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1 UNITED STATES OF AMERICA

2 NUCLEAR REGULATORY COMMISSION

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4 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

5 (ACRS)

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7 AP1000 SUBCOMMITTEE

8 + + + + +

9 OPEN SESSION

10 + + + + +

11 WEDNESDAY

12 SEPTEMBER 17, 2014

13 + + + + +

14 ROCKVILLE, MARYLAND

15 + + + + +

16 The Subcommittee met at the Nuclear
17 Regulatory Commission, Two White Flint North, Room
18 T2B1, 11545 Rockville Pike, at 1:00 p.m., Harold D. Ray,
19 Chairman, presiding.

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1 COMMITTEE MEMBERS:
2 HAROLD D. RAY, Chairman
3 RONALD G. BALLINGER, Member
4 SANJOY BANERJEE, Member
5 DENNIS C. BLEY, Member
6 CHARLES H. BROWN, JR., Member
7 MICHAEL CORRADINI, Member*
8 JOY REMPE, Member
9 PETER C. RICCARDELLA, Member
10 STEPHEN P. SCHULTZ, Member
11 GORDON R. SKILLMAN, Member
12 JOHN W. STETKAR, Member
13 DESIGNATED FEDERAL OFFICIAL:
14 PETER WEN
15 ALSO PRESENT:
16 LARRY BURKHART
17 MIKE CORLETTI
18 JOE DONOGHUE
19 TIM DRZEWIECKI
20 DON HABIB
21 BOB KITCHEN
22 JOHN McKIRGAN
23 RICHARD OFSTUN
24 TERRY SCHULZ
25 BOYCE TRAVIS

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

2 1:03 p.m.

3 CHAIRMAN RAY: (presiding) The meeting

4 will now come to order.

5 This is a meeting of the ACRS AP1000

6 Subcommittee. I am Harold Ray, Chairman of the

7 Subcommittee.

8 ACRS members in attendance are Sanjoy

9 Banerjee, Charles Brown -- John Stetkar will join us

10 shortly -- Joy Rempe, Dick Skillman, Steve Schultz,

11 Dennis Bley, Ron Ballinger, and Pete Riccardella.

12 Mike Corradini will follow the presentations by phone,

13 and I will invite any questions or comments from him

14 at times during the presentation separate from when I

15 ask for public comment.

16 Peter Wen of the ACRS staff is the

17 Designated Federal Official for this meeting.

18 The purpose of this meeting is to review

19 a departure and exemption request regarding the Levy

20 Nuclear Plant Units 1 and 2 COLA resulting from a design

21 change involving a containment condensate return to the

22 in-containment refilling water storage tank, or IRWST.

23 A design change constitutes a Tier 1

24 deviation from the approved AP1000 Design Control

25 Document Revision 19, which was the basis for the AP1000

1 Design Certification Amendment Final Rule in December
2 2011.
3 I have asked the staff to include in their
4 opening remarks a review of the issue history using
5 slides 27 and 28 from their presentation, as I feel this
6 provides important context relating to where we are
7 today and the expectations going forward.
8 Suffice it to say it is critical that we
9 be as transparent as possible concerning these
10 expectations, owing to the number of ongoing activities
11 that can be affected. In that regard, based on review
12 of available information at the September full
13 Committee meeting, we expect that a summary of today's
14 meeting will be presented at the October full Committee
15 meeting and that a Committee letter may result. Such
16 a letter could either be specific to this review or
17 generic.
18 Now this Subcommittee was briefed by
19 Westinghouse on the technical issues involved in a
20 meeting on April 9th of this year, a little over five
21 months ago. In fact, review of today's presentation
22 slides, which were received yesterday, indicates that
23 a large number of them, both those to be presented by
24 Westinghouse and by Duke Energy are identical to those
25 we reviewed on April 9th. Nevertheless, there have

1 been several changes in results that are important to
2 note, and it is necessary to provide context for them.
3 I ask that, in the interest of time and
4 efficient closure on this matter, presenters focus on
5 what has changed in these many slides and assume that
6 the Subcommittee is at least generally familiar with
7 the material presented previously.
8 Also in the interest of efficiency, I
9 suggest thinking about the changes described in what
10 I will now refer to as the Levy Advanced Safety
11 Evaluation, forwarded to members on August 25th, as
12 having three elements as follows:
13 First, technical adequacy of the design
14 following implementation of the departure from the DCD.
15 And this element is always our first concern.
16 Second, process issues related to the
17 implementation of 10 CFR Part 52, including the use of
18 a COL departure from a DCD where such departure is for
19 the purpose of resolving issues in the design or
20 analyses which are described in the DCD, or the status
21 of COL holders who are similarly affected by the cause
22 of the departure.
23 And finally, compliance with the
24 requirements of 10 CFR Part 21 relative to the reasons
25 for the departure from the DCD.

1 Third and finally, root-cause and
2 extent-of-condition issues are a third category, such
3 as, what would the expected performance of the affected
4 systems be in the absence of the COL departure; why was
5 the need for the changes described in the COL departure
6 not identified earlier; what else may be similarly
7 affected by the same or similar root cause, and what
8 implications of this experience are there for matters
9 such as the uncertainty which should be associated with
10 the functioning of passive safety systems?
11 Our greatest interest may be in the last
12 category I mentioned; that is, what are the lessons that
13 we should draw from this experience? In any case, I
14 would like to defer as many of the process issues as
15 possible for discussion in the second open session we
16 will have today.
17 Based partly on the desire to separate
18 process issues from the technical review and partly on
19 a member's schedule conflict later this afternoon, I
20 am going to modify the agenda you have before you and
21 ask that, other than their opening remarks, the staff
22 presentation take place in the second open session
23 shown, and that the closed session commence immediately
24 following the open session presentations by Duke and
25 Westinghouse.

1 We will provide opportunity for public
2 comment, both at the end of the first open session prior
3 to going into closed session and at the end of the second
4 open session open session, following the staff
5 presentation and before taking member comments.
6 A portion of the meeting will be closed in
7 order to discuss information that is proprietary to
8 Westinghouse, pursuant to 5 USC 552(b)(c)(3) and (4).
9 Attendance at this portion of the meeting dealing with
10 such information will be limited to the NRC staff,
11 Westinghouse, and those individuals and organizations
12 who have entered into an appropriate confidentiality
13 agreement with Westinghouse.
14 Consequently, we will need to confirm that
15 we have only eligible observers and participants in the
16 room and confirm the closure of the public phone line
17 for that portion of the meeting. At the time of meeting
18 closure, I will indicate the approximate time when we
19 expect to be able to resume the open meeting.
20 Because the Subcommittee meeting will
21 involve both open and proprietary sessions, and the
22 members will not always be able to parse their questions
23 so that full responses can be given in an open session,
24 respondents will need to tell us when part or all of
25 a response must be deferred.

1 The rules for participation in today's
2 meeting have been announced as part of the notice for
3 this meeting previously published in The Federal
4 Register. Therefore, we request that participants in
5 this meeting use the microphones located throughout the
6 meeting room when addressing the Subcommittee.
7 Participants should first identify themselves and
8 speak with sufficient clarity and volume, so that they
9 can be readily heard.
10 We will now proceed with the meeting, and
11 I call upon Mr. Larry Burkhart of NRO to begin.
12 MR. BURKHART: Thank you, Chair, and thank
13 you, AP1000 Subcommittee, for giving us the opportunity
14 to show you and discuss our evaluation with you. Of
15 course, the Applicants will provide a description of
16 the change, and you have already got a look at that from
17 the April 9th Subcommittee meeting.
18 So, why are we here? We are here, as the
19 Chair said, to discuss a design change that was
20 submitted by Levy in support of their combined license
21 application.
22 Just to go a little bit back, we completed
23 our Final Safety Evaluation Report on the initial
24 AP1000 standard design in 2005. It was certified in
25 2006.

1 This portion of the issue that we are
2 talking about goes back to that far, and there's even
3 some base in the AP600 review. So, the amendment that
4 was certified in 2011 didn't affect what we are talking
5 about today. So, that goes to may some of the issues
6 that the Chair was talking about in No. 3, which we kind
7 of I think discussed throughout our presentation and
8 at anytime you would like.
9 This change was submitted to us now. We
10 have to recognize that we already have a letter from
11 the full Committee, ACRS Committee, from December of
12 2011. So, this change is coming now because it is of
13 a significance that it should be reviewed and we should
14 have an evaluation before we go to the Final Safety
15 Evaluation Report and we go to any mandatory hearing
16 and issue any license.
17 So, the guidance we have about this sort
18 of change and what changes need to come to the staff
19 before licensing decisions are made are what we call
20 Interim Staff Guidance 11. And that is what you see
21 in the second bullet.
22 So, the Applicant, Duke, did, I would say,
23 an adequate job in doing this evaluation, with, of
24 course, help from their contractor. So, that is why
25 we have this design in front of us and that is why we

1 are here today.

2 So, what you see, the rest of this slide

3 and the next slide, is just a little bit of the history

4 on when we received some documents from Duke Energy,

5 some audits that the staff did.

6 And if you go to the next slide, you can

7 just see a progression of activity. I can say that what

8 that shows is the complexity of the analysis that you

9 will hear about to justify the change, the condensate

10 return into the IRWST, given losses to various factors.

11 And you will hear more details as we go along.

12 So, I think that highlights that it wasn't

13 necessarily a simple, straightforward change to

14 identify and, then, to do the calculations to back it

15 up. Likewise, the staff took a lot of time in reviewing

16 those documents.

17 CHAIRMAN RAY: Larry, is there anything

18 you can say about the period July-October 2013 there?

19 MR. BURKHART: Yes.

20 CHAIRMAN RAY: It is perhaps not as

21 remarkable, but, yes, the need to incorporate further

22 modifications, and so on.

23 MR. BURKHART: Yes. Duke and

24 Westinghouse can get into more details, but I do

25 remember this: there was a time when I believe

1 Westinghouse wanted to have a third-party review of the
2 four calculations that you will hear about in detail.
3 And there was modification to make sure that they
4 captured the condensate that was lost in the polar crane
5 girder which wasn't previously accounted for. So,
6 there was a need to do a design change, and it was the
7 right thing to do to capture the condensate that is
8 caught in the polar crane girder.
9 Again, you will hear more details in the
10 technical evaluations. So, there is a reason for why
11 they delayed.
12 CHAIRMAN RAY: Yes. Well, I wanted to lay
13 out this timeline because, when you are talking about
14 technical issues, it is a little hard at that point to
15 put them in some kind of a time sequence because you
16 are trying to understand what the technical subject is.
17 MR. BURKHART: Right.
18 CHAIRMAN RAY: And this has had the
19 history that you have outlined, and I thought it was
20 important for the Subcommittee to understand that.
21 MR. BURKHART: Yes. I mean, this is the
22 first time we have had a change that tripped the ISG-11
23 criteria for the AP1000s anyway. So, that kind of
24 tells you what the significance is.
25 With that said, then you will hear more

about -- you mentioned Part 21, and there was a Part 21 evaluation done, and it was decided that it didn't trip the criteria to make that report.

CHAIRMAN RAY: Okay. That will be after in the session later on --

MR. BURKHART: Yes, sir. Yes, sir.

CHAIRMAN RAY: -- when people have satisfied themselves about the technical issue. I didn't want to get into that now --

MR. BURKHART: Yes, sir.

CHAIRMAN RAY: -- but I am glad that you are going to be prepared for that.

MR. BURKHART: So, that is a summary of basically the schedule to date. And, of course, we're here, and now the schedule right now is to have the Final Safety Evaluation Report completed by March of next year, barring no other design changes. And that may go to one of the other questions you have, Mr. Chair, about the extent of condition and what other issues might be out there.

CHAIRMAN RAY: Okay.

MR. BURKHART: So, that is our current schedule.

CHAIRMAN RAY: Good. Well, we will look forward to seeing the staff up after the closed session.

1 MR. BURKHART: Yes.
2 CHAIRMAN RAY: Do you have anything else?
3 MR. BURKHART: No, sir.
4 CHAIRMAN RAY: All right.
5 MR. BURKHART: Thank you very much.
6 CHAIRMAN RAY: Then, I guess we have Duke
7 Energy and Westinghouse. Are you going in series or
8 together.
9 MR. KITCHEN: No, we are going together.
10 CHAIRMAN RAY: All right. That is what we
11 had hoped. Thank you.
12 How are you, Bob?
13 MR. KITCHEN: I'm good.
14 Chairman Ray and Members of the ACRS, just
15 one clarification on the sequence. We had planned to
16 do the open discussion, and the staff will do their open
17 discussion and, then, we would be closed. Is that, to
18 understand, we are still going to stick with that
19 approach --
20 CHAIRMAN RAY: No.
21 MR. KITCHEN: -- to the closed session?
22 CHAIRMAN RAY: And the reason is we want
23 to get the closed discussion that you'll present done
24 earlier.
25 MR. KITCHEN: Okay.

1 CHAIRMAN RAY: And this is the only way I
2 can do it.
3 MR. KITCHEN: All right.
4 CHAIRMAN RAY: Okay?
5 MR. KITCHEN: No problem.
6 Okay. I'm Bob Kitchen with Duke Energy,
7 Licensing Manager. Terry Schulz with Westinghouse is
8 with me. He will be presenting portions of this open
9 session. And then, for the closed discussion, a more
10 detailed discussion of the analysis that was done,
11 Terry and Rick Ofstun will be presenting that. It was
12 really the Westinghouse analysis and details.
13 And I know that you will tell me if I need
14 to move on. So, we are going to try to make sure we
15 cover the things that you need to hear, but --
16 CHAIRMAN RAY: Take your time. Just as I
17 said, these aren't so much the case, but later on there
18 is stuff we have seen and it has not changed at all.
19 MR. KITCHEN: Right.
20 CHAIRMAN RAY: But take your time here,
21 whatever you want.
22 MR. KITCHEN: Okay. Well, our intent
23 here is to present to make sure that we're all on the
24 same page, so to speak, in terms of how the system works,
25 what are the issues, and what has been done to this

1 point. But, then, we will go into more detail about
2 the particular analyses in the second, the closed
3 portion, and go into quite a bit of detail. We will
4 modify this approach as needed, and then, some
5 discussion on testing, although you have seen most of
6 what we have there.
7 Just on the system briefly, the system is
8 designed to support probably really non-LOCA operation
9 in the containment refilling water storage tank, which
10 is shown here. It contains the passive RHR heat
11 exchanger which rejects the heat to the IRWST. So,
12 after a period of time in circulation, that water in
13 IRWST reaches saturation and starts to vent into
14 containment, which is the discharge of steam and
15 containment creates the condensate and, thus, the
16 return that we are talking about.
17 This is showing the containment in total.
18 I think you're probably very familiar with this slide.
19 It shows the containment with the cooler water which
20 comes down over the containment is the heat rejection
21 for containment. The IRWST is shown in the lower left
22 corner of that drawing. It is quite a large tank, quite
23 a bit of heat reject capability. But, as you can see,
24 that tank, as we described, vents into containment.
25 And then, the condensate literally forms

on the containment walls and runs down the walls, and is captured by a containment system which existed but has been expanded due to recognition of features in the containment that have a bigger contribution to condensate and needed to be directed back to the IRWST.

So, that is really the gist of what has been done there. It is a very complex analysis. As we talk through that, I know it will be apparent. But it is very simplistic in terms of the design approach, which is basically to put in a catchment system of gutters and drains to return water to the IRWST.

Safe shutdown is a feature we need to talk about a bit. The safe shutdown is a goal to achieve with the passive RHR heating exchanger system. Safe shutdown was defined in the AP1000 as 420 degrees and achieved in 36 hours. That temperature is not a regulatory requirement. Really, the key is that we achieve a safe, stable operation with the system. And there is some variation in that temperature. It is not a hard requirement.

In fact, in doing our analysis, as Terry will talk about later, really there are two key analyses that support that. One is to demonstrate, we'll call it the Chapter 15 analysis for the Final Safety Analysis Report, which is rigid design-basis accident analysis

1 conditions, to demonstrate that the system can achieve
2 safe, stable shutdown and maintain for at least 72
3 hours. That is all with the typical safety analyses,
4 conservative, very limiting assumptions.
5 The longer-term operation of safe shutdown
6 is demonstrated with conservative, but not bounding
7 analyses. And we will talk more about that. But that
8 is to show that we can maintain, and with that analysis,
9 we show that we can achieve the 420 in less than 36 hours
10 and maintain it for a considerable length of time.
11 As always, the system also has the
12 capability -- in fact, it automatically occurs -- 22
13 hours into an accident sequence if there is no operator
14 action. This is another topic we will discuss a bit.
15 But, without operator action, at 22 hours the system
16 would automatically actuate ADS and depressurize. And
17 that achieves very quickly the cooldown and sustains
18 indefinitely.
19 So, basically, as Larry can describe the
20 sequence, it became apparent that Westinghouse, as part
21 of the design finalization detail and, then, as Larry
22 indicated, questions from the UK regulator, the need
23 to go back and relook at the technical basis for the
24 condensate return.
25 I think the value that was in use at that

1 time was 90 percent, and it was also assumed to be a
2 fixed 90 percent. As with a lot of things, it is not
3 that simple. That was an overly-optimistic number,
4 and it also determined that the condensate return value
5 varies with time. It is not a fixed value. It is going
6 to vary. As the plant depressurizes, this condensate,
7 just the return rate varies.
8 So, there was significant effort to go back
9 and look at what additional mechanisms occurred to
10 cause this. Quite a bit of the detailed analysis
11 centers around that. You know, at what point does the
12 condensate stop raining from the roof of the
13 containment and adhere to the liner -- or excuse
14 me -- the walls of the containment? How do you model
15 and analyze the impact of attachments to the
16 containment wall, which early, early in the design may
17 not have even been recognized to be needed?
18 So, we will talk a bit about what
19 complexities were there. As Larry said, it took quite
20 a while to work through those and to find them.
21 That required a study to go back and do
22 testing, and Westinghouse did a very thorough testing
23 evaluation using full-scale mockups of their facility
24 to look at and characterize these behaviors as the
25 condensate characteristics.

1 CHAIRMAN RAY: Bob, before you move on,
2 this is maybe, well, it is mostly a process question.
3 Therefore, I am going to say that upfront and say I want
4 to put it off until later in terms of exploring it in
5 detail.
6 But, so that I don't ask you to come back
7 later unnecessarily, can you just answer a simple
8 question for me, which would be, under Part 52, do you,
9 as the COL holder or Applicant, have an Appendix B role
10 here when this sort of thing occurs, to determine what
11 the reason was for this problem existing, the problem
12 being an assumption about condensate return, which was
13 determined to be unconservative? I'll choose those
14 words, maybe not too carefully. But, in any event, did
15 you guys feel, as you would under Part 50, I believe,
16 a need to get engaged in how did this happen, what is
17 the extent of condition, that sort of thing?
18 MR. KITCHEN: We certainly have an
19 Appendix B role to make sure that we develop a change
20 to our license application that is correct and complete
21 and reflects what is needed. To go back and do, as you
22 described, basically, an investigation of that cause,
23 we have not and did not see that as a role of the utility.
24 CHAIRMAN RAY: Fair enough. I just
25 wanted to get that clarified. There is no point in

1 asking you to come back up and talk about something that
2 you didn't see as an obligation or a requirement.
3 MR. KITCHEN: Yes, but, I mean, a
4 fundamental change here that I know you recognize is
5 that our application is built on a certified design.
6 CHAIRMAN RAY: Right. That's what I
7 meant by --
8 MR. KITCHEN: As we go forward, a change
9 to that certified design becomes our application. So,
10 there is a definite switch with this.
11 CHAIRMAN RAY: I know, but I think you can
12 see -- you don't need to agree with me -- but I think
13 you can see there is a transition there. Whereas, you
14 don't have the responsibility for the certified design,
15 you do have the responsibility for the change in the
16 certified design under Appendix B. And it is that
17 difference that I am trying to understand. Okay?
18 MR. KITCHEN: Right.
19 CHAIRMAN RAY: Okay, go ahead.
20 MR. KITCHEN: Okay. So, that is up
21 through the development test program, and there will
22 be more discussion on that in the closed session.
23 I have touched on a lot of this already,
24 but basically the testing revealed, just as we have
25 described, the condensate return was not what we

1 thought in terms of the amount. It was considerably
2 lower, and significantly lower, in fact, enough to
3 affect the results, which is why we are talking about
4 it.
5 It was evaluated by Westinghouse in terms
6 of safety and determined not to have a safety impact.
7 But the safe shutdown temperature evaluation would not
8 be bounding. In other words, the assumptions there
9 were couldn't do the analysis to meet that analysis.
10 MEMBER SKILLMAN: Would you repeat,
11 please, what you just said?
12 MR. KITCHEN: The Part 21 analysis showed
13 that the plant was still safe. In other words, there
14 was not damage to the plant. But the analysis with the
15 assumptions were not bounding for those results. In
16 other words, it is not a safety issue, but we couldn't
17 demonstrate, as you would normally in an FSAR, the
18 results.
19 CHAIRMAN RAY: Well, let's not try to
20 decide what is a safety issue or not in that respect.
21 The point is that you couldn't comply with the licensing
22 basis.
23 MR. KITCHEN: Right.
24 CHAIRMAN RAY: And whether that is safe or
25 unsafe is a discussion maybe for later, another day,

1 or something. But that is the issue.

2 And we will come back to that again as a

3 process question about Part 21, what does it really say,

4 and so on. But I don't want to get off on that sidetrack

5 now.

6 MR. KITCHEN: Okay.

7 MEMBER BLEY: Well, we blow right past

8 this, I just want to make sure I understood what you

9 said and what you implied. And that is, when you did

10 an analysis, under the assumptions that turned out to

11 be wrong and accounted for wherever the water was going,

12 it wasn't where you expected, you didn't get the core

13 damage for a Design Basis event?

14 MR. KITCHEN: Correct, using best

15 estimate values.

16 MEMBER BLEY: Okay.

17 MEMBER BANERJEE: But you didn't satisfy

18 your licensing basis?

19 MR. KITCHEN: That's correct.

20 MEMBER BANERJEE: And now, you are going

21 to talk about the improvements. If I remember, you

22 said 90 percent of the water was assumed to return. And

23 then, you found that this became a function of time,

24 or Westinghouse did. I am saying "you" as them.

25 CHAIRMAN RAY: Sanjoy, speak up just a

bit, please.

MEMBER BANERJEE: Sorry.

How much water is now returning after all these modifications have been made?

MR. KITCHEN: Well, I'm sure Terry will show that when he --

MR. SCHULZ: Yes, I think we should defer that to --

MEMBER BANERJEE: Do you want to hold that until the closed session?

MR. SCHULZ: The closed, yes.

MEMBER BANERJEE: All right. So, let's table that question. It will be interesting to know. I mean, there's a lot of detail there. But I want to just know how much water is returning and what the rate of change is from that, just as a number, compared to the 90 percent.

MR. KITCHEN: Okay. So, basically, with the results of the testing, we have shown that there is significantly less return, and the decision was made to improve the design, to improve catchment, particularly since we are around the polar crane girder and attachment plate areas, to improve that.

The bottom line is we show that the safe shutdown objectives are met with these changes. So,

1 we do comply with our license basis and requirements.
2 As I mentioned earlier, there really are
3 two analyses that are key to this. One is the Chapter
4 15 analysis. I guess one note is that the Design Basis
5 accident analysis with the indefinite operation, or
6 basically no loss that was of significance, achieved
7 or demonstrated previously, resulted in as soon as you
8 could show that you achieved your conditions for stable
9 plant operation, the analysis stopped.
10 So, one of the things that the staff
11 required, it was asked in terms of the review to go back
12 and demonstrate by the Chapter 15 bounding analysis
13 through the entire 72-hour period that, with passive
14 RHR and closed loop cooling, that the requirements were
15 met. So, that was a change in analysis duration, let's
16 say, but not in terms of the methodology.
17 CHAIRMAN RAY: And that was part of the RAI
18 submitted?
19 MR. KITCHEN: It was an RAI question.
20 CHAIRMAN RAY: So, that sort of helps me
21 understand what took place during that period of time.
22 MR. KITCHEN: Right.
23 CHAIRMAN RAY: Okay.
24 MR. KITCHEN: Terry can speak to it
25 better, but that is very complex, to extend that

1 analysis out.

2 The other was to look at safe shutdown

3 temperature analysis and basically the achievement of

4 less than 420 degrees in 36 hours. That is done with

5 a conservative, but not bounding analysis, in fact.

6 So, not all the required conservatisms in a Chapter 15

7 analysis are imposed on safe shutdown for the long-term

8 operation, to demonstrate this cooldown in less than

9 36 hours.

10 The other was, as we have indicated, the

11 FSAR -- excuse me -- the DCD stated that the passive

12 RHR and closed loop could operate indefinitely, which

13 was a bad choice of words and, also, not correct.

14 Really, when we ran through the analysis, it shows that

15 we have run significantly longer than 14 days. I think

16 the analysis shows close to 20 days, but that we have

17 changed our license basis to reflect that safe shutdown

18 operation can achieve 420 in 36 hours and maintain it

19 for at least 14 days, which is a very conservative

20 period of time to restore and be able to use active

21 systems, if you needed to.

22 The other thing to also realize is that we

23 can also actuate ADS to depressurize and go into open

24 loop cooling, if that were required, although it is

25 certainly not desired. So, this whole thing was an

1 attempt here to show our closed loop capability.
2 It is no change to our methods that were
3 used before with the DCD, but it is a change in the
4 results.
5 MEMBER SCHULTZ: You are, then,
6 differentiating between the methods and the
7 assumptions that are used as input --
8 MR. KITCHEN: Right.
9 MEMBER SCHULTZ: -- for the evaluation?
10 Okay. Thank you.
11 MEMBER BANERJEE: That was my question,
12 too. Your assumptions are different now for the safe
13 shutdown analysis. Are they different from what you
14 had previously?
15 MEMBER SCHULTZ: You indicated they were
16 no longer bounding?
17 MR. KITCHEN: Well, we are using, of
18 course, the condensate return results. I don't
19 remember all of the -- the design assumptions I can't
20 say for sure they were all the same as the DCD, but they
21 were for the most part conservative. And the most
22 significant that were nominal were decay heat values
23 were used or the core design values as opposed to a
24 similar value..
25 MR. SCHULZ: I think with the safe

shutdown analysis, the same method was used in terms of the LOFTRAN code. The assumptions on decay heat were the same as the DCD Rev 19 as we are doing now.

Obviously, we changed the condensate return input --

MEMBER BANERJEE: That's the only thing or was there anything else that you --

MR. SCHULZ: That's my understanding, yes. The issue with the previous analysis was it used 90 percent constant return. And as we learned how the plant really operated and did our testing and analysis on condensate return losses, we determined that that condensate return was not only less than 90 percent, it varied with time. So, we had to modify the input to the LOFTRAN analysis to be consistent with the modified design and our understanding of how that worked.

MEMBER BANERJEE: No other assumptions have changed? Or at least none that was so important that you remember?

MR. SCHULZ: Yes. Correct.

MR. KITCHEN: And then, this just summarizes the COL impact. So, basically, there's a number of sections there. There were changes to figures and descriptions to show the type of gutter

1 system and routings and, also, that it affected some
2 Tier 1 table to reflect additional components, which,
3 of course, the impact of Tier 1 are in ITAAC, which lists
4 systems that need to be verified or installed as built,
5 affects Tier 1, and would require an exemption, which
6 is why that alone drove us to do an exemption.
7 MEMBER BANERJEE: So, sorry. Just to go
8 back to those assumptions, I am sure the staff will
9 comment on that as well, if they saw any significant
10 change other than condensate return calculation. So,
11 any other assumptions, we would look for validation or
12 verification of that. That is an important point to
13 make, that it didn't change other things.
14 CHAIRMAN RAY: Okay.
15 MR. KITCHEN: I'm sorry?
16 CHAIRMAN RAY: I was just going to make
17 sure, Sanjoy, if you had anything more you wanted us
18 to keep track of or anything.
19 MEMBER BANERJEE: No, not right now.
20 CHAIRMAN RAY: Bob, do you have more you
21 want to talk about?
22 MR. KITCHEN: Just the lesser questions on
23 this. The tech specs, we changed the bases only to
24 reflect components that needed to be included in the
25 surveillance, which is in the tech specs, but it didn't

1 change the surveillance requirement at all.

2 The departures and exemption, obviously,

3 were included to reflect the changes from this

4 installation of piping and guards. And then, the ITAAC

5 was affected because the component is not what is done

6 in the ITAAC, but what we have to look at. So, that

7 is really the extent of the changes to the COL itself.

8 CHAIRMAN RAY: Okay. But, again, we are

9 off into pretty procedural stuff at this point in time.

10 And I want to keep the focus here, if we can, on -- and

11 we are going to have Terry talk now, I guess, is that

12 right --

13 MR. SCHULZ: Yes.

14 CHAIRMAN RAY: -- on the technical aspects

15 without getting into which chapters, and so on and so

16 forth.

17 Is the line open now?

18 We have a bridge line. There are many

19 people on it, I can tell. But I am only going to ask

20 an ACRS member who couldn't be with us today, who I

21 believe is on the line, Mike Corradini.

22 Mike, are you there?

23 MEMBER CORRADINI: Yes, sir.

24 CHAIRMAN RAY: Do you have any questions

25 for Duke?

1 MEMBER CORRADINI: No, I thin Sanjoy has
2 asked most of them. I think most of them are
3 procedural. I want to wait until we get to the
4 calculations about the basis for the change and how they
5 meet the condition.
6 CHAIRMAN RAY: Okay. We're going to
7 close the line again now and proceed on with
8 Westinghouse.
9 MEMBER CORRADINI: Okay, and I will send
10 a note to Joy or --
11 CHAIRMAN RAY: That's fine. You can send
12 it to Joy.
13 And by the way, it sounds like you're on
14 a cell phone or something. It is cutting in and out.
15 So, why don't you just go ahead from here on until we
16 get into closed session and send any questions you have
17 to Joy, and I will ask if she has got anything from you?
18 (Laughter.)
19 Anything that she can talk about in the
20 open meeting. Okay.
21 Nothing else for Duke at this point?
22 (No response.)
23 Okay. Terry?
24 MR. SCHULZ: Okay. What I am going to be
25 talking about here, first, and this is where we hope

1 we can get to it in terms of conclusions, having talked
2 about the changes that we have made and making sure we
3 understand those, talking about the testing and
4 analysis that we have done, to show that those changes
5 work.
6 And then, of course, the staff will talk
7 about their audit and review. The last time we talked,
8 we were really just in the middle of that, and now we
9 are basically through that.
10 In terms of the agenda, the next thing I
11 will talk about is the systems and operation of the
12 plant. One thing that we have tried to do here is
13 identify things that are different from the previous
14 presentation in terms of highlighting them in sort of
15 a light blue text. And so, when you see a slide like
16 this that doesn't have any of that light blue text on
17 it, it is telling you and me that nothing really
18 changed.
19 CHAIRMAN RAY: Right.
20 MR. SCHULZ: And this slide, basically,
21 says, kind of as Bob had said, the passive RHR is what
22 we rely on to remove decay heat in non-LOCA accidents,
23 but that the passive safety injection features can
24 operate in a passive feed-and-bleed mode and provide
25 a backup to the passive RHR in non-LOCA events. So,

1 that is one of the things that is part of our
2 defense-in-depth capabilities of the AP1000.
3 This is a semi-animated-type slide. It
4 just reminds you where all the steam can go. After
5 leaving the IRWST, some of it is going to stay in the
6 containment atmosphere because the containment gets
7 pressurized during this event. Some of it will
8 condense on structures, steel and concrete walls that
9 are inside containment. And that condensate doesn't
10 get back into the IRWST.
11 Some of it, of course, in most of it we like
12 to get to the containment vessel and drain it back into
13 the IRWST. But, you know, some of that will splash off
14 and not get into the IRWST. And we will talk more
15 about, especially in the closed session, exactly what
16 those losses are and how we quantified them.
17 Another thing that we discovered -- and we
18 talked in the last session -- is that the condensate
19 that is lost, the bulk of that will drain down into the
20 bottom of the containment. And after enough
21 accumulates, it will contact the outside of the reactor
22 vessel, which will still be hot in this situation. And
23 that will create steam in the bottom of the containment,
24 which will have consequences in terms of heating up
25 structures that might not heat up as fast due to the

1 fact that our IRWST release point is above the operating
2 deck, and there is a tendency for the containment to
3 stratify.
4 And that is one of the things we were, say,
5 wrestling with earlier on in this process. We finally
6 recognized that this steaming will go on low in the
7 containment. So, the loop compartment areas and those
8 areas below the operating deck will see fresh steam
9 generation due to this contact with the reactor vessel,
10 which will eventually heat up all those structures that
11 are low in the containment. It also has some
12 beneficial effects where that steam will tend to get
13 up into the upper part of the containment, and some of
14 it will work its way back into the IRWST.
15 This is a detail -- again, nothing really
16 changed here -- showing a cross-section of the passive
17 RHR. The operating deck is above it. It is a
18 seed-tube type design, normally covered with water.
19 When the passive RHR starts, of course,
20 that water is covering the heat exchanger. And as we
21 just talked about, over the long-term there are
22 condensate losses that will eventually drop the level
23 in the IRWST. As that level drops, as long as it is
24 above the top of the tubes, again, we impact on the
25 performance of the passive RHR.

1 Later on, as time goes by, the level will
2 drop down below the top of the tubes. You will start
3 to uncover tubes. You will lose effective heat
4 transfer surface area, and that will reduce the
5 performance of the passive RHR.
6 Now, given that this takes a good amount
7 of time to happen, decay heat is also dropping during
8 this timeframe. We will show you a plot later on of,
9 versus time, the water level in the IRWST and the
10 temperature in the reactor coolant system. And
11 eventually, it does start going back up again, but --
12 MEMBER BANERJEE: What goes back up again?
13 MR. SCHULZ: The RCS temperature. Okay?
14 In the plot I will show you it is around 16 days it starts
15 going back up. It takes another four days to get back
16 up to 420. So, it goes up fairly slowly because the
17 passive RHR doesn't stop working. It just starts
18 falling behind decay heat, and that gap, that delta,
19 starts going into heating up the water and steel in the
20 reactor coolant system.
21 MEMBER BANERJEE: So, is this a period
22 when all the tubes are uncovered or is there some
23 covered?
24 MR. SCHULZ: No, there are still some
25 covered. What you will see is, when the water level

in that particular case gets down near to the bottom horizontal section, when you start uncovering in that area, you start falling behind decay heat. So, in that case, you substantially uncover a lot of the tubes.

MEMBER BANERJEE: So, the vertical spots, and, of course, the top, is uncovered at this point, and you are starting to uncover the bottom part?

MR. SCHULZ: The bottom part, right.

MEMBER SKILLMAN: Terry, in this scenario, I presume that you are making up to the reactor coolant system from some source?

MR. SCHULZ: The makeup is from the core makeup tank.

MEMBER SKILLMAN: Okay.

MR. SCHULZ: Okay? Yes.

MEMBER SKILLMAN: Can you speak to the non-condensable vapor content, such that by making up to the reactor coolant system, you are actually getting into gas binding on the top of this tube bundle?

MR. SCHULZ: Well, the core makeup tanks have no gas in them. They are not like accumulators. Okay?

Depending on the duration of the event, you actually may get some accumulator water in. The accumulators will not empty in any of the scenarios.

1 The pressure doesn't get that low in the reactor coolant
2 system.
3 So, it would be a little bit of nitrogen
4 that would come in with the accumulator water which
5 would be very late in the process here. And the way
6 the passive water piping goes, it goes up to a high point
7 that is 6 or 7 feet above what you see there. So, it
8 goes above the operating deck and comes back down again.
9 And it is a big pipe. It is 14-inch, a nominal size.
10 So, even if you accumulated a little bit
11 of gas at the top, it would tend to stay there. The
12 flow rates in the long-term are very low because decay
13 heat has dropped off. You have started uncovering
14 tubes on the IRWST side. So, the heat removal and,
15 therefore, the actual circulation flows slow down
16 considerably. And I think in the whole effort that we
17 put into on gas accumulation in passive system piping,
18 looked at some accumulation of gas up there that would
19 stay and not get swept into the heat exchanger.
20 MEMBER SKILLMAN: Thank you.
21 MR. SCHULZ: Okay?
22 This is, again, a table we showed you. We
23 actually have revised this a little bit. When we talk
24 about 420, we talk about a T-average of 420. T-hot will
25 actually be a little bit above that, of course, in an

1 active circulation situation. Our calculations
2 indicate that it is on the order of 20 degrees
3 Fahrenheit higher than the T-average and that, if you
4 are talking about what is the pressure in the reactor
5 coolant system in those conditions, it will tend to be
6 saturated pressure at T-hot. Now that is not going to
7 the case very shortly after passive RHR, but in the
8 longer-terms of interest here you will lose heat from
9 the pressurizer and you will come down to a saturated
10 condition. So, that will be this pressure as
11 indicated.
12 And then, I have just shown a range of
13 conditions. The 490, you will see later on, is one of
14 the temperatures of interest that we show in our 72-hour
15 conservative Chapter 15 extension condition at --
16 MEMBER BANERJEE: So, 490 at the core
17 outlet, is that the temperature?
18 MR. SCHULZ: The T-hot.
19 MEMBER BANERJEE: The T-hot?
20 MR. SCHULZ: Yes.
21 MEMBER BANERJEE: So, it would be off of
22 the core, right?
23 MR. SCHULZ: Yes, yes.
24 MEMBER BANERJEE: And it is still single
25 phase at that point or is there some boiling? I don't

1 know what the pressure is in the system.

2 MR. SCHULZ: Well, we expect the pressure

3 to come down to saturation. We don't have pressurizer

4 heaters.

5 MEMBER BANERJEE: So, it will just --

6 MR. SCHULZ: It will --

7 MEMBER BANERJEE: The head and the

8 pressurizer will keep it from boiling?

9 MR. SCHULZ: Yes, and you also have, of

10 course, in these later timeframes, you know, you just

11 have decay heat. And it is a low amount of decay heat

12 because you are in this case out --

13 MEMBER BANERJEE: Uh-hum.

14 MR. SCHULZ: -- a couple of days, a couple

15 three days. So, the heat transfer rates through the

16 fuel are low, much lower than at-power kind of

17 conditions.

18 I can't answer whether there's --

19 MEMBER BANERJEE: Well, it is just a

20 question of whether it reaches saturation temperature

21 under conditions where you can get some boiling and some

22 core uncovery or a vapor bubble sitting there, which

23 is unlikely, right?

24 MR. SCHULZ: Yes, I don't see there being

25 a challenge there. You've got lots of water. Your

decay heat levels are low. So, if you had any --

MEMBER BANERJEE: Well, in any long-term coolant problem, we are always worried about core uncovery or that it happens, you know.

CHAIRMAN RAY: Well, I think this one where you need to help me a little bit because some of these numbers double.

MR. SCHULZ: Well, because we were looking at some higher temperatures than we did in the past, and it was pretty arbitrary what we picked. The reason why I was saying that we picked this 490, which is considerably higher than what we showed before --

CHAIRMAN RAY: Right.

MR. SCHULZ: -- was because we had done the 72-hour conservative Chapter 15 extension case. And with the very conservative decay heat that is in that, that is primarily the big driver and difference in terms of what happens in that 72-hour Chapter 15 case versus our more expected case with best estimate decay heat, is that it drives the RCS temperature higher. It doesn't come down.

Again, you still meet all the Chapter 15 analysis criteria in terms of we don't fill the pressurizer, the core is cooled, no DNB. All those kinds of conditions are satisfied, even with the

1 higher. And so, the RCS pressure, yes, it is higher,
2 but it is driven by the fact that we were now looking
3 at a higher T-hot, T-average T-hot.
4 CHAIRMAN RAY: Right. I mean, I think
5 that is the -- and what I am trying to do, and I have
6 just passed my presentation over to Sanjoy -- because
7 I realize you pick numbers there, and that drives what
8 appears to the right. But, on the other hand, to
9 somebody like myself, that implies something that I'm
10 trying to get a better understanding of.
11 And you are saying it is the duration
12 extension of the analysis?
13 MR. SCHULZ: The reason we are showing
14 this slide at all is to give you a feeling for the
15 percent of RCS pressure that we are getting to. Part
16 of the claiming the plant is safe is that not only is
17 it stable, the core being cooled, but that the change
18 of having a subsequent pipe break is low.
19 CHAIRMAN RAY: Yes, and I certainly would
20 agree that that is the case here. But, like I say, I
21 noticed that the percent of the RCS pressure has gone
22 from 13 to 28 --
23 MR. SCHULZ: Yes.
24 CHAIRMAN RAY: -- that sort of thing. So,
25 it is not something that is just a refinement. It is

reflecting --

MEMBER BANERJEE: I guess your question is -- I didn't have this slide --

CHAIRMAN RAY: I know, but I am giving it to you now --

MEMBER BANERJEE: Yes.

CHAIRMAN RAY: -- so you can ask whatever question --

MEMBER BANERJEE: Yes.

CHAIRMAN RAY: -- I would ask if I were smart enough to do it.

MEMBER BANERJEE: Well, you obviously noticed it; I didn't.

So, I guess Harold's and my question would be, what caused you to revise that table and bring up to 490? What was the discovery you made between the time you presented that to us in April, or whenever it was, and what you are showing now? Because the limit has gone from 440 to 490, the T-average that you are showing here.

MR. SCHULZ: The primary thing that happened was that the staff had asked us some questions about what the Design Basis was, what was the licensing commitment, what were the safety requirements. And as a result of all of that, we came up with what Bob Kitchen

showed.

It was basically a dual approach. One leg of the approach was -- and it was new because we hadn't done this before -- was an extension of Chapter 15 for 72 hours using completely bounding Chapter 15 assumptions. So, high decay heat and all that.

MEMBER BANERJEE: No, that is clear, yes.

MR. SCHULZ: That is the case that came up with the 490.

MEMBER BANERJEE: That is where it came from?

MR. SCHULZ: That is where it came from.

MEMBER REMPE: So, when you interacted with the staff -- and this is from Mike Corradini -- I assume you provided plots --

MR. SCHULZ: Yes.

MEMBER REMPE: -- and they have reviewed it and they do audit calculations?

MR. SCHULZ: You would have to ask them. I think so. They're nodding their heads yes.

And in the closed session I will actually show you a plot that Westinghouse did for this 72-hour Chapter 15 extension case.

MEMBER REMPE: And I elaborated on some of his question.

1 MEMBER BANERJEE: Yes, I guess the
2 confusion is coming because you are calling this the
3 safe shutdown. And sort of what Bob Kitchen did is
4 he divided things into two, right? He said there was
5 an FSAR Chapter 15 Design Basis --
6 MR. SCHULZ: Uh-hum.
7 MEMBER BANERJEE: -- for 72 hours. And
8 then, he said there is the safe shutdown analysis. And
9 when you have got this safe shutdown, in that you have
10 to have conditions that say nominally less than 420 in
11 less than 36 hours.
12 So, is this calculation you are presenting
13 here related to that trying to get to 420 in 36 hours
14 or is it related to the 72 hours? I am a little bit
15 confused about that.
16 MR. SCHULZ: Okay. Well, the reason why
17 we have got this table at all --
18 MEMBER BANERJEE: Yes.
19 MR. SCHULZ: -- is because we have been
20 saying that 420 is not a cliff; it is not a safety
21 requirement. So, if --
22 MEMBER BANERJEE: I understand that.
23 MR. SCHULZ: Okay. And that is the whole
24 purpose of this, is to show that it is not a cliff.
25 MEMBER BANERJEE: Okay.

1 MR. SCHULZ: The other thing about the 490
2 is, if we didn't put it on there, you would have asked
3 us about it, you know, what the pressure was at 490.
4 (Laughter.)
5 So, it was preemptive to show you that,
6 even in the very conservative bounding Chapter 15
7 extension case, which is probably on the order of a
8 10-to-the-minus-8 kind of probability of
9 occurrence -- and we have actually put some numbers on
10 that --
11 MEMBER BANERJEE: So, you are using the
12 Chapter 15 calculations to sort of indicate that 490
13 is still gives you relatively --
14 MR. SCHULZ: It is still a low chance of
15 having subsequent failures, yes.
16 CHAIRMAN RAY: And the calculations back
17 in April were best estimate, right?
18 MR. SCHULZ: They're not best estimate.
19 They are still bounding, except for basically decay
20 heat. That is the key one. It was best estimate.
21 CHAIRMAN RAY: Okay.
22 MR. SCHULZ: And we are still using that
23 in our demonstration of meeting 420, that approach.
24 Okay? And with those inputs and assumptions, we do
25 achieve 420. We are not 430 or 460, or especially 490.

1 We are still --

2 MEMBER BANERJEE: But this is based on

3 actually the calculations you did for the first part

4 of the Chapter 15?

5 MR. SCHULZ: That is where the 490 comes

6 from.

7 MEMBER BANERJEE: This still is coming

8 from that, which is conservative?

9 MR. SCHULZ: Yes. Right, very

10 conservative.

11 MEMBER BLEY: And it is not just the 490.

12 All the other numbers are higher because they did it

13 under different assumptions?

14 MR. SCHULZ: Yes, it is more "what if?"

15 MEMBER BLEY: Yes.

16 MR. SCHULZ: You know, we don't really

17 have a calculation that comes out at 430. It was more,

18 what if it was 430; what if it was 460?

19 MEMBER BLEY: Right.

20 MR. SCHULZ: This just shows you where you

21 would be in terms of percent of RCS design pressure.

22 MR. CORLETTI: Terry, this is Mike

23 Corletti.

24 This is a parametric assessment?

25 MR. SCHULZ: Yes.

1 MEMBER SCHULTZ: And you were hoping that
2 this would show us that there is a safety margin that
3 is associated with the overall evaluations, and even
4 at 490, you have these conditions which should be
5 acceptable?
6 MR. SCHULZ: Yes. Yes.
7 MEMBER SCHULTZ: That was your goal?
8 MR. SCHULZ: Yes.
9 (Laughter.)
10 MEMBER SCHULTZ: Thank you.
11 MEMBER BANERJEE: But, I mean, it is
12 almost, then, an obvious conclusion in the sense that
13 all you are doing is saturation pressure at 490. It
14 is just a steam table, right?
15 MR. SCHULZ: Yes. Well, it is actually
16 510 because you have to add a little bit on for T-average
17 to T-hot. But, yes, it is very simple. This table is
18 just a steam table kind of thing, but it is trying,
19 again, to demonstrate that, if you go a little above
20 420, there is not a cliff.
21 MEMBER BANERJEE: Yes, you are just trying
22 to say 420 is not a magic number. But is that part of
23 your licensing basis, that you have to achieve 420, or
24 what is the --
25 MR. SCHULZ: Well, what we were saying in

April was that 420 was a safety criteria. Okay? And our argument --

MEMBER BANERJEE: What does that mean exactly?

MR. SCHULZ: That we would have to meet it showing conservative bounding assumptions, okay, typically. But we weren't. So, we had to put an argument together that had four or five legs, that passive RHR is fully safety-related and automatic. We had safety-related feed-and-bleed backing that up. We did a little probability study that showed the probability of losing offsite power and not getting it back in 24 hours, and having decay heat be above best estimate. All those things occurring, it is like 10-to-the-minus-8 probability.

So, it seemed justifiable and reasonable to us that the approach of using best estimate decay heat was appropriate for a safety criteria. But, after discussions with the staff, they were uncomfortable with that. And so, we kind of went back and forth, and we adopted a slightly different approach, which is to have a Chapter 15 extension to 72 hours with fully bounding analysis, but it didn't meet 420.

Then, we had another case that was not considered to be a safety requirement, but it was still

a licensing requirement for the plant. It was 420, but it didn't have to use the safety bounding analysis.

So, we are doing both now. And Bob tried to sort of outline that in one of his slides.

MEMBER BANERJEE: So, if you use, let's say, the bounding analysis, you end up with some number which is more like 490. Is that it?

MR. SCHULZ: yes.

MEMBER BANERJEE: That's why the 490 has appeared?

MR. SCHULZ: That's right.

MEMBER BANERJEE: Okay.

MR. SCHULZ: That's all.

MEMBER BANERJEE: Yes, that is what I was trying to understand.

CHAIRMAN RAY: Yes, and again, I want to emphasize that our first threshold of understanding and basis for moving forward is that we are now doing what the licensing basis says we are going to do, regardless of whether we are still a long way from the safety problem, or whatnot.

MR. SCHULZ: Uh-hum.

CHAIRMAN RAY: We had this discussion during the amendment process of how important is it to be rigorous on something that is a very remote safety

1 issue. And as far as I'm concerned, anyway, the answer
2 is you've got to do what you say you are going to do.
3 If you can't, change what you say you are going to do.
4 MR. SCHULZ: Yes.
5 CHAIRMAN RAY: Okay?
6 MR. SCHULZ: Yes.
7 CHAIRMAN RAY: And you can also say, "And,
8 by the way, I'm still very safe." But the first measure
9 is to say I have to change what I said I'm going to do.
10 MR. SCHULZ: And that is part of what we
11 are doing here, is to make very clear what we claim the
12 plant is doing and, then, demonstrate that in a
13 consistent way, that it does do that.
14 MEMBER BLEY: I have a point of
15 clarification, and, Sanjoy, it is related to things you
16 are interested in. I think I understand from this
17 discussion not about this slide, but back in April when
18 you showed us the best estimate, almost best
19 estimate --
20 MR. SCHULZ: Yes.
21 MEMBER BLEY: -- with the one change in it,
22 they mean something different from best estimate than
23 we usually mean or we usually mean best estimate with
24 uncertainty.
25 In that case, for the best estimate

1 factors, you would take kind of the most likely
2 condition that you are in, not something that addresses
3 the uncertainty of that. Correct?
4 MR. SCHULZ: That would be -- and that is
5 why we actually don't use the term "best estimate" when
6 we talk about the 420 in 36 hours.
7 MEMBER BLEY: That's good.
8 MR. SCHULZ: Because we have had that
9 internal confusion, and we were trying to stay away.
10 So, we have talked about that analysis as being
11 conservative, but not bounding. And it is not bounding
12 principally because the decay heat is more of a nominal
13 value, but everything else in the analysis, virtually
14 everything as far as I know, the initial conditions,
15 RCS water levels and pressurizer pressures, the passive
16 RHR tube plugging, is conservative. It is not nominal.
17 So, there are many bounding conservative
18 assumptions in the 420, in the analysis that we used
19 to demonstrate 420 in 36, but decay heat is a principal
20 exception.
21 MEMBER BANERJEE: So, the principal
22 difference is the decay heat then?
23 MR. SCHULZ: Yes, which is important.
24 MEMBER BANERJEE: Well, it was very
25 important.

1 MR. SCHULZ: Yes, yes.

2 MEMBER BANERJEE: Dominant.

3 MR. SCHULZ: Yes.

4 CHAIRMAN RAY: Okay. We have stuck you
5 here on this table for long enough. We probably should
6 move on.

7 MR. SCHULZ: Okay. This slide is doing
8 something similar to the previous slide. And again,
9 nothing really changed here. It is trying to deal our
10 use of the word "indefinite". This is one of the
11 changes we are proposing to make to the FSAR, is to
12 remove the word "indefinite" from passive RHR operation
13 and to use something like -- it's not something
14 like -- to use 14 days. And this is the basis for that.

15 Again, we are going to have a two-legged
16 approach which says Chapter 15 extension,
17 conservative, is 72 hours, and then, this on a
18 conservative non-bounding basis would be 14 days. And
19 this basically gives us and the utilities a high
20 confidence that you wouldn't really have to use ADS in
21 a reasonable approach, event.

22 Okay.

23 MEMBER BANERJEE: This is based on what,
24 the pressure, or what is the reason this -- temperature
25 is what, 490, or whatever it is?

1 MR. SCHULZ: Well, no. In the 14-day
2 case, again, you are back to the conservative, but not
3 bounding. So, you do get down to 420. You actually
4 drift below 420. In our analysis, when you get above
5 420, we have an objective to have that be longer than
6 14 days.
7 So, you know, even when that happens,
8 again, you wouldn't have to actuate ADS. You could
9 wait a little bit longer. The temperature will keep
10 drifting up. You know you are okay to at least 490.
11 But, eventually, you are going to run into a problem
12 if you don't recover AC power and defense-in-depth
13 systems.
14 MEMBER BANERJEE: They just keep going up?
15 MR. SCHULZ: They would keep going up,
16 ramping up. And the procedures would be to actuate ADS
17 to --
18 MEMBER BANERJEE: And the main reason is
19 you have uncovered the tubes?
20 MR. SCHULZ: Too much of the passive RHR
21 tubes, yes.
22 MEMBER SKILLMAN: Let me just take off my
23 engineer hat and my new cap for a minute and put on my
24 public hat and say, golly, I was willing to not
25 intervene because the plant that they were going to

1 build in my neighborhood was going to be able to protect
2 itself indefinitely. But you guys are doing bait and
3 switch and changing indefinitely at 14 days.
4 MR. SCHULZ: It still has a definite
5 capability. It just means you have to switch to the
6 feed-and-bleed cooling mode, which, if you have a small
7 LOCA, you're into right away. If you don't take
8 operator action in 22 hours, like Bob said, there is
9 an automatic timer that will turn on ADS.
10 Now the procedures are observe the plant.
11 If it is stable, the pressurizer level is not going
12 down, the core makeup tanks aren't draining, then you
13 can block that signal and actually turn off the power
14 to the PMS actuation cabinets, which blocks ADS.
15 Thereafter, the operators would continue to monitor the
16 plant conditions. And if it did start approaching
17 pressurizer emptying or makeup tanks draining, then
18 they would power back up to PMS. And again, things
19 happen slowly, days out there. They would turn it back
20 on.
21 You can also have conditions where, say you
22 have abnormal RCS leakage at the beginning of the
23 non-LOCA event. Well, at one day you are still going
24 to be okay. The pressurizer level would be slowly
25 dropping, but it would still be stable. For makeup

1 tanks, it wouldn't be draining. But maybe three, four,
2 five days out, you could run into a problem due to RCS
3 inventory, not due to passive RHR cooling capability.
4 So, there are several reasons why you could
5 go into ADS. Principally, it is small LOCAs, but even
6 big RCS leaks could drive you there. The plant is still
7 safe indefinitely.
8 MEMBER BANERJEE: So, the main thing that
9 is happening compared to what was happening
10 before -- I'm just trying to get this clear -- is that
11 the water, instead of going into the IRWST, is going
12 around the reactor vessel?
13 MR. SCHULZ: It is missing the gutter
14 somehow.
15 MEMBER BANERJEE: And it is falling
16 somewhere else, but that is --
17 MR. SCHULZ: And so, the IRWST level is
18 dropping more than we thought it would based on the
19 previous --
20 MEMBER BANERJEE: But the water has to go
21 somewhere.
22 MR. SCHULZ: It is still in containment.
23 MEMBER BANERJEE: Yes, it is going just to
24 a different part of the containment.
25 MR. SCHULZ: Which is why you ultimately

1 can put the plant safe in a feed-and-bleed mode which
2 uses the water in the containment in a direct cooling
3 mode, injection mode, recirc mode, back into the
4 reactor, which is what happens in a LOCA situation.
5 You eventually --
6 MEMBER BANERJEE: You just submerge your
7 break, right? There's no problem?
8 MR. SCHULZ: Well, we have screens.
9 MEMBER BANERJEE: No, but I mean,
10 eventually, you submerge the break.
11 CHAIRMAN RAY: Let's not go into GSI-191.
12 (Laughter.)
13 MEMBER BANERJEE: No, no, this is not
14 GSI-191.
15 MR. SCHULZ: Well, in a non --
16 CHAIRMAN RAY: I'm just being a little
17 humorous, Sanjoy.
18 MR. SCHULZ: Yes, thank you.
19 MEMBER BANERJEE: He doesn't ever want to
20 hear that word again.
21 (Laughter.)
22 CHAIRMAN RAY: I know.
23 MEMBER BANERJEE: He is roasted on that.
24 (Laughter.)
25 CHAIRMAN RAY: I would suggest we move on.

1 We have got quite a lot in the closed section to do that
2 will take us back through this again. So, go ahead,
3 Terry.
4 MR. SCHULZ: So, this next section is
5 talking about the changes we have made. Bob outlined
6 them very briefly, and I will give you a little bit more
7 information.
8 Probably the most important changes had to
9 do with using, adding downspouts to the stiffener and
10 polar crane girder. And I will show you a sketch of
11 what that looks like.
12 So, that is basically taking the
13 condensate that gets basically stripped off the
14 containment. So, when the condensate is coming down
15 and gets to the polar crane girder, that goes all the
16 way around the containment and it is welded to the
17 containment. So, it goes on to the top surface of the
18 polar crane girder. And what we are doing now is we
19 are connecting downspouts to that; actually, four of
20 them around the containment. So, we take that
21 condensate directly down and put it into the IRWST.
22 So, there is no additional chance of losing some of that
23 condensate. Do the same thing at the stiffener, which
24 is, again, very similar orientation.
25 The gutter, we actually didn't put the

1 gutter above the equipment hatch and personnel hatches,
2 and we have added the gutter to there, to more
3 positively capture condensate that might come down to
4 the equipment hatch.
5 And then, there were some changes to cables
6 that were going up to hydrogen sensors that are in the
7 upper dome. Unfortunately, the way the cables were
8 routed, they went up in one place and they ran around
9 the containment, two-thirds of the way around, and they
10 put support plates like every foot. To minimize the
11 need for cable trays, they basically supported the
12 cables directly off of the support plates.
13 So, we ended up with a string of support
14 plates that basically stripped, tend to strip off the
15 condensate that gets to them. And this was a ways down
16 the upper head.
17 So, we have changed that now, so that we
18 come up in three places right under where the sensors
19 are, the three sensors. So, we don't have this
20 horizontal band of support plates. So, those are the
21 three areas.
22 This shows you a system kind of sketch of
23 the downspouts that we are adding. And the top part
24 here is showing the polar crane girder. And I think
25 Bob mentioned a second change that we made. The polar

crane girder is, I think, about 8-feet high. So, there is a top plate and a bottom plate, and there is about 8 foot of containment shell that is in between them.

And there is condensation going on inside the polar crane. Now the polar crane has big holes in it for inspection, so steam from the containment gets in there and there will be condensation. And it is not a great deal, but it was enough to worry about.

And we didn't think about that when we added the drains to the top surface. But, then, we have gone back and we added these drains on the bottom surface. These are small pipes compared to the pipes here. So, we are capturing that condensation that occurs inside the polar crane girder. The stiffener doesn't have that. It is a single plate. So, there is no need to add additional.

And this is routed together in two separate downspouts that go into what we call collection boxes. This is what the gutter that is at the operating deck feeds into, and the collection boxes, then, divert to the IRWST. Normally, they drain down into the waste sump. There are valves here that close off that block that flow path anytime you actuate the passive RHR, so that the condensate gets collected in any of these areas that get to the collection box, go back into the IRWST.

1 And that is the end of our open.

2 CHAIRMAN RAY: All right. What we are

3 going to do now is, as I promised, we will open the phone

4 line as well as inquire here in the room, if there is

5 any comments that any member of the public wishes to

6 make.

7 I trust that Mike Corradini has been

8 communicating with you, Joy.

9 MEMBER REMPE: Some.

10 (Laughter.)

11 I forget to check sometimes.

12 CHAIRMAN RAY: In any case, the point is

13 that I want to not ask the members of the public to wait

14 until suppertime, or whenever it is going to be that

15 we get done here today, to have an opportunity for

16 comments, because that wouldn't be fair.

17 On the other hand, we need another comment

18 period after the staff has been able to make their

19 presentation. So, this will be the first of two.

20 And I will turn to the phone line first and

21 ask, if there is any member of the public, to please

22 identify themselves and give us any comment they would

23 like to make at this time.

24 (No response.)

25 (Sound of dialing on phone line.)

1 Well, I am not sure. What does that mean?
2 Is that how we open it?
3 All right. Well, while that is going,
4 anyway, is there anybody here in the room who would like
5 to make a comment?
6 (No response.)
7 Okay, seeing none, we will have to endure
8 this (referring to computerized comments on phone
9 line).
10 I think we disconnected him somewhere
11 along the way, at least as far as my operation of
12 conference calls goes. So, we will wait a second and
13 see if there is anybody who wants to comment. And then,
14 we will have to proceed.
15 Also, I will say, given that it is 2:15,
16 we will take a break now because we have got to forge
17 on after that. I don't want to wait until four o'clock.
18 Okay, we have, I think, restored at least
19 the open line for this AP1000 Subcommittee meeting. Is
20 there anybody on the line who wishes to make a comment
21 at this time? This is the first of two periods when
22 we will have an open line following an open portion of
23 the meeting.
24 (No response.)
25 No one wishes to make a comment?

1 We are going to proceed as follows then:
2 we will close this line.
3 MEMBER REMPE: Mike has cut off, by the
4 way.
5 CHAIRMAN RAY: Yes, I figured that is what
6 happened, is the line got dropped, and we are not going
7 to repeat the last bit of the conference according.
8 But we will, nevertheless, invite and hear any comments
9 that people want to make now or at the end, following
10 the second open session.
11 Once again, anybody wish to make a comment
12 now?
13 (No response.)
14 Okay. We will be taking a break, closing
15 the line, having the closed session then, immediately
16 following that, starting at 2:30. I expect that closed
17 meeting to go until either a quarter to 4:00 or four
18 o'clock. Maybe I will revise and say somewhere between
19 3:30 and 4:00 I expect we will end the closed portion
20 of the meeting.
21 We will resume the open section of the
22 meeting by having the staff come up and make their
23 presentation. And we will have another opportunity
24 for public comment at the end of that period, perhaps
25 on the order of 4:30 or five o'clock.

1 But I expect we will back in the open
2 session somewhere between 3:30 and four o'clock. That
3 is an hour to an hour and a half after we resume
4 following this break.
5 All right. With that, let's close the
6 line, please. We will take our break, and I would ask
7 Westinghouse to help us assure that we only have those
8 authorized in the room when we resume at 2:30.
9 (Whereupon, at 2:18 p.m., the meeting went
10 off the record from open session to take a break and,
11 then, to resume in closed session at 2:30 p.m.)
12 (Whereupon, at 3:57 p.m., the meeting
13 resumed in open session.)
14 CHAIRMAN RAY: Sorry to make you guys wait
15 so long. I hope you've been entertained by all of this,
16 but we are going to now engage with you for a while.
17 So, please proceed.
18 MEMBER BLEY: There wasn't anybody
19 outside or anything waiting for us to open the meeting,
20 was there?
21 CHAIRMAN RAY: Well, I don't know. I'll
22 ask Peter to go check on that.
23 Is there anyone who is standing by next
24 door who was thrown out of the meeting room here?
25 It's all yours, Don.

1 MR. HABIB: Thank you.
2 Good afternoon.
3 My name is Don Habib, and this presentation
4 summarizes the staff review of the changes to the AP1000
5 passive core cooling system condensate return. And
6 this is described in the staff's Revised Advanced
7 Safety Evaluation for Section 6.3. I'm the Project
8 Manager for the staff review of the Levy Nuclear Plant
9 Units 1 and 2 Combined License or COL application.
10 The staff review of the passive core
11 cooling system condensate return was performed under
12 the Levy COL application. It was in response to
13 submittals from Duke Energy, Florida, which is the
14 Applicant for the Levy COL. And these changes,
15 associated with the design change, have also been
16 submitted by the Vogtle Units 3 and 4 licensee.
17 CHAIRMAN RAY: Hear that, guys, on Levy?
18 So, we've got a Vogtle change in-house.
19 MR. HABIB: The primary reviewers and
20 presenters today are Boyce Travis from the Containment
21 and Ventilation Branch and Tim Drzewiecki from the
22 Reactor Systems Branch. And they were supported by Yiu
23 Law from the Mechanical Engineering Branch and Derek
24 Scully from the Balance of Plant and Technical
25 Specifications Branch.

1 For the Levy COL application, the ACRS
2 conducted Subcommittee and full Committee meetings
3 back in 2011 and issued their letter of conclusions and
4 recommendations to the Commission at that time. Since
5 then, the staff has conducted additional reviews of
6 additional applicant submittals under the Levy COL
7 docket, and the staff has issued or reissued several
8 chapters of the Levy Advanced SE.
9 Most recently, and the subject of today's
10 meeting, the staff reissued the Section 6.3. Before
11 that, the staff issued Chapter 20 to address
12 recommendations for the Fukushima Near-Term Task
13 Force, and we specifically gave a presentation on the
14 Recommendation 2.1, which was the seismic
15 reevaluation.
16 Also, earlier in 2014, we reissued
17 Chapters 8 and 13. And this was to address the staff
18 review of the electrical loss-of-phase condition
19 described both in 2012.01 and the Emergency
20 Preparedness Enhancement Rule. And the ACRS has not
21 asked for presentations of these topics.
22 I will now discuss the licensing impact of
23 the design change to the passive core cooling system
24 condensate return. The design change is represented
25 in the Applicant submittals as an exemption request and

1 two departures from the AP1000 DCD Rev 19.
2 The exemption request calls for changes to
3 Tier 1 information of the AP1000 DCD. And notably,
4 there are changes to two Tier 1 tables, and these tables
5 were modified. These tables list the components and
6 piping of the passive core cooling system, and they were
7 modified to include the screens and downspouts of the
8 design change. And these tables are cited in several
9 of the ITAAC for the passive core cooling system.
10 For the two departures included in the
11 submittals, one was in Chapter 3, and this was
12 modifications to the polar crane girder, internal
13 stiffener, and passive core cooling system gutters.
14 And then, the second departure dealt more
15 with the performance of the system and changes to the
16 capability of the system to maintain safe shutdown for
17 the non-LOCA events, basically, changing indefinitely
18 to 14 days or 72 hours for the safety-related mission
19 time.
20 CHAIRMAN RAY: Okay. Now we make these
21 changes. We review them. We ask many, many
22 questions. We find them to be satisfactory, let's say.
23 But there just seems something very odd about what we're
24 doing now as a way of correcting or resolving
25 inconsistency between analyses and the -- I don't want

1 to call it "licensing basis" -- what the DCD says here.
2 I mean, supposing we had a dozen of these
3 things. Is there ever any intent to revise the design,
4 the Certified Design Document? Does it matter that it
5 is not correct, if I can use that sort of simplistic
6 term?
7 MR. BURKHART: That's a great question,
8 Mr. Chair. If we have asked ourselves that question.
9 And there is 5263, which is the finality
10 provisions of design cert, which, arguably, basically,
11 we can only impose changes when there are issues with
12 compliance and safety. And actually, this is a
13 candidate -- and there are some other things in
14 here -- this is a candidate of something that we should
15 go back and look at for revisions to the certified
16 design.
17 And one of the questions is pragmatism and
18 how do we do that in a way that does not make the
19 regulatory regime unpredictable. So, you're right, we
20 are collecting some of these things like that, that at
21 some -- and we have already started engaging
22 Westinghouse on this, when might be the right time to
23 have an amendment or revision to the certified design.
24 CHAIRMAN RAY: Well, you recall that I
25 happen to go back far enough -- maybe you do, too -- to

1 before Part 52 was adopted. This, to me, seems
2 inherent in the concept of Part 52.
3 And you recall earlier this afternoon I
4 mentioned the potential at least exists for us to come
5 to some generic observation in the wake of all of this.
6 This is an example -- I don't know that
7 there would be any traction for it -- but it is an
8 example of a generic issue or concern that emerges from
9 all of this.
10 How the heck could we go around fixing -- I
11 can't find the right word. I don't want to call it
12 "deficiencies" or "errors," or whatever. How can we
13 go around doing that with this kind of licensing action?
14 Just right now I don't have an answer to it.
15 Well, thank you for your comments. Let's
16 go ahead.
17 MEMBER SKILLMAN: Harold, may I?
18 CHAIRMAN RAY: Well, if you keep it short,
19 because we are --
20 MEMBER SKILLMAN: The Chairman has
21 restrained me on this, and I have knowledge of Harold's
22 discipline to hold me throw. I want to make two
23 comments.
24 In my view, Part 52 requires Appendix B.
25 Appendix B Criterion 3 is designed control and XVI, 16,

1 is corrective action. I don't understand why this was
2 not entered into Criterion 16 on the design cert and,
3 then, handled as a Part 21 that would have assured
4 extended condition and root cause.
5 CHAIRMAN RAY: Well, we're going to come
6 back to that, if you can --
7 MEMBER SKILLMAN: I believe the tools are
8 in place to do this, and I know it has been done on
9 another design certification.
10 MR. BURKHART: And it should be done.
11 MEMBER SKILLMAN: So, I think you had
12 asked, from a pragmatic point of view, how do we handle
13 this. I believe that if all of the tools are in place
14 to ensure that this gets ventilated on the cert and in
15 every subsequent SCOL --
16 MR. BURKHART: Yes, we would expect --
17 MEMBER SKILLMAN: And with that, I'll
18 stop.
19 CHAIRMAN RAY: Okay. Well, I was going to
20 come to the issue you raise, but later. I just wanted
21 to insert here the question the way I asked the other
22 question, which is, what is the applicability of
23 Appendix B? We heard Westinghouse say they're doing
24 testing now, for example. Does that testing, if there
25 happens to be a criterion in the 18 criterion of

1 Appendix B having to do with test control, and so on,
2 is that applicable? If so, fine. Is the Vendor
3 Inspection Branch looking at it from that standpoint?
4 There are many, many questions we can ask
5 here, but it is 10 minutes after 4:00, and these poor
6 people haven't had a chance to make their presentation.
7 So, I am going to have us proceed.
8 MEMBER BANERJEE: And Mike is going to ask
9 my questions.
10 CHAIRMAN RAY: Huh? Mike wants to ask a
11 question? You've got it --
12 MEMBER BANERJEE: No, he will ask the
13 questions I've got.
14 CHAIRMAN RAY: Oh, he will? He is going
15 to assume your responsibility in presenting? Okay.
16 Well, he is on a line now in a public meeting that we
17 will have to open for him later in order for him to do
18 that, unless he can send us an email.
19 Westinghouse wants to answer a question.
20 MR. CORLETTI: The Westinghouse people
21 are saying the open line is not open.
22 CHAIRMAN RAY: That repeats the
23 experience of a little while ago. I'm not going to get
24 up and do anything about it. This gentleman right here
25 will.

1 Let's go ahead.
2 Thank you.
3 MR. HABIB: All right. I will now turn it
4 over to Boyce Travis to present the next portion of our
5 presentation.
6 MR. TRAVIS: Thanks, Don.
7 I'm Boyce Travis. I'm a reviewer with the
8 Containment and Ventilation Branch.
9 First, I am going to speak briefly to the
10 regulations and guidance the staff used to inform us
11 in their review. As you know, this is something of a
12 novel issue and doesn't directly conform to any of the
13 existing guidance we have.
14 We applied GDC 34, Residual Heat Removal,
15 because the PRHR is the primary credited safety-related
16 decay heat removal system following a non-LOCA
17 transient. GDC 44, Cooling Water, because the
18 condensation on the containment wall is the mechanism
19 the AP1000 uses to transfer heat to the ultimate heat
20 sink.
21 CHAIRMAN RAY: Boyce, I need to interrupt
22 you --
23 MR. TRAVIS: Uh-hum.
24 CHAIRMAN RAY: -- because, although
25 Westinghouse says the line isn't open, and I'm sure

they're right about that, I hear noise here that sounds like there is some telephone line open.

Mike, are you there?

(No response.)

Okay. There is a telephone line open. Whether it is the right one or not is perhaps the question.

Go ahead.

MR. TRAVIS: Okay. Also, we took advantage or looked at the EPRI Utility Requirements Document, the URD, and the associated Staff Safety Evaluation on that. It stipulates that passive plants have a 72-hour Design Basis and provides the impetus that safety-related systems be capable of reaching of 420 degrees in 36 hours.

In the Safety Evaluation for that document, the staff recognized that 420 was not -- and/or cold shutdown -- was not the only safe, stable shutdown condition for a plant.

We also looked at SECY-94-084, the title of which you can see on the slide. And that acknowledged the 420-degree Fahrenheit in 36 hours criteria for safe shutdown, and that is what is being used by the AP1000 DCD Chapter 6, or was being used by the DCD in Chapter 6 and Appendix 19(e).

1 CHAIRMAN RAY: Now that is an important
2 point that Boyce just went over. Any questions anybody
3 has?
4 (No response.)
5 Okay, go ahead.
6 MR. TRAVIS: We're on the next slide.
7 And so, I am going to briefly talk about
8 the review history.
9 MEMBER STETKAR: Don, keep your paper off
10 the microphone. You're the one who is --
11 CHAIRMAN RAY: Oh, you're the guy "on the
12 telephone"? I see. All right.
13 (Laughter.)
14 MEMBER STETKAR: Other than the beeps,
15 which are obviously telephone.
16 MR. TRAVIS: And so, I will briefly talk
17 about the review history here as well.
18 For the AP600 design, it was capable of
19 removing decay heat via the IRWST for 72 hours with no
20 condensate return. That is specified in 5.4.14 --
21 (Interruption by computerized phone
22 line.)
23 MR. TRAVIS: All right.
24 CHAIRMAN RAY: Wait.
25 Okay, for those on the line, we are just

1 beginning the open session with the staff presentation,
2 and we are delinquent in getting the line
3 reestablished.
4 Go ahead.
5 MR. TRAVIS: Okay. And so, speaking to
6 the review history on the matter, the AP600 was capable
7 of removing decay heat via the IRWST for 72 hours with
8 no condensate return, although it did include a
9 safety-related gutter system that was made
10 safety-related as a response to staff concerns that the
11 changeover valves going from the sump to the IRWST might
12 not open.
13 In addition, for AP600, there was no
14 explicit modeling of a scale or integrated event that
15 involved the non-LOCA transient; that is, something
16 where there was a tank in containment that was heated,
17 steamed, and then, condensate was returned to the tank.
18 Bits of this system was tested separately, but there
19 was no integrated test on this specific issue.
20 For the AP1000, the language changes for
21 non-LOCA transient, as Westinghouse spoke to, that the
22 IRWST and PRHR heat exchanger can remove the core decay
23 heat for an unlimited period of time. The volume of
24 the tank was increased. In addition, the area and flow
25 rate through the heat exchanger were increased to

1 compensate commensurate with the power change for going
2 from 600 to 1,000.
3 And the staff found that the scaling regime
4 that was applied going from the testing to AP600 was
5 also for the most part applicable to AP1000.
6 CHAIRMAN RAY: Okay. Now this is a
7 recital of the facts. The obvious question is, well,
8 why? But this is not the time to go into it. But I
9 just want to note that we're not answering the question
10 of, well, why did we do it this way, and that is a
11 question that we are going to have to come to grips with.
12 MR. TRAVIS: And we will try to speak to
13 that a little later in the presentation.
14 CHAIRMAN RAY: Okay. All right, good.
15 Thank you.
16 MR. TRAVIS: We can move on to then next
17 slide.
18 And so, in performing the review, this kind
19 of summarizes the containment response, what we looked
20 at in the containment response. We took a look at
21 whether the analysis change had any impact on the deep
22 pressure analyses that were already performed.
23 We evaluated whether this analysis had any
24 change on the containment flood uplevel. That is, what
25 the level in containment is following a LOCA or an ADS

1 actuation.

2 We looked at the test data that

3 Westinghouse used to justify some of what you saw in

4 the previous presentation. And we also focused on the

5 inputs to the RCS analyses, which primarily are the

6 condensate return to the IRWST and the containment

7 pressure, which has a direct impact on the boiling from

8 the PRHR heat exchanger.

9 We can go to the next slide.

10 And so, the review approach for the passive

11 core cooling system, or PXS, focused on evaluating the

12 impact of the PXS safety functions for which the PRHR

13 heat exchanger is primarily emergency decay heat

14 removal. The PXS also has the other three functions

15 listed on this slide, and Tim will speak to all four

16 of them later in the presentation.

17 The review also looked at the impact on the

18 safe shutdown analyses, which have been separated from

19 the Chapter 15 analyses, and looked at the impact on

20 the Chapter 15 analyses themselves. When we say "safe

21 shutdown" in this slide, we are speaking to the analyses

22 that appear in Appendix 19(e) of the DCD and the FSAR.

23 This slide I will just go over briefly.

24 You have already had the Applicant walk through the

25 calculational approach. Staff audited the four

1 calculations directly as well as approximately 20
2 calculations supporting these four calcs. This is
3 just kind of a summary of the staff's understanding of
4 what we used from the calculations in order to inform
5 our review.
6 And so, the containment analysis focused
7 on two primary areas, one of which was holdup. And when
8 I say "holdup," I'm referring to the various means by
9 which condensate is lost from the IRWST. There are
10 some one-time holdup losses, like the pressurizing of
11 the containment atmosphere, film losses, condensation
12 on passive heat sinks that doesn't drip down into the
13 sump under the reactor cavity. And then, transient
14 losses, which included tech spec containment leakage,
15 which is fairly minimal; losses over wall attachments
16 and obstructions, that the Applicant went over in
17 detail, and then, raining from the shell and dome.
18 Approximately 17 percent of the condensate
19 that gets to the shell does not return to the IRWST,
20 is instead directed to the sump and/or reactor cavity.
21 They kind of communicate, as Westinghouse showed in the
22 nodalization.
23 One of the areas that staff had some
24 questions about related to film thickness. We
25 questioned the applicability of the approximation that

1 Westinghouse used in their analyses to calculate the
2 thickness of films in containment, holding up on heat
3 sinks, the operating deck, et cetera.
4 In an RAI response, the Applicant
5 reevaluated the film thickness. They determined that
6 there was a more conservative method that could be used,
7 and they performed a sensitivity study that
8 incorporated that more conservative method for film
9 holdup.
10 The effect is negligible in the first 72
11 hours. We are talking about on the order of minutes
12 in reduction of level in the IRWST and in the long-term
13 a fairly small effect. And when I say "long-term," I'm
14 referring to longer than 72 hours.
15 The other primary area of staff focus was
16 the termination of the condensate return rate. And in
17 this, the big unanalyzed portion was the losses over
18 wall attachments that did not previously exist in the
19 staff review.
20 Staff asked the applicant to justify
21 whether the correlation they were using for wall losses
22 in testing was applicable. As Westinghouse summarized
23 earlier, testing was done at temperatures lower than
24 what would be encountered during the containment event.
25 Along the wall, temperatures would exceed 200 degrees.

1 Again, the Applicant performed a
2 sensitivity study for increased wall losses. This one
3 has a slightly larger effect than the increased film
4 thickness, but, again, in the first 72 hours the effect
5 is negligible. And beyond 72 hours, you start to see
6 some effect, but it is fairly small.
7 CHAIRMAN RAY: What do you think about
8 this weld business that we were talking about that is
9 similar to an attachment?
10 MR. TRAVIS: Yes. And so, the
11 determination for the one at 5.8 degrees and 12 degrees,
12 we felt that 100 percent loss was conservative. Based
13 on the test data that we saw over the angled plate, we
14 felt that, considering the shallowness of the weld, was
15 a fair treatment of what goes on in that 33-degree weld.
16 CHAIRMAN RAY: Okay. So, just exercising
17 judgment, you think it is reasonable?
18 MR. TRAVIS: That's correct.
19 And so, the findings we made for the
20 containment impact: the peak pressure analyses that
21 is currently in effect in DCD remains unchanged. The
22 new calculation increases the heat sink area to
23 maximize condensation, and that would be a
24 non-conservative assumption for the peak pressure
25 analyses.

1 The initial conditions for this are
2 slightly different than that for a LOCA. Internal
3 containment temperatures are lower for this
4 calculation than they would be in the peak pressure
5 case. Again, the lower containment temperature would
6 reduce the peak pressure and, therefore, would be an
7 inappropriate assumption for a peak pressure
8 calculation.
9 And the effect of additional condensate
10 return and holdup that takes place in this analysis
11 doesn't have a significant impact on the peak pressure
12 analyses until well after the point of peak pressure
13 is reached. So, there is no impact from these analyses
14 on the peak pressure.
15 Staff also looked at the containment flood
16 uplevel following an ADS actuation or a LOCA. The only
17 major impact that was not analyzed in the flood
18 calculation before was the new film thickness method
19 that we asked in the RAI about.
20 We performed some confirmatory analyses to
21 determine whether that would have any effect on the
22 flood uplevel, and the effect is very small.
23 Containment is rather large. And so, a small increase
24 in film does not reduce the flood uplevel adversely.
25 We also looked at the potential or the

1 effect of a lowered IRWST level following an ADS 1, 2,
2 3 actuation. ADS 1, 2, 3 involves spargers in the
3 IRWST, and staff was concerned that the spargers might
4 not be rated for uncovered depressurization in the
5 IRWST or that damage would occur to the surrounding
6 structures. We asked in an RAI about this.
7 Westinghouse got back to us. The spargers are rated
8 for -- they do not need to be submerged in order to admit
9 water.
10 And somewhat related to the change, the PXS
11 downspout screens, consistent with the elements of the
12 gutter system that already exist, are Safety Class C,
13 Seismic Category 1 components. They are qualified
14 under the QA process, and the existing ITAAC amendments
15 will apply. The same goes for the PXS downspout
16 piping.
17 And with that, I will turn to Tim to talk
18 about the PXS and RCS impacts.
19 CHAIRMAN RAY: Okay. We will come back to
20 this business of Appendix B later.
21 MR. DRZEWIECKI: Okay. So now, we are
22 going to go through how the review was done for the
23 passive core cooling system.
24 As Boyce stated before, this was done by
25 looking at the safety functions performed by the

passive core cooling system and looking at the impact on each function. And that starts off with the emergency decay heat removal.

So, this departure had revealed we can rely on the PRHR heat exchanger for a finite period of time before we would have to get support from either a RETINA system or the transition to open loop cooling.

So, staff inquired what's the safety-related mission time for the PRHR heat exchanger. That was issued out in an RAI, and the response came with an FSAR update that changed the language from a definite to a 72-hour operational requirement for the PRHR heat exchanger. This is consistent with the Commission's position for satisfying GDC 34 and 44.

So, the next step was the performance of the PRHR heat exchanger, which is demonstrated in Chapter 15, Safety Analyses, and Chapter 19, Shutdown Analyses. So, those analyses are run out less than nine hours.

So, staff had questions about if the heat exchanger would uncover on the timeframe of a 72-hour mission time and how it would perform during that time. So, an RAI was issued in order to bound all the Chapter 15 events to, one, identify what is the most limiting

1 event in terms of PRHR heat exchanger performance, and
2 to run that event out 72 hours.
3 So, the limiting event was identified as
4 a 15.2.6 loss of AC power station auxiliaries. This
5 conclusion was supported by the Applicant's
6 sensitivity studies as well as staff calculations that
7 came to this conclusion.
8 The next calculation was ran out for 72
9 hours using the approved LOFTRAN code. It used inputs
10 for the containment response; namely, the pressure for
11 that containment as well as the condensate return rate.
12 These calculations did demonstrate
13 partial uncovery of the PRHR heat exchanger. In fact,
14 the top horizontal bundle does uncover. However, the
15 Chapter 15 acceptance criteria for this event remains
16 satisfied over the duration of the calculation, the
17 acceptance criteria being no liquid relief through the
18 pressurizer safety valves. Staff did their own
19 calculations that came to the same conclusion, which
20 is what we will be walking through now.
21 So, this next slide, it shows the limiting
22 event in terms of PRHR heat exchanger performance.
23 This is the hot and cold leg temperatures and the loop
24 that contains the PRHR heat exchanger. The dots that
25 you see, that's data that was taken from the DCD event

in 15.2.6, and the solid lines all are the staff confirmatory calculations.

The agreement between these two sets of calculations gave the staff confidence that the modeling that they had for the system was consistent with what is in the certified design, and there was no trips or any physics that were largely different between these two models.

So, now walking through this event, the transient starts. Only 10 seconds into the event there is a loss of feedwater. One minute after you have a loss of feedwater, that is when your low-range steam generator level trip is encountered. That causes a reactor trip. That is going to stop your turbine stop valves. And this is also where you are going to trip the reactor coolant pumps because of a loss of AC power.

With the closure of the turbine stop valves, you are going to get an increase in pressure in the steam generator that is going to cause the RCS to heat up. That is what you see here.

One minute after you get your reactor trip, that is going to actuate the PRHR heat exchanger. That trip is going to come in on the low, narrow-range steam generator level coincident with the loss of startup feedwater.

1 So, as that injects, there is going to be
2 this initial cold water which is the PRHR heat
3 exchanger. So, that is going to cause this dead -- and
4 then, the system is going to cool down at a steady pace
5 until the cold leg gets 500 degrees Fahrenheit. When
6 that happens, that is going to open up your discharge
7 valve on the core makeup tanks, and that is going to
8 inject a large volume of relatively-cool water into the
9 system.
10 So, that cools down the system to the point
11 where the heat removal from the PRHR heat exchanger is
12 less than your core decay heat. So, the system is going
13 to heat up again until the heat removal from the PRHR
14 heat exchanger equals and, then, ultimately, exceeds
15 the core decay heat. And that turns this event around.
16 So, this is the base event for Chapter
17 15.2.6. The next step was to impose the containment
18 response, which is the pressure within the containment
19 as well as the condensate return rate, and extend this
20 calculation out to 72 hours. And that is what you see
21 on this next slide.
22 So, the graph looks the same, but now there
23 are these two new dotted lines. And what this shows
24 is that the system -- and these two vertical lines, this
25 is at 36 hours and 72 hours, respectively.

1 So, you do see this little dip here. Now,
2 of course, it looks like a peak, but this is on a
3 semi-log plot, so it is actually over the course of many
4 hours. There is a slight heatup when you see the top
5 horizontal bundle uncovered, but it is slight and
6 there's not much expansion of the RSC and it continues
7 to perform its safety function of removing the core
8 decay heat.
9 As stated before, the acceptance criteria
10 for these event is preventing water relief through the
11 pressurizer safeties. And that is demonstrated by
12 looking at the pressurizer, the volume of water inside
13 of the pressurizer.
14 So, this dashed line that is at the top of
15 the plot, that is the total value that is available in
16 the pressurizer and the surge line. And this line,
17 that is the staff's calculation using the base
18 condensate return rate that was obtained from the
19 Westinghouse calculations.
20 Next -- is there a question?
21 MEMBER RICCARDELLA: In all these
22 calculations you were using that 98 percent return
23 rate?
24 MR. DRZEWIECKI: No. This was using the
25 current updated return rate that is provided by --

1 MEMBER RICCARDELLA: So, that is
2 80-something percent?
3 MR. DRZEWIECKI: I don't want to get into
4 the actual value.
5 MEMBER RICCARDELLA: Oh, okay.
6 MR. DRZEWIECKI: We do know what it is, but
7 that is a proprietary value that I can kind of pass on
8 later.
9 MEMBER RICCARDELLA: Oh, I'm sorry.
10 MEMBER REMPE: Could you clarify, did you
11 use LOFTRAN also or what did you use?
12 MR. DRZEWIECKI: Okay. So, early in the
13 process we engaged Research and they did calculations
14 using TRACE. However, the event that they ran was a
15 slightly different event, and so, it didn't match up
16 on exactly what you are seeing here. These results you
17 are seeing are a RELAP calculation. These are based
18 in RELAP5.
19 Okay. So next, staff wanted to look at how
20 sensitive these results were based on the condensate
21 return rate. So, we took the base curve, and we began
22 to chop back what the condensate return rate would
23 approach. So, here it is cut back to 70 percent, and
24 you see a small impact on the change of expansion of
25 the RCS. At 60 percent, it looks like you are starting

1 heat up the RCS slightly, but very small. And then,
2 at 50 percent, it looks like you would be trending
3 towards failure at this.
4 This informed the staff of two things.
5 One, that with respect to the condensate return ratio,
6 there appears to be significant margin for the PRHR heat
7 exchanger to do its function; and, two, if there was
8 less return rate, the heatup is very slow. It occurs
9 over tens of hours.
10 Okay. So, that was the emergency decay
11 heat removal. The other functions performed by the
12 passive core cooling system are emergency makeup and
13 boration. That is the function of the core makeup
14 tanks. There is no impact of that function based on
15 this design change.
16 The safety injection, staff wanted to
17 ensure that at anytime you could transition to open loop
18 cooling. And the one thing that was different was
19 that, if the operators do take action to block ADS
20 actuation at about 22 hours, that when they do bring
21 it back, they could be a much lower level within the
22 IRWST. So, it is a series of RAIs to clarify that. It
23 was clear that there is no minimum level required for
24 ADS actuation.
25 CHAIRMAN RAY: Well, were you going to say

1 something more? I'm sorry.

2 MR. DRZEWIECKI: No.

3 CHAIRMAN RAY: Well, I mean, not as far as

4 the sparger is concerned, but there are some other

5 questions that might be asked about what the operation

6 of the spargers when they are not uncovered, what effect

7 that might have on other things, isn't there?

8 MR. DRZEWIECKI: Yes. We did ask about

9 what is the impact or could there be damage to any of

10 the surrounding structures as well as the IRWST itself.

11 CHAIRMAN RAY: Or equipment in the area or

12 not?

13 MR. DRZEWIECKI: Yes. And that was

14 resolved based on how far away these spargers are from

15 the sides of the tank and the fact that, if they were

16 to actuate in this scenario, you would be at a reduced

17 RCS pressure.

18 CHAIRMAN RAY: You don't have anything

19 pending resolution in that regard then?

20 MR. DRZEWIECKI: We were satisfied with

21 those RAI responses. They did quantify about how the

22 pressure was going to dissipate based on the jet and

23 how far and what they would hit.

24 CHAIRMAN RAY: You are talking about the

25 center in which we defer operation of the ADS and, then,

1 we decide we want to actuate it, right?

2 MR. DRZEWIECKI: Yes.

3 CHAIRMAN RAY: Well if you have any other

4 information that comes to your attention, please pass

5 it along to us.

6 MR. DRZEWIECKI: Will do.

7 Okay. So, the last aspect of this review

8 had to do with the safe shutdown. And this is the

9 ability to get down to 420 degrees Fahrenheit within

10 36 hours.

11 Now the approach that was used for this

12 analysis is the same approach that was used in the

13 certified design. And that is this non-bounding

14 conservative analysis, some conservative assumptions;

15 namely, the condensate return rate, and some initial

16 conditions, as well as a modeling of the PRHR heat

17 exchanger itself.

18 So, this approach, it remains consistent

19 with the prior position that was approved by the

20 Commission in their response to SECY-94-084. Staff

21 has done their own confirmatory calculations and they

22 have come to the same result, that they do achieve RCS

23 temperature below 420 degrees in 36 hours using these

24 assumptions.

25 Now this last bullet, this is talking about

1 the Safety Design Basis of achieving 420 in 36 hours.
2 Previously, within a DCD it is stated that this is part
3 of the Safety Design Basis. Looking at the
4 calculation, staff would expect that an analysis that
5 is going to support a Safety Design Basis would be
6 consistent with SRP 1502.
7 This analysis does not rise to that
8 criteria. And so, staff was concerned that the DCD may
9 be inconsistent.
10 So, after going back and forth, the
11 language that had identified reaching 420 in 36 as a
12 Safety Design Basis has been removed from the FSAR.
13 However, it is still part of the Design Basis and is
14 analyzed in Chapter 19.
15 MEMBER SKILLMAN: Say that again?
16 MR. DRZEWIECKI: Okay.
17 MEMBER SKILLMAN: You really lost me in
18 the last three or four sentences.
19 MR. DRZEWIECKI: Okay. So, reaching 420
20 has been determined by doing several analyses,
21 especially the one that was written in response to the
22 RAI, that reaching 420 is not required to maintain the
23 safe shutdown of the plant; that you can have a safe,
24 stable RCS condition and a temperature above 420
25 degrees. Therefore, reaching 420 does not rise to the

criterion of being safety-related in and of itself.

Therefore, the language that had identified reaching 420 in 36 is no longer part of the Safety Design Basis. It is part of the Design Basis, but it is not considered a safety-related design requirement.

MEMBER STETKAR: Tim, is it part of the Safety Design Basis for any other certified design now?

MR. DRZEWIECKI: Not that I am aware of.

MEMBER STETKAR: Because I don't have the ability to follow through all of these particulars and back through the many years.

What exactly is the Commission position? I mean, you know, what was the magic of 420 degrees Fahrenheit in 36 hours, such that it was defined as a Safety Design Basis and now isn't?

MR. DRZEWIECKI: Okay. Well, to be clear --

MEMBER STETKAR: It isn't AP1000, but may still be, we're not sure, for any of the other designs.

MR. DRZEWIECKI: Yes. To be clear, it was never, okay, it was never identified in this SECY that this is part of the Safety Design Basis.

MEMBER STETKAR: Okay.

MR. DRZEWIECKI: When we pulled the thread

1 to find out what the history was of 420, it looked like
2 it appeared as part of the URD. And then, the staff
3 had approved that in their SER. And then, there is a
4 SECY paper. And then, the Commission voted on it and
5 said, yes, that's a fine position.
6 That was really in response to this Reg
7 Guide 1.139, I believe it is, in which that had stated
8 they should get down to a cold shutdown within 36 hours
9 of 200 degrees. Now, with a passive system, you can't
10 get there. All right? So, 420 seems to be something
11 that they thought they could make. And now that it is
12 designed and it is real, it is more challenging.
13 MEMBER STETKAR: Okay. Now we have got
14 this thing that is called a passive design. It will
15 just be called AP1000. We have got other things that
16 happen to be called U.S. APWR and U.S. EPR, which happen
17 to be called not passive. Is getting down to 420
18 degrees in 36 hours part of the safety requirements for
19 those designs? Because those are now active designs.
20 They still look like reactors to me, but I get lost on
21 the passive and active stuff.
22 MR. DRZEWIECKI: In the active designs, it
23 is important to get down to 350 degrees in order to
24 transition over to your RHR system.
25 MEMBER STETKAR: Yes. Okay. That's

1 what you just said, and that is important to me because
2 you just said, if I have an active design, it is
3 important to get to what you're calling cold shutdown.
4 But I heard Tim say, if I have a passive design, I can't
5 get what you're calling cold shutdown. So, that isn't
6 part of the safety basis. I don't get it.
7 MR. DRZEWIECKI: Well, okay.
8 MR. DONOGHUE: This is Joe Donoghue.
9 To clear up what I think Tim was getting
10 at, the 420 in 36 was related to the passive plant design
11 that the staff knew it was going to be reviewing.
12 Active designs still have a difficult shutdown.
13 CHAIRMAN RAY: Okay. Wait a minute.
14 This is now into the domain that I was wanting to address
15 after we had gotten through the technical review.
16 MEMBER STETKAR: Okay, I'll be quiet.
17 CHAIRMAN RAY: No, I'm not asking that. I
18 think we are basically through the technical review.
19 But it is, at least as I see it and as
20 implied by what you are saying, John, which I think is
21 correct, and it goes back to things that Dick has said
22 as well, the explanation you just gave, as far as I can
23 tell, is accurate but dumbfounding at the same time.
24 (Laughter.)
25 But it's not the first time. The one thing

1 that I guess I want to observe here is we got ourselves
2 into a position of not fully appreciating what we were
3 doing on the subject of containment overpressure. I
4 don't want to do that again here, based on what you just
5 recited to us about it not being part of the Safety
6 Design Basis.
7 I mean, we've been faced repeatedly with
8 the fact that this being a passive and, therefore, much
9 safer design, some of the requirements -- I will use
10 that term -- for it we can look at as being, as you I
11 think said, subject to revision when we find out, well,
12 we can't really make it, what we said we would do.
13 Okay.
14 I don't think anybody in the room disagrees
15 with the proposition that we are supposed to do what
16 we say. And so, we are going to revise things, so that
17 we say now something different.
18 But, in making that change, the ones that
19 you list up there in your presentation, it does raise
20 the question that we are grappling with now. And
21 again, I will go back to my comment about perhaps we
22 will end up in a generic situation.
23 And I think goes to the full Committee
24 presentation by the staff, by the way, coming up in
25 October. We have to understand this better than we do

1 because, when you start referencing the intent of a SECY
2 and the Commission's response to it, and so on, as
3 justifying a change like this, it gets over our head
4 pretty quickly. You guys deal with it perhaps a lot
5 more than we do, but we want to understand better what
6 exactly it is that we mean when we do what you just
7 described. It is no longer part of the Safety Design
8 Basis. It's part of the licensing basis, or whatever.
9 And we are not going to be able to do that
10 sitting here now. Now, I mean, you can respond to what
11 John and I have said and others as much as you would
12 like now, but I don't want to ask you to try and explain
13 something. I am trying to explain to you what we need
14 to understand better.
15 And if there is a lack of clarity somewhere
16 in this, much as we were talking about earlier in a
17 somewhat different aspect having to do with revision
18 of the DCD, we need to understand it. Maybe we need
19 to get the General Counsel in here or something. I
20 don't know.
21 But I don't think we can just go along
22 saying, well, somebody says that we don't have to make
23 it part of the Safety Design Basis anymore, so we will
24 just change it. Maybe I am exaggerating my concern
25 here, but I am trying to communicate to you that that

1 is just not going to work.

2 We need to have a better understanding, a

3 better explanation of what, in fact, is happening when

4 you certify a design to do a certain thing, and then,

5 later on, you say, well, we don't need to do that after

6 all; we can do something different, or we can describe

7 it in a different way. It doesn't really make any

8 difference at the end of the day. We are not there yet.

9 I would like to separate what I just said

10 from the ongoing need to get a licensing action taken

11 on the Applicants. But, on the other hand, I don't know

12 yet that we can separate these two things.

13 And so, I have sort of lectured you here

14 about something off the cuff, but we've got to have a

15 better, more clear understanding of what the heck it

16 is we are doing here.

17 MR. McKIRGAN: Mr. Chairman, thank you.

18 This is John McKirgan from the staff.

19 I appreciate that request. I think we

20 might benefit from some further reactions of the

21 Committee, so we bring back a more meaningful

22 presentation on that topic for the full Committee

23 meeting. I don't know that we will be able to do it

24 justice here.

25 CHAIRMAN RAY: I'm sure we can't.

1 MR. McKIRGAN: But we would like to
2 interact further, so that we better understand your
3 comment.
4 CHAIRMAN RAY: Yes. Now, again, I am
5 looking to the need for us to tell you what it is we
6 are going to do that is related to this licensing
7 action. We can't do that except as a full Committee,
8 and that means we have got to go over some of this
9 material with the full Committee in October or whenever
10 we can get it done.
11 But I am trying to describe now a separate
12 problem. I think you understand it well enough, which
13 is we need to also understand better what, in fact, it
14 is we are doing from a process standpoint. Okay?
15 This hasn't got to do with what the
16 assumption about a condensate return percentage or loss
17 percentage is or which computer codes we are using for
18 a particular analysis, or how many calculations we did
19 in this case. It has to do with the basic rules that
20 we have to live by here. Okay?
21 All right. Now, with that sermon behind
22 us, we should move on and close out. I have one more
23 thing, and then, my colleagues have other things they
24 would like to add.
25 But one other thing that I still find very

1 disconcerting is the idea that we are doing work on,
2 I'll use the word safety. At least I think compliance
3 with the licensing basis is a safety issue. And I am
4 not clear whether or not we are applying Appendix B to
5 that work. The COLA holder I don't think can intervene
6 with the Certified Design --
7 MR. BURKHART: This is Larry Burkhart.
8 I think that all of these activities apply
9 under Appendix B. Westinghouse and the COLA and the
10 Applicants, you know, they incorporate by reference the
11 DCD, which becomes part of their FSAR. So, they are
12 required to deal with any issues. So, all these
13 activities are covered under Appendix B and should be
14 in the corrective action program. And there are
15 reporting requirements in 52.6, Part 21, and some of
16 the reporting requirements for operating reactors
17 don't apply until the 103(g) finding and they wrote
18 fuel. But all of these activities are covered under
19 Appendix B.
20 CHAIRMAN RAY: Well, I would think so, and
21 I don't find your saying that at all surprising. But,
22 if you read Appendix B, it is not clear how it works
23 under Part 52.
24 Now maybe the Vendor Inspection Branch is
25 the one that provides oversight of its implementation.

1 Okay? But the Vendor Inspection Branch normally
2 inspects somebody that is also being inspected by a
3 licensee.
4 MR. BURKHART: Then, that should be the
5 same case.
6 CHAIRMAN RAY: Well, that is not what I
7 hear happening. It is not clear to me how it even could
8 happen in this case.
9 But, in any event, these are generic kinds
10 of issues that we need to understand better that I don't
11 think we want to get tangled up with any concerns or
12 issues we have with this particular licensing action
13 we are taking here now.
14 But, on the other hand, like I said in the
15 example of containment overpressure, we wound up
16 thinking we were doing one thing and wound up doing
17 something else, apparently. And we don't want to wind
18 up in that position here.
19 MR. BURKHART: Again, you have to say one
20 more thing about this particular change. It is that,
21 from my understanding, what we are intending to approve
22 is very consistent with what we have already approved
23 in previous design certifications, well, in the AP1000
24 design certification. So, we are not deviating much
25 from how the calculations were done to support getting

1 to 420 in 36 hours, which meets the intent of -- which
2 meets the SECY requirement.
3 CHAIRMAN RAY: Well, when you say, "which
4 meets the SECY," that is when you begin to get into a
5 murky area.
6 MR. BURKHART: Well, certainly the staff
7 should consider whether they should make that
8 regulation. Why is it just staying a SECY?
9 CHAIRMAN RAY: Yes.
10 MR. BURKHART: We should probably somehow
11 bring that into the regulations.
12 CHAIRMAN RAY: Well, again, we are now
13 deep into the weeds of process and important issues,
14 but I think we want to just voice them here. To the
15 extent we can separate them from what needs to be done
16 to responsibly handle the proceeding in front of us,
17 we should do that.
18 But this idea that it was a safety -- what
19 is the word, safety --
20 MR. DRZEWIECKI: Safety-related Design
21 Basis.
22 CHAIRMAN RAY: Well, it's safety --
23 MEMBER BLEY: It is right up here.
24 CHAIRMAN RAY: Yes, excuse me. Safety
25 Design Basis. It is still something we say we are going

1 to do in 19(e), but it is not something that is part
2 of the Safety Design Basis anymore. I mean, that is
3 something that is not easy for us to process, anyway.
4 It may be easier for you guys.
5 MR. BURKHART: You're right, it is the
6 licensing basis that is something that they need to
7 comply with.
8 MR. CORLETTI: This is Mike Corletti from
9 Westinghouse.
10 Maybe just to add in, I think the language
11 that is giving people pause is that this analysis that
12 shows safe shutdown after 420 was not a Chapter 15
13 accident analysis. And these words "Safety Design
14 Basis" often refer to Chapter 15 accident analysis.
15 And in our certification, it wasn't a
16 Chapter 15 accident analysis. It was an analysis. It
17 was a conservative analysis that was presented in
18 Chapter 19(e) as part of our licensing basis.
19 People, I think plus the analysis of the
20 staff, got a little bit hung up on those particular
21 words, which in other places means Chapter 15. And
22 this analysis was never part of our Chapter 15 accident
23 analysis.
24 So, I think a bit of this, they are really
25 not trying to change the intent. They are trying to

1 clean up, maybe clean up the language because these
2 words often refer to Chapter 15, and this analysis was
3 in Chapter 19. And the SECY did not require it to be
4 a Chapter 15 accident analysis, but it did require it
5 to be part of our licensing basis, which I believe it
6 was and still is.
7 CHAIRMAN RAY: Okay, but, again, we have
8 a responsibility to understand that independently of
9 you representing to us, and I'm afraid we are not there
10 yet.
11 MR. CORLETTI: Okay.
12 MR. BURKHART: And it took the staff a
13 while to get there, too.
14 CHAIRMAN RAY: Yes. So, I wish I could
15 cleanly cleave off the process issues and say, "Come
16 and give us a tutorial someday on how this is supposed
17 to be looked at." But all I can do now is say, when
18 we have the full Committee meeting -- and that's not
19 very long off -- I hope we can somehow make it possible
20 for the Committee to decide that whatever action is
21 deemed appropriate in the context of this licensing
22 action before us can be separated from -- in other
23 words, that we are not violating unintentionally some
24 requirement that we don't really quite appreciate.
25 Okay? Easier said than done, I know.

1 Okay, go ahead.

2 MEMBER BLEY: Well, excuse me.

3 CHAIRMAN RAY: Yes. I did this so I would

4 remember. I rambled. Now I have to remember what -- I

5 rambled on too much. I apologize.

6 (Laughter.)

7 MEMBER BLEY: When we have this meeting

8 separate from the AP1000, some of us would like to see

9 a focus on the idea of consistency and why we can't be

10 consistent, how we could be consistent.

11 Some of the problems, like the one Mr.

12 Stetkar brought up, are kind of tied up in our old

13 notions of safety-related and not safety-related.

14 This plant is non-safety-related

15 equipment, can get all the way to cold shutdown this

16 way. I think you can run with that.

17 I mean, why shouldn't there be kind of

18 functional requirements for all plants, rather than

19 something that seems a bit arbitrary as we go from plant

20 to plant, and gets us tied in knots occasionally like

21 this? So, for the next time.

22 CHAIRMAN RAY: Okay. This was unscripted

23 and too long-winded, but it is something that is

24 troubling us, or at least some of us, most of us, I

25 suppose. And we don't really feel comfortable just

1 saying, "Oh, well, yes, it's part of the Design Basis
2 in 1980, but it is no longer part of the Safety Design
3 Basis." We just don't understand that yet.
4 What more would you like to tell us?
5 MR. DRZEWIECKI: Well, I've just go a few
6 slides.
7 This is just our calculation compared with
8 the Westinghouse calculation that shows a good
9 agreement. This is RELAP versus the LOFTRAN
10 calculation.
11 MEMBER REMPE: Before you leave that
12 slide --
13 MR. DRZEWIECKI: Yes?
14 MEMBER REMPE: -- Professor Corradini is
15 really wondering what caused the bump of four hours in
16 your analysis.
17 MR. DRZEWIECKI: Four?
18 MEMBER REMPE: Four hours. You will see
19 all three of your curves kind of increase around four
20 hours.
21 MR. DRZEWIECKI: Oh, yes, okay.
22 CHAIRMAN RAY: Yes, he mentioned that.
23 MR. DRZEWIECKI: Yes. Okay. So, there
24 is some uncovery of the PRHR heat exchanger in this
25 analysis. So, when you begin to uncover some tubes,

1 when you see there is a peak, there is an inflection
2 certainly --
3 MEMBER REMPE: It is an increase, yes.
4 MR. DRZEWIECKI: Yes.
5 MEMBER REMPE: Okay. Thank you.
6 MR. DRZEWIECKI: No problem.
7 Okay. So, then, our conclusions. So,
8 our conclusions on this review were that the design
9 changes and the FSAR changes are acceptable. The
10 Chapter 15 analyses are not affected. However, there
11 is a new section that was added to Section 6.3 that
12 describes a 72-hour analysis that bounds all Chapter
13 15 analyses that take credit for the PRHR heat
14 exchanger.
15 That analysis was supported by staff
16 confirmatory calculations. We achieved 420 degrees in
17 36 hours. It is met using the analysis approach, those
18 previously approved for Chapter 19(e). This is part
19 of the Design Basis, but it is not safety-related.
20 This is also supported by staff confirmatory
21 calculations.
22 CHAIRMAN RAY: Part of the Design Basis,
23 but it is not safety-related. I understand the English
24 words, but I'm trying to understand what the heck it
25 means.

(Laughter.)

MEMBER STETKAR: Written as part of the Design Basis; it is not safety-related.

CHAIRMAN RAY: Oh, you're meaning safety-related in the old sense?

MEMBER STETKAR: Well, that is part of -- yes. I think that is what this means.

CHAIRMAN RAY: Well, yes, but --

MR. BURKHART: The key message to take is that we are doing nothing inconsistent from what we did before, how the calculation was done. We may be fooling around with some words, but how the calculations were done is the same; it is consistent with --

MEMBER STETKAR: On the other hand, my point is "fooling around with some words" has real implications on people who design, build, and license and operate plants. And "fooling around with words" is not what the regulator ought to do. We ought to understand what those words mean and apply them, as Dennis said, apply them consistently across all of the designs.

MR. DONOGHUE: Joe Donoghue again.

The staff recognizes this question to be part of this review. We didn't come to an easy

1 conclusion, Mr. Chairman. And you thought it was easy,
2 but it wasn't easy for us to do that.
3 I think what you heard was in Chapter 15
4 the safety concern or the safety focus for the system
5 is don't go solid. The 420/36 would certainly
6 guarantee that.
7 And in the course of this review, staff and
8 Westinghouse came to the conclusion that we weren't
9 getting close to challenging the system, the safety
10 function of the system. And in Chapter 19, that
11 analysis which was always there, which is affected by
12 the design change, was reviewed thoroughly. And we
13 think that in that case they still meet the 420 in 36.
14 Okay?
15 CHAIRMAN RAY: Okay, but no.
16 (Laughter.)
17 MR. DONOGHUE: No?
18 CHAIRMAN RAY: Look, I spent my life
19 knowing the difference between safety-related and not
20 safety-related.
21 MR. DONOGHUE: Okay.
22 CHAIRMAN RAY: Trust me, I do know. But
23 I apply it to hardware, to structures, systems, and
24 components. I don't apply it to a performance
25 requirement.

1 So, let me ask this question: is what you
2 need to do in order to ensure 420 degrees in 36 hours
3 is met going to be part of the tech specs? Or I
4 shouldn't say that that way because that is already,
5 I guess, in the COLA.
6 But I would need to know whether meeting
7 that requirement was something that was subject to tech
8 spec non-compliance if I failed to it, tech-spec-level
9 enforcement action, for example. Is it or isn't it?
10 MR. BURKHART: Actually, it helps define
11 the modes on when some aspects will be critical.
12 CHAIRMAN RAY: You know, I mean, if I treat
13 a safety-related piece of equipment as
14 non-safety-related, I can be cited for failure to
15 comply with my license.
16 I am just sort of dumbfounded by the idea
17 that there are performance objectives now that are
18 safety-related or not safety-related, as opposed to
19 hardware, structures, systems, and components. That
20 I'm used to.
21 Now, when we decide we are going to change
22 something that we have called safety-related and say,
23 no, it's not safety-related anymore because the SECY
24 doesn't require it, or something of that kind, I am just
25 really lost. And I have been in this business a long

1 time. But I will confess Part 52 is a learning
2 experience. So, I'm ready to learn. Okay?
3 MR. BURKHART: Okay.
4 CHAIRMAN RAY: All right. Now, with
5 that, does that conclude the staff presentation?
6 MR. DRZEWIECKI: Yes.
7 CHAIRMAN RAY: All right. Because what
8 we are going to do is, with you still here, we are going
9 to invite public comment again, just in case -- because
10 it comes at the end of your presentation, basically.
11 I mean, you're not going to run off, I'm sure.
12 So, let's open the telephone lines. And
13 while that is being done, I'll ask, is there anyone here
14 in the room who wishes to make a comment at this time?
15 (No response.)
16 Okay. Seeing none, we'll ask a similar
17 question to the phone line.
18 Mike, are you there?
19 MEMBER CORRADINI: I am here, unless you
20 can't hear me.
21 CHAIRMAN RAY: I can hear you, and I'll
22 start with you, and then, ask if there is anyone else.
23 Do you have anything you would like to offer after this
24 terribly confusing discussion we just had?
25 MEMBER STETKAR: Actually, he can ask

1 questions because --

2 CHAIRMAN RAY: Yes, he can. He can ask

3 questions as well as make comments.

4 MEMBER CORRADINI: No, I passed on my

5 questions to Sanjoy and to Joy. So, I'm fine.

6 CHAIRMAN RAY: All right. Do you want to

7 weigh-in on this religious discussion we were just

8 having?

9 MEMBER CORRADINI: No, I'm agnostic.

10 I'll let you Catholics and Protestants there --

11 (Laughter.)

12 CHAIRMAN RAY: Okay. Fair enough.

13 Any other person on the telephone line who

14 would like to make a comment?

15 (No response.)

16 Hearing none, we will, then -- I will poll

17 the members here at the table. We will close the line

18 and consider that. Are you going to leave it open?

19 All right. I don't care.

20 Oh, all right. Let's go around the table

21 here, as we normally do at this juncture, and see if

22 there are things that any of the members still with us

23 wish to add to the record, starting with you, Pete.

24 MEMBER RICCARDELLA: I don't have any

25 comments.

1 CHAIRMAN RAY: Dick?

2 MEMBER SKILLMAN: I do. Harold, you have
3 communicated to my satisfaction the anxiety that we
4 feel about the process part of this. So, I thank you
5 for that, and it's on the record. And I believe it
6 bears real scrutiny.

7 I want to make one, maybe two other
8 comments. First of all, the authors of the design cert
9 were not and are not clairvoyant. And so, there is room
10 for the design cert to be amended to be correct. So,
11 there's no harm, no foul, as long as the design cert
12 author steps forward and says, "We understand the
13 deficiency and here's how we're going to fix it."

14 I would make just one final comment. When
15 one reads the regulatory evaluation -- my prep for this
16 meeting was pouring over the RAIs and doing analysis
17 on my own. But here's a wrinkle that I think the staff
18 ought to look at very carefully.

19 In the regulatory evaluation, the same
20 comments from 50.59 are asked regarding significant
21 hazard consideration. "Does the proposed change
22 involve a significant increase in the probability?",
23 and the other questions. And in each case, it is
24 convenient to answer no on a 50.52 item.

25 If the question was changed in this case

1 to, if the change had not been made to the downspouts,
2 to the gutters -- there were modifications to WGOTHIC,
3 which is why Sanjoy asked the question -- if those
4 changes had not been made, how would those significant
5 hazard consideration questions have been answered?
6 And I would suggest to you that they may have been
7 answered quite differently than they show up in the
8 record. The text would be, "If this change had not been
9 made, would there have been a different outcome?"
10 So, I am going to go back to my Chairman,
11 but those are my comments.
12 MR. BURKHART: I understand the question.
13 It's just license amendments are done in accordance
14 with 50.91, and the hazard consideration doesn't ask
15 that question in that way. I understand what you are
16 saying. And actually, the staff has gone there when
17 we were going through the significance of this issue
18 and totally agree.
19 Remember, certification is a rulemaking,
20 a good-faith effort on everybody's side to do that.
21 So, I can tell you that Westinghouse -- and they can
22 speak for themselves, too -- but I know that they are
23 gathering things beyond that amendment. It may be not
24 until the renewal.
25 But what I want to say is that, for those

1 things that are adequate protection compliance issues,
2 our focus is on the facilities that are licensed or
3 getting licensed. Our first priority is not
4 necessarily amending the design cert. It is making
5 sure that those who are licensed or soon to be licensed
6 adequately address the issue.
7 But I totally understand and agree with
8 what you're saying.
9 MEMBER SKILLMAN: Okay. Thank you.
10 CHAIRMAN RAY: Steve?
11 MEMBER SCHULTZ: I appreciate the
12 presentations today.
13 And I share your concern, Harold. I think
14 we have a good understanding based on the
15 presentations, all parties today, of the technical
16 evaluations that have been done and of the design
17 changes and how those design changes and the evaluation
18 has resulted in improved performance. But the
19 licensing portion of this is still to me not fully
20 clear, and I do believe it needs to be. So, I am looking
21 forward to more understanding between now and the time
22 we meet with the full Committee.
23 CHAIRMAN RAY: Thank you.
24 Dennis?
25 MEMBER BLEY: Nothing more, but the words.

1 I didn't say anything about the words. But I'm not sure
2 anybody can point me to a place that says here's the
3 Safety Design Basis for a plant. I know I can look at
4 the design cert and see the Design Basis. But the three
5 phrases, Design Basis, licensing basis, and Safety
6 Design Basis as an ensemble, I am not sure are really
7 defined. I wouldn't mind being shown I'm wrong.
8 CHAIRMAN RAY: Yes. As I have said
9 repeatedly, I have a similar feeling.
10 John?
11 MEMBER STETKAR: I don't have anything
12 more.
13 CHAIRMAN RAY: Ron?
14 MEMBER BALLINGER: Nothing more.
15 CHAIRMAN RAY: Charlie?
16 MEMBER BROWN: Nothing.
17 CHAIRMAN RAY: Joy?
18 MEMBER REMPE: Nothing.
19 CHAIRMAN RAY: Okay. Well, we didn't
20 explore something that was mentioned, but, again, I
21 think it wouldn't be terribly productive right now,
22 since I think we heard that a Part 21 report analysis
23 was done, and it was deemed not to be required. That
24 is what I was reading 10 CFR about yesterday, John.
25 I have my own reading of what Part 21 says.

1 I have had some experience with it, too. Dick has had
2 his experience.
3 It is very murky to me how we are supposed
4 to function in this world with regard to, like I say,
5 Part 21 or oversight of the implementation of Appendix
6 B by a design certification holder, et cetera. And I
7 think we have got to find some way to learn about this,
8 but we all don't want to get off into that sort of an
9 exercise and cause it to hold up the action that is
10 pending here with regard to the Levy and Vogtle, and
11 so on.
12 So, my best guess is that we will try and
13 preserve the need to better understand the process, but
14 try to focus ourselves just on what is being proposed
15 here. Maybe we will say we reserve judgment on this
16 business about, as you summarize up there, about it is
17 part of the Design Basis, but not safety-related.
18 Still, it puzzles me.
19 And we need to learn more. But,
20 nevertheless, we have looked at what specifically is
21 being done in this instance and have whatever
22 conclusions the full Committee has when they happen
23 about it.
24 At least as the Chairman of this
25 Subcommittee, I'll strive to do that. I don't know if

1 I can do it successfully or not, but I'll give it a try.
2 So, when you come back at the full
3 Committee -- and I am going to say this to Westinghouse
4 and Duke as well -- bear in mind that we're not going
5 to be easily accepting of what I'll call simplistic
6 process answers. But, on the other hand, we are going
7 to try to focus on the technical issues at hand and
8 separate out the process questions for discussion
9 elsewhere.
10 So, what I'm saying is don't tell us, "Oh,
11 don't worry about that because we've got this
12 interpretation of the rules that say you don't need to
13 worry about it." Let's just stick with the work that
14 you have done, which all of us have looked at, and as
15 best I can tell, meet the needs of moving ahead.
16 And then, we will try to carve out the
17 issues that we have been talking about for the last 15
18 minutes and deal with them separately.
19 Anything else that anyone wishes to say?
20 (No response.)
21 If not, we'll call the meeting adjourned.
22 (Whereupon, at 5:08 p.m., the meeting was
23 adjourned.)

Issue History

December 2011 – UK GDA questions original condensate return assumption (constant 90%)

December 2012 – Applicant verbally advised NRC of issue and changes under ISG-011.

April 2013 – Formal submittal (Levy - departure and exemption request): design change adds downspouts to polar crane and stiffener, improves gutter design to increase condensate return rate + revised analysis incorporating changes.

May 2013 – NRC staff audits condensate flow over gutter and attachment plates test plan. Staff terminated the audit for lack of calculation reports.

Issue History

July/October 2013 – Applicant advised NRC of delay in submittal, citing third-party review and need to incorporate further modifications made to design into calculations.

January 2014 – Levy submits revision of formal departure and exemption request, makes supporting calculations available for NRC audit. The staff began a second audit, which is open.

February 2014 – Staff issues first round of RAIs concerning supporting analysis under audit.

April 2014 – Vogtle submits LAR similar to Levy departure request.

LEVY
ACRS UPDATE
09-17-14

"Changes to Passive Core Cooling System Condensate Return"

AGENDA

Open Session

- Overview of long-term PRHR HX operation
- AP1000 safe shutdown systems / operation
- PRHR Reevaluation and Licensing Impacts
- Design changes to improve containment condensate return to IRWST

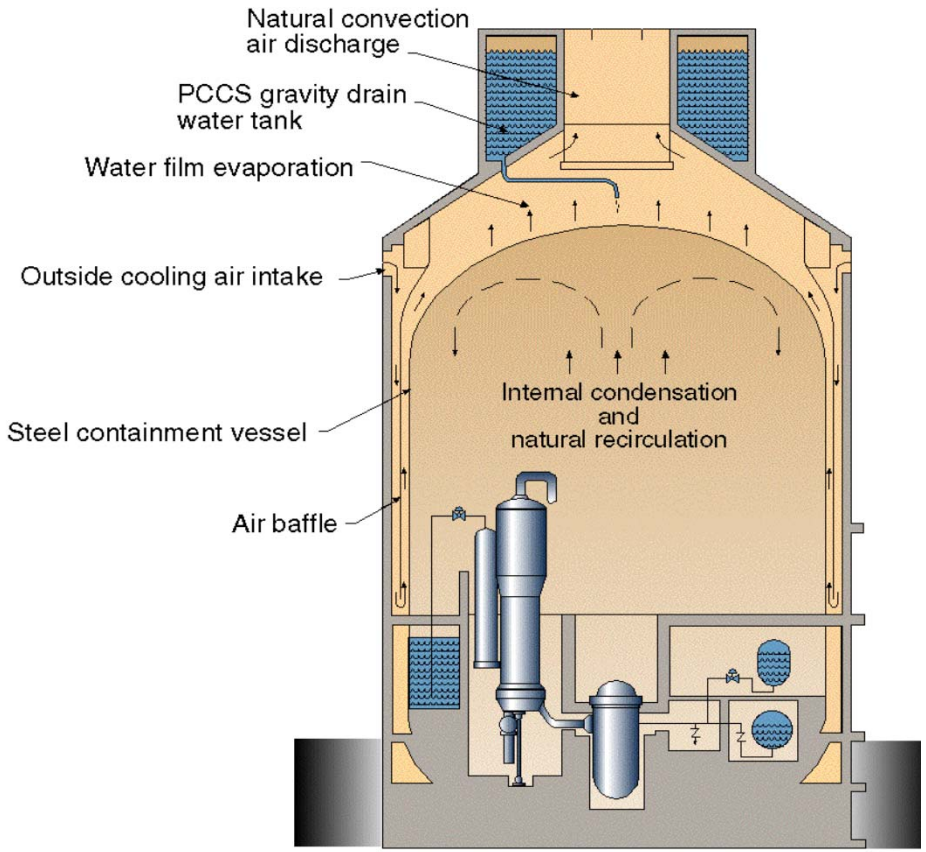
Closed Session

- Analyses performed to support long-term PXS operation:
  - What each calculation does and methodologies used
  - Discussion of results
- WEC condensate return testing

APC_APG_000175 Attachment 1

PXS Safety Design Description: non-LOCA Operation

- During non-LOCA events IRWST water absorbs heat from PRHR HX
  - Takes 2-4 hours to heat up to saturation, begins to boil
  - Steam is discharged to Containment through vents in IRWST roof
- Steam condenses on Containment surfaces
- Condensate flows down Containment walls to the condensate return gutter and returns to IRWST



AP1000 Safe Shutdown

- In non-loss of coolant accident events, the PRHR HX will bring the plant to safe shutdown and maintain this condition
  - AP1000 safe shutdown defined as reactor coolant system (RCS) temperature ≤ 420°F in 36 hr
  - This temperature does not represent a plant safety limit, if the RCS temperature is somewhat higher it would have no consequences
- In loss of coolant accidents, passive safety injection and ADS will achieve and maintain safe shutdown for an unlimited time
  - These features also provide diverse safety-related backup to PRHR HX operation

Technical Issue: Identification

- During detailed design implementation Westinghouse identified the need to revisit the technical basis for the condensate return rate
  - Condensate return rate varies with time
  - Additional mechanisms for condensate loss were identified or better quantified
- Westinghouse initiated a study to fully characterize and quantify condensate return rate
  - Apparatus testing, design improvements identified
  - Analysis of thermodynamic behavior during steaming and condensation undertaken

Technical Issue: Quantification

- Westinghouse test / analysis results:
  - Condensate losses due to physical features were quantified by test
  - Condensate return rate was lower than assumed in the DCD Chapter 19E shutdown temperature evaluation using the PRHR HX
  - Plant would still be safe, however the Chapter 19E shutdown temperature evaluation would not being bounding
- Decision made to improve gutter system condensate return
  - Use polar crane girder (PCG) and stiffener as intermediate level gutters and add downspouts to transfer directly to IRWST
  - Modify operating deck gutter to reduce losses
- Allows plant to meet safe shutdown temperature / time (Chapter 19E)

Results of PRHR Reevaluation

- FSAR Chapter 15 Design Basis Accident (DBA) Analysis
  - Demonstrates PRHR Closed Loop cooling achieves safe, stable condition for 72 hours
- Safe Shutdown (SSD) Analysis
  - Achieve SSD conditions (<420F) in less than 36 hours
  - Maintain SSD for more than 14 days
  - No change in evaluation methods from certified design

COLA Impacts

- Part 2 - FSAR
  - Chapter 1, Table 1.8-201; Section 3.2; Section 3.8; Section 5.4; Section 6.3; Section 7.4; Section 9.5, Table 9.5-201; Section 14.3, Table 14.3-202; Chapter 15; Chapter 19
- Part 4 – Technical Specification
  - Change to Bases Only
- Part 7 – Departures and Exemption Requests
  - Departures 3.2-1 and 6.3-1 and Exemption
- Part 10 – ITAAC
  - Appendix B – Tier 1 Departures

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AP1000 Plant Condensate Return to IRWST

Terry Schulz
Consulting Engineer, Westinghouse Electric Co.

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IRWST Steam Condensate Return Conclusions

- **AP1000** plant changes will be made to increase condensate return to IRWST
  - Downspouts from Polar Crane Girder and Stiffener to IRWST
  - Gutter location and design
  - Elimination of many H2 sensor cable support plates in dome
- Testing and analysis confirm that revised design meets safe shutdown cooldown and duration criteria / objectives
- Testing, analysis and design changes have undergone staff audit / review

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Agenda

- Overview of long-term PRHR HX operation
  - Includes summary of issue, plant changes, licensing actions
- **AP1000** plant safe shutdown systems / operation
- Design changes to improve containment condensate return to IRWST
- Analyses performed to support long-term PXS operation:
  - Each calculations purpose, methodology, and results
- WEC condensate return testing

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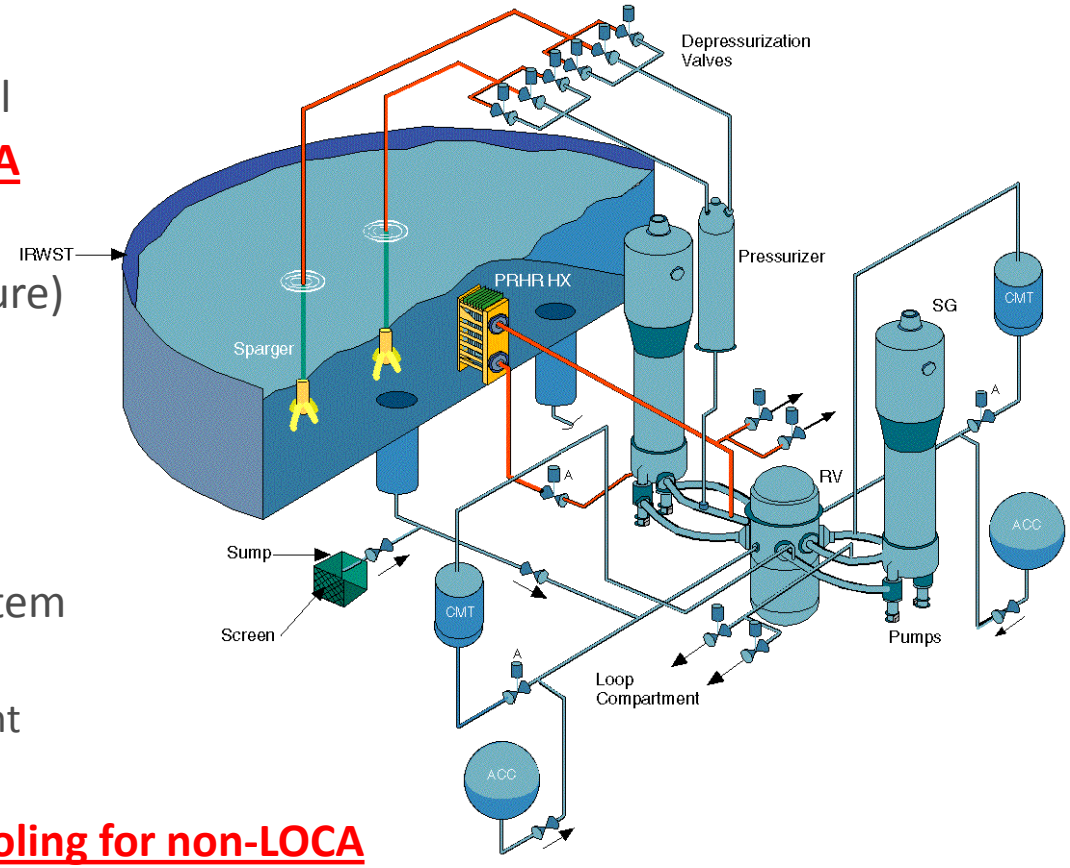
PXS Decay Heat Removal

- PRHR HX
  - Natural circ. decay heat removal
  - **Long-term cooling for non-LOCA**
- Passive safety injection
  - Core makeup tanks (High Pressure)
  - Accumulators (Intermediate Pressure)
  - IRWST Injection (Low Pressure)
  - Containment Recirculation
  - Automatic depressurization system
    - Stages 1-3 release to IRWST
    - Stage 4 releases to containment
  - Long-term cooling for LOCA
    - **Also backups long-term cooling for non-LOCA**



If PRHR cooling decreased below decay heat, backup core cooling would be provided by passive feed/bleed (safety related)

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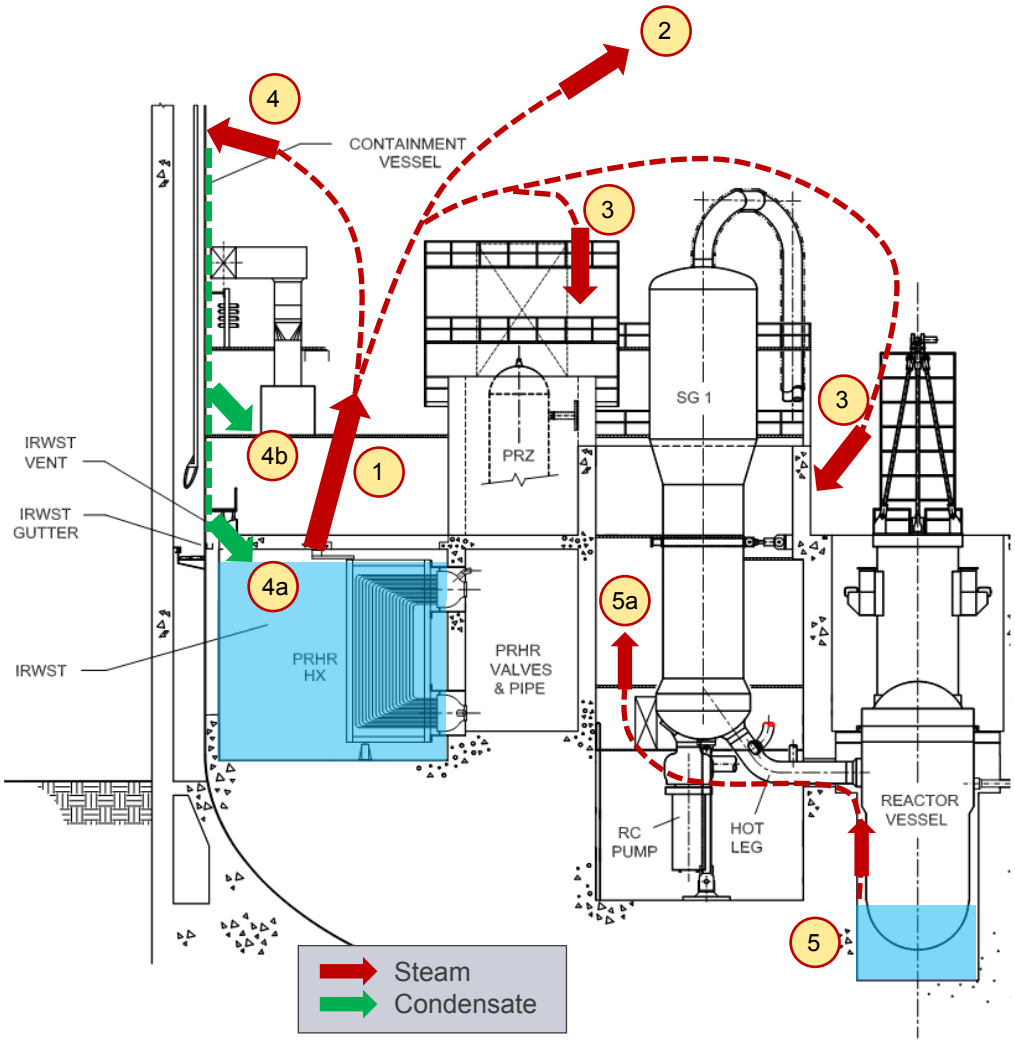
Where Does IRWST Steam Go?

1. Steam leaving IRWST
2. Pressurizes containment
   a. Lost from IRWST
3. Condenses on walls, floors, structures
   a. Lost from IRWST
4. Condenses on CV
   a. Most collected and returned to IRWST
   b. Some splashes / spills off
5. Losses from IRWST collect under RV, contact hot RV
   a. Steam rises up into cont.



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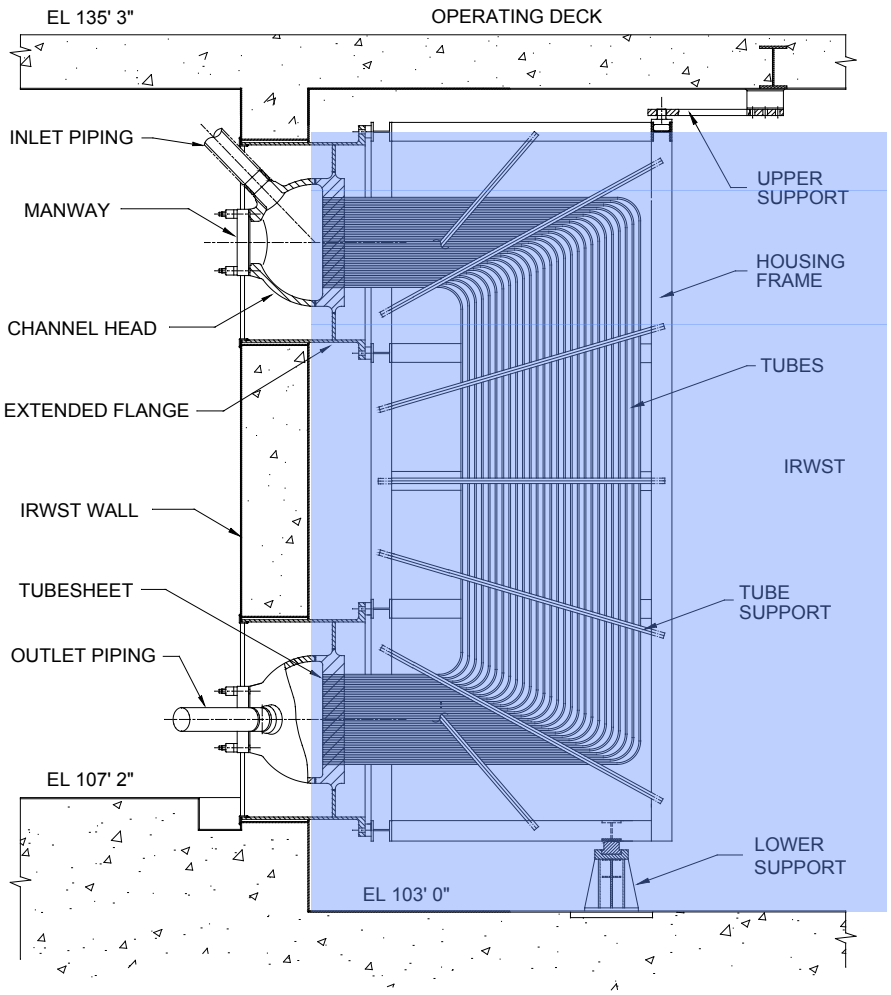
Passive Decay Heat Removal

- DCD/FSAR Safety Analysis assumed constant fraction of steam to atmosphere returned to IRWST
  - Actual losses from the IRWST are larger and vary with time
- Multiple mechanisms exist for condensate losses
- Condensate losses will cause IRWST level to decrease
- In long term, PRHR HX tubes uncover, performance is reduced
  - Safe shutdown temperature can be maintained even with substantial tube uncovery



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AP1000 Plant Safe Shutdown Criteria

- Safe Shutdown temperature (420°F) is a licensing commitment
- This temperature was selected to achieve a safe stable, low-energy condition in the RCS within the PRHR HX capability
  - RCS pressure will decrease to small fraction of design pressure (2500 psig)
  - 420°F Tavg >> 440F Th >> RCS pres >> ~337 psid (13.6% of RCS design)
    - Assumes RCS drops to saturated pressure, reasonable since no Pzr heaters

Tavg (F)	Th (F)	Sat. Pres. (psia)	Delta Pres. (psid)*	Percent RCS
420	440	382	337	13.6%
430	450	423	378	15.2%
460	480	566	521	21.0%
490	510	744	700	28.2%

* Reduced by 30 psig containment pressure

If RCS temperature exceeds 420°F somewhat, Safe Shutdown would not be challenged

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AP1000 Plant Safe Shutdown Criteria

- DCD / FSARs state PRHR HX can maintain safe shutdown conditions for non-LOCA accidents “indefinitely”
- Have adopted quantitative duration as internal design objective
  - 14 days was selected based on that time being long enough to essentially eliminate the need to switch to passive feed/bleed cooling except for very unlikely / extreme hazard events
    - For most events AC power / DiD systems will be recovered in < 3 days
    - Only challenge would be extreme hazard events (seismic, tornado) that might damage plant features and prevent DiD recovery in 14 days
  - 14 days is good objective; not a safety requirement because …
    - Larger than expected RCS leakage can limit duration
    - Open-loop core cooling using ADS and passive injection is always available as a safety backup to closed-loop PRHR HX cooling

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Agenda

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Design Changes To Improve Condensate Return to IRWST After Station Blackout

- Changes developed to increase condensate return to the IRWST
  - Use polar crane girder and internal stiffener as intermediate gutters and add down spouts to drain condensate to IRWST
    - Minimizes losses associated with flow over obstacles
  - Optimize IRWST gutter
    - Extended to collect above upper equipment hatch and personnel airlock
  - Change routing of cables to hydrogen sensors
    - Reduces quantity of support plates (obstacles) attached to the containment dome

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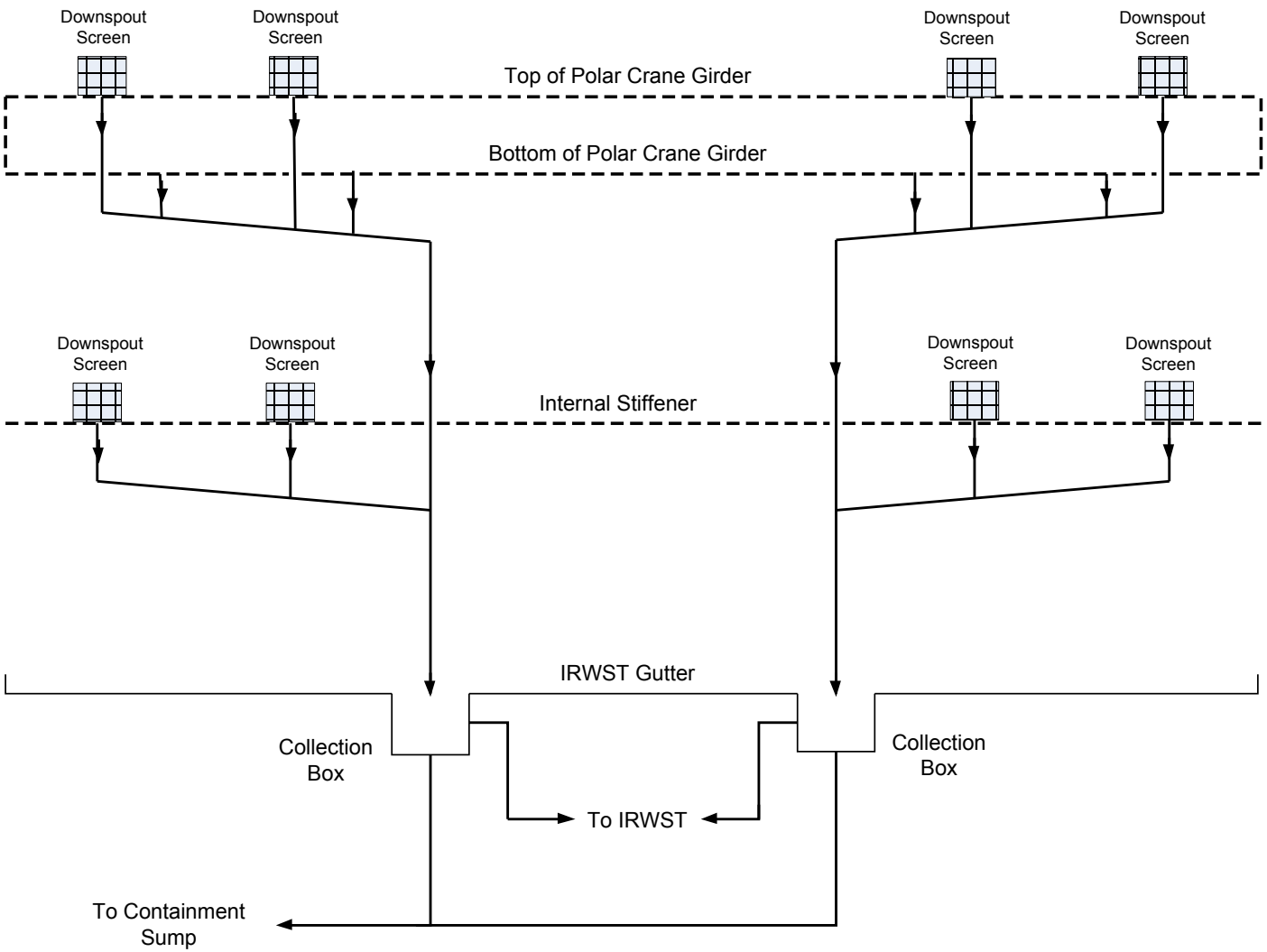
Design Changes To Improve Condensate Return to IRWST After Station Blackout

- Down spouts added to internal stiffener and polar crane girder to direct condensate to IRWST
- Drain holes plugged
- Rough screens over downspout entrances prevent potential plugging of downspouts



U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Presentation to the ACRS Subcommittee

Staff Review of Changes to AP1000 Passive Core Cooling System Condensate Return Section 6.3

September 17, 2014

Outline

- Staff Review Team
- Background (Levy COL)
- Licensing Impact
- Regulations/Guidance
- Review Approach
- Review History
- Technical Issues Encountered – Areas of Staff Focus
- Staff Findings
- Conclusion

Staff Review Team

- Boyce Travis
  - Containment and Ventilation (presenter)
- Tim Drzewiecki
  - Reactor Systems (presenter)
- Yiu Law
  - Mechanical Engineering
- Derek Scully
  - Balance of Plant and Technical Specifications
- Don Habib
  - Project Management

Background – Levy COL

- Levy COL staff interaction with ACRS 2011
  - Letter of conclusion and recommendations

- 2012-2014 staff review of additional applicant submittals
  - Key chapters of advanced safety evaluation issued or re-issued

Topic	Advanced SE	Interaction
Condensate return design change	Section 6.3	September 2014
Fukushima recommendations	Chapter 20	January 2013 (seismic)
Bulletin 2012-01	Chapter 8	Not planned
Emergency preparedness enhancements	Chapter 13	Not planned

Licensing Impact

- Design change includes exemption request and two departures from AP1000 DCD Revision 19

- Exemption Request – Change to certified Tier 1 information
  - Table 2.2.3-1
    - Modified list of components in passive core cooling system design description (added downspout screens)
  - Table 2.2.3-2
    - Modified list of piping in passive core cooling system design description (added downspout drain lines)
  - Modified Tier 1 tables are cited in ITAAC for passive core cooling system

Licensing Impact
(continued)

- Departure 3.2-1
  - Modifications to the Polar Crane Girder (PCG), Internal Stiffener, and Passive Core Cooling System (PXS) gutters

- Departure 6.3-1
  - Changes DCD PRHR-HX capability to maintain safe shutdown for non-LOCA events from “indefinitely” to 14 days (72-hour safety-related mission time)

- Levy FSAR/DCD Chapter and Section Changes
  - 3.2, 3.8, 5.4, 6.3, 7.4, 9.5, 14.3, 15, 15.2.6, 19, 19E and technical specification bases (Chapter 16)

Regulations/Guidance Informing the Review

- GDC 34 - Residual heat removal
- GDC 44 - Cooling water
- EPRI Utility Requirements Document for passive LWRs and associated SE
- SECY-94-084 ("Policy and Technical Issues Associated with the Regulatory Treatment of Non-safety Systems in Passive Plant Designs")

Review History

- AP600
  - Capable of 72 hours of decay heat removal for non-LOCA transient even with no condensate return (IRWST Volume = 70,000 ft^3)
  - No explicit modeling of SBO/non-LOCA tests using only PRHR-HX and condensate return, only WGOTHIC analysis and ADS tests

- AP1000
  - For non-LOCA transients, PRHR HX "removes core decay heat for an unlimited amount of time…in closed-loop mode" (IRWST Volume = 73,100 ft^3)
  - PRHR-HX area, flow rate increased to compensate for increase in power
  - Staff found AP600 testing applicable to AP1000 as part of the DCD review

Review Approach
Containment Response

- Evaluate impact on peak pressure analyses
- Evaluate impact on containment floodup level
- Evaluate applicability of test data
- Evaluate inputs to reactor coolant system analyses
  - Condensate return rate to IRWST
  - Containment pressure

Review Approach
Passive Core Cooling System

- Evaluate impact to PXS safety functions
  - **Emergency decay heat removal**
  - Emergency reactor makeup/boration
  - Safety injection
  - Containment pH control
- Evaluate impact on safe shutdown
- Evaluate impact on Chapter 15 analyses

Summary of Applicant's Calculation Approach

- ~20 calculations related to the design change supporting four calculations referenced in the submittal:
- **Calc. (1)**: WGOTHIC containment response
  - Models containment + PCS; No RCS
  - Forcing function incorporates wall losses from (2)
- **Calc. (2)**: Condensate return from shell
  - Uses test data + conditions from (1) to calc. losses over shell attachments
- **Calc. (3)**: PRHR HX sizing / performance calculation
  - Combines results from (1) and (2) to provide transient condensate return rate to IRWST for (4)
  - Basis for applicant justification of long-term behavior (>72 hours) of the PRHR HX
- **Calc. (4)**: LOFTRAN
  - Calculates 36 hour system response using inputs from (1) and (3)
  - Demonstrate T_{ave} < 420 ℉ in 36 hours (using BE assumptions)
  - Provides bounding values (DB + assumptions) to Calc. 1 for decay heat to IRWST, temperature of reactor vessel

Review Focus – Containment Analysis

- Holdup
  - Determination of total holdup
  - Film thickness
    - Staff questioned applicability of approximation used in submittal (RAI 7439, 06.03-3)
    - Applicant re-evaluated film thickness, performed sensitivity study for more film holdup; negligible effect on the performance of the PRHR-HX during the first 72 hours
- Determination of condensate return rate
  - Losses over wall attachments
    - Staff asked applicant to justify correlation for wall losses from testing (RAI 7439, 06.03-5) - Applicant tested losses over wall attachments at non-prototypic temperatures, extrapolated
    - Applicant performed sensitivity studies for increased wall losses, indicated almost no impact on first 72 hours and small reduction in long-term (beyond 72-hour) mission time

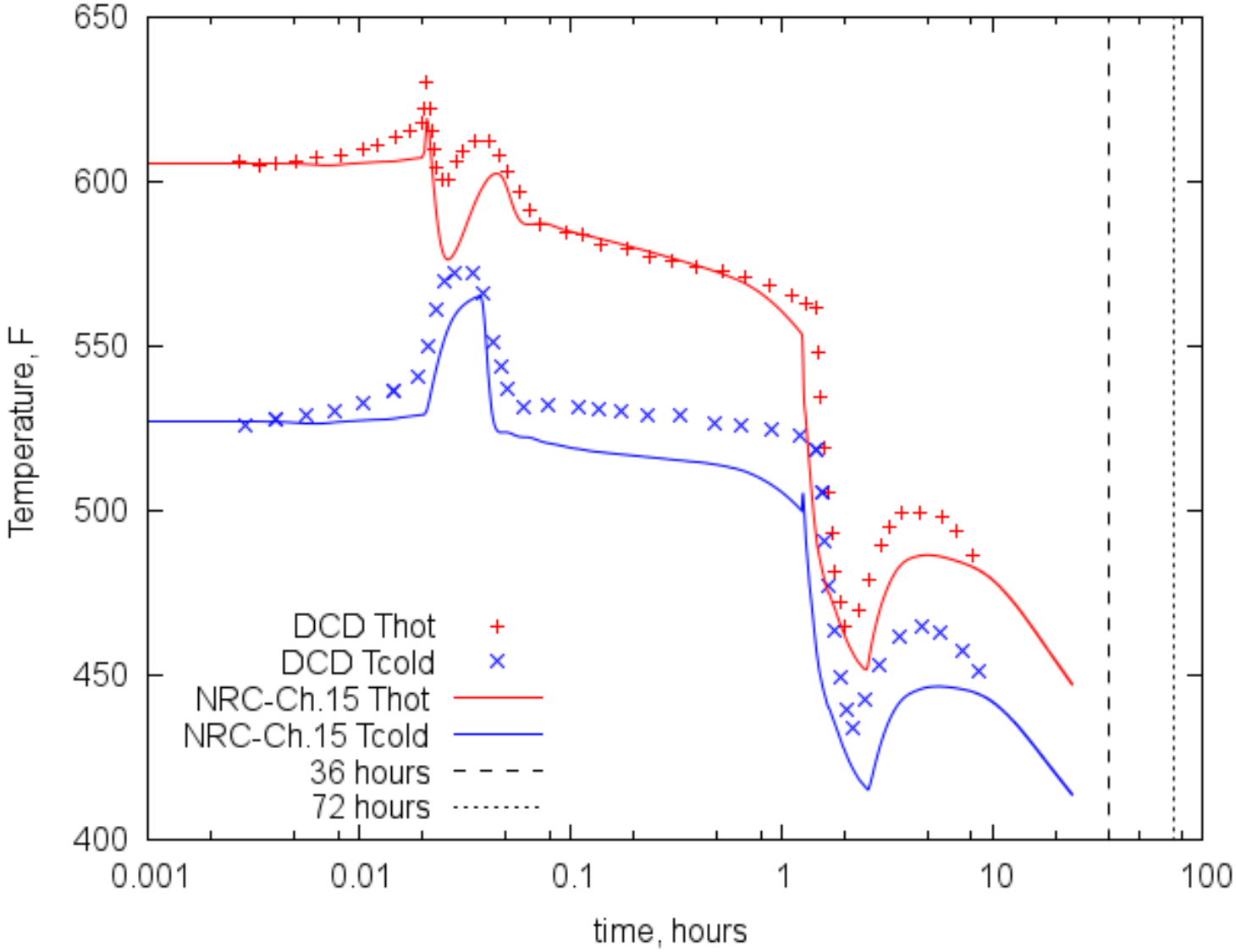
Staff Findings – Containment Impact

- Containment peak pressure unchanged
- Containment floodup level following ADS actuation or LOCA for containment recirculation not adversely affected
- Potential lowered IRWST level following PRHR-HX actuation does not challenge ADS 1/2/3 actuation
- The PXS downspout screens are AP1000 safety class C, seismic Category I components and will meet the QA requirement of 10 CFR Part 50, Appendix B. Existing ITAAC design commitments also apply.
- The PXS downspout piping are AP1000 safety class C, seismic Category I piping, designed to ASME Code Section III and will meet the QA requirement of 10 CFR Part 50, Appendix B. Existing ITAAC design commitments also apply.

Review Focus – PXS Safety Design Basis

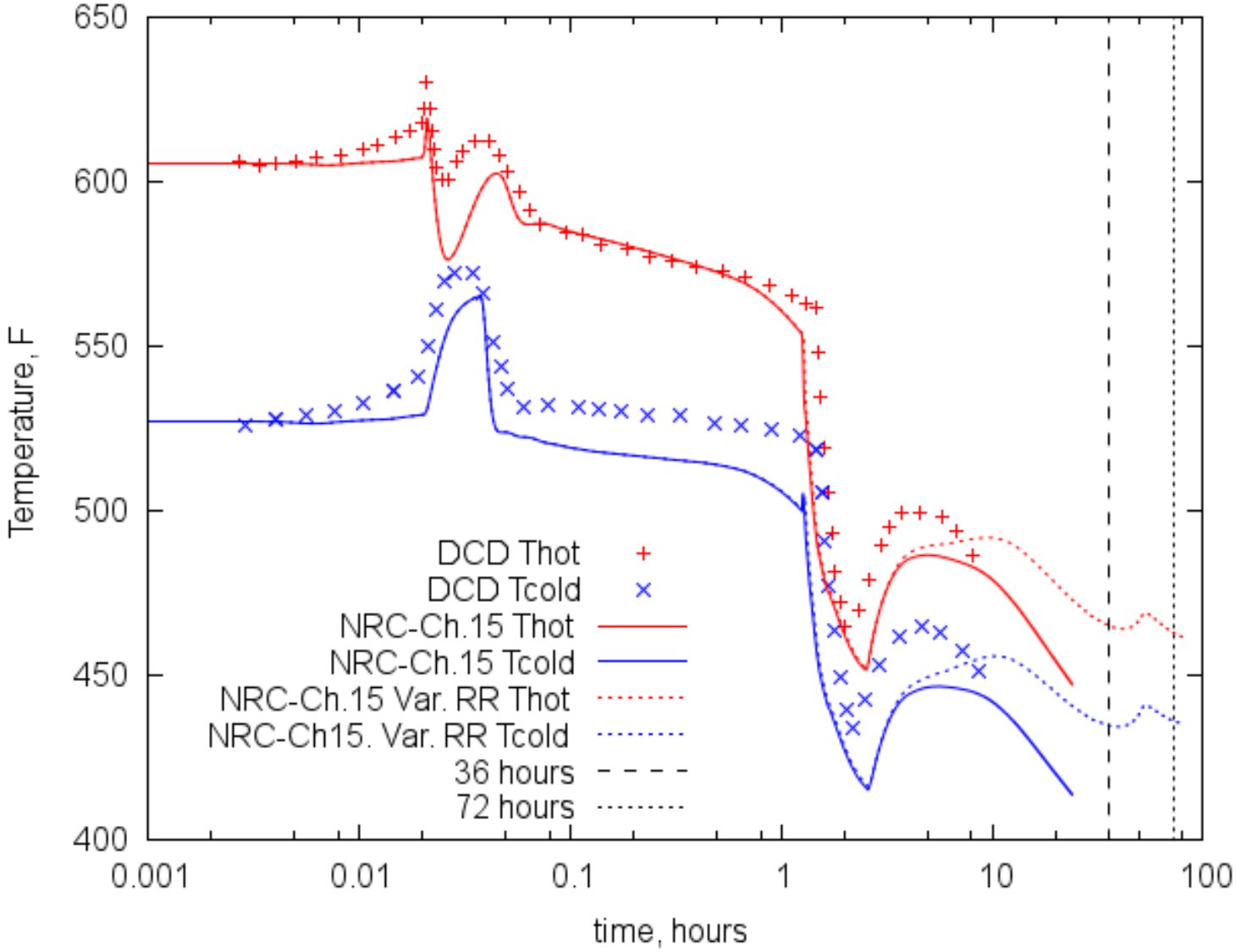
- Emergency Decay Heat Removal
  - From “indefinite” to “72-hour operational requirement” for PRHR-HX
  - Limiting Chapter 15 event determined to be Loss of AC Power to Plant Auxiliaries (LOAC)
    - Supported by sensitivity studies performed by applicant (RAI 7440, 15.02.06-2)
    - Confirmed by sensitivity studies performed by NRC staff
  - 72-hour calculation (LOFTRAN)
    - PRHR-HX uncovery is experienced during 72-hour event
    - Chapter 15 acceptance criteria remain satisfied
    - Confirmed by NRC staff calculations

Confirmatory Analysis Results
DBA RCS Temperature



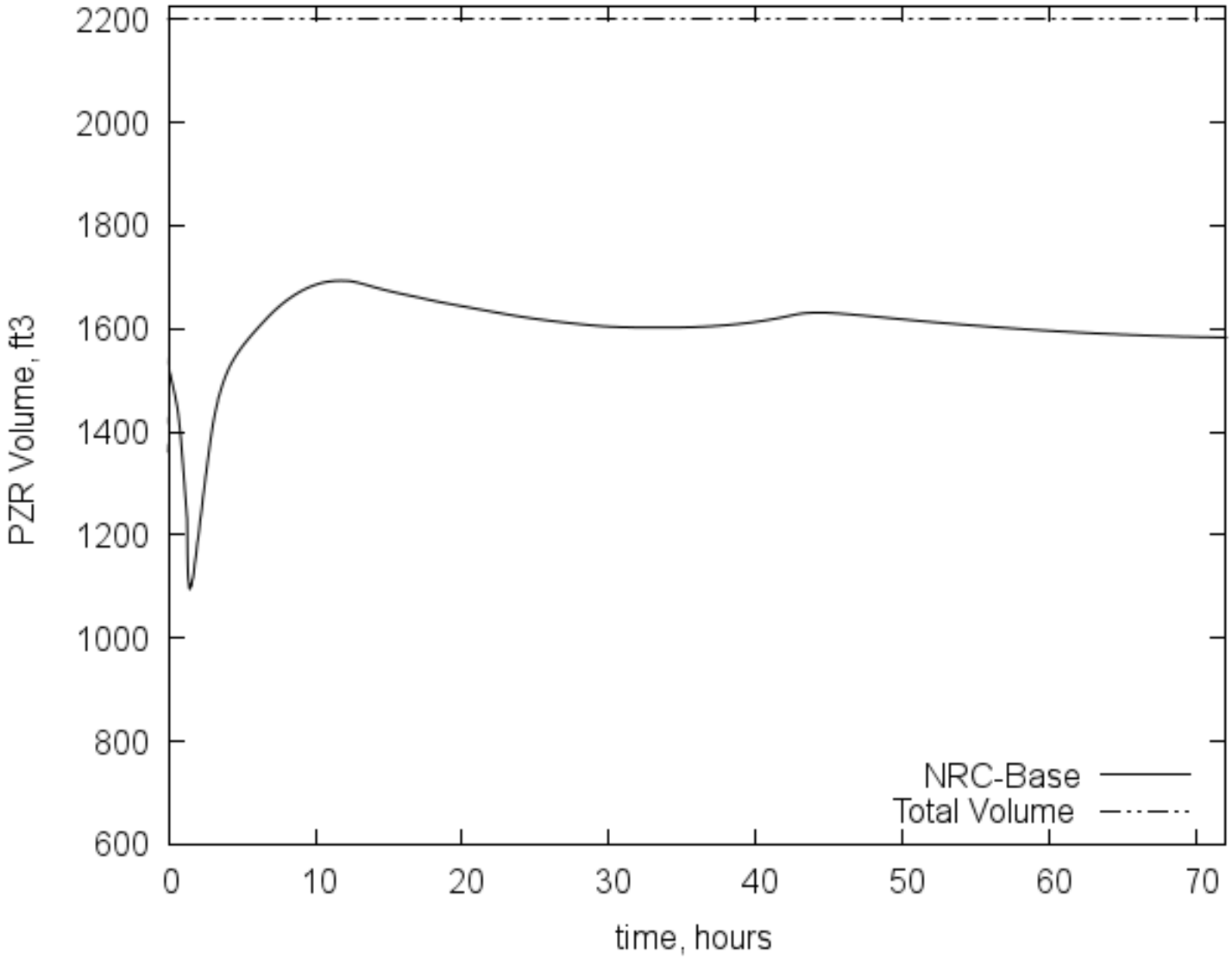
Review Focus – 72 hour analysis

RCS Temperatures



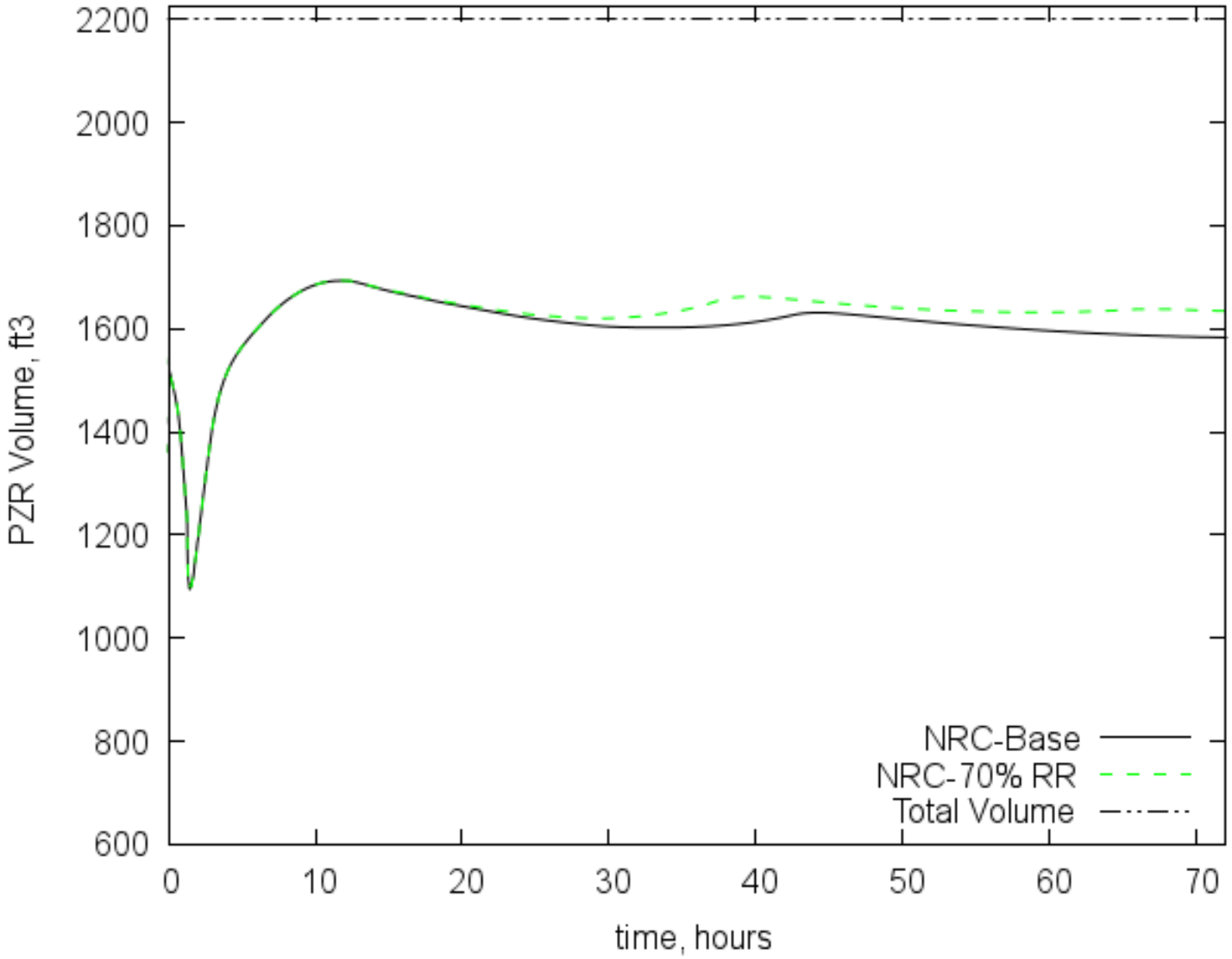
Review Focus – 72 hour analysis

Volume in Pressurizer



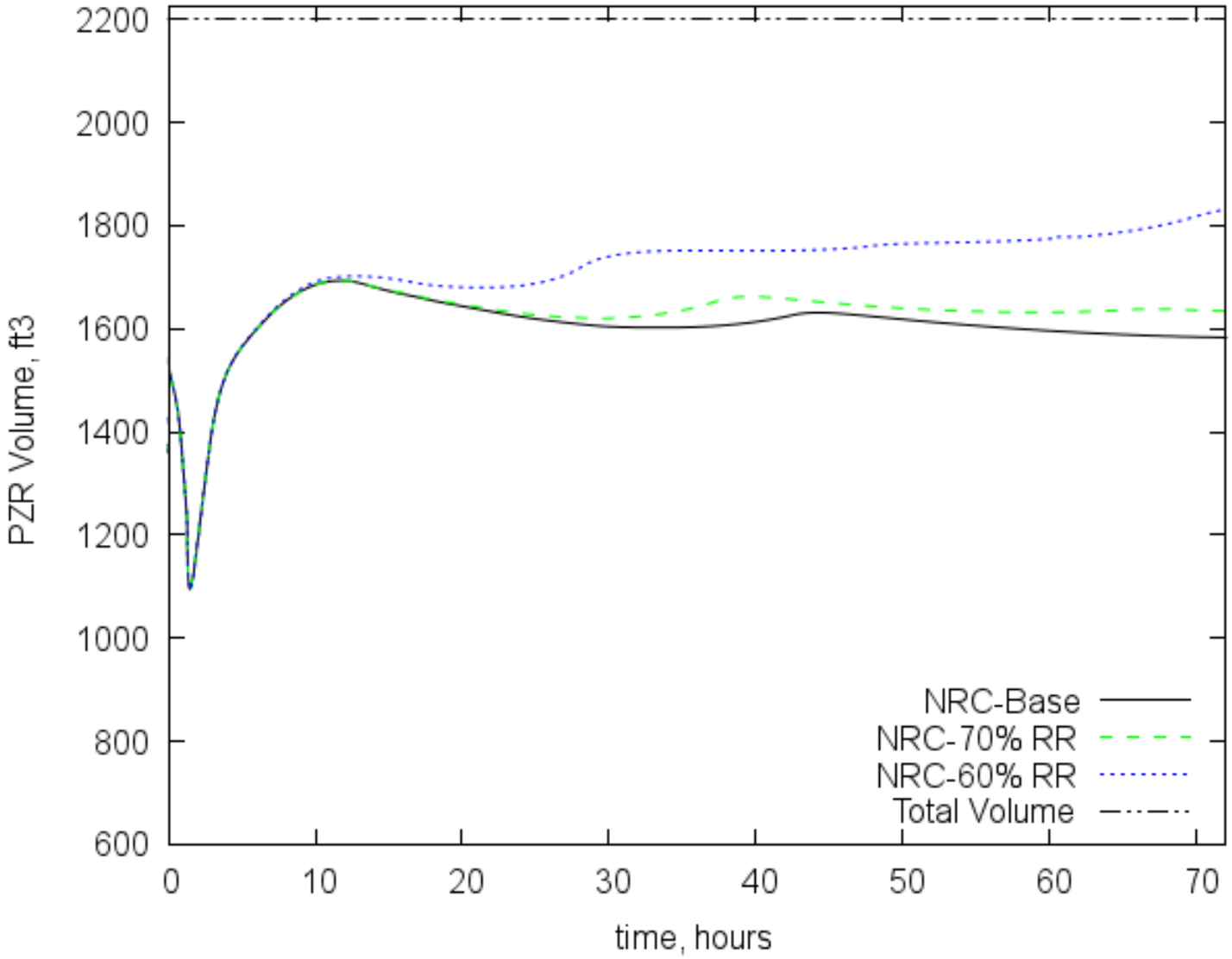
Review Focus – 72 hour analysis

Volume in Pressurizer



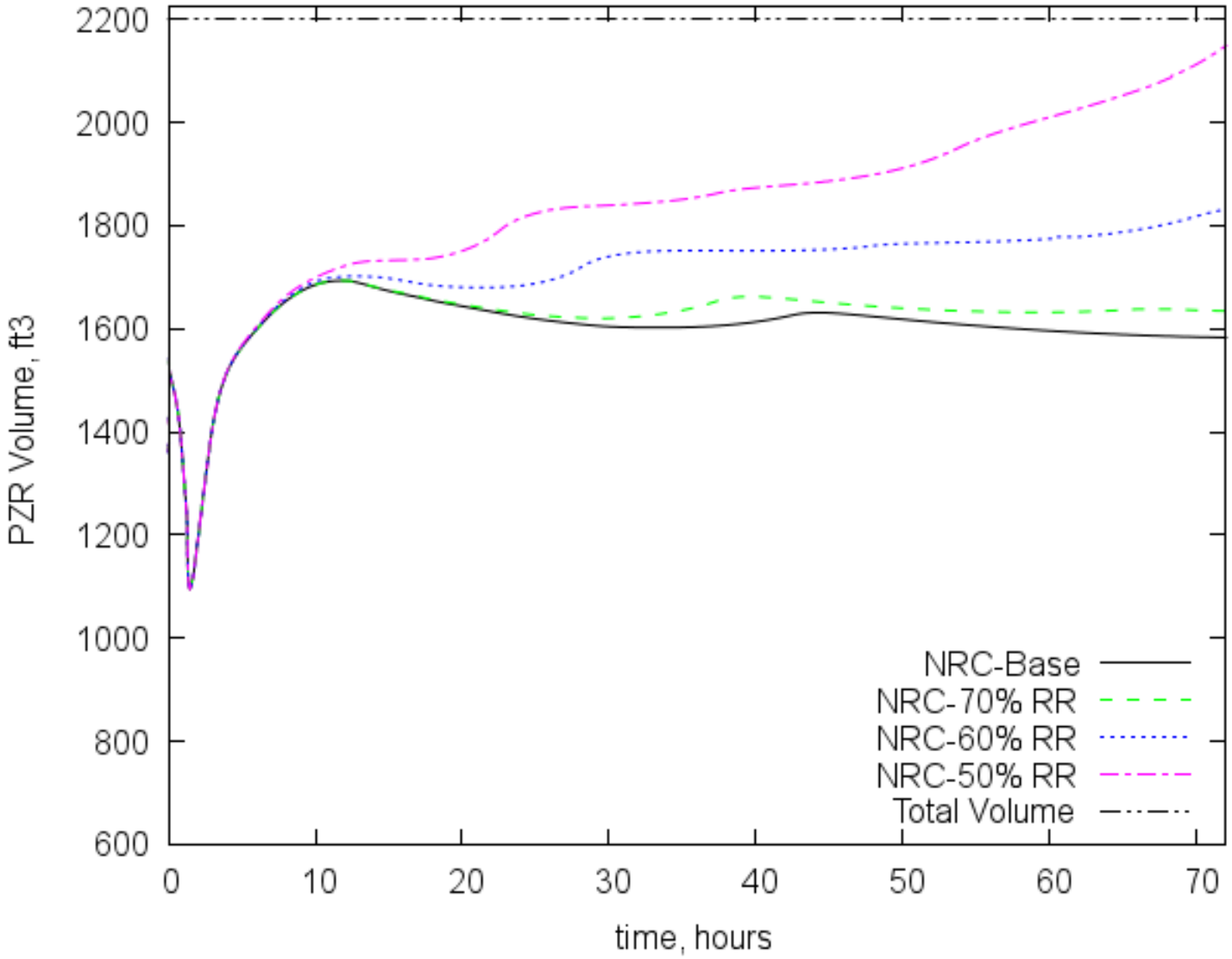
Review Focus – 72 hour analysis

Volume in Pressurizer



Review Focus – 72 hour analysis

Volume in Pressurizer



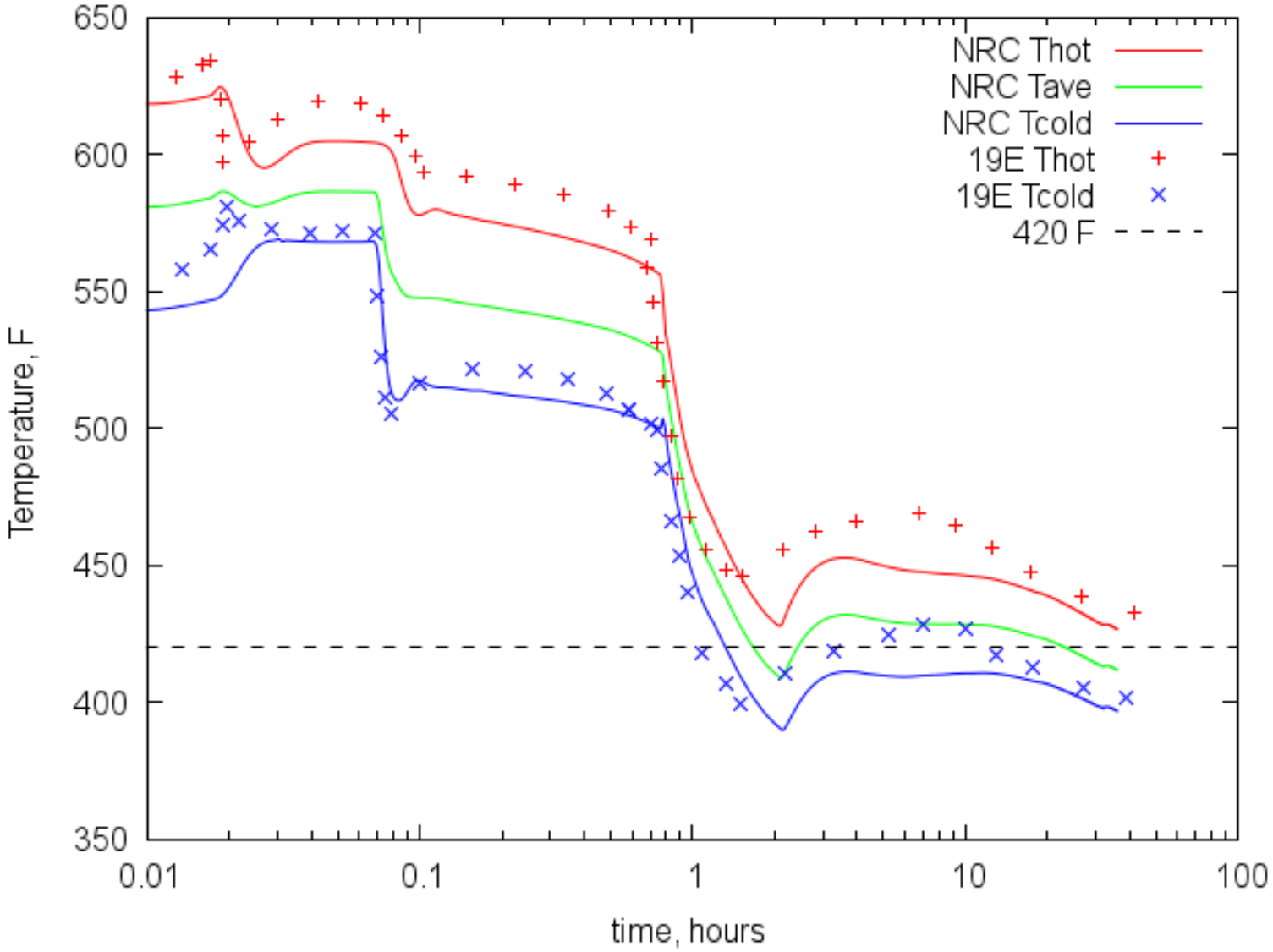
Review Focus – PXS Safety Design Basis

- Emergency makeup/boration
  - No impact
- Safety injection
  - Transition to open loop cooling is retained as defense-in-depth
  - No minimum level in IRWST is required for transition to open loop cooling
- Containment pH control
  - No impact

Review Focus – Safe Shutdown Analysis

- Applicant asserts 420 °F in 36 h achieved using conditions consistent with previously approved analysis in 19E following design changes
  - "non-bounding, conservative analysis"
    - Some nominal values used—most significantly, for decay heat
    - Also incorporates conservatisms in containment initial conditions, environment temperatures
- Remains consistent with the prior position approved by the commission in SECY 94-084
- Supported by staff confirmatory analysis
- 420 °F in 36 h removed from safety design basis in 6.3.1.1
  - Still part of the design basis in 19E

Confirmatory Analysis – Safe Shutdown Temperature



Conclusions

Design changes and FSAR changes are acceptable

Chapter 15 analyses are not affected

- Bounding analysis described in updated FSAR Section 6.3.3.2.1.1
- Supported by staff confirmatory analyses

420 °F in 36 h is met, by using analysis in Chapter 19E

- This is part of the design basis, but not safety-related
- Supported by staff confirmatory analysis

Acronyms

- ADS – Automatic Depressurization System
- IRWST – In Containment Refueling Water Storage Tank
- PCCS – Passive Containment Cooling System
- PCCWST – Passive Containment Cooling Water Storage Tank
- PCG – Polar Crane Girder
- PRHR HX – Passive Residual Heat Removal Heat Exchanger
- PXS – Passive Core Cooling System

Backup Slides

Issue History

December 2011 – UK GDA questions original condensate return assumption (constant 90%)

December 2012 – Applicant verbally advised NRC of issue and changes under ISG-011.

April 2013 – Formal submittal (Levy - departure and exemption request): design change adds downspouts to polar crane and stiffener, improves gutter design to increase condensate return rate + revised analysis incorporating changes.

May 2013 – NRC staff audits condensate flow over gutter and attachment plates test plan. Staff terminated the audit for lack of calculation reports.

Issue History

July/October 2013 – Applicant advised NRC of delay in submittal, citing third-party review and need to incorporate further modifications made to design into calculations.

January 2014 – Levy submits revision of formal departure and exemption request, makes supporting calculations available for NRC audit. The staff began a second audit, which is open.

February 2014 – Staff issues first round of RAIs concerning supporting analysis under audit.

April 2014 – Vogtle submits LAR similar to Levy departure request.

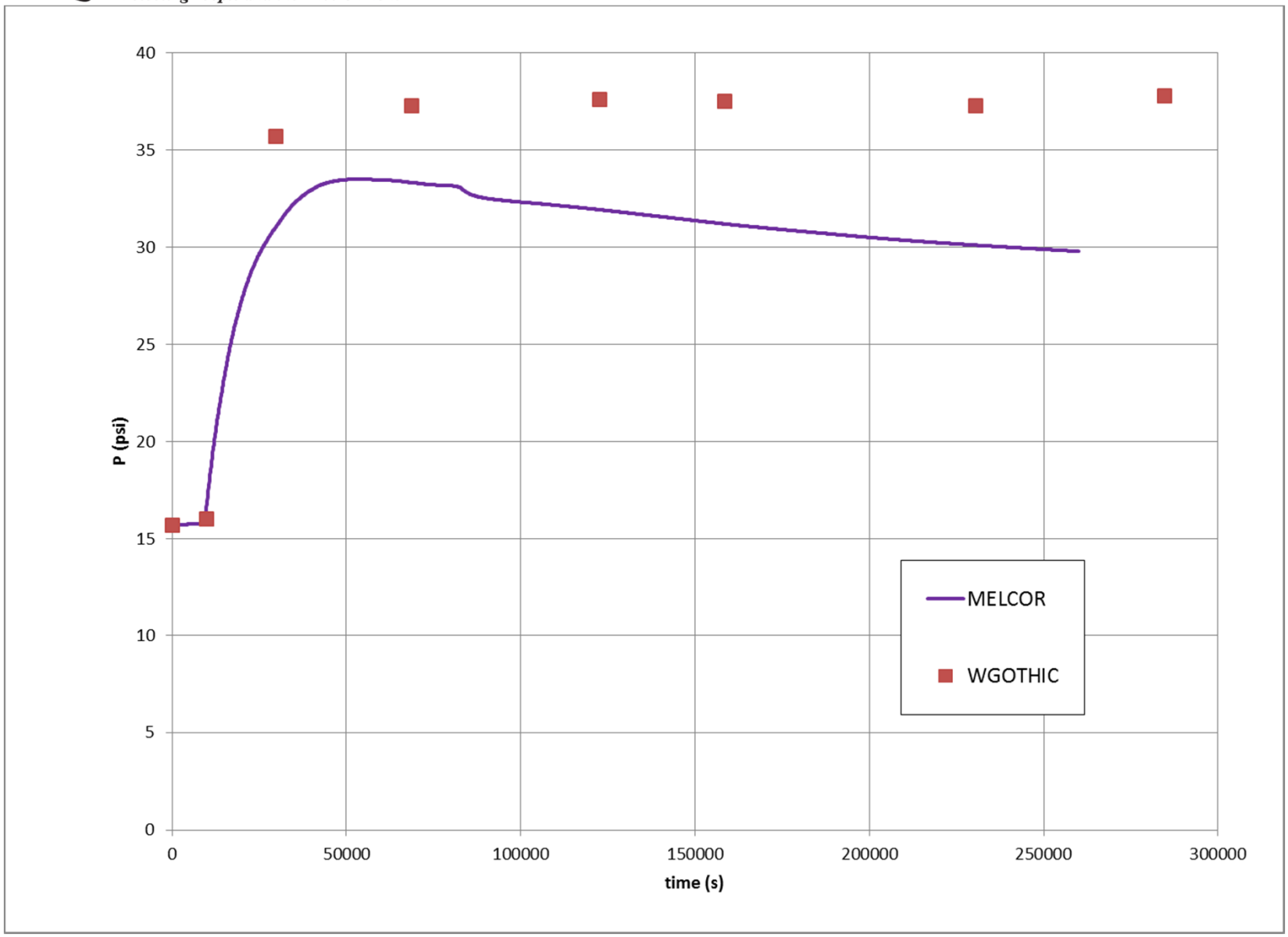
Technical Rationale for Changes

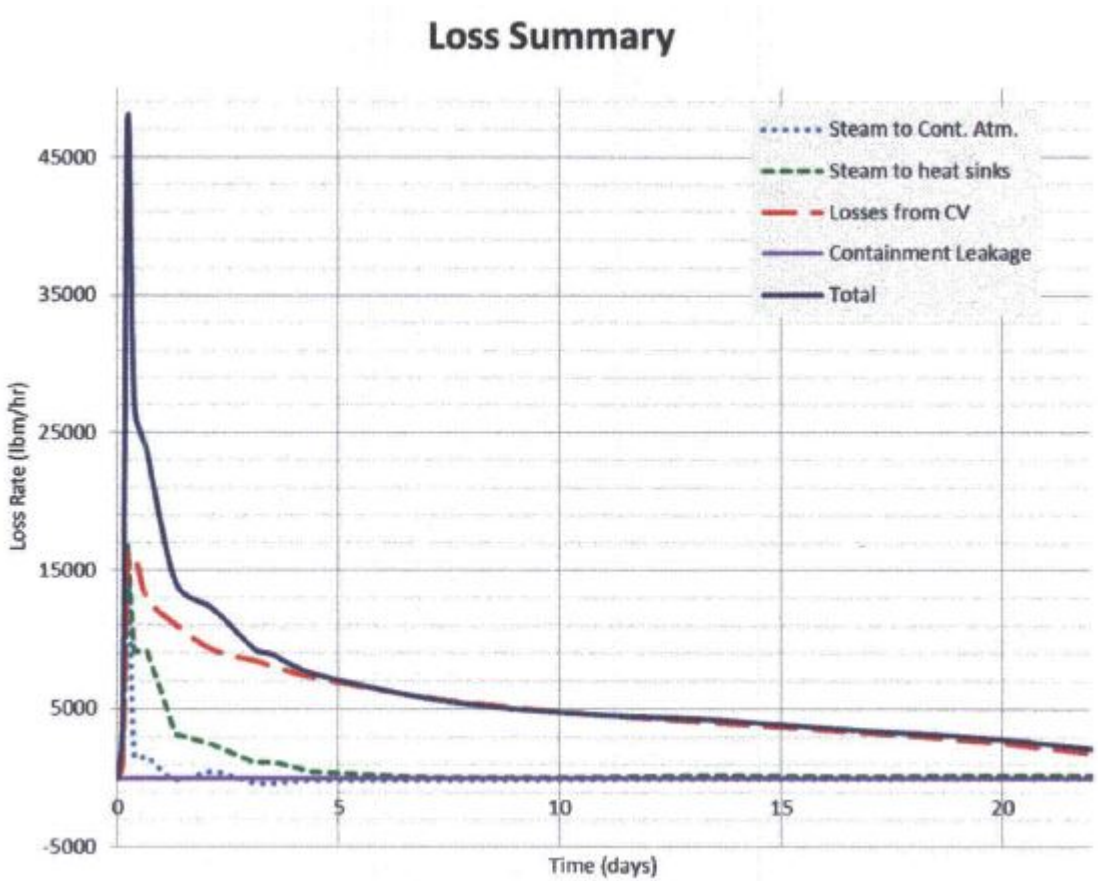
- Applicant states:

  Changes are necessary to reflect a 'significant technical correction associated with the design described in the licensing document that, if not changed, would **preclude operation within the bounds of the licensing basis**'

  - DCD Chapter 19E "Shutdown Temperature Evaluation"
  - Without changes, Chapter 15 non-LOCA analyses would require revision
- Change requires approval because Tier 1 material is modified: new gutters and downspouts are safety-related and therefore seismic Category 1

Confirmatory Analysis Results: Containment Pressure

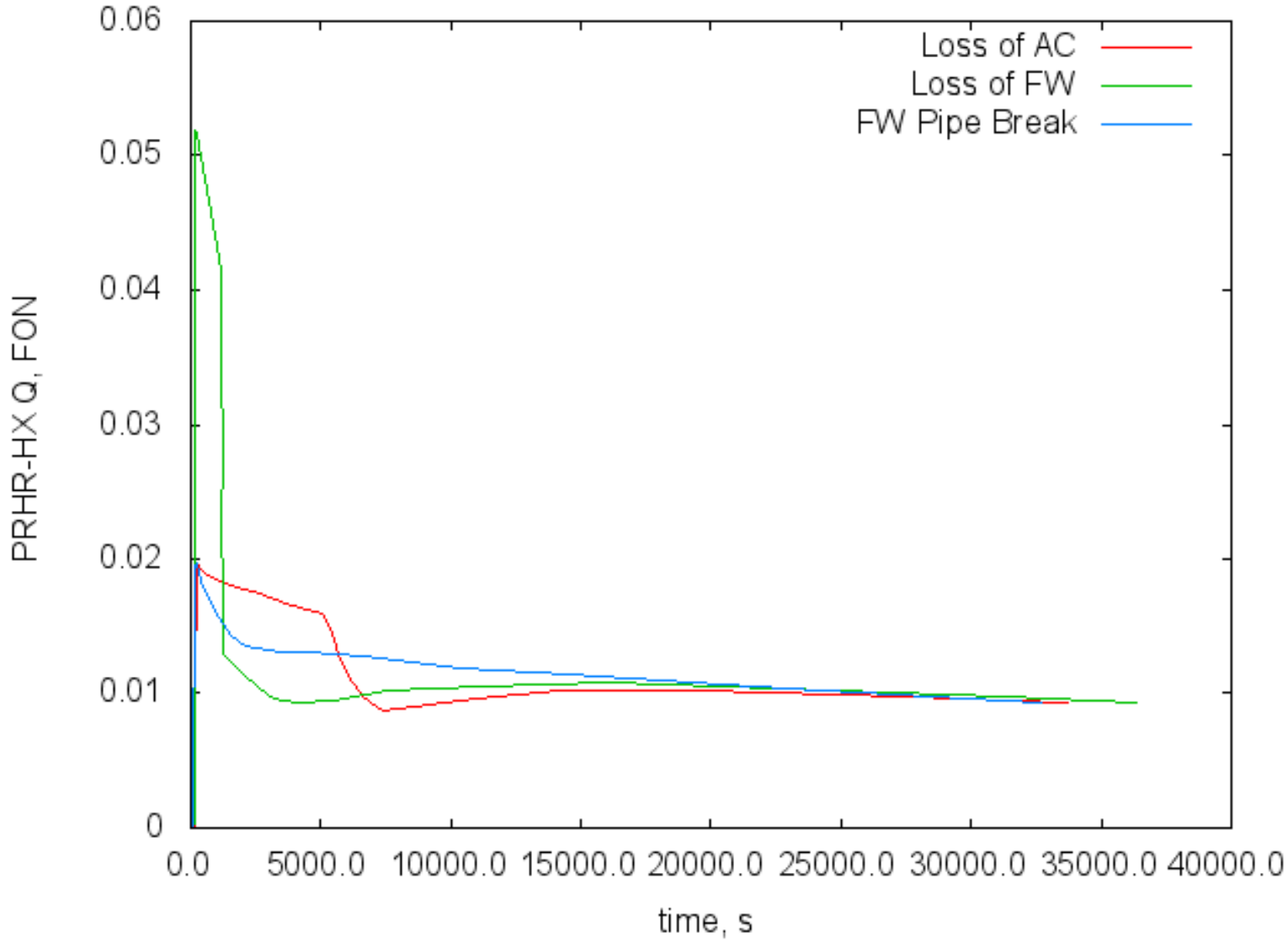



Loss Summary
Steam to Cont. Atm.
Steam to heat sinks
Losses from CV
Containment Leakage
Total
Loss Rate (lbm/hr)
45000
35000
25000
15000
5000
-5000
0
5
10
15
20
Time (days)

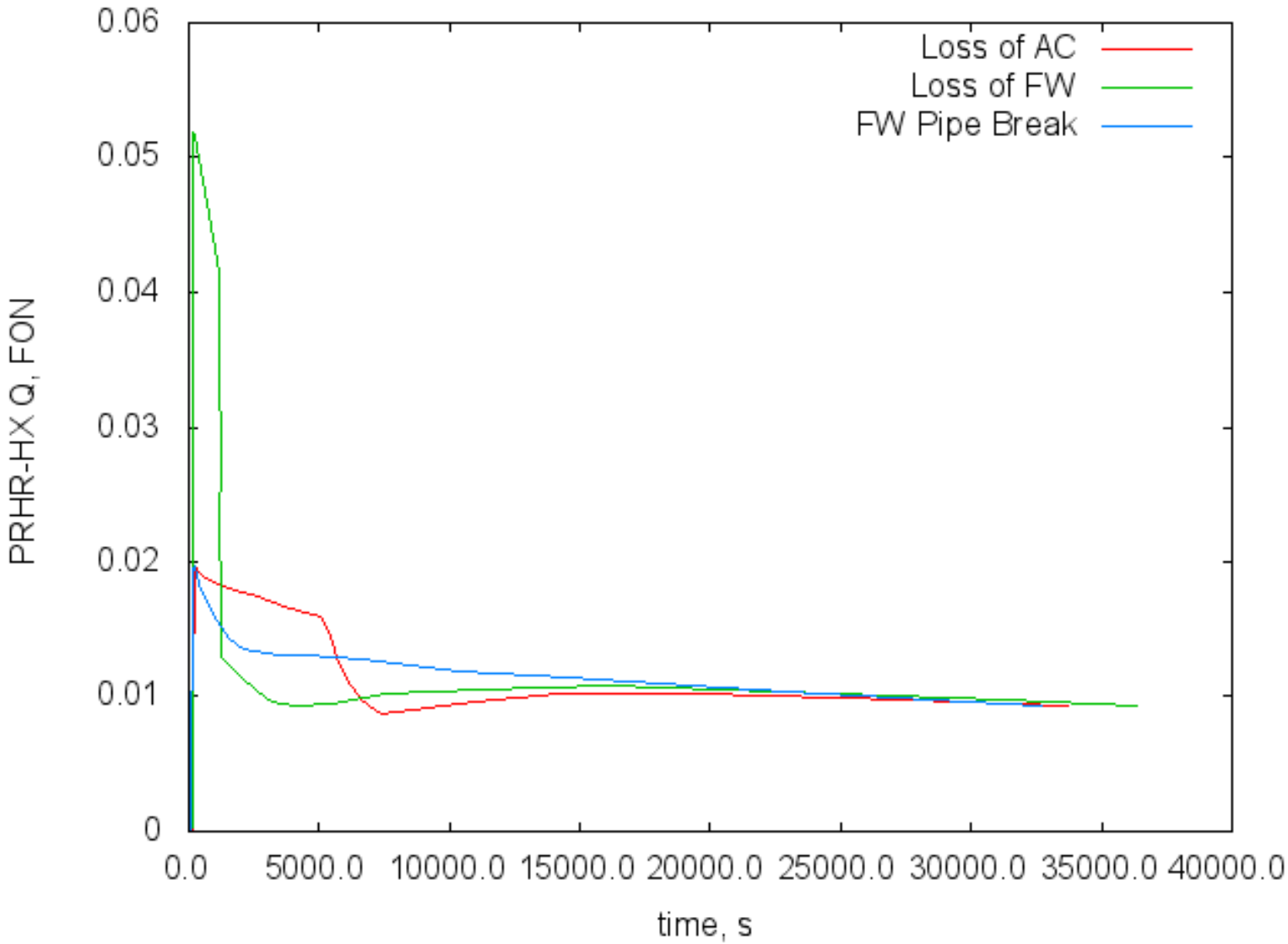
Limiting Event

DCD Section	Scenario	Calculation Duration
15.2.6	Loss of AC Power to Plant Aux.	6.2 hours
15.2.7	Loss of Feedwater	5.4 hours
15.2.8	Feedwater System Pipe Break	3.1 hours
15.5.1	Inadvertent Operation of CMTs During Power Operation	8.6 hours
15.5.2	CVCS Malfunction that Increases RCS Inventory	5.6 hours
15.6.3	Steam Generator Tube Rupture	6.7 hours

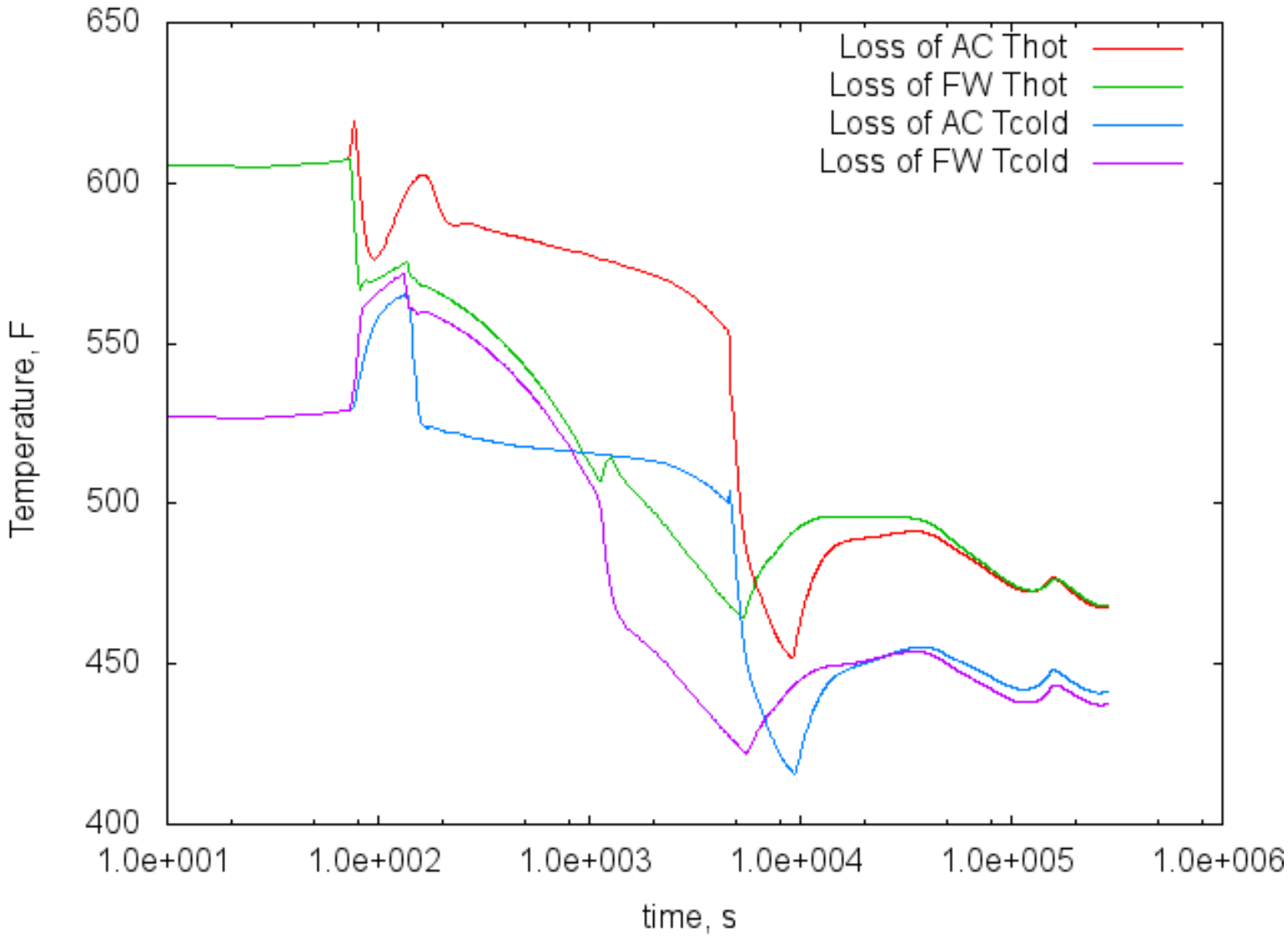
Confirmatory Analysis – Limiting Event



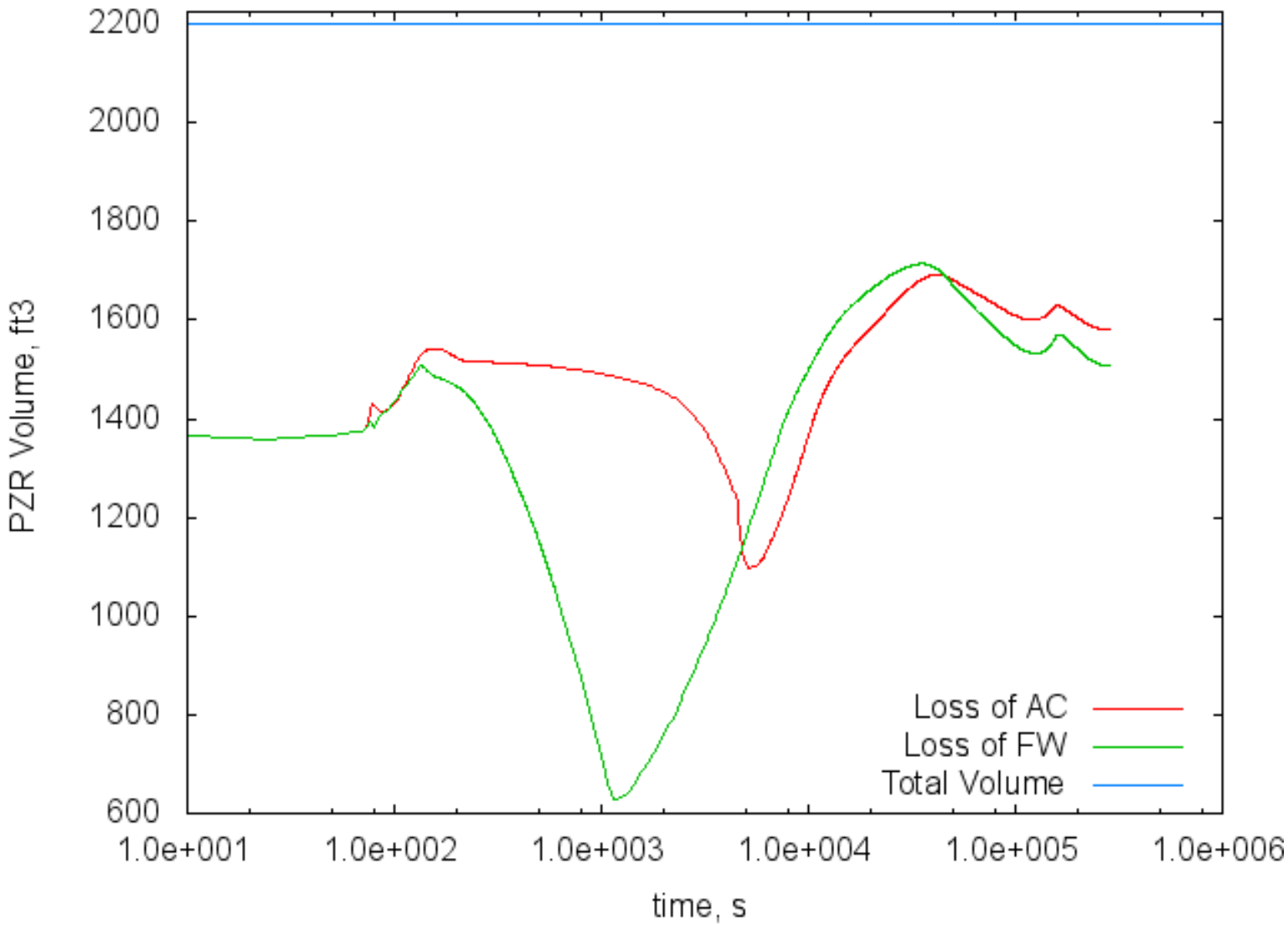
Limiting Event



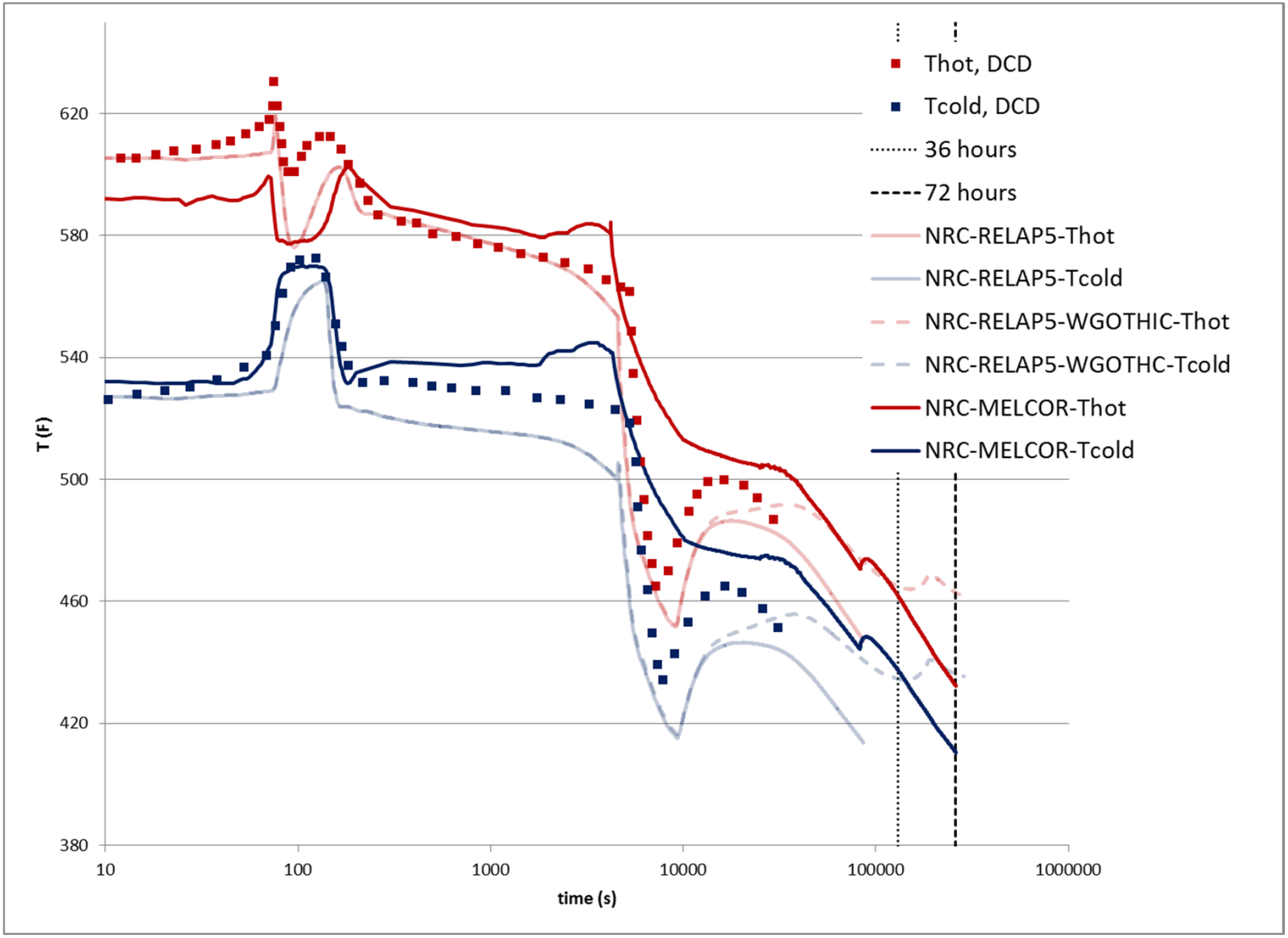
Limiting Event



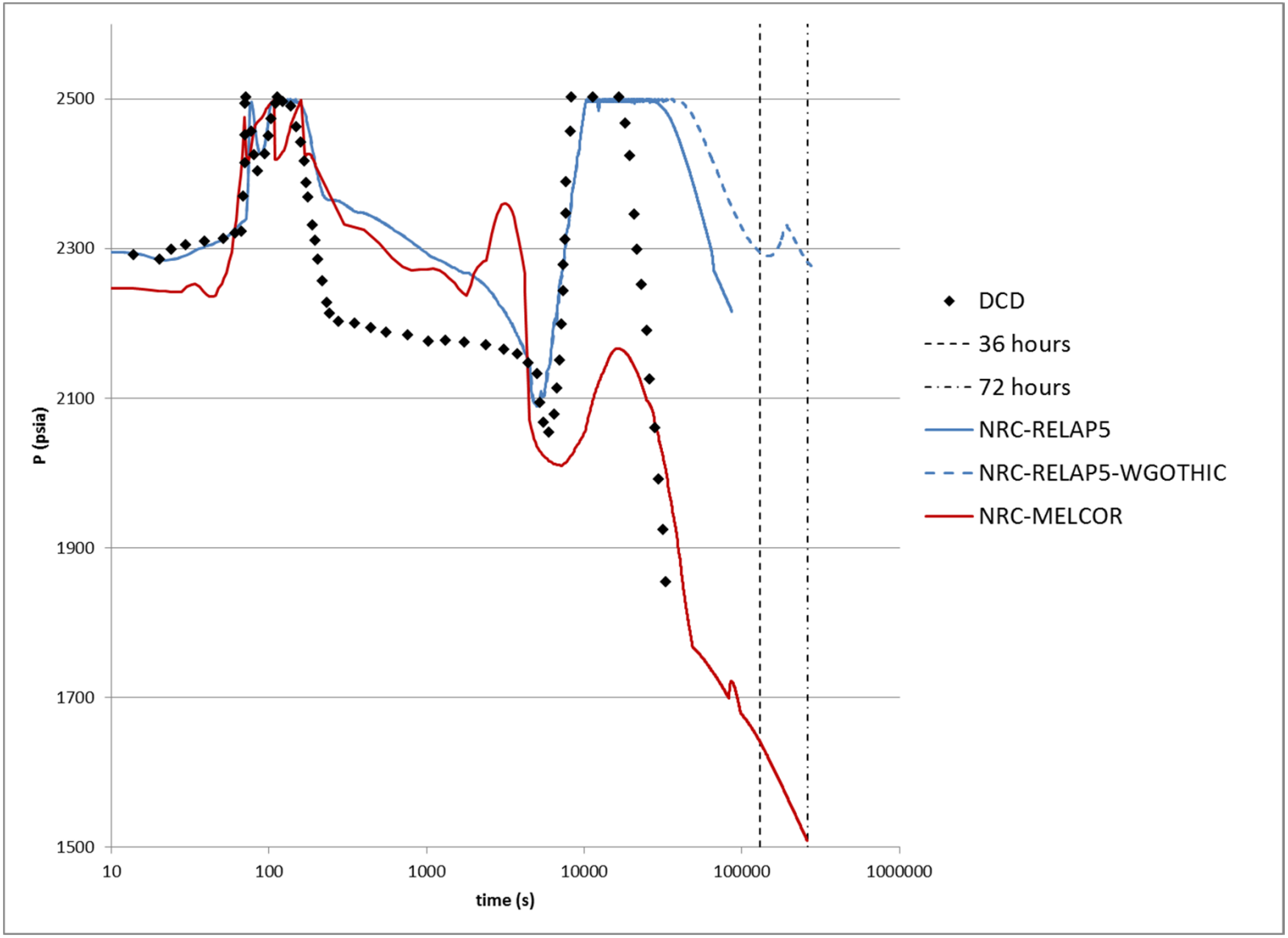
Limiting Event



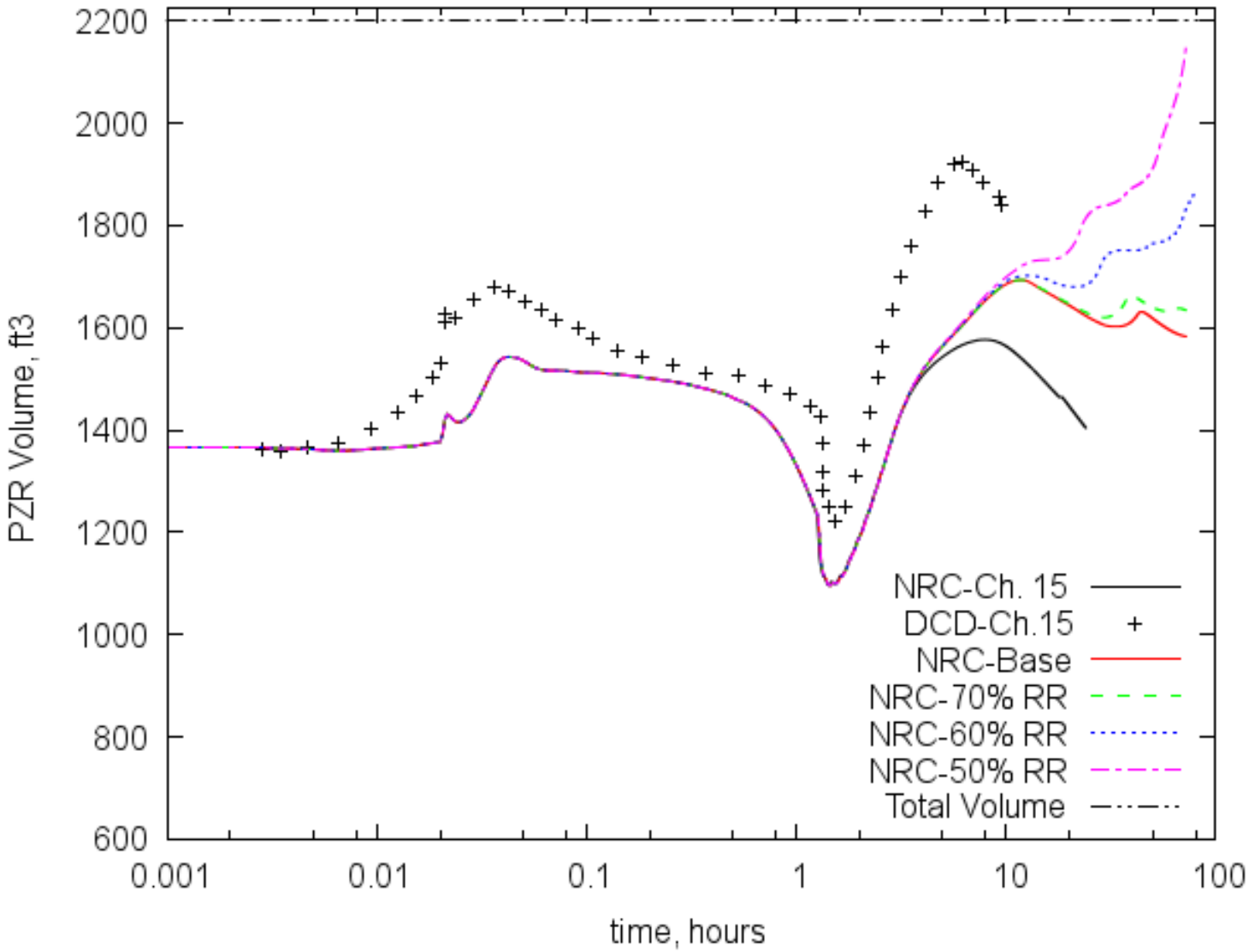
Confirmatory Analysis Results
DBA RCS Temperature



Confirmatory Analysis Results: DBA RCS Pressure



Confirmatory Analysis – PZR Volume



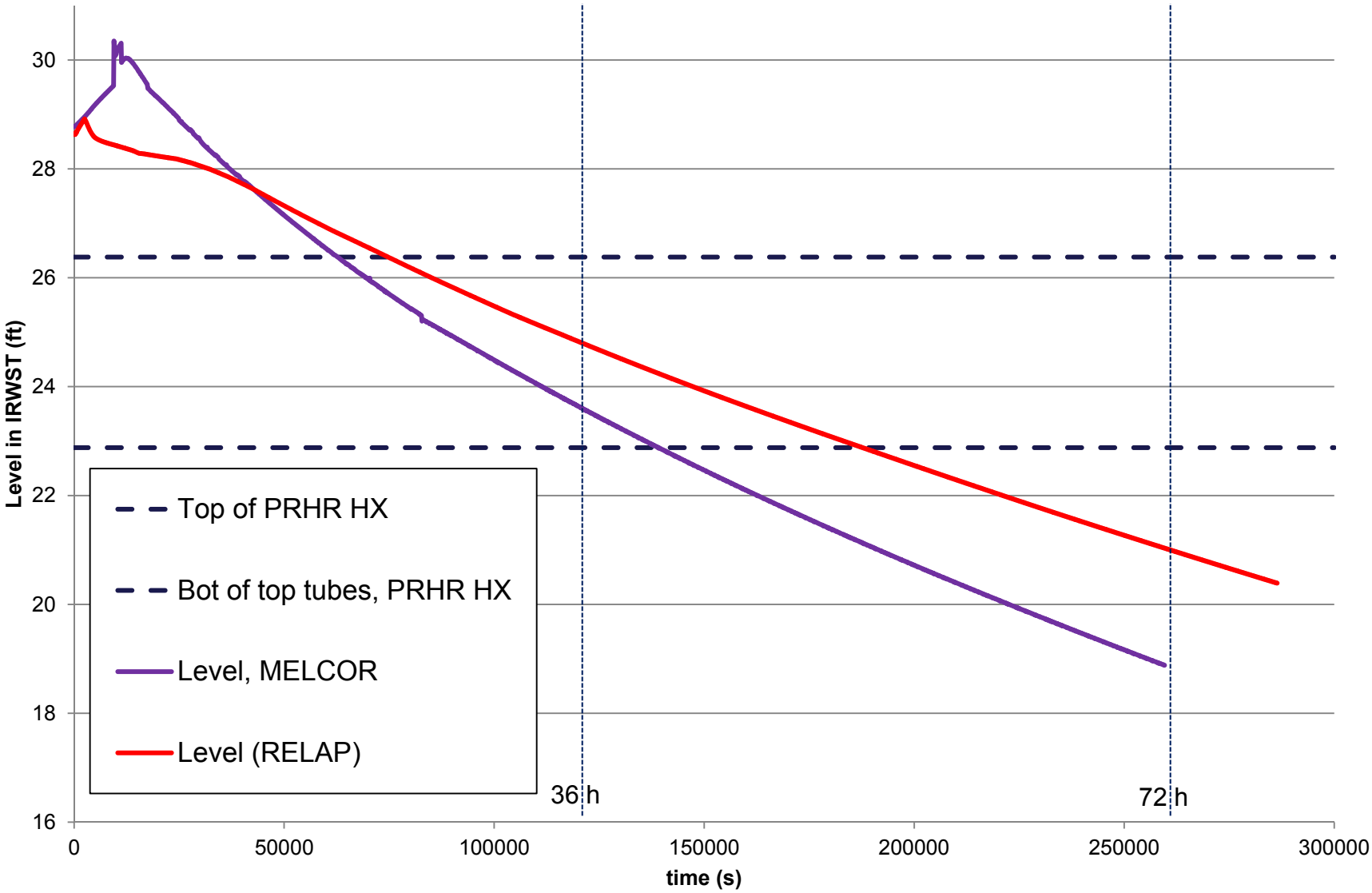
Review Focus – Design Basis Impact

- PRHR remains primary safety related system for mitigating non-LOCA transients

- Safe shutdown achieved with design modifications under traditional design basis, Chapter 15 conditions

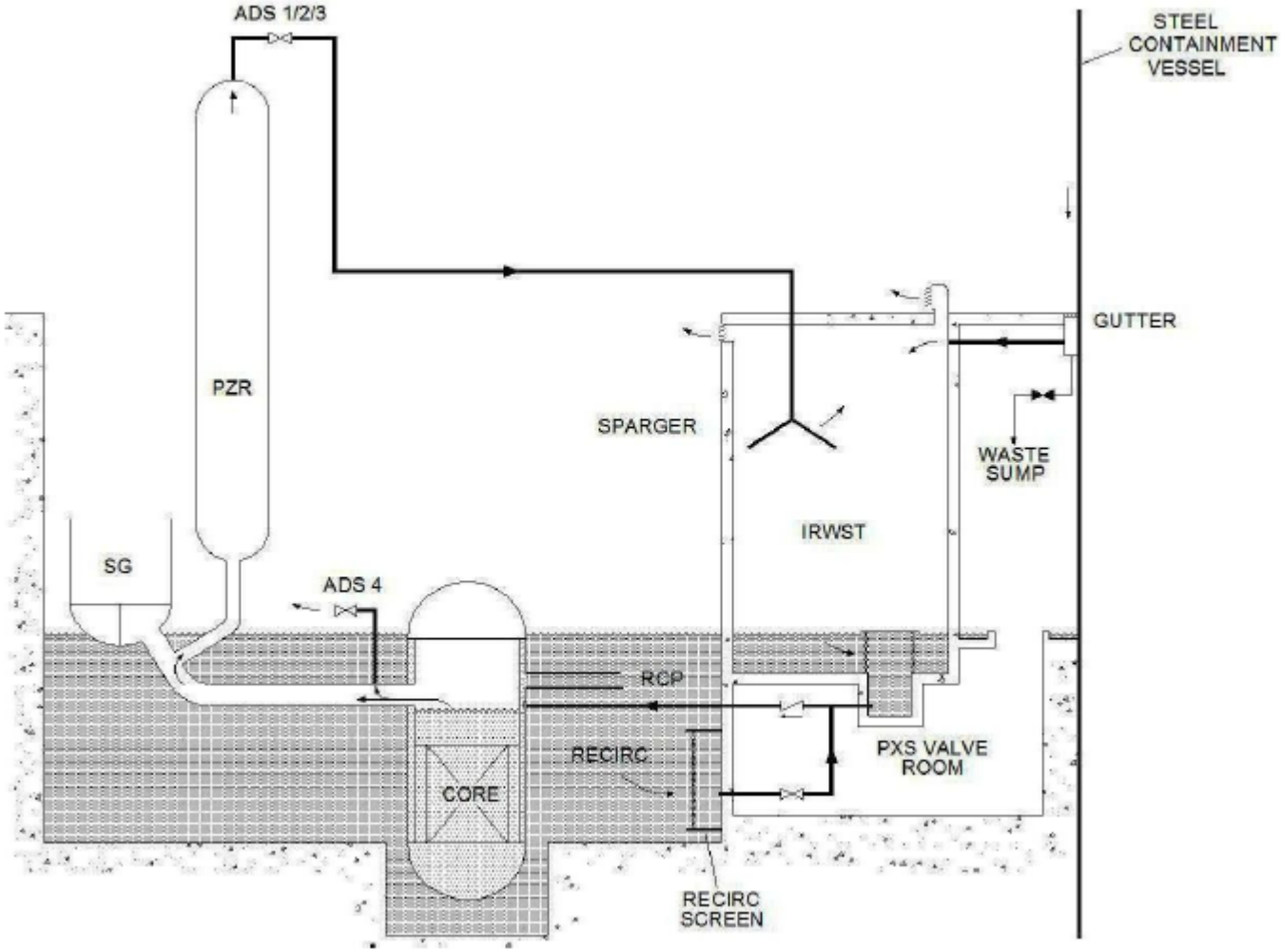
- Criteria required:
  - Stable or decreasing RCS temperatures
  - Heat removal from PRHR exceeds core decay heat
  - No liquid relief through the pressurizer safeties
  - Fuel safety limits and pressure boundary design limits not challenged

Confirmatory Analysis – IRWST Level



Review Focus – Design Basis Mission Time

- Post 72-hour actions
  - Staff requested clarification of actions post-72 hours following a non-LOCA transient (RAI 7440, 15.02.06-3)
  - Applicant stated containment makeup could be necessary dependent on containment leakage
- PRHR HX mission time
  - Staff requested the applicant clarify the PRHR mission time, safety-related design basis, use of “indefinite” in FSAR (RAIs 7475, 06.03-10 and 11 and 7484, 06.03-12)
  - Applicant revised PRHR HX performance into two periods: 72-hour safety-related and 14-day non-safety design basis
  - Subsequent FSAR revision removed 420 °F in 36 h from safety-related design basis


ADS 1/2/3
STEEL CONTAINMENT VESSEL
GUTTER
PZR
SPARGER
WASTE SUMP
IRWST
SG
ADS 4
RCP
RECIRC
PXS VALVE ROOM
CORE
RECIRC SCREEN