of the core to the bottom of the hot leg

1 elevation inside the reactor vessel.

2 MR. WARD: Well, what I want to do is show
3 you some of the calculations that the Staff did. I
4 want to show the effect of the additional mixing
5 volumes, we've got hot legs, upper plenum regions,
6 lower plenum regions. What's the affect of the higher
7 containment pressure? What's the affect of the Decay
8 Heat multiplier, just to show you how the
9 concentration profile with time changes.

10 Now all the calculations that I did had a
11 multiplier of 1.2 during the whole transient. There's
12 no credit for liquid entrainment. During the
13 injection phase, you've thrown out a lot of mass, and
14 probably for the first 15 or 30 minutes, you're not
15 going to see much of a concentration rise at all
16 because it's all going out. We're assuming it stays
17 in there and it increases during that first half-hour.
18 No credit for anything going in the bypass.

19 Now, also, what I did, the boric acid
20 makeup tanks, and these concentrations in these tanks
21 are twice the RWST; 6187 PPM. What I assumed is that
22 went directly into the core, didn't mix anywhere, and
23 then what -- any additional boil-off --

24 DR. WALLIS: Where was that injected?

25 It's not injected --

1 MR. WARD: It's injected into the cold
2 legs.

3 DR. WALLIS: So it mixes with all the
4 material on --

5 MR. WARD: It would go in the downcomer,
6 lower plenum before it gets in the core. It's going
7 to spread out, so I've got --

8 DR. WALLIS: You're assuming that what
9 goes into the bottom of the core, comes down the
10 downcomer, 6187 --

11 MR. WARD: Yes. I'm assuming that the
12 three charging pumps pumping in that concentration
13 directly into the core. And then the rest is made up
14 by the RWST, which is 3000 PPM.

15 DR. WALLIS: Now there was a GSI 185 that
16 looked at boron mixing and more realistic.

17 MR. WARD: Well, I mean, I could -- I'm
18 going to --

19 DR. WALLIS: It seems to me that the NRC
20 doesn't have some sort of accepted way of doing it
21 right. You're inventing something --

22 MR. WARD: I'm making a conservative.

23 DR. WALLIS: PSI 185, something else was
24 done, and the vendors were allowed to do whatever they
25 want to do.

1 MR. WARD: I'm just doing this
2 conservative. This is the worst situation. It's not
3 going to be this. I'm going to make it concentrate
4 fast, as quick as I can.

5 DR. WALLIS: Okay.

6 MR. WARD: I mean, I'm off to the extreme
7 here. I'm not real in that regard. The upper plenum
8 pressure is going to be higher than the containment
9 pressure by the loop pressure drop, and during this
10 transient out to three-hours, that's anywhere from
11 about 6 or 7 psi to about 2.8 to 3. The water during
12 the injection phase is sub-cooled. There's a sub-cool
13 level at the bottom of the core. There's pure liquid
14 down there in about the bottom quarter. I'm assuming
15 it's going in saturated. Okay.

16 So these are the assumptions that I made
17 that I'll make in the calculations that I did. And
18 just to describe this slide, if we separate these
19 curves here, these are what I call licensing-type
20 calculations. I mean, the Decay Heat multiplier is
21 1.2. Down here since these have multiplier of 1.0,
22 let's try to call these best judgment, more towards
23 where I really would expect we really are.

24 DR. WALLIS: Oh, I don't understand this
25 business of the circles and the squares, containment

1 pressure 14.7 --

2 MR. WARD: Okay. Well, I'll get to that.

3 DR. WALLIS: Because we asked the
4 Westinghouse folks, and they said there's no effect,
5 very little effect of containment pressure on the
6 mixing processes and the concentration. It's all in
7 its effect on saturation temperature. That's what
8 your horizontal line --

9 MR. WARD: Those are the two lines there.

10 DR. WALLIS: You seem to be showing an
11 effect on the entire transient.

12 MR. WARD: Well, there is an effect there,
13 because what they do is they're assuming the mixing
14 volume is fixed during the whole event. And what I'm
15 doing is, I'm trying to do it right. I'm balancing
16 the hydrostatic heads between the downcomer and the
17 core with the loop pressure drop. So in the beginning
18 when your steaming is high, the two-phase level is in
19 the middle of the core. This is the start of this
20 reflood transient. And as the Decay Heat drops, the
21 two-phase level will move up the core into the upper
22 plenum. And it gets up into that region around 1-1/2
23 hours. Okay. Between one and 1-1/2 hours, so as long
24 as the two-phase level is up there synonymous with
25 their licensing calculation, we're consistent, but

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1 before that, we're not.

2 DR. WALLIS: What I read in the
3 Westinghouse, this report on BACCHUS, is the
4 conclusion that says it's expected that containment
5 pressure assumption would have only a small impact on
6 the calculated core region boron concentration
7 transient. That's a different conclusion than you're
8 reaching.

9 MR. WARD: Yes.

10 DR. WALLIS: You have a huge impact.

11 MR. WARD: Well, here is the licensing-
12 type calculation with the non-conservative assumption
13 replaced, nothing else, same mixing volume. Now if we
14 assume -- if we go to a 20 psi containment, I'm
15 assuming 20 psi in the upper plenum. It's really
16 higher than that, because it's a loop pressure drop,
17 but let's assume it's 20. That shifts the curve down
18 to here. Okay. That gives this result right here.

19 Now all of that -- this just includes the
20 core and the upper plenum up to a region near the top
21 of the hot leg. I'm staying about a half a foot below
22 the top of the hot leg because the steam that you're
23 producing is going to bleed out there. And once it
24 reaches that point, I just leave it there, even though
25 the loop pressure continues to drop.

1 DR. WALLIS: We haven't studied the basis
2 of Westinghouse's statement that containment pressure
3 has no effect. We haven't studied your analysis which
4 has a big effect, so I don't know who to believe.

5 MR. WARD: I don't think they need to take
6 credit for that in the long run, but let's -- you may
7 not even ask that question when we see where we're
8 going here. If now I throw in the hot leg in the
9 mixing volume, I've got more volume to mix. The two-
10 phase level is now near the top of the hot leg. It's
11 going to delay the precipitation time, and if we look
12 at three-hours, I mean, we're down around 24 percent.
13 And if we're using a 14.7 limit, a 20 psi limit, or
14 with the TSP, the limit is up here.

15 Now this is a licensing-type cal. Okay.
16 Now if we remove the hot leg mixing volume, and now go
17 from the base case and just throw lower plenum mixing
18 in --

19 DR. WALLIS: That's the entire lower
20 plenum?

21 MR. WARD: That's the entire lower plenum.
22 I mean, you're here. Now if I go to a Decay Heat
23 multiplier of one, I'm here. Now if I fill the hot
24 leg in there in addition, so I have the hot leg, the
25 lower plenum, this is about as best as you're going to

1 get, let's say. I mean, I'm not taking credit for
2 subcooling entrainment. If I did that, this curve
3 would shift over here, shift this down maybe another
4 30-minutes.

5 The point I'm trying to make is, here's
6 where we are, somewhere in this band in here. Okay.
7 Based on what Jerry Holman gave for a list of
8 assumptions that he's taken credit for half the lower
9 plenum, they're going to be somewhere in here. I
10 would expect their calculation when they submit it is
11 going to show something in this range. Now if we take
12 the TSP, what is that - that's beyond six hours.
13 We're switching back here two to three hours, when the
14 concentrations, even without the 20 psia, you're still
15 okay for the containment.

16 DR. WALLIS: You said something about the
17 Westinghouse - I guess it's the Westinghouse
18 calculation that when they submit it, so they have not
19 yet submitted that?

20 MR. WARD: Well, they're going to submit
21 an analysis of record.

22 DR. WALLIS: So we're going to make the
23 decision based on something which has not yet been
24 submitted?

25 MR. WARD: Well, I'm -- if I look at their

1 assumptions --

2 MR. MARSH: Well, let me interrupt. The
3 answer is no, Mr. Chairman, we're not going to make
4 a decision based on something that's not docketed.
5 No, we'll get it docketed. We'll look at it. And as
6 I said, we'll supplement the safety evaluation too.
7 This is the information that we've heard over the
8 telephone, in meetings, in raw form. We need to get
9 the information docketed to look at it.

10 DR. WALLIS: I'm just a little concerned
11 about this committee making a decision that everything
12 is okay when so much seems to be work-in-progress.

13 MR. CLEARY: This is Joe Cleary from
14 Westinghouse. Entergy has docketed the supplemental
15 calculation, and what we will be doing is identifying
16 one of the specific points in that calculation as the
17 new licensing basis calculation for the Waterford
18 uprate. The point that credits the appropriate amount
19 of conservatisms and removing some of the other
20 conservatisms that we relaxed over the full range of
21 calculations, that is identified in the supplemental
22 information.

23 MR. WARD: Well, all I want to do is show
24 you an envelope, and based on their list, we expect
25 they're going to fall somewhere in here. I mean, that

1 remains to be seen, but I wanted to give you an idea
2 of where they are. And this is about where they are.

3 DR. WALLIS: How much of this is due to
4 the uprate? We're talking about an uprate, and you
5 seem to be talking about a generic problem with all
6 such systems, which this doesn't address the question
7 of what's the effect of the uprate on all this. Does
8 the uprate make any difference to these curves?
9 That's what we're talking about is a power uprate.
10 WE're not talking about --

11 MR. WARD: That's correct.

12 DR. WALLIS: -- whether or not there's
13 some kind of a glitch in the way in which this boron
14 mixing is evaluated. Do you have it in the
15 perspective of the power uprate decision?

16 MR. CLEARY: The power uprate has a
17 relatively small effect on all of this. You could
18 determine that from looking at the effect of changing
19 the Decay Heat multipliers from realistic to Best
20 Estimate. Any percent change in Decay Heat would
21 effectively represent the effect of the power uprate
22 on this topic.

23 DR. WALLIS: So we should have a DH
24 multiplier of 1.08 or something, and that would do it?

25 DR. DENNING: I thought we also had a

1 higher boron concentration?

2 MR. CLEARY: The maximum values used in
3 boric acid precipitation analysis did not change in
4 the power uprate, some of the minimum values I believe
5 in the plant increased.

6 DR. WALLIS: I think it had more boron in
7 the tanks than before.

8 MR. CLEARY: Actually, for the large break
9 LOCA analysis, as a result of that analysis, we're
10 decreasing the maximum level of the safety injection
11 tanks in order to get more nitrogen and to increase
12 the initial flow rate. That was addressed at the
13 subcommittee meeting two weeks ago.

14 DR. WALLIS: So is it conceivable that
15 with the power uprate you're better off?

16 MR. CLEARY: The safety injection tank
17 contribute to the boric acid precipitation analysis or
18 the change in the maximum level is very, very small,
19 and I would consider it insignificant.

20 MR. HOLMAN: The long-term cooling
21 analysis done for power uprate uses maximum boron
22 concentrations in all of the tanks. Those really did
23 not change.

24 MR. ROSEN: So for me, the bottom line of
25 this is, you're showing, maybe if I don't want to

1 credit over-pressure, you're showing they read the
2 14.7 psia limit - I don't know where you put your -
3 maybe five hours.

4 MR. WARD: Yes, right. Five hours.

5 MR. ROSEN: And they switch over by
6 operator action in three hours.

7 MR. WARD: Two to three. In this range
8 here.

9 MR. ROSEN: So I have a margin when I
10 switch-over of we say a factor of two in time.

11 MR. WARD: Right. I mean, if this stuff
12 was up here, then we wouldn't be talking right now.
13 Okay.

14 MR. CLEARY: Len, I'd make one clarifying
15 statement. Maybe it's an obvious statement.

16 MR. WARD: Okay.

17 MR. CLEARY: All these calculations are
18 obviously using Decay Heat based on the uprated power.
19 I believe Len's fourth and fifth lines are the down
20 point to triangles and the diamonds show the effect of
21 change in Decay Heat multiplier of either 10 percent
22 or 20 percent, depending upon the downward pointing
23 triangles, so that would be the effect of -- more than
24 the effect of the power uprate.

25 DR. WALLIS: So with all these curves,

1 what is your official position on which curve is
2 acceptable?

3 MR. WARD: Well, they need to show a
4 licensing calculation that precipitates beyond their
5 switch time. And based on their assumptions, if I
6 take that, they're going to be somewhere in here. And
7 that's acceptable. That says they're switching early
8 when the concentrations are really low, but not too
9 early. I can't switch before two hours, because then
10 the injection can't match the boil-off, so you don't
11 want to go beyond that. But after that point, the
12 earliest time you switch is going to be the safest
13 because the concentrations are the lowest. And
14 remember, I haven't taken credit for subcooling or
15 entrainment, or anything. That's going to bring these
16 curves down even more.

17 DR. WALLIS: Is there any downside to
18 switching too early?

19 MR. WARD: Yes. If you switch too early
20 when the Decay Heat is too high, you can't make --
21 then you're losing half of your high pressure
22 injection. The other half better match boil-off.

23 DR. WALLIS: So there's something that the
24 operators are told that --

25 MR. WARD: Two to three hours they switch.

1 DR. WALLIS: Two to three hours?

2 MR. WARD: Right here, during this time
3 frame.

4 DR. WALLIS: That goes for all break
5 sizes?

6 MR. WARD: That's right.

7 DR. WALLIS: They must not switch before
8 two hours, but they must switch before three, in-
9 between two and three hours.

10 MR. WARD: Between two and three hours.
11 To maintain those margins, yes. That's right.

12 MR. HOLMAN: This Jerry Holman. That's
13 correct, and that's the way the emergency operating
14 procedures are written.

15 MR. WARD: So I guess what I --

16 MR. HOLMAN: In terms -- this is Jerry
17 Holman again. In terms of the updated licensing basis
18 analysis, the last slide that I presented provides
19 some of the assumptions that will go into what we're
20 going to docket as our updated licensing basis
21 analysis. And all of those calculations come from the
22 supplemental calculations that have already been
23 submitted and docketed in our report.

24 MR. MARSH: Mr. Chairman, this is Tad
25 Marsh again. We look forward to that information to

1 substantiate what we have heard, but we look also
2 forward to it being made very clear what is the
3 licensing basis calculation compared to what are
4 supplemental calculations, which may show
5 conservatisms. So that submittal needs to make it
6 very clear what is the licensing basis, because these
7 calculations that Len has showed you are confirmatory,
8 and they're interesting, and the Staff's information.
9 But what the licensee says on the docket is what we
10 will count on for that decision.

11 MR. WARD: So I guess what I'm saying is
12 the best judgment calculation shows about 14 wt%, and
13 if you want to compare that to 14.7 at three-hours --

14 DR. WALLIS: At the time --

15 MR. WARD: At three hours, if you want to
16 use 14.7, it's compared to 28. If you want to use 20
17 psi, whether that's the higher containment pressure or
18 you're accounting for the loop pressure drop, you're
19 close to that - it's 32. And then if you add the TSP,
20 it's somewhere up near 40.

21 DR. WALLIS: Well, this is not a new
22 question. Wasn't this resolved years ago, and how was
23 it resolved? Was it resolved in the same way you've
24 done it?

25 MR. WARD: Yes. Remember years ago,

1 precipitation - because plant power levels were lower,
2 concentrations were lower, precipitation times were 10
3 to 15-hours. So if they were off two of three hours,
4 it didn't matter. It was easy to balance some changes
5 with precip times, I mean, because they were so late,
6 and they're switching so much earlier. So now with
7 these uprates and these higher powers, everything is
8 pushed earlier, so when you have a -- you at least
9 want to have a licensing calculation that's
10 demonstrated to be conservative, that shows you're
11 switching early enough so the concentration really is
12 low, but not too early so that you uncover the core.

13 DR. WALLIS: Now is this an effect of the
14 uprate, that in order to control radioactivity when
15 you have a -- reactivity when you have a new core, you
16 need to have more boron? Is that part of the problem
17 you have, part of what makes this different?

18 MR. CLEARY: No, the maximum -- the
19 analysis uses maximum values, tech spec values for the
20 boric acid sources, and those maximum values have not
21 increased as a result of the uprate.

22 DR. WALLIS: So it's not a question of the
23 uprate increasing the need of boric acid and more of
24 it if you have high reactivity at startup.

25 MR. HOLMAN: That is correct. This is not

1 a phenomenon driven by power uprate. The only effect
2 of the power uprate is the higher Decay Heat. That's
3 correct. To answer your question previously, it
4 hadn't come up in the past, and had been evaluated in
5 a similar manner to show that there are conservatisms
6 and margins that exist when you look at a more best
7 estimate analysis.

8 MR. WARD: So these calculations show that
9 you're at half the limit at the switch time, and they
10 even show that you could -- you don't need the higher
11 containment pressure, and you could even almost go as
12 far as to say if you look at those curves without
13 lower plenum mixing, but with the hot legs, you're
14 still beyond four hours, so it tells me there's some
15 margin here. It's comforting.

16 DR. DENNING: In your model, what's the
17 cause for the peak in the concentration? What's the
18 phenomenon that --

19 MR. WARD: Well, what brings it back down
20 is that's when the two-phase level gets up into the
21 upper plenum, the area's factor of two larger than the
22 core, so to balance the heads, you're going to get a
23 lot of liquid in there, and it drops the
24 concentration. There's a huge change in area.

25 DR. WALLIS: So you get more liquid coming

1 in from the lower plenum.

2 MR. WARD: Right. I'm balancing the head
3 with the loop pressure drop. And when it says I can
4 go there, it also says I can have more liquid there.
5 The void fraction decreases when you go into that
6 larger area. It's about 70 percent at the top of the
7 core. It decreases to about 61, 62 percent.

8 MR. HOLMAN: This is Jerry Holman again.
9 I think that difference is one of the major
10 conservatisms of why there's a difference in the
11 effect of pressure between the Westinghouse model and
12 Len's model. Len is doing a time-dependent two-phase
13 level, which shows that dependence a little bit
14 greater.

15 DR. WALLIS: Are we ready to wind up this
16 presentation and take a break? I'd like to take a
17 break until quarter to 11. We're 15-minutes late, but
18 I think we can finish this morning. I hope we can.
19 We've got a few more issues. This seemed to be the
20 major one. Okay. So we'll take a break for 15-
21 minutes and come back here at quarter to 11.

22 (Whereupon, the proceedings in the
23 foregoing matter went off the record at
24 10:32 a.m. and went back on the record at
25 10:47 a.m.)

1 MEMBER WALLIS: Back into session. Could
2 we have some quiet, please?

3 Go ahead.

4 MR. MITCHELL: Okay. I'm Tim Mitchell.
5 I'm going to make just a couple closing points on the
6 boron precipitation subject and the introduce the
7 large transient testing.

8 I want to reinforce a couple of points --
9 that the original design for long-term cooling did
10 include a simplification. However, I think what we've
11 shown today is that there's a lot of conservatisms in
12 that as well. We have docketed all of the
13 information, the full range of information, and have
14 agreed upon what point would be our future licensing
15 basis, which would still be conservative with respect
16 to some of the information that we've presented here.

17 MEMBER WALLIS: But you have not yet
18 submitted your formal document?

19 MR. MITCHELL: We have presented all of
20 the information. However, we do need to present a
21 formal declaration of what -- which point is the
22 licensing basis, even though we have agreed with the
23 staff on what point that would be from the docketed
24 information. And those are the points that Jerry
25 Holman covered -- what assumptions we would include

1 and not include, or what inputs would.

2 So, in conclusion, boron precipitation
3 will not prevent adequate long-term cooling from all
4 of the information that we have presented.

5 Now, with your permission, I'd like to
6 proceed on to large transient tests. We had a lot of
7 discussion during the subcommittee meeting, and we
8 have prepared some more information. The staff has
9 challenged us on this topic not once but actually
10 three times, on three separate occasions. Entergy
11 senior management also challenged us with the
12 appropriateness of what testing we would go do. And,
13 as I mentioned, the subcommittee also challenged us,
14 and we have gone back and reevaluated our position
15 with each challenge.

16 Our testing program we believe does
17 adequately demonstrate proper operation of the EPU.
18 One other thing I would like to reinforce -- in my
19 time on a previous uprate as Ops Manager, we went
20 through a lot of this same type of evaluation. But
21 our presentation will demonstrate that a large
22 transient test will provide minimal assurance of the
23 modifications, does come with some risk, even though
24 that risk is small.

25 And I'll turn it over to David, and we'll

1 proceed with our presentation.

2 MR. CONSTANCE: Hello. I'm David
3 Constance. I've been with Entergy for 17 years. I'm
4 a Shift Technical Advisor, and I have a current Senior
5 Reactor Operator license on the unit, and I'm here to
6 talk about transient testing.

7 Let's start with talking about power
8 ascension testing, so you get a flavor for the types
9 of tests, retests --

10 MEMBER WALLIS: Where are we in the
11 handout?

12 MR. CONSTANCE: I'm on slide 27.

13 MEMBER WALLIS: 27, okay. Thank you.

14 MR. CONSTANCE: You're welcome.

15 I'll begin with describing our post-
16 modification testing program and power ascension
17 testing program in relationship to the modifications
18 and changes in the plant operating conditions that go
19 along with extended power uprate.

20 Power ascension testing will consist of
21 reactor engineering tests and power verification,
22 transient and data state -- transient and steady state
23 data record collection, post-modification testing,
24 which I'll go into in more detail in the next slide,
25 a plant maneuvering test from 100 percent to 90

1 percent, and post 100 percent testing, data
2 collection, and surveys, and a vibration -- and
3 vibration monitoring program.

4 Next slide.

5 What you see here is the plant power
6 ascension. This power ascension profile includes
7 seven power plateaus followed by a maneuvering
8 transient test.

9 Next slide.

10 Startup testing begins with low power
11 physics testing, which will remain unchanged for
12 extended power uprate. We will be performing the same
13 tests. We'll be performing more of them at different
14 power levels, but it will still be essentially the
15 same tests that we perform during every startup
16 testing and essentially the same test program that was
17 implemented during initial startup testing.

18 MEMBER POWERS: You do these every
19 refueling.

20 MR. CONSTANCE: That's right. We'll just
21 do them at -- at the power plateaus I had displayed up
22 there.

23 MEMBER POWERS: Right.

24 MR. CONSTANCE: We'll repeat the same
25 tests.

1 MEMBER WALLIS: I think we determined at
2 the subcommittee meeting there was going to be an NRC
3 inspector present for these tests.

4 MR. CONSTANCE: That's right. That's
5 right. There was a discussion about guidance. There
6 is some public guidance for the residents concerning
7 power ascension testing and his participation in that.

8 Power ascension then commences with data
9 set collections, which will be collected every 10
10 percent from 20 percent to 100 percent power. Also,
11 it will be collected at seven power plateaus. We'll
12 be monitoring approximately 1,000 parameters, and this
13 data will be automatically collected and processed and
14 will be automatically compared to predetermined
15 acceptance criteria.

16 MEMBER WALLIS: Part of this data involves
17 vibrations?

18 MR. CONSTANCE: That's correct. We have
19 a vibration collection plan that extends from inside
20 containment, main feed, main steam inside containment,
21 all the way out through the plant into the transformer
22 yard.

23 MEMBER RANSOM: Does that include the
24 reactor coolant pumps?

25 MEMBER WALLIS: No.

1 MR. CONSTANCE: It does. We use -- we're
2 using our installed equipment. We are going to
3 monitor them. We don't expect any changes, but it is
4 a two-degree drop in -- or two- to four-degree drop in
5 T cold, so we are going to include the vibration
6 monitoring using our installed spectrum analysis
7 equipment that we have.

8 MEMBER RANSOM: Oh, okay.

9 MR. CONSTANCE: Plant Safety Subcommittee
10 will convene to review the Results Report at every
11 power plateau greater than 68 percent. This report
12 will include the testing results, a list of any
13 equipment out of service, the calculation of a Plant
14 Safety Index.

15 The Plant Safety Subcommittee
16 recommendation will then be needed for continued power
17 ascension. The Plant Manager, Operations Manager, and
18 Test Director approval is required for continued power
19 ascension.

20 So that describes our structure of our
21 post -- I'm sorry, our startup testing post EPU.

22 In considering a large transient test, we
23 performed a review of the initial plant startup test,
24 per our standard review plan 14.2.1. Of the initial
25 large transient tests that were performed, only the

1 turbine trip test, which was originally performed at
2 84 percent reactor trip power, was judged to be
3 potentially applicable to the planned power uprate.

4 MEMBER ROSEN: Why was it only done at 84
5 percent rather than at full power?

6 MR. CONSTANCE: During initial plant
7 startup, there was a small fire in the exciter
8 cubicle, which resulted in a turbine trip by the
9 operator, and we took credit for that and collected
10 that data and used it to benchmark the codes that were
11 used for transient analysis in initial plant design.

12 MEMBER ROSEN: That was not your intent.
13 You intended to do it at full power, correct?

14 MR. CONSTANCE: That's correct.

15 MEMBER ROSEN: It goes with this fire in
16 the exciter cubicle. The plant was tripped at 84
17 percent as a result of the fire.

18 MR. CONSTANCE: That's correct. The
19 intention was to do it at 100 percent.

20 MEMBER ROSEN: But was it manually
21 tripped, or did it automatically trip?

22 MR. CONSTANCE: I believe it was manually
23 tripped. I'm not certain of that, but I believe it
24 was manually tripped.

25 In considering use of this in a large

1 transient test, Entergy considered transient testing
2 in relation to the full spectrum of activities which
3 establish and maintain equipment operability. For
4 EPU, this includes power ascension testing, post-
5 modification testing, routine testing, surveillance,
6 and trend programs, and continuous active monitoring
7 of plant equipment.

8 The next two slides present these
9 modifications, and the planned post-modification
10 testing specifically, and then a determination of
11 whether the system or component performance would be
12 further demonstrated by a turbine trip test.

13 Beginning with the atmospheric dump valves
14 and the low steam generator pressure, steam generator
15 pressure trip setpoints -- setpoint, they will both be
16 changed. These setpoints will both be changed for
17 power uprate. The post-modification testing for each
18 is a channel calibration to verify the setpoint is
19 correct.

20 Upon a turbine trip, steam generator
21 pressure is controlled by the steam bypass control
22 system. The atmospheric dump valve will not be
23 actuated on a turbine trip. Similarly, since steam
24 generator pressure rises on the turbine trip, the low
25 steam generator pressure setpoint will not be

1 actuated. Thus, we concluded that these setpoint
2 changes will not be further tested by a turbine trip.

3 Program constants will be changed for the
4 feedwater, steam bypass, and reactor regulating
5 control systems to establish new a plant operating
6 point. The post-modification testing for these
7 control systems will be channel calibration, transient
8 and steady state data record collection, and a load
9 change test following 100 percent power.

10 Certain features of the control -- yes,
11 certain features of the control system -- let me
12 rephrase that. These systems will be or can be
13 somewhat tested by a turbine trip, partially tested by
14 a turbine trip test. However, certain features of the
15 control systems -- for example, reactor trip override,
16 quick open block, and auto withdrawal prohibit -- will
17 not be demonstrated by a turbine trip.

18 Additionally, the beginning of cycle
19 turbine trip is not the most challenging initial
20 condition for these -- for these control systems.
21 Thus, a turbine trip will partially test these control
22 systems, but not provide us with the complete test.

23 Moving on, the permissive setpoint for the
24 reactor trip or turbine trip will be changed for an
25 extended power uprate. The post-modification testing

1 for this is a channel calibration. However, during
2 the turbine trip, we will have reactor power cutback
3 in service, so this system will not be in service and
4 will not be tested on a turbine trip.

5 The high pressure turbine rotor will be
6 replaced for extended power uprate. The post-
7 modification testing for this change is a 120 percent
8 rotor speed factory test, transient and steady state
9 data record collection, and will validate the turbine
10 first stage power constants, perform an overspeed trip
11 test, perform vibration monitoring, and finally a
12 thermal performance test.

13 MEMBER ROSEN: Now, the overspeed trip
14 test is one you'll do at the plant.

15 MR. CONSTANCE: That's right, but it will
16 be unloaded. In other words, we will just -- we will
17 just spin the turbine up unloaded until we reach the
18 trip setpoint and observe that the trip occurs.

19 MEMBER ROSEN: But, obviously, the turbine
20 trip at full power is a loaded trip test. So you
21 won't have that if your proposal to waive these tests
22 is accepted until whenever it happens for the first
23 time, to have a loaded trip of the overspeed trip test
24 mechanisms.

25 MR. CONSTANCE: That's correct.

1 MEMBER ROSEN: The initial test -- I'm
2 sorry.

3 MR. CONSTANCE: There is not an overspeed
4 test at 100 percent. I'm not sure if I understood the
5 question correctly, but with the generator tied to the
6 grid you can't do an overspeed test. It has to be
7 done with the generator breakers essentially open --

8 MEMBER ROSEN: Right.

9 MR. CONSTANCE: -- in order to speed it
10 up.

11 MR. MITCHELL: Opening the generator
12 breakers lets the generator -- lets the turbine
13 accelerate and requires the closure of the turbine
14 trip and throttle valves.

15 MEMBER ROSEN: That's the test that won't
16 be done is what I understand your proposal is.

17 MR. CONSTANCE: Well, the question goes to
18 -- will we be performing -- or has an opportunity to
19 perform a test to demonstrate the turbine -- turbine
20 overspeed/overshoot. All right. We will see this
21 turbine trip at the trip setpoint, but it won't -- it
22 won't overshoot it based upon a no-load turbine trip
23 test, overspeed test, right? On the --

24 MEMBER ROSEN: It's an artificial
25 circumstance in the sense that, yes, tripping it

1 unloaded is -- is one thing you want to be sure it
2 does.

3 MR. CONSTANCE: Right.

4 MEMBER ROSEN: But tripping it loaded is
5 another -- another function of the test.

6 MR. CONSTANCE: Right.

7 MR. MITCHELL: Well, Dave, why don't you
8 describe the normal turbine trip sequence, because the
9 turbine trips first and then the generator trips, so
10 let's make sure we're describing the actual trip
11 sequence on a normal turbine trip.

12 MR. CONSTANCE: On the turbine trip that
13 was performed during initial startup, it was initiated
14 by tripping it --

15 MEMBER ROSEN: At 84 percent.

16 MR. CONSTANCE: -- at 84 percent. It was
17 initiated by tripping the turbine, which means that
18 the governor valves and throttle valves immediately go
19 closed, and there is no turbine overspeed, and there
20 is no turbine acceleration.

21 MEMBER ROSEN: There's a deceleration.

22 MR. CONSTANCE: There is only a
23 deceleration, right.

24 We could propose a different test, for
25 example, to open the exciter field breaker, which

1 would create an overspeed. But it would not be a
2 design basis overspeed, because there are several
3 preemptory trips that would occur before the turbine
4 overspeed trip. You open the generator field breaker,
5 and that causes a loss of fuel which immediately trips
6 the turbine. You would not reach the overspeed trip
7 setpoint before you'd get the turbine trip signal.

8 So it would not be a complete test of that
9 overspeed. There has been no complete test of an
10 overspeed trip in the design condition, because it
11 would require defeating several preemptory strikes
12 which -- which is not consistent with nuclear safety.

13 So I've pretty much just described here
14 where we feel that a turbine trip test would not
15 further test a high pressure turbine rotor. On the
16 turbine control DEH control system, we will change
17 program constants for intended power uprate. The
18 post-modification testing for these changes is a
19 channel calibration, a transient and steady state data
20 record collection, and a load change test.

21 On a turbine trip, it's initiated by
22 closure of the governor and throttle valves, which is
23 accomplished by a method which overrides the DEH
24 control system. So the DEH control system plays no
25 role in a turbine trip.

1 Next slide.

2 For extended power uprate, we will rewind
3 the main generator. There is a whole slew of
4 electrical tests for post-modification testing. There
5 is also a transient/steady state data record, isophase
6 bus temperature monitoring, vibration monitoring, and,
7 finally, a generator capability test.

8 On a turbine trip, the main generator is
9 automatically deenergized following a turbine trip by
10 the automatic tripping of the exciter field breaker.
11 This breaker, and the associated trip circuitry, is
12 unchanged by power uprate. Therefore, a turbine trip
13 does not further demonstrate or does not further test
14 the main generator.

15 For power uprate, main transformer alpha
16 will be replaced, and main transformer bravo will have
17 enhanced cooling installed. Post-maintenance testing
18 for this includes a 100 percent factory load test of
19 main transformer alpha, synchronizing check -- I'm
20 sorry, I skipped that -- temperature survey of
21 connectors monitor transformer temperatures during
22 power ascension and following power ascension, and
23 also performing oil samples and analysis.

24 On the turbine trip, the main transformers
25 are simply deenergized by opening of the -- of the

1 generator output breakers. The circuitry and the
2 breakers associated with deenergizing the main
3 transformers except for the generator output breakers,
4 which I'll get to, have not been changed by power
5 uprate, and the transferring of the house loads to
6 offsite power are also unchanged by power uprate.
7 Therefore, the main transformers themselves are not
8 further tested by a turbine trip.

9 The generator output breakers will be
10 replaced for extended power uprate, and one has
11 already been replaced. The post-maintenance testing
12 for this is AC and DC acceptance test, synchronizing
13 check calibration, power factor tests, and timing
14 tests.

15 On a turbine trip, the generator output
16 breakers are opened at near no-load conditions. The
17 circuitry which opens the generator output breaker is
18 not changed by extended power uprate. Therefore, a
19 turbine trip does not further test the generator
20 output breakers.

21 The valve trim will be replaced on the
22 drain collection tank normal level control valves for
23 extended power uprate. The post-modification testing
24 for this is a channel calibration, transient/steady
25 state data reactor, air operator valve testing, and a

1 load change test.

2 On the turbine trip, these valves will
3 modulate closed following the turbine trip. This is
4 not a different function than is demonstrated during
5 normal plant startup or shutdown. Therefore, the
6 drain collection tank, normal level control valves,
7 are not further tested during a turbine trip.

8 We will be installing connector tubes for
9 additional support of the condenser tubes for extended
10 power uprate. The post-modification testing for this
11 is a circulating water tube leakage check, and to
12 monitor secondary chemistry on power ascension.

13 MEMBER WALLIS: But that doesn't test
14 whether the staking works or not.

15 MR. CONSTANCE: For vibration? We will
16 also be performing an acoustic survey of the condenser
17 at the current 100 percent power level prior to the
18 outage, and then we'll be reperforming that at 100
19 percent post outage.

20 It was listed in a separate --

21 MEMBER WALLIS: As you do the power
22 ascension, you will be monitoring the acoustic level
23 in the condenser. Is that --

24 MR. CONSTANCE: We'll monitor that at the
25 new 100 percent level.

1 On a turbine trip, the steam bypass
2 control valves open, which will pass approximately 65
3 percent of current reactor trip -- I'm sorry -- of
4 current rated thermal power. This compares to 100
5 percent EPU which will be tested at power -- during
6 power ascension once we reach 100 percent power.

7 So performing any type of acoustic survey
8 at that time is actually at a lesser steam flow than
9 we have at 100 percent power. So we feel that testing
10 at 100 percent power is the preferred testing and that
11 a turbine trip doesn't provide any additional testing
12 of the condenser tubes needed.

13 MEMBER WALLIS: Doesn't a turbine trip
14 test whether everything sort of works together okay?
15 I mean, you can do all these individual tests of
16 things, but testing whether the whole system responds
17 okay.

18 MR. CONSTANCE: Right.

19 MEMBER WALLIS: Doesn't that require a
20 system test?

21 MR. CONSTANCE: Right. The question goes
22 to an integrated system performance, whereas much of
23 this post-modification testing is focused on testing
24 individual components.

25 We covered that earlier, and I will

1 discuss that a little further. The area of integrated
2 system performance where I think it might have its
3 most benefit is for control system interactions and
4 control system performance. One of the weaknesses of
5 that is that you're only testing the integrated system
6 performance in one transient sequence from one initial
7 condition.

8 That really doesn't let us know that it's
9 going to -- that really doesn't tell us anything about
10 the performance of the control systems in an entire
11 pantheon of transients and initial conditions, and we
12 need to find another way to demonstrate that. Just
13 that one test wouldn't satisfy our -- the level of
14 quality that we need -- level of quality check that we
15 need to ensure that that system will perform its
16 function in an integrated manner for other transients.

17 The only thing I had left here is static
18 cooling water alkalizer skid. We will be performing
19 chemistry monitoring, post power uprate, as a post-
20 modification test, and that system plays no role in
21 the turbine trip, so it won't be tested on a turbine
22 trip.

23 Next slide.

24 MEMBER SIEBER: What is that skid?

25 MR. CONSTANCE: It controls the pH of the

1 static cooling water to limit the amount of corrosion
2 we have in the static cooling water system.

3 MEMBER SIEBER: Static cooling water.
4 Okay.

5 MR. CONSTANCE: That's right. Generator
6 static cooling water.

7 MEMBER SIEBER: In some plants it's called
8 holy water.

9 MR. CONSTANCE: Holy water?

10 MEMBER SIEBER: Yes.

11 (Laughter.)

12 MR. CONSTANCE: All right. From this
13 detailed review of the specific modifications that we
14 are performing, we observed that except for control
15 systems a turbine trip test is not an effective test
16 for demonstrating the performance of the modifications
17 planned for the Waterford 3 extended power uprate.

18 MEMBER ROSEN: And your argument for that
19 is that it's only at one condition, and there are many
20 conditions from which -- initial conditions from which
21 the control systems must control the shutdown,
22 correct? And my feeling is that the weakness of that
23 argument is that, although it's true, the weaknesses
24 that most of the time the plant is operating, it is at
25 the test conditions of full power. In other words --

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1 MR. CONSTANCE: That's right.

2 MEMBER ROSEN: -- the test from full power
3 tests the circumstances which are percentage-wise the
4 conditions that the plant is most in.

5 MR. CONSTANCE: Do you want me to respond
6 to that, or -- I think you're saying that there are
7 other conditions, initial conditions, that -- that may
8 be less likely. So perhaps when we look at it, we
9 should look at -- we should weight it heavier for the
10 100 percent. It's still not complete.

11 MEMBER ROSEN: Yes, we all recognize
12 that --

13 MR. CONSTANCE: Right.

14 MEMBER ROSEN: -- as you do, and I think
15 your argument is a good one, that -- that the control
16 systems have to work from 20 percent power, 40 percent
17 power, all the --

18 MR. CONSTANCE: Right.

19 MEMBER ROSEN: But you're only at 20
20 percent power and 40 percent power for brief periods
21 of time.

22 MR. CONSTANCE: Right. There's also
23 initial condition effects of time and life also, but
24 a bigger aspect is, what about other transients? What
25 about loss of feed pump? What about loss of both feed

1 pumps?

2 MEMBER ROSEN: You're arguing for more
3 large transient testing, I think.

4 (Laughter.)

5 We might go easy -- go along with that.

6 MR. CONSTANCE: Well, what I think I'm
7 arguing for is that we need to establish the
8 performance and operability in the confidence level in
9 these systems in some other manner other than
10 challenging them in their design basis transient. If
11 you think there's a flaw, that seems to be the poorest
12 time to try to demonstrate that flaw.

13 Rather, we need -- what we're trying to
14 demonstrate here is that we perform --

15 MEMBER ROSEN: No. We think the converse.
16 We think there's not a flaw, but we need you to
17 demonstrate that. That's a view that some of the
18 members of the committee hold. And it goes back to
19 some of the comments my esteemed colleague Dr.
20 Apostolakis has made in another context about model
21 uncertainty. And that is, you don't know what you
22 don't know. So how can one conduct a test to find out
23 those things. It's obviously not possible.

24 MR. CONSTANCE: That's right.

25 MEMBER ROSEN: So one needs to think about

1 not being so certain that you know everything you know
2 -- that you need to know about the plant, because
3 there is always model uncertainty in both the
4 calculations or by analogy here in the plant
5 condition.

6 MR. MITCHELL: This is Tim Mitchell, and
7 I guess I'd like to phrase it a little different. The
8 act of going through low power on a powerplant tests
9 things like feedwater control and steam dumps, and
10 those type control systems in an integrated fashion,
11 that is more challenging, in my opinion, than the
12 active trip in the turbine.

13 So between the testing that we're doing
14 and the power ascension program itself, I would argue
15 that we are subjecting the systems to much more
16 stringent testing than would be exhibited by a turbine
17 trip.

18 MEMBER SIEBER: I think one could also
19 reach a conclusion that a trip from any higher power
20 level, from a control system standpoint, causes the
21 controls to act the same as they would from the
22 highest license power level.

23 In other words, if you trip the plant from
24 80 percent, most things will close except heater
25 levels which modulate, and, you know, all your heater

1 drain system valves close, your -- to limit the amount
2 of stored energy that goes through the turbine.

3 And so to demonstrate that, you really
4 don't need to do it at 100 percent power. What you do
5 learn from a trip at 100 percent power is -- will a
6 water hammer occur? Will pipe movements occur that
7 will strain or damage pipe hangers? Things of that
8 nature? And, of course, after a trip I'm sure your
9 plant, like most I've been in, does a walkdown of all
10 of these systems to make sure everything is taken care
11 of.

12 So if you're looking at control systems,
13 to me, I don't think that a trip from 100 percent
14 power really tells you too much. On the other hand,
15 it does tell you about the overall mechanical response
16 of the plant, where the pipes move, where the hangers
17 -- whether they -- the hangers and snubbers get bent,
18 or something like that. And so there is some value in
19 doing that.

20 But I would think that if you wanted to
21 argue to say the licensee ought to do it, that should
22 be the basis.

23 MR. CONSTANCE: If I can continue on --

24 MEMBER WALLIS: This is likely to occur
25 anyway within the next few years, whether you test --

1 whether you plan it or not, isn't it?

2 MR. CONSTANCE: That's right. It is
3 likely to occur. We expect it to occur sometime in
4 the life of the plant. When we go through a refueling
5 outage, any refueling outage, but especially during a
6 power uprate refueling outage, and we put the plant
7 online, we then go into a -- we then go in -- well, we
8 then go into a -- we then enter into our routine
9 surveillance and monitoring programs.

10 These programs have an opportunity to
11 detect any degradations that might exist in the plant,
12 before we reach a point where we might actually need
13 them. So that trip may not occur for six months, it
14 may not occur for five years, and in that period the
15 operators and the engineers and the technicians have
16 an opportunity through our routine monitoring and
17 surveillance program to detect this degradation and
18 correct it.

19 MR. MITCHELL: Plus, our post power
20 ascension or our power ascension testing program will
21 look for -- is piping and hangers -- are all thermal
22 growths as predicted, and is it consistent with what
23 we would expect? And we have looked at it from an
24 analysis standpoint, what the effects would be.

25 MR. CONSTANCE: So if you are asking if I

1 would rather take a turbine trip now than later, I'd
2 have to say later. All right.

3 MEMBER SIEBER: Spoken like a true
4 operator.

5 (Laughter.)

6 MEMBER ROSEN: Especially on somebody
7 else's shift.

8 (Laughter.)

9 MR. CONSTANCE: We did discuss a little
10 bit about the control systems, and for the control
11 systems the turbine trip will provide a limited
12 demonstration of system performance. However, a
13 turbine trip represents only one transient of interest
14 and is performed in only one initial condition. A
15 turbine trip transient will not test all of the
16 functions of these control systems, nor will the
17 systems be tested in their most challenging
18 conditions.

19 Rather, a control system performance is
20 more rigorously evaluated using a calculational model.
21 Utilizing the LTC code, 42 different scenarios have
22 been evaluated representing six transients from
23 multiple initial conditions, all with acceptable
24 results.

25 MEMBER DENNING: One second. With regards

1 to point simulator, would it make sense to -- and to
2 what extent what -- is the integrated control system
3 adequately modeled in the point simulator that you
4 should run a series of tests with the point simulator
5 to check the logical control system performance?

6 MR. CONSTANCE: The question is: to what
7 extent can we use the plant simulator to model these
8 transients? And we all have -- we have a commitment
9 -- we covered this earlier at the subcommittee
10 meeting, that we will train all operating crews that
11 are in transient accident conditions on the simulator
12 prior to -- prior to the refueling outage. So the
13 simulator will be fully exercised under transient and
14 accident conditions.

15 There is -- the simulators across the
16 nation are of some, but limited, use. It usually
17 works the other way around. You benchmark the
18 simulator to the plant, or you benchmark the simulator
19 to a more detailed model, like the LTC code. But we
20 still use the simulator as a second check, a third
21 check, but we recognize its limitations.

22 So the answer is, yes, we'll exercise it;
23 yes, we'll look at it. If we find any -- any
24 abhorrent behavior or abnormal results, we will
25 certainly look into that further. But it is -- it's

1 a tool, but it --

2 MEMBER ROSEN: Isn't that another argument
3 for doing the turbine trip test at the new 108 percent
4 power, so that you can get the data you need to tune
5 the fidelity of the simulator?

6 MR. MITCHELL: We believe that we'll be
7 able to get that data through the power ascension
8 program also. They will be collecting data off the
9 plant computer that will allow updating the simulator,
10 and the simulator is a valuable tool. Everything
11 David said is correct, but I can tell you during a
12 previous power uprate, in my experience, we did find
13 something -- running stuff on a simulator that would
14 not have been found under a normal turbine trip
15 dealing with feed pump speeds. So we were able to
16 correct something based on the simulator data.

17 MEMBER DENNING: In Russia, there is a
18 regulation that any new significant change in the
19 control system has to be tested on a simulator before
20 it is actually operated in the plant.

21 MR. CONSTANCE: I guess what I'm saying,
22 the LTC code is a better simulation than what we have
23 installed at Waterford, yes, which is a good simulator
24 for training purposes.

25 MEMBER WALLIS: Can we move on?

1 MR. CONSTANCE: Yes. I wanted to point
2 out that the LTC code has a long history of accurate
3 -- accurate modeling of plant performance at numerous
4 plants including being tested -- being used to model
5 Appendix K power uprates and one extended power
6 uprate. The LTC code has been well benchmarked at
7 Waterford 3 using natural plant transients.

8 Next slide.

9 This slide lists the recent plant
10 transients that were used to validate the LTC code.
11 Benchmarking revealed good to excellent correlation
12 between the calculational model and the actual plant
13 response.

14 Note that in contrast -- in contrast to
15 the original turbine trip transient, which was
16 performed at 84 percent rated thermal power, the
17 current benchmark load rejection transient is a 100
18 percent turbine trip, which is approximately 92.5
19 percent of the post power uprate rate at thermal
20 power.

21 So we have a current benchmark which is
22 closer to the one that was found acceptable in initial
23 power startup testing.

24 Next slide.

25 After reviewing each planned

1 modification --

2 MEMBER WALLIS: Is this a summary of what
3 you just told us?

4 MR. CONSTANCE: I think so. The only
5 thing I wanted to add was that we -- we looked hard to
6 find ways to validate the performance of this
7 equipment and systems before we incur a transient,
8 planned or not planned.

9 The reason for this is that a large
10 transient from a high power level resulted in
11 unnecessary and undesirable transient cycle and plant
12 systems. And the risk associated with the intentional
13 introduction of a transient initiator, while small,
14 should not be incurred unnecessarily. The additional
15 risk in the power grid, while not quantified, should
16 also not be overlooked.

17 Based on this, we find that the value that
18 is left in performing a large transient test doesn't
19 justify the small increased -- small risk incurred due
20 to a transient test, and it doesn't justify the
21 transient on the plant equipment and the challenge to
22 plant equipment systems.

23 We believe that our post-modification
24 testing and our startup testing, and our continuous
25 test program validates and verifies the operability of

1 the systems required for extended power uprate.

2 MEMBER WALLIS: Does the committee have
3 any more questions, or can we move on to the staff
4 presentation? Thank you very much.

5 MR. CONSTANCE: All right. You're
6 welcome.

7 MR. MARSH: Thank you, Mr. Chairman. I'd
8 like to introduce Steve Jones, who is a Senior Reactor
9 Engineer from Plant Systems Branch. Steve is an ex-
10 Senior Resident Inspector of Millstone and has
11 operational experience.

12 MR. JONES: Good morning. As Tad
13 mentioned, I'm Senior Reactor Systems -- Steve Jones,
14 Senior Reactor Systems Engineer at Plant Systems
15 Branch, and currently Acting Section Chief of the
16 Balance of Plant Section.

17 Briefly, I think you've seen the
18 modification several times before. I just wanted to
19 point out that they -- the physical modifications of
20 plant as opposed to instrumentation setpoint changes
21 are outside the safety-related or important to safety
22 boundary near the steam generators.

23 Next slide, please.

24 As Tad mentioned earlier today, this is
25 the first application of our new review standard, and

1 also the first real challenge to the standard review
2 plan Section 14.2.1. That guideline for extended
3 power uprate test program does look initially at what
4 the initial test program was for the plant and
5 includes the large transient testing and the scope of
6 that review standard.

7 Next slide, please.

8 Okay. The justification for eliminating
9 large transient testing -- I'm sorry. The SRP
10 provides supplemental guidance for evaluating the
11 alternative approaches that might be used to justify
12 elimination of large transient tests, and a lot of
13 that is based on operating experience, the potential
14 that the modifications might introduce a new or
15 unexpected phenomena or system interaction, the
16 validity of the analytical methods used for analyzing
17 the plant response to transients at the EPU
18 conditions, and the degree of margin reduction in the
19 safety analysis.

20 MEMBER WALLIS: Well, that last bullet is
21 something which is really quantified. So how do you
22 decide what the degree of margin reduction is?

23 MR. JONES: I think --

24 MEMBER WALLIS: We all have a suspicion
25 that as you start, you know, pushing the envelope and

1 doing various things you may be reducing some margin,
2 but we don't have some numbers for it.

3 MR. JONES: Well, there are certain
4 transients that certainly show up, like the amount of
5 auxiliary feedwater flow that's needed at post EPU may
6 change what was needed before. But if it stays within
7 the design capability of the degraded single AFU pump,
8 you'll have an idea that the margin change is not all
9 that great.

10 MEMBER WALLIS: So then you're looking at
11 how close something is to the limit.

12 MR. JONES: In terms of the systems, we
13 are largely discussing what the turbine trip or load
14 rejection -- for instance, you don't -- that would not
15 be testing those types of systems. So, in general, we
16 don't -- we don't have that issue here. But that is
17 included as one of the parameters to consider in the
18 SRP review.

19 The initial application didn't address
20 specifically or in great detail the SRP review
21 criteria. The staff requested additional information
22 in those several areas, and the justification provided
23 by Waterford -- next slide, please -- included
24 describing their test program in more detail and the
25 monitoring of important parameters during EPU power

1 ascension as Entergy just described.

2 Also, there are existing tech spec
3 surveillance and post-modification testing that will
4 be performed on modified components.

5 In addition to the operating experience
6 that Entergy described at Waterford that was used to
7 benchmark the code, they also provided information on
8 use of that code at ANO-2 for a post uprate transient
9 and the degree to -- that that code was able to
10 successfully model the transient at ANO-2.

11 Let's see. Again, as Entergy mentioned,
12 the code has been benchmarked to that operating
13 expense for use at Waterford, and the scope of
14 modifications likely to affect the transient response
15 of the plant are limited to largely the setpoint
16 changes, mostly having to do with the steam bypass
17 control system and the feedwater control system.

18 One point we noted with the code used, the
19 LTC code used to model plant responses, that it did
20 model specifically the transmitter response, and that
21 it could accept a setpoint change and look at the
22 changes in the plant response based on that input.

23 Next slide, please.

24 The objectives for the test program are
25 largely laid out in Reg. Guide 1.68, involves operator

1 training and familiarization with the plant,
2 confirmation that the design and installation of
3 equipment is adequate, benchmarking of an analytical
4 code to the plant is accurate, and confirming the
5 adequacy of emergency and operating procedures.

6 We considered that many of those, or
7 essentially all of those, objectives are satisfied
8 based on the operating experience that the plant has
9 recently had, and those -- that operating experience
10 being used to benchmark the existing code.

11 Due to the limited extent of
12 modifications, any benefit we would see from a large
13 transient test here seems very limited to problems
14 that may exist at -- you know, following any refueling
15 outage essentially that could introduce --

16 MEMBER ROSEN: It's a curious word -- you
17 use "limited" extent of modifications. I would have
18 characterized the modification extent as significant.
19 Why do you have a view that they're limited?

20 MR. JONES: Well, I mean, it didn't
21 involve the, for instance, replacement of a feedwater
22 pump, addition of a second atmospheric dump valve.

23 MEMBER ROSEN: It's got a whole new high
24 pressure end to the turbine.

25 MR. JONES: I don't find that to be

1 significant with respect to reactor safety.

2 MEMBER ROSEN: There's a long list of
3 things that -- you've been through that list and still
4 believe that's a limited modification. I would say
5 the engineers at Waterford probably don't think so,
6 but --

7 MR. JONES: Compared to what I expect to
8 see from other EPUs, this is a fairly limited scope of
9 modification.

10 MR. MITCHELL: Waterford would agree with
11 that. We don't feel that the modifications for this
12 power uprate are that extensive. The HP turbine is
13 the biggest of those, where we're changing the steam
14 path. Again, we don't feel that a large transient
15 test would provide any additional assurance of that
16 modification.

17 MR. MARSH: But what I think Steve is
18 saying -- this is Tad Marsh -- is no new structures,
19 no new systems, no new instrumentations, no new trips
20 being added to the plant, no new safety analyses,
21 evaluating new types of events. This is basically
22 taking the plant, modifying it safely, and analyzing
23 the new plant to make sure that it's going to operate
24 correctly.

25 MEMBER ROSEN: Analyzing but not testing.

1 MR. MARSH: True.

2 MR. JONES: But testing -- all of the
3 equipment, as I had mentioned, has been tested from a
4 plant trip at 92-1/2 percent of the uprated power.
5 The only new device is really the high pressure
6 turbine, and that's simply isolated at the time of the
7 turbine trip. It's not -- it's not really going to be
8 successfully tested by that transient.

9 MEMBER WALLIS: I wonder whether
10 modification would be necessary in order for you to
11 ever require a large transient test. What kind of
12 modification would lead you to require a large
13 transient test?

14 MR. JONES: Certainly if it came to the
15 extent of adding new components that were never part
16 of the plant before, or new accident analysis,
17 something that would introduce a new accident,
18 certainly --

19 MR. MARSH: Or if there were a plant that
20 had been shut down for an extended period of time, and
21 whose structures and systems hadn't been exercised,
22 you know, that may be an opportunity to -- a point
23 where it may be necessary.

24 Mr. Chairman, let me say something. This
25 is -- as we tried to say before to the committee and

1 to the subcommittee, this is not a clear-cut issue.
2 This is nothing that is absolutely definitively you
3 fall on one side. There are good arguments and points
4 that need to be aired both sides on this -- on this
5 point, and this is something that we -- we have done.

6 There are folks on the staff who feel
7 differently about the conclusion that we have drawn,
8 and we have ventilated those issues. So this is
9 certainly not something that absolutely positively
10 we're all, you know, on this side.

11 This is a close call, and this is one that
12 we carefully consider. We believe we've made the
13 right decision, justified by our own judgment. But
14 there are good views to the -- on the opposite side,
15 and we've heard some of those.

16 MEMBER WALLIS: Okay.

17 MR. JONES: Last slide, please.

18 Okay. Just to wrap it all up, the
19 standard review plan, Section 14.2.1, laid out some
20 specific justifications that staff has used in
21 evaluating whether or not elimination of large
22 transient tests is justified.

23 In response to the staff's RAIs related to
24 this issue, Entergy provided substantial information
25 in line with the SRP requirements, and we believe they

1 provided adequate justification to eliminate the large
2 transient tests. Did not believe the large transient
3 tests would provide any new significant information
4 that would enhance nuclear safety or really enhance
5 their ability to model plant transients, given the
6 existing operating experience of the plant.

7 And the fact that the existing equipment
8 in the plant has been maintained, there is no -- no
9 change in valve components or instrumentation that --
10 that would respond to a reactor trip or a load
11 rejection transient.

12 MEMBER WALLIS: All right. Thank you very
13 much.

14 Are we ready to move on to hear more about
15 steam generator dryers?

16 MR. TATUM: Dr. Wallis, if I may, I have
17 some clarifying comments I'd like to make on this
18 large transient testing. My name is Jim Tatum. I'm
19 Senior Reactor Engineer from the Plant Systems Branch.

20 And there's a couple of points that I
21 think deserve clarification, because they don't really
22 come out very well in the safety evaluation that we've
23 written.

24 And I don't know to what extent that may
25 have some bearing on the decision, but, first of all,

1 the modeling of the secondary plant in the transients
2 that are done -- the Licensee uses the LTC code, and
3 based on what we've seen for the current power level
4 operation, we would I think agree that the modeling
5 has been done well, it's been benchmarked for the
6 current 100 percent power level operation.

7 However, as far as the uprate goes, eight
8 percent uprate -- and I think, you know, there's been
9 a lot of discussion here about the specific
10 modifications in question, but I would suggest we not
11 lose sight of the fact that one of the modifications
12 is, in fact, the eight percent uprate.

13 And the staff -- we have not looked or
14 done any sort of a review of the LTC code to
15 understand what are the sensitivities, what are the
16 non-linearities in uprating eight percent, and, in
17 fact, whether or not the plant would be adequately
18 modeled at the eight percent uprate level such that
19 the elimination of any transient testing is really
20 warranted.

21 So that's one point that's not brought
22 out. We did not do a detailed technical review of the
23 LTC code, so we don't have that information. Our
24 judgment is qualitative and it's based on what the
25 Licensee has given us.

1 The other point that I would like to make
2 is that -- and this is a clarification going back to
3 the subcommittee. We had indicated that there have
4 been a number of precedents set for the power uprates,
5 and that's true. However, focusing specifically on a
6 PWR uprate, the only other uprate that has been done
7 for a PWR is ANO-2 back -- we approved that back in
8 April of 2002.

9 Now, in that case, the Licensee had
10 planned to do a 25 percent load rejection, at least to
11 get some test data to confirm the adequacy of the
12 modeling, and what not, the assumptions that had been
13 done. So, you know, if we're talking about
14 precedents, I think it's important to focus on PWRs
15 versus PWRs and not the whole range of uprates that
16 are out there, because PWRs are very different from
17 boilers.

18 And as far as the LTC code, the staff
19 typically, when we do reviews for the balance of plant
20 systems for that part of the plant, we don't typically
21 review those codes. We rely on the licensees to do
22 that, and typically they do a good job, and we don't
23 expect to see problems during transient testing.

24 However, because all the plants are
25 different on the secondary side, it would be a

1 monumental task for us to review in detail the codes
2 and how they're applied in all cases in a manner
3 similar to what Reactor Systems Branch does.

4 And so historically what we have done is
5 we have relied upon transient testing. Granted, it
6 may be a few data points, but what those data points
7 do for you is it provides the Licensee an opportunity
8 to go back and check the modeling that has been done
9 and confirm that it -- at the uprated power level
10 that, in fact, the predictions are satisfied for those
11 specifics tests that were run.

12 And so it gives us some additional level
13 of comfort, I would say, in demonstrating that the
14 modeling was done properly, since we really don't do
15 a detailed technical review of that.

16 And that -- those are the couple of
17 points. I just wanted to make sure the committee was
18 familiar with the extent of the staff review with
19 regard to the modeling that's done. I wouldn't want
20 you to have the wrong impression.

21 MEMBER ROSEN: Let me ask just one
22 followup question. You did say that ANO-2 is the only
23 precedent for this BWR uprate of this size?

24 MR. TATUM: In fact, it's the only one I'm
25 familiar with, and it's not of this size. It's a

1 smaller plant. Even now at the uprate condition I
2 don't believe it operates at the power level that
3 we're looking at here, and so the LTC code -- its use
4 on ANO really would not reflect the higher power level
5 that we're looking at here for Waterford.

6 MEMBER ROSEN: But staying with ANO now,
7 did you say that ANO did a generator breaker opening
8 test at 25 percent power?

9 MR. TATUM: They were -- as a result of
10 the review, they had committed to do a 25 percent load
11 rejection. The initial attempt for the load rejection
12 was delayed due to some problems. They had
13 rescheduled it for 90 percent power. They had some
14 problems with the turbine control valves before they
15 did the test and convinced the staff that they got
16 enough data from that problem with the turbine control
17 valves that they satisfied the 25 percent load
18 rejection.

19 MEMBER ROSEN: So they never did the test.

20 MR. TATUM: Never did the test that I am
21 aware of, other than -- and I don't know. I couldn't
22 speak to what the actual load rejection might have
23 been with the problem with the turbine control valves.

24 MEMBER ROSEN: Okay.

25 MR. TATUM: But I would agree with Tad

1 Marsh. I mean, reasonable people can agree to
2 disagree, but I think we all should be working from
3 the same facts.

4 MR. MARSH: Mr. Chairman?

5 MEMBER WALLIS: If the decision is equally
6 balanced, maybe it's not too important.

7 MR. MARSH: Yes. Mr. Chairman, I just
8 want to thank Jim for commenting, and this is -- this
9 is demonstrating what we're saying, that there are
10 good questions, good arguments, that can come out, and
11 we appreciate these views. We did -- and Jim has more
12 thoughts I know that we've talked about internally,
13 and we have ventilated these up through our senior
14 management.

15 And I'm not sure what you would like to do
16 at this point, whether you would like to go point by
17 point, or how you would like us to go --

18 MEMBER WALLIS: Let's just move on. I'd
19 not sure the committee needs to --

20 MR. MARSH: Okay.

21 MEMBER WALLIS: -- although I'm happy with
22 whatever way you wish to do so.

23 MR. MARSH: Right.

24 MEMBER WALLIS: My inclination is to move
25 on to hear about steam dryers.

1 MEMBER ROSEN: Yes. I am, too, and I
2 think I agree with Tad -- is that this is a question
3 of -- I think we all have almost the same set of
4 facts.

5 MR. MARSH: Right.

6 MEMBER ROSEN: I think it's a question
7 where you come down on it.

8 MEMBER WALLIS: I think we've got the
9 information. Thank you.

10 MR. MITCHELL: Just in closing up that
11 section, I guess I can provide a couple more facts on
12 ANO-2, because I was present for that. It was never
13 a breaker open test. It was 25 percent load rejection
14 from 100 percent was the original intent.

15 The control valve transient was about a 10
16 percent transient that did prove the transient, and
17 subsequent ANO did have 100 percent -- had a reverse
18 power relay fail that would have been a breaker open
19 test. But it was an unplanned trip approximately six
20 months into the cycle.

21 In that case, the LTC code, which is one
22 of the pieces that we looked at heavily, did predict
23 accurately the performance of ANO-2. And we have used
24 ANO-2 data as well as our own data to make sure that
25 our LTC code is also capable of predicting that

1 performance.

2 MEMBER ROSEN: So it was a generator load
3 reject of 25 percent from 100 percent is what they
4 planned to do?

5 MR. MITCHELL: It was a generator load
6 rejection, not a breaker open. It was a 25 percent
7 transient. It was actually a turbine load reduction.

8 MEMBER ROSEN: So, yes, the plant would
9 have ended up at 75 percent as tested and done
10 successfully.

11 MR. MITCHELL: That was the original plan,
12 that is correct.

13 MEMBER ROSEN: Okay.

14 MR. MITCHELL: Now, there were actually
15 two incidents of the control valves going closed. It
16 was due to a turbine control valve problem. That data
17 did substantiate the LTC code, as well as six months
18 later the plant tripped, as part of a reverse power
19 relay failure.

20 So, in conclusion, I'd also like to stress
21 that we have challenged ourselves internally and been
22 challenged externally at looking at transient testing,
23 and we have concluded what we presented today, really,
24 that there is very little additional data provided
25 over what we've been able to ascertain, and that the

1 testing we do plan adequately proves the uprated plan.

2 Now we're going to shift towards the steam
3 dryers, just a little bit of introduction. As we
4 discussed in the subcommittee, past operating
5 experience and inspections we believe proves our dryer
6 performance. There are a number of differences
7 between our dryers and those dryers on a boiling water
8 reactor, and we do have some good comparisons with
9 Palo Verde that we will be able to go through where
10 the dryers see a higher loading than what we will
11 experience with our power uprate.

12 So this -- it was also requested that we
13 provide a visual comparison between the Waterford 3
14 dryers and the Palo Verde, and we will provide that.
15 And we also had a lot of discussion on MSIV operations
16 -- was there any way a loose part could impact the
17 operation of the main steam isolation valves. We'll
18 also talk about that.

19 So right now I'll turn it over to Don.

20 VICE CHAIRMAN SHACK: Just another
21 question on the steam generator. What kind of
22 plugging margin would you have left after the uprate?

23 MR. MITCHELL: We are analyzed to go to
24 1,000 tubes per generator. We are currently at
25 roughly 1,000 total per generator. One is at I

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1 believe around 600, and the other one is a little
2 under 400.

3 VICE CHAIRMAN SHACK: Fifty percent I
4 guess that --

5 MR. MITCHELL: Don?

6 MR. SISKA: Good morning. My name is Don
7 Siska. I worked at Combustion Engineering
8 Westinghouse for a little over 28 years, about the
9 last 13 years or so did primarily with operating steam
10 generators. So I'm going to give a little discussion
11 on the dryers that are currently in the Waterford
12 steam generators.

13 As you can see, these things are really
14 fairly small. They are only about 8-5/8 inches tall.
15 There are 162 of them in the Waterford steam
16 generators, arranged in about 12 rows across the upper
17 steam drum.

18 MEMBER WALLIS: These are not safety-
19 related components.

20 MR. SISKA: That is correct, sir.

21 Each dryer has 78 chevrons or corrugated
22 plates on each side, so there is a total of 156 of
23 these chevrons in each dryer. And you'll see in those
24 little holes that they kind of put in there by hand,
25 those represent half-inch bolts that connect each

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1 dryer to each other. So it's a total of four along
2 the bottom and then one up about 3-1/2 inches up from
3 the others. And those are on each side of the row.

4 So if you can imagine, each one of those
5 connects to another and another and another, as many
6 as 20 across one row.

7 What's not shown there is on the side
8 underneath the chevrons. There are three slotted
9 holes in which three more bolts -- half-inch bolts go
10 in, so there's a total of three on each side.

11 MEMBER ROSEN: And those bolts are up and
12 down?

13 MR. SISKKA: Right. Those are also
14 sideways. They're little U channels that come up, and
15 they bolt sideways into it.

16 MEMBER ROSEN: So this is all to hold this
17 massive -- all these modules, we'll call them,
18 together.

19 MR. SISKKA: Right. There are a total of
20 16 half-inch bolts in each dryer.

21 MEMBER ROSEN: And the steam flow
22 direction is upward through the bottom?

23 MR. SISKKA: It is up and then out in like
24 a Y.

25 MEMBER ROSEN: Okay.

1 MR. SISKKA: So these dryers individually
2 are very small, you know, and have a very rigid --
3 rigid structure to them, very kind of robust and
4 compact if you will.

5 MEMBER ROSEN: And they're made out of?

6 MR. SISKKA: The sides are 3/16 carbon
7 steel, and the top and bottom plate are 10-gauge
8 carbon steel.

9 MEMBER ROSEN: The chevrons themselves
10 are?

11 MR. SISKKA: The chevrons themselves are
12 24-gauge carbon steel.

13 MEMBER ROSEN: These dryers are not
14 unusual. They're the same dryers that have been in
15 all original Combustion Engineering steam generators
16 since CE started building steam generators. They are
17 also -- they came really from the original history
18 that Combustion Engineering had with the Fossil units.
19 They're the same ones -- in fact, what's left of
20 Combustion Engineering Fossil now puts in some of
21 their units. They are very similar.

22 They have been used, really, since the
23 1940s. As I said, they are 8-5/8 inch tall, and they
24 have at the base 12 -- essentially a one square foot
25 entrance region for the steam. And they have a very,

1 very low pressure drop. So they're not designed to
2 remove a whole lot of moisture, if you will. The
3 pressure drop that we predict for Waterford goes up
4 from about .2 to .25, so it's a very, very small
5 change we expect in these dryers.

6 Now, back in the 1970s, these dryers --

7 MEMBER WALLIS: Is this steam slightly
8 wetter with the uprate or --

9 MR. SISKKA: It's possible, yes. We're
10 predicting a slight increase in the moisture
11 carryover.

12 MEMBER ROSEN: Can you quantify that?
13 What is it now, and what would you --

14 MR. SISKKA: Well, right now I believe the
15 measured value is around .15, .18, in that region. We
16 expect it to go up about --

17 MEMBER WALLIS: That's in percent?

18 MR. SISKKA: In percent, yes.

19 MEMBER ROSEN: Finish your sentence. You
20 expect it to go to?

21 MR. SISKKA: About .22. But that value is
22 -- is a calculated value. I believe Waterford is
23 planning on running a moisture carryover test.

24 MR. MITCHELL: This is Tim Mitchell. We
25 are doing a moisture carryover test early in the

1 cycle, so --

2 MEMBER WALLIS: This is the moisture after
3 the steam dryers or before?

4 MR. SISKKA: After.

5 MEMBER WALLIS: So when it comes in, what
6 sort of moisture is there?

7 MR. SISKKA: Typically quite low. The
8 separators output a value of around two to four
9 percent, so the input to the dryers is very low
10 moisture.

11 MEMBER WALLIS: But input is probably two
12 percent, and then it dries it out to .2 percent.

13 MR. SISKKA: To .2 about, right. That's a
14 typical number.

15 MEMBER SIEBER: So underneath this is a
16 steam separator?

17 MR. SISKKA: Correct.

18 MEMBER SIEBER: Centrifugal?

19 MR. SISKKA: Yes.

20 MEMBER SIEBER: Okay.

21 MR. SISKKA: Back when Combustion
22 Engineering was designing Palo Verde, there was some
23 concern that these dryers would not be able to
24 withstand the higher loadings, so we initiated a test
25 program and ran typical loads of about 30- to 60,000

1 pounds per hour, also varied the pressure from about
2 600 psi to about 1,200 psi, and collected data on a
3 number of things, primarily --

4 MEMBER WALLIS: You varied the wetness as
5 well, varied the amount of moisture?

6 MR. SISKA: Well, it was -- yes, because
7 it was a test of both separators and dryers. So the
8 higher flows would see more moisture in some cases,
9 and in some cases less. And essentially what we did
10 is develop curves.

11 MEMBER WALLIS: So you covered the flow
12 rate range and the moisture rate -- moisture range
13 from Waterford?

14 MR. SISKA: Yes. And right now we expect
15 the average flow through these dryers to be a little
16 over 51,000 pounds per hour, so that's well within
17 what we would see at -- in our test program.

18 This slide shows a comparison with Palo
19 Verde, and I want to emphasize these are identical
20 steam dryers. Palo Verde upper steam drum has a
21 little smaller -- it's about 20 inches smaller, it's
22 232 inches versus Waterford, which is 253 inches. As
23 a result, Palo Verde has 20 fewer dryers. It has 142
24 versus Waterford's --

25 MEMBER WALLIS: But they're the same dryer

1 in units.

2 MR. SISKKA: They're identical, correct.

3 Of course, you can also notice Palo Verde
4 has two main steam nozzles. One other point I'd like
5 to make about that is the distance, you know, from the
6 dryers to the nozzles is rather significant. You
7 know, the flow that comes up through the dryers, once
8 it gets through the dryers, it's a very wide section
9 of the steam drum, and really slows down. So the
10 dryers do not see any of the real turbulent region in
11 the steam drum.

12 MEMBER ROSEN: And there's nothing else up
13 there.

14 MR. SISKKA: Absolutely nothing. You can
15 walk around up there. In fact, Waterford even has
16 more room, because it's a -- it's a bigger head than
17 Palo Verde. One other thing that Waterford --

18 MEMBER WALLIS: It's a short person if
19 they're walking around at Palo Verde.

20 MR. SISKKA: Well, at Palo Verde you would
21 be, correct. But you could be fairly tall at
22 Waterford.

23 Palo Verde also has two -- the two nozzles
24 have Venturis in them. So actually the one nozzle in
25 Waterford has more flow area than the two nozzles at

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1 Palo Verde.

2 MEMBER FORD: So your CPI is that -- is
3 very unlikely, even though a part of the steam dryer
4 may become detached by corrosion fatigue or whatever.
5 It is very unlikely that it could be going up that
6 seven feet up into the main steam isolation valve, is
7 that right?

8 MR. SISKKA: That's correct. The flows are
9 just too small. And I'll go into that in a little
10 more --

11 MEMBER WALLIS: Okay.

12 MR. SISKKA: -- detail. This slide I'd
13 like to just go through quickly. It shows the
14 comparison of Waterford to a typical BWR, and I'm
15 certainly not going to be here to discuss the BWRs.
16 But the one point I wanted to make is that in general
17 in the BWRs the flow goes up, takes a 180-degree turn,
18 and then takes another 90-degree turn to get out the
19 nozzle.

20 And in that one region it's susceptible to
21 -- it's a very high flow. It flows upwards of 100
22 feet per second and power -- or pressure fluctuations.
23 And the only point I want to make with this slide is
24 that the Waterford upper steam drum is a completely
25 different animal.

1 MEMBER ROSEN: And the velocity is in
2 Waterford? What do you --

3 MR. SISKKA: Typically about nine feet per
4 second.

5 MEMBER ROSEN: Versus 100 feet per second.

6 MR. SISKKA: That's nine feet per second
7 through the dryer. It then slows down after it goes
8 back, and then as it goes towards the nozzle of course
9 it speeds up again. But through the dryer, where we
10 would expect to see the problems, it's about nine feet
11 per second, 9.3 I think to be exact.

12 MEMBER SIEBER: What is the total steam
13 flow to the turbine at Waterford from the first steam
14 generator?

15 MR. SISKKA: The first steam generator --
16 8.3, 8.2996×10^6 to be exact.

17 MEMBER SIEBER: Okay. And so the number
18 you quote here for the flow is per dryer.

19 MR. SISKKA: Correct.

20 MEMBER SIEBER: Okay.

21 MR. SISKKA: And, again, that's an average
22 value.

23 MEMBER SIEBER: Yes, the 58 or 51,000.

24 MEMBER WALLIS: You tested one dryer at a
25 time.

1 MEMBER FORD: When you did the testing,
2 when you mentioned you had done some testing
3 beforehand, what were the outputs from that test?

4 MR. SISKKA: Primarily, we were looking for
5 pressure drop and moisture content.

6 MEMBER FORD: But no vibration.

7 MR. SISKKA: No. No. We were not looking
8 at structural issues there. We did not consider that
9 to be of concern.

10 MEMBER FORD: The reason why I guess that
11 we keep bringing it up, it's of course hinged on the
12 BWR performance.

13 MR. SISKKA: Right.

14 MEMBER FORD: And you correctly point out
15 that it's very different designs. But in the BWR
16 performance, the unexpected failure that occurred at
17 Quad Cities, etcetera, was because of not primary mode
18 vibration but secondary and tertiary mode vibration.

19 So you don't really know -- and I'm just
20 being devil's advocate here -- you don't really know
21 that by increasing the flow rate through the steam
22 dryer at Waterford that you are not increasing the
23 vibration frequency amplitude.

24 MR. SISKKA: We can't say for 100 percent
25 sure. However, it is still bounded by the 20 years of

1 operation at Palo Verde. They have higher steam flows
2 than --

3 MEMBER FORD: But surely the aerodynamics
4 at Palo Verde is not the same as at Waterford.

5 MR. SISKKA: Probably not. I mean, they're
6 not identical, but they're very, very close. I would
7 expect because it's a smaller steam drum that the
8 conditions at Palo Verde would be more severe.

9 MEMBER FORD: Yes.

10 MR. SISKKA: But, you know, there's no way
11 to say for sure. That would be my expectation.

12 MR. MITCHELL: I believe the testing that
13 was done prior to them being used at Palo Verde also
14 provides us data and assurance that we know the
15 conditions post power uprate on our dryers.

16 MR. SISKKA: During the last subcommittee
17 meeting, there was also some discussion about loose
18 parts. I wanted to include at least one slide on
19 that. The first thing I wanted to say is that there
20 has never been a dryer failure that we know of.

21 MEMBER SIEBER: Yet.

22 MR. SISKKA: There has been over 200
23 reactor-years of operation. We believe the Palo Verde
24 operation shows -- is more severe than what Waterford
25 will experience during the uprate, or following the

1 uprate.

2 The only failures, if there are any, that
3 I could speak of are summertimes we have gone in
4 during an outage to do an inspection and find a bolt
5 missing. There are -- these nuts and bolts are almost
6 all below the dryer deck, with the exception of those
7 that have to attach to the channels and at the end.

8 And if you can imagine, to get to these
9 dryers and to take them out, there's only one way to
10 get to them and that's from underneath. So the nuts
11 that are on the other side are all welded in place,
12 and just the bolt will go in there. So even if one of
13 those nuts fell off, they essentially just fall into
14 the dryer drain channel. And there's almost no flow
15 there.

16 So, really, all of the nuts, bolts, and
17 lock washers are either below the dryer deck or, at
18 worse, would fall into a dryer drain channel.

19 MEMBER ROSEN: Is there any way into that
20 drain channel? And could you go in and look to see if
21 you were losing --

22 MR. SISK: Yes, by going -- and Waterford
23 does, on a regular basis, not every outage, but they
24 will take the -- several dryers out and go out and
25 look above to make sure, you know, everything looks

1 okay out there.

2 MEMBER ROSEN: So they actually can get a
3 person in?

4 MR. SISKKA: Yes. You have to take three
5 or four dryers out, depending on the girth of the
6 person.

7 MEMBER ROSEN: So what has been found?
8 What has been found there?

9 MR. SISKKA: To my knowledge, nothing.

10 MEMBER SIEBER: Have you ever had
11 instances where nuts and bolts went down through the
12 tube bundle through the separator?

13 MR. SISKKA: We have certainly found nuts
14 and bolts down on the tube bundle. I don't know --

15 MEMBER SIEBER: From the dryer.

16 MR. SISKKA: Yes. I don't know if they,
17 you know, were from the dryer.

18 MEMBER ROSEN: Can we hear from the
19 applicant what you've seen if you have done those
20 inspections?

21 MR. MITCHELL: The inspection program has
22 never revealed anything. I can't say that we've never
23 seen a bolt or a nut missing. Okay. I have
24 validation. We have never found a nut or a bolt
25 missing. While I agree that that is possible, I think

1 it would be trapped up above and captured in the drain
2 area, just from the physical --

3 MEMBER WALLIS: Never found a bolt missing
4 or a missing bolt? And a bolt missing would be a hole
5 with no bolt, but --

6 MR. MITCHELL: Right.

7 MEMBER WALLIS: -- a missing bolt would be
8 a bolt with no place to go.

9 MR. MITCHELL: We have never found a bolt
10 missing.

11 MR. SISKKA: Yes. In another plant, I got
12 a phone call one time and got a picture -- they sent
13 me a picture of the missing bolt.

14 (Laughter.)

15 Which was actually -- was a --

16 MEMBER WALLIS: It may never have been a
17 bolt.

18 MR. SISKKA: Right. We did not find it
19 anywhere. It was not --

20 MEMBER SIEBER: I think you have a slide
21 like that in here.

22 MR. SISKKA: I do. You're right.

23 MEMBER WALLIS: A missing slide?

24 MEMBER SIEBER: Yes.

25 MEMBER WALLIS: Okay. I would be more

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1 concerned about flying louvers I think, but --

2 MR. SISKKA: Yes, there's just no real --

3 MEMBER WALLIS: -- they rattle, and then
4 they can break off, and -- but that has never
5 happened.

6 MR. SISKKA: We've never seen that, no.

7 MEMBER SIEBER: Can you tell us what the
8 steam velocity and feet per second was through the
9 loop?

10 MEMBER WALLIS: 1.3, I think you said.

11 MEMBER SIEBER: That's pretty low.

12 MR. SISKKA: That's through the dryer vent.

13 MEMBER SIEBER: Yes, that's pretty slow.

14 VICE CHAIRMAN SHACK: And what's the
15 velocity at Palo Verde?

16 MR. SISKKA: Palo Verde is slightly less
17 than that, but it has much higher pressures. Palo
18 Verde I believe is 8.6.

19 MEMBER WALLIS: RV-squared might be more.

20 MR. SISKKA: Right. So the Rowe V-squared
21 or dynamic pressure is about 10 percent higher at Palo
22 Verde.

23 MEMBER SIEBER: Okay.

24 MR. SISKKA: So, in summary, you know, I --
25 I'm very comfortable saying that the EPU conditions at

1 Waterford are bothered both by the test program that
2 we ran back in the 1970s and by 20 years of operation,
3 or very close to 20 years of operation, by Palo Verde.

4 The flow loadings through these dryers are
5 very, very small. You know, the absorbed energy that
6 you get is very small, and it's really not significant
7 to cause vibration. And any loose parts -- nuts,
8 bolts, lock washers -- the only things we've ever seen
9 and expect -- could not enter the main steam line.

10 MEMBER ROSEN: That's because they formed
11 below? They would be below the dryers?

12 MR. SISKKA: Right. Ninety-five percent of
13 them would be below the --

14 MEMBER ROSEN: Well, what if one was above
15 the dryer? Is there enough lift to get --

16 MR. SISKKA: No. As I said, the only thing
17 that's above are those nuts that are connected to the
18 drain channels. And they're welded. If they happen
19 to come off, they would just fall over. There's no
20 flow right there.

21 MEMBER ROSEN: But even if you took 9.3
22 feet per second and took a nut or a bolt and dropped
23 it, would it fly, or would it just fall down?

24 MR. SISKKA: I'd have to look at it. My
25 guess is it would just fall straight down. They would

1 hardly even notice it.

2 MEMBER ROSEN: The only thing, as Chairman
3 Wallis says, is the chevrons themselves if they came
4 loose might -- might fly in that stream.

5 MR. SISKKA: Those would make a pretty good
6 wing.

7 MEMBER ROSEN: Yes.

8 MR. SISKKA: I do not expect to see any
9 kind of --

10 MEMBER ROSEN: But they are about that
11 long, 10, 12 inches long?

12 MR. SISKKA: No. They're about -- I think
13 they're about seven inches long by some and four and
14 some.

15 MEMBER SIEBER: That's why they have
16 screens on the throttle valves.

17 MEMBER FORD: Could I just as a subsidiary
18 question?

19 MR. SISKKA: Certainly.

20 MEMBER FORD: Does Waterford have glass
21 condensers?

22 MR. MITCHELL: Waterford has a stainless
23 steel condenser.

24 MEMBER FORD: Okay. The reason for the
25 question is it might impact on the value of the steam

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1 dryers.

2 MR. SISKKA: Okay. We're talking tube
3 material, correct?

4 MEMBER FORD: Pardon?

5 MR. SISKKA: Your question was tube
6 material, right, in the condenser? Tube material?
7 Yes, the main condenser has stainless steel tubes.

8 Okay. Thank you very much.

9 MEMBER WALLIS: Thank you.

10 Does the staff have any comment on steam
11 dryers?

12 MR. KALYANAM: No, we are not going to
13 present anything.

14 MEMBER WALLIS: So where are we? Are we
15 at the end here and everyone is going to sum up?

16 MEMBER SIEBER: They must be. It's noon.

17 MEMBER WALLIS: Right. Are you going to
18 sum up first or --

19 MR. MITCHELL: Mr. Chairman, I do have
20 some updated or more precise information that -- tube
21 plugging on the steam generators.

22 MEMBER WALLIS: Yes.

23 MR. MITCHELL: 571 on one generator, and
24 440 -- 484, excuse me, on the other steam generator.
25 So the total number is roughly what I told you.

1 MEMBER WALLIS: I'd like to say that that
2 discussion of the steam dryers was very responsive to
3 the subcommittee's questions. Thank you.

4 MEMBER ROSEN: Joe, could I ask you a
5 question before you start?

6 MR. VENABLE: Yes, sir.

7 MEMBER ROSEN: If for some reason this
8 uprate was not: a) approved, or approved soon, what
9 would -- what would you do at Waterford in terms of --
10 would you refuel and make mods anyway, and go back to
11 existing power?

12 MR. VENABLE: Yes, sir. We have various
13 contingency plans that we have already developed. The
14 generator rewind pretty much does need to be done at
15 Waterford. It's concurrent with the power uprate. We
16 would probably continue and do the generator rewind.
17 We'd replace our main transformer, we'd replace the
18 output breakers, those things on the secondary side we
19 felt we needed to do.

20 We'd definitely make a decision on the
21 turbine rotor itself, and we'd have to do the --
22 execute the contingency planning for the fuel that
23 we've already purchased and how that would interface
24 with the plant. We do -- we are looking at that, and
25 that is a viable option for us if it's not approved.

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1 MEMBER ROSEN: Well, I'm not thinking it
2 wouldn't be approved, but I'm just thinking what would
3 the -- would the plant end up be sitting there
4 forever?

5 MR. VENABLE: No. No, it would not. In
6 fact, with the power uprated like this, you can
7 imagine we just offloaded a 420-ton main transformer
8 associated with the power uprate at our station. Had
9 that transformer been damaged somehow and could not
10 have been able to be used, we would have to fall back
11 on the contingency plan again on what power level we'd
12 go to and how we would do that.

13 MEMBER ROSEN: Okay.

14 MR. VENABLE: So I think all the way
15 through the power uprate there is contingencies for us
16 on what we should do here. Some of them may require
17 more evaluation and decisionmaking.

18 Mr. Chairman, I first would like to thank
19 this committee and the NRC staff for the work
20 performed toward the Waterford 3 power uprate. It's
21 pretty extensive work. We saw a lot of that here
22 today. Again, this was a very challenging,
23 systematic, and thorough approach to a power uprate,
24 and I value that very much as the site vice president.

25 Entergy operates from multiple nuclear

1 sites, both BWR and PWR. We have a depth of our
2 experience in our leadership team that we share and
3 challenge every endeavor that we make.

4 Myself -- my background -- I didn't say
5 that to begin with, but I'll give you a little bit
6 today. I've been working with Entergy for 25 years.
7 Prior to that, I was Navy Nuclear. I have been a
8 Maintenance Superintendent in construction, went
9 through initial startup and testing, normal power
10 operations, refuelings at multiple sites, both BWR and
11 PWR in my 25 years. Been at Waterford for about three
12 years.

13 Been involved with this power uprate since
14 the very first presentation to the Board of Directors.
15 I made the presentation to our Board of Directors,
16 looking and seeing if this power uprate were safe and
17 appropriate for Waterford. We had quite a discussion
18 there at our Board meeting on whether this was
19 appropriate for our station.

20 Last week I personally challenged
21 Westinghouse, Intercon, and Entergy engineers asking
22 them if anyone had any reservation, whether it was
23 margin that was too small, or something that they
24 weren't comfortable with, that we should bring forward
25 and either resolve or stop our power uprate.

1 I still have that question on the table
2 for all of our engineers going forward, anything that
3 may be discovered.

4 I got positive results from that. In
5 fact, got letters from Westinghouse via e-mail right
6 away, challenging -- they set engineers aside, asked
7 open questions with nuclear safety as a priority. No
8 economic questions, no pressure questions, just
9 nuclear safety. They got very, very favorable and
10 positive results.

11 I will tell you that we will continue to
12 challenge, evaluate, and monitor all aspects of this
13 power uprate, and we will do what's appropriate to
14 assure that Waterford is operated safely and reliably.
15 And, again, I'd like to personally thank the committee
16 and the NRC staff for working so diligently with us to
17 get to this point in this power uprate.

18 So I appreciate that, Mr. Chairman.

19 Any questions for me?

20 MEMBER WALLIS: Well, we seem to be
21 mutually thanking each other, so I will thank you.

22 MR. VENABLE: Very good.

23 (Laughter.)

24 Thank you, sir.

25 MEMBER WALLIS: Do we have some final

1 words from the staff?

2 MR. MARSH: Yes. Thank you, Mr. Chairman.
3 I guess I'm sorry, thank you, but --

4 (Laughter.)

5 I appreciate the conversation that we've
6 had today, and I appreciate the dialogue we've had
7 with the licensee. I hope you got a sense of the
8 extent of the staff review, and also the necessity to
9 keep looking at this review standard to make sure that
10 we've got it in an appropriate place, to make sure
11 that we've tuned it properly to issue whatever
12 guidance we need to to the industry in terms of
13 completeness and thoroughness of submittals.

14 Stepping kind of back through the
15 presentations today, long presentations and a lot of
16 discussion on born precipitation today, and I said
17 we'd come back to that, especially the generic aspects
18 of the boron precipitation. So I've asked Mike
19 Johnson, who is the Deputy Director for the Division
20 of Safety Systems and Assessment, to work with the
21 staff and to perhaps summarize for us today where we
22 think we need to go.

23 So, Mike?

24 MR. JOHNSON: Thanks, Tad. I was looking
25 around to see if Frank Akstulewicz was in the room,

1 and he's not. I guess we finished a little bit sooner
2 than he anticipated.

3 Michael Johnson. Frank is in the room.

4 We will be responsive to the issues that
5 are raised by the ACRS, and, of course, if you should
6 recommend, we'll look into the generic aspects of this
7 issue. And I won't go beyond what we've already said
8 with respect to having looked specifically for
9 Waterford and being comfortable with respect to our
10 analysis on boron precipitation and being ready to
11 move forward with respect to that.

12 MR. MARSH: Thank you, Mike.

13 Mr. Chairman, we are satisfied with the
14 information that we've received from the licensee.
15 Recognizing that there still is this docketing
16 information that will come in, we are satisfied with
17 what we have heard in the dialogues that we -- what
18 we've gotten so far.

19 So you and I were chatting just before we
20 reconvened about what -- what to do. I do request
21 that a letter be written endorsing the staff's
22 approach. Staff will not issue the amendment in final
23 unless we are satisfied with the information that
24 comes in. So that's a review that needs to take
25 place.

1 But based on the dialogue that we have
2 had, based on the -- what we have heard today, the
3 dissertations today, we are satisfied, recognizing
4 what Mike said, that we need to look at this
5 generically to see what needs to be done with respect
6 to the staff's approval of the topical report and
7 whether we need to -- to think more carefully. But we
8 do request a letter endorsing our approach.

9 MEMBER WALLIS: Now, this boron
10 precipitation, I understand work was being done until
11 a very short while ago in preparation for these
12 presentations. And my experience of writing reports
13 is that until I've written it down and reviewed it
14 carefully, I don't have an opinion. I'm very careful
15 about saying I decided until I've really decided.

16 So we're sort of waiting for the applicant
17 to give its final word on what it wants to submit on
18 the boron precipitation in terms of the final
19 statement, and we're also waiting for your final
20 review of that. Is that true?

21 MR. MARSH: True enough. We do not have
22 in writing what we have said back and forth to each
23 other. But we would not be recommending to you to
24 approve what the staff is approaching, if we had
25 concerns about the approach that we've heard thus far.

1 So we are satisfied.

2 We've heard verbally -- you are right --
3 we have to review in writing what we have heard to
4 make sure that we get in writing what we thought we
5 were going to get, and that's my commitment to you and
6 to all of us that the amendment won't be issued unless
7 we're satisfied with it. It would not.

8 If the committee is more comfortable
9 waiting for the staff to give you a thumbs up that
10 we've got in writing what we thought we heard, that's
11 fine. We are comfortable with what we've heard
12 verbally thus far.

13 MEMBER WALLIS: Are you comfortable with
14 an experiment where materials are put in a beaker and
15 it's observed but it's not really as a quality
16 assurance test, it's sort of a very, very quick and --

17 MR. MARSH: To be honest with you, it was
18 unclear to me the extent to which the licensee was
19 relying on that for the licensing calculation. You
20 know, it was -- it was unclear to me.

21 MEMBER WALLIS: It would seem to be the
22 basis of this 40 percent number for solubility limit.

23 MR. MARSH: I'm not sure, to be honest
24 with you. Staff could help on that? I mean, I'm not
25 sure the extent to which those numbers came from that

1 experiment.

2 MEMBER WALLIS: So you'd like a letter
3 which says, "We think the staff is on the right track
4 and there;s" --

5 MR. MARSH: Yes, sir.

6 MEMBER WALLIS: -- "one or two things to
7 be resolved, but we believe they will be resolved"?
8 Is that the sort of thing --

9 MR. MARSH: Yes.

10 MEMBER WALLIS: -- you'd like to hear?

11 MR. MARSH: Yes, I do.

12 MEMBER WALLIS: I guess I have to discuss
13 that with my colleagues to see what they --

14 MR. MARSH: Sure.

15 MEMBER WALLIS: -- feel about that. But
16 not at this point.

17 MR. HOLMAN: This is Jerry Holman from
18 Waterford 3. We are relying on those tests to show
19 the solubility limit elevation as a result of the TSP.
20 That would result in a solubility limit of about 36
21 percent, compared to the 28 percent roughly that's
22 used in the current analysis that does not credit any
23 TSP or containment pressure.

24 MEMBER POWERS: A couple more questions
25 about that solubility limit. You're looking at the

1 effect of the trisodium phosphate on the solubility of
2 boric acid in the water, and that trisodium phosphate
3 comes from water dissolving dust pellets that you've
4 put someplace.

5 That someplace, does it bring any
6 additional contamination in -- in particular, things
7 like dust?

8 MR. HOLMAN: The baskets that are filled
9 with the TSP are located in the containment floor
10 where they will be submerged with water. Obviously,
11 there is the potential for debris that gets swept up
12 in that sump water.

13 MEMBER POWERS: What I am concerned about
14 is there are a variety of calcium borate/calcium
15 phosphate compounds that have extraordinarily low
16 solubilities. And if you would per chance incorporate
17 into this some calcium carbonate or, worse, calcium
18 hydroxide, would that cause precipitation of solids?
19 And does that have any detrimental consequences? At
20 what level would that start having detrimental
21 consequences?

22 MR. MITCHELL: This is Tim Mitchell. We
23 talked about insulation and containment as part of the
24 sump debris discussion during a subcommittee. And we
25 did report there that we don't have any calcium

1 carbonate insulation in the containment, so that would
2 be one of the primary sources of --

3 MEMBER POWERS: I guarantee you absolutely
4 you've got calcium carbonate in that containment.

5 MEMBER WALLIS: Coming from the concrete.

6 MEMBER POWERS: That one I positively
7 guarantee you.

8 MEMBER WALLIS: Concrete dust is the --

9 MR. MITCHELL: You said calcium carbonate
10 insulation. Did you mean calcium silicate?

11 MEMBER POWERS: Yes. I'm sorry, I
12 misspoke. You're correct.

13 But I would like to emphasize that the TSP
14 piece is just one element of the conservatism that we
15 were going over. So --

16 MEMBER WALLIS: Anything else? Are we
17 ready to take a break for lunch?

18 MR. MARSH: Mr. Akstulewicz here was just
19 showing some data which the staff has on -- with
20 respect to solubility limits. I just want to make
21 sure that you have that, which seems to agree with the
22 data that we've heard today, you know, with respect to
23 solubility limits. We'd be glad to share that with
24 you, but --

25 MEMBER WALLIS: Is it something you could

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1 put up on the screen? Or just tell us the numbers.
2 Can you tell us the numbers?

3 MR. AKSTULEWICZ: This is Frank
4 Akstulewicz with the staff. There is a graph or a
5 figure in the CENPD document itself which is the
6 approved topical report that is a solubility curve
7 with respect to temperature, and it's -- the source is
8 the U.S. Borox and Chemical Corporation. So we'd be
9 happy to provide this to the committee today, if it
10 would help.

11 MEMBER WALLIS: Okay. Thank you.

12 MEMBER POWERS: Has the staff looked to
13 see if there are precipitates perhaps involving iron?
14 Involved with either the phosphate or the borate or
15 the ternary system?

16 MR. AKSTULEWICZ: I don't know. This is
17 Frank again. From the staff's perspective, we haven't
18 looked at the effect of debris on boric acid
19 precipitation. That's one area that is well beyond
20 where we've been, so we don't have any real
21 information to provide on that.

22 MR. MARSH: This is Ted Marsh again.
23 That's probably part of the going forward that Mike
24 Johnson was talking about -- issues of this sort, to
25 see where we need to go, if we need to think about

1 those things.

2 MEMBER POWERS: Do you have any idea of
3 what -- what level of particulate would start to cause
4 you a headache?

5 MR. MARSH: I'm sorry. What would cause
6 as a headache precipitation -- I missed the first
7 part. I'm sorry.

8 MEMBER POWERS: What concentration of
9 particulate would start causing you a headache?
10 Suppose you got flocculent precipitate.

11 MR. MARSH: I'm sorry. I don't. I'm
12 sorry. I don't know that. I do not have any
13 information one way or the other.

14 MEMBER POWERS: I don't either.

15 MR. MARSH: I just don't have a benchmark
16 for myself. It sounds like we don't.

17 MEMBER WALLIS: Do you have any idea about
18 when boron precipitates how it does it? Does it
19 precipitate on the surfaces? Or does it just make
20 sort of a mush of -- in the liquid, and, therefore, it
21 doesn't really block anything.

22 MR. MARSH: These are good questions.

23 MEMBER WALLIS: Okay. There are a whole
24 lot of questions scientifically about the basis for
25 what happens with concentrated boron --

1 MR. MARSH: I understand.

2 MEMBER WALLIS: -- solution.

3 MR. MARSH: But I think that's -- these
4 are questions the staff needs to think about in terms
5 of the regulatory position, the licensing basis for
6 this and other plants.

7 MEMBER SIEBER: There might even be some
8 research done?

9 (Laughter.)

10 MR. MARSH: What should I say? There
11 might be.

12 MEMBER WALLIS: Is there anything else on
13 Waterford before we break for lunch? Anything else
14 that committee members have on this Waterford uprate?

15 MR. MARSH: Thank you very much.

16 MEMBER WALLIS: Thank you. I propose that
17 we take a break now, and that we break until 1:15, and
18 then we'll take up the matter of the MOX fuel
19 fabrication facility.

20 Thank you.

21 (Whereupon, at 12:17 p.m., the
22 proceedings in the foregoing matter
23 recessed for lunch.)

24 DR. WALLIS: On the record. We are going
25 to take up the matter of the Mixed Oxide Fuel

1 Fabrication Facility and I will hand over to my
2 esteemed colleague, Dana Powers, to lead us through
3 that.

4 DR. POWERS: We'll talk about the Mixed
5 Oxide Fuel Fabrication Facility. The Facility as you
6 are aware is to fabricate fuel made with plutonium
7 dioxide and uranium dioxide for use in a commercial
8 nuclear power reactor. It is in the midst of a
9 licensing approval process that involves two stages.
10 This is the stage that involves the construction
11 permit.

12 There is a subsequent stage that involves
13 the license to possess and utilize special nuclear
14 material. And as you are aware, the requirements for
15 this stage are constrained and in your handout are the
16 specific requirements. I'm sure the staff will touch
17 upon the specific requirement for this stage.

18 But bear in mind the detailed
19 quantification of the safety of this facility is not
20 part of this stage. We are looking primarily of this
21 stage and what are called the design bases, some
22 aspects of the quality assurance program, some aspects
23 of the definitions of structures, systems and
24 components that help provide the functions at this
25 stage.

1 We have had several meetings in connection
2 with this particular facility as it's gone through
3 some evolution in its mission. We did have a recent
4 subcommittee meeting in which I think most of the
5 members were in attendance. Those that were not, I
6 hope we can catch you up to speed very quickly on the
7 facility.

8 We are at the stage now where the staff
9 has completed its safety evaluation report of the
10 construction authorization request and they are
11 looking for a letter from us saying that, I'm sure
12 that they would like it to say that, they had done a
13 wonderful and outstanding job and was complete in all
14 details. We'll see how that comes out, but I know
15 that's what their aspiration is and I believe it is
16 our intention to produce a letter at this meeting.

17 With that introduction, I will say that
18 we're going to talk primarily with the staff here
19 today about their safety evaluation report. DCS has
20 been enough to attend with an interest in answering
21 any questions that we may have about details of the
22 detail and their safety philosophy and I presume some
23 of their plans for moving ahead into the next stage of
24 operation if that comes up. So with that, I'll turn
25 it over to Joe and you guys can go ahead and start

1 unless there are any questions or comments the members
2 would like to make.

3 DR. RANSOM: I have a real quick one. I
4 think I read on some of the NRC home page material
5 that this is only for processing excess plutonium from
6 the U.S.

7 DR. POWERS: Yes.

8 DR. RANSOM: I thought originally it was
9 part of the European or --

10 DR. POWERS: It is part of a cooperative
11 treaty between ourselves and Russia. There is a
12 parallel activity going on in Russia. The two
13 activities are supposed to be moving along with some
14 parallelism. I don't know exactly how parallel they
15 are, but there will be occasional interruptions, I'm
16 sure, as things don't become parallel none of which
17 has any bearing on how we view this AP evaluation
18 report.

19 DR. APOSTOLAKIS: We're not even using the
20 whole amount of America plutonium. Right? Or MOX?

21 DR. POWERS: Absolutely down to the last
22 gram and atom in this country. No. The system is
23 handle about 37 tons.

24 DR. APOSTOLAKIS: I'm a bit confused about
25 what is needed for the construction part.

1 DR. POWERS: We're going to talk about
2 that.

3 DR. APOSTOLAKIS: It's a design basis
4 analysis. Right? But the design basis includes the
5 design basis accidents, doesn't it not?

6 DR. POWERS: Well design basis accidents
7 is a term more peculiar to the reactors. Here you're
8 looking at probable or potential accidents at the
9 facility.

10 DR. APOSTOLAKIS: But are these part of
11 the design basis? I mean we're not going beyond the
12 design basis. Is there such a thing as beyond design
13 basis?

14 DR. POWERS: I mean really. Clearly, you
15 have accidents like meteorite strikes on the facility
16 that we can safely assume are not included in the
17 design basis. And I think this is more a process
18 facility examination. It is a first look at what the
19 safety philosophy of the facility is. They are
20 required to look at things like difference in depth as
21 strategies and not required to adopt them in other
22 cases.

23 You're more likely looking at how they
24 think they're going to approach it. There is a clear
25 bias in the regulations for engineering controls in

1 preference to administrative controls. That doesn't
2 mean to the inclusion of administrative controls.

3 DR. APOSTOLAKIS: Yes.

4 DR. POWERS: So you're trying to look at
5 what the mix is here between prevention and
6 mitigation, what kinds of things that they are doing
7 to protect the work force and the public, what kinds
8 of hazards they are anticipating to take into account.
9 You're not asking them what the risk of the facility
10 is.

11 DR. DENNING: But, and George will be
12 interested in this, there is a risk-based approach
13 towards deciding how much has to be done, when things
14 have to be done.

15 DR. POWERS: Yes, but we don't get into
16 that until stage two.

17 DR. APOSTOLAKIS: Yes, that's what I'm
18 saying but you still have now. This is not for the
19 construction.

20 DR. POWERS: Look at this as the
21 deterministic phase and a good PRA, George.

22 DR. APOSTOLAKIS: Yes.

23 MR. ROSEN: When we get into the other
24 phase, do we call that the ISA?

25 DR. POWERS: Yes, right. Integrated

1 Safety Analysis and that's when George will lose
2 whatever hair remains.

3 MR. ROSEN: And whatever degree of
4 composure.

5 DR. WALLIS: Dana, I have a question for
6 you. You said that this stage we have to be satisfied
7 that the design will provide the function without
8 going into the details. Now sometimes it is easy and
9 even if it's a reactor which has been used before and
10 it's being controlled from going into some unstable
11 region by vents and cooling and all that, that's all
12 state of the art and it's been done before. We don't
13 need to go into the details. It's been done before
14 and it provides a function.

15 But if we have a reactor where we're told
16 it's going to provide the function by venting and
17 cooling and we don't have enough evidence that it's
18 been done this way before without going into the
19 details, we don't know if it's going to work. So how
20 do we assure ourselves something will provide the
21 function.

22 DR. POWERS: The regulations involved here
23 do require that there be some justification for values
24 and what not in them. Now to say it hasn't been done
25 before, I can think of nothing in a fuel fabrication

1 facility that has not been done before multiple times,
2 in multiple ways.

3 DR. WALLIS: Maybe that's where we get
4 assurance, the suitable experience.

5 DR. POWERS: And this particular facility,
6 in particular, is fairly well patterned after existing
7 facilities.

8 DR. WALLIS: Well, maybe that needs to be
9 emphasized.

10 DR. APOSTOLAKIS: So 10 CFR 70 has been
11 used in other context.

12 DR. POWERS: Oh, no. Most fuel
13 fabrication facility, processing facilities, fuel
14 fabrication, yeah, that's done before, but fuel
15 processing facilities have largely been done in this
16 country in the DOE context where you use PUREX and
17 things like that. And there have been a lot of those
18 facilities set up, torn down, rebuilt, blown up.

19 DR. APOSTOLAKIS: So 10 CFR 70 is
20 implemented here for the first time?

21 DR. POWERS: No, I don't think that's
22 clear at all. There are some unique features being
23 applied to the MOX facilities. Dave, do you want
24 touch on that?

25 MR. BROWN: In my presentation, I'll

1 describe a little bit of the history of Part 70.

2 DR. APOSTOLAKIS: Okay.

3 MR. BROWN: And what parts of it are being
4 applied for nearly the first time.

5 DR. APOSTOLAKIS: That's fine.

6 MR. GIITTER: We're currently applying
7 Part 70 to the gas centrifuge licensing reviews for
8 example.

9 DR. APOSTOLAKIS: Let me ask another.
10 Okay. We'll come to that.

11 DR. WALLIS: Let me ask a question in
12 terms of scope of what the British expect of us. If
13 we have questions about the absolute completeness of
14 the design basis parameters.

15 DR. POWERS: Option of what? I'm sorry.

16 DR. WALLIS: The design basis parameters.

17 DR. POWERS: Completeness.

18 DR. WALLIS: For instance the degree of
19 process control or chemical control, the absolute
20 values are put onto those lists. Is that within the
21 scope of our expectations? What is the data? What is
22 the analysis to come up with the voracity of that data
23 and analyses to come up with those design basis
24 parameters?

25 DR. POWERS: Let me say this. I can't

1 give you a completely generalized answer. What I can
2 say is the question that you had posed to me is fair
3 game.

4 DR. WALLIS: Okay.

5 DR. POWERS: The answer may not be
6 entirely satisfactory to you.

7 DR. WALLIS: Right.

8 DR. POWERS: But the question that you
9 have posed in writing is fair game for this briefing.

10 DR. WALLIS: Good.

11 DR. DENNING: Perhaps one area that is
12 clear is the focus is on structure systems and
13 compliments that provide safety. Have they identified
14 really those? We ask this question in -- But with
15 regard to set points, this is not the time when we
16 worry about the set points. It's really a question of
17 have they really identified the structures, systems
18 and components that have to be incorporated into this.

19 DR. APOSTOLAKIS: I don't know what
20 "identified" means.

21 DR. POWERS: That's a different question.

22 DR. DENNING: "Identified" is more than
23 just identified. It's really they've characterized
24 how they're going to include it. I mean we're talking
25 about constructing --

1 DR. APOSTOLAKIS: And why.

2 DR. DENNING: Oh yes, and the why,
3 absolutely. But that's really the question. Have
4 they really provided for the structures, systems and
5 components that will provide after they fine tune them
6 and cut set points and stuff like that the level of
7 safety that will ultimately have to be demonstrated at
8 the operating point.

9 DR. APOSTOLAKIS: Okay.

10 DR. POWERS: Are there any other
11 questions?

12 MR. GIITTER: Okay. Thank you, Dr.
13 Powers. My name is Joe Giitter and I'm Chief of the
14 Special Projects Branch in the NMSS Fuel Cycle
15 Division. As Dr. Power explained, we are proposing to
16 issue a construction permit for the Mixed Oxide Fuel
17 Fabrication Facility and we've asked the Committee to
18 write a letter in support of the staff's safety
19 evaluation report. The road that we've traveled to
20 get to this point hasn't always been free of curves,
21 hills and an occasional chuckhole.

22 In 1998, Congress granted NRC authority to
23 license the Department of Energy Mixed Oxide Fuel
24 Fabrication Facility. At that time, DOE had completed
25 its initial studies on the methods to dispose of

1 surplus weapons grade plutonium and had selected its
2 radiation of MOX fuel in commercial nuclear power
3 plants as a viable disposition path.

4 NRC was faced with the possibility of
5 reviewing its first plutonium facility license
6 application in over 30 years. Two years later in
7 September 2000, NRC staff completed a nine year effort
8 to revise the Part 70 regulations for fuel cycle
9 facilities. The Part 70 revision was one of several
10 initiatives at NRC to risk inform its licensing
11 regulations. The novel challenges of licensing a MOX
12 facility were compounded by the challenge of
13 implementing a new risk informed regulation.

14 To meet this new challenge of licensing a
15 MOX facility, NMSS assembled a high performing team of
16 specialists with the diversity of backgrounds and
17 technical disciplines. Because it has been over 30
18 years since the NRC had conducted a safety review of
19 plutonium facility, we worked with Los Alamos National
20 Laboratory to develop and conduct a training course on
21 topics relevant to the production of MOX fuel. We
22 were also able --

23 DR. APOSTOLAKIS: Excuse me. I don't
24 understand that. You hadn't done it for 30 years.
25 Therefore Los Alamos comes into the picture. Why?

1 MR. GIITTER: To provide training to the
2 staff. We want them familiar with plutonium
3 technology.

4 DR. POWERS: Los Alamos operates T055
5 which is a miniature facility that essentially does
6 every one of the actions here. In addition, they have
7 a long history of providing technical background for
8 much of the plutonium activities within the DOE
9 complex.

10 MR. GIITTER: Thank you. We were also
11 able to send some of our key staff to the LaHague and
12 Melox facilities in France which are the reference
13 plants for the U.S. MOX design.

14 In early 2002 and again in late 2003, DOE
15 decided to initiate major changes to the surplus
16 plutonium disposition program which resulted in
17 changes to the MOX facility. These program changes
18 posed additional challenges to the staff by raising
19 additional environmental and safety questions.

20 More recently in October 2004, the NRC
21 suspended public access to the ADAMS On-line Library
22 and some other parts of its website to review
23 documents and remove any that could reasonably be
24 expected to aid a potential terrorist. The
25 considerable staff effort that was required to screen,

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1 redact and remove sensitive information and restore
2 public access to ADAMS which has had an impact on
3 several important licensing efforts including the MOX
4 construction authorization review. As a result, the
5 shutdown of ADAMS, we do anticipate completing, the
6 preparation of the FSER and construction permit in
7 February, but we do not anticipate completing the
8 review in February, but we will make every effort to
9 complete this review by mid March or perhaps the end
10 of March.

11 To conclude, I'd like to tell the
12 Committee that I appreciate all the hard work and
13 quality efforts that my staff had put forth to
14 complete the final safety evaluation report. This
15 project has required a significant and sustained
16 effort by a team of very talented scientists and
17 engineers and I'm proud of what they've accomplished
18 given all the obstacles before them. We're looking
19 forward to your questions and comments and with that,
20 I'd like Dave to start on the presentation and
21 describe what we did on the FSER in more detail.

22 MR. BROWN: Good afternoon. I'm Dave
23 Brown. I'm the Project Manager for the U.S. Mixed
24 Oxide Fuel Project Licensing Project. I appreciate
25 the time you're taking this afternoon to listen to our

1 presentation. Am I being heard well? In the back?
2 Okay?

3 DR. WALLIS: Yes.

4 MR. BROWN: What I'd like to do is just
5 briefly summarize what I'll be doing this afternoon
6 which is to first discuss the regulatory framework for
7 the construction authorization which is a question
8 that has already come up. Having established what's
9 needed for a construction authorization, I'll also
10 summarize what we're then expecting in a later license
11 application and ISA summary.

12 I'll provide a description of the facility
13 so that will provide you some context for
14 understanding what DCS did in their safety assessment,
15 what sorts of things they looked at as hazards. Then
16 I'll provide an example of one of the hazards and how
17 DCS implemented its safety assessment methodology and
18 what are some of the things that the staff did to
19 review that along the way. Then I'll summarize.

20 The purpose of this meeting is to just
21 brief you on the construction authorization request
22 review which we've already described. This is a flow
23 chart we put together some time ago that describes
24 this two-step licensing process. Along the top row
25 this flow chart you see the construction authorization

1 phase for this facility and along the bottom row you
2 see the later phase that would be the review of the
3 license application for possession and use of licensed
4 material.

5 So where we are in this process, this is
6 four years down the road, is the ACRS review of the
7 construction authorization. The staff is reviewing
8 the construction authorization request. We will then
9 shortly issue the SER and then there'll be an
10 opportunity for late filed contentions and the
11 hearing, and there may be a hearing. Then having
12 issued the construction permit, we would later review
13 the license application. That starts a whole other
14 stage of the review and of course, continuing, we
15 anticipate, the ACRS involvement.

16 What I want to do though, having said
17 that, just provide a little bit of historical context.
18 Why are we doing it this way? In 1971, what was then
19 the Atomic Energy Commission reviewed the safety at
20 what were then eleven operating mixed oxide fuel
21 facilities. This is not the first facility of its
22 type to be built and operated in the U.S. In 1971,
23 there were eleven operational facilities. They
24 certainly weren't at this scale. They were small-
25 scale operations, but there's a plant in New York,

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1 Pennsylvania, Oklahoma, Tennessee.

2 DR. WALLIS: Did these use the same basic
3 chemical process as the one we're discussing today?

4 MR. BROWN: The plutonium would have been
5 purified by a very similar chemical process, a PUREX
6 type process and then in most cases, the fuel was
7 produced for light water reactors. So it was the same
8 pelletized in clad fuel and it was used in commercial
9 nuclear power plants anyway. At that time, some of
10 the fuel that was being produced was for different
11 types of reactors such as the fast flux reactors. But
12 many of the processes were similar.

13 At that time, the Atomic Energy Commission
14 determined that these plants could not withstand
15 natural phenomena events such as tornados or
16 earthquakes. They were built to essentially uniform
17 building code type standards and there would be
18 considerable consequences if any of these plants
19 suffered a severe natural phenomenon event.

20 At that time, they decided to revise the
21 rule so that at that time AEC would first review and
22 approve the design bases for principal structures,
23 systems and components before a MOX facility could be
24 built. It was required then that an applicant for
25 such a facility would have to include this safety

1 assessment of the design bases, a site description and
2 a quality assurance plan. The staff would have to
3 review that before construction could start.

4 The design bases is a term used in Part 70
5 but it's not defined there. So staff for the current
6 purposes have adopted the Part 50 definition of design
7 bases which are "the specific functions to be
8 performed by a structure, system or component of a
9 facility and the specific values or ranges of values
10 chosen for controlling parameters as referenced
11 balanced for design." And I think perhaps the best
12 thing is just to use an example to go through that,
13 but in the current --

14 DR. APOSTOLAKIS: Is this definition
15 consistent with the definition in regulatory guide
16 1.174 or is it different?

17 MR. BROWN: I do not know.

18 MR. MAGRUDER: This is Stu Magruder of the
19 staff. Actually I helped developed 1.174 and we
20 worked directly from this 50.2 definition. So it is
21 consistent.

22 DR. FORD: Can I ask a question? Further
23 on in 50.2, it goes on "under the design basis
24 description as determined by calculation and/or
25 experiment." Most of your design basis parameters are

1 based on calculation. At what point the qualification
2 of the code associated with that calculation, at what
3 point is there qualification of the code versus data?
4 How important is this data?

5 MR. BROWN: In cases where, for example,
6 for conception design basis for this facility, there
7 were computer models used. For example for
8 criticality of safety, we reviewed the criticality
9 validation reports which were the documentation for
10 those codes that were implementing the available
11 physics if you will on criticality.

12 DR. FORD: There's also chemistry codes.

13 MR. BROWN: In the case of the chemistry
14 codes review at this point what we've done is deferred
15 some of the validation of that data to the ISA stage.
16 For example for --

17 DR. FORD: You said the validation of that
18 data. Did you mean that or do those validate the
19 calculations?

20 MR. BROWN: No. The data is available.
21 It's in a single published literature. For example,
22 it supports the prevention of explosions involving
23 hydroxylamine nitrate. Just an example. One of the
24 things, and the data that's available is based on
25 individual tests that were performed to achieve

1 different goals. Now what in this case the applicant
2 has done is integrated that data in a way that they've
3 come up and shown that they can establish safe
4 operating ranges based on a model that fits that data.
5 We have accepted a commitment that they would validate
6 that model with further testing experiments as part of
7 the ISA.

8 DR. FORD: That validation is called the
9 code. Clinical validations come at a later stage are
10 you saying?

11 MR. BROWN: Yes.

12 DR. KRESS: That definition, the word
13 control, is that an adjective or a verb?

14 MR. BROWN: That's a good question. I see
15 it as an adjective. The parameters of -

16 DR. KRESS: That's the way I was reading
17 it but I wasn't sure.

18 MR. BROWN: Okay. Let me just go through
19 that example I mentioned before. For example, for
20 criticality safety, one of the things that we're
21 looking at closely now is what is the safe margin of
22 subcriticality, for example, a K effective of 0.93.
23 That is the controlling parameter for design at this
24 point. The structure perhaps could be a vessel.

25 Having established a design basis and the

1 principal SSC for example a vessel, I still have
2 considerable flexibility in design, design alone. I
3 can use neutron absorbers. I could use geometry
4 controls. I could any number of different types of
5 controls to maintain that subcritical margin. So
6 that's the kind of thing we've had to establish as
7 part of this review. Do we have an accepted design
8 basis and have we allowed the flexibility in design
9 for the applicant to later implement whatever kind of
10 design they feel is necessary.

11 DR. WALLIS: Can we pursue this a little
12 bit? Now if I have a reactor, presumably what you're
13 looking for in the design basis is that it's operating
14 in some range of pressure and temperature or
15 something. That's what you mean by controlling
16 parameter.

17 MR. BROWN: Yes.

18 DR. WALLIS: But that doesn't say how big
19 it has to be or how big the vent valves have to be or
20 how big the heat exchanger has to be to cool it. It
21 simply says that it has some means of cooling and some
22 means of venting. Is that what you understand at this
23 point?

24 MR. BROWN: Yes.

25 DR. WALLIS: So we assume that that can be

1 worked out later. Right?

2 DR. APOSTOLAKIS: That's why I was
3 reminded of the 1.174 definition because there the
4 words that are used are "the totality of the
5 commitments." Isn't that what it is which would
6 include all of them that the licensee has made which
7 includes all these plus whatever else they have
8 committed to? Or is there a difference between
9 design basis and licensing basis?

10 DR. POWERS: Yes, there is.

11 DR. APOSTOLAKIS: What is it?

12 DR. POWERS: We won't see the licensing
13 basis until we get to stage two.

14 MR. BROWN: Right. The design basis is a
15 subset of the licensing basis.

16 DR. APOSTOLAKIS: It's a subset. Okay.
17 That makes sense.

18 DR. POWERS: This is not going to be
19 absolutely correct. I'm sure Joe's just going to
20 cringe when I say that, but to my mind this is an
21 opportunity for us to get a quick look at what's going
22 to happen in this design, what the concerns are and
23 there's going to be a lot of flexibility left in this
24 thing. What you, what I want to come out of is is it
25 possible to build a facility to do the function that's

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1 being asked at this site. Can you do it? Not so much
2 have you done it, but can it be done. Okay.

3 DR. APOSTOLAKIS: It has to be done safe.

4 DR. POWERS: I mean there's just an
5 enormous amount of work. This is setting a framework
6 more than it is to say, "Okay, I'm going to build this
7 particular silo" or something like that and it lays
8 down kind of a philosophical approach. How am I going
9 to approach this? Am I going to do this old double
10 contingency kind of design? Am I going to take design
11 basis? Am I going to use pressure vessel code
12 throughout this thing? What's my philosophical basis?
13 That's the way I look at it. It may not be precisely
14 correct, but it served me well in trying to decide
15 whether to lose my temper over something or say, "Oh,
16 yeah, this is good."

17 MR. BROWN: I do want to say and add to
18 that that there was always, I think, a propensity by
19 the staff to look a little bit further beyond this to
20 say, "Okay, I understand what your design basis is but
21 can you really do this?" I think we asked the
22 appropriate questions.

23 DR. POWERS: Yes, I mean if a guy comes in
24 and says this is really easy to build, all I need is
25 impervium, you probably are not going to accept that.

1 If you come in and say all I need is metallurgic
2 engineering like they have at General Electric, you'd
3 say, "Well, maybe you need something better than
4 that."

5 DR. WALLIS: This is where having been
6 done before would be very convincing to me. I mean if
7 this reactor already has been built in France and it's
8 already operated with these kinds of controlling
9 parameters, then one can assume it can be built here.
10 So we don't have to have all this reassurance of
11 exactly modeling the chemistry and all that kind of
12 stuff.

13 MR. BROWN: Right. So I just wanted to
14 then summarize the two stages. What we've been
15 looking at is the construction authorization which
16 includes a site description, a safety assessment of
17 the design bases and the quality assurance plan. What
18 comes later are more detailed safety program
19 descriptions, the ISA summary which as I'll point out
20 in a minute grows from the safety assessment of the
21 design bases and the other plans that are required in
22 accordance with the regulations, security plans, FNMCP
23 and the emergency plans for example

24 So that 1971 rulemaking established these
25 two steps. Further, looking in the more recent

1 history then in September 2000 after a near miss
2 criticality event at a low enriched fuel fabrication
3 facility in 1991, the staff began another rulemaking
4 to institute these ISA requirements that fuel cycle
5 facilities would identify potential accidents and the
6 items relied on for safety to reduce the risk of those
7 accidents, the measures that are required to maintain
8 those items reliable and available, that sort of
9 thing.

10 So that is the newer requirement which
11 also instituted the risk informed part of what is now
12 this Part 70 which establishes this paradigm if you
13 will that in order to reduce the risk of accidents you
14 first establish where are you using an unmitigated
15 assessment. For example, a high consequence event
16 with an unlike likelihood either needs to be
17 prevented, to be made highly unlikely --

18 DR. WALLIS: Not unlikely means likely,
19 does it?

20 MR. BROWN: Yes. I'm using the regulatory
21 language. It does mean essentially likely.

22 DR. APOSTOLAKIS: Do there are no
23 quantitative definitions of these terms, are there?

24 MR. BROWN: We have guidance that's in our
25 standard review plan.

1 DR. APOSTOLAKIS: Can you tell us what it
2 is?

3 DR. DENNING: Yes, we forced it out of
4 them at the subcommittee meeting. You may as well
5 tell them what you told us.

6 MR. BROWN: Okay. In the MOX Standard
7 Review Plan, the quantitative guidance for these
8 likelihoods is a likelihood -- Let me start at that
9 bottom.

10 DR. APOSTOLAKIS: Yes.

11 MR. BROWN: This is less than 10⁻⁵
12 probability of the event per year is the upper bounds
13 on highly unlikely. The next bound, the upper bound
14 on unlikely, is 4(10⁻³).

15 DR. APOSTOLAKIS: Ten to the minus five to
16 four times ten to the minus 3.

17 MR. BROWN: And then not unlikely is above
18 that. Now what's interesting though is the regulation
19 doesn't require a quantitative analysis of likelihood.
20 A qualitative assessment is okay. What's important is
21 that an applicant or a licensee make a distinction
22 between highly unlikely and unlikely. That's really
23 what is required at this point.

24 DR. APOSTOLAKIS: So this is the result of
25 this revision in 2000?

1 MR. BROWN: Yes.

2 DR. APOSTOLAKIS: And surely by that time,
3 everybody knew that this Agency is risk informing its
4 regulations. So I don't understand the statement
5 "quantitative estimates are not required."

6 MR. BROWN: Well, I'm not familiar with
7 the history of the rulemaking. I'm merely stating the
8 fact that that is what they've decided for these types
9 of facilities. More generally, the risks are lower
10 than for reactors for example.

11 DR. APOSTOLAKIS: Yes.

12 MR. GIITTER: This rule was written to
13 provide flexibility. So we don't require licensees to
14 do a quantitative or semi-quantitative analysis. They
15 can do a qualitative one and many of them do.

16 DR. APOSTOLAKIS: I understand that. The
17 thing I don't understand is why not.

18 MR. BROWN: I can't answer that.

19 DR. POWERS: And it's not a question that
20 we're trying to address in this particular letter.

21 DR. APOSTOLAKIS: I understand that, too.
22 The thing I don't want to do is two, three years from
23 now to complain about something and have people say
24 "But why didn't you say in February of 2005?"

25 MR. BROWN: I understand.

1 DR. APOSTOLAKIS: Okay.

2 MR. ROSEN: Well, the most encouraging
3 thing I've heard said about that, George, in answer to
4 why not is that all these facilities are different and
5 all their components and all of that stuff operate
6 differently and the data that would be needed to do a
7 quantitative estimate unlike in reactors where you
8 have lots of similar components is just not available.

9 MR. GIITTER: That's correct. I have also
10 heard that explanation.

11 MR. ROSEN: I don't happen to agree with
12 that, but that's the argument I've heard.

13 DR. APOSTOLAKIS: I completely disagree
14 with that.

15 MR. ROSEN: That's as close as cogency as
16 I've heard in response to that.

17 MR. GIITTER: I've also heard that.

18 DR. APOSTOLAKIS: But I think also mostly
19 that these people are not reactor people so they don't
20 do things like way.

21 MR. ROSEN: They don't know about --
22 secrets.

23 DR. APOSTOLAKIS: The reactor people
24 didn't want to do these things. You remember that?
25 There was a generic lab --

1 MR. ROSEN: I always was for this.

2 DR. APOSTOLAKIS: Yeah.

3 DR. POWERS: Let me interject here just a
4 little bit on this is this particular regulation as
5 it's written parallels very closely of what the
6 American Institute of Chemical Engineers requires for
7 chemical facilities and it is clear whether if the
8 regulation was very familiar with that genre of
9 safety. I should point out that where that has been
10 applied they have an awfully good track record. So
11 that it could well, and I know this is heresy, but it
12 could well be just as effective as the Reg. Guide
13 1.174 in probabilistic risk assessment I know.

14 DR. KRESS: Let me point out something
15 else to you, George, on that table we just saw. Those
16 are sequence by sequence numbers. They're not the
17 summations.

18 DR. APOSTOLAKIS: Which ones?

19 DR. KRESS: If you look at say any of the
20 categories like high unlikely, you don't take all of
21 the sequences that are in there.

22 DR. APOSTOLAKIS: No.

23 DR. KRESS: Each one of them has to
24 conform to that. That's a different philosophy.

25 DR. APOSTOLAKIS: But this is fatal flaw.

1 DR. KRESS: Yes.

2 DR. APOSTOLAKIS: Because there's no
3 definition of a sequence.

4 DR. KRESS: That's why I brought it out.
5 It's a fatal flaw.

6 DR. APOSTOLAKIS: Okay.

7 DR. POWERS: Well, again I would point
8 that they may find it flawed. I will stack up
9 Dupont's safety record against anything you would like
10 to bring forward including since the day worker injury
11 incident is lower even than in offices of secretarial
12 functions. They must do pretty well. So calling it
13 a fatal flaw might be a little strong.

14 DR. KRESS: I would agree with that.
15 Fatal flaw, you're right. We're going overboard.

16 MR. BROWN: One of the things I'm pointing
17 out here too is this is the framework that's the
18 generic framework. I'll also describe what DCS did to
19 establish a qualitative definition when I get to that
20 later in the presentation. But the point I want to
21 make here is that so we have the two step licensing.
22 We need to have a safety assessment of the design
23 basis first and the new ISA requirements that would
24 apply to this facility. So it was only natural then
25 to develop a paradigm if you will that the safety

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1 assessment of the design basis is just a first step in
2 establishing your complete ISA and that those
3 performance requirements I listed earlier then are the
4 decision levels if you will for when do you establish
5 what's a PSSC or not. That's how we've rolled those
6 two new requirements or the two requirements together.

7 In addition to those, DCS will be expected
8 to address the baseline design criteria which are part
9 of the revised Part 70 that was instituted in
10 September 2000. What this is is just a list of
11 criteria that DCS must show that it has addressed in
12 establishing its first safety assessment and then it's
13 later ISA.

14 Then lastly, DCS must show that they've
15 designed with the philosophy of defense in depth. I
16 think Dr. Powers said it better than I could with
17 respect to what that means. It doesn't mean that
18 where for example it says preference for the selection
19 of engineer controls over administrative controls,
20 that doesn't mean that all administrative controls are
21 excluded. This is a general overall philosophy.
22 They've indicated a preference for one over the other.

23 DR. APOSTOLAKIS: This is the only
24 requirement set because you have the three dots at the
25 beginning. This is the only one that refers to

1 defense in depth.

2 MR. BROWN: Right.

3 DR. APOSTOLAKIS: Really?

4 MR. BROWN: This is the only section in
5 the regulation which addresses defense in depth.

6 DR. APOSTOLAKIS: It doesn't say anything
7 about multiple barriers anywhere.

8 MR. BROWN: Well, there is the Item 2
9 here, features that enhance safety by reducing
10 challenges. It doesn't explicitly say multiple
11 barriers, but it does indicate --

12 DR. APOSTOLAKIS: Well, multiple barriers,
13 you put multiple barriers to reduce challenges. No.
14 To mitigate.

15 DR. POWERS: Reducing challenges to safety
16 systems is an element of defense in depth but it
17 didn't matter how many barriers you have.

18 DR. APOSTOLAKIS: That's right.

19 DR. POWERS: It's an operational
20 philosophy not a design philosophy.

21 MR. BROWN: Okay. I understand your
22 point. I will point out in just a minute or two that
23 notwithstanding what this requirement says, that this
24 facility does have substantial defense in depth in
25 terms of barriers and what I have is a floor plan of

1 the plant that shows that.

2 DR. POWERS: It seems to me, David, that
3 it is better to look upon defense in depth here not as
4 multiple barriers but a balance between prevention and
5 mitigation. Using that definition, you'll get a lot
6 farther with this facility than using the multiple
7 barrier kind of concept.

8 MR. BROWN: Okay.

9 DR. POWERS: There are multiple barriers.
10 You can find cases where the multiple barriers I think
11 philosophically it falls more in the category of a
12 balance between prevention and mitigation.

13 MR. BROWN: Okay.

14 DR. KRESS: Without specifying what we
15 mean by balance.

16 MR. BROWN: Quantitatively.

17 DR. KRESS: It's not an equal balance.

18 MR. BROWN: Right. I understand.

19 MR. BROWN: It depends on the hazards
20 which are posed. What I have done up to this point is
21 established what we need for the construction
22 authorization. So just to reiterate, what are we
23 expecting later with the license application? Again,
24 it's the safety program descriptions that will
25 establish the programs that will support safety at

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1 that plant, an ISA summary which I'll describe in a
2 little bit more detail in a moment and the other
3 required plans.

4 As I stated earlier, the safety assessment
5 of the design bases is like a preliminary ISA. It's
6 the first step. So the ISA then will develop items
7 relied on for safety or identify these items at a
8 somewhat greater level of detail at the component
9 level rather than at the system level which is how
10 they are defined in the safety assessment. It will
11 also include a facility description and process
12 description, the team qualifications and ultimately
13 the methods that were used to establish the ISA and a
14 list of IROFS.

15 One of the things I should point out at
16 this point that's at the top of this slide here, I say
17 "ISA Summary." That is what the applicant is required
18 to submit to NRC. The ISA is in what we've done in
19 Part 70, it says that the ISA is something that
20 resides at the plant or with the applicant and is open
21 for review by NRC staff. So that was an agreement
22 received during this rulemaking. The entire ISA
23 including all of the calculations that support the
24 safety decisions, it's not submitted. A bulk of it is
25 left at the site.

1 DR. APOSTOLAKIS: And why is that?

2 MR. BROWN: Why is that?

3 DR. APOSTOLAKIS: Yes.

4 MR. BROWN: That was just an outcome of
5 the rulemaking, something that was agreed to with the
6 industry. It doesn't mean that safety isn't
7 documented. All I'm merely pointing is where it is.

8 DR. APOSTOLAKIS: You have access to it?

9 MR. BROWN: We have full access to it.

10 DR. APOSTOLAKIS: It's just that
11 physically they don't want to give it to you.

12 MR. BROWN: Just physically we don't have
13 it here.

14 MR. ROSEN: They could put it on a CD and
15 give it to you probably.

16 MR. BROWN: Well, yes. I mean in some
17 cases the ISA is sufficiently well defined in terms of
18 its bounds. This is the ISA but they could do that.

19 MR. ROSEN: If you're relying on it, it
20 has to be defined. Right?

21 MR. BROWN: Yes.

22 DR. POWERS: Is there any conceptual
23 difference between this and the IPEEEs?

24 DR. APOSTOLAKIS: Yes. The IPEEEs were
25 not used for any licensing decision. This is part of

1 licensing the facility.

2 DR. POWERS: Okay. Is there any
3 conceptual difference between this and the licensing
4 basis for fire protection of the plant?

5 DR. APOSTOLAKIS: I don't know now. Just
6 because there is precedent, it just sounds funny. We
7 are going to have it on the site but we're not going
8 to view it.

9 DR. POWERS: You might want this thing
10 delivered to you.

11 DR. APOSTOLAKIS: What?

12 DR. POWERS: Your house is not big enough
13 to hold this thing. You do not want it delivered to
14 you.

15 DR. APOSTOLAKIS: A lot of inconvenience
16 that we shouldn't even talk about.

17 MR. GIITTER: Just to put it in
18 perspective, we have not received the ISA summary yet
19 for the MOX license application but we understand that
20 it's over 4,000 pages and that's just the summary. So
21 you can imagine that the entire ISA is very
22 voluminous.

23 DR. POWERS: And, George, have some faith
24 when the staff asks us to approve their SER for the
25 ISA and what not. The subcommittee will go and see

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1 the ISA. You will get to look at this.

2 DR. APOSTOLAKIS: I'll come along.

3 DR. POWERS: All right. Your presence
4 will be mandatory.

5 DR. APOSTOLAKIS: What is it? Savannah
6 River, is that what it is? One of the great resorts
7 of this country. You know I think we're getting in
8 childish things. I mean what you described earlier
9 about methods for likelihood and all that I don't know
10 why you have to call that ISA.

11 DR. POWERS: Because it's written in the
12 regulations.

13 DR. APOSTOLAKIS: If I find a method later
14 that will not be up to the state of the art or the
15 state of the practice regarding the likelihood
16 evaluation methods, I don't care whether it's a PRA
17 method or an RPA or an APR method. You would have to
18 use the state of the practice methods. You can't say
19 I'm doing an ISA so I'm going to use a Mickey Mouse
20 method. So I don't care about the PRA and ISA. The
21 words you used are fine. They set the stage on Slide
22 14.

23 MR. BROWN: Okay.

24 DR. APOSTOLAKIS: It's fine.

25 MR. BROWN: Okay.

1 DR. APOSTOLAKIS: Okay. Now for
2 regulatory purposes, we may want to use ISA. That's
3 fine too. I don't object to that.

4 MR. BROWN: Right.

5 DR. APOSTOLAKIS: But everything in the
6 parenthesis there, that's what we do.

7 MR. BROWN: Okay.

8 DR. APOSTOLAKIS: Now the other thing that
9 struck me when I started reading this is the
10 incredible number of acronyms.

11 MR. BROWN: Yes.

12 DR. APOSTOLAKIS: IROFS and this and that.
13 I mean within one paragraph you could define 23 of
14 those. Is that also part of the chemical tradition
15 here that we don't want to shake? That's a Mickey
16 Mouse. Keep going.

17 MR. BROWN: Okay. What I want to talk a
18 little bit now about is the actual facility so we can
19 have some context in which to discuss some of the
20 hazards. This is merely a map showing the approximate
21 location of the facility, where it would be, on the
22 Savannah River site. The Savannah River site is 310
23 square miles in South Carolina. The point of that
24 arrow is more than five miles from the boundary in any
25 direction and it's just about the north side of F area

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1 there.

2 Having established what the site is, one
3 of the things --

4 DR. POWERS: David, that's a bit
5 misleading, isn't it?

6 DR. KRESS: There are thousands of people
7 in the city.

8 DR. POWERS: Yes, that's absolutely true,
9 but the way they've explained their site boundary is
10 coincident with facility boundary.

11 MR. BROWN: Right.

12 DR. POWERS: So it's just as Tom says.
13 Well at that time, there was 22,000. I would think
14 it's only 17,000 now. There's a small city there.

15 DR. KRESS: And even George might be there
16 once and a while.

17 DR. POWERS: It's mandatory. In fact, I
18 think they ought to build into the probabilistic risk
19 structure.

20 DR. KRESS: That's what I think. That
21 name is sequester from MIT.

22 MR. MAGRUDER: Dave, this is Stuart. You
23 might clarify that the actual MOX facility is only 41
24 acres.

25 MR. BROWN: Right, and that's where the

1 boundary is around that 41 acres not the whole thing.

2 MR. ROSEN: The distance to the site
3 boundary is typically in hundreds of meters. Right?

4 MR. BROWN: Right, for the purposes of
5 actually performing a dose analysis for the safety
6 assessment.

7 MR. ROSEN: Right.

8 MR. BROWN: The site boundary is, and I
9 should be --

10 MR. ROSEN: The site boundary of the MOX
11 facility.

12 DR. APOSTOLAKIS: The MOX facility.

13 MR. ROSEN: There's a couple of hundred
14 meters from the center line of the plant.

15 MR. BROWN: What we call that for this
16 facility is the controlled area boundary.

17 DR. APOSTOLAKIS: And what's the distance
18 from there? The Savannah Site model.

19 MR. ROSEN: It's about five miles.

20 MR. BROWN: More than five miles in any
21 direction.

22 DR. POWERS: When you initially think
23 about this facility and you say it's five miles away,
24 you say "Now what kind of an event could possibly
25 disperse things that far" and you scratch your head

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1 and say, "It's hard to think of something that would
2 get to five miles and have a lethal dose at this
3 facility." When you ask the same question at 100
4 yards, you say, "Gee, there are quite a few things
5 that can give you a lethal dose."

6 MR. BROWN: Right. I certainly didn't
7 mean to mislead you that this was the important
8 boundary with respect to the safety assessment. I
9 just wanted to provide some context for where the
10 plant is in South Carolina.

11 MR. ROSEN: In other words, the important
12 boundary for the safety assessment is a couple of
13 hundred meters from the plant.

14 MR. BROWN: Is 160 meters.

15 DR. POWERS: Is that that little figure
16 that's right under the arrow there, that little box?

17 MR. BROWN: That little box is at the
18 area. If I were to draw the site on there, I should
19 probably just pick up a dull pencil and dropped it and
20 that would probably describe 41 acres.

21 DR. APOSTOLAKIS: How big is the Savannah
22 River area?

23 MR. BROWN: Really what I wanted to get to
24 is this point these are the kinds of things related to
25 that site that were screened out as being important

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1 events that needed to be considered in the safety
2 assessment, wind, fire -

3 MR. ROSEN: Screened out. You mean
4 screened in.

5 MR. BROWN: Screened in. Sorry. That's
6 a good point.

7 DR. POWERS: This site has been
8 characterized up one side and down the other for every
9 facility that we ever built there. It's been
10 scrutinized by the National Academy of Science. It's
11 been folded, spindled and mutilated in every
12 conceivable fashion. Did DCS do anything different
13 than what's been done in the last five years for the
14 safety analysis of DOE facilities there with respect
15 to these natural hazards?

16 MR. BROWN: To my knowledge except for
17 some characterization of the soils --

18 DR. POWERS: Which has always been an
19 issue there.

20 MR. BROWN: Yes.

21 DR. POWERS: Because there are places
22 there on the site that liquify quite easily and there
23 are places on the site that don't liquify at all.

24 MR. BROWN: Right, but I think even that
25 information was already available and DCS can correct

1 me on that if you're aware of data that you collected
2 as part of assessing the natural phenomena hazards.

3 MR. ASHE: This is Ken Ashe with DCS.
4 That's pretty much correct. We relied very heavily on
5 the Savannah River site data. We did do some bore
6 holes specific for our site just to make sure that we
7 understood for our particular site. But basically we
8 used the Savannah River site data.

9 DR. POWERS: Yes. Savannah River has been
10 characterized like crazy. F area has been
11 characterized a lot even within Savannah River context
12 but you still have to look at the place you're
13 actually physically going to build it.

14 MR. ASHE: That's correct.

15 MR. BROWN: I started with a 300 square
16 mile plot and just coming in closer here inside the
17 plant the process does include essentially two major
18 parts of the plant which are really represented by
19 these two rows of boxes in the flow chart. They first
20 need to purify the plutonium using a PUREX-like
21 purification process and reprecipitate plutonium
22 oxylate and then calcined it in a calcining furnace to
23 produce purified plutonium dioxide which would then be
24 ready for MOX fuel production which is blending with
25 depleted uranium oxide to the specified blend,

1 pressing of pellets, centering the pellets in fuel
2 fabrication.

3 DR. WALLIS: Is the stuff comes in as
4 plutonium oxide, why does it have to be purified?

5 MR. BROWN: This plutonium dioxide being
6 surplus from the weapon program contains among other
7 impurities things like gallium which was part of the
8 weapon component.

9 DR. WALLIS: So there would be raw
10 material in plutonium oxide.

11 MR. BROWN: The raw material is plutonium
12 dioxide and other elements to different levels of
13 impurity.

14 DR. POWERS: There are four different
15 feeds but the mainline feed if you looked at it you
16 would it's plutonium dioxide. But it has a small
17 fraction of gallium in it which we're concerned about
18 and it will always have a certain amount of americium
19 in it.

20 Now let me ask you just one question
21 because maybe I misunderstood, Dave. Your scope of
22 this may be more macroscopic than what I've seen.
23 My understanding is in this pellet fabrication they're
24 putting 20 percent plutonium dioxide and uranium
25 dioxide solid solution which is actually micronized

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1 with uranium oxide to form the pellets.

2 MR. BROWN: Correct.

3 DR. POWERS: Okay. Is that 20 percent
4 solid solution formed at the convert stage or is it
5 formed in a micronizing process?

6 MR. BROWN: It's formed in the micronizing
7 process. I'm aware for example that history there was
8 a process of co-precipitating these materials of
9 uranium and plutonium together. That is not the
10 process here. Plutonium dioxide is when it's purified
11 it's remade as pure plutonium dioxide and then --

12 DR. POWERS: They burn the oxylate, throw
13 in the plutonium dioxide and then they fabricate a
14 solid solution.

15 MR. BROWN: Yes.

16 DR. POWERS: I'm glad I don't have to run
17 that process.

18 MR. BROWN: Why is that?

19 DR. POWERS: It's hard to do, to get a
20 homogenous solid solution.

21 MR. BROWN: I understand that there is art
22 and the science that has gone into this process.

23 DR. POWERS: Yes, micronizing is not so
24 difficult because you don't have to form a homogenous
25 solution.

1 MR. BROWN: I see what you mean.

2 DR. POWERS: But the form of a 20 percent
3 plutonium dioxide/uranium dioxide solid solution
4 that's reasonably homogenous, I'm glad I don't have to
5 do that.

6 MR. ASHE: This is Ken Ashe again. I
7 would like to point out in response to a statement
8 earlier and also in response to this is that we do
9 have the reference facilities in France up at LaHague
10 and at Melox where they have done similar type items
11 and so we do have that expertise and Cogema is one of
12 our key partners with respect to this. So we have
13 their understanding and backing and etc. and their
14 facility has been operating. I think that Melox
15 facility is about eight, ten years.

16 MR. BROWN: Ten years now.

17 MR. ASHE: Right. And actually longer for
18 parts of it.

19 MR. BROWN: What I would like to do is
20 just put that in a physical context so you have an
21 idea of how this material flows. The plutonium
22 dioxide will come from different sources. One of them
23 for example will be the next door PIT disassembly and
24 conversion facility. It would come in by truck and be
25 received at the shipping and new receiving area and

1 then stored prior to being further processed. The
2 depleted uranium dioxide of course a very important
3 part of this process comes in and is stored in the
4 secured warehouse prior to being brought over and also
5 loaded in at the shipping and receiving area.

6 The plutonium dioxide is then routed to
7 the aqueous polishing building where it undergoes this
8 partially PUREX type process in a building that really
9 looks like a number of process cells, closed up
10 concrete cells, where the intent is to put the
11 process, build the process, test it and then button up
12 these cells and only go back in there for any
13 necessary maintenance or surveillance. There are some
14 gloveboxes in there.

15 For example, when the purified plutonium
16 nitrate is ready for precipitation as the oxylate that
17 plutonium oxylate then comes into a glovebox where
18 there's a calcinate furnace. The calcined plutonium
19 oxylate, now plutonium dioxide again, comes back into
20 the MOX fuel fabrication area and is stored again
21 which is all I mean by that convention there. It's
22 just momentarily stored in storage and then the
23 plutonium dioxide is taken --

24 DR. WALLIS: So all this chemical
25 processing, you're concerned about various runaway

1 reactions or implosions or whatever.

2 MR. BROWN: Yes.

3 DR. WALLIS: It's in that aqueous
4 polishing room there.

5 MR. BROWN: Right. Almost all of the
6 chemical hazards we've discussed before.

7 DR. WALLIS: So there is multiple barrier
8 or something associated with that region, area that
9 contain things if they get out of hand.

10 MR. ROSEN: You shouldn't see that as a
11 room. It's a series of rooms.

12 DR. WALLIS: Series of rooms.

13 MR. ROSEN: Four or five stories.

14 DR. WALLIS: So all sorts of ventilation
15 control and stuff.

16 MR. BROWN: Yes. There are five stories.
17 It is a series of cells, many rooms.

18 DR. WALLIS: It's designed so if something
19 gets out in one space it doesn't spread to other
20 spaces and all that.

21 MR. BROWN: Correct.

22 DR. WALLIS: You're not going to tell us
23 anything about that or we just assume it happens.

24 MR. BROWN: Did DCS tell us anything about
25 that? Yes. I had to give you a fairly, I realize,

1 high level overview of the design of this.

2 DR. WALLIS: It's so high level that it
3 doesn't tell us very much.

4 MR. ROSEN: Not yet.

5 MR. MAGRUDER: Dave, I think you have more
6 detail in your next slide that would be helpful.

7 MR. GIITTER: You might point out the safe
8 haven and the purpose of that.

9 MR. BROWN: Okay.

10 MR. GIITTER: That is it's easy to see
11 here.

12 DR. WALLIS: It's for women and children.

13 MR. BROWN: Right. You guys got the rest
14 of it. The fuel is then pressed, centered. The
15 future fuel storage is over here and then fuel
16 assemblies are loaded into their cask and backed out.
17 So essentially material does flow in that direction.
18 I did point on this simplified cartoon if you will the
19 safe havens which are DCS's provisions for emergency
20 preparedness in case employees do need to escape an
21 area.

22 MR. ROSEN: You said five of them? Is
23 that what I'm supposed to believe?

24 MR. BROWN: Five, yes.

25 MR. ROSEN: Those are all those records.

1 DR. WALLIS: Five safe havens.

2 MR. BROWN: (Indicating.) This one.

3 MR. ROSEN: (Indicating.) That one.

4 MR. BROWN: (Indicating.) That one.

5 MR. ROSEN: Yes.

6 MR. BROWN: (Indicating.) That one, that
7 one and that one.

8 MR. ROSEN: And you just want to make sure
9 you're on the right floor when you have the accident.
10 Right? Because otherwise, you might be on the fifth
11 floor and have to go down to the first floor to get to
12 safety.

13 MR. BROWN: I don't know.

14 DR. APOSTOLAKIS: What is it that makes
15 them safe havens?

16 MR. BROWN: I'm sorry.

17 DR. APOSTOLAKIS: Why do you call them
18 safe havens?

19 MR. BROWN: Because that's what they are.
20 They are places where employees can escape to escape
21 an event if they need to and what they provide for is
22 a physical, well, material security. They don't have,
23 for example, crash bars on a facility like this where
24 employees can escape. But you need to balance then
25 the need for material security with the need for

1 personnel safety. These safe havens do that. It's an
2 area where the employees can get out. They're in a
3 separate ventilated area under positive pressure. The
4 function of these is such that the guards come and
5 then let people out.

6 DR. WALLIS: There's access to the outside
7 world presumably.

8 MR. BROWN: There are doors to the
9 outdoors from these areas but they're controlled.

10 DR. WALLIS: It's just a holding place.

11 MR. BROWN: They're a temporary holding
12 for folks who've had to escape an area. Another, I
13 guess, important area is the reagents processing
14 building which is a separate area where chemicals
15 which are necessary for the aqueous polishing process
16 are prepared and then transferred underground to the
17 aqueous polishing step.

18 DR. WALLIS: Now is there waste stream
19 from all this somewhere?

20 MR. BROWN: There are both solid and
21 liquid waste streams to deal with. Yes. As you can
22 well imagine, a lot of liquid waste streams are coming
23 from aqueous polishing.

24 Yes, as Joe pointed out, I did provide
25 this additional cartoon to try to describe the

1 multiple barriers or what they've called the tertiary
2 confinement system at this plant. This demonstrates
3 defense in depth. The first confinement, primary
4 confinement, in this example for powder processing
5 areas is the glovebox. Secondary confinement provided
6 by the room where you find the glovebox and ultimately
7 tertiary confinement provided by the exterior boundary
8 of the building. Each of those served by their own
9 ventilation system with HEPA filters.

10 DR. APOSTOLAKIS: What is it that makes
11 one a barrier dynamic?

12 MR. BROWN: I'm sorry. How do I tell the
13 difference between the barriers?

14 DR. APOSTOLAKIS: You said static and
15 dynamic. What does that mean, dynamic? The secondary
16 confinements.

17 MR. BROWN: The static barrier is simply
18 the fixed object that defines the --

19 DR. APOSTOLAKIS: The structure.

20 MR. BROWN: -- the area. It could be a
21 wall or it could be a HEPA filter also.

22 DR. APOSTOLAKIS: Okay.

23 MR. BROWN: The active components are the
24 blowers if you will that provide the negative
25 pressure.

1 DR. APOSTOLAKIS: I see.

2 MR. BROWN: So that there is a pressure
3 differential also that's here so that air tends to
4 flow towards the C-4 areas. Having provided that
5 somewhat of a context for what the facility looks
6 like, how it's laid out, I now want to talk to you
7 about the safety assessment methodology that DCS
8 implemented which starts with hazard identification
9 identifying where all the radioactive hazardous
10 chemical inventory is in the facility and what sorts
11 of events can be made to release that.

12 The safety assessment includes a hazard
13 evaluation and what DCS has done is set up event
14 groups. All the important events that are considered
15 in the safety assessment are one of these, ones that
16 I've listed here, loss of confinement, fire and so
17 forth. Having established that an event could occur
18 in a given area, for example, fire in a certain
19 glovebox in a certain room, that is then grouped with
20 other fires and other gloveboxes in other similar
21 rooms. An unmitigated event description is provided
22 which is merely to say that there could be a fire in
23 the glovebox that involves plutonium dioxide powder
24 for example.

25 They do go so far as to say that they do

1 screen some things out on the basis of whether it's
2 feasible. For example, in areas where I have powders
3 that haven't been processed yet I won't have a red oil
4 explosion for example. So there is some assessment of
5 what are the feasible events.

6 Internal events are then screened by
7 consequence. So looking at a specific kind of event,
8 DCS did a consequence assessment. How bad would the
9 dose be? They're looking at the facility worker right
10 next to this area, the site worker immediately
11 outdoors, someone standing at the control boundary
12 that are 160 meters away and they are also looking at
13 the environment. We have performance requirements for
14 all four of those.

15 DR. WALLIS: How do you evaluate the
16 likelihood of a red oil runaway reaction?

17 MR. BROWN: In this case in that second
18 bullet, they are described as an internal event.
19 There's no assessment of likelihood except to say it
20 could happen. If I have solvent in a mix with nitric
21 acid then I have a possibility of red oil.

22 DR. WALLIS: So you're saying it could
23 happen.

24 MR. BROWN: At this stage in the hazard
25 evaluation stage, they're saying --

1 DR. WALLIS: Later on you say something
2 more about how likely it is.

3 MR. BROWN: At this point, the likelihood
4 is one. It is not unlikely if you will.

5 DR. WALLIS: Well, I hope it's one.

6 MR. BROWN: At this stage, there is no
7 attempt to screen it out based on likelihood by
8 saying, "Oh, well, it's not" --

9 DR. WALLIS: Just say it could happen.
10 That's all. It doesn't tell us much at all. But this
11 is a screen. Right?

12 MR. BROWN: At this stage of our screening
13 that's all you need to know.

14 DR. WALLIS: If this is a screening,
15 that's all you want. Okay. So are you going to get
16 to the meat of this somewhere?

17 MR. BROWN: Yes sir.

18 DR. WALLIS: Okay.

19 MR. BROWN: I'll move on.

20 MR. ROSEN: Maybe we should -

21 DR. POWERS: Maybe we should be very
22 clear. I'm not sure what Professor Wallis is looking
23 for. If he is looking for the kind of detail that we
24 we would do in a subcommittee meeting, he is going to
25 be disappointed.

1 DR. WALLIS: But there must be something
2 important you're going to get to.

3 DR. POWERS: Well, I think he's done a
4 great deal of important topics.

5 DR. WALLIS: It seems to be so
6 descriptive. I haven't gotten a hold of anything yet.

7 DR. POWERS: Well again I'm not sure. You
8 need to clarify for us what you're looking for. I
9 have a feeling you're going to be disappointed.

10 DR. WALLIS: Maybe I will be. Yes.

11 DR. FORD: I think it comes down to the
12 basic question of what we're being asked to do. As I
13 understand it, Graham, like you, I'm a bit frustrated
14 that we haven't seen any of the discussion of what we
15 heard in the subcommittee meeting.

16 DR. POWERS: Well you won't.

17 DR. FORD: And now I'm hearing that from
18 you and therefore I'm divining from that what we're
19 asked to do is write a letter to say, "Yes, you're on
20 the right track about it, but don't expect us to write
21 a letter endorsing the specific value of the design
22 basis from it." That is correct.

23 MR. SIEBER: They didn't provide any of
24 this.

25 DR. FORD: But in the subcommittee meeting

1 they did. A detailed list of process control and
2 clinical control processes.

3 DR. POWERS: You are free to ask any
4 question you want.

5 DR. FORD: Yes, but I think --

6 DR. POWERS: Now we have given the staff
7 guidance of what they should present and we have given
8 them the guidance to present a more general overview
9 of all the material that was presented to us at now
10 what is something like seven meetings. Now if you are
11 asking them, if you care to ask them what is the
12 particular value for the valve size on line number
13 six, I'm sure Dave would be happy to answer you.

14 But I did not ask him to go through that
15 kind of detail. It would be inappropriate and he
16 couldn't possibly do that. I asked him to anticipate
17 every detailed question that this August committee
18 would care to ask and said do that in two hours. He
19 would speak very quickly. Now back to Dr. Wallis.

20 DR. WALLIS: This is the final
21 presentation before we write a letter.

22 MR. BROWN: Yes.

23 DR. WALLIS: So there has to be something
24 in the story you're telling us now which gives us
25 assurance that things are being done right.

1 MR. BROWN: Okay.

2 DR. WALLIS: It's a long litany and you
3 haven't yet gotten to the point where you've given me
4 that assurance. Maybe you're going to get there.

5 MR. BROWN: Okay.

6 DR. FORD: I have a specific question
7 because flipping through the charts, I don't see it
8 being addressed. One thing I am uncertain about is
9 for instances in the control of the preparation where
10 we're introducing nitrous oxide in the control column
11 as oxidation somewhere or another it is stated that
12 there could be process control from the fuel rate of
13 nitrous oxide. That has been withdrawn. Am I correct
14 on that? That control is actually no longer being
15 applied. Is that correct?

16 MR. BROWN: No, I don't think that's
17 correct. For the purposes of protecting someone
18 outdoors from an overexposure to nitrous oxide, the
19 flow rate of nitrous oxide in the oxidation column is
20 controlled as a PSSC. Do we have a design basis value
21 for the flow rate anybody in the audience and I do
22 want to attempt to be responsive on specific questions
23 of that nature.

24 MR. MURRAY: Yes, let me try and help you
25 out, Dave. Good afternoon. I'm Alex Murray, the Lead

1 Chemical Safety Review for MOX. I know you all know
2 that, but I just wanted to make it clear for the
3 transcripts. I see your questions have to do with
4 just a little more extra level of detail.

5 Let me first answer the immediate question
6 which has to do with the flow rate of nitrogen
7 tetraonidae, how it is controlled to prevent its
8 release of the oxidation column. The applicant has
9 proposed an active flow control strategy. This is
10 essentially a common type of approach which has been
11 used in industry.

12 It can be very well defined subsequently
13 in the license application stage. There could be
14 multiple type of flow elements, different types of
15 flow valves, different types of transducers, different
16 types of controls and logic applied and we would
17 expect to see these in the subsequent license
18 application, all the details on the items relied on
19 for safety. However at this time, we, the staff, know
20 by analogy to industry plus a number of very
21 simplified fault analyses we have done, conceptual
22 type levels, that that type of strategy has the
23 potential to achieve essentially any type of
24 likelihood level that is desired.

25 Now in addition to there being an active

1 control, you have to have a design basis for it to
2 meet. In the case of nitrogen tetraonidae release,
3 the applicant has stated that the design basis will be
4 not exceed the low chemical consequence criteria.
5 They have identified what that criteria is in terms of
6 concentration, so many milligrams per cubic meter.
7 The staff has reviewed that and the staff has included
8 that as an acceptable design basis at this time, i.e.
9 the potential consequence of the event would be indeed
10 low by what we call RAGAGEP, Reasonable and Generally
11 Accepted Good Engineering Practices.

12 We have compared some of the values to
13 values in the literature used by NIOSH, OSHA and
14 Environmental Protection Agency and we have concluded
15 yes, an exposure up to one hour, the potential health
16 impacts would correspond to low. Low is defined as
17 being mildly irritating, perhaps an odor, but not
18 interfering with any type of operator functions.

19 MR. GIITTER: Thanks, Al. This was
20 interesting. Dr. Wallis, I wanted to respond to your
21 question to Dave. I think to get a picture of why
22 it's okay to write a letter for construction
23 authorization is it's important to read the safety
24 evaluation report. What Dave's going to do is we're
25 going to walk you through an example for fire

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1 protection that will give you some idea of how we went
2 about doing our evaluation and why it's okay using
3 that one specific example. But to get a detailed
4 understanding of why it's okay, I really think you
5 have to read the safety evaluation report. It's
6 difficult to really cover that in two hours.

7 DR. FORD: I think our problem is that
8 when you read this safety evaluation report there are
9 no analyses in that report. There are no detailed
10 engineering data-driven analyses in that report. I
11 think that's the frustration of some of us.

12 CHAIRMAN BONACA: But there is a
13 discussion of the professional initiators if you want
14 to call them so of how the conceptual design presented
15 here with different enclosures and individual vacuum
16 systems would in fact deal with maintaining and
17 providing protection and assurance of a level of
18 safety. It's not quite defined the way of having
19 still setpoints or specifics of the components they
20 are going to use. But I think as far as the SER it
21 made a credible case for the accessibility of the
22 design at the conceptual level.

23 MR. ROSEN: Those of us who were around
24 and I know you were, Mario, in the early days of
25 reactors when we had something called preliminary

1 design analysis reports.

2 CHAIRMAN BONACA: Absolutely.

3 MR. ROSEN: These were documents not
4 unlike what we're looking at here.

5 CHAIRMAN BONACA: Very similar.

6 MR. ROSEN: Basically, it says, "Here is
7 the envelope. We think you could build a nuclear
8 plant and meet the criteria in this document." That's
9 really all you have. If that's not enough, that's a
10 little bit like smoke. It's hard to grab a hold of
11 because you're trying to think, "Now what's it going
12 to be like to meet this requirement. What's the
13 actual physical hardware of configuration going to be
14 like to meet this criteria." And it's not very
15 satisfying because you might think of something and
16 say, "Well, that might meet it and that might not."

17 DR. WALLIS: What I found missing was all
18 this description now this thing is going to be
19 controlled by using flow or temperature or something.
20 Now if you could simply show that this has been done
21 before in some plant, that it works, or something. But
22 simply to say, it's going to be controlled by using
23 temperature gives no assurance that that can be done.

24 MR. ROSEN: Well, I think what we're being
25 told with regard to that is that this plant is very

1 like the ones in Europe.

2 DR. WALLIS: Well, I think you should
3 emphasize. It's all been done before. There's lots
4 of precedent and not stepping outside the box of
5 experience. Therefore, you have a lot of assurance it
6 will work.

7 MR. ROSEN: And what I think you and I
8 should do is coil up to strike when we get the ISA. I
9 know George is doing that. No, you are. So that when
10 we get the ISA which will have the kind of details
11 you're looking for now.

12 DR. APOSTOLAKIS: When will this be by the
13 way? In the future. Right?

14 MR. ROSEN: We have the ISA summary and
15 then we'll have to go Savannah River to get the ISA
16 details. But that will be at some point in the
17 future.

18 DR. APOSTOLAKIS: Sometime in the future.

19 DR. DENNING: I'd like to make some
20 comment about history though and that is that I think
21 that certainly as far as the feasibility of building
22 and operating this facility, there's no question that
23 that history is very valuable. It's also valuable to
24 have seen what they used for safety systems, but the
25 fact that they've operated those for X number of years

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1 does not fully provide the level of consideration that
2 has to be done by the NRC because that's a very
3 limited lifetime.

4 But on the other hand, I know that we've
5 gone through these detailed looking at the various
6 types of accidents that have been done and I don't
7 know whether you've had the chance to do that. And
8 then you have problems that a lot of that's fairly
9 qualitative or there are some kind of holes there.
10 But I think we need to be careful to say just because
11 this facility is operated and safely for a period of
12 time, that's not adequate for what the NRC has to do.

13 CHAIRMAN BONACA: Yes, but again going
14 back to the example of the PSRs, it wasn't unusual at
15 the FSER stage that you would have to modify your
16 conception design or protection system. In fact, you
17 had new functions you had to add. Some of them you
18 subtracted because at the moment to implementation
19 either you couldn't make certain criteria or the NRC
20 didn't accept what you presented.

21 I could see that there are really
22 adjustments to do it now. There could be some further
23 flaw than they have required some measure will work.
24 I think the experience we had, and I didn't see the
25 one in France, gives us some comfort maybe that

1 probably a measuring work is not necessary. I mean
2 that's the way I've been thinking about it. But I
3 think as far as what has been addressed here and the
4 issues and possible initiating issues I think is
5 convincing enough to me that at least there is a
6 conceptual design here that qualitatively should be
7 functioning.

8 MR. BROWN: Let me continue talking a
9 little bit about the likelihood definitions but before
10 I go any further, I should have pointed out, I do want
11 to point out now. I did ask the technical review
12 staff to be here. DCS is here as you will know by
13 now. The Department of Energy is represented. So if
14 there are any specific questions.

15 DR. APOSTOLAKIS: What's a lifetime of a
16 facility?

17 MR. BROWN: It's assumed for the purpose
18 of this assessment to be 50 years which is larger than
19 the expected mission time which would be about
20 something like 15 years.

21 MR. ROSEN: I have a specific technical
22 concern that I've been voicing ever since the
23 beginning of this thing started. Dana, do you think
24 this is appropriate time for me to raise it?

25 DR. POWERS: Well, we need to get it on

1 the table right away. He's going to go through an
2 example that deals with fire protection. So why don't
3 we wait for there because I want to get that one out
4 right now. I mean that one needs to come out.

5 MR. ROSEN: I think that was what this
6 effort was designed for. To bring a concern like that
7 was its conceptual concern.

8 DR. POWERS: Yes, bring that one forward
9 because that hits at really design philosophy here.
10 With this sort of situation, you have to come up with
11 a philosophy on the approach here. So I think he'll
12 get to it.

13 MR. ROSEN: Okay. I'll hold off.

14 DR. POWERS: Okay.

15 MR. ROSEN: I won't forget it.

16 DR. POWERS: Well, I definitely want to
17 get a resolution. I mean I want the facts on that one
18 for all parties because that clearly is one that in
19 our draft letter right now, just like I'm interested
20 in getting a resolution on Peter's question which I
21 think we got.

22 DR. FORD: Yes, I did.

23 DR. POWERS: So please charge ahead.

24 MR. BROWN: I will charge ahead.

25 DR. POWERS: And get to your examples as

1 quick as you can.

2 MR. BROWN: Okay. I did mention earlier
3 that a qualitative definition of likelihood is
4 allowed. It is in fact what is used here. Those
5 definitions are there. The goal for many events is to
6 reach a highly unlikely likelihood.

7 DR. WALLIS: What do you do with something
8 like the red oil runaway reaction? You make an
9 assessment of how likely it is. I never saw anything
10 like that.

11 MR. BROWN: No, at this stage the
12 likelihood determinations for red oil event will be as
13 part of the ISA summary in the ISA. What we need now
14 is what are the safe operating ranges to prevent a red
15 oil event.

16 DR. POWERS: I think you answered his
17 question. I think we need to resolve this issue. At
18 this stage you came in and said, "Is a red oil runaway
19 reaction possible?"

20 MR. BROWN: Right.

21 DR. POWERS: Your answer was yes.

22 MR. BROWN: The answer is yes wherever the
23 two things are together, nitric acid and solvent.

24 DR. POWERS: Correct me if I make a
25 mistake.

1 MR. BROWN: I'm sorry.

2 DR. POWERS: Okay because you said, "Yes,
3 it is possible" ergo there must be something done to
4 prevent that from happening because for reasons that
5 are deserving of discussion at some point, maybe not
6 today, we don't like red oil runaway reactions. The
7 fact is whether runaway reactions take place typically
8 in material, it's not particularly radioactive. They
9 typically take replacing the solvent recovery or the
10 acid recovery station.

11 MR. BROWN: Right.

12 DR. POWERS: Which we would hope is
13 relatively deplete of plutonium but we don't like
14 them. So we prevent them. Now you ask at that point
15 is possible to prevent these. The answer is yes. We
16 run solvent recovery operations. They are running
17 today as we speak. There are solvent recovery
18 operations going on and not having red oil reactions.
19 How do they do that? We looked and indeed there are
20 standards set up by the DOE that says they can with
21 these facilities with this, just do this and at least
22 we'd never had one when we did those things.

23 Then you look and say, "Gee, there are
24 some facilities on the site where they don't fit this.
25 Gee DCS, what do you do about that?" And they came

1 back and said, "Okay, we have this clever idea. We're
2 going to have a vent and then a quench operation and
3 you looked at that and said, "That looks like it could
4 do it." Am I correct?

5 MR. BROWN: Correct. There is a somewhat
6 -- Yes. You say as when the PSSC has been identified
7 you do have to make some judgement as to whether you
8 think they can get there. But it's not a detailed
9 analysis of reliability or availability.

10 DR. POWERS: What I think Professor Wallis
11 would like to understand better is how far did you go
12 into can they do that. If the vent has to be the size
13 of the Houston Astrodome in order to satisfy that,
14 he's not going to believe you can do that. If on the
15 other hand, a two inch plastic safety relief valve
16 will do, then he might believe that it could be done.
17 Can you answer his question? How far did you go into
18 looking at this to see if this vent and quench process
19 will in fact work?

20 MR. BROWN: We did verify that the use of
21 a vent is supported by experimental data. There is
22 published literature out there that assesses what an
23 appropriate vent size is given a certain amount of
24 material. We further independently checked to see
25 what the margin of safety is.

1 DR. WALLIS: This is in a closed system
2 now.

3 MR. BROWN: I'm speaking of right now an
4 open system.

5 DR. WALLIS: I think the concern we have
6 is with a closed system.

7 MR. BROWN: I'm sorry.

8 DR. WALLIS: We had much more concern with
9 a closed system.

10 MR. BROWN: Right. So in that case for
11 example there is --

12 DR. WALLIS: The vent needs to be bigger,
13 right, for a closed system?

14 MR. BROWN: Well, what we did is we looked
15 at what is really causing the event and it's the
16 build-up of volatile organic compounds, degradation
17 products in the solvent. If there's a means to remove
18 those, then we could prevent the event from occurring
19 at lower temperatures. So that is something we looked
20 at and established that if we added an off-cask
21 treatment system that could remove gases like the
22 volatile reaction products then we could essentially
23 prevent that event.

24 Now how reliable is the off-cask treatment
25 system? What sorts of things could cause a blockage?

1 These are the kinds of details that we would have to
2 establish in the ISA. But the fact that it's there is
3 what we're trying to determine before allowing them to
4 build the plant, keeping in mind that the whole focus
5 here back from 1971 is don't allow them to build
6 something that they can't later operate. If we have
7 the equipment in there then we can work on how
8 reliable it has to be, how much surveillance we're
9 going to need to do, how much maintenance does that
10 equipment need to maintain a high level of
11 reliability.

12 MR. ROSEN: Like the through-puts should
13 be.

14 MR. BROWN: Right.

15 MR. MURRAY: Could I just interject just
16 for a second please? Good afternoon. Hopefully my
17 voice will hold up here. I'm Alex Murray again, the
18 Lead Chemical Safety Reviewer and I just would like to
19 point out a couple items which are explained in the
20 final safety evaluation report draft which I think you
21 have. We do have a rather extensive section on the
22 red oil phenomena. All right. We do go into quite a
23 bit of detail about what has been proposed as controls
24 in the literature and also how the applicant has
25 proposed to control it.

1 I would also like to explain that in the
2 analyses which the staff has done we looked at this
3 from the perspective of does the system have the
4 ability or could have the ability if it constructed
5 appropriately to the PSSCs and design basis
6 information that we have now. It could result in a
7 plant, or I should say, a system with the potential
8 for a red oil explosion where that potential would be
9 rendered to be highly unlikely.

10 To help support that analyses, we used an
11 approach very similar to what is used by the American
12 Institute of Chemical Engineers. It is top level. It
13 is semi-quantitative, semi-qualitative. At one point,
14 we did do some very top level fault analysis to look
15 at how the different controls would assist safety and
16 prevent the phenomena from occurring. So we did go
17 into quite a bit of detail. I believe some of the top
18 level fault analyses were provided at an ACRS meeting back
19 in 2003.

20 DR. WALLIS: I'm just trying to figure out
21 where all this fits into the picture you're painting
22 for us. On page 24, you have this preliminary
23 accident analysis. That doesn't tell me where in this
24 stage you do this kind of in-depth look at the
25 literature and convince yourselves that it is

1 physically possible, chemically possible to do things.
2 That doesn't come across in your listing of your
3 activities here.

4 MR. BROWN: What I should make clear here
5 is for example on page 24 this is what the applicant
6 did. This is what DCS did to establish their safety
7 assessment. What isn't clear from this slide is what
8 did we do. What did the NRC staff do to validate?

9 DR. WALLIS: The design basis PSSCs, is
10 that what we were just talking about or would that
11 fall in that box then? The red oil.

12 MR. BROWN: Establishing what they are.
13 Right. For example, the 125 degrees.

14 DR. WALLIS: So what you did was then you
15 looked at the design basis of all these PSSCs and
16 asked a lot of questions.

17 MR. BROWN: Yes.

18 DR. WALLIS: And convinced yourselves that
19 the logical know-how was such that this design basis
20 --

21 MR. BROWN: In a nut's shell, that's the
22 approach.

23 DR. WALLIS: You think you did that.

24 MR. BROWN: Yes. For example, if I may go
25 back to an example, the initial design bases for

1 limiting temperature for red oil prevention was 135
2 degrees Celsius. We looked at it. We, the staff,
3 looked at the available literature and decided that
4 was a bit too close to the initiation temperature for
5 that event.

6 PARTICIPANT: But it's two degrees below.

7 DR. WALLIS: But you convinced yourselves
8 that you said 125 degrees everything would be okay.
9 You did that sort of analysis.

10 MR. BROWN: Yes. We made that sort of
11 assessment. Yes.

12 DR. WALLIS: I think it's important that
13 we would get that impression. Otherwise it's such a
14 high level to understand the depth to which you went
15 to satisfy yourselves that the design bases were okay.

16 MR. BROWN: Okay.

17 MR. GIITTER: Excuse me. As Dave goes
18 through the example on fire protection if he can
19 elaborate on what the staff did or Sharon Steele, our
20 Protection Engineer, do that, then I think it may make
21 more sense to you.

22 DR. POWERS: But I want to pursue this one
23 just a little further here with Alex and you as well,
24 Dave. You've gone through and you've looked at these.
25 You've looked at the literature. You have a candidate

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1 design or a design concept. I think we'd call it a
2 preconceptual design on how to handle this, red oil
3 and the closed system. It looks perfectly plausible.
4 At what point do you say "Yes now prove it to me and
5 what constitutes proof"?

6 MR. MURRAY: Can I answer that?

7 DR. POWERS: Sure.

8 MR. MURRAY: The actual proof or
9 demonstration of the controls for preventing in this
10 case a red oil event would have to be done by the
11 applicant in the license application and you would
12 think that the ISA summary would have quite a bit of
13 information on the red oil or potential red oil event
14 because of the potential severity and known ability to
15 occur in these types of facilities.

16 DR. POWERS: But what constitutes the
17 proof?

18 MR. MURRAY: The proof, what we would
19 anticipate, and I want to emphasize this is forward
20 looking, would be the identification of safety
21 controls at the component level. We would expect a
22 clear logical and/or semi-quantitative or if the
23 applicant feels it is important enough, a quantitative
24 demonstration to show that the event can be rendered
25 highly unlikely. It is the applicant's choice to

1 select exactly which approach or which way they want
2 to show that demonstration. As part of the staff's
3 review of that demonstration, we would anticipate that
4 we would get more into semi-quantitative analysis
5 somewhat like a layer of protection analyses which is
6 performed by the chemical industry.

7 MR. ROSEN: Let's get to specifics now.
8 If the applicant says something is highly unlikely
9 that means it's 10^{-5} , right, or less?

10 MR. MURRAY: By our guidance.

11 MR. ROSEN: Yes? So that's what you're
12 trying to agree at. It is 10^{-5} . He's already
13 asserted that. He's giving you a detailed design and
14 now you're trying to see if you think that this red
15 oil explosion or whatever was going to be at less than
16 10^{-5} .

17 MR. MURRAY: Yes.

18 MR. ROSEN: Now to do that you're going to
19 have to sequences.

20 MR. MURRAY: That's correct.

21 MR. ROSEN: And those sequences are going
22 to have to have numbers on them and you're going to
23 have branch points where you're going to have
24 conditional split fractions where something works and
25 something doesn't work. And it's all going to start

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1 looking like, Dr. Apostolakis, a PRA.

2 MR. GIITTER: That's if they decide to
3 take a quantitative approach which they're not
4 required to do in a Part 70.

5 MR. ROSEN: Right. So they can come in
6 and wave their arms or other appurtenances and say,
7 "Therefore it's 10^{-5} " and you're, poor Alex, is
8 probably the only person on earth who could do it, can
9 conclude from a semi-quantitative or non-quantitative
10 analysis a quantitative result. Remarkable.

11 MR. MURRAY: I as Alex Murray, the Lead
12 Chemical Safety Reviewer, would almost certainly back
13 that up with some of my own calculations.

14 MR. ROSEN: Well, I don't see how you can
15 do it.

16 MR. MURRAY: As long as I have a detailed
17 design and identification of the safety --

18 MR. ROSEN: But why would be a hero other
19 than the factor that we already know you are? Why
20 would you? Why wouldn't you just say "Gee, you're
21 asking me to draw a quantitative conclusion, Mr.
22 Applicant and I don't have any way of doing so and I
23 think the answer is you didn't make it. Do you want
24 a semi-quantitative answer or you want a qualitative
25 answer. My answer is no. What part of no don't you

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1 understand? Now if you want to change my mind, come
2 back with a quantitative argument."

3 MR. BROWN: Well, you just hit on it if I
4 might add. While we don't require that everything be
5 considered in quantitative fashion, if for example in
6 this instance the sequences are complex that really
7 deserve some kind of quantitative analysis, that
8 certainly is not precluded.

9 MR. ROSEN: Something has to open.
10 Something has to close. Some fan has to start. Some
11 this or that. You know.

12 MR. BROWN: Yes.

13 MR. MURRAY: That's right.

14 MR. BROWN: Those kinds of things are
15 allowed and if that's what DCS needs to do to make its
16 case, that's what they will do.

17 DR. WALLIS: What about the future here?

18 MR. BROWN: Right. We're speculating on
19 what the future holds.

20 DR. APOSTOLAKIS: This is not the future,
21 is it?

22 DR. WALLIS: What kind of proof are you
23 going to get? Now the person stage, you're nowhere
24 near that. All you're saying is that we've looked at
25 the way in which these reactions have been controlled

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1 in the past. We have reasonable assurance that when
2 they've done all the detailed design they're going to
3 be able to come up with a number something like 10^{-5} .

4 DR. APOSTOLAKIS: That's what they're
5 saying.

6 DR. WALLIS: But you're not saying that
7 they can do that.

8 DR. APOSTOLAKIS: Unless they don't want
9 to.

10 DR. WALLIS: You're saying you have a feel
11 based on experience and some bounding parameters that
12 it's feasible.

13 MR. MURRAY: That's right. That we have
14 come to a conclusion that they have reasonable
15 assurance and to have some reasonable assurance is
16 more than just a feel. Usually we have a linkage to
17 clear statements and an analogy in the literature. In
18 the case of red oil, some parts of the applicant's
19 proposal lined up very well with practices at existing
20 facilities such as the evaporators in the DOE complex.
21 In some other parts of that proposed safety strategy,
22 there was not that clear an alignment. So it went
23 into a more detailed analyses and actually I did some
24 quantitative work in that area and that allowed us to
25 come to a conclusion we do not have the system

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1 described at the component level. We have the
2 controls described at more of a system level.
3 However, if you use typical values for some of those
4 components like controllers, like valves, like pumps
5 which can put in quench water, you can get to some
6 assurance that, yes, if they design it right with
7 specific components, yes this should have the ability
8 to get to the highly unlikely likelihood and then have
9 to demonstrate that at the ISA stage.

10 MR. GIITTER: I would just add there were
11 some areas in using verterall (PH) as an example where
12 we felt we needed some more information that the DCS
13 committed to provide at the license application stage
14 in terms of testing to confirm, confirmatory testing
15 to confirm what was stated in their construction
16 authorization request.

17 DR. POWERS: Yes, I think you have given
18 the answer that I was looking for, Alex, here. Let me
19 just summarize. I'm going to take a break here by the
20 way and come back. I think we're at the precipice of
21 doing the examples.

22 MR. BROWN: We are.

23 DR. POWERS: But what you did not say is
24 you did not say they are going to have to come in and
25 do an experimental proof that should they get a red

1 oil excursion in this facility, it will indeed handle
2 that. You did not say that.

3 MR. MURRAY: Could you repeat that again,
4 Dana? I just want to make sure I have the sequence
5 right.

6 DR. POWERS: You did not say that you were
7 going to have to do an experimental demonstration.

8 MR. ROSEN: Like futile phosphate.

9 DR. POWERS: That in a red oil
10 decomposition excursion the facility will indeed be
11 able to coop with it.

12 MR. MURRAY: The proposed approach is a
13 convention strategy. So the red oil excursion event
14 would not occur if they do it the usual way.

15 DR. POWERS: You did not say, "Okay, put
16 a bunch of red oil in there, run this thing and show
17 me that that works." You did not say that.

18 MR. MURRAY: We did not say that because
19 -

20 DR. POWERS: That would be an impossible
21 thing to do.

22 MR. BROWN: Well, let me just say. There
23 is for open systems we're saying the red oil event
24 could in fact begin.

25 DR. POWERS: We're talking quotes here.

1 MR. BROWN: Right. An event of such and
2 such size, a design basis value that we have will
3 relieve the pressure even as the event occurs. Now
4 does that mean I'm going to go off to do an
5 experimental apparatus and cook this thing up and show
6 that that vent is sufficient size? No, we don't have
7 that commitment and at this point, we don't have. We
8 didn't say that that was something they were going to
9 do.

10 DR. POWERS: It would be an impossible
11 task because nobody has found a way to reduce the
12 manufacture of red oil.

13 MR. BROWN: No, the basis for the defense
14 size that we have is experimental data.

15 MR. MURRAY: Right.

16 DR. POWERS: It's experiential data.

17 MR. BROWN: I want to say it's
18 experimental.

19 DR. WALLIS: You have to be committed to
20 a research program to understand the red oil reaction
21 better. What is the output of that program? What is
22 it supposed to do if it's not going to satisfy what
23 Dana is asking for which is an experimental
24 demonstration that your theories are okay?

25 MR. BROWN: As I understand that

1 experimental program, that is focused on establishing
2 a temperature margin.

3 MR. MURRAY: Right.

4 DR. WALLIS: Well, that's very important.

5 MR. BROWN: I'm sorry.

6 DR. WALLIS: It's very important what the
7 temperature is.

8 MR. BROWN: It is very important.

9 DR. WALLIS: They do experiments and show
10 that if you get to 126 degrees it's very bad. You
11 might say, "Oh, wait a minute. You can't operate at
12 125."

13 MR. MURRAY: That's correct.

14 DR. WALLIS: They might learn something
15 from the experiment.

16 MR. MURRAY: That is correct. Yes.

17 DR. POWERS: Let me make it very clear.
18 I'm much more comfortable with the approach that Alex
19 laid out than I am with somebody did some experiments
20 and found out that the number was 130 because with
21 this particular red oil you never know if the
22 experiment the fellow is doing is reducing the
23 material that appears by accident. I'm much more
24 comfortable with this, "I've bounded things. I've
25 looked at the design. I know these kinds. I have

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1 fundamental physical understanding of quenching
2 phenomena and stuff like that. We'll get rid of it"
3 than I am somebody producing an experimental datapoint
4 because I think I'm privy to every experiment that's
5 ever been done and I have never seen any of those
6 experiments come back and "Yes, what we produced here
7 in the laboratory is exactly what was produced in the
8 accident at this facility."

9 MR. MURRAY: That's correct.

10 DR. WALLIS: But you know enough to know
11 how much quenching you need to provide to be sure
12 enough. You know enough to be able to evaluate that?

13 MR. MURRAY: The, if you will, amount of
14 quenching that is needed will have to be demonstrated
15 by the applicant at the ISA stage.

16 DR. WALLIS: How will they demonstrate it?

17 MR. MURRAY: We know what the heat of
18 reactions are if you completely oxidize.

19 DR. WALLIS: So it would be bounding
20 calculation.

21 MR. MURRAY: It might be a bounding type
22 calculation. That is correct. But these sort of
23 things can be calculated. Obviously we also will put
24 the applicant in the ISA and the license application
25 plus also to start as part of our review we'll look to

1 see if this is reasonable to accomplish.

2 If for example quenching requires one or
3 two gallons per minute, that is a very reasonable
4 thing. If it turns out quenching requires say 100,000
5 per minute, okay, that is no a reasonable control
6 strategy. But some of this reasonableness and
7 comparison with accepted practice, again the term
8 which we like to use is RAGAGEP or sometimes usual and
9 customary is another term, we can look into this and
10 see where the applicant's proposed strategy stands now
11 and also where it would be when we get to the license
12 application stage.

13 MR. SIEBER: It seems to me though that as
14 far as red oil is concerned no two cans of red oil are
15 the same and therefore you have to have some kind of
16 process controls so that you know that the red oil
17 you're dealing with is in the bounds of the analysis
18 that says "This is the right temperature and this is
19 how much quenching I need." Is that correct?

20 DR. POWERS: Yes. I think that's the
21 strategy they've taken. For the open systems, they've
22 said, "Look this is not different from the kinds of
23 systems where these standards apply." For the closed
24 system, there's more to do here because we have less
25 experience here.

1 MR. MURRAY: And I will just add a couple
2 of the safety controls which the applicant has
3 proposed actually focus on eliminating some of the
4 potential reaction pathways such as the presence of
5 impurities to start out with, such as the presence of
6 certain types of compounds primarily alicyclic
7 compounds in the diluent which can if you will
8 accelerate or contribute to red oil events at lower
9 temperature.

10 They also have identified controls on the
11 impurities primarily C4 type of compounds such as
12 butanol as well as some of the lower esters like a
13 tributyl phosphate. They have also proposed a control
14 on resonance time which of course interacts with the
15 amount of nitration which would occur of the diluent
16 and tributyl phosphate mixture. So they have screened
17 some of the pathways out which historically have
18 contributed to all of the unpredictability of the red
19 oil phenomena plus the ability of controls to be
20 effective.

21 DR. WALLIS: It seems to me you're doing
22 something satisfying yourself that an ECCS system will
23 work without the benefit of relap or track or any of
24 those codes. You're doing it at some global level
25 making use of the kinds of analyses you know how to do

1 and that's what you have to base it on because you
2 don't have a good model for what happens. Is that
3 where you are?

4 MR. MURRAY: I think that's correct. At
5 this stage, we have done what I will call a process
6 analogous to the LOCA process, the American Institute
7 of Chemical Engineers process.

8 DR. WALLIS: It doesn't have the benefit
9 of a code that pretends to describe what's happening.

10 MR. MURRAY: Right.

11 DR. POWERS: What I'd like to do now is
12 just go ahead and take about a 15 minute break and I
13 think at that point we'll come back.

14 MR. ROSEN: Dana, are we going to discuss
15 this slide 27 before we've --

16 DR. APOSTOLAKIS: Well, there is one -- in
17 26 of questions.

18 DR. POWERS: Okay. I'm going to take a
19 break. Off the record.

20 (Whereupon, the foregoing matter went off
21 the record at 3:05 p.m. and went back on the record at
22 3:22 p.m.)

23 DR. WALLIS: Back in session.

24 DR. POWERS;: If you don't do your example
25 soon, we'll be stuck on the 26 and 27 for eternity.

1 MR. ROSEN: But I want to have one
2 question answered. If you can't answer it, then
3 that's fine. You can answer it later. It's on the
4 next slide, not 26.

5 DR. POWERS: Get on that one as quick as
6 you.

7 MR. ROSEN: Second yellow bullet,
8 application in Part 50 Appendix B. You know it's the
9 devil and the devil's in the details. Part 50
10 Appendix is eighteen criteria.

11 MR. BROWN: Eighteen criteria.

12 MR. ROSEN: That are just very high level
13 that when you try to comply with that you really have
14 to comply with the daughters standards and reg guides
15 all of them which are many and multi-faceted including
16 such things as design control and how one goes about
17 doing design in accordance with Appendix B. Let me
18 tell you. Those standards are very onerous. Is that
19 what you really mean? I mean it's the same site as
20 for reactors. I tell you what I think the staff will
21 do. They'll come in and their QA guys will come down
22 to your contractors and apply the same Appendix and
23 daughter standards that they do on reactors and you're
24 going to be unless they know it's coming, it will be
25 a train wreck.

1 MR. BROWN: At this point what we have
2 because what the regulation requires at this stage is
3 I mentioned the safety assessment of the design basis,
4 the site description and the quality assurance plan.
5 So DCS submitted a quality assurance program plan that
6 is tailored after the 10 CFR 50 Appendix B criteria.

7 MR. ROSEN: The normal Appendix B, people
8 reviewed it.

9 MR. BROWN: Yes.

10 MR. ROSEN: The same guys reviewed it and
11 said that's an Appendix B program. That seems
12 appropriate to us.

13 MR. BROWN: We had a quality assurance.
14 Yes, and that's what required for a MOX facility.

15 MR. ROSEN: All right.

16 MR. MAGRUDER: And they are anticipating.
17 We've already talked about doing joint QA audits and
18 visits and we're going to vendors to them and things
19 like that.

20 MR. ROSEN: Oh boy. We have them now.

21 DR. POWERS: He's not joking. This is
22 something I wouldn't wish upon my worst enemy.

23 MR. ASHE: Excuse me. This is Ken Ashe
24 again. For 10 CFR Part 70, we didn't have a choice.
25 I mean that's what it says we have to do.

1 MR. ROSEN: Oh, having fun. You might
2 want to hire a few people who've been through it.

3 DR. POWERS: Or maybe not.

4 MR. BROWN: Something I just want to get
5 back to and I apologize if I'm backtracking too far,
6 but there was some question earlier about what is
7 meant by defense in depth. That term is clarified in
8 the regulation and it does mean a design philosophy
9 applied from the outset to completion of the design.
10 It is based on providing successive levels of
11 protection such as health and safety will not be
12 wholly dependent upon any single element of the
13 design, construction, maintenance or operation of the
14 facility.

15 DR. KRESS: It came out of the
16 commissioner's white paper.

17 MR. BROWN: Yes, that's right.

18 DR. KRESS: I think that's the words they
19 used.

20 MR. BROWN: Okay. If I may now move right
21 on to the example then. The example I chose here for
22 this is the possibility of fire in a glovebox
23 containing plutonium dioxide powder. It is a credible
24 event. One of the ways that we've determined that is
25 are there any causes. Is there combustible material

1 present? Are there ignition sources? And in fact,
2 there are.

3 So the next step then is to establish,
4 okay if I had such a fire, what are the consequences
5 to each of the receptors. DCS did this in its safety
6 assessment and the staff independently did this part
7 of its safety evaluation to assess whether or not DCS
8 was correctly categorizing events as low, intermediate
9 or high consequence events.

10 Having established that this would be a
11 high consequence event and DCS did that, staff
12 independently verified, yes, it looks like a high
13 consequence event. They needed to establish a
14 strategy and for this event what they're doing is
15 trying to make what is high consequence low by
16 mitigation. So the strategy for example for the
17 facility worker as I've described is escape.

18 MR. ROSEN: Run like hell.

19 MR. SIEBER: Run.

20 MR. BROWN: Basically. So we have to ask
21 ourselves "Well is it reasonable that a worker in a
22 plutonium processing facility would in fact run if he
23 saw a fire in a glovebox? Are there reasonable
24 indications of danger that would cause the right
25 response?"

1 DR. WALLIS: He doesn't put it out or
2 anything. He just runs away.

3 MR. BROWN: As I go on, I'll describe some
4 of the other things that are there by way of available
5 CO₂ cartridges for fighting the fire but in the event
6 that this person decides, well, the first thing this
7 person should do is what he's trained to do which is
8 to get out of there. This is administrative control.
9 I can't tell you what the design basis is. It's
10 qualitative. He responds to the indication of fire.

11 For mitigation for protection of folks
12 outside, it's that tertiary confinement system. That
13 is the PSSC. The C4 system is the filters on the
14 glovebox ventilation system. The C3 system represents
15 the process room where the glovebox is contained. You
16 need both.

17 DR. WALLIS: So the design basis is that
18 the whole thing burns up and none of the products get
19 out of a certain space.

20 MR. BROWN: The event is that the glovebox
21 burns up, consumes, involves all the material in that
22 glovebox.

23 MR. ROSEN: Is there a criticality concern
24 in this glovebox in your example?

25 MR. BROWN: In this example, no, there's

1 not a criticality. Let me ask what your question is
2 again though.

3 MR. ROSEN: Well, is there a criticality
4 concern because if there is then you won't be able to
5 use water-base via suppression systems and you'll be
6 using a clean agent suppression systems and I have
7 problems with fires that are suppressed by clean agent
8 systems.

9 MR. BROWN: Okay.

10 MR. ROSEN: Because they don't cool
11 anything. They just suppress the fire. The minute
12 you get air you have a fire again.

13 MR. BROWN: I understand.

14 MR. ROSEN: That's the essence of my
15 technical concern and the one Dana asked me to
16 postpone until this example.

17 MR. BROWN: Okay. The answer is yes there
18 is a criticality concern in areas where there's
19 plutonium powder stored. They may be moderator
20 controlled areas, areas where they are specifically
21 including the water.

22 DR. WALLIS: We are talking about a
23 glovebox here. Are we or are we talking more
24 generally?

25 MR. BROWN: Talking about a glovebox.

1 DR. POWERS: For this example.

2 MR. BROWN: For this example right.

3 DR. WALLIS: So there's a criticality
4 concern with this example.

5 MR. SIEBER: There could be.

6 MR. BROWN: If the decision was to fight
7 that fire with water, there is a potential criticality
8 concern.

9 DR. WALLIS: You've also gotten molten
10 plastic and stuff. We talked about it at the
11 subcommittee.

12 MR. BROWN: Yes.

13 DR. WALLIS: It's not as if there aren't
14 any moderators around.

15 MR. BROWN: Correct. That would have to
16 be considered in a criticality safety evaluation.

17 MR. ROSEN: So I'm going to assume that
18 there is a criticality concern here.

19 MR. BROWN: Right. The event then with
20 these PSSCs in place is as we've described.

21 MR. ROSEN: Operator bagging.

22 MR. BROWN: The ventilation system will be
23 able to withstand the fire to completion involving all
24 of the combustible materials and the soot loading on
25 the filters would not damage the filters or in any way

1 impair their function. One of the ways they do that
2 is this second to last bullet is to confine that fire
3 to that fire area using the two and three hour rated
4 fire compartments. That's what's necessary to achieve
5 the performance requirements. So those are the PSSCs
6 they need to have.

7 But beyond that is this C2 confinement,
8 fire detection and suppression systems that are also
9 there. They are just not credited to achieve the
10 performance requirements in this case. So they
11 represent defense in depth.

12 MR. SIEBER: The main mitigating strategy
13 is to allow it to burn until the fuel is consumed.

14 MR. BROWN: Right. The assumption is.

15 MR. SIEBER: And the secondary, the back
16 up, defense in depth is to put the fire out.

17 MR. BROWN: I think it's important that
18 when we say that that there's a philosophy here. Yes,
19 there's a philosophy of "I could withstand full
20 burning, all of the combustible material is burned."
21 Does that mean that's going to be my operational
22 strategy? That's how I'm going to respond to a fire.
23 No, certainly not. But from a safety assessment point
24 of view, I'm demonstrating that I could in fact do
25 that and I don't need to go fight the fire.

1 DCS has other concerns. They want to keep
2 this plant operational. They have a customer they
3 need to satisfy. They're going to do something to put
4 the fire out and those provisions are in place also.
5 We talked about the dry stand pipes and the ability to
6 go in there if they had to to fight the fire with
7 water. But what's in there is a clean agent
8 suppression system for these areas.

9 DR. POWERS: I guess I'm still looking for
10 the answer to Steve's statement that suppose the
11 combustible inventory is substantial such that you
12 can't really afford to have this fire go on to the
13 point that it consumes all the combustible. And you
14 use the clean agent and sure enough, it crusts over
15 the fire. As soon as you evacuate the clean agent and
16 let air in again, it flares up again and this will go
17 on. We certainly know of examples of it going on
18 literally for hours. Now what do you do?

19 MR. BROWN: I see Sharon is approaching
20 the microphone. I would like to defer to her on that
21 question. Did you understand the question?

22 MS. STEELE: I don't know if I heard the
23 entire question, but one of my initial responses is
24 that combustible loading controls is a PSSC for
25 gloveboxes that have radiologicals stored. So what

1 DCS has done is through the combustible loading
2 controls look at fixed combustibles, things that are
3 going to be there by design and transient
4 combustibles, thing that are necessary to continue the
5 operations. As best as possible, they will minimize
6 the combustible load within the gloveboxes. I think
7 that would probably satisfy this question.

8 MR. BROWN: Well, I think you're getting
9 to that answer which is that there are another suite
10 of controls if you will, another PSSC which is these
11 combustible loading controls and the management
12 measures which are in place to ensure that there is
13 not a build-up of transient combustibles and such.

14 MS. STEELE: Further to answer Dana's
15 concern, if there is an excess amount of combustibles
16 in those gloveboxes that could lead to a fire that
17 could potentially overwhelm the systems that are in
18 place, for that what DCS has done through calculations
19 was demonstrate that for the very worst case assuming
20 a fire that had 80 adiabatic temperatures within the
21 room, that the ventilation system would be able to
22 dilute the fire air with sufficient air to reduce the
23 temperatures and so that a fire would not affect the
24 HEPA filters downstream. That's one of the analyses
25 that they have done.

1 MR. BROWN: As I understand that, they
2 looked for and found the two adjacent fire areas that
3 had the highest combustible loading and used that in
4 the analysis.

5 MS. STEELE: Right. And as a separate
6 analysis just looking at whether the fire barriers
7 could withstand an intense fire, they selected two
8 fire areas, one adjacent to each other with a maximum
9 amount of field loading and used that as a basis for
10 demonstrating that the barriers would be adequate even
11 though the intent is to limit the fire size or a
12 potential fire to one fire area.

13 DR. POWERS: So what you're saying is that
14 they are removing the hypothesis.

15 MS. STEELE: Yes.

16 DR. POWERS: That is that there is a fire
17 area such that the combustible loading is so high you
18 can't tolerate the combustion of that entire fire
19 loading. They are eliminating that hypothesis is what
20 you're saying.

21 MS. STEELE: Yes.

22 DR. DENNING: But within an administrative
23 control.

24 DR. POWERS: Yes, it's clearly an
25 administrative control.

1 MR. ROSEN: And that does block that and
2 protects the filters downstream or protects the walls
3 of the enclosure.

4 MS. STEELE: Right.

5 MR. ROSEN: It does all those things, but
6 inside the enclosure you have a fire that consumes a
7 limited amount of in-place combustibles plus transient
8 combustibles and some of this tributyl phosphate and
9 other stuff that's in there along with plutonium and
10 so and so. That all burns, but it burns and it's
11 suppressed by a clean agent. Now here's where you
12 are. You have this glovebox which is still intact,
13 still hot, filled up with halon or something like
14 that.

15 MS. STEELE: I was going to just get back.
16 The gloveboxes themselves do not have clean agent
17 suppression. Clean agent suppression is applied to
18 the fire areas themselves where gloveboxes are present
19 that contain radiological material.

20 MR. ROSEN: Okay. So the gloveboxes have
21 nitrogen or something like that.

22 MS. STEELE: Some have the gloveboxes
23 whether it's physio-material (PH) or inerted. That is
24 for process reasons. It is not identified as a PSSC.

25 MR. ROSEN: So that's helpful.

1 MS. STEELE: Right.

2 MR. ROSEN: Now let me go back to the
3 beginning again. You have this glovebox which may be
4 inerted. It has tributyl phosphate perhaps and
5 plutonium in it and maybe some other combustibles at
6 a fix like seals or something like that.

7 MS. STEELE: Right.

8 MR. ROSEN: And it catches on fire. Bang,
9 off goes the halon, well, no. It catches on fire.

10 MS. STEELE: You're still in the glovebox.

11 MR. ROSEN: You're still in the glovebox.
12 You have nitrogen. So it can't burn much but it's
13 burning somehow.

14 MR. SIEBER: How?

15 MS. STEELE: I don't think so. There's
16 not sufficient support combustion.

17 MR. ROSEN: The things never leak? They
18 never leak?

19 MR. BROWN: Well, just don't --

20 MR. ROSEN: Then we don't have a fire
21 program. We don't need it, I guess.

22 MR. BROWN: They do because when you look
23 at this philosophically you're saying as Sharon
24 pointed out the nitrogen is not credited as a safety
25 control. So you don't assume it's even there.

1 MR. ROSEN: Okay. So it is burning.

2 MR. BROWN: It's burning.

3 MR. ROSEN: Somehow it leaked let's just
4 say. Now it's burning. It's getting hot. It
5 destroys the glovebox enough or it breaches the
6 glovebox.

7 MR. BROWN: Breaches.

8 MR. ROSEN: And now it's detected and the
9 halon system, the clean agent suppression, goes off.

10 MS. STEELE: Right. And it would be
11 detected even before there's a breach because there
12 are at least two fire detectors in each glovebox and
13 those are credited as PSSCs. So somewhere in the
14 facility you would know -

15 MR. ROSEN: So probably early --

16 MS. STEELE: -- that there's something
17 going on there.

18 MR. ROSEN: So now we have a detection and
19 a breach of a glovebox and a halon system discharge
20 and the area operators have left already because they
21 know they're off to get to the safe haven.

22 MS. STEELE: Right. There is a fire
23 brigade also.

24 MR. ROSEN: If they show up. I'm sure
25 they will.

1 MS. STEELE: They show up.

2 MR. ROSEN: But there is a fire of some
3 kind going on in that glovebox inside that breach and
4 it's hot. Fires are hot. There's butane, tributyl
5 phosphate, who knows all what else in there but it's
6 hot and there's nothing cooling it off except what?
7 There has to be some conduction. There has to be some
8 radiation cooling.

9 MR. SIEBER: Radiation.

10 MR. ROSEN: There has to be some of that
11 going on and when all of the combustibles have
12 combusted.

13 DR. KRESS: It mixes with the air in the
14 room.

15 MR. ROSEN: Mixes with the air in the
16 room.

17 DR. KRESS: At the cooling process.

18 MR. ROSEN: Yes, but the air has been
19 replaced to a large degree by the halon. I'm still
20 trying to figure out how does one eventually get the
21 thing cooled off.

22 DR. KRESS: There's a cooling out there.

23 MS. STEELE: Well, see the C3 ventilation
24 system, it's safety function is to remain operable.
25 That would also be diluting the air within the room

1 and throughout the C3 system. However, if it's
2 determined that for some reason the temperatures in
3 the fire area are larger than what they're
4 anticipating, there will be procedures where you can
5 actually close the dampers to that particular fire
6 area and still contain the fire to that fire area
7 whose barriers included in the dampers are designed to
8 withstand a two hour fire.

9 MR. ROSEN: So now it keeps burning until
10 it's a two hour fire, but still hot although it's
11 maybe lost some of the, I mean quantitatively whether
12 or not that's a good heat loss mechanism but still you
13 haven't described to me how one actually gets the
14 cool-down you need. I'm an old fire protection guy
15 from the plants and the thing that they taught us and
16 that we learned at Brown's Ferry is eventually you
17 need spring water on this thing to cool it off.

18 MS. STEELE: They can eventually do that.
19 Remember the fire area confines two hour fire limit.
20 There's not enough in most cases combustibles to even
21 have a two hour fire. So assuming there's no oxygen
22 coming in, the C3 systems are shut down, dampers are
23 closed, there will not be enough combustibles to go
24 beyond the limits of the fire area if necessary.

25 MR. BROWN: I do want to try to understand

1 this better because the fire has occurred and it may
2 be faster than two hours and there is still heat in
3 the room, but other than being a hot room what
4 concerns do I have left? The ventilation system has
5 captured all of the potential release. The fire is
6 contained. The fire is out and I just have to wait
7 until the room cools down.

8 That's philosophically what we're talking
9 about with respect to what the PSSCs will do.
10 Sharon's acknowledging certainly that there are other
11 things they can do and we'll be asking them to do.
12 But that room will cool down eventually.

13 MR. ROSEN: It depends on how much
14 loading, doesn't it?

15 MR. BROWN: How much loading there is?

16 MR. ROSEN: Yes.

17 MR. BROWN: Oh, absolutely. Yes, we
18 addressed that with the combustible loading controls.

19 MR. ROSEN: Well, if it doesn't cool down
20 right away, pretty soon you start having fires
21 external to the glovebox in the cables.

22 MR. BROWN: Right.

23 MR. ROSEN: Cable trays, anything else in
24 the room in the enclosure starts to catch fire.

25 MS. STEELE: Cables that are in the rooms

1 where there are gloveboxes are encased in metal
2 conduit and all cables are designed to be IEEE
3 qualified to begin with, cables that enter those
4 rooms.

5 MR. ROSEN: The bookcases and whatever
6 else is there that's combustible.

7 MS. STEELE: Not in those areas where
8 there are gloveboxes.

9 MR. ROSEN: Okay. So these are all
10 matters for the ISA for me to look at in detail.

11 MR. BROWN: Yes, they are.

12 MS. STEELE: Yes.

13 MR. ROSEN: And see what the combustible
14 loading are and whether I believe that there's
15 conduction and the conduction in radiative terms are
16 large enough to actually result in a cool-down.

17 MS. STEELE: And you're absolutely right,
18 Steve. There's always a potential for fire to come
19 through the barriers. There's going to be penetration
20 seals, penetration seals programs and the barriers
21 themselves which are PSSCs will be designed such that
22 We would largely eliminate that possibility. They're
23 going to meet typical NFPA standards.

24 MR. ROSEN: You're not going to leave it
25 to me to do this. This is what you're doing.

1 DR. POWERS: You're the lead analyst.

2 MR. ROSEN: This is what you're going to
3 do.

4 DR. POWERS: Sharon has other jobs to do.
5 She's not around to help anymore.

6 MR. ROSEN: If I got paid what Sharon got
7 paid, I might be willing to do it.

8 MR. MAGRUDER: I also want to point out
9 that it doesn't stop there. During construction,
10 we're going to have a lot of inspectors on site.
11 There'll be a resident inspector there at the site.
12 He'll be doing tours.

13 MR. ROSEN: To make sure there's not
14 transient combustibles being produced.

15 MR. MAGRUDER: Exactly.

16 MR. ROSEN: So at the design stage, the
17 ISA stage, the kinds of thought processes we just went
18 through kind of as an experiment is what the staff
19 will be doing to show themselves that the applicant
20 has indeed proposed a set of controls that makes
21 sense.

22 MR. MAGRUDER: Yes.

23 MS. STEELE: And that's what we're
24 approving it based on.

25 DR. POWERS: How much thermal leg can you

1 put?

2 (Laughter.)

3 MR. ROSEN: All these Appendix B
4 Standards, all of this work that you'll be reviewing
5 will be to Appendix B Standards.

6 MR. BROWN: That's right.

7 DR. POWERS: This could easily be the most
8 expensive fuel that's ever been up in any reactor.

9 MR. BROWN: What I'd like to do is focus
10 on one of the PSSCs that I just talked about, the C3
11 ventilation confinement. So why do we believe that
12 they've identified design bases that will make that
13 thing work even though there's a fire. The safety
14 function is to remain operable. There are spark
15 arresters. There are on the two stages of spark
16 arrester on the final HEPA filter assemblies that
17 protect the final HEPA filters. That's somewhat of a
18 rather qualitative argument that have these there on
19 protecting the filters from hot embers and particles
20 that may be coming down the pipe.

21 The filters themselves are designed to
22 withstand 450 degree Fahrenheit temperatures and this
23 is an analysis that DCS did and we looked at. Because
24 this plant is divided into 350 areas when I have only
25 one fire area involved, I have a considerable amount

1 of dilution flow from areas that are not involved in
2 a fire.

3 DR. WALLIS: This is air?

4 MR. BROWN: Of air. Yes.

5 DR. WALLIS: So you're going to mix air
6 with what could be combustible products coming out of
7 the glovebox?

8 MR. BROWN: Yes, I believe that was a
9 question that we raised during the review. Was it
10 not, Sharon, the possibility for combustible like
11 paralysis products I believe they are called coming
12 out of a fire?

13 DR. WALLIS: And they mix them with air
14 and there are glowing particles in there to set them
15 off.

16 MR. BROWN: Yes.

17 MS. STEELE: You're saying that the
18 products of combustion would be coming from one
19 particular fire area and mixing with clean or
20 relatively clean air from the remaining 349 areas.
21 Right?

22 MR. BROWN: Right.

23 DR. WALLIS: What I'm saying is the
24 combustion could have cells themselves be combustible.

25 DR. POWERS: Quite often are.

1 DR. WALLIS: Quite often are. Incomplete
2 combustion decompose to plastic and something else.

3 MR. BROWN: Right and that's going into
4 the ventilation stream along being mixed with fresh
5 oxygen. That's the scenario that you're laying out.

6 DR. WALLIS: Right. That's the scenario.

7 MR. BROWN: Right. Do you recall, Sharon,
8 how that addressed?

9 MS. STEELE: No, I don't.

10 MR. BROWN: I believe that is part of the
11 analysis where we're showing that even though that may
12 occur say in some manifold immediately downstream of
13 a given area prior to getting to the final HEPA
14 filters which are all the way downstream, they're not
15 likely to see temperatures anywhere near 450 degree
16 Fahrenheit.

17 DR. KRESS: I could see how you could do
18 that if you knew what the combustibles were and how
19 much because you can take that and mix it with your
20 incoming air and combust it all the way and see what
21 temperature that takes you to without loss. It can be
22 done.

23 DR. WALLIS: With enough air to cool it
24 down.

25 DR. KRESS: You have to know how much

1 dilution air you have. That's an assumption.

2 MS. STEELE: Right.

3 MR. BROWN: Keep in mind. That
4 essentially has 349 times the amount of dilution air.

5 DR. KRESS: Yes. You have to define what
6 combustibles are and what their heat of combustion is.

7 MS. STEELE: One of the conservative
8 analyses which looked at the dilution of the hot air
9 assumed that the hot air was at a temperature of 2,000
10 degrees Fahrenheit. I mean that would be the
11 adiabatic temperature that you could expect from a
12 fire involving ordinary combustibles and I don't think
13 there are too many things at the facility where you
14 get a temperature beyond that.

15 That's really extreme. With that
16 analysis, they were able to demonstrate that the
17 temperatures before you got to the final HEPA filters
18 were within the limits that the HEPA filter could
19 withstand.

20 MR. BROWN: We at one point carried an
21 open item in the staff's review with regard to how
22 good these filters actually survive a fire. One of
23 the things DCS did to resolve that was these certain
24 pressure conditions calculations to show that, yes, we
25 think DCS had said they think these filters would

1 survive these types of events. We also received at
2 that time a commitment that they would go off and do
3 experimental tests, not only do this by calculation
4 but later show by test that these filters could
5 withstand these kinds of conditions.

6 MS. STEELE: Let me just add also. Dave
7 talked about the two stage pre-filters.

8 MR. BROWN: Yes.

9 MS. STEELE: One of them is a spark
10 arrester which is made of metal and it would prevent
11 any embers, any sparks, from going beyond to reach the
12 HEPA final filters themselves.

13 MR. BROWN: And so just following through
14 on the methodology here, we know this now. What are
15 we expecting later? The C4 confinement ventilation
16 system, it's just that. We're saying it's the
17 glovebox ventilation system at a system level. DCS
18 will need to identify of that what are the important
19 items relied on for safety and break it down to the
20 component level. Then we want them to show that those
21 things which need to be reliable and available on
22 demand will be so and that in order to get to that
23 point they've identified the appropriate management
24 measures.

25 For HEPA filters not relating necessarily

1 to a fire, but just the on-going performance of the
2 filters is something you'd want to routinely test and
3 that's normally done on some surveillance frequency.
4 The provisions are in the design that these filters
5 can be individually, the two stages of filters, tested
6 online. I'm going to move to some of my last remarks
7 unless there are any other questions on that fire
8 example.

9 DR. WALLIS: This soot deposits on a
10 filter which is made out of what?

11 MR. BROWN: The filter itself is --

12 MR. GIITTER: The question is what the
13 soot would be deposited on which would be before it
14 actually reaches the HEPA filter.

15 MS. STEELE: Well, you have the metal
16 spark arrester.

17 MR. BROWN: Two stage spark arrester
18 stainless steel.

19 MS. STEELE: The two stage.

20 DR. WALLIS: What's the filter material in
21 the HEPA filter?

22 MR. BROWN: Porous silicon glass.

23 DR. WALLIS: So it's not a conductor. So
24 you get charged soot particles that charge up this
25 thing and there's a spark in the HEPA filter.

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1 MR. BROWN: I'm not sure I understand.
2 You're postulating a condition where the filters could
3 burn.

4 MR. SIEBER: Yes.

5 DR. WALLIS: I'm just postulating a
6 condition where electrostatic charge could build up in
7 the filter in various regions.

8 MR. BROWN: Okay.

9 DR. WALLIS: And then discharge and have
10 a source of ignition. That's all.

11 MR. BROWN: Okay.

12 DR. POWERS: Ignition of what?

13 DR. WALLIS: It burns the soot which is
14 deposited in there.

15 MR. BROWN: Okay. That's not --

16 DR. WALLIS: I guess you're going to
17 consider all these things.

18 MR. BROWN: We didn't consider that as
19 initiating event for damage for the filter.

20 MS. STEELE: Well, certainly there will be
21 many answers when DCS performs their actual tests.

22 DR. WALLIS: I just know that they might
23 put a vacuum cleaner on soot by a furnace like in a
24 spa. I think it's something to do with the charges on
25 the soot products.

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1 MR. BROWN: Okay.

2 DR. WALLIS: I don't know what causes it,
3 but it happens.

4 MR. BROWN: Yes. WE haven't considered
5 that at this point. That's an interesting question.
6 Last time we spoke with the subcommittee. We were
7 talking about the closure of what open items remained.
8 Those have all been resolved. We had discussed at
9 that time a permit condition that will be applied for
10 maintaining habitable conditions in the control room.
11 We have discussed that again with DCS and that
12 condition will remain in the permit. I mentioned
13 briefly on that second day of the subcommittee meeting
14 in December that we had some follow up items we were
15 looking into in criticality safety.

16 DR. WALLIS: So all this discussion about
17 the safety is examples. It's assessment that a fire
18 in the glovebox was supposed to convince us that you
19 had everything under control. Is that what the
20 discussion was for?

21 MR. BROWN: It was intended to be an
22 example, just that illustrative of the approach that
23 we took.

24 DR. WALLIS: It does seem to be that for
25 all the questions it didn't have very quantitative or

1 convincing answers.

2 MR. BROWN: You mean in that example you
3 weren't convinced by it.

4 DR. WALLIS: Yes. Did I miss something?
5 We won't able to ask the questions that didn't have
6 any crisp, reassuring answers.

7 MR. ROSEN: Certainly no quantitative
8 answers.

9 MR. BROWN: I think Sharon described for
10 example that the temperatures that were assumed as
11 part of the fire assessment to show that the filters
12 would meet or the temperatures at the filters would be
13 well below the temperatures at which they're rated.
14 We were specific in the numbers that we described
15 starting with the temperature of 2,000 degrees
16 Fahrenheit in a fire area, not likely to exceed 450
17 degree Fahrenheit at the final filter.

18 DR. WALLIS: And then no secondary
19 combustion on the way there? No combustion that
20 collects in the pipe to the filter?

21 MR. BROWN: I understand your question.
22 I think we explained it that the very conservative
23 assumption that we've had, Sharon, I think described
24 an adiabatic type fire of very high temperatures
25 bounds, those sorts of phenomenon. That mixing of

1 combustion products would occur immediately downstream
2 of the fire area. So I assume it would be at
3 temperatures not very much different from the
4 temperature we assume to be in the fire area of 2,000
5 degree Fahrenheit.

6 MR. ROSEN: Which would immediately
7 destroy the ducts.

8 MR. BROWN: I'm sorry. Immediately be --

9 MR. ROSEN: Two thousand degrees
10 Fahrenheit, what kind of ventilation ducts are we
11 making these days?

12 DR. POWERS: Think of the heat capacity,
13 Steve. You're total enthalpy in the gas is
14 microscopic compared to the total enthalpy in the
15 duct. It won't heat the duct up at all.

16 MR. ROSEN: I see what Graham's point is.
17 We haven't seen any of those calculations. We can do
18 them and talk about them.

19 DR. POWERS: There are calculations that
20 I need to write on paper and the calculations I can do
21 in my head and the heat capacity of a sheet metal duct
22 and the heat capacity of gas are numbers that I know
23 somewhat intuitively.

24 MR. ROSEN: I understand all that, but the
25 point here is that we're not doing the calculations

1 here. We're just trying to think about whether or not
2 they could be done, I guess, not with assurances that
3 they will be done either by the applicant or the staff
4 at some point. All we're doing here is making sure
5 that we believe that there's a reasonable assurance
6 you'll be successful when you do those things.

7 DR. WALLIS: You're telling us that you go
8 to 2,000 degrees in the glovebox and then everything
9 gets cooled off in the pipe. It could well be that
10 you have an oxygen short fire in the glovebox and you
11 boil off all kinds of products from the polymethyl
12 methacrylate which deposit in the exhaust pipe to the
13 filter and at some time later on catch fire up there.
14 I just don't know.

15 DR. KRESS: I think what they're saying is
16 if you take all the combustibles that are inside the
17 box adiabatically combusted to get a temperature and
18 then you mix that temperature with the air and if
19 that's the low --

20 DR. WALLIS: But that's not necessarily
21 the worst case.

22 DR. KRESS: Yes, I think it is.

23 DR. WALLIS: You can the adiabatic case up
24 in the pipe.

25 DR. KRESS: I don't see how it can be

1 worst than that even if some of it comes off as soot
2 and ends up in the pipe.

3 DR. WALLIS: Yes, but then you have a big
4 fire in the pipe. All the glovebox is is a pyrolitic
5 converter that sends off combustible materials into
6 the pipe. Then you reach your enthalpy somewhere in
7 the pipe and it depends a lot on how much air you put
8 in there.

9 DR. KRESS: Of course, it depends on how
10 much air, but the process they're talking about I
11 think bounds it.

12 DR. WALLIS: This is typical though of
13 what we've seen all along. There's a lot of
14 discussion, but there's nothing much to go on in terms
15 of an analysis that we look at. So we have to ask a
16 few questions and say, "You know generally it looks as
17 if you guys know what you're doing."

18 MS. STEELE: This is Sharon again. One of
19 your concerns is the combustion of particulates that
20 are in the ducts if there were a fire. As we
21 understand it, the velocities in the duct through the
22 C3 system for example would be high enough that
23 there's always a flow of those particulates and they
24 would be caught on the HEPA filters. HEPA filters are
25 changed out every so often and so that would help to

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1 eliminate that concern.

2 Another issue is that the HEPA filters
3 themselves are a great distance away from those fire
4 areas that contain those gloveboxes. I don't know
5 exactly what the distance is but that certainly helps
6 with dilution and the reduction in temperatures of any
7 product of combustion before you get to the spark
8 arrester which would eliminate the embers and before
9 you get to the other pre-filter which prevents the
10 passage of items that are greater than one micron
11 which are certainly before the final HEPA filters
12 themselves.

13 There is also temperature detectors in the
14 duct work which would let you know that there is
15 something going in the duct if there is a fire in the
16 room itself. It would let you know there is something
17 going on there that's unacceptable.

18 DR. WALLIS: I think we were discussing
19 gaseous combustible products in the pipe, not
20 necessarily just particles.

21 DR. POWERS: I guess I am at total loss to
22 understand how I can put more enthalpy in the
23 adiabatic enthalpy.

24 DR. KRESS: That's exactly right.

25 DR. WALLIS: That depends on what it's

1 diluted with. If you have the fire --

2 DR. POWERS: How can I possibly put more
3 enthalpy into a system than the adiabatic enthalpy?

4 DR. WALLIS: You're saying you can get say
5 2,000 degrees coming out of the glovebox and you
6 dilute it with air and you get down to 500. I'm
7 saying you could have 1,000 degrees in the glovebox.
8 You could have a fire in the pipe which gets you up to
9 this maximum enthalpy and so you have 2,000 degrees in
10 the pipe and now you're not diluting with anything.
11 Your area around the pipe --

12 DR. POWERS: I guess I'm at a total loss
13 how I'm going to not dilute with air.

14 DR. WALLIS: The air is now supporting the
15 combustion in the pipe. Now if you add a lot more --

16 DR. POWERS: You will knock the
17 temperature down like crazy. So now I do an analysis
18 in which I put the adiabatic enthalpy and I dilute it.

19 DR. WALLIS: Sure. If you dilute enough,
20 you can always do it.

21 DR. POWERS: And by the design, how many
22 flows do I have? Thirty-nine volumetric flows in.

23 DR. WALLIS: So the argument --

24 DR. POWERS: I'm sorry. Three hundred
25 fifty-five areas.

1 DR. WALLIS: -- is that you completely
2 overwhelm your energy source. We could have said that
3 at the beginning and avoided this whole thing.

4 DR. POWERS: I think we tried to.

5 MR. ROSEN: Let's talk about one other
6 thing which is assuming you don't have this dilution.
7 You don't want to overwhelm anything. Are all these
8 spaces available in the plant where you might have
9 moderation control? Do you have pre-action systems
10 available to respond to this?

11 MS. STEELE: Right. Outside of areas
12 where there is physio-material like in the corridors
13 and so on, there are pre-action suppression systems,
14 water based.

15 MR. ROSEN: So I could say something like
16 you should demonstrate that if you had a fire and
17 recognizing that you don't need this -- the responders
18 could ultimately use under the management control,
19 administrative control or post fire plans a preaction
20 type, they would have access to water through a
21 preaction type system.

22 MS. STEELE: Right. They would access to
23 water through the dry stand and they are water-based
24 suppression systems outside of those areas where there
25 are gloveboxes.

1 MR. ROSEN: So that the option is
2 available to them if they analyze the situation and
3 believe for example that though it's a moderation
4 controlled space they are having a fire but there is
5 material in there that could induce criticality at
6 this time. So they could make a decision conscious
7 decision to use these things.

8 MS. STEELE: They could. Yes. Even with
9 the clean agent system, it's not a done deal. They
10 have to ensure that they can maintain pressures and so
11 on throughout the facility and that would be
12 demonstrated during the ISA stage. So I would imagine
13 that if for some reason it's been demonstrated that
14 the clean agent suppression system would not be
15 effective that they would consider other types of
16 systems. Of course, we'd have to compare our analyses
17 with the other folks.

18 MR. ROSEN: I needed that answer.

19 DR. POWERS: Dave, I want you to go
20 through your summary real quick because I have one
21 more question to ask you.

22 MR. BROWN: Okay. With regard to
23 resolution of open items, we have received recent
24 changes to the construction authorization request. We
25 will certainly incorporate those in our safety

1 evaluation report by citation. This slide is merely
2 to go back over those things which we needed to find
3 now namely that the design basis of PSSCs were
4 acceptable, if they've addressed the baseline
5 criteria.

6 DR. POWERS: -- is really PSSCs. Right?

7 MR. BROWN: You got me. Yes. PSSC.

8 DR. POWERS: Just have to harass you a
9 little bit.

10 MR. BROWN: I was waiting. Then that they
11 designed this in accordance with the defense in depth
12 philosophy. That's the conclusion of my presentation.

13 DR. POWERS: One more question that came
14 up at the subcommittee meeting, and I guess we're
15 looking again for a crisp answer on this, is that
16 right now the facility is part of an integrated
17 complex. Unfortunately two elements of that
18 integrated complex are promised but not yet designed.
19 One is to feed and the other one is to receive waste.
20 The question comes up because many examples within the
21 DOE complex have shown us that when you interrupt the
22 output of the systems so that they can't deliver their
23 waste stream to whatever the receiving organization is
24 and they have an interruption, that we have very
25 frequently seen that that produces safety hazards

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1 within the facility itself.

2 So the question comes up right now you're
3 going to deliver this waste stream to a facility that
4 the NRC does not regulate. Some other entity
5 regulates it. What happened if that facility
6 receiving the waste shuts down and it says you can't
7 send me anything anymore? Have you looked at that and
8 what's the conclusion on that?

9 MR. BROWN: What you have looked at is
10 certainly those things that could affect safety as
11 material is making its way to base storage at the MOX
12 facility. An example is a metal azide build-up inside
13 the waste tanks resulting from incomplete processing
14 in the process. When waste is transferred to the
15 temporary holding tanks at the MOX facility, DCS has
16 assessed and we have evaluated what the different
17 hazards that can come out of that.

18 So as I understand the question, there is
19 this issue of capacity. If the MOX waste tank is
20 nearly full and DCS is processing material and
21 simultaneously, the offsite waste treatment facility
22 suddenly declares a stop and I have to bring the plant
23 to a safe condition so I needed to have margin in my
24 waste tank in order to fill it up with the waste that
25 would be generated as a result of bringing the plant

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1 to a safe condition, have I considered that now as
2 part of the safety assessment of the design basis?

3 No, I don't think that we've looked at
4 that scenario as part of the safety assessment. That
5 to me is more of an operational concern that it is
6 likely that, in fact, I think that's a very credible
7 scenario, they will have to have some sort of
8 operating limits such that they always have sufficient
9 volume in the tanks to deal with the shutdown
10 condition without the ability to transfer. That's
11 something we'll have to look at.

12 MR. ASHE: Excuse me. Ken Ashe with DCS
13 and you're absolutely right, Dave. It is what we've
14 looked at and I believe that we have had some
15 discussions about the fact that we have a 90 day
16 capacity if you will and the process is set up now so
17 that every couple weeks we will take and have batch
18 transfers to the waste solidification building. So we
19 believe we would ample capacity. It's not our intent
20 to take and nearly fill up our tank and from
21 operationally standpoint that is true. It's also true
22 that if the Department of Energy says that we're not
23 receiving any additional waste we will shut down. We
24 would have to do that.

25 MR. BROWN: Let's stop at that point. I

1 want to be sure we answered the question.

2 DR. POWERS: Okay. You've certainly
3 answered the first question which is do you have
4 capacity. What's gotten us into trouble in many
5 facilities not only in the United States but in Russia
6 and every place else is that you sit there and that
7 stuff starts aging. It's sitting there and many, many
8 of these chemicals are far from the most stable form
9 of the elements.

10 So they evolve and I think ellia (PH)
11 protogene (PH) had something to say about all this.
12 They tend to evolve to higher enthalpy states. Life
13 starts to be created I think in these things. Will
14 the evolution as you sit here and wait for DOE to say
15 yes has any of that scenario been examined if there's
16 any credible hazard there?

17 MR. BROWN: Yes, that's what I meant by
18 for example of looking at that metal azide
19 accumulation. For example one of the controls, now
20 this gets a little bit away from waste. So I
21 apologize. But for long terms for shutdowns, one of
22 the things we need to watch out for and it's an
23 identified control is the evaporation of solution in
24 any tank containing hydroxylimine nitrate which would
25 cause the hydroxylimine nitrate to unintentionally

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1 concentrate and essentially start going into a
2 dangerous condition.

3 That kind of thing has happened at another
4 facility and I think it was Hanford. We've identified
5 that. DCS has identified that. It's a specific
6 control for this facility. I said I got away from
7 waste because I think I really did. That's really the
8 chemical storage in the plant.

9 The other things we have to look out for
10 is radiolysis reactions. If I have a tank of, and
11 this is somewhat very significant quantities of,
12 Americium 241 in the high alpha activity waste. Up to
13 84,000 curies per year would be produced at DCS's
14 maximum production capacity. They do transfer as Ken
15 pointed out every two weeks, but still I could have a
16 significant quantity of Americium 241 in a waste tank
17 producing hydrogen by radiolysis. That has been
18 considered in the safety assessment through a
19 scavenging area to make sure that hydrogen doesn't
20 build up.

21 So I want to be clear that while that
22 stuff isn't on site and it's licensed material that
23 DCS must consider in its safety assessment, those
24 considered those kinds of things. But I thought the
25 question had more to do with making sure not just that

1 it was safe but that you had somewhere for it to go if
2 you had to go into a shutdown condition.

3 DR. POWERS: Steve, the first part of the
4 question is yes, you have a place for it to put this
5 thing or you have to get yourself traps so you have to
6 keep it. The second question is because we can site
7 numerous cases where DOE has shutdown facilities and
8 for a protracted period of time and so now we need to
9 know about how the material in the waste tank begins
10 to evolve and radiolysis produced hydrogen is coming
11 into it.

12 MR. BROWN: Right.

13 DR. POWERS: But one can imagine there to
14 be a lot of other things might happen here and to what
15 extent do we look at that and maybe it borders on a
16 philosophical question but you want to make sure.

17 MR. BROWN: Yes.

18 MR. RYAN: And again I apologize for not
19 being an expert on the process but I think about your
20 question then as well on target and let's say three
21 time horizons if I have to stop sending waste today
22 that has a days or weeks sort of implication and then
23 it's months and then on to years and the point you're
24 raising about what would the technical issues be could
25 be bent according to those time horizons.

1 Certainly some things would be at issue
2 much later in the process or later in time for the
3 process than some short term interruption. You might
4 find that tanks that contain a lot of acid or other
5 things might become more problematic over time if they
6 have to continue to hold it then say for a week or a
7 day and then you back up on a normal kind of mode. So
8 I think the time horizon aspect of it is one.

9 To me the other part which crosses this,
10 what the NRC regulation, what is DOE's responsibility
11 is this question of the waste acceptance criteria that
12 they may impose. I've yet to see a real detailed WAC
13 for the waste you're going to produce or the waste
14 received. It raises a question that again I think as
15 David has pointed out is often a question of a match
16 or a potential mismatch of are you going to produce
17 something they'll take. It's a very basic question
18 and I guess I'm not sure if that's been answered yet
19 or how that's working and if they'll take it, what's
20 your assurance they're going to take everything you're
21 producing at the rate you're producing it and so forth
22 and so on. How far along is that process?

23 MR. ASHE: Excuse me. This is Ken Ashe
24 again. Clearly the DOE is the only rebirth facility
25 and it's their program overall where they want to do

1 this. For the waste acceptance criteria, we've been
2 working with the people, the waste solidification
3 building, and so we understand what they can accept.
4 They understand what we're producing. Clearly, we'll
5 have to make sure that it matches up and we have a
6 commitment in the CAR that we will loop their WAC,
7 their waste acceptance criteria. We believe that that
8 has been covered and that there shouldn't be an issue
9 of blocking.

10 MR. RYAN: It's kind of on the list of, I
11 think, Professor Wallis has been talking about.
12 That's one of those things we'll have to maybe see the
13 detail to really say, "Yes, now we agree with that."
14 But I understand you have a commitment. They are
15 going to produce a WAC and you're going to meet it,
16 but with the details that's where you need to provide
17 an answer.

18 DR. POWERS: I guess that answer leaves me
19 somewhat distressed. Suppose they come back with the
20 WAC that says you need another component on the
21 system.

22 MR. RYAN: That's my last point. There's
23 very often a match up of a waste acceptance criteria
24 and a process. It means the process has to change
25 from the ideal to meet some condition. That's a

1 general question and I recognize you're capable of
2 dealing with the variables. But at this stage at this
3 level of detail, it's not there. It's causing members
4 of this committee asking questions and certainly me on
5 this waste question.

6 MR. ASHE: It should also be recognized
7 that the waste building is tied to the PDCF and to the
8 MOX facility. It's clearly that they have that in
9 mind as to the design for the waste building and etc.

10 MR. RYAN: And again are the details
11 apparent today so we can figure out it can work?

12 MR. BROWN: But as I understand it, those
13 details are not apparent today what the waste criteria
14 are as compared to the waste that's going to be
15 produced. There is of course a legal issue here that
16 because that there's an interface here between NRC and
17 DOE with respect to license material and then DOE
18 owned material. There will be transfer of custody
19 from DCS to DOE of that material. At that point there
20 is an obligation that DOE must fulfill to deal with
21 that waste and we will certainly pay attention to
22 facility safety and protect those boundaries including
23 any changes the plant might have to make to meet the
24 WAC. Those have to be reviewed according to our
25 regulations for the facility.

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1 MR. RYAN: Sure. I can imagine the
2 handoff has to be pretty clear from a legal
3 perspective. That's clearly right, but the technical
4 aspects of the handoff, you have to make sure that the
5 rails line up.

6 MR. BROWN: No, I'll say those details are
7 not crystal clear at this point, exactly when that
8 handoff occurs, where it occurs.

9 MR. RYAN: Hopefully at the next stage of
10 the safety analysis work because again I think it's
11 possible. It may not be possible in this case to a
12 high probability but it's possible that that waste
13 handoff and requirements for that handoff affect the
14 design of the process and in turn affect your safety
15 analysis of it.

16 MR. BROWN: I would agree with that.

17 MR. RYAN: Okay.

18 DR. POWERS: Any other? You've wrapped
19 up.

20 MR. BROWN: No, I have no other comments.

21 DR. POWERS: Any other questions for the
22 speaker? Well, thank you, Dave.

23 MR. BROWN: Thank you.

24 DR. POWERS: Joe, do you have any closing
25 comments to make?

1 MR. GIITTER: No closing comments.

2 DR. POWERS: Good. We have another
3 speaker here to hear from. Ed Lyman has volunteered
4 to make a few comments to us. Ed, you want me to give
5 an elaborative introduction or do you think everybody
6 knows you here.

7 DR. LYMAN: No introduction. I'm Ed Lyman
8 from the Union of Concerned Scientists and I just
9 wanted to make a few brief remarks given that this may
10 be the last meeting of the ACRS before a letter is
11 written regarding the construction authorization
12 request.

13 I think the first remark I'd start with
14 was actually the last one on my list. But since you
15 were just discussing waste issues, I thought I'd bring
16 it up and that's the fact that the Department of
17 Energy in their budget released on Monday indicated
18 for the first time that there may not be a waste
19 solidification building at all and that the program is
20 now on hold. I'll just read from this. "The detailed
21 design is on hold pending evaluation of cost effective
22 alternatives involving the use of existing facilities
23 to provide radioactive waste treatment capabilities.
24 At the Savannah River site, a decision is expected
25 later in FY 2005."

1 Any hope that the facility you're talking
2 about is going to be designed in any way with a clear
3 understanding of where the waste is going to go once
4 that transfer takes over. There's no hope right now
5 because it looks like the Department of Energy isn't
6 even sure any more what it is going to do with that
7 waste. So I think you're a step even further back
8 than you were last week.

9 DR. POWERS: Don't tell us we're moving
10 backwards, Ed.

11 DR. LYMAN: Well, anything involving DOE,
12 backward is the best you can hope for. The other
13 issues I wanted to discuss which weren't raised, I
14 don't believe, they were raised as this meeting, had
15 to do with the issue of material control and
16 accounting and physical protection at this facility
17 and its relationship to the CAR.

18 In 2001, I assisted the environmental
19 group, Georgians Against Nuclear Energy, in their
20 intervention against the construction authorization
21 request and the first two contentions which I
22 participated in had to do with the issue that the CAR
23 as originally presented had no information regarding
24 the design bases for either material control and
25 accounting or physical protection. There was simply

1 a commitment in the case of the former that the
2 operating license application would contain a
3 fundamental nuclear material control plan. In the
4 case of the latter, the operating license application
5 would contain a physical protection plan and that
6 there was a verbal assurance that whatever they did
7 those plans would be able to meet the regulatory
8 requirements.

9 We on the other hand recognize that there
10 are potentially significant design issues that have a
11 bearing on the ability of the facility to come up with
12 an effective plan either for material control and
13 accounting or for physical protection and that it's
14 quite possible that integrating those issues into the
15 design of the plant would lead to efficiencies and in
16 fact a superior operating license application when it
17 came to that stage. So the substance of our two
18 contentions were first that the CAR itself did not
19 contain detailed information on design features
20 sufficient to establish that the applicant's design
21 basis for MC&A will lead to FNMCP that will meet
22 regulatory requirements.

23 The second was essentially the same issue
24 regarding the design basis for physical protection.
25 In other words, does the CAR establish a design basis

1 that would enable a physical protection plan to be put
2 into place that has a chance at being effective in
3 meeting the regulatory requirements?

4 In that we did refer to the definition of
5 design basis that was presented before in 10 CFR 50.2
6 which is that information which identifies the
7 specific functions to be performed by a structure
8 system or component of the facility and the specific
9 values or ranges of values for controlling parameters
10 as reference has been for design. So design basis
11 does have a numerical aspect in that it does where
12 possible request some sort of quantitative bounds on
13 on the various parameters of interest in the system
14 you're talking about.

15 DR. WALLIS: Could I ask you what you mean
16 by "materials control"? I guess you mean keeping a
17 count of where the plutonium goes.

18 MR. LYMAN: That's right. It's all the
19 activities associated with establishing --

20 DR. WALLIS: Hundreds of units come in.
21 You want to know with some accuracy where it has all
22 gone when you add up all the different streams and
23 everything. Is that what you mean?

24 MR. LYMAN: Yes, that's right. In Part
25 74, there are requirements for a facility that

1 processes special nuclear material that establishes
2 the need to close your material balance on a periodic
3 basis. It establishes the limits of error that your
4 measurements have to conform to to be able to say that
5 you've closed the material balance and ensure that
6 there hasn't been any diversion of special nuclear
7 material along the way.

8 So those are the two design issues we
9 raised and those contentions were admitted in December
10 of 2001 based on the standards for admitting
11 contentions that those were, I don't have the standard
12 in front of me, issues that could reasonably lead to
13 a dispute with the applicant that would require a
14 hearing to resolve.

15 The original CAR like I said, just
16 contained commitments and no detail of that MC&A or
17 physical protection. During the course of the
18 proceeding and in discovery, the first stages of
19 discovery, DCS did provide what they called the design
20 bases for physical protection for MC&A. This was an
21 additional chapter or an addition to the CAR which is
22 on the order of 15 or 20 pages describing general
23 issues having to do with MC&A and physical protection.
24 Those are deemed proprietary so I can't discuss them
25 here. But you're certainly privy to them in the

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1 proprietary version of the CAR.

2 One feature that was discussed that was
3 contained in those design bases was the so-called safe
4 havens, the very fact that they had instituted rooms
5 where in the event of an emergency you would be able
6 to send staff so that they wouldn't be allowed to
7 leave the site, yet would remain safe in the event of
8 an accident so that it would deal with the concern
9 that how do you ensure that if there is an accident
10 that you have to have evacuation from the site and
11 that you're also ensuring that no one is walking off
12 with any plutonium. So the very presence of safe
13 haven was an aspect of the design basis for physical
14 protection that was submitted.

15 But overall we didn't feel that the detail
16 in that information was sufficient to meet the
17 definition of design basis in 10 CFR 50.2. In other
18 words, there was no real bound parameters arranged for
19 parameters for various structures of interest either
20 to MC&A or to physical protection.

21 However, DCS filed a motion for summary
22 disposition on those two contentions essentially
23 saying that our contention just said we criticized the
24 CAR for not having any information at all about these
25 issues. It didn't say that the information had to be

1 adequate. So now they've done something and it
2 doesn't matter whether or not we think it's adequate.
3 The very fact that there's something now means our
4 contentions are moot and the Atomic Safety and
5 Licensing Board after a long period of deliberation
6 granted those motions basically saying if we didn't
7 like the information we got we should have changed the
8 contention and said, "It's not just that it's nothing
9 as opposed to something, but that something also has
10 to be good." We didn't do that. So we're out of
11 luck.

12 I'm bringing this up because I just want
13 to emphasize that I believe these issues were
14 dismissed not because they were resolved, but simply
15 on the basis of a technicality which I think sounds
16 pretty absurd to me given the gravity of the issue
17 associated with the fact that this is a facility whose
18 main purpose is to try to provide assurance that the
19 U.S. is taking plutonium out of dismantled weapons and
20 converting them to a form which is less useful for
21 terrorists and encouraging Russia to do the same thing
22 in which case issues of physical protection and MC&A
23 are crucial. I just wanted to emphasize that point
24 that I think these issues are still ripe and I was
25 quite surprised when I heard the new Secretary of

1 Energy say on Monday that an important new strategy
2 for the Department of Energy would be to rethink the
3 whole concept of facility design with regard to
4 security and he even said that in the past facilities
5 would be built and security would be imposed post hoc
6 and now they want to do things the other way around.

7 I was quite shocked to here that and I
8 didn't know if he was aware that his own department
9 had encouraged essentially a philosophy contrary to
10 that for one of the major capital projects that
11 they're engaged in. I think there's some confusion
12 now on the part of the Department of Energy as to this
13 issue.

14 Related to that is the whole issue of the
15 design basis threat. The fact is that the design
16 basis threat for Category One facilities as applied to
17 the design of the MOX plant is a pre-September 11th
18 threat and that's for the simple fact that when the
19 design basis threats for operating facilities were
20 amended after September 11th to take into account
21 greater adversary or more severe adversary
22 characteristics, they were done in the form of orders
23 for facilities that already had licenses as a change
24 to their license. Therefore, this MOX plant since it
25 doesn't have a license yet that couldn't be done.

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1 Again a technicality, but the bottomline is that the
2 design basis threat applicable to this plant was a
3 pre-September 11th threat.

4 Now to the extent that the design basis
5 threat has some impact on the design of the plant, I
6 think anyone can see that this will lead to another
7 paradoxical situation in that if the design is
8 approved by the NRC then it will be issued a new
9 design basis threat taking into account greater
10 adversary characteristics which may render some of the
11 design features that were just approved as things that
12 have to be upgraded. Again, being caught up in these
13 regulatory traps is not leading to the most efficient
14 way to go about designing this facility and would
15 ensure physical protection.

16 Now this is all an artifact of the two-
17 step licensing process that was described at the
18 beginning of the presentation today, but I think there
19 was a misrepresentation in the description of this
20 two-step process. The process as DCS has implemented
21 it was never envisioned by the regulations. The
22 regulations simply said if you're a fuel cycle
23 facility you apply for a license. You give us all the
24 information to support the license. If you are a
25 plutonium facility, we're going to impose extra

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1 requirements on you. You have to do something extra
2 in order before you start construction. You have to
3 satisfy us about the design bases that your license
4 application supports before you start construction.
5 So this is meant as an extra layer of protection.

6 There was nothing in the regulations that
7 contemplated the fact that that meant you could give
8 only partial information at the beginning, base the
9 construction decision on that and give everything else
10 later. That was a novel interpretation in the context
11 of this current license application.

12 The Commission later upheld that again
13 it's not clear whether or not it's consistent with the
14 regulations that are written. In fact, that
15 bifurcation of this two-step process I think has led
16 to a number of the problems that we've experienced
17 today with the confusion about the right level of
18 detail on which the NRC can make a decision to go
19 ahead and build this facility.

20 In that regard, the Department of Energy
21 has announced that construction is not likely or will
22 not begin before as a minimum May 2006. That means
23 that approval as expected of the CAR which will be in
24 March 2005 will be more than a year before
25 construction actually starts and if DCS submits the

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1 operating license application in the spring, I believe
2 March 2005 is also the target date, that means the NRC
3 will have the operating license application for more
4 than a year before construction starts.

5 Now this provides an opportunity really
6 that whatever perceived advantage there was in having
7 the two-step process in the first place has evaporated
8 now because the NRC is going to have all the licensing
9 information well before construction starts. That
10 does provide another opportunity for rethinking this
11 process and the fact of whether there may be
12 efficiencies gained in waiting until the operating
13 license is submitted before approving construction
14 because simply the construction isn't going to be
15 taking place for a long time anyway and I find it hard
16 to believe that there won't be issues that arise in
17 the operating license application that won't suggest
18 at a minimum changes to the design. So that's the
19 state of things today. That is all I have to say.
20 Thank you.

21 DR. POWERS: Any questions for Dr. Lyman?

22 DR. KRESS: One maybe. It seemed to me
23 that the concern here was mostly the efficiency.
24 Other than that, you think these things could be
25 worked out if there were design changes based on

1 physical, security or stuff that all this might just
2 result in delays and more hearings and so forth. But
3 it could be worked out.

4 DR. LYMAN: Well, it could be worked out.
5 But again depending on the specific issue, it could
6 require a significant upgrading. One of example and
7 I have absolutely no idea, but I know that most DOE
8 facilities today would not withstand a sabotage attack
9 by a small aircraft or even a helicopter. That's an
10 established fact. That was never a part of the design
11 basis for those buildings.

12 Perhaps post September 11th for a facility
13 that handles plutonium, you might want to have that
14 kind of construction that could withstand a greater
15 impact. That would mean essentially a more robust
16 building, more concrete, more Rebar or even going into
17 the ground. So to that extent if it means significant
18 changes to the basic infrastructure of the plan once
19 you start construction, that will be much harder to
20 do. So there are potentially issues which would mean
21 starting from scratch or really undoing what you're
22 done at great cost. So it does boil down again to a
23 delay in efficiency but as taxpayers we're the ones
24 who are paying for any mistakes that are made.

25 DR. KRESS: Are you concerned that the new

1 requirements say for a design basis threat may be so
2 onerous in terms of complying with it but they might
3 go ahead anyway trying to get around it some way?

4 DR. LYMAN: Well, I'd hate to speculate,
5 but there is the facts on the ground issue which is
6 once you've gone far enough wouldn't it make more
7 sense just to give us an exemption rather than to make
8 us do something else?

9 DR. KRESS: That's basically what I meant.

10 DR. LYMAN: Yes, and I think we've seen
11 that in another related hearing associated with the
12 MOX lead test assemblies and the security plan that's
13 been proposed for protecting them at the Catawba
14 Nuclear Power Plant. I can't talk about the details
15 there, but there is an element of if we'd like to
16 implement that requirement. But it would be so
17 onerous and it would take so long that it doesn't make
18 sense anymore. It's definitely a possibility.

19 DR. KRESS: So that may be a part of your
20 concern.

21 DR. LYMAN: Yes.

22 MR. ROSEN: Aside from the questions of
23 efficiency, Ed, is your organization in favor of the
24 purposes of this facility?

25 DR. LYMAN: We're in favor of the overall

1 mission, but on a philosophical basis, the idea of
2 plutonium disposition is to reduce the risk posed by
3 separating plutonium. You don't want to increase the
4 risk of a near term to reduce it in the long term. So
5 if it's going to be done, it has to be done with as
6 much attention to safeguard and physical protection
7 issues as possible.

8 I don't think that all the options were
9 fully explored to maximize the benefit and minimize
10 the risk and so to that extent we have concerns of the
11 MOX program and believe that there were alternatives
12 that had been considered that might have been able to
13 achieve similar results both with lower risk and lower
14 cost. But that said, if there is certainly a safety
15 and security regime where if it were implemented, I
16 would say I would have confidence the cure isn't worst
17 than the disease.

18 Unfortunately what's happened is it's so
19 expensive, the delays have become so expensive, that
20 you're starting to cut corners in a way which really
21 acts against the overall purpose of the program. The
22 biggest implication is what the Russians will do and
23 that is a direct bearing on the decisions that were
24 made here. If we show that we think that physical
25 protection and MC&A are not such important issues in

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1 certain respects, that sends exactly the wrong signal
2 to Russia. So there's a real danger that this program
3 could undermine its ultimate purpose.

4 DR. POWERS: Any other questions? Thank
5 you, Dr. Lyman.

6 DR. LYMAN: Thank you. I appreciate it.

7 DR. POWERS: Chairman, I think we've
8 concluded our presentation on these subjects. So I'll
9 take it back to you.

10 DR. WALLIS: Well, thank you, Dr. Powers,
11 for leading us through the intricacies of this
12 application. We have finished the formal part of
13 today. We don't need the transcript anymore. We're
14 going to take a break and when we come back you will
15 consider the draft versions of the two letters we have
16 to write and what I want to achieve is that we
17 understand as a committee what our position is going
18 to be that we take in these letters, that the
19 substance of the letter is agreed to and then we can
20 work on the details tomorrow. Since you have been so
21 good, I would give a little break until 5:00 p.m. Off
22 the record.

23 (Whereupon, at 4:39 p.m., the above-
24 entitled matter concluded.)

25