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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 US EPR SUBCOMMITTEE

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9 OPEN SESSION

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11 MONDAY

12 NOVEMBER 14, 2011

13 + + + + +

14 ROCKVILLE, MARYLAND

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16 The Subcommittee met at the Nuclear
17 Regulatory Commission, Two White Flint North, Room
18 T2B1, 11545 Rockville Pike, at 8:30 a.m., Dana A.
19 Powers, Chairman, presiding.

20 SUBCOMMITTEE MEMBERS PRESENT:

21 DANA A. POWERS, Chairman

22 SANJOY BANERJEE

23 CHARLES H. BROWN, JR.

24 GORDON R. SKILLMAN

25 JOHN W. STETKAR

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1 NRC STAFF PRESENT:

2 DEREK WIDMAYER, Designated Federal Official

3 SURINDER ARORA

4 TANYA FORD

5 PAUL PIERINGER

6 GETACHEW TESFAYE

7 JOE COLACCINO

8 ED McCANN

9 PHYLLIS CLARK

10 LARRY WHEELER

11 RYAN EUL

12 JAMES O'DRISCOLL

13 EDUARDO SASTRE

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1 ALSO PRESENT:
2 MARK FINLEY
3 CYRIL RODEN
4 TOM ROBERTS
5 SANDRA SLOAN
6 KEVIN CONNELL
7 FRED MAASS
8 EUGENE MOORE
9 DARRELL GARDNER
10 STEVE HUDDLESTON
11 JEAN LINDSTROM
12 TIM STACK
13 RAM SARMA
14 SUSAN McCONATY
15 TONY LITTLE
16 JOHN CROWTHER
17 RICHARD BASHALL
18 ROBERT DAY
19 ROBERT LITMAN
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P R O C E E D I N G S

8:30 a.m.

CHAIR POWERS: This meeting will now come to order. This is a meeting of the Advisory Committee on Reactor Safeguards, US EPR Subcommittee. I am Dana Powers, Chairman of the Subcommittee.

ACRS members in attendance are Dick Skillman and John Stetkar. Charles Brown will join us tomorrow I think, or maybe this afternoon. Derek Widmayer of the ACRS staff is the designated federal official for this meeting.

The purpose of the meeting is to continue our review of the SER with Open Items for the design certification document submitted by AREVA NP for the US EPR design and the SER with Open Items for the combined operations licence application submitted by UniStar for the Calvert Cliffs nuclear power plant Unit 3.

We will hear presentations on the discussed Chapter 7, instrumentation and controls, group 1, Chapter 9 Auxiliary Systems, the DCD SER, and Chapter 7, instrumentation and controls, and Chapter 18, human factors engineering of R-COLA SER.

The Subcommittee will also hear an introductory presentation to evaluations conducted by

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1 AREVA to address GSI-191, and I address during that
2 part of the presentation we may close the meeting to
3 protect proprietary interests.

4 The Subcommittee will hear presentations
5 by and hold discussions with representatives of AREVA
6 NP, UniStar and the NRC staff and other interested
7 persons regarding these matters.

8 The Subcommittee will gather relevant
9 information today and plans to take the results of the
10 reviews of these chapters, along with other chapters
11 reviewed by the Subcommittee, to the full Committee at
12 future full Committee meetings to be determined.

13 The rules for participation in today's
14 meeting have been announced as part of the notice of
15 this meeting previously published in the Federal
16 Register.

17 We have received no written comments or
18 requests for time to make oral statements from members
19 of the public regarding today's meeting. A transcript
20 of the meeting is being kept and will be made
21 available as stated in the Federal Register notice.

22 Therefore, we request that participants in
23 this meeting use the microphones located throughout
24 the meeting room when addressed the Subcommittee. The
25 participants should first identify themselves and

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1 speak with sufficient clarity and volume so they may
2 be readily heard.

3 Copies of the meeting agenda and handouts
4 are available in the back of the meeting room. A
5 telephone bridge line has been established with the
6 meeting room today and I understand we will have
7 participants from AREVA NP and UniStar on the line
8 periodically during the meeting.

9 We request that participants on the bridge
10 line identify themselves when they speak, and keep
11 their telephone on mute during times when they are
12 just listening.

13 Do members of the Subcommittee have any
14 opening statement?

15 I noted that Professor Banerjee has joined
16 us. Thank you very much sir.

17 MEMBER BANERJEE: I am at your disposal.

18 CHAIR POWERS: We are just in your debt.
19 That's all. No opening statements? Then I will
20 proceed. I will call upon Surinder Arora, the NRR
21 Project Manager, for the Calvert Cliffs Unit 3 review,
22 to open the meeting.

23 MR. ARORA: Good morning everybody. My
24 name is Surinder Arora and I am the lead PM for the
25 Calvert Cliffs Unit 3 COL application reviews.

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1 The way we are going to present today the
2 order of presentation is on Slide number two, which is
3 currently being displayed.

4 I will give a brief overview of the
5 project, where we are today, and then I will turn over
6 the presentation part to UniStar and after UniStar
7 finishes their presentation, we will have the
8 technical presentation.

9 The slide which is being displayed now,
10 number three, provides a chronological order of major
11 milestones of the Calvert Cliffs Unit 3 COL reviews.

12 As of today we have presented to ACRS
13 Committee 11 complete chapters and one partial
14 chapter. Two more chapters are scheduled for
15 presentation during this November meeting. One of
16 them is being presented now. That's Chapter 18. And
17 tomorrow we will be presenting Chapter 7.

18 Next slide please. This slide provides
19 details of the completed chapters with Subcommittee
20 review dates, and as previously stated, two more
21 chapters, 18 and 7, are scheduled for presentation
22 during this meeting, but those are the two highlighted
23 chapters.

24 That's basically where we are today in the
25 COL review process and I will take this opportunity to

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1 introduce Tanya Ford. She is the chapter PM. She
2 will be coming back later and presenting the technical
3 portion of our presentation today.

4 And with that, I will now turn over the
5 meeting to Mr. Mark Finley. He is the Vice-President
6 of UniStar and he will introduce his team and start
7 with the UniStar presentation for Chapter 18.

8 CHAIR POWERS: Let me just interrupt and
9 check and see if any of the members of the
10 Subcommittee have questions for Surinder.

11 Not at this time. Mark.

12 MR. FINLEY: Good morning. Thank you,
13 Surinder. Like Surinder said my name is Mark
14 Finley. for those of you who don't know I have been
15 with UniStar for five years. Previously I had been in
16 charge of the engineering area and just recently we
17 have combined engineering and regulatory affairs and I
18 am the Senior Vice-President, Regulatory Affairs and
19 Engineering for UniStar.

20 Greg Gibson, who was formally in charge of
21 regulatory affairs, you know him well, he sends his
22 regards. He has been promoted. He is actually
23 President of UniSgtar.

24 CHAIR POWERS: It doesn't matter. We
25 still can assign him tasks, and will do so.

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1 MR. FINLEY: Through me, we can still
2 assign him tasks. So good morning, we appreciate the
3 time slot this morning, and tomorrow afternoon, as
4 Surinder said, to cross two more chapters off the list
5 for Calvert Cliffs 3.

6 So, good, John, thank you. So we are on
7 Slide 2 and there should be a brief discussion this
8 morning. Chapter 18, mainly we incorporate by
9 reference the Chapter 18 from AREVA as you have seen.

10 We will focus on supplementary
11 information, site-specific information and we have one
12 departure that we will talk about. We are building
13 off-of the meeting, Chapter 18, for the US EPR FSAR
14 back in August 18th of 2011.

15 Slide 3. As you will see we have one
16 departure, really as much an enhancement as a
17 departure -- we will talk about that in some detail --
18 regarding the human performance monitoring program.

19 We have no ASLB contentions. There are
20 five COL information items we will discuss, no SER
21 Open Items and two confirmatory SER items.

22 My team here today, and on the phone,
23 Cyril Roden will lead the presentation. He is our
24 manager of I&C and electrical engineering at UniStar,
25 and supported by Tom Roberts, who is our manager of

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1 operations and maintenance, and John Rucke will
2 support with the slides.

3 And we have some other support on the
4 phone here. As you see the names, I won't discuss
5 each of those names.

6 Slide 5, again a fairly brief
7 presentation. Cyril will discuss the COL items and
8 the one departure with Tom's support, and then we will
9 have some conclusions and that should be it.

10 Please don't hesitate to ask questions
11 when they pop into your head.

12 CHAIR POWERS: Do you really need to
13 provoke this Subcommittee?

14 (Laughter)

15 I have never seen them reluctant to ask
16 questions.

17 MR. FINLEY: This I know. And Cyril,
18 Slide 6.

19 MR. RODEN: Okay, thank you Mark. My name
20 is Cyril Roden. As you may guess, I am from France,
21 from my accent. I joined UniStar in August 2010 to
22 work in engineering on I&C and electrical.

23 Prior to that I worked for 11 years within
24 EDF in nuclear engineering, working on I&C and
25 electrical topics, both for operating plants and new

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1 build, and I have got a French engineering degree on
2 electrical design, signal processing and automation.

3 So, the presentation will focus on the
4 description of the COL items and the departure. So on
5 Slide 6 we have our first COL item on our chapter,
6 which in fact states that UniStar operating service
7 will execute the NRC-approved HFE program as described
8 in the DC.

9 Next slide. The second COL item deals
10 with the emergency operations facilities concerning
11 the EOF. The plan is to modify the existing Calvert
12 Cliffs Unit 1 and 2 EOF to accommodate and interface
13 with Calvert Cliffs Unit 3.

14 And this modification will be consistent
15 with the US EPR HFE program described within the DC
16 and consistent with the NUREG-0696, which is about the
17 EOF.

18 We commit in our COLA to of course check
19 the operability of the EOF for Calvert Cliffs Unit 3,
20 but also be sure that there is no degradation for
21 Calvert Cliff Unit 1 and 2.

22 And I state in the second bullet the
23 correct implementation of this HFE program will be
24 verified through site-specific ITAAC, which is part of
25 our COL.

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1 Concerning the operational support center,
2 the OSC will be designed for Calvert Cliffs Unit 3 and
3 will not be shared with Calvert Cliffs unit 1 and 2,
4 and this OSC will be designed also consistently with
5 the US EPR HFE program as referenced in the DC.

6 MEMBER STETKAR: Cyril.

7 MR. RODEN: Yes.

8 MEMBER STETKAR: I've forgotten, if I ever
9 knew. Where is the emergency operating facility
10 located at Calvert Cliffs, physically?

11 MR. RODEN: It's -- I'll just look at --

12 MR. ROBERTS: My name is Tom Roberts. I
13 have been in the industry for 38 years and I have held
14 different positions in operations, engineering,
15 maintenance and construction.

16 I have had multiple leadership roles at
17 several plants across the US including St Lucie plant,
18 Turkey Point, Byron nuclear station and Calvet Cliffs.

19 Recently I have just finished a two--year
20 assignment out of Flamanville Unit 2 in the
21 construction organization. I have a B.S., Bachelor of
22 Science degree and civil structural engineering with a
23 minor in environmental engineering.

24 I am a Registered Professional Engineer
25 and I also have the INPO Plant Manager Certification.

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1 To answer your question, at Calvert Cliffs, the OSC
2 is located right in the security complex.

3 MEMBER STETKAR: Not the OSC, the EOF.

4 MR. ROBERTS: The EOF?

5 MEMBER STETKAR: Yes.

6 MR. ROBERTS: The EOF is located up in
7 Prince Frederick so it's approximately 12 miles away.

8 MEMBER STETKAR: Okay, thanks.

9 MR. ROBERTS: I didn't remember. OSC must
10 be somewhere, you know, within the fence

11 MEMBER STETKAR: Right, it's just outside
12 the main -- the security fence going into the
13 protected area --

14 MR. ROBERTS: Okay.

15 MEMBER STETKAR: at Calvert Cliffs.

16 MR. ROBERTS: Okay, thanks.

17 MR. RODEN: Any other question on that
18 slide?

19 (No response)

20 MR. RODEN: So let's move to the next one.

21 Slide number 8. This core item deals with staffing
22 levels and qualification. The staffing levels of
23 qualifications of plant personnel specified in the CC
24 Unit 3 FSAR will conform to the regulatory
25 requirements.

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1 And the results of the staffing and
2 qualification analysis shall be verified by the
3 implementation of an ITAAC, which is in the DC, and as
4 it states in these slides, the staffing and
5 qualification will be based on the HSI, the human
6 system interface design features as described in the
7 task analysis implementation plan.

8 MEMBER STETKAR: Just be careful with the
9 microphone. I don't want to move the --

10 MR. RODEN: No, it's me. Sorry.

11 MEMBER STETKAR: They are really, really
12 sensitive.

13 MR. RODEN: Okay. Sorry about that.

14 MEMBER STETKAR: It just bothers the
15 transcript.

16 MR. RODEN: Yes, understood. Next slide
17 please. The two next COL items, the first one deals
18 with principles and site procedures. The HFE
19 principles and criteria are incorporated into the
20 program for site procedures and which is consistent
21 with the guidance of the operational guidelines
22 described in section 13.5 of our COL.

23 And concerning the principles and the
24 training program, these -- the HFE principles and
25 criteria are incorporated into the development of the

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1 training program scope, structure and methodology, and
2 this is described in section 13.2 of the CC Unit 3
3 FSAR.

4 And these two COL items are the last ones
5 we have in our Chapter 18.

6 MEMBER SKILLMAN: I am Dick Skillman. I
7 would like to ask a question.

8 MR. RODEN: Yes.

9 MEMBER SKILLMAN: It goes back to your EOF
10 and combining the Calvert 3 EOF activities with the
11 present Calvert 1 and 2 EOF activities, and this is as
12 much a human factors question as it is a practical,
13 nuclear power plant question.

14 You have got two Ps that are a vintage,
15 and then you have the super whamodyne P that is, in
16 all candor, a very different machine -- similar
17 technology but a different machine.

18 What actions will you be taking in UniStar
19 to ensure that the personnel in the EOF and the
20 recognition of the EALs for Calvert 1 and 2 that are
21 probably different than Calvert 3, are separated, that
22 these people understand these are not three very
23 similar machines, they are two very, very similar
24 machines, and one very different machine. The EALs
25 will likely be different. So I understand

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1 So I understand the notion of combining
2 the EOF. The question is around the human factors of
3 assuring that the people in EOF understand they are
4 dealing with two different machines. Their responses
5 may be very different because of the design
6 differences.

7 What is the vision for how that will be
8 addressed? I think maybe Tom would be the best to
9 answer that question.

10 MR. ROBERTS: What we've done is we have
11 walked down the EOF with Calvert Cliffs Units 1 and 2,
12 their operating staff, and we realize there's still a
13 lot of work to do in that modification.

14 So we are still negotiating that with
15 Units 1 and 2, but what we had envisioned is that you
16 would almost have two separate areas with a combined
17 area, but it's very preliminary.

18 So we understand that there's going to be
19 some differences, specifically on EOP, some slight
20 differences in the emergency response and the EALs,
21 but we don't think there's going to be any problems
22 overcoming that.

23 But it's not going to be like it's all in
24 one area.

25 MR. FINLEY: I would also add, I think

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1 your question got to training as well, and at this
2 point we expect to use separate teams, essentially a
3 team trained for the Calvert Cliffs Unit 3 through a
4 separate training process from the teams that would
5 staff the EOF for Calvert Cliffs 1 and 2.

6 Right now we don't see a significant
7 overlap in the personnel that would be staff. So the
8 idea is more to share the physical facility as opposed
9 to sharing the staff so that the training programs
10 would be separate and obviously focused on the EPR
11 processes and parameters.

12 MEMBER SKILLMAN: Thank you. MR.

13 RODEN: Any other questions? So let's move to Slide
14 10.

15 CHAIR POWERS: Does that mean that if I am
16 trained to run 3, I cannot be cross-trained to run 1
17 and 2?

18 MR. FINLEY: No, I wouldn't say that.
19 It's our staffing plan, Dr. Powers, just envisions a
20 separate staffing and not a sharing of the licensed
21 operators at this point in time, or the emergency
22 response staff.

23 CHAIR POWERS: How about fire brigades?

24 MR. FINLEY: Fire brigades? Tom, do you
25 want to --

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1 MR. ROBERTS: The specific question about
2 sharing of fire brigades?

3 CHAIR POWERS: Yes.

4 MR. ROBERTS: The Unit 1 and 2 is about a
5 half mile from Unit 3, so we will have separate fire
6 brigades as part of our emergency planning between
7 those two different units.

8 If there's a case that potentially that
9 later on down the road we can look at combining some
10 fire brigades to make a more robust response, we will
11 do that. But we haven't considered that at this
12 point.

13 MR. RODEN: Slide 10. Here is the human
14 performance-monitoring program. On that area we
15 decided to take a departure from the DC, the US EPR
16 HPM is replaced, that the UniStar HPM program, both
17 program rae very similar. We adapted the program on
18 our needs.

19 The ,key differences we have between the
20 two programs are summarized in that slide. We use an
21 Operational Focus Aggregate Index to trend the
22 performance of key variables that can impact the
23 operations' human performance.

24 And this aligns with INPO guidance and we
25 use our UniStar Corrective Action Program as one

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1 unique overarching program to track HFE issues and to
2 get operational feedback.

3 And we do not use a separate program for
4 human performance monitoring, but this is part of our
5 corrective action program.

6 MEMBER SKILLMAN: What is the
7 classification of this departure? It's a two-star or
8 Tier 1 or Tier 2?

9 MR. RODEN: It is Tier 2.

10 MEMBER SKILLMAN: Okay, thank you.

11 MEMBER STETKAR: I am assuming this
12 process is in place already at Units 1 and 2? Is that
13 true?

14 MR. ROBERTS: You are referring to the
15 operational index?

16 MEMBER STETKAR: Yes.

17 MR. ROBERTS: Yes. That is correct and
18 it's the way the industry is headed, down this road.

19 MEMBER STETKAR: Thank you.

20 MR. RODEN: On next slide there is a
21 little more details on the human performance-
22 monitoring program. The bottom line, we meet the
23 requirements of the NUREG-0711, and we have five
24 sub-bullets which describe the set of tools that build
25 this program.

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1 As already talked, we have the corrective
2 action program that will be used to track, to
3 document, to trend and to resolve issue that may
4 occur.

5 We will have a design change control
6 process that will be used any time a significant
7 modification will affect the human-system interface
8 and we will use a similar tool and monitor the
9 performance, the human performance with this change,
10 to be sure that there is no degradation.

11 We will use the Probabilistic Risk
12 Assessment any time we will have an issue where the
13 plant or the personnel cannot be monitored or
14 simulated easily, and we will have our plant
15 maintenance and inspection program to have our SSC
16 working properly and to have the operator will have
17 proper notification when a system or equipment is
18 unavailable.

19 And the last bullet is about the
20 Operational Focus Aggregate Index that we use to trend
21 the performance of the personnel of the plant.

22 MEMBER STETKAR: Cyril, I am going to put
23 you on the spot for the PRA bullet. We had a little
24 bit of discussion about that topic during the DCD
25 Chapter 18 discussions.

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1 At that time, AREVA said that they were
2 determining the significance of particular operator
3 actions for special attention or incorporation within
4 the human factors engineering program, based on some
5 type of numerical importance ranking, that it's my
6 understanding works as follows, that suppose you have
7 two actions, one action during full-power operation
8 and a different action during shutdown, and you do the
9 risk assessment, and each of those actions has the
10 same Risk Achievement Worth. Let's just call it an
11 index of 100.

12 However if the risk, the total risk
13 average -- excuse me, it's early in the morning, I'll
14 say it again -- average annual risk during shutdown
15 was only 10 percent of the average annual risk during
16 power operation because you are only shut down a small
17 fraction of the time, that particular action during
18 shutdown would be discounted by a factor of 10. In
19 other words, it's not as important so it would receive
20 less attention.

21 That doesn't seem to be reasonable for the
22 purposes of placing an emphasis on human factors
23 engineering for that second action. If it's very,
24 very, very important to risk during shutdown, I should
25 care an awful lot, for example, that the operators

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1 have adequate alarms, indications, procedures for that
2 action, regardless of the fact that I am only in
3 shutdown, you know, a month out of every couple of
4 years or so.

5 So I was curious whether you had thought
6 much about that as you transition from sort of, that
7 guidance in the DCD human factors engineering process
8 to your own plant-specific human factors engineering,
9 whether you were just basically going to adopt that
10 scaling process verbatim, and if so, why that's
11 reasonable.

12 It's a long question. You are not a PRA
13 guide but your slide does have a bullet that says PRA.

14 CHAIR POWERS: But this is a critical
15 aspect of human engineering. I don't care --

16 MEMBER STETKAR: Well, it isn't --

17 CHAIR POWERS: if you use PRA or roll dice
18 to do it, we still need to understand If there is a
19 critical action during shutdown that's risk-important,
20 I don't think you should be de-weighting.

21 MR. RODEN: No, you should -- you should -
22 - that's my opinion anyway, you should make sure that
23 you have adequate you know, indications, alarms in the
24 control room, that you have adequate procedures, you
25 have adequate training for the operator, because if

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1 the operator's ever placed in that situation during
2 shutdown and he doesn't have that supporting
3 information, it's not going to be a good day at 3.

4 MR. RODEN: I do not have a clear answer
5 to that. As you said, it's a long question. From the
6 human performance-monitoring program itself, as I
7 stated, the use of the PRA is really used when you
8 can't modulate or use a simulator to that particular
9 area.

10 MEMBER STETKAR: Yes, it's a slightly, you
11 know the way you described it, and the way it's
12 described in your FSAR, it's a slightly different
13 context from the context that I brought up.

14 The context I am concerned about is how is
15 the PRA used or how are those risk-significance
16 measures used to identify risk-critical actions that
17 you want to pay particular attention to, either in the
18 hardware design, the layout of the boards and things
19 like that, or you know, if not that, certainly in your
20 procedures and your training for specific actions, and
21 in particular during shutdown because shutdown is
22 typically you know, discounted numerically in that
23 average annualized risk, just because of the short
24 term time of shutdown.

25 MR. ROBERTS: I might offer a little bit

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1 more information. It's -- you know if you look at our
2 PRAs, you have your shutdown risk PRA, it's a specific
3 document and within that document when we do our task
4 analysis for all our procedures that we use during
5 shutdown or Modes 4 through 6, we would specifically
6 look at those tasks to determine how reliable the
7 human performance is within those tasks and come up
8 with a human performance reliability type number that
9 would feed into that specific PRA, so it's not
10 necessarily a scaling between your full power PRA.

11 CHAIR POWERS: But the PRA is doing the
12 scaling for you automatically.

13 MEMBER STETKAR: But Tom, what you just
14 said is if you do that separately, you know if you
15 have a full-power PRA model and a shutdown PRA model,
16 and if you look at those human actions within the
17 context of each of those models, without worrying
18 about stitching them together, to get some sort of
19 average, overall plant risk, that sounds like it's
20 more responsive to my concern than, than the statement
21 in the DCD which says -- I won't read it verbatim --
22 but it essentially says that you discount the human
23 actions for example during shutdown, if the shutdown
24 produces lower average annualized risk when you put
25 the two models together.

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1 I mean, that's -- that's -- and we had
2 some discussion about that and they, you know,
3 essentially confirmed that's the way it was envisioned
4 to work.

5 From what you just said, if you do it
6 separately, then those two actions that I mentioned
7 that would have a numerical weighting of 100 during
8 shutdown and 100 during power, in principle should
9 receive equal attention, if I understood what you were
10 telling me about the process that you used.

11 So that's somewhat encouraging, but it's a
12 little bit different than the process that's
13 described, or at least the way I understand it in the
14 DCD, as far as identifying which of those actions you
15 really do want to pay attention to.

16 So you may want to think about that a
17 little bit. It's -- in -- I don't know what -- in Rev
18 2 of the DCD the discussion is in section 18.6.3 --
19 I'm sorry, that's of the SER. I don't have the
20 section number of the DCD.

21 But it has to do with -- it quotes
22 Fussell-Vesely importance and risk achievement worth
23 and how you weight things, so you may want to look at
24 that and think about it in the context of how you are
25 actually going to implement the program at Unit 3.

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1 MR. ROBERTS: We'll do that. Thank you.

2 MEMBER STETKAR: I recognize that this is
3 a bit of a discussion for the DCD, but if indeed you
4 had a little bit different philosophy about how you
5 wanted to do that, that's the reason I was sort of
6 asking you to explore whether you had thought about
7 that at all.

8 MR. FINLEY: Right, to this point, we
9 haven't developed the details of the program that
10 would use the PRA insights, so we plan to follow
11 essentially what's in the US EPR FSAR at this point,
12 and have not actually written the process.

13 MEMBER STETKAR: Okay.

14 MR. RODEN: And that is all for me. Thank
15 you very much.

16 MR. FINLEY: Thank you, Cyril. So in
17 conclusion, Slide 13, Cyril has discussed the five COL
18 items. Again, we have no ASLB contentions. There is
19 one departure, enhancement I would say, to the human
20 performance monitoring program. We have no SER open
21 items. We have responded to all the REIs and there
22 are two SER confirmatory items and if there's no other
23 questions, that's all we have.

24 CHAIR POWERS: Any other questions you
25 would like to pose? Let me emphasize that we are very

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1 interested in this prioritization of importance of
2 tasks, especially in the shutdown versus the normal
3 operations so we will be interested in how that comes
4 along once it starts coming along.

5 MR. ARORA: Okay, understand, thank you.

6 MS. FORD: All right, good morning. As I
7 mentioned before, my name is Tanya Ford and I am the
8 project manager responsible for coordinating the
9 staff's review of Chapter 18, for the Calvert Cliffs
10 Unit 3 Combined License Application.

11 Today's presentation will cover the
12 staff's Phase II Safety Evaluation Report for Chapter
13 18. The technical staff that supported this review
14 include members of the Operator Licensing and Human
15 Performance Branch, Paul Pieringer and Jim Bongarra.

16 There were two questions issued to the
17 applicant requesting additional information for
18 Chapter 18. As stated previously, there are no open
19 items identified, however there are two confirmatory
20 items that will be discussed later in the
21 presentation.

22 If there are no general questions, at this
23 time I would turn the presentation over to Mr. Paul
24 Pieringer, who will continue the human factors
25 engineering presentation for the staff. Paul?

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1 MR. PIERINGER:. I'm Paul Pieringer. I am
2 the technical reviewer for Chapter 18. I guess one
3 point of clarification. We do have one open item that
4 tracks completion of the EPR FSAR, just to make sure
5 that when that's done we go back and check this
6 particular safety evaluation and make sure it's
7 accurate.

8 There are two confirmatory items. Both of
9 these, the applicants provided updated documents to
10 reflect an update to the latest revision of the FSAR
11 plus the answer to the two questions from the RAIs.
12 I'll discuss those in more detail in the next slide.

13 The COL information item that dealt with
14 the design of the emergency operating facility does
15 conform to NUREG-0696. The staff's concern here has
16 been that many applicants just say use an IBR, and
17 they go directly to the Design Certification Document,
18 which typically, to my experience, only covers the
19 data that is going to be presented in the EOF, not
20 necessarily the layout of the complex, trending of
21 data, accessibility of data, those other elements that
22 HFE design looks at.

23 So by virtue of the applicant's reference
24 to the NUREG-0696 and the design certification, he had
25 a complete set of commitments relative to that

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1 particular design.

2 The staffing and qualifications
3 information item, the applicants provided the standard
4 industry list of engineering expertise and operating
5 expertise that's based from operating experience from
6 the operating reactors.

7 What we are particularly interested in in
8 this area, is that the staffing they are committed to
9 is actually bounded by the existing regulations. The
10 reason we are interested in that is because as we get
11 more towards advanced reactors and passive cooling
12 designs etcetera, there's different qualifications and
13 perhaps different staffing levels could potentially be
14 needed.

15 And so what we do is we back up to the EPR
16 FSAR in this case, particularly the task analysis
17 element and we look at that task analysis result and
18 verify that the qualifications and staffing
19 requirements identified in that task analysis are
20 actually consistent with what the applicant is
21 submitting in their FSAR and in this case we are still
22 waiting for that task analysis to be completed.

23 So this is one of those interfaces between
24 the EPR FSAR and the Calvert FSAR, and so ITAAC 5 is
25 there and we credited that with completing this

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1 verification.

2 Procedures and training are both operating
3 programs, they are addressed in Chapter 13. What we
4 are doing here is we are eliminating redundancy in the
5 safety evaluation reviews.

6 We have gone back and we have verified
7 that everything that we would look at in human factors
8 space is included in the inspections that are
9 conducted under the operating programs.

10 I did want to take a little bit of a
11 digression here and just go through the -- an outline
12 of how procedures are handled because it was
13 discussed at a previous meeting here.

14 But the Chapter 13 review specifically
15 looks at the scope of procedures, both administrative
16 and operating, and then at the program for developing
17 those procedures.

18 And then most importantly, it looks at the
19 procedure generation package. I can discuss procedure
20 generation package in more detail if there's interest,
21 but the bottom line on that is that three months
22 before training on EOP starts, the staff receives step
23 procedure generation package, reviews it and writes a
24 safety evaluation on it.

25 MEMBER STETKAR: And Paul, that is three

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1 months before training, so that would be in principle
2 perhaps a couple of years before fuel load?

3 MR. PIERINGER:. Exactly.

4 MEMBER STETKAR: Okay.

5 MR. PIERINGER:. And it is formal
6 training, so they may be doing some informal training
7 even before that.

8 MEMBER STETKAR: Right, but as soon as you
9 start actually giving people exams -- okay, thanks.

10 MR. PIERINGER:. And then as we talked
11 about before, we also look at how these procedures
12 integrate with the operating panels and the training
13 programs during the integrated system validation that
14 is done as part of the HFE program.

15 The human performance monitoring program
16 is submitted as a deviation but I can tell you that
17 the EPR FSAR is virtually the same as the Calvert FSAR
18 in terms of fundamental program scope.

19 The reason it was submitted as a deviation
20 is because both the -- DCD -- I used the term
21 interchangeably, okay, DCD or the Calvert FSAR are
22 much more detailed than what we are used to seeing in
23 an HPM submittal.

24 And so Calvert was faced with having to
25 either take a lot of deviations to very small detail

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1 or one deviation which allowed the staff to basically
2 review their program directly against the 0711, and
3 for us that was -- we appreciated that decision
4 because it actually made -- it simplified our review.

5 They have included the fundamentals as we
6 see it and that's an integration with the corrective
7 action process, integration with operating experience
8 and integration with the operator training program.

9 And those are the three pieces that 0711
10 fundamentally directs us towards and they had a good
11 program for doing that, and a lot of other detail on
12 how they were going to trend and track the results
13 from that program.

14 MEMBER STETKAR: Paul, before you leave
15 this slide, when -- your brief discussion of the first
16 bullet reminded me of something from our -- in our
17 meeting in August, and I also tend to call things the
18 DCD, but the design certification FSAR.

19 Some submittals include what's called a
20 minimum inventory of annunciators, alarms, displays in
21 the main control room as part of either the certified
22 design or the COL application.

23 This one does not, and my recollection was
24 the staff apparently issued a revision to Branch
25 Technical Position 18-1 -- I am reading from my notes

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1 here so excuse me if they are wrong, I wanted to see
2 if I could get some clarification -- saying that that
3 is not necessary because since the entire human
4 factors engineering program or the vast majority of it
5 is a post-COL activity, there's no need to submit
6 those minimum inventories until some time before fuel
7 load. Is that -- am I interpreting that correctly?

8 MR. PIERINGER:. I'd like to add a little
9 bit more --

10 MEMBER STETKAR: Okay.

11 MR. PIERINGER:. of the fundamentals of
12 why we made that decision. It's not that minimum
13 inventory is not important. In fact, it's probably
14 the most important set of controls, displays and
15 alarms that we are interested in.

16 MEMBER STETKAR: Right.

17 MR. PIERINGER:. What we didn't want to
18 happen is to have that most important set developed
19 outside of the staff-approved processes and so what we
20 saw happening was is that to meet the -- let me see,
21 the EPR FSAR deadlines, the EPR staff was using
22 generic technical guidelines and coming up with their
23 set of what they believed to be the best controls,
24 displays and alarms.

25 And it was pretty good but in my opinion,

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1 I was reluctant to say it was good enough because when
2 you go to the NUREG-0711 process, what it drives you
3 towards is first a specification on what functions are
4 being performed and then how those functions are
5 allocated, either automated actions or manual actions.

6 And then you do a task analysis using
7 that== taking those functions to a lower level of
8 detail, and then off the task analysis, you develop
9 your list of controls, displays and alarms.

10 And so I was probably the driver for
11 saying we really need to make sure that we keep the
12 controls, displays and alarms connected with the
13 functional analysis that's happening, the functional
14 allocation and then the task analysis, so that we
15 maintain the process and we don't encourage secondary
16 processes to develop that could undermine our primary
17 process. So that was more the fundamental argument
18 being used.

19 MEMBER STETKAR: Yes, and that's -- you
20 know, that's essential, that sort of feedback, if you
21 can call it -- I don't know whether it's a feed
22 forward or a feedback loop.

23 But I guess my concern is looking back at
24 the whole design certification and licensing process
25 is that identification of some person's or group's

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1 concept of a minimum inventory of important
2 indications and alarms early in the process, could
3 help the designers if the designers hadn't -- the
4 hardware designers, the people who are actually, you
5 know, building the hardware to the extent that it's
6 built, identifies things that they might not have
7 thought of otherwise.

8 And if you delay that process until too
9 late in the evaluations, there may be a lot of
10 reluctance on the part of hardware designers for
11 example to install new indications and alarms.

12 So there's always that risk. There's
13 always the risk that when you complete the entire
14 human factors engineering process, you identify
15 something that you hadn't thought about.

16 The question is where in the whole
17 timeline of the process is the applicant or the
18 combined applicants willing to accept that risk?
19 Because you are right, you really never know exactly
20 what you might need until you finish that final task
21 analysis.

22 MR. PIERINGER:. And I would say that
23 perhaps you may not even know what you really need
24 until you finish the final V&V.

25 MEMBER STETKAR: That's probably true.

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1 MR. PIERINGER:. And the same argument you
2 are making could be applied to like operating
3 experience. There are like -- well, you are familiar
4 with the six first elements of the 0711 process are
5 all design inputs, and so what we have been stressing
6 to the applicants is you really can't do your HSI
7 design, which is section 8 of the 0711, until you have
8 got these design inputs done.

9 So it doesn't make a lot of sense to us if
10 you come in with an application that's got all your
11 design input work deferred out.

12 And so more and more are coming in with a
13 lot of that work submitted as final design versus DAC,
14 now not all, and so we still -- we still are
15 challenged by that point you are making here of how
16 quickly can you get that design input information.

17 MEMBER STETKAR: In particular because we
18 are talking about EPR, you know, US EPR today, they
19 are one of the design centers that have a lot more
20 information about the design available at the design
21 certification stage rather than pushing it off to DAC.

22 And that's you know, another reason why I
23 was a little bit -- I don't want to use the term
24 concerned -- curious at least for this particular
25 design center, why, you know why they couldn't at

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1 least specify some of that minimum inventory,
2 recognizing it will, of necessity it still is not
3 complete until you do all of the HFE work.

4 MR. PIERINGER:. There's a -- I don't
5 remember -- I only worked on the V&V section for the
6 EPR FSAR, but I believe they still have used DAC quite
7 extensively through their submittal, even on some of
8 the areas where they may have the design they have
9 submitted as a DAC.

10 MEMBER STETKAR: There is some, I mean I
11 am just looking at it in comparison to some of the
12 other design centers. There's much less here.

13 MR. PIERINGER:. Okay.

14 MEMBER STETKAR: Well let's just say less.
15 But I didn't -- if I hear you, the basic idea is that
16 from the staff's perspective, you would rather see a
17 submittal -- well, it's not a submittal though because
18 all of this will be examined during an inspection
19 process.

20 MR. PIERINGER:. It becomes an ITAAC.

21 MEMBER STETKAR: It's an ITAAC, right.

22 MR. PIERINGER:. Right.

23 MEMBER STETKAR: But you'd rather have
24 that project process essentially one inspection of a
25 fully-integrated set of human factors, engineering and

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1 design rather than effectively a two-step process
2 where you look at you know the, whatever minimum
3 inventory is submitted at either the design
4 certification or the COL stage and then go back and
5 close the loop later.

6 MR. PIERINGER:. Yes. And it gives you
7 that connectivity too, with functions in particular,
8 so that you have --

9 MEMBER STETKAR: Well, but I mean that
10 connectivity would -- in principle would be available
11 at the ITAAC inspection stage anyway. Okay.

12 MR. PIERINGER:. It would be, yes.

13 MEMBER STETKAR: Thank you.

14 MR. PIERINGER:. That concludes my
15 presentation, pending any further questions.

16 CHAIR POWERS: I have a question. I don't
17 know whether -- I am not even sure how to ask it. But
18 what I am struggling with here is trying to understand
19 here's a plant that we have no -- no similar plant has
20 been built and operated, but there are plans afoot to
21 do so.

22 Do we get information from those plants
23 that come online earlier that is of any use to us?

24 MR. PIERINGER:. This borders between an
25 opinion here. From the EPR FSAR perspective, to my

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1 knowledge no, you don't get any additional operating
2 experience fed back in once you are into rulemaking,
3 unless the applicant decides they want to revise it
4 like Westinghouse did, and then we do look for an
5 update on the operating experience.

6 In thinking through that, I think the same
7 would be true of the COL applicant's SER. Once we
8 have approved that, that completes the operating
9 experience input.

10 Now, where you will see it interface is in
11 the V&V effort. On a full-scope simulator they run
12 scenarios, they come up with deviations. Those
13 deviations have to be resolved.

14 When they resolve them, they look, as you
15 would in any corrective action process, they look for
16 whether it's procedure-related deviation, a training-
17 related deviation, a human factors-related deviation
18 and they use operating experience to feed their
19 selection of corrective actions for whatever created
20 the problem.

21 And by virtue of Appendix B now, and
22 particularly the corrective action process, you will
23 see operating experience fed back in that way. But
24 that's the only way I know of where it's factored in.

25 MEMBER STETKAR: I mean, in principle, you

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1 know, you characterized it as this is a brand new
2 plant that has never been built or operated. That's
3 certainly true for the United States, but this design
4 in particular is not wildly different from designs
5 that had been operated in Europe for several years,
6 the basic, fundamental plant design, you know, the
7 operation of the systems and --

8 CHAIR POWERS: Well, it's the problem that
9 I'm wrestling with. I can find plants that are
10 sisters in this country and each has different
11 operating characteristics, remarkable differences.

12 And so here I am thinking what a real
13 challenge Tanya faced here in reviewing this because
14 the plant's never -- it hasn't been built. Nobody has
15 operated this plant.

16 And what you think about and the chances
17 that you, the applicants, the licensees had left
18 something out, seems to me to be extraordinarily high.

19 MEMBER STETKAR: Now, that's why I like
20 that minimum inventory early on because it gives you
21 some insights about what, you know, people have
22 thought about and in principle, where they have
23 learned from that relevant operating experience, what
24 are -- you know, whatever degree of relevance it might
25 have from sister plants in particular in Europe.

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1 At least you know it's not complete, you
2 know that it needs to be, to be checked and verified,
3 when they complete the human factors engineering, but
4 it in principle, if somebody had discovered because of
5 operating experience it would be really, really good
6 for an operator to have a certain alarm that very
7 obviously alerted the operators to a particular
8 condition, you know, that in principle would show in
9 that minimum inventory early on, or should or could.

10 CHAIR POWERS: But it may not.

11 MEMBER STETKAR: It may not. It may not.
12 That's right. It may not. It may not.

13 CHAIR POWERS: Let me ask another question
14 that I again don't know how to ask, but we heard at
15 the beginning of this presentation, COLA applicant
16 outlined that he was setting up systems to be
17 independent and not shared with Units 1 and 2.

18 And he didn't go through clearly the trade
19 study that he did to come to that decision. He just
20 said here is how we are going to do it. When the
21 staff reviews those kinds of decisions, what kinds of
22 pros and cons does it look for?

23 I mean we are going to have here a system
24 in which two-thirds of the operators are trained on
25 one system, and one-third are trained on a different

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1 system. How do you look at that?

2 MR. PIERINGER:. From a -- I'm going to
3 narrow this to the how do we look at it from an HFE
4 perspective.

5 CHAIR POWERS: Yes, it's the HFE that I am
6 --

7 MR. PIERINGER:. It's obviously the
8 training and emergency planning --

9 CHAIR POWERS: Yes, there are lots of
10 other things. I'm interested in the HFE, yes, that's
11 right.

12 MR. PIERINGER:. But fundamentally we
13 assume that they are going to be trained and that
14 training is effective. If it's not, then it's found
15 during emergency drill exercises.

16 So we understand there's several barriers
17 in emergency planning area that are downstream that
18 aid us in identifying human performance issues, and
19 that is the primary reason I think that the HFE
20 prescription for the Tech Support Center in the EOF
21 aren't as fully-developed as they are for the Control
22 Room.

23 So, when we get to the EOF, we are faced
24 with what I would call more generic guidance and the
25 way we apply that is fundamentally we look for data

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1 accessibility, can the person who needs the data find
2 it and get to it accurately, which takes you back to
3 plant layout and Control Room console -- EOF console
4 design, and anthropometric data, how big the screen
5 sizes are etcetera.

6 So we look at that element, and then we
7 look at data presentation, trending -- is trending
8 available -- to some extent, data recovery. In this
9 case one of the concerns was that the EOF is certainly
10 getting all the data from the -- the plant computer,
11 from the integrated digital platform, wherever it's
12 coming from.

13 But the EOF is also getting typically
14 radiological protective information from a lot of
15 teams. It doesn't necessarily go through any --
16 through the Control Room.

17 So we are looking to make sure that that
18 particular element of the EOF is addressed within the
19 scope of the plan. Now that is primarily done however
20 under ITAACs.

21 We look at their commitment to 0696 and it
22 says yes, they are going to meet these general
23 standards and then we wait until the ITAAC and we do
24 inspections to verify that they have actually
25 succeeded in meeting those standards, and we do the

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1 judgement by analyzing their performance during the
2 emergency drills.

3 And it's that transition where you are
4 going from human factors really to emergency planning
5 space and it's the emergency planning inspectors who
6 are doing that assessment.

7 CHAIR POWERS: I think what -- correct me
8 if I am wrong. I am coming away with the impression,
9 in this particular area we review things as best we
10 can, based on the inventory of experience that we have
11 derived from a variety of sources and whatnot.

12 And what we are relying on in all these
13 pre-activities -- the training, the simulators, and
14 things like that -- will catch anything that we may
15 have omitted or been pollyanna-ish in our views about
16 and things like that, that the system -- I mean,
17 essentially the system is set up, you review as best
18 you can and then you have a checking function that
19 presumably catches the more egregious omissions.

20 MR. PIERINGER:. Where I would add to what
21 you stated was that we have a fairly -- we have a
22 detailed process for how to do human factors
23 engineering, and I would say that it has a high
24 potential for identifying 99 percent of the necessary
25 --

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1 CHAIR POWERS: I fully agree with that.

2 MR. PIERINGER:. Right. And when we get
3 to the V&V section, it's not so much the egregious
4 misses that we are looking for, it's the subtle
5 things, it's the interfaces between operators,
6 communications that takes place or doesn't take place,
7 it's things that are in the wrong location, things
8 that can't be read, hesitation, things that just cause
9 the operators to stop and think or stop and get
10 confused --

11 CHAIR POWERS: What's going on here.

12 MR. PIERINGER:. or whatever, right?

13 CHAIR POWERS: Yes.

14 MR. PIERINGER:. And so the test is, is
15 the process really robust? We believe it is, and as
16 we have done reviews, we have found areas that we
17 needed to develop further and we are doing that in Rev
18 3 now.

19 But generally, those have been more of
20 enhancements, not fundamental changes to what we are
21 looking at.

22 CHAIR POWERS: Where I think you have hit
23 the nail on the head is, is the process robust, is
24 really the question that should be asked and
25 apparently is asked, and you are coming away with an

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1 affirmative conclusion on that.

2 MR. PIERINGER:. I am convinced that it is
3 by virtue of the level of detail we go to in
4 understanding the process. Typically a general
5 applicant comes in with a pretty general statement of
6 how the HFE program is going to run, and the first set
7 of RAIs drives us down to working-level procedures and
8 we pull up a lot of information from working-level
9 procedures to tell the staff how the process is
10 working, you know, what criteria are being used, when
11 things are reviewed, how they are reviewed, etcetera,
12 and it's that level of detail we are really using to
13 validate the process.

14 Now, there's a part of me that wants to
15 reserve, kind of, aside, five percent safety margin
16 here that says we will really know how well it works
17 when we see that V&V.

18 And so we have got a fairly developed
19 inspection plan going forward to look at that V&V
20 effort, make sure its being run in accordance with all
21 the direction for V&V, but make sure that it actually
22 results in a V&V that exercises the processes that we
23 have approved.

24 So it's the classic comparison of here's
25 our licencing basis, we are going to validate that,

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1 and here are the results, we are going to validate
2 that, and I think that -- by looking at the results
3 from that V&V inspection, we'll be in a very
4 comfortable position at that point. I'll be able to
5 take my five percent safety factor and report back to
6 you that it's either good or we have some additional
7 improvement.

8 MEMBER STETKAR: I think a lot of that --
9 and remind me if I'm wrong, because I've a terrible
10 problem remembering details of things these days -- I
11 think an important part of that V&V process though is
12 the selection of the scenarios that you actually use
13 for your V&V activities and you know, by implication,
14 serve as a basis for your inspection activity.

15 If those scenarios are not cleverly -- let
16 me use that term -- selected to challenge a fairly
17 broad spectrum of human performance, both individual
18 and team interactions, procedures and potential
19 confusion and whatnot, then all you are doing is
20 verifying, you know, essentially rubber-stamping
21 something that you knew already, that yes indeed, they
22 can start up the plant, yes indeed, they can shut down
23 the plant, but --

24 So I'm hoping that the guidance for your
25 inspectors and the guidance in the guidance documents

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1 spends a little bit of time on how one crafts those
2 scenarios.

3 Because if you know, the -- the
4 appropriate selection of those scenarios will do awn
5 awful lot to give you that extra confidence, that
6 extra five percent that you are talking about.

7 MR. PIERINGER:. I am in 100 percent
8 agreement. In fact, EPR was the design center where
9 we really exercised or developed, fully developed
10 that. We did it with the ESBWR, too, but we
11 specifically asked for all scenarios to be submitted
12 as part of the DCD for that reason.

13 What we found is that that was not a
14 reasonable request because part of the scenario is
15 specific acceptance criteria and many of those
16 acceptance criteria aren't available yet because they
17 mostly relate back to thermodynamic performance of the
18 plant in terms of pass/fail and then the rest of the
19 criteria are more human performance.

20 But so what we said is okay, well if you
21 can't provide all the scenarios, we want a minimum of
22 three scenarios that represent diverse types of plant
23 transients.

24 And then we reviewed those three as models
25 against all the criteria from 0711, and we accepted

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1 those three plus the commitment in an implementation
2 plan for V&V.

3 And then there's an ITAAC to complete
4 development of the remaining scenarios and so during
5 this discussion we have, it's clear that those ITAAC -
6 - those ITAAC scenarios have to reviewed and approved
7 prior to running the I&V, and there's a timeline here,
8 just like there's a timeline with the rest of the
9 sections of 0711.

10 MEMBER STETKAR: My recollection is that
11 the inventory of those scenarios, I think someone told
12 me, is typically on the order of 10 to 15 to 20 type
13 scenarios. I mean it's not 100 scenarios and it's not
14 5.

15 MR. PIERINGER:. Typically the numbers we
16 have seen are 20 or more.

17 MEMBER STETKAR: Okay.

18 MR. PIERINGER:. And they aren't just a
19 LOCA, large-break LOCA.

20 MEMBER STETKAR: Right, no that's --

21 MR. PIERINGER:. They are --

22 MEMBER STETKAR: That's what you don't
23 want to run.

24 MR. PIERINGER:. They are a LOCA with a
25 lot of distractions to the operator, equipment

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1 failing, equipment doesn't work, you know, just trying
2 to put the operator in a worst-case configuration.

3 And what we have stressed is that we are
4 not testing the operator. We are testing the
5 human-system interface. And so applicants were
6 initially coming in with training scenarios and those
7 really weren't in my opinion challenging enough.

8 And so when we worked through the guidance
9 in 0711 plus these draft scenarios these sample
10 scenarios, we came up with what I thought was a good
11 combination.

12 And so the draft scenarios, the sample
13 scenarios -- I'm sorry -- the sample scenarios will
14 actually establish kind of a precedent that inspectors
15 will use to say that the other 17 or whatever are
16 comparable to the three that the staff has already
17 reviewed.

18 MEMBER STETKAR: I'd be interested to see
19 how that works out. That's not part of a COL activity
20 obviously, but somehow.

21 CHAIR POWERS: I find this discussion just
22 very, very useful by the way, I mean, it's a nice
23 discussion to understand how you do things, because I
24 am sitting here blanching at, oh my God, how do you do
25 this thing, and you guys have obviously done it and

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1 it's nice to hear how you are thinking.

2 Other questions you'd like to pose to the
3 speakers?

4 MS. FORD: Well, this concludes our
5 Chapter 18 presentation from the staff, and thank you
6 for your time.

7 MR. ARORA: I want to thank you, Dr.
8 Powers and members of the Subcommittee for giving us
9 the opportunity to bring this Chapter to you today.

10 CHAIR POWERS: Again, this kind of
11 discussion on how you think about doing things and how
12 you go about doing it was just extraordinarily helpful
13 to me anyway, and I appreciate you taking the time to
14 do that.

15 MR. ARORA: Sure.

16 CHAIR POWERS: The number of outstanding
17 items is all very interesting but how you think about
18 things is really quite interesting.

19 No further comments, we will break until
20 10 o'clock.

21 (Whereupon the above-entitled matter went
22 off the record at 9:39 a.m. and resumed at 10:00 a.m.)

23 CHAIR POWERS: Let's come back into
24 session. We are going to discuss the US EPR's design
25 certification overview of the GSI-191 approach.

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1 Getachew Tesfaye will begin the discussion for us.

2 MR. TESHAYE: Thank you Mr. Chairman.
3 Thank everyone. Good morning. My name is Getachew
4 Tesfaye. I am the NRC project manager for AREVA's US
5 EPR design certification project.

6 Today and tomorrow we continue our first
7 three ACRS presentation of the staff's Safety
8 Evaluation Report with open items. For the record, I
9 will briefly summarize our first three activities.

10 To date, we have completed the first three
11 presentation of 14 of 19 chapters. We have presented
12 Chapter 8, electric power, and Chapter 2, site
13 characteristics on November 3rd, 2009, and Chapter 10,
14 steam power conversion system and Chapter 12,
15 radiation protection, on November 19th, 2009.

16 On February 18 and 19, 2010, we presented
17 Chapter 17, Quality Assurance, and portions of Chapter
18 19 for realistic risk assessment in civil accident
19 evaluation.

20 On March 3, 2010, we presented Chapter 4,
21 reactor, Chapter 5, reactor coolant systems and
22 connector systems.

23 On April 6, 2010, we presented Chapter 11,
24 radioactive waste management, and Chapter 16,
25 technical specifications.

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1 On April 8th, 2010, we briefed the ACRS
2 full Committee on the seven chapters that were
3 completed through March 2010.

4 On April 21, 2010, we completed the
5 Chapter 19 presentation. Also on April 21, 2010 we
6 received a letter from the ACRS full Committee
7 Chairman on the seven chapters that were completed
8 through March 2010.

9 The letter stated ACRS has not identified
10 any issues that merit further discussion. On May 27,
11 2010, the staff submitted its reply to ACRS.

12 On November 30, 2010 we presented Chapter
13 13, conduct of operation. On February 7 and 8, 2011,
14 we presented group 1 sections of Chapter 15, transient
15 and accident analysis. On March 23, 2011, we began
16 the Chapter 15 group 2 presentations with realistic
17 large-break LOCA topical report presentation.

18 On April 5, 2011, we presented Chapter 6,
19 engine and safety features. On August 18, 2011, we
20 presented Chapter 18, human factors engineering and
21 completed Chapter 15, transient and accident analysis
22 by presenting group 2 sections.

23 Today and tomorrow, November 14 and 15, we
24 will present Chapter 9, auxiliary systems, all
25 sections except 9.1, and Chapter 7, instrumentation

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1 and controls.

2 In addition, AREVA will make an
3 informational presentation on Generic Safety Issue
4 191, GSL-191, assessment of debris accumulation on PWR
5 sump performance.

6 We plan to present chapter 9, section 9.1
7 and Chapter 3, design of structures, components,
8 equipment and systems, on January 17/18, 2012. Our
9 current schedule calls for completing first
10 representation by February 2012.

11 That completes my prepared remark, Mr.
12 Chairman, and thank you.

13 CHAIR POWERS: Derek, have we volunteered
14 to bring some chapters forward?

15 MR. WIDMAYER: We did but we are not going
16 to be doing it in December. We volunteered, but it's
17 not going to work out.

18 CHAIR POWERS: They are not cooperating
19 with us, huh?

20 MR. WIDMAYER: I didn't say anything.

21 CHAIR POWERS: Have we moved it to
22 January?

23 MR. WIDMAYER: We can take it up with the
24 full Committee.

25 CHAIR POWERS: Yes, it looked to me like

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1 that was kind of low-intensity when I last looked at
2 it, because I mean we are developing kind of an
3 inventory of chapters that we have largely completed
4 and we just need to move them into the next section.

5 MR. WIDMAYER: Yes, we will look at
6 January.

7 CHAIR POWERS: Okay.

8 MR. COLACCINO: Dr. Powers, this is Joe
9 Colaccino at GPPR projects branch. We appreciate that
10 move to January. Quite frankly the staff is working
11 very, very hard to finish Phase II by the December
12 time frame so that we could definitely support
13 something in January.

14 CHAIR POWERS: Okay. We will look at it.
15 I know we volunteered to do it in December and I
16 think we got bounced for other things, and they have
17 just voted to have a January meeting but it looked to
18 me like the agenda was fairly light.

19 So we will try to make a press to move
20 some more chapters there and Derek will keep you
21 informed on that.

22 MR. COLACCINO: Right, you wouldn't be
23 able to do everything, obviously, that's -- and we are
24 -- we have just got --

25 CHAIR POWERS: We have got half a dozen

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1 that there were not any great controversies associated
2 with, so we can identify and just move them -- move
3 them forward in the process so we don't hang things
4 up.

5 MR. COLACCINO: Agreed. Thank you.

6 CHAIR POWERS: I mean I think that's
7 useful, just to get the letter to say we have done
8 this and to mark progress and things like that. I
9 mean clearly those issues that are deeply
10 controversial, and any one of the presentations which
11 Sloan failed to attend gets additional scrutiny, but
12 those where she was here and added incredible value,
13 we can move forward on. I couldn't resist.

14 MS. SLOAN: It's been a few months --

15 (Laughter)

16 CHAIR POWERS: Okay. We are going to
17 proceed on to the GSI-191. I understand that at some
18 point here you are going to want us to close this for
19 proprietary material.

20 MS. SLOAN: And we have a breakpoint slide
21 that will indicate when we have come to the portion of
22 the presentation that has proprietary information. I
23 would just say in advance of that, our colleagues from
24 UniStar and if there's anyone here from PPL, are
25 welcome to stay for the closed portion of the session,

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1 but we would ask the members of the public to be
2 dismissed.

3 CHAIR POWERS: We can think about doing
4 that.

5 (Laughter)

6 CHAIR POWERS: Okay. Are you ready? Go
7 ahead.

8 MS. SLOAN: We are ready.

9 CHAIR POWERS: Okay.

10 MS. SLOAN: It will be Dr. Powers and the
11 other members of the Subcommittee. We appreciate the
12 opportunity to come before you today.

13 CHAIR POWERS: More lies, right?

14 (Laughter)

15 MS. SLOAN: I'm paid to say that.

16 CHAIR POWERS: I see.

17 MS. SLOAN: Appreciate the opportunity to
18 come in advance of when you actually see the SER with
19 open items associated with GSI-191. We asked for this
20 opportunity at this point in time to give you an
21 overview of the US EPR approach for addressing GSI-101
22 related issues.

23 And within the time allotted, and we
24 recognize that this is a topic that has historically
25 generated quite a bit of interest. But within the

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1 time allotted today, which is approximately two hours,
2 we would like to give you an overview of the US EPR
3 approach to address GSI-191 issues, such as those
4 associated with sump strainer clogging, chemical
5 effects and fuel downstream effects.

6 I will say, knowing that there is
7 historically a lot of interest in this subject matter,
8 we will try our best to answer your questions today.
9 But if there are areas that you feel like we need
10 additional follow-up on, or you have other questions,
11 we will make note of those and we will come prepared
12 in our meeting in 2012 to address those particular
13 topics.

14 We have brought some of our subject matter
15 experts from AREVA today. Because it is, again, a
16 two-hour discussion, we brought these particular
17 folks. There is quite a larger team that is working
18 on GSI-191 for AREVA, who we can take the followup
19 questions back to, but we will try to do our best
20 today to answer your questions.

21 What I would like for you to get out of
22 the presentation today is that for EPR, our approach
23 reflects the commitment to resolving these issues at
24 the design phase, which is really I think unique
25 compared to, say, operating plants, where we are faced

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1 with the issue of trying to in retrospect, if you
2 will, backfit the plants to address these issues.

3 So by design, from the beginning, EPR
4 considered these effects, which gives us quite a few
5 advantages to resolve those issues at the design
6 phase.

7 You will also hear about the extensive
8 analytical evaluations that we have performed, as well
9 as a complementary test program to confirm performance
10 characteristics, and to demonstrate design margins.

11 Let's see. And I mentioned that portions
12 of the presentation will be closed. There will be a
13 pause prior to that, and then we will begin the
14 proprietary part of the discussion.

15 I will turn it over at this point in time
16 to my colleague Kevin Connell, who will introduce
17 himself, and then what we'd like to do is at the very
18 beginning, take the opportunity to have each of our
19 staff here talk about their background and
20 qualifications at the beginning, so that when it comes
21 time for the Q&A, they can just jump in and answer any
22 questions.

23 MEMBER BANERJEE: Let me just ask you a
24 question before you start. You have an extensive
25 effort in Erlangen AREVA, I don't know --

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1 MS. SLOAN: GmbH.

2 MEMBER BANERJEE: Yes, are you in touch
3 and are there people in Erlangen involved in your
4 program?

5 MS. SLOAN: Yes. And it's part of AREVA.
6 There are centers of expertise if you will, but then
7 there is collaboration across the various regions. On
8 this particular topic, there were experts engaged from
9 Germany, France and the US to address this issue.

10 MEMBER BANERJEE: They have also extensive
11 test facilities. Are you using any of those?

12 MR. CONNELL: We have used mainly the ones
13 in the United States that were already certified for
14 the --

15 MEMBER BANERJEE: Well, the first time I
16 actually saw downstream effects was in your Erlangen
17 facility.

18 MR. CONNELL: Yes, we had thought about
19 doing more of an integrated type of approach too, but
20 for the types of testing and the type of debris that
21 we had, we didn't feel as though we needed --

22 MEMBER BANERJEE: Was your debris
23 different from theirs?

24 MR. CONNELL: We have a low-fiber plant.
25 We are using lower fiber here in the United States.

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1 MS. SLOAN: What you will find, not
2 surprisingly, you probably appreciate, in each of the
3 different licencing environments, there are different
4 expectations.

5 MR. CONNELL: We presented this also to
6 MDEP in Helsinki a few weeks ago, and we went through
7 the differences and the similarities. The design is
8 the same.

9 The differences in the debris stream and
10 the regulations, we discussed that, too.

11 MEMBER BANERJEE: Is it regulatory-driven
12 or is it actual plant -- there are differences in the
13 plants?

14 MR. CONNELL: Oh, there's different
15 testing protocols that have already been established
16 here in the United States, and it's simpler to go
17 through the established protocols for the operating
18 plants and then for the previous design centers, than
19 it would be to renew the protocols, demonstrate why
20 these protocols are the most conservative.

21 There's so much history involved, we
22 decided to keep going down the same path that our
23 operating plants have been doing.

24 MEMBER BANERJEE: Okay --

25 MS. SLOAN: Just to address your question,

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1 it's both things.

2 MEMBER BANERJEE: Yes.

3 MS. SLOAN: There are slight differences
4 in the debris that Kevin talked about, in the design
5 in the different countries., the choices of insulating
6 materials, and assumptions, but there are also
7 differences in protocols.

8 MEMBER BANERJEE: Okay, let's hear it.

9 MR. CONNELL: Okay.

10 MEMBER BANERJEE: Because this was a very
11 impressive facility and I haven't seen the equivalent
12 here. Perhaps you have one, I haven't seen your
13 facility.

14 MR. CONNELL: Oh yes. Well, we have
15 similar testing facilities that we used here. But --
16 thank you Sandra -- as Sandra said, my name is Kevin
17 Connell, and I presented before a year -- I guess two
18 years ago, for Chapter 10.

19 But just a brief background. For the past
20 four years I have been manager of the systems and
21 plant design group for AREVA for new plants. Prior to
22 that, I had performed, it was project engineering
23 manager and procurement engineer for steam generator
24 replacements, performed 12 of those with Duke Power
25 and also with Duke Engineering Services and then AREVA

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1 SGT.

2 I started my career almost 30 years ago
3 with Duke Power as a system engineer, design engineer
4 for the original construction and start-up and
5 operation of Catawba Nuclear Station, so I have kind
6 of come complete circle in getting back to the plant
7 design also again.

8 I have with me Fred Maass, who is our
9 manager of the systems group and also Eugene Moore,
10 who is our thermal hydraulic expert. And do you want
11 to give a little bit of background?

12 MR. MAASS:. My name is Fred Maass. I am
13 manager at EPR systems, I have a BS in Mechanical
14 Engineering. I have been in the industry
15 approximately 25 years, in the commercial industry,
16 spent a few years with the the naval nuclear reactor
17 program.

18 Currently we are working on finalizing
19 this particular topic as part of our efforts in
20 systems engineering. So --

21 MR. MOORE: Good morning. My name is
22 Eugene Moore and I have a BS in mechanical engineering
23 from Ohio State and a Masters in nuclear from Texas
24 A&M. I have been with AREVA for almost six years and
25 for most of that time I have been in safety analysis,

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1 but for the last year and a half I have been on GSI-
2 191.

3 MR. CONNELL: And I failed to mention that
4 I have a Bachelors from Purdue University and a
5 Masters from the University of South Carolina, and
6 since both Fred and I went to Purdue and Gene went to
7 Ohio State and Ohio State lost to Purdue this weekend,
8 he has the honor of directing the slides.

9 (Laughter)

10 MR. CONNELL: All right. Thank you very
11 much. The next -- what we want to try to do, as
12 Sandra had said, is really give more of a
13 presentation, give you information about what we have.

14 We will go through a little bit of the details of our
15 design.

16 I'm not really sure how familiar you are
17 with the design. We will go through some of the test
18 facility information. We always have the opportunity
19 to come back later too, to give you some more
20 information as requested.

21 But this -- really the idea behind this is
22 mainly to get input, what kind of concerns, what kind
23 of questions you have. You have seen this of course
24 with other design centers, so what we want to do is
25 present what we have done with our design center, and

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1 see if there's any other information you would require
2 for that.

3 So for this presentation, what we will do
4 is go through a brief overview of the plant design
5 with respect to the debris-retention system, and then
6 get more into the strainer head loss testing program
7 and then into the final fuel assembly, downstream
8 effects testing.

9 So our basic design approach, what we did
10 was build from operating plant experience. One of the
11 key difference between the operating plants and what
12 we have here with the EPR is our in-containment
13 refueling water storage tank.

14 Now this is similar to a function with the
15 refueling water storage tanks, the RWSTs that are in
16 operating plants. This IRWST is located immediately
17 below the RCS systems, below the heavy floor. We will
18 have a cutaway section so you see that. It's a very
19 large pool for over 400,000 gallons, and that's the
20 primary difference between it.

21 We also have what we feel is a very robust
22 three-tiered retention system. We have first a weir
23 with a trash rack associate with it that's right below
24 the RCS, then it goes into retaining baskets and those
25 retaining baskets are partially submerged in the

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1 IRWST, and then it would then get carried to the
2 strainer itself.

3 CHAIR POWERS: What are the surfaces in
4 the IRWST?

5 MR. CONNELL: These are mesh surfaces, not
6 perforated plate, but mesh surfaces.

7 CHAIR POWERS: That's on the filter, the
8 IRWST itself?

9 MR. CONNELL: Oh, it's stainless steel.

10 CHAIR POWERS: Stainless steel, unpainted?

11 MR. CONNELL: Unpainted. And again I will
12 get into some more details and we will have some
13 pictures too we can take a look at, of our sister
14 plant, OL3. But the other part that we have really
15 focused on too, especially in the last year, was
16 trying to reduce the overall risk by creating -- by
17 specifying low fiber, in fact we don't have any fiber
18 in the zone of influence for this design.

19 MEMBER BANERJEE: Do you have it outside
20 the zone of influence?

21 MR. CONNELL: Outside, there may be some.
22 We reserved the right to be able to do some of that
23 too, but -- and our testing has had of course some
24 fiber testing in its --

25 MEMBER BANERJEE: What is the fiber?

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1 MR. CONNELL: Nukon blanket.

2 MEMBER BANERJEE: And within the zone of
3 influence you have what, jacketed Nukon?

4 MR. CONNELL: Reflective metal. And so
5 the other part of our program too, to reduce the risk,
6 is to have a cleanliness program that restricts the
7 amount of latent debris and as a result the latent
8 fiber that is in the latent debris.

9 This has been reviewed and discussed and
10 agreed upon with our COL applicants too. It is an
11 aggressive but very achievable cleanliness program,
12 but again, focused to reduce the overall debris and
13 then as a result, the latent debris.

14 CHAIR POWERS: In the zone of influence,
15 all your coatings are qualified?

16 MR. CONNELL: Yes.

17 CHAIR POWERS: So you don't have any
18 unqualified coatings going in?

19 MR. CONNELL: No. I don't believe so.
20 Fred?

21 MR. MAASS:. No.

22 MR. CONNELL: Okay. Now, this is a
23 cross-section of our debris-retention system.

24 MEMBER BANERJEE: Your buffer is?

25 MR. CONNELL: Is TSP, trisodium phosphate.

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1 That's actually located right here. In this cross-
2 section, picture just above here would be where the
3 RCS is. This is the heavy floor right below the
4 reactor coolant system. A break location up here
5 would then flow through the -- across the heavy floor
6 to our two-inch weir, and then we have a trash rack
7 that would then cover the opening to the IRWST.

8 The trash rack is a four by four inch
9 grid. The water would spill through, our TSP baskets
10 are located here, and our buffer would then take
11 effect with the flow that comes into the IRWST.

12 This here is the IRWST. Partially
13 submerged in this, is our retaining basket. That's
14 our -- this, if you think of it, would be our first
15 line of defense, the weir and the trash rack. The
16 second line of defense --

17 CHAIR POWERS: And the surfaces in that
18 weir and trash rack and things like that, they are all
19 stainless steel as well?

20 MR. CONNELL: This would be coated
21 concrete, correct?

22 CHAIR POWERS: Coated with what?

23 MR. CONNELL: Qualified coatings, epoxy --

24 MR. MAASS: That's what we've assumed is
25 epoxy, top-coated epoxy.

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1 MEMBER SKILLMAN: Trash rack area,
2 approximately how much please?

3 MR. CONNELL: Trash rack area is
4 approximately, I thought it was around six foot by
5 around four foot approximate area. I have seen this a
6 few weeks ago at OL3 in there, and it was
7 approximately six foot by four feet.

8 MEMBER SKILLMAN: The cross-section there
9 shows that it is vertical. Is that a cage, or is that
10 a floor -- MR. CONNELL: Yes, there's a
11 few more slides on -- this is what it actually looks
12 like.

13 MEMBER SKILLMAN: Oh, okay. I'm sorry.
14 You can go back to where you were. Thank you.

15 MR. CONNELL: No problem.

16 MEMBER SKILLMAN: Oh, one more question.

17 MR. CONNELL: Yes.

18 MEMBER SKILLMAN: The vertical drop from
19 the trash rack area down into the retaining basket?

20 MR. CONNELL: Yes.

21 MEMBER SKILLMAN: Is this a funneled or
22 conduited entry, or is this just Katie bar the door,
23 down comes the water and it ends up where it ends up?

24 MR. CONNELL: Well, the gap between the
25 top of the retaining basket and the bottom of the

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1 heavy floor is a foot and a half. It's not very far.

2 And there is an overlap region. There's -- the
3 baskets are wider than the opening itself.

4 MEMBER SKILLMAN: Thank you.

5 MR. CONNELL: So the break flow again
6 would come down into -- first it would flow down into
7 the retaining basket. Now, heavy debris, reflective
8 metal, insulation, large components, gloves, you know,
9 any kind of large debris, would first get stopped by
10 this trash rack.

11 Whatever would come through a four by four
12 opening, then would go down into our retaining basket.
13 The retaining basket has a 0.08 by 0.08 inch mesh. So
14 the flow would then come down into here.

15 Initially, of course, it would be at the
16 same level as the IRWST but as debris would
17 accumulate, it is allowed to then rise and the basket
18 filtration system keeps filtering the debris before it
19 communicates directly into the IRWST.

20 And in the case where you would have
21 complete debris blockage in here, which we didn't
22 necessarily have, but you would then flow over into
23 the IRWST.

24 Now, so the fluid would communicate
25 through the retaining basket, through the 0.08 mesh,

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1 and also could communicate over the top of the
2 retaining basket.

3 And then -- so this would be more or less
4 the second line of defense. The last line of defense
5 would be the strainer itself, and again, the material
6 is the same strainer material we have on the basket of
7 0.08 inch by 0.08 inch grid.

8 And then the flow would then be taken into
9 the suction of the ECCS pumps.

10 MEMBER SKILLMAN: How was the 0.08 by 0.08
11 mesh chosen?

12 MR. CONNELL: Good question. It was the
13 original design we had for OL3. That was designed for
14 the types of debris that they have had through
15 operating plants.

16 Last year we went through another
17 sensitivity testing program to see if we could tune
18 that material to something possibly smaller. Some of
19 the plants have been using some smaller perforated
20 plate, smaller grids.

21 We found that that did not significantly
22 affect the bypass for the type of debris that we have,
23 so we found that that was optimum from the standpoint
24 of retaining the debris, you know, getting a
25 sufficiently low bypass, and still allowing though,

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1 still preventing a large delta-P that we would have
2 across the strainer.

3 We don't want to have a large delta-P that
4 would starve our pumps for NPSH purposes.

5 MEMBER SKILLMAN: How is the open area
6 that is the particle size that can find its way
7 through that mesh, how is that particle size addressed
8 on the downstream pumps and the downstream equipment
9 beyond the strainer, the SIS strainer?

10 MR. CONNELL: Yes, we have done testing
11 and qualification for that. Do you want to talk a
12 little bit about the downstream?

13 MEMBER SKILLMAN: Will it be later in your
14 slides?

15 MR. CONNELL: Well, we talk about the
16 downstream effects for the fuel assembly. We will
17 talk about that in a --

18 MEMBER SKILLMAN: Fuel assembly is only
19 one piece.

20 MR. CONNELL: Right.

21 MEMBER SKILLMAN: Here are your pumps.
22 Here are the internal ports and passages, there could
23 be cooling passages in there, sealing areas.

24 MR. CONNELL: Right.

25 MEMBER SKILLMAN: And my real question

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1 gets to how are those capillaries protected by this
2 strainer? That's my real question.

3 MEMBER BANERJEE: Are you able to access
4 all the information that has been developed in
5 response to Dr. Skillman's question, which has some
6 proprietary aspects to it, by the PWR Owners Group.
7 Do you have access to that or will you be getting
8 access to that information?

9 MR. CONNELL: Yes, we have access to the
10 PWR Owners Group.

11 MEMBER BANERJEE: Right. That's
12 proprietary information, to some extent. It's in the
13 Reg Guide 1.82 revision. It's revision 4. It's been
14 referred to. The revision is still not out, it's
15 draft, but nonetheless it's there, and you will have
16 that information.

17 MR. CONNELL: Yes, we do. Yes. Do you
18 want to talk about it --

19 MR. MAASS:. Yes, the access we have is to
20 the testing that was done by AREVA for our fuel
21 owners, so --

22 MEMBER BANERJEE: For the downstream
23 effects?

24 MR. MAASS:. Yes, for the fuel assembly
25 downstream effects.

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1 MEMBER BANERJEE: Nono, I'm not talking
2 about those. I'm talking about specifically leaving
3 aside the downstream effects, the other information.

4 MEMBER SKILLMAN: My question is a
5 plumbing question. Are we going to goo up the pumps
6 with this fine debris?

7 MEMBER BANERJEE: But there is a lot of
8 information out there, obviously, and there's been a
9 huge amount of testing done on that.

10 MR. CONNELL: Fred, did you want to
11 address that?

12 MR. MAASS:. Well, one of the ways we are
13 controlling that is by specifying the concentration of
14 debris material that goes into the downstream fluids.
15 We will require our vendors, our component vendors to
16 address that as part of their testing program, to
17 qualify our permit.

18 MR. CONNELL: Is that for valves and pumps
19 and --

20 MR. MAASS:. Yes. And the amount of
21 testing that was done for I guess the proprietary
22 document that you are referring to, that was done a
23 lot more along the lines for existing components, and
24 essentially what we have planned to do is try and
25 build that in up front, that experience from our

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1 vendors, to capitalize on that, the work they have
2 done for the operating plants, so by specifying our --

3 MEMBER BANERJEE: Really my question is,
4 will you be able to access it under whatever
5 arrangement is needed, that proprietary information?

6 There is proprietary information on
7 exactly the question that he asked, and that's for
8 existing plants. But you learn a lot from that, and I
9 don't know if AREVA has access to that information or
10 not. That's really the question.

11 MR. CONNELL: For any of the information
12 that we don't have access to, we would have to
13 replicate.

14 MS. SLOAN: The answer is yes and no, when
15 it comes to the Owners Group. I think if I captured
16 this correctly. For tests that we performed on behalf
17 of the Owners Group, we have the rights of access to
18 that data. We do not have right of access to all of
19 the PWR Owners Group data.

20 MEMBER BANERJEE: And you are not -- I am
21 not talking about downstream fuel effects.

22 MS. SLOAN: Right.

23 MEMBER BANERJEE: I'm talking of
24 downstream effects other than the fuel effects.

25 MR. CONNELL: That's right.

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1 MEMBER BANERJEE: So you don't have access
2 to any of that data that was developed by other
3 vendors or whatever, for the Owners Group?

4 MR. CONNELL: No, none of the proprietary
5 information that was developed for --

6 MEMBER BANERJEE: Right, and you haven't
7 bought into getting that information?

8 MR. CONNELL: No, not at this time.

9 MEMBER BANERJEE: Okay, so that -- we can
10 have an offline conversation but there's a lot of
11 information on the topic. But they don't have access
12 to it.

13 MEMBER SKILLMAN: And there have been
14 utilities that have been forced to do an overwhelming
15 amount of testing in order to get restarted, that did
16 this exact same thing.

17 I appreciate your opening comment, Sandra,
18 that it is your intention to resolve these issues at
19 the design stage, and for me, part of the design stage
20 includes recognizing that with the combination of
21 sieves and strainers and that type of equipment,
22 particularly the emergency core cooling equipment has
23 been protected internally, and that's really what I'm
24 asking about and that's what Dr. Banerjee is also
25 communicating.

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1 We can talk off-line but there's the fuel
2 I understand, the fuel and plugging the fuel
3 assemblies, but there are also some mighty important
4 components that do have some vulnerabilities, and if
5 you are really in the mind set of designing in the
6 front to prevent having to go through some painful OE
7 later, now's the time to address those issues. Thank
8 you. Thank you.

9 MR. CONNELL: Okay. Thank you, I
10 appreciate the comment. Are there any other questions
11 on the retaining system itself? I can go to the next
12 slide.

13 MEMBER STETKAR: Kevin, just one and it's
14 sort of a geometry question. Off to the right there,
15 there's an arrow coming in from the annulus. So in
16 principle, if the retaining baskets fill really full,
17 they could spill over out into the annulus?

18 MR. CONNELL: Yes. Thank you. That is a
19 key feature to this too, because --

20 MEMBER STETKAR: I was curious, you know,
21 why.

22 MR. CONNELL: The idea is that it is nice
23 that these retaining baskets -- now there' four of
24 these located and four openings of course -- that they
25 can communicate to the other retaining baskets.

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1 So as soon as it -- as soon as we rise to
2 this level, it communicates to the other four baskets,
3 other three baskets, through the retaining -- through
4 the annular region, and so that could then -- in
5 essence you would have to fill up all four of those to
6 finally get an overflow over.

7 MEMBER STETKAR: Thank you. Is there
8 nothing down in the bottom of the annulus that you
9 care about in terms of equipment? I've seen some
10 designs that, because of protecting valves and things
11 like that, they tend to find their ways into the
12 annulus.

13 MR. CONNELL: For the considerations we
14 have, we know that this area could during accident
15 conditions be flooded, so we have --

16 MEMBER STETKAR: Anything that --

17 MR. CONNELL: Right, designed around those
18 --

19 MEMBER STETKAR: is up at a much higher
20 level --

21 MR. CONNELL: either consideration that it
22 doesn't matter if it's submerged or if it is, that we
23 have it designed.

24 MEMBER STETKAR: Thank you.

25 MEMBER BANERJEE: You mentioned that you

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1 can back-flush. Can you show me on this?

2 MR. CONNELL: It doesn't show it here but
3 there is a -- it would have a -- there's a flow that
4 you can align so that it would then have a larger
5 pressure in this area and it would create the flush
6 from inside the strainer on out.

7 We do have --

8 MEMBER BANERJEE: That's an operator
9 action?

10 MR. CONNELL: Yes. Again, we don't take
11 credit for it --

12 MEMBER BANERJEE: No, I know.

13 MR. CONNELL: in safety space or safety
14 analysis.

15 CHAIR POWERS: In your upper portion where
16 you have your trash racks.

17 MR. CONNELL: Up here.

18 CHAIR POWERS: Do you proscribe galvanized
19 and aluminum?

20 MR. CONNELL: We restricted the amount of
21 aluminum in that area. We did allow -- in our testing
22 we did allow for some aluminum in our autoclave
23 testing. We allowed for some that would be maybe tags
24 or such, but the design is such that we do not allow
25 the aluminum in that area that would uncoated --

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1 CHAIR POWERS: How about galvanized
2 materials?

3 MR. CONNELL: Galvanized, I don't believe
4 so either, did we?

5 MR. MAASS:. I don't believe so.

6 MEMBER BANERJEE: There is no galvanized
7 material up there?

8 MR. CONNELL: Not in the flood area, not
9 in the area that we are looking for the break
10 location. We'll need to verify that also but --

11 MEMBER BANERJEE: Because you know that
12 your German counterparts found that unless you buffer
13 the solution, if you have boric acid, you get
14 significant attack of the zinc and that causes -- I
15 have a beautiful curve which shows how the pressure
16 losses go up within about a little while, which was
17 done by your colleagues in AREVE actually. Okay.

18 MR. CONNELL: And again, we don't plan to
19 have that, we'll do a verification of that. I don't
20 want to just leave it off the top of my head.

21 Okay, the next view is from our three-
22 dimensional model. This shows the area of the IRWST.
23 As you can see here, it surrounds most of the bottom
24 part of containment.

25 So this is the entire pool, approximately

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1 433,000 gallons. These are the retaining baskets, and
2 then we have four of those. We have one located here
3 and here, these are similar designs, and then we have
4 designs for the open areas here and here.

5 Just above these locations are where the
6 openings from the heavy floor and the trash rack are
7 located. So again, the flow would come into these
8 baskets, these retaining baskets, enter the area of
9 the IRWST. These are the four strainer locations that
10 are poised above the suction of the ECCS system.

11 Okay, next slide. This goes into a little
12 bit of the detail that we had talked about earlier,
13 defense in depth, first line of defense we are looking
14 at is the two-inch weir and the four by four inch grid
15 surface, the trash rack area that is above the opening
16 that goes down into the IRWST.

17 MEMBER BANERJEE: What's the material
18 again?

19 MR. CONNELL: This is stainless steel,
20 four by four inch grid, with the two-inch weir that
21 would be surrounding the outside of this.

22 Now we have the retaining baskets. We
23 have two single compartment baskets that are designed
24 like this and then two double-compartment baskets.

25 The minimum flow filtering area that we

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1 have is approximately 721 square feet. The minimum
2 volume for these is 1,500 cubic feet, and then as we
3 mentioned before, 0.08 by 0.08 mesh.

4 MEMBER BANERJEE: What do you mean by two
5 double-compartment and two single -- I --

6 MR. CONNELL: This double-compartment
7 design we have adopted from the OL3 design. It's
8 identical to that. There was more concern with some
9 debris coming in from the annular area for this
10 design.

11 So the idea was that we would have a
12 compartment that would possibly take most of the
13 debris that would come from the annular area and then
14 be able to rise up separate from the other debris that
15 would come down from the RCS floor.

16 This is all one large compartment through
17 here. So the design was such that we could take more
18 debris from the annular area. This could then
19 overflow, communicate through the annulus to these
20 other retaining baskets, and wouldn't necessarily
21 overload a basket --

22 MEMBER BANERJEE: So you have a basket
23 that is not shown behind --

24 MR. CONNELL: No, oh, I'm sorry, this is
25 just a wall that is in here. So it's double-

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1 compartment, it has another wall right here that has
2 an eight by eight -- 0.08 by 0.08 inch mesh separating
3 this portion of the basket.

4 What's not shown here of course is the
5 wall of the IRWST, so the flow would come in from the
6 annular area area into this smaller compartment here.
7 There's a wall there that has a 0.08 inch mesh.

8 MEMBER BANERJEE: Okay, so that's what's
9 missing.

10 That's what I --

11 MR. CONNELL: It's a little bit confusing
12 from that standpoint.

13 MEMBER SKILLMAN: So, as we look at this,
14 Kevin, there are four, approximately 721 square foot
15 --

16 MR. CONNELL: Retaining baskets.

17 MEMBER SKILLMAN: retaining baskets. You
18 have 28, 2,900 square feet of protection on the four
19 different sets. Is that --

20 MR. CONNELL: More than that, yes yes. In
21 our second line of defense, just the retaining basket.
22 And then we will get into the strainer itself.

23 MEMBER SKILLMAN: And when one looks at
24 the -- if you will, the highest specific velocity
25 through the most compromised strainer, what are you

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1 seeing in terms of acceptable velocities?

2 MR. CONNELL: Do you recall what the
3 actual velocities were for this?

4 MR. MAASS: No, I do not.

5 MR. CONNELL: What we did of course was
6 set up our tests so that we would replicate in full
7 scale what the velocity would be, the approach
8 velocity would be for that.

9 So I know we have done the tests and
10 studied what the approach velocity was.

11 MS. SLOAN: We'll just have to take a
12 follow up item.

13 MEMBER SKILLMAN: That is fine. What I am
14 really thinking about is even with, say you do have
15 aluminum and you do have zinc and you do get some type
16 of precipitate and it's very small, but it does begin
17 to compromise this 0.08 by 0.08 screen, now do you
18 have a delta-P and a vector that's going to collapse
19 the membrane?

20 MR. CONNELL: Yes, and we have done
21 testing with precipitants and well, we will go into
22 more of the testing that we have done for that.

23 MEMBER SKILLMAN: Okay, thank you.

24 MR. CONNELL: But we will address that.

25 MEMBER SKILLMAN: Thank you.

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1 MR. CONNELL: Okay.

2 MEMBER BANERJEE: So you basically have
3 two screens in series --

4 MR. CONNELL: Yes, let's go back to one
5 more.

6 MEMBER BANERJEE: of the same --

7 MR. CONNELL: So essentially, we almost
8 have three screens in series. We have the trash rack,
9 we have the retaining basket screen but the trash rack
10 is four by four inch, and then a 0.08 inch mesh and
11 then another 0.08 inch mesh.

12 MEMBER BANERJEE: Yes, two similar
13 screens.

14 MR. CONNELL: Right. We looked at
15 sensitivity --

16 MEMBER SKILLMAN: Times four.

17 MR. CONNELL: Times four, correct. Yes,
18 looking at these four locations for the baskets of
19 course and then four for the suction strainers.

20 Okay. Now these are pictures of the
21 actual IRWST at OL3 and as I mentioned, I was in there
22 a few weeks ago. I actually had to dress-out to get
23 down into it. You had to put -- because it's a clean
24 area now, you had to make sure that you had booties
25 and overalls that were clean material. They didn't

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1 want construction material coming into this, and they
2 have actually done down here, you can see a leak test
3 of this.

4 It's, you know I have seen drawings of it
5 and I have seen the design, but until you go down into
6 that area, it's hard to picture.

7 The inventory itself as I have mentioned
8 before, 433,000 gallons and even though in our testing
9 we have done some circulation across the bottom so
10 that we prevent any kind of settling in our testing,
11 as you can see, there's plenty of surface area here
12 for debris to settle out also on this floor, as well
13 as above that on the heavy floor too, under the RCS.

14 MEMBER BANERJEE: So these holes are about
15 two millimeters roughly right?

16 MR. CONNELL: About a 12th of an inch
17 square.

18 MEMBER BANERJEE: About two millimeters?

19 CHAIR POWERS: They are almost exactly two
20 millimeters.

21 MEMBER BANERJEE: So they are not that
22 small.

23 MR. CONNELL: But they are good, from the
24 standpoint that they do retain the debris. We had --

25 MEMBER BANERJEE: They let a lot of fiber

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1 and particulate matter through, right?

2 MR. CONNELL: Yes, about a 70 percent
3 bypass for the -- when you do fiber only through this,
4 you get about 70 percent bypass.

5 MEMBER BANERJEE: Okay, that's
6 interesting. The -- when you say promotes settling of
7 fine debris, that's a nice statement, but do you
8 actually take credit for it?

9 MR. CONNELL: No. As I mentioned, we --
10 in our testing we tried to sweep the bottom of the --

11 MEMBER BANERJEE: Because it's very hard
12 to take credit for that.

13 MR. CONNELL: And we had contemplated
14 doing intricate models to show what that is, and we
15 said --

16 MEMBER BANERJEE: Forget it.

17 MR. CONNELL: no, it's simpler, let's just
18 keep it stirred up and not even worry about it.

19 MEMBER BANERJEE: Okay.

20 MR. CONNELL: Okay.

21 CHAIR POWERS: It's great that we can ask
22 more questions but --

23 (Laughter)

24 MEMBER BANERJEE: I don't think you should
25 waste your time.

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1 MR. CONNELL: Somebody had mentioned too
2 you put a picture in it and a picture is worth a
3 thousand questions too. So, but I think it also gives
4 you the idea though of what we are looking at.

5 Here is the strainer. Now this does not
6 have the mesh on it. This is just before the mesh is
7 put on there. It's approximately, just under eight
8 feet tall and the minimum filtering area is 690 square
9 feet.

10 And again we have the mesh and as we have
11 mentioned before there are four of these --

12 CHAIR POWERS: I am not sure what you mean
13 by minimum filtering area when you quote that number.

14 MEMBER BANERJEE: Why the minimum?

15 MR. CONNELL: This is -- for the size that
16 we have right -- the minimum is taking into account
17 the amount material that would not be filtering or we
18 don't take credit for filtering, because of the area
19 behind it has a structure, support structure.

20 CHAIR POWERS: So you assume that all
21 unobstructed screen --

22 MR. CONNELL: That's correct.

23 CHAIR POWERS: to the full height, so you
24 have water clear up to there.

25 MR. CONNELL: Yes, water about two and a

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1 half feet to a little over two feet above at the
2 minimum level, so it's --

3 CHAIR POWERS: So that really isn't a
4 minimum. It's what you expect.

5 MR. CONNELL: Yes. Yes. Okay, so
6 additional features that we have. As we mentioned to
7 you the --

8 MEMBER BANERJEE: Are these also installed
9 in your Finnish plant?

10 MR. CONNELL: Yes.

11 MEMBER BANERJEE: So, it's identical in
12 fact?

13 MR. CONNELL: Identical to the OL3 design.

14 MS. SLOAN: That's where the pictures are
15 coming from.

16 MR. CONNELL: Yes. In fact that's the
17 Finnish strainer right now.

18 MEMBER BANERJEE: The whole layout and
19 everything is the same?

20 MR. CONNELL: Yes.

21 MEMBER BANERJEE: That you showed?

22 MR. CONNELL: Yes.

23 MEMBER BANERJEE: So if we wanted to, we
24 could go and take a look at that?

25 MR. CONNELL: Yes.

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1 MEMBER BANERJEE: Okay.

2 CHAIR POWERS: I think it's particularly
3 appropriate for you to go and visit that and look,
4 especially since it's February.

5 (Laughter)

6 MEMBER BANERJEE: I am in there almost
7 every two months so it's not such a big deal to go
8 down.

9 CHAIR POWERS: February would be an
10 admirabl etime --

11 MR. CONNELL: Yes, maybe in the springtime
12 would be a little bit better.

13 CHAIR POWERS: No. No. Nono.

14 MR. TESFAYE: Well, we are planning a site
15 visit in January, so you are welcome to join us.

16 CHAIR POWERS: There you go, Sanjoy. No
17 one can claim that as a boondoggle, can they?

18 (Laughter)

19 MEMBER SKILLMAN: As we talk about the GSI
20 implication of this, I am interested at some point in
21 seeing a cross-section of how this robust straining
22 and filtering design enables the refueling equipment
23 to function. This is your RWST in the building and I
24 am curious what the relationship is between that name,
25 RWST, and where your fuel is, because I'm thinking

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1 your fuel's up 30, 40 meters above you.

2 So I'm curious, the use of the term and
3 how you move that inventory where you refuel it.

4 MR. CONNELL: We can get more into the
5 description of that.

6 MEMBER SKILLMAN: Thank you.

7 MR. CONNELL: Okay, so other features that
8 we had talked about the retaining basket is oversized,
9 overlapped the trash rack portal, there's a gap
10 between the top of the retaining basket and the bottom
11 of the heavy floor, about a foot and a half associated
12 with that.

13 Retaining basket size, mesh size is
14 equivalent to -- is the exact same mesh size as what's
15 used on the strainer. We have inverted side screens
16 on the sump strainer and that really just refers to
17 this slant here.

18 In order to promote any sloughing of
19 material as you would build a bed, gravity would help
20 have this either slough down or slough off and of
21 course once we use some of the back-flush, it would
22 give the ability to slough off a little bit easier.

23 And we had also mentioned fibrous
24 insulation was eliminated from zone of influence and
25 we have the non-safety related back-flush capability.

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1 Now I was going to go into our testing
2 program. What we have done is we of course did
3 confirmatory chemical debris testing, and what that
4 did was validate our chemical debris analysis so that
5 we know what chemicals are produced as a function of
6 time through the accident in the IRWST.

7 CHAIR POWERS: I have no idea what that
8 means.

9 MR. CONNELL: Okay. It's autoclave
10 testing that we have done for the materials that would
11 be found in containment. We did autoclave testing for
12 using 2,800 ppm boron solution, and then we injected
13 over a period of two hours our buffering solution and
14 then what we did was be able to analyze --

15 CHAIR POWERS: Did you test epoxy-coated
16 concrete in contact with these various solutions?

17 MR. CONNELL: Yes, concrete was part of
18 the testing also, yes

19 CHAIR POWERS: But epoxy-coated concrete.

20 MR. MAASS:. It wasn't painted.

21 MR. CONNELL: Did we have any epoxy in it?

22 MR. MAASS:. No.

23 MR. CONNELL: Okay.

24 CHAIR POWERS: So you don't think epoxy
25 does anything in this stuff?

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1 MR. MAASS:. We didn't test it, so --

2 CHAIR POWERS: Why not?

3 MR. CONNELL: We'll take a look at -- we
4 didn't believe that it would interact in a way that
5 would create any harmful chemical precipitants.

6 CHAIR POWERS: What is the dose rate?

7 MR. CONNELL: The dose rate in lower
8 containment?

9 CHAIR POWERS: The dose rate in that
10 solution that you are creating.

11 MR. CONNELL: The radiation dose rate?

12 CHAIR POWERS: No, we did not radiate
13 during the autoclave testing, correct?

14 MR. MAASS:. No.

15 CHAIR POWERS: What -- the epoxy that you
16 use has a solvent. What is that solvent?

17 MR. CONNELL: The solvent for the epoxy?

18 CHAIR POWERS: Yes.

19 MR. CONNELL: I don't know what that would
20 be. Do you have any idea?

21 MR. MAASS:. No, we'd be using similar
22 specifications that are used for operating platns but
23 I don't know what the solvent is.

24 CHAIR POWERS: You would typically -- the
25 paints -- epoxy paints give off solvent throughout

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1 their lifetime. You don't heat-treat them or anything
2 like that. You put them up and just let them dry.
3 And I presume that is what you do on these concrete
4 surfaces as well.

5 And the solvents tend to be pretty mobile.
6 They tend to react negatively to being irradiated,
7 make something that looks a lot like glue.

8 MS. SLOAN: I think we are going to have
9 to --

10 MR. CONNELL: Yes, we'll take an action
11 item on that.

12 MEMBER BANERJEE: The chemical autoclave
13 tests and things, were they similar to the ICET tests
14 that were done in the early stages of the chemical
15 effects program under NRC sponsorship?

16 MR. CONNELL: Are you familiar with the --

17 MR. MAASS:. Not exactly familiar with all
18 of the ICET tests, the way they were done. What we
19 did was we utilized the information that was gained
20 from that testing and augmented it with the testing
21 that we did. So that was the goal of our program, was
22 to --

23 MEMBER BANERJEE: But was the design of
24 the experiment similar, or was it different and --

25 MR. MAASS: That I do not know.

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1 MR. CONNELL: Like we said, we can bring
2 our chemistry department in and we can --

3 MEMBER BANERJEE: Yes, it would be good to
4 know a few more details --

5 MS. SLOAN: I don't think we bother
6 chemists today, but there are a team of them --

7 CHAIR POWERS: Well, when you do that, you
8 might ask them about, well you did testing with
9 concrete and coated concrete so I presume you got some
10 Wollastonite precipitation and things like that.

11 MS. SLOAN: What sort of precipitation,
12 Dr. Powers?

13 CHAIR POWERS: Calcium phosphate.

14 MR. CONNELL: Yes, we had calcium
15 phosphate, aluminum oxyhydroxide and sodium aluminum
16 silicate, were the typical precipitates --

17 CHAIR POWERS: Everywhere, that's dirt.
18 You have got bromide coming out because you had some
19 aluminum in there. It's interesting. It's hot. How
20 how was your autoclave test?

21 MR. CONNELL: We've had the range of -- we
22 tried to follow the range of the temperatures of the
23 IRWST so we started it around 120 degrees and went up
24 to saturation at around 210 and then came off of that.

25 Again, we tried to follow the same profile

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1 that we'd expect.

2 CHAIR POWERS: There's an ASTM standard
3 for qualified coatings that involve substantially
4 hotter temperatures than those for more protracted
5 times. I wonder why you didn't follow that protocol.
6 Maybe you did, because it's -- I mean, it's a strange
7 ASTM test. You calculate what your environment is and
8 that dictates the temperature and pressure protocols,
9 so maybe you did. I don't know.

10 MR. CONNELL: I don't know. We have to
11 check with our chemistry department.

12 CHAIR POWERS: That would be interesting
13 to see.

14 MR. CONNELL: Okay.

15 MEMBER SKILLMAN: I would like to add to
16 Dr. Powers' question about the coatings and the
17 radiation level on the coatings. It sounds like you
18 know, why would that matter.

19 And I would offer that the most important
20 time when this equipment is responding is when there
21 has been a core damage accident and you are pouring
22 highly radioactive water down into the sumps, and in a
23 sampling of one, TMI's water, it was 150-200
24 microcuries per cc, and the primary emitter is cesium
25 strontium, and we pooled the water, 55 ccs for an

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1 eight R per hour meter. The water itself was the
2 source term and its residue remains there today.

3 And so at the time when the success of the
4 coatings and the strainers and the filtration are most
5 important, can be when the radiation level is beyond
6 what most people might have considered.

7 And so if that source term is able to
8 release from the coatings, from the epoxy, some form
9 of a solvent, or if it's able to lift the epoxy off
10 the concrete, then I would suggest that for the design
11 to be complete, that needs to be a design
12 consideration, what's the radiation level that this
13 material is successful with.

14 And that data is easily available but I
15 would just offer that those radiation levels were
16 beyond what most people ever imagined.

17 MR. CONNELL: Okay.

18 MEMBER SKILLMAN: Thank you.

19 MR. CONNELL: Yes, we'll follow up on
20 that.

21 CHAIR POWERS: The equivalent
22 qualification dose rates are pretty formidable. It
23 surprises me how high.

24 MR. CONNELL: For our other testing of
25 course we went through strainer retainer basket

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1 testing. We tested those both in tandem, and then we
2 also conducted our fuel assembly downstream effects
3 testing.

4 MEMBER BANERJEE: So did you do what we
5 would call a prototypical geometry test, or are you
6 going to go into these tests --

7 MR. CONNELL: Yes.

8 MEMBER BANERJEE: in more detail?

9 MR. CONNELL: I'll go into the geometry
10 that we used, the scaling that we used.

11 MEMBER BANERJEE: And did you use chemical
12 surrogates?

13 MR. CONNELL: Yes.

14 MEMBER BANERJEE: And these were the
15 approved surrogates?

16 MR. CONNELL: That's correct.

17 MS. SLOAN: Can we go back to your
18 question about situations with core damage. At that
19 point, I think you are beyond the design basis
20 conditions from which we would be able to analyze
21 this.

22 CHAIR POWERS: It doesn't matter. The
23 source term you have to consider in the DBA is close
24 enough to a severe accident source term so it doesn't
25 really matter. His point is still valid.

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1 MS. SLOAN: Okay.

2 CHAIR POWERS: Because you have presumably
3 ballooned and ruptured cladding.

4 MS. SLOAN: I guess I would argue that
5 perhaps we might end up addressing it in a different
6 way because I think the story you will hear from Kevin
7 is we have taken every possible conservatism we
8 believe is reasonable in how to address a design-basis
9 accident, and I think once we got into beyond design-
10 basis type conditions, there might be different
11 assumptions and ways that we would evaluate that.

12 I think we've had to think a little bit
13 about conditions where the core is degraded.

14 MR. CONNELL: Yes, and again we did it
15 consistent with the protocols of testing that the
16 industry has used up to this point. So the only
17 hesitancy I wanted to express though is I wanted to go
18 back and talk to my chemistry folks before I said
19 exactly what kind of radiation levels or why we did
20 not consider radiation levels.

21 MEMBER BANERJEE: But I guess Dana's point
22 is that even in the design basis scenario, you have to
23 consider pretty high radiation levels.

24 MR. CONNELL: That's what I want to go
25 back and investigate, yes.

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1 MEMBER BANERJEE: Yes.

2 MR. CONNELL: What is postulated -- what
3 are the radiation levels postulated for a loss of
4 coolant accident? That's what we will need to go back
5 and take a look at.

6 Okay. This gives you a little bit of an
7 overview of the timeline of our testing. Owners'
8 group downstream effects testing took place in the end
9 of 2009.

10 We did our autoclave testing also in that
11 same period. We did a number of strainer basket head
12 loss testing through 2010 and then we conducted our
13 own downstream effects testing at the end of 2010, and
14 then again earlier in mid-part of this year.

15 We'll go into a little bit more detail but
16 it will just give you a little bit of a timeline of
17 the progression of the testing we had.

18 MEMBER BANERJEE: I'm just trying to read
19 this fiber bypass and maximizing thin-bed effects had
20 no what?

21 MR. CONNELL: We'll go into that in a
22 little bit more detail.

23 MEMBER BANERJEE: Had no effect?

24 MR. CONNELL: Right.

25 MEMBER BANERJEE: Ah, effect was missing.

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1 MR. CONNELL: Which one are you talking
2 about?

3 MR. MAASS:. Second one over.

4 MR. CONNELL: Second one over.

5 MR. MAASS:. Yes, missing the final
6 punchline.

7 CHAIR POWERS: It has no S. It must get
8 cut off in the --

9 MEMBER BANERJEE: Attempts to reduce --
10 increase strainer head loss I assume. Well, that's to
11 be expected right? It reduces bypass.

12 MR. CONNELL: What we had to consider was
13 how much fiber we had. We had two considerations.
14 You have fiber in containment, you want to be able to
15 strain it, but then again you don't want to have too
16 much of a head loss so that you'd start your ECCS
17 pumps.

18 So we -- what we do, we did sensitivity
19 testing on the strainer material itself to see if we
20 can optimize that somehow, maybe even have a variation
21 between the basket and the strainer.

22 And what we determined was those
23 variations really did not make that much of a
24 difference, so that -- part of the key was that the
25 system was already designed fairly well. The key was

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1 let's reduce the source, let's look at of course
2 eliminating all the fibrous insulation in zone of
3 influence, and then also have a cleanliness program
4 that maintains that, so that the latent debris and the
5 fiber in that latent debris are also minimized too.

6 MEMBER BANERJEE: In the Finnish plants do
7 they also use two-millimeter holes?

8 MR. CONNELL: Yes.

9 MEMBER BANERJEE: So it's the same hole?

10 MR. CONNELL: Same, same design. Okay.
11 So the testing that we have done for the strainer
12 basket head loss testing, we did five types of tests.
13 What we were really trying to concentrate on though
14 was two objectives, of being -- making sure that the
15 dp, differential pressure across the strainer and the
16 basket, mostly the strainer, is maintained at an
17 adequate level that does not starve the NPSH for the
18 pumps.

19 And then also what we wanted to do was to
20 try to optimize or minimize the amount of bypass that
21 gets downstream to the downstream effects testing.

22 MEMBER BANERJEE: You said that 70 percent
23 bypasses of the fiber.

24 MR. CONNELL: We -- it was less than 70
25 but we conservatively bounded at 70, yes.

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1 MEMBER BANERJEE: So a lot of fiber that
2 gets through.

3 MR. CONNELL: Unless you don't have much
4 to begin with.

5 MEMBER BANERJEE: There is always fiber.
6 That's the problem. Anyway, let's go on.

7 MR. CONNELL: Okay. So the five tests
8 that we did was debris transport, the clean strainer
9 head loss test, the design basis debris load test, and
10 then we did the thin bed and fiber-only tests, and
11 I'll go into a little bit more detail with what we
12 looked at for those.

13 But first I wanted to talk about the
14 scaling. For the vertical scaling we essentially have
15 a full height scale test. It was essentially a slice
16 of the basket and strainer combination.

17 For the flow area we had slightly less
18 than 1 to 10. For the --

19 MEMBER BANERJEE: It was a smaller basket
20 or a full-sized basket?

21 MR. CONNELL: Full-sized basket. We'll go
22 through to an actual picture of this. So this kis si
23 the test facility. It's a test flume, that we have
24 the basket that is designed here, and on this side we
25 would have the 0.08 inch mesh and allow it to actually

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1 overflow if necessary and come down into the IRWST,
2 the rest of the IRWST.

3 This is the strainer and again it was
4 essentially a slice of the -- it's a full height of
5 the basket and a full height of the strainer itself
6 but not full width.

7 We just took a portion of that to
8 represent a little bit less than one tenth.

9 Okay. You want to go back? Yes. Thanks.
10 The flow area, again, we had 1 to 10 and then the flow
11 rate, the overall flow rate was 1 to 10.

12 Now that the actual velocity though that
13 it would encounter would be similar to the velocities
14 that we would expect in the actual IRWST.

15 MEMBER BANERJEE: When you've got stuff
16 falling ointo this, does it -- this is coming fomr
17 what? A few feet up?

18 MR. CONNELL: Yeyes.

19 MEMBER BANERJEE: And does it cause the
20 fluid to be turbulent in this basket?

21 MR. CONNELL: There are some dynamics
22 inside the basket area, and that's what we had looked
23 at to see if we could possibly optimize that with some
24 of our sensitivities, but you do have some of the
25 turbulence of course, of the churn of that but then of

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1 course you would have the flow that goes straight out
2 through the basket itself.

3 We have been able to actually look at even
4 some smaller sections of this, some even smaller scale
5 testing and see what kind of flow patterns we would
6 have to see if we could optimize it from that
7 standpoint.

8 But in the end the best material was
9 sufficient for what we really needed to do, the
10 straining capability and, the robustness of capturing
11 any paint chips, any debris that come through the
12 trash racks, that basket was ideal from that
13 standpoint.

14 MEMBER BANERJEE: The flow coming into the
15 basket, does it sort of come down like a waterfall, or
16 what's the --

17 MR. CONNELL: Yes, it would be free fall
18 from the floor, and it would create a turbulence.

19 MEMBER BANERJEE: And would it be like a
20 sheet of water or a jet of water or --

21 MR. CONNELL: More of like a jet of water
22 you know, you would be coming from all sides. What we
23 simulated that was a jet of water from three different
24 nozzles coming down into it to simulate the contact.

25 MEMBER BANERJEE: But when you scaled this

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1 experiment, you had a setup to add water in the same
2 way, like a small section of what you'd expect.

3 MR. CONNELL: Correct. For the same
4 amount of flow that that section would see.

5 MEMBER BANERJEE: Right, and how much --
6 what was the velocity of the falling water?

7 MR. CONNELL: I'm not sure.

8 MEMBER BANERJEE: It's only two feet up.
9 What's your --

10 MR. CONNELL: Yes, we --

11 MR. MAASS:. The velocity -- well, our
12 flow rate for the pumps were about between 300 and 325
13 gallons per minute. The initial drop from the heavy
14 floor to the surface of the IRWST is approximately
15 seven to eight feet.

16 MEMBER BANERJEE: Oh okay. So it was
17 coming down quite a clip.

18 MR. MAASS:. Yes.

19 MEMBER BANERJEE: So roughly how many feet
20 per second?

21 MR. MAASS:. That I couldn't tell you
22 right off the top of my head.

23 MEMBER BANERJEE: I just want to get a
24 feel for how turbulent this is. Was it splashing
25 around or was it just --

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1 MR. CONNELL: Yes ,there was some you
2 could see, also you would have the -- the flow would
3 go in below the surface and come back up again. It
4 would only be about half a flick below the surface
5 that the water that the jet would penetrate roughly.

6 But that is all contained within the
7 basket area too, so you would have that type of
8 frothing, that type of turbulent water. There's a lot
9 on the surface. It would create some sort of a flow
10 stream also through the basket. It would be randomly
11 turbulent through that area too, but again, then it
12 would flow out, of course, we have the suction point
13 in the strainer area so that would then eventually
14 create flow streams that would go through the
15 retaining basket and then through the strainer.

16 MEMBER BANERJEE: And the velocity,
17 typical velocities through these two-millimeter holes,
18 or screens, how much was this?

19 MR. CONNELL: It varies of course. At the
20 surface it was a lot higher. We had some -- I don't
21 recall exactly what those velocities were though.
22 They had -- we had plotted out as part of our tests
23 what types of velocities we would see at the varying
24 heights.

25 MEMBER BANERJEE: So you would expect that

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1 the velocities would be a bit higher at the bottom
2 because of the head of water but you are saying that
3 it was higher at the surface?

4 MR. CONNELL: You would have some surface
5 flow right through and again, it depended on you know
6 what stage your basket was filtering at, you know, at
7 the first, yes, you would get a lot of flow because it
8 would be --

9 MEMBER BANERJEE: At the bottom.

10 MR. CONNELL: At the bottom, right.

11 MEMBER BANERJEE: And that would clog up -

12 -

13 MR. CONNELL: And then you would start to
14 rise up and then you would get a little bit more flow
15 through there. You'd still have flow of course
16 through the whole entire basket, and at different high
17 flow areas you would have a little bit less debris
18 until they would essentially film, you know, form a
19 film --

20 MEMBER BANERJEE: So if you ran this for a
21 long time, did you find that the debris became fairly
22 uniform after a while, or did you still have a
23 gradation?

24 MR. CONNELL: No, it became -- we were
25 able to reach a steady state.

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1 MEMBER BANERJEE: So it would come to --
2 more or less cover the --

3 MR. CONNELL: Once we added all our
4 debris, yes.

5 MEMBER BANERJEE: Yes.

6 MR. CONNELL: As we added stages it would
7 come to a steady state for that, and then -- and you
8 are right, it was pretty much evenly distributed
9 because as you can imagine, you would have flow
10 through the less dense areas, you would have more flow
11 and then of course they would bring more and more
12 debris until you hit a point where it would equalize.

13 MEMBER BANERJEE: But the thing is, if
14 let's say you have got 70 percent fiber bypass,
15 ultimately you know, assuming it doesn't get stuck in
16 the fuel, or if it -- let's hope not -- it comes back
17 in some form, doesn't it?

18 MR. CONNELL: Yes. We recirculate --

19 MEMBER BANERJEE: You recirculate it. So
20 does that mean that you eventually take out all the
21 fiber, or does it still continue to give you a bypass?

22 As you slowly form a mat on this, did you find that
23 it would eventually take out all the fiber?

24 MR. CONNELL: Well, the way we had tested
25 it, we had filter bags so that -- for the bypass

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1 testing --

2 MEMBER BANERJEE: Okay.

3 MR. CONNELL: We simulated, assumed the
4 very worst case, just fiber, and then we would only go
5 through one pass of it.

6 MEMBER BANERJEE: Just one pass.

7 MR. CONNELL: Right. And then we would
8 capture the fiber and we'd say that's the bypass. In
9 reality you're right, it would continue to filter
10 itself, and so it wouldn't continually see -- the 70
11 percent bypass would degrade over time, but we did not
12 assume any of that.

13 MEMBER BANERJEE: Yes, the concern, well,
14 the problem is on two sides. One is of course the
15 fiber going through what effect it might have on
16 downstream effects. And now the other concern is that
17 as you push the 70 percent through, assuming that now
18 it doesn't get stuck in the fuel and all that stuff,
19 that it comes back eventually, then does it build up,
20 you know, and progressively you filter that out, so
21 ultimately all of it ends up on your screens?

22 MR. CONNELL: Yes.

23 MEMBER BANERJEE: So that two different
24 scenarios, I mean building up on the screens is
25 probably not as getting caught in the fuel, but

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1 nonetheless one has to look at those two extremes, and
2 I'm wondering how you did that.

3 MR. CONNELL: Well, and essentially our
4 design debris loading test did that. We threw all the
5 debris in. We would measure the dp across the
6 strainer, and again it's in the basket strainer
7 combination.

8 The other conservatism is we threw all the
9 debris, the 100 percent of the design debris, into the
10 one basket. We assumed all of it came into one
11 because we could not necessarily prove that -- what
12 the exact split would be between the different
13 baskets.

14 MEMBER BANERJEE: Right right, I
15 understand.

16 MR. CONNELL: So we threw all that in.
17 The result is the basket did fill up with paint chips
18 and such, it filled up and it actually overflowed, but
19 the downstream effect of that was there was no dp, no
20 significant dp across the strainer itself.

21 The basket took most of that filtration
22 off, so we looked at that as our design debris, you
23 throw everything in, what happens?

24 And that was then compared to of course
25 the thin bed and also the fiber-only test too. The

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1 fiber-only test was the worst-case study to say how
2 much would get downstream, because what we found is if
3 you throw other debris in, that debris helps filter it
4 too, you know, the paint chips and the RMI and all the
5 other debris, that helps retain it too.

6 What would happen in the worst case, if
7 you didn't have any other debris, you just had the
8 fiber and that's where you get the downstream effects
9 basis.

10 MEMBER BANERJEE: Right, no, all I'm
11 trying to understand is I mean there are two sort of
12 broad scenarios. One is that you know you just have
13 essentially one path and it goes through your -- some
14 material goes through your baskets, some goes through
15 your strainers, and that eventually they get to the
16 in-vessel or whatever, and some of that gets caught
17 there.

18 And let's say that all the fiber is taken
19 out in this process so none of it recycles back.
20 That's one limiting scenario. The other limiting
21 scenario is that all of it recycles back so that 100
22 percent of your fiber ultimately ends up on your
23 strainer so that in order to get let's say a bounding
24 estimate, because fibers we have found settles very
25 slowly in turbulent flows, so it's very hard to make a

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1 case for fibre or fine particulate settling. This is
2 an ongoing debate with existing plants as you know.

3 MR. CONNELL: Yes.

4 MEMBER BANERJEE: But it's been very hard
5 to prove that there will be significant settling given
6 the highly turbulent conditions and inlet settling and
7 all that sort of stuff.

8 So let's assume that everything is
9 particulate and fiber, let's just, I'm postulating
10 this as a thought problem, is brought to your baskets
11 and strainers. Some of it gets through.

12 And then whatever happens downstream,
13 happens downstream and none come back, which is the
14 sort of thing that I'm sure your strainers and your
15 baskets work well for that.

16 Now imagine that on the other hand the
17 other bad scenario is none of it gets stuck and all of
18 it eventually comes back because it's always
19 entrained, and so you will eventually end up with 100
20 percent of your fibers and particulates on your
21 strainer and your baskets.

22 Now, when that happens, that means you
23 have been recirculating that flow for a long time.
24 Have you done tests of that nature really?

25 MR. CONNELL: Let me describe the test

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1 that we did. I believe it addresses the issues you
2 are talking about. When we do a fiber-only test, for
3 the strainer basket combination, from there it is only
4 a one-pass, again this is the worst case, we throw in
5 all the fiber, we actually batch it in small amounts,
6 so that we are not just throwing it in in clumps onto
7 the --

8 MEMBER BANERJEE: Nono, I realize, that is
9 the worst-case -- the worst-case downstream effect.

10 MR. CONNELL: So it collects all that
11 fiber.

12 MEMBER BANERJEE: Right.

13 MR. CONNELL: Now, we take that to
14 downstream effects testing --

15 MEMBER BANERJEE: Right.

16 MR. CONNELL: And we say we are not taking
17 account for the fact that it could get refiltered
18 again --

19 MEMBER BANERJEE: That's the worst case
20 for your downstream.

21 MR. CONNELL: So we are throwing all that
22 into our fuel assembly and at that point, that's when
23 we measure the delta-P and then we throw in the
24 chemical precipitants too, because that's really the
25 bad actor that starts to make the goo --

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1 MEMBER BANERJEE: And I hope you throw in
2 particulates.

3 MR. CONNELL: We throw in particulates,
4 yes.

5 MS. SLOAN: But I think your question Dr.
6 Banerjee is if all the fiber collected on the screens,
7 what would the dp be, what would the net effect be.

8 MEMBER BANERJEE: Yes, all the fiber and
9 particles.

10 MS. SLOAN: It just recirculates to
11 infinity where it all finally ends up on the screen
12 surface.

13 MEMBER BANERJEE: That's exactly my
14 question.

15 MR. CONNELL: But that case should have
16 been covered though in the original design debris case
17 --

18 MEMBER BANERJEE: Perhaps it was --

19 MR. CONNELL: we threw all of it in there.
20 Yes. And we kept recirculating and until it --

21 MEMBER BANERJEE: Okay, so you have
22 answered my question then. That's really what I was
23 asking.

24 MR. CONNELL: Yes.

25 MEMBER BANERJEE: Did you throw it all and

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1 just keep recirculating

2 MR. CONNELL: Yes.

3 MEMBER BANERJEE: so it all ended up on
4 the screens. So you did that.

5 MR. CONNELL: Yes.

6 MEMBER BANERJEE: And you did -- because
7 it's not just fiber, it's fiber plus particulate plus
8 chemicals that matter. I mean all of the above,
9 right?

10 MR. CONNELL: Yes. Did you want to add
11 anything, any other details to that?

12 MR. MAASS:. No. Yes, we did use the
13 standard. We put particulates in first and then fiber
14 and then the chemicals and we ran the test for
15 approximately 24 to 36 hours.

16 MEMBER BANERJEE: And you used silicon
17 carbide for your particulates?

18 MR. MAASS:. Yes.

19 MEMBER BANERJEE: So you used all the
20 usual surrogates?

21 MR. MAASS:. Yes.

22 MEMBER BANERJEE: Did you use hair?

23 MR. MAASS:. No we did not.

24 MEMBER BANERJEE: Not for your fuel right,
25 fuel downstream effects?

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1 MR. MAASS:. No.

2 MEMBER BANERJEE: We've had problems with
3 hair. They don't behave the same as other fiber. I
4 can't tell you how we know. Some other people have --

5 MEMBER SKILLMAN: My I ask if I could go
6 back to 15 please. I believe the second bullet is
7 communicating that the velocity that you used is the
8 velocity that you would expect to see in an actual
9 event. That's what one to one means?

10 MR. CONNELL: That's correct.

11 MEMBER SKILLMAN: The horizontal direction
12 seems to me to deserve an explanation. If I read the
13 little Excel top chart there it's 1 in 10. Should I
14 interpret that to mean instead of using what could
15 have been 20 feet a second horizontal, you used two?

16 MR. CONNELL: Oh no, that wouldn't be
17 velocity. That would be --

18 MEMBER SKILLMAN: It says flow rate --

19 (Simultaneous speaking)

20 MEMBER SKILLMAN: Q always equals AV and
21 so what I am really getting at is the aerial flow rate
22 in a horizontal direction that is kilograms per second
23 per 100 square centimeters or gallons per second per
24 square foot or whatever metric you might use, the
25 danger in these systems is the velocity.

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1 And if the velocity is stemmed because of
2 plugging, that is your delta-P and that is what will
3 starve ECCS. So please explain that third bullet, the
4 scaling, please.

5 MR. CONNELL: Gene will go ahead and talk
6 through this one then.

7 MEMBER SKILLMAN: Okay.

8 MR. MOORE: I will -- Kevin is bringing
9 the slides, picture.

10 MR. CONNELL: Okay, what we have is actual
11 recirculation flow at the bottom of the test facility.
12 This recirculation flow is meant to disrupt any
13 material that would form at the very bottom of that.
14 We would still have, for the horizontal flow coming
15 into the strainer itself, it still would be a one to
16 one type of communication.

17 MEMBER SKILLMAN: And one to one in that
18 context means the velocity horizontally through the
19 slanted strainer, 0.08 0.08, is the velocity that
20 would be experienced by the actual ECCS pumping
21 equipment when it was in service after a LOCA.

22 MR. CONNELL: That is correct.

23 MEMBER SKILLMAN: Thank you.

24 MEMBER BANERJEE: There is a subtle aspect
25 to this and I think it's fairly important to

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1 understand, that if you did this test in this segment,
2 you have to really ensure that there is no settling
3 between the basket and the strainer, because in real
4 life, if you look at this, this is very turbulent,
5 there are flows parallel to the -- you know because of
6 the geometry of the system.

7 MR. CONNELL: Yes.

8 MEMBER BANERJEE: So did you ensure that
9 nothing settled between them?

10 MR. CONNELL: Yes.

11 MEMBER BANERJEE: Stir it up or whatever?

12 MR. CONNELL: Yes that's what this pipe
13 arrangement is. This is the region between the
14 strainer and the basket. The recirculation flow that
15 we had, you can see the pipe go across the bottom of
16 this too.

17 It had jets of water that would flow out
18 across the flow --

19 MEMBER BANERJEE: Keep it entrained.

20 MR. CONNELL: Yes, to keep --

21 MEMBER BANERJEE: Okay.

22 MR. CONNELL: so that there would not be
23 any settling --

24 MEMBER BANERJEE: All right.

25 MR. CONNELL: on that floor.

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1 MEMBER BANERJEE: So you guys did
2 everything on that one,

3 MR. CONNELL: We think so, yes.

4 MEMBER BANERJEE: We'll have to go and
5 take a close look at it at some point, but it's still
6 operational?

7 MR. CONNELL: We have had the staff of
8 course --

9 MEMBER BANERJEE: Yes yes.

10 MR. CONNELL: witness many of these tests.

11 MEMBER BANERJEE: Okay.

12 MR. CONNELL: Okay. We talked about many
13 of these tests before so I will go through a little
14 bit faster to see if there's any questions associated
15 with it.

16 So the thin bed test. This was really
17 designed to make sure that we did not have a thin bed
18 issue where, as you know, you could build up a very
19 thin bed that would have a larger delta-P than
20 possibly having a large amount of fiber from the
21 testing --

22 MEMBER BANERJEE: There's many experiments
23 which have shown this of course.

24 MR. CONNELL: Yes. That's right. So what
25 we have done for the US EPR, we were able to cut down

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1 on the batch sizing so that we added smaller and
2 smaller batch sizes to see if we would create a thin
3 bed effect on that, and for the -- again we threw 100
4 percent of the debris in for this strainer test.

5 Results was that the basket did not
6 overflow. We did see some rise in the basket but it
7 did not overflow. So it -- so that is telling us that
8 everything is getting strained by that first retention
9 basket strainer and then we didn't have to take into
10 effect any other kind of flow over that that would
11 then carry fiber directly from the heavy floor on into
12 the strainer itself.

13 MEMBER BANERJEE: Don't go so fast. And
14 this was ==was this test also done with this
15 recirculation that you are talking about, so
16 ultimately all the fiber ended up on these beds or --

17 MR. CONNELL: Yes.

18 MEMBER BANERJEE: As you formed the mat,
19 it will eventually --

20 MR. CONNELL: It kept rising in the
21 basket, rising in the basket, but for the design-basis
22 amount that we threw in, the 100 percent, it never
23 reached the top of the basket.

24 MEMBER BANERJEE: Okay, but you
25 effectively took out all the fiber? At the end of the

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1 day you got almost clear water going through?

2 MR. CONNELL: What we did was we ran the
3 test until we had a stable level of water. Now I
4 don't think we ran the test until we filtered 100
5 percent out.

6 MEMBER BANERJEE: Okay, so whatever. Some
7 fiber may still have been going through.

8 MR. CONNELL: That's right. But as a
9 function of time it would diminish, your actual bypass
10 would diminish.

11 MEMBER BANERJEE: You did this with fiber
12 only, with fiber and particulates and fiber,
13 particulates and chemicals? I just want to make sure
14 I get this clear in my mind.

15 MR. CONNELL: The thin bed and -- it was
16 just the fiber and particulate, correct, I mean and
17 the precipitants, right?

18 MR. MAASS:. No, for the thin bed test and
19 the design-basis test, it was all three. We added the
20 particulate first, then the fiber, and then the
21 chemicals for everything except for the fiber-bypass
22 only tests. And that was just fiber.

23 MEMBER BANERJEE: And you ran them to
24 steady state?

25 MR. MAASS:. Yes.

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1 MEMBER BANERJEE: How many hours did that
2 take?

3 MR. MAASS:. Roughly between 24 and 36.

4 MEMBER BANERJEE: That's long enough.

5 MR. CONNELL: And we talked about the
6 fiber-only test. Again, we used 100 percent of the --
7 let me add too, with the fiber-only test, another
8 conservatism was that we used the filter bags with one
9 micron?

10 MR. MAASS:. One micron.

11 MEMBER BANERJEE: But that was to find the
12 bypass.

13 MR. CONNELL: To find the bypass, but if
14 you think about it, it's -- all we do is weigh it
15 before and then weigh it after, and we are assuming
16 every bit of weight difference is fiber.

17 MEMBER BANERJEE: Yes, there's some
18 particulates in it as well.

19 MR. CONNELL: Right. Right. So, but it
20 was very accurate as far as --

21 MEMBER BANERJEE: You have the same
22 problems as everybody else.

23 MR. CONNELL: Yes. You have seen it
24 before.

25 MEMBER BANERJEE: But nonetheless,

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1 everybody also assumes fiber because there is no --
2 well, you could analyze what's in there --

3 MR. CONNELL: Yes, we could.

4 MEMBER BANERJEE: of course. And you
5 could get a better picture of what --

6 MR. CONNELL: The SEM. And in fact, we
7 originally did not use the filter bags. We usually
8 did SEM analysis. We found that that was very much
9 less than 70 -- we had a smaller bypass.

10 MEMBER BANERJEE: You had the option to do
11 detailed analysis --

12 MR. CONNELL: I know but we were able to
13 get all the way through it with this, so we said
14 that's accepted protocol, there's very little
15 questions that we would anticipate with that approach.

16 We talked a little bit about the zone of
17 influence. This is the standard zone of influence
18 that we used in our design for metal reflective and
19 for qualified coatings, inorganic zinc and then
20 jacketed Nukon.

21 As I mentioned before too, the design --
22 we have eliminated the use of the fibrous insulation
23 in the zone of influence so the only fiber that we
24 have to contend with at this point is the fiber that
25 is in the latent debris.

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1 MEMBER BANERJEE: So now, with this
2 jacketed Nukon, 17D, you are assuming that the jacket
3 will protect the Nukon, or do you not have any Nukon?

4 MR. CONNELL: It is defined in our zone of
5 influence that if we used Nukon bands, we would use
6 that, but we eliminated it. So we didn't have to take
7 it into --

8 MEMBER BANERJEE: Okay. But that's sort
9 of a little misleading.

10 MR. CONNELL: Yes.

11 MEMBER BANERJEE: Okay. Because you don't
12 have Nukon within your 17D. Is that how I understand
13 it?

14 MR. CONNELL: No, we do not have Nukon
15 within our 17D.

16 MEMBER BANERJEE: Okay. So that you can
17 take it out.

18 MR. CONNELL: You can take it out.

19 MEMBER BANERJEE: So that we don't get
20 confused.

21 MR. CONNELL: But for completeness that's
22 what we would have assumed.

23 MEMBER BANERJEE: That you would have
24 assumed, but you don't have Nukon there.

25 MR. CONNELL: That's correct.

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1 MEMBER BANERJEE: Okay.

2 MR. CONNELL: And the chemical debris that
3 we had talked about before, we used a StreamAnalyzer
4 to predict what the aqueous solution specification
5 should be, the pH, precipitants, form versus time,
6 performed autoclave testing and then yielded the
7 precipitants that we had talked about, the aluminum
8 oxyhydroxide, calcium phosphate and then sodium
9 aluminum silicate.

10 Of course we didn't use -- we used a
11 surrogate for the aluminum -- the sodium aluminum
12 silicate because of the hazardous material for that

13 MEMBER BANERJEE: But you used the
14 surrogate in your experiment?

15 MR. CONNELL: Yes.

16 MEMBER BANERJEE: The approved surrogate.

17 MR. CONNELL: Right, that's correct.

18 CHAIR POWERS: Derek is now -- has the
19 material.

20 MR. CONNELL: Okay, so as a summary of the
21 strainer and retaining basket tests, we ran 50 small-
22 scale sensitivity tests --

23 MEMBER BANERJEE: Excuse me I need to get
24 back. Where do you have fibrous insulation at the
25 moment?

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1 MR. CONNELL: We have some fibrous
2 insulation that we would allow in lower containment.
3 Our RCS system is all reflective metal, even down to
4 small bore. We have it all designed for reflective
5 metal.

6 Presently the bottom of the pressurizer,
7 all the RCS components, they are all reflective metal.
8 We would anticipate, Fred, what other locations --

9 MR. MAASS:. Areas where we would expect
10 would be outside the zone of influence like steam
11 piping and things like that we have the option of
12 putting fibrous material outside that, and that's
13 generally outside the equipment space since we have a
14 two-room containment.

15 MEMBER BANERJEE: And are there any
16 accidents which would require recirculation cooling
17 which would occur in these areas, forming jets?

18 MR. MAASS:. No.

19 MEMBER BANERJEE: None whatsoever. None
20 of them require any form of --

21 MR. MAASS:. That is correct.

22 MEMBER STETKAR: If the baskets fill up
23 there will be water flowing out there though.

24 MR. MAASS:. Yes.

25 MEMBER STETKAR: That's a --

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1 MR. MAASS:. Annular space.

2 MEMBER STETKAR: question I asked about
3 that --

4 MR. MAASS:. Yes.

5 MEMBER STETKAR: That annular space --

6 (Simultaneous speaking)

7 MEMBER STETKAR: penetration areas that --

8 MR. MAASS: Yes.

9 MEMBER STETKAR: But those aren't jets.
10 That's just circulation of fluid. Is the fibrous
11 insulation out in those areas up high or is it down in
12 those areas?

13 I've been looking at geometrical layouts
14 because I don't know anything about fibers and things
15 like that, but those are characterized as pipe
16 penetration areas. Are there piping penetration areas
17 or -- what are they? The spaces are characterized on
18 the plan views as penetration areas.

19 MR. MAASS:. The -- we will try and make a
20 distinction in what we are saying. The annular space
21 is in the service area inside the containment that we
22 are talking about, as opposed to the annulus building
23 itself. Okay.

24 MEMBER STETKAR: Yes, and I understand, if
25 you go back to Slide 4, that that -- what I will call

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1 the spill-over space goes into the annular spaces
2 inside the = what I'll call the, I don't know, the
3 shield wall or something like that.

4 MR. MAASS:. Right.

5 MEMBER STETKAR: So and those are
6 characterized, at least on the plan drawings, as
7 penetration areas.

8 MR. MAASS:. Yes, the piping won't go
9 through there. We have no intention of allowing any
10 fibrous insulation below the flood level.

11 MEMBER STETKAR: Below the flood level.
12 Okay.

13 MR. MAASS:. Which is approximately seven
14 to eight inches.

15 MEMBER STETKAR: Yes, I mean, you know, I
16 have been trying to look at elevations and plans and
17 you don't get the full picture, but okay.

18 MEMBER BANERJEE: It'd be interesting
19 though to just know where, you know, it's some sort of
20 a layout where the -- maybe it's already there in your
21 --

22 MEMBER STETKAR: In principle, there's no
23 water out there unless the baskets fill up on this
24 drawing to minus seven feet, you know, and the water
25 spills out into that area.

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1 But that area goes down -- I think that
2 areas goes down below that to some level, right?

3 MEMBER BANERJEE: You may already have the
4 information somewhere where you can just point us to
5 it, but we would like to see where you are going to
6 allow fibrous insulation.

7 MR. CONNELL: We can follow up on that.

8 MEMBER BANERJEE: It may be prudent for
9 people not to put it in anyways, but that's a separate
10 issue.

11 MR. CONNELL: Okay. So that brings us to
12 the summary. As I mentioned before, we had 50 small-
13 scale sensitivity tests that took place late last year
14 and then continued on to the very beginning of this
15 year.

16 That's where we looked at varying the
17 material that we had for the filtering medium, looked
18 at smaller and smaller hole sizes, perforated plate as
19 well as mesh, determined that for our design, it
20 really was the optimum for 0.08 inch mesh material.

21 Then we conducted 15 large-scale tests to
22 determine what the actual bypass --

23 MEMBER BANERJEE: How small were the
24 small-scale tests?

25 MR. CONNELL: They were more table-top

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1 tests that were conducted at Alliance Research.

2 MR. MAASS:. Halden.

3 MR. CONNELL: Halden, I'm sorry. And I
4 guess the --

5 MEMBER BANERJEE: This is Halden, where is
6 it, New Jersey?

7 MR. MAASS:. Worcester, Massachusetts,
8 near there.

9 MEMBER BANERJEE: Worcester, Massachusetts.
10 There are two or three places doing testing and so I
11 keep getting mixed up where they are.

12 MR. MAASS:. The downstream testing was
13 done in Ewing, New Jersey.

14 MEMBER BANERJEE: Okay. So these small-
15 scale tests and then the large-scale tests were done
16 at the same place?

17 MR. MAASS:. Yes.

18 MEMBER BANERJEE: Are these tests still
19 operational or have you have closed them down?

20 MR. CONNELL: They can be restarted again
21 --

22 MEMBER BANERJEE: If needed.

23 MR. CONNELL: if we needed to.

24 MEMBER BANERJEE: Okay.

25 MR. CONNELL: The flumes still exist.

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1 They are with the strainer and basket.

2 MEMBER BANERJEE: But you'd have so little
3 -- essentially you are saying you have latent debris.
4 There's nothing else.

5 MR. CONNELL: That's right. We have
6 gotten down to the point where that's all we have, is
7 latent fiber. And they were summarized in our tech
8 report

9 MEMBER BANERJEE: You reported these
10 tests, they are available? The staff have them?

11 MR. CONNELL: They will have the latest
12 report on the 18th.

13 MEMBER BANERJEE: Okay.

14 MR. CONNELL: Okay. That concludes our
15 open session.

16 MEMBER BANERJEE: Let me just -- one
17 second.

18 MR. CONNELL: Sure.

19 MEMBER BANERJEE: So no significant head
20 because everything was taken out by your baskets,
21 right?

22 MR. CONNELL: Correct.

23 MEMBER BANERJEE: Okay, thanks.

24 MEMBER STETKAR: I think it's a good
25 question that Dr. Banerjee raised about where you will

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1 have fibrous insulation. I am thinking about things
2 like feedwater and steamline breaks that would then
3 communicate -- you do get high-pressure jets out there
4 in the penetration areas, let's call it.

5 That water will then -- it's not a LOCA
6 but that water will then flow down through that space
7 and communicate in through those annular openings into
8 the IRWST from which you know, injection pumps --
9 we are not talking about recirculation now. We are
10 just talking about normal plant injection, which you
11 will need in some form for steamliner --

12 MEMBER BANERJEE: It happened in the past.

13 MEMBER STETKAR: Yes.

14 MEMBER BANERJEE: Yes.

15 MEMBER STETKAR: So despite the fact that
16 it's not a design-basis LOCA type zone of influence,
17 because of those communication pathways there might be
18 stuff that comes in the other way, for not necessarily
19 LOCA recirculation, either, I'm just thinking about
20 normal -- because it's your IRWST after all.

21 MR. CONNELL: But again it had to go
22 through the tortuous path, settle out --

23 MEMBER STETKAR: It does indeed. It has
24 to be able to get there. But --

25 MR. CONNELL: Yes. Yes. And you still

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1 have the trash rack and then the basket itself.

2 MEMBER STETKAR: Exactly. Sure.

3 MR. CONNELL: So those are fairly large
4 surfaces too. And we also find the clump material, I
5 mean we are taking the most restrictive fines you
6 know, and when you clump the material, that doesn't
7 have as much of a dp, that doesn't have as much of a
8 concern. It gets caught in the basket, it doesn't
9 even really get to the strainer is what we have been
10 finding.

11 MEMBER BANERJEE: So ultimately if it is
12 exposed for a long period of time --

13 MR. CONNELL: And baked.

14 MEMBER BANERJEE: Yes. Yes. So I think
15 you are doing okay. All right.

16 MS. SLOAN: So we should pause.

17 CHAIR POWERS: We now have a pause to
18 close this session and I turn to our --

19 MR. WIDMAYER: We are good right now.

20 CHAIR POWERS: You are good? We think we
21 are good. Do you think we are good?

22 MS. SLOAN: If he says we are good, we are
23 good.

24 CHAIR POWERS: Well, it's your material.

25 MEMBER BANERJEE: It's your material, it's

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1 your audience.

2 MS. SLOAN: If there are members of the
3 public who are not AREVA, UniStar, PPL or Bechtel, I
4 would say we need to ask them to leave.

5 MR. CONNELL: But Bechtel is okay. You can
6 stay.

7 CHAIR POWERS: Please charge ahead then.

8 MR. CONNELL: Okay.

9 (Whereupon, the matter went off the record
10 to go into closed session at 11:37 a.m.)

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AFTERNOON SESSION

1:01 p.m.

CHAIR POWERS: Okay, we are going to move to Auxiliary Systems I guess. Getachew, you're going to lead us out?

MR. TESFAYE: Yes. Today we hope to finish Chapter 9, Group 1 which is all the sections except 9.1 Fuel Handling and Storage Systems. Our plan is to complete that today so that we can devote the whole full day for Chapter 7 and Charlie tomorrow.

CHAIR POWERS: Okay, so we should be done by no later than 1:30 tomorrow, right?

(Laughter)

MEMBER STETKAR: You mean 1:30 tomorrow with Chapter 9?

CHAIR POWERS: No.

MEMBER STETKAR: Okay.

CHAIR POWERS: I'm counting on us being done with it early tomorrow.

MR. TESFAYE: Hopefully we'll bring the second part of Chapter 9 in January.

CHAIR POWERS: In January, okay. Okay.

MR. TESFAYE: With that I guess I leave it to AREVA to make their presentation.

CHAIR POWERS: Oh Darrell, are you leading

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1 the charge here?

2 MR. GARDNER: Yes, sir.

3 CHAIR POWERS: You can do this without
4 Sloan supervision?

5 MR. GARDNER: She's close enough to reach
6 over and whack me if I deserve it.

7 CHAIR POWERS: All right, okay. We don't
8 have her up there front and center. You guys did it
9 great. That information briefing was terrific. I
10 liked it. I know you were quiet, you didn't say
11 anything.

12 (Laughter)

13 CHAIR POWERS: When you come for the full
14 thing she does the chemistry section, okay? Go ahead,
15 Darrell, I'm sorry.

16 MR. GARDNER: That's all right. So as
17 Getachew said we're going to do Chapter 9 today. It's
18 an overview of what's in the US EPR FSAR with the
19 exception of Section 9.1 which we'll discuss hopefully
20 in January. Today's overview will focus on the most
21 significant systems within this portion of the
22 chapter. While we have not prepared specific
23 presentation materials on all the systems such as the
24 non-safety systems, turbine island, secondary side
25 heat removal, those kinds of things, we are prepared

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1 to answer any member's questions on those systems
2 should you have any. The EPR design approach for
3 those systems are fairly typical and consistent with
4 the existing operating fleet. And given the scope and
5 size of the material in this chapter we're focusing on
6 the most important systems.

7 So with that, we have a pretty good team
8 here assembled this morning, this afternoon now.
9 Steve Huddleston will be doing the water systems and
10 Jean Lindstrom will be doing the drains and sampling
11 systems, and Fred Maass will be covering a CBC PASS
12 and extra boarding system. And then we're going to do
13 a little bit of a shuffle to get through the rest of
14 the chapters with more presenters. So with that I'll
15 turn it over to Steve to get started.

16 I guess I just want to make one quick
17 introductory remark I guess to follow on on the water
18 systems. Again, many, many water systems in Chapter
19 9. We're focusing on the most important. Okay?

20 MR. HUDDLESTON: Okay, thanks Darrell. My
21 name is Steve Huddleston. I've been with the EPR
22 project since 2005. I'm currently, I manage BOP
23 systems engineering group. At the time that I was
24 with the EPR project I supervised the fluids systems
25 on Section 9.2 and I'll be talking about four of the

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1 safety-related fluids systems in Section 9.2. I've
2 been in the industry on the military side and on the
3 civilian side since the 1970s and I have a degree in
4 mechanical engineering from Purdue University and I'm
5 a registered PE in Illinois.

6 CHAIR POWERS: So Purdue is up a hand over
7 Ohio State today.

8 MR. HUDDLESTON: I'll be talking about the
9 essential service water system, the ultimate heat
10 sink, component cooling water system and the safety-
11 chilled water system. I'm showing right now, this is
12 a compound figure. It illustrates how these fluid
13 systems tie together. If you'll direct your attention
14 to the essential service water system you'll see that
15 it provides cooling water to the CCW heat exchanger
16 and to the emergency diesel generators. During
17 operation of course it would only supply cooling water
18 to the CCW heat exchanger. It returns that water to
19 the ultimate heat sink which is a mechanical draft
20 cooling tower.

21 And on the other side you'll see the CCW
22 system picks up loads throughout the nuclear island
23 both non-safety and safety loads including the safety
24 chilled water system. And I'll just note that two
25 divisions of the safety chilled water system are

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1 water-cooled by CCW, two divisions are air-cooled.

2 Essential service water system operates
3 during normal operation, safe shutdown and cooldown
4 and following a design basis accident in which case,
5 and this will be true for all the trains that we
6 discuss, two trains are required for safe shutdown.
7 We also have one dedicated non-safety train which
8 allows the removal and is designed for the removal of
9 severe accident heat removal.

10 The safety-related essential service water
11 system provides cooling to the component cooling water
12 heat exchangers, the emergency diesel generator heat
13 exchangers and the essential water system pump room
14 coolers. And as I said before this heat is removed to
15 the ultimate heat sink cooling towers. This is a
16 schematic that demonstrates the flow path of the
17 system as it's laid out. Essentially we take water
18 from the cooling tower basin using the essential
19 service water pump that's pumped through a debris
20 filter and then it goes to supply the room coolers and
21 the CCW heat exchanger and the EDG coolers. This is
22 the flow path through the component cooling water
23 system heat exchanger and the emergency diesel
24 generator coolers. And this is the return flow path
25 to the ultimate heat sink cooling towers. You'll note

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1 that there's a bypass valve. The bypass valve is in
2 operation during cold weather to keep cooling tower
3 basin warm.

4 There's also a keep-fill line. A keep-
5 fill line provides fill to vertical portions of the
6 piping when that system is out for maintenance so that
7 we don't have void formation in the piping.

8 The dedicated train, the non-safety
9 dedicated train, that takes a suction and is located
10 in the Train 4 ultimate heat sink cooling tower basin.

11 And it's powered from Division 4 Class 1E power
12 source EDGs. Yes?

13 MEMBER STETKAR: Steve?

14 MR. HUDDLESTON: Yes.

15 MEMBER STETKAR: Back on slide 9 the --
16 you have to excuse me. Let me preface all of my
17 comments by saying the only document I had was FSAR
18 Revision 2. I haven't seen the interim Revision 3.

19 MR. HUDDLESTON: Okay.

20 MEMBER STETKAR: So any of the stupid
21 comments that I make that are answered easily in that
22 interim Revision 3 please tell me. I just didn't have
23 it. The keep-fill line, is it there or is it to the
24 left of the return isolation valve?

25 MR. HUDDLESTON: No, it's there. It's on

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1 the right-hand side.

2 MEMBER STETKAR: It is.

3 MR. HUDDLESTON: Yes. That valve would be
4 shut.

5 MEMBER STETKAR: Okay.

6 MR. HUDDLESTON: And that way it retains
7 the volume in that line when it's -- when the line is
8 shut down.

9 MEMBER STETKAR: It strikes me that if it
10 was there it's just spraying in the spray nozzles.

11 MR. HUDDLESTON: Well, that's -- it looks
12 that way because in the figure the line shows
13 horizontal, but in the actual geometry there's a
14 vertical portion of the line that fills up.

15 MEMBER STETKAR: Okay, so it's just a low-
16 pressure. Okay, I got it.

17 MR. HUDDLESTON: There's a level indicator
18 there.

19 MEMBER STETKAR: I got it.

20 MR. HUDDLESTON: That the operators have
21 to --

22 MEMBER STETKAR: I got it. Thank you.

23 MR. HUDDLESTON: Okay.

24 MR. GARDNER: Mr. Stetkar, I'll also point
25 it's actually Revision 3 was issued in August. So

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1 it's no longer an interim, it's a full Revision 3,
2 August of this year.

3 MEMBER STETKAR: Our thanks to the staff
4 for getting it to us in a timely fashion. We haven't
5 seen it yet.

6 CHAIR POWERS: I thought I had it.

7 MEMBER STETKAR: I only have -- Derek?

8 MR. WIDMAYER: I have to check. I thought
9 we had Revision 3.

10 MEMBER STETKAR: I only think I have
11 Revision 2. But anyway.

12 MR. TESHAYE: The SE is based on Revision
13 2 but the staff has used interim Revision 3.

14 MEMBER STETKAR: Well actually I think
15 it's based on Revision 3 because a lot of the
16 questions are compiled. Check, Derek, because maybe I
17 misplaced Revision 3, but anyway. Continue. I'm
18 sorry.

19 MR. HUDDLESTON: Just to --

20 MEMBER STETKAR: I was trying to guess
21 where it was because I didn't have it in Revision 2,
22 so thanks.

23 MR. HUDDLESTON: Just to recap, I was
24 talking about the dedicated train. The important
25 thing here is that it's powered both from a Class 1E

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1 Division 4 source and from the station blackout diesel
2 generator for diversity.

3 MEMBER STETKAR: Before you get to the
4 ultimate heat sink because we're going to switch gears
5 as I understand it there are level, sump-level
6 switches in the Safeguards Building that isolate
7 essential service water and trip the pump on level to
8 preclude apparently some flooding scenario where you
9 could actually flood up above zero elevation and
10 affect two divisions anyway if not more. Again, I
11 don't have any information about those signals or the
12 switches. The -- what I could find was in the safety
13 evaluation report it says each sump is equipped with
14 two level instruments, actuation of one of two will
15 provide an alarm in the control room and isolate the
16 affected division. That means that I can shut down an
17 ESWS division if I have a signal from one level
18 switch. Is that the logic, it's a one out of two for
19 the division?

20 MR. HUDDLESTON: I couldn't speak to the
21 logic.

22 MEMBER STETKAR: Well, perhaps I can get
23 the questions on the table then and you can say you
24 can't speak to the logic. If that's the case does
25 that flood isolation signal override safeguard signals

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1 for essential service water? In other words, if I get
2 a safeguards actuation and essential service water
3 gets an on signal, if I have a high-level signal from
4 a level switch will that shut down the division
5 despite the fact that I have a safeguards actuation
6 signal? Do you know that?

7 MR. GARDNER: I think we don't have our
8 I&C folders here but we understand the question.

9 MEMBER STETKAR: I was hoping that they
10 would be here since Chapter 7 is tomorrow. So maybe
11 you can caucus with them.

12 MS. LINDSTROM: This is Jean Lindstrom.
13 I'll answer that for the vents and drains portion.
14 The sumps are in the vents and drains system.

15 MEMBER STETKAR: Yes.

16 MS. LINDSTROM: The instruments are and
17 actually there's one.

18 MEMBER STETKAR: There's only one?

19 MS. LINDSTROM: There's one safety-related
20 per division.

21 MEMBER STETKAR: Okay, so this statement
22 of one of two is not even --

23 MS. LINDSTROM: You'll see the new
24 revision has been corrected.

25 MEMBER STETKAR: Okay.

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1 MS. LINDSTROM: And the scenario is just
2 one. The scenario is you won't have two divisions
3 that fail, one will -- well anyway it will go there,
4 in the vents/drains system but --

5 MEMBER STETKAR: Okay, if you're going to
6 address it in vents and drains we'll wait till we get
7 there.

8 MS. LINDSTROM: It does shut down the
9 essential service water pump and the valve.

10 MEMBER STETKAR: Yes, I understood that.
11 It closes the valve, it trips the pump.

12 MS. LINDSTROM: Yes.

13 MEMBER STETKAR: But even with a
14 safeguards signal in place.

15 MS. LINDSTROM: We'll have to recheck the
16 I&C part but it does shut it down.

17 MEMBER STETKAR: My question, where I'm
18 headed with this line of questioning is I wanted to
19 first understand how the system worked and if it does
20 shut it off, you know, if it overrides a safeguards
21 signal for example then the next question was going to
22 be can the operators in turn manually override that
23 signal. Because the concern is about flooding in the
24 Safeguards Building, I understand that concern.
25 However, shutting down ESWS also kills one of the

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1 diesels which is not a load that you particularly care
2 about this particular flooding scenario. So I'm
3 curious whether there's some way that the operators
4 can restore cooling to the diesel if indeed this
5 occurs during a safeguards situation. That's why I'm
6 asking questions about, you know, numbers since --
7 because a spurious high-level signal for whatever
8 reason because there might be other water from other
9 sources in that area during a seismic event let's say
10 or a fire protection system might go off for whatever
11 reason let's say could also isolate perhaps one or
12 maybe even two of your ESWS divisions.

13 MR. GARDNER: So are you asking this from
14 an equipment protection standpoint?

15 MEMBER STETKAR: I'm asking it from an
16 integrated system response perspective. My concern is
17 can we shut down ESWS, one train, maybe two trains
18 because I don't know about the physical geometry of
19 the Safeguards Building or where various piping
20 systems are routed within that building. My concern
21 is if there is a signal from a single level
22 transmitter that can shut down a train of ESWS and
23 prevent either its automatic response during
24 safeguards condition, and I understand the problem
25 about flooding, but prevent cooling for a diesel is a

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1 bigger concern, I -- that may satisfy all of the
2 design and licensing criteria but I would like to
3 understand how that system works. My problem is I
4 don't know enough right now to know what follow-on
5 questions to ask because I don't really know enough
6 about how those isolation signals work, whether they
7 can -- whether they override a safeguards signal,
8 whether they in turn if they do override the
9 safeguards signal can be reset by the operators such
10 that the operators could restore cooling let's say to
11 a diesel if you needed it by isolating the supply to
12 the Safeguards Building.

13 MS. LINDSTROM: Yes, currently there is an
14 open item for that particular item on the vents and
15 drain system RAI 476. So that's an open item being
16 tracked --

17 MEMBER STETKAR: Okay.

18 MS. LINDSTROM: -- about the use of those
19 functions.

20 MR. WIDMAYER: Dr. Powers, you guys are
21 working with Revision 2. That's the current version.
22 I was unaware that any SERs chapter was being
23 prepared on Revision 3, so.

24 MEMBER STETKAR: Well, it's -- the way
25 it's characterized in the SER is there apparently was

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1 an RAI response and AREVA can correct me if I'm wrong.

2 My interpretation is there was an RAI response that
3 compiled essentially the responses to several, a large
4 number of RAIs, you know, 50-plus type RAIs and as a
5 result of resolutions of those RAIs developed what's
6 characterized in the SER as an interim Revision 3 of
7 at least Section 9.2 of the FSAR. And it's
8 characterized in the SER as an interim Revision 3 in
9 response to RAI 465, Question 9.2.1-51.

10 MR. TESFAYE: That is correct. That
11 applies only to that particular section, Section 9.2,
12 the water systems. By basing it on the interim
13 Revision 3 to eliminate the number of discussion of
14 those multitude of questions.

15 MEMBER STETKAR: I'll only say it's
16 really, really difficult for folks like me who like to
17 understand how systems work to shoot at a moving
18 target because we don't get all of the RAIs and
19 responses, nor do we particularly want all of the RAIs
20 and responses. You know, perhaps some of the
21 questions that I'm going to be asking could have been,
22 I could have answered them for myself rather than
23 bringing them up in the context of this meeting had we
24 had that information. It's even a bit more troubling
25 if indeed Revision 3 of the FSAR was issued in August

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1 and we didn't have it. I mean, it is --

2 MR. WIDMAYER: But see, I'm not going to
3 give it to you until I find out it's the official
4 version.

5 MEMBER STETKAR: Yes.

6 MR. WIDMAYER: So you're not inundated
7 with material.

8 MEMBER STETKAR: No.

9 MR. WIDMAYER: I've not been told that
10 Revision 3 is the official.

11 MEMBER STETKAR: Okay.

12 MR. TEFAYE: I repeat again Revision 3 is
13 not the best for this SE. Revision 3 for that
14 particular section, that's in response to that RAI,
15 that particular RAI just mentioned. Interim Revision
16 3 is the FSAR markup in response to that particular
17 RAI. So, interim Revision 3 is what you have in
18 response to that RAI.

19 MR. WIDMAYER: Yes, but he doesn't have
20 that. That's --

21 MEMBER STETKAR: Yes.

22 MR. TEFAYE: You don't have that.

23 MEMBER STETKAR: But I don't have that,
24 for example.

25 MR. TEFAYE: Okay. Understood.

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1 MEMBER STETKAR: I'm sorry, Steve. Did
2 you at least get the questions about the level
3 switches and that stuff? Because the concern was
4 trying to understand, you know, how they interact and
5 under what conditions could it shut the system down.
6 There are also concerns, for example, if they're just
7 level switches you could have leaks from other
8 systems, in particular fire protection systems out in
9 the Safeguards Building that would isolate ESWS. It
10 has nothing to do with ESWS. ESWS would be perfectly
11 happy cooling water and the diesel generator. And
12 perhaps the operators might want to make it do that
13 under certain circumstances but if the isolation
14 signals won't let them that could be a problem.
15 That's why I'm trying to understand what those
16 interactions are. Okay, thank you.

17 MR. HUDDLESTON: I'll move on to the
18 ultimate heat sink. The ultimate heat sink is four
19 redundant safety-related trains eject heat from the
20 ESW during normal operation, cool-down, shutdown, DBA
21 accident. And as before we need two ultimate heat
22 sink trains to shut down a design basis accident.

23 Each ultimate heat sink consists of a
24 mechanical draft cooling tower with two fans. There's
25 two 50 percent fans, spray nozzles, tower fill, drift

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1 eliminator. It's a fairly conventional design for a
2 cooling tower. The tower contains the two 50 percent
3 fans are powered from the EDGs during DBA. For the
4 train 4 cooling tower fans can be powered both from
5 EDG and from SBODG diesels.

6 MEMBER SKILLMAN: I'd like to ask a
7 question, please.

8 MR. HUDDLESTON: Yes.

9 MEMBER SKILLMAN: The switchgear to
10 account for that capability, has that been evaluated
11 in Chapter 8? That is -- could conceivably be a
12 common mode failure. Should the switchgear fail then
13 neither can respond. Can you please speak to how the
14 switchgear for the selection between EDG or a station
15 blackout diesel has been evaluated?

16 MR. HUDDLESTON: I don't think I could
17 address --

18 MEMBER SKILLMAN: I would like to put that
19 on the record, please.

20 MEMBER STETKAR: I can help you out there
21 a little bit. We did go through that quite a bit in
22 Chapter 8. It's a manual. The station blackout
23 diesels, I think they start automatically but they're
24 aligned manually.

25 MR. STACK: Yes, that's correct. The SBO

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1 diesels are automatically --

2 MR. WIDMAYER: Name, please.

3 MR. STACK: I'm sorry. Tim Stack from
4 AREVA. I can go through the introduction if you want
5 or just answer the question. The SBO diesels are
6 going to automatically start on the loop and it'll be
7 manually loaded so that you wouldn't parallel the bus.
8 You would only go and start reloading some common
9 loads if the EDGs did not start.

10 MEMBER SKILLMAN: Okay, thank you.

11 MEMBER STETKAR: And EDGs, I checked last
12 night. The EDGs have enough capacity to pick up these
13 fans. They're pretty healthy fans but they're pretty
14 healthy SBO diesels also.

15 MEMBER SKILLMAN: I was more concerned
16 about a common mode failure defeating both
17 simultaneously. Thanks.

18 MR. HUDDLESTON: The ultimate heat sink
19 basin has a 72-hour capacity. An SBO would not
20 require or would be able to survive no makeup for 72
21 hours. And that would provide the capacity for
22 evaporation and drainage or water loss from the
23 cooling tower.

24 MEMBER STETKAR: Steve, that capacity --
25 I've now lost myself completely so bear with me. Let

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1 me just see if you're going to address it. Again,
2 this is rev 2 of the FSAR. There is a discussion and
3 a table, it's Table 9.2.5-4 regarding what are
4 characterized as, I don't know if they're called worst
5 case, but yes, worst case heat removal conditions in
6 terms of local environmental conditions, wet-bulb
7 temperature and so forth. The only thing I wanted to
8 confirm is the discussion in the FSAR shows those
9 conditions over a 24-hour period. It doesn't show the
10 actual temperature in the cooling tower basin, it only
11 shows the input wet-bulb and I think dry-bulb
12 temperatures that you use for that worst case
13 analysis. The conclusion was that the maximum ESWS
14 supply temperature does not exceed 95 degrees. Is
15 that true for the full 72 hours or is that only true
16 for the 24 hours that you applied those particular
17 conditions to? In other words, at the end of 24 hours
18 did you stop the analysis and say okay, I have less
19 than 95 degrees C -- degrees Fahrenheit so I'm okay,
20 or did you actually run the worst case conditions out
21 over the 72-hour design basis LOCA?

22 MR. HUDDLESTON: Well, there were two
23 different types of analysis performed. One was to
24 determine the worst case evaporative conditions.

25 MEMBER STETKAR: Yes, that's the one that

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1 I'm talking about.

2 MR. HUDDLESTON: Yes. Then the 24-hour
3 also determines the greatest heat load on the basin so
4 that's where we see the greatest challenge to the 95
5 degrees.

6 MEMBER STETKAR: That's the greatest qdot,
7 it's not the integrated heat which would determine the
8 final temperature.

9 MR. HUDDLESTON: Not over the 72 hours --

10 MEMBER STETKAR: Right.

11 MR. HUDDLESTON: -- but the response on
12 the basin is to peak and then begin to drop off. And
13 that --

14 MEMBER STETKAR: Do you have an analysis
15 that shows what the basin temperature looks like for
16 72 hours under those worst case evaporative conditions
17 for design basis?

18 MR. HUDDLESTON: We do have an analysis.

19 MEMBER STETKAR: Does the temperature
20 exceed 95 degrees?

21 MR. HUDDLESTON: No.

22 MEMBER STETKAR: It does not. I see a lot
23 of people looking back and forth at each other which
24 leads me to pause.

25 MR. SARMA: This is Ram Sarma from

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1 Bechtel. The way the analysis was the first 24 hours
2 when we did the analysis and applied worst case heat
3 load after about 12 hours the basin temperature kept
4 on -- it peaked at 94.6 and then it went down from
5 there so the analysis was terminated at 24 hours.
6 Because the heat load was also continuously --

7 MEMBER STETKAR: Yes, I understand the
8 heat load is certainly going to decrease but the
9 actual, the temperature profile showed a peak and then
10 actually started to decrease. Okay, that's -- thanks.

11 Thanks. You said 94.6? Which I guess is less than
12 95. Thanks.

13 MR. HUDDLESTON: This figure just simply
14 demonstrates the functions that are provided to the
15 cooling tower basin in the sense that we have a normal
16 makeup path and an emergency makeup path and a normal
17 chemical addition path. Also, you'll notice the
18 normal makeup path provides water to the keep-fill
19 line.

20 Moving on to the component cooling water
21 system, it's also a four train system. A closed loop
22 provides heat removal to safety and non-safety related
23 components.

24 MEMBER STETKAR: I'm sorry. I have to
25 write notes here otherwise I never remember anything.

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1 Can you go back to the ultimate heat sink? This is I
2 hope a simple question. For potential ice removal
3 conditions I notice that you can run the cooling tower
4 fans in reverse.

5 MR. HUDDLESTON: Yes.

6 MEMBER STETKAR: There's some statements
7 in the FSAR about if it's operating in reverse the
8 division is still considered operable. When you get a
9 safety ejection signal any fan operating in a reverse
10 direction will automatically trip and restart
11 following a coast-down. Is that restart interlocked
12 with an actual zero rotation signal or is it only
13 based on a time delay? I don't really want to start a
14 fan, try to start a fan if it's running in reverse
15 because I'm going to trip the circuit breaker for that
16 fan.

17 MR. HUDDLESTON: Yes, it's a good
18 question. I don't think I have the details on that,
19 on the circuit arrangement. I'm not sure if it would.

20 MEMBER STETKAR: Okay. The first thing I
21 think about, you know, if it's only a time delay then
22 I really want to be sure that that fan is stationary
23 when I try to start it. Otherwise the in-rush current
24 on that circuit breaker, it's going to be really
25 large. I mean you'd almost guarantee the fan supply

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1 breaker is going to trip.

2 MR. SARMA: The current logic is there is
3 -- the cooling tower fans has to coast down, reverse
4 rotating fan has to coast down and there's a certain
5 time that the cooling tower manufacturer recommends
6 for it to coast down to a complete stop. And after
7 that the fan will --

8 MEMBER STETKAR: So it's based on a time
9 delay. I guess then my question is what type of tests
10 are you going to be performing because the
11 manufacturer may have made some, I don't know,
12 conservative assumptions that they thought were
13 conservative for their particular use that may not be
14 conservative for this particular application regarding
15 the coast-down time. You know, so I guess the
16 question is if it is based on a time delay what tests
17 are you going to perform on the as-built, as-installed
18 system to make sure that they do, those fans do indeed
19 become either stationary or that the load is at least
20 low enough so that when you give it a signal to start
21 in the forward direction you don't actually trip those
22 circuit breakers. Having burned up motors in my time
23 because of mis-wired windings I'm aware of this.
24 Okay, so maybe you want to think about that. That's -
25 - if it is on a time delay then it's a question more

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1 in terms of your startup testing program and whether
2 you have an ITAAC in place to confirm that. Thank
3 you. I'm sorry for being so slow but notes take long
4 to write.

5 MR. HUDDLESTON: Back to the component
6 cooling water system. It -- we have a shallow tube
7 heat exchanger that's cooled by ESW as we talked about
8 before. And as we mentioned I think a couple of times
9 now so far we have two trains, CCW required and design
10 basis accident heat removal. The important point here
11 is the safety-related loads, RHR, safety injection,
12 reactor coolant pump, thermal barrier cooling, the
13 safety chiller cooling of which we cool two trains,
14 train 2 and 3 with CCW and spent fuel pool cooling
15 heat exchangers.

16 This is a listing of non-safety loads. I
17 won't go through it, it's quite extensive, but I'll
18 just point out some of the major loads to the CCW
19 system from these non-safety loads would be for
20 example operational chiller. That's a fairly good-
21 sized load and the chemical and volume control high-
22 pressure heat exchangers are also a fairly good-sized
23 load.

24 MEMBER SKILLMAN: May I ask you, please,
25 to explain why that particular load is not categorized

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1 as safety grade?

2 MR. HUDDLESTON: It's all of -- it's not
3 relied on for accident mitigation.

4 MEMBER SKILLMAN: Do you have to run your
5 reactor coolant pumps?

6 MR. HUDDLESTON: Not necessarily.

7 MEMBER SKILLMAN: Just from a lot of
8 experience in this particular system why wouldn't you
9 just opt on the side of safety, put that over on the
10 safety side so that you always retain the option of
11 running your reactor coolant pumps and letting down at
12 least your seal injection flow rate. It seems to me
13 that that's one that's almost worth arm-wrestling
14 over. You understand what I'm saying?

15 MR. HUDDLESTON: I do. It's a choice.

16 MEMBER SKILLMAN: I think in the years
17 gone by there was a time early on when we would
18 isolate component cooling water and in time we
19 realized, golly, you've got to keep component cooling
20 water going because you've got a thermal barrier heat
21 exchanger and you've got your letdown pumps.

22 MR. HUDDLESTON: We do have thermal
23 barrier backup coolants.

24 MEMBER SKILLMAN: But it just seems that
25 this is one that might have been put over in the --

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1 it's easier to take it out of the keep it in category
2 when keeping it in may give some rather significant
3 operator flexibility.

4 MR. HUDDLESTON: That's a question we'll
5 take.

6 MEMBER SKILLMAN: Thank you. Thanks. I
7 would offer that the other items you've identified I
8 think kind of pass the common sense test as probably
9 not being needed but this is one that can give the
10 operators a chance to run reactor coolant pumps in an
11 awkward position. So maybe it means you've got to
12 take a couple more thousand BTUs an hour, whatever the
13 number is, in order to grant that flexibility that
14 could be significant in terms of some form of accident
15 response.

16 MR. HUDDLESTON: Okay. Going on to the
17 dedicated CCW train which is provided for severe
18 accident heat removal, also of course Class 1E power
19 from Division 4 and from station blackout diesel
20 generators as well as the EDGs.

21 As we go on and look at the safety-related
22 trains we'll find that the design or the architecture
23 of the system is such that we have two trains on two
24 sides, so we have four trains together. Each of the
25 two trains on each side supply a common header and we

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1 refer to those as common headers 1 and 2. And if I
2 move on to the figure layout it might be a little
3 easier to explain. In this case we're looking at
4 train 1 and train 2. Here are the CCW pumps supplying
5 flow through each of their heat exchangers. Only one
6 train at a time can supply the common header. In this
7 case common header 1.B, this is the common header,
8 supplies loads that are both safety-related side and
9 some non-safety related loads which can be isolated in
10 an accident. Up here we have the common 1.A which is
11 the fuel pool cooling heat exchanger.

12 So there are different modes of operation.

13 For example, typically we might have one train
14 supplies all of the common loads on one side and then
15 on the other side we'd have another train supplying
16 both the common loads and fuel pool cooling. During
17 normal operation we would expect to supply one fuel
18 pool cooling heat exchanger. In an accident, when we
19 have an accident condition we would supply both common
20 headers and eventually all of the LHSI heat exchangers
21 for RHR heat removal.

22 And if we're -- I'll move on to the other
23 side. So we see that here we have train 3 and 4.
24 Train architecture are essentially duplicated. Once
25 again, on the side 2 we're supplying the fuel pool

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1 heat exchanger, one fuel pool heat exchanger, and we
2 also note that we supply the reactor coolant pump
3 thermal barriers.

4 MEMBER STETKAR: Steve, before you get
5 into the thermal barrier stuff because that's sort of
6 a little bit different animal to think about let me --
7 I really like this drawing. It takes awhile for at
8 least rev 2 of the FSAR to figure out how everything
9 is tied together. This is a good drawing.

10 As I was reading the SER and this again
11 may be a problem with timing, there apparently in
12 reply to some questions from the staff they asked
13 about essentially failure modes of the transfer
14 valves.

15 MR. HUDDLESTON: Yes.

16 MEMBER STETKAR: And my reading of the SER
17 anyway is that it was stated that the, let me call it
18 the train transfer valves between train 3 and 4 on
19 this drawing fail as is where the valves for the non-
20 safety consumers fail closed. So for example on this
21 particular drawing there's a couple of hydraulic-
22 operated valves in the upper right center of your
23 middle oval there that supply the non-safety loads
24 kind of within the right-hand side of that oval, that
25 those would fail closed but the train 3 to train 4

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1 transfer valves up on the main header fail as is. Is
2 that correct?

3 MR. HUDDLESTON: Well, we went through
4 several iterations on the logic for those valves and
5 basically I think where we ended up was we could go
6 through a train transfer. Basically you can't have --
7 it's set up so you can't have the transfer valves on
8 both sides open at the same time. So.

9 MEMBER STETKAR: You need -- and let me
10 make sure I understand that. As I understand it both
11 -- let's say train 3 is normally aligned and operating
12 so that the supply valve is open and a return valve is
13 open.

14 MR. HUDDLESTON: Right.

15 MEMBER STETKAR: Both of those valves must
16 be closed before either of the train 4 valves open, is
17 that right?

18 MR. HUDDLESTON: Yes, that's right.

19 MEMBER STETKAR: So for example if I have,
20 I think of failure modes because I'm a PRA kind of
21 guy, if either of the train 3 valves fails to close
22 the transfer will not occur, is that correct?

23 MR. HUDDLESTON: Right.

24 MEMBER STETKAR: Or if either of the,
25 obviously if either of the train 4 valves fails to

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1 open the transfer doesn't occur.

2 MR. HUDDLESTON: Right.

3 MEMBER STETKAR: So any four of those
4 single-valve failures will disable the transfer.

5 MR. HUDDLESTON: Yes.

6 MEMBER STETKAR: Okay. So I understand
7 that part. Now, in terms of -- since they're
8 hydraulically operated valves they can -- you can wire
9 them up to pretty much do anything you want to do with
10 them. Which direction do those valves go when you
11 lose power to the hydraulic operator? And I have no
12 idea what the hydraulic operator, I don't know whether
13 it's a solenoid or --

14 MR. HUDDLESTON: Well, bear in mind that
15 those valves aren't specified yet.

16 MEMBER STETKAR: I understand, but the
17 design, this is a design philosophy. It's not a
18 particular valve that I'm talking about.

19 MR. HUDDLESTON: And the design answer
20 that we had so far is it will require that they fail
21 shut.

22 MEMBER STETKAR: Fail closed.

23 MR. HUDDLESTON: Yes.

24 MEMBER STETKAR: Okay. And that's --
25 because that was different from what I read in the

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1 SER. So that answer --

2 MR. HUDDLESTON: I could be wrong. I
3 could be wrong. So if --

4 MEMBER STETKAR: Well, if you're wrong
5 I've got a bunch of questions. I'm not sure -- if
6 they fail closed I may have some questions. If they
7 don't, if they fail as is, in other words remain open
8 I have a line of questioning that I'd like to pursue.
9 But I don't want to ask a number of questions that
10 are pointless if I don't know how those valves work.

11 MR. GARDNER: Sounds like we need to get
12 the answer for you if we know it.

13 MEMBER STETKAR: Yes. Because I don't
14 want to waste our collective time here asking
15 questions that are not applicable if the valves
16 actually do fail closed. I'll ask the staff how come
17 they understand that the valves fail as is, but that's
18 a different issue. I'll have to think about it, Dana.

19 We'll keep moving. Let me think about this at the
20 break. I may want to come back to component cooling
21 water, but I don't want to waste time with my --

22 MEMBER SKILLMAN: I would like to ask a
23 question on component cooling water, please, and it's
24 to you, Steve.

25 MR. HUDDLESTON: Yes.

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1 MEMBER SKILLMAN: I spent three years on
2 the design team in Germany with my family building
3 Muelheim Kaerlich. And Kaerlich was the BMW 205
4 plant, very much like Bellefonte but with this design,
5 almost this identical design. And those of us who
6 were part of the team came to learn that of all of the
7 systems, of all of the auxiliary systems in the plant
8 this is basically the largest. It's complicated, it's
9 got a lot of E loads, it's got four strings, actually
10 it's got eight 50 percenters so that you have four 100
11 percenters. You can take a signal act and a single
12 pass of a maintenance failure and still survive. So
13 the overarching engineering is remarkable. But the
14 question that we kept testing with each other is what
15 happens when everything works the way it's supposed
16 to. If you do have a LOCA and everything gets
17 commanded to start are we going to be in an over-
18 cooling situation that we had not anticipated? My
19 question is have you given that question
20 consideration? In other words, can you be in a
21 situation with so much hardware and so much defense-
22 in-depth and redundancy that you now have a different
23 problem that you hadn't anticipated: too much cooling.

24 MR. HUDDLESTON: Right. Your question is
25 have we analyzed for the case where we have all four

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1 ultimate heat sinks --

2 MEMBER SKILLMAN: Everything goes flat all
3 at one time and gee whiz, how did we get here. That's
4 my question. And I'd be curious. To me it's -- it
5 sounds like a tricky question and I'm not trying to be
6 coy or tricky. I'm just thinking this plant's never
7 been built, this one, and is there a situation where
8 everything functions exactly like it's supposed to in
9 an upset condition and now the operator is being taken
10 to a new place that the operator didn't anticipate.
11 And I may be wrong. Maybe this plant's been built and
12 they've had that incident and you've got data that
13 shows it's a non-event.

14 MR. HUDDLESTON: I don't have any numbers
15 for it.

16 MEMBER SKILLMAN: Okay.

17 MR. HUDDLESTON: We'll get you some
18 numbers on that.

19 MEMBER SKILLMAN: Thank you.

20 MEMBER STETKAR: Just out of curiosity,
21 Steve, I'm pretty familiar with kind of a German plant
22 precursor to this basic plant design but not familiar
23 with the EPR. Is this cross-tied system configuration
24 common or is this a particular U.S. EPR design? I
25 haven't seen this sort of cross-tied, you know, dual

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1 division cross-tie in CCWS and ESWS.

2 MR. HUDDLESTON: No, not on the U.S. side
3 I wouldn't say it's common from my experience.

4 MEMBER STETKAR: But is it common over in
5 Europe? Is this a --

6 MR. HUDDLESTON: I have seen some German
7 designs.

8 MEMBER STETKAR: You have? Okay. Okay.
9 Thanks. I was just curious. I hadn't run into it.
10 Okay.

11 MR. HUDDLESTON: Okay, thermal barriers.
12 Thermal barriers to the main coolant pumps are
13 supplied from either one of the two common header
14 sides. And this is the simplified arrangement. On
15 one side we have one common header, over on the other
16 side we have the other common header. During normal
17 operation only one side at a time is lined up to
18 supply the four reactor coolant pump thermal barriers.

19 And you can switch sides but just as we discussed
20 before the logic is set up so that the valves are not
21 all open at the same time.

22 MEMBER STETKAR: A couple of questions
23 here, and it's not so much CCWS but it's related.
24 This again I'm paraphrasing from the SER because I
25 don't have rev 3 of the FSAR. But the SER says that

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1 RCP seal degradation is expected to occur in as little
2 as two minutes if all cooling is lost, both for
3 thermal barrier cooling now and seal injection.
4 What's the basis for that two minutes? Have you
5 actually run tests on these seal packages to see that
6 the seals start to fail and what does degradation
7 mean? I mean, degradation can be anything from not
8 being perfect to failure.

9 MR. HUDDLESTON: No, I'm familiar with the
10 number but I don't know how it was obtained, whether
11 it was by test or by design.

12 MEMBER STETKAR: Because that two-minute
13 time period is a fairly short period, especially if it
14 means the onset of external leakage.

15 MR. HUDDLESTON: Right, and you're
16 referring to the two minutes required to keep the
17 reactor coolant pump --

18 MEMBER STETKAR: It came up in the notion
19 of the transfer, for example, if you had a problem --

20 MR. HUDDLESTON: Right.

21 MEMBER STETKAR: -- getting the, you know,
22 the black valves open and the white valves closed
23 basically. There was some discussion about, you know,
24 transit times on the valves and things like that.

25 MR. HUDDLESTON: So your question is how -

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1 -

2 MEMBER STETKAR: What's the basis for that
3 two minutes?

4 MR. HUDDLESTON: What is the basis for the
5 seal failure in two minutes.

6 MEMBER STETKAR: Well first of all it's
7 characterized as seal degradation and I don't know
8 what that means. That could be anything from, you
9 know, not absolutely perfect conditions to absolute
10 disappearance of the seal package. And I don't know
11 what that means. And so I'm curious about, you know,
12 what level of degradation will be achieved and whether
13 or not you've done anything that looks at the rate of
14 leakage from the seals as a function of time after
15 loss of all cooling because that's another part of the
16 supporting analyses for component cooling water and
17 also something that feeds into the tech specs as I
18 suspect. I just don't know whether you've done any of
19 those analyses on the seal packages that you expect to
20 install on these pumps.

21 MR. STACK: Steve, this is Tim Stack. Let
22 me speak a little more to that, John. I mean, and I
23 haven't read that specific language in the SAR in that
24 section but you're going to have seal injection which
25 is redundant to the thermal barrier cooling. And if

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1 you lose all your seal cooling you still have the
2 stand-still seals with pumps tripped.

3 MEMBER STETKAR: Well, that's -- what I
4 wanted to ask you and I looked in Chapter 5. I mean,
5 I understand the discretion of the stand-still seals
6 in Chapter 5 but they are always characterized as when
7 the pump becomes stationary, you know, it settles
8 down, you get the face-rubbing seal and even above
9 that you get the nitrogen pressure that sort of closes
10 it. They're never characterized as stopping leakage
11 after failure of the original, you know, the basic
12 seal package occurs. And there's no drawings in there
13 that shows me how all of those seals are arranged. So
14 I don't know how that all works. As I said, it's part
15 of -- there is a discussion in terms of a time
16 progression that says you will develop -- in fact, it
17 says -- there's a discussion, again I'm paraphrasing
18 from the SER so you have to excuse me, that under a
19 station blackout condition for example, loss of all
20 CCW, loss of all seal injection, that the normal seals
21 will fail in 10 minutes but within 15 minutes the
22 stand-still seal will stop everything. You know, and
23 there's something like a hundred gallons a minute
24 leakage rate, starts at 10 minutes and then it drops
25 off to about 2 gallons a minute after the stand-still

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1 seals ostensibly stop it. But I don't know how all
2 those seals work together and I couldn't find any
3 drawings of the seal package, at least in the FSAR
4 that I have. So that's sort of this line of
5 questioning about what's the basis for 2 minutes,
6 what's the basis for 10 minutes, how does the stand-
7 still seal stop everything within 15 minutes.

8 MR. STACK: We'll take that as a question.

9 MEMBER STETKAR: Again, it's not
10 particularly CCWS but it's related to the CCWS seal-
11 cooling function. You know, if you have a detailed
12 picture of the seal package itself it might explain an
13 awful lot about how the hydraulics work in there. I
14 just couldn't find one.

15 MR. HUDDLESTON: Okay. Safety chilled
16 water system. Safety chilled water system consists of
17 four trains as we've talked about before. Two of
18 those trains are water-cooled, two of the trains are
19 air-cooled. Provide safety-related HVAC systems,
20 supply chilled water to the low-head safety injection
21 pumps, trains 1 and 4, to the fuel building
22 ventilation system. Each train consists of a
23 refrigeration chiller unit, two pumps and an expansion
24 tank. One chiller train is sized to meet the cooling
25 load of two trains. Each train is located within its

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1 own safeguard building. Division 1 and 4 are backed
2 by the SBO diesels. Cross-tie valves on these between
3 the trains will be open normally with one train in
4 operation. So what you see here is this is an
5 arrangement for two of the four trains where we have
6 cross-tie valves between the two trains. During
7 normal operation we would have two pumps in operation,
8 one chiller online. That chiller would be supplying
9 chilled water to both division 1 and 2 loads for
10 example, and back to the pumps. In the event of a
11 line failure where we detected a loss of pressure in
12 the surge tanks indicating a failure on one side we
13 would shut these cross-tie valves, the cross-tie
14 valves would be shut.

15 MEMBER STETKAR: Let me ask you more about
16 cross-ties now.

17 MR. HUDDLESTON: Sure.

18 MEMBER STETKAR: I love cross-tied systems
19 so you have to bear with me. I got really confused
20 reading the SER about this particular system so let me
21 just ask questions. The train cross-tie valves, the
22 two motor-operated valves that cross-tie the trains
23 there, are they -- there's two signals that I read
24 about. One signal is called a LOW-2 system pressure
25 signal and there's another signal called a MIN-2

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1 pressure signal that I understand the MIN-2 pressure
2 signal is always discussed with regard to the
3 expansion tank, surge tank, whatever you want to call
4 it there.

5 MR. HUDDLESTON: Yes.

6 MEMBER STETKAR: The LOW-2 pressure signal
7 is discussed separately but I don't know whether those
8 two signals are the same signal just given different
9 names or whether they're separate signals.

10 MR. HUDDLESTON: I'm not sure of the exact
11 wording and why it's discussed that way but part of
12 the confusion may be that we have a LOW DP signal and
13 that's a low pressure signal across the chiller which
14 is an indication of low flow in the system.

15 MEMBER STETKAR: This wouldn't, I was
16 thinking about pipe breaks, take a consumer out
17 somewhere, break the pipe and --

18 MR. HUDDLESTON: Right. The pipe break is
19 supposed to be the MIN --

20 MEMBER STETKAR: MIN-2.

21 MR. HUDDLESTON: MIN-2 in the surge tank.

22 MEMBER STETKAR: Okay, well I don't --
23 maybe -- I thought that the FSAR -- yes, the FSAR
24 also, rev 2, Section 9.2.8.6 says, "The cross-tie
25 isolation MOVs close on LOW-2 system pressure," L-O-W-

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1 2. And there's, in Section 9.2.8.2.2 of the FSAR it
2 says, "Complete loss of nitrogen or water volume in an
3 expansion tank will close the cross-tie valves on MIN-
4 2," M-I-N all caps pressure because there's also a
5 MIN-3 pressure signal that comes in at a lower value.

6 MR. HUDDLESTON: Yes.

7 MEMBER STETKAR: So it sounds in the FSAR
8 as if there are two separate signals. The staff in
9 the SER discusses them as if they're two separate
10 signals. And the problem is there's a confusion in the
11 SER about whether they're automatic or manual signals.

12 So I was going to ask you if there are two separate
13 signals are they both automatic, are they both manual?

14 In other words, is this simply an alarm that the
15 operators receive and they must close the valves
16 manually to isolate the break or is it an actual
17 automatic signal that closes the valve?

18 MR. HUDDLESTON: I think the intention was
19 that it was a manual signal.

20 MEMBER STETKAR: Okay. If it's a manual
21 signal then I have real questions because why am I
22 then not going to fail two divisions of SCWS with a
23 pipe break that drains both expansion tanks because
24 both expansion tanks are connected to the system
25 continuously? If that pipe break occurs and the

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1 operators don't respond within X minutes where X
2 varies depending on the size of the break I can drain
3 those expansion tanks and it looks like I might lose
4 suction for those pumps in two divisions. MR.

5 HUDDLESTON: If the operators are not fast enough.

6 MEMBER STETKAR: If they're not fast
7 enough. Now, you know, there's some 4-inch lines out
8 there and the, at least if I read in the SER again
9 there is in response to one of the questions is I have
10 100 gallons, 100 gallons of water in each of those
11 expansion tanks. So I've got a 200 gallon margin on a
12 system that normally has a 565 gallons per minute
13 flow. Now, it depends on how big the break size is
14 but if I break a 4-inch pipe I'm pretty much going to
15 drain those tanks pretty much faster than most
16 operators can respond I think. Not so much if I break
17 a half-inch line.

18 MR. HUDDLESTON: True.

19 MEMBER STETKAR: So if they're manual
20 signals what I'd like to know is what time is
21 available for the operators to actually close those
22 valves before I lose expansion tank inventory. For
23 example, if I break -- the consumers, the line sizes
24 are all over the place but you've got three-quarter
25 inch lines, you've got an inch line out there, a few 2

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1 and a half-inch lines and the headers, and then
2 there's a big 4-inch header that supplies something or
3 other out there. So I'm really curious if they're all
4 manual.

5 MR. HUDDLESTON: So, are you -- would the
6 question be --

7 MEMBER STETKAR: The real question is if
8 they're manual I'd like to know how much time is
9 available for the operators to manually isolate the
10 break for a break -- for a broken three-quarter inch
11 line, a broken 1-inch line, a broken 2 and a half-inch
12 line, and a broken 4-inch line before you actually
13 lose suction for the SCW pumps and disable both of
14 those trains.

15 MR. HUDDLESTON: Right. I would presume
16 the operator time would be -- the time for the
17 operator to react would essentially be the same for
18 all of those things. Once he's reacted then it's the
19 closure.

20 MEMBER STETKAR: I'm talking about the
21 time available for him to react before I lose suction,
22 not how long it takes him to push a button.

23 MR. HUDDLESTON: Which should be enveloped
24 by the 4-inch line.

25 MEMBER STETKAR: The minimum would be

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1 influenced by the 4-inch line so if you want to just
2 look at the minimum it would be the 4-inch line. The
3 reason I ask is because also the thing I read is the
4 de-min water makeup to the expansion tank is manually,
5 locally manually --

6 MR. HUDDLESTON: Yes.

7 MEMBER STETKAR: -- aligned. So it's, you
8 don't get automatic makeup --

9 MR. HUDDLESTON: Right.

10 MEMBER STETKAR: -- that's going to, you
11 know, feed the system and keep feeding the break to
12 extend the available time interval. So yes, I mean if
13 you want to do it for the 4-inch that's fine. I was
14 trying to get a range of times and a range of, you
15 know, available times. But if you want to do it for
16 the 4-inch that would certainly bound the minimum time
17 for the operator response.

18 Is that also true, when you say the
19 isolation is manual is that also true for the MIN-2
20 pressure signal from the expansion tank? Again, I'm
21 operating under the notion that there are two separate
22 signals here which might be misguided. But the notion
23 is that on MIN-2 pressure in the expansion tank the
24 operators would receive that alarm and then manually
25 close the cross-tie valves.

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1 MR. HUDDLESTON: Right.

2 MEMBER STETKAR: Because I'm also trying
3 to -- I got mixed messages trying to read the FSAR and
4 read what was in the SER about whether either of those
5 isolations if indeed there are two were manual or
6 automatic.

7 MR. HUDDLESTON: Okay.

8 MEMBER STETKAR: But it's your
9 understanding that they're all manual. Okay, thanks.

10 And a final question on the SCWS and this is
11 regarding tech specs -- ESWS tech specs and CCWS tech
12 specs are consistent. They allow a single train to be
13 inoperable for 120 days and two trains to be
14 inoperable for 72 hours and I sort of understand that
15 logic. SCWS is different. SCWS allows a single train
16 to be inoperable for 30 days and if -- because there's
17 no other limitation. If more than one train is
18 inoperable you go into whatever the 3.0, you know, you
19 basically shut down. What's the basis for the 30-day
20 SCWS tech spec as compared to 120 days, and why is it
21 different? I mean conceptually why is this system
22 treated differently in terms of tech spec space than
23 CCWS or ESWS? Especially CCWS because CCWS also
24 operates in kind of a cross-tied mode.

25 MR. HUDDLESTON: You think it should be

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1 120 days?

2 MEMBER STETKAR: I'm not going to tell you
3 what I think it should be because I don't have any
4 basis for any of these numbers. I'm just curious why
5 is it different? I mean, it's so obviously different
6 that it seems like there must have been some
7 forethought put into this and some rationale of why
8 it's different. And I'm not necessarily advocating
9 that it should be the same, I'm just raising the
10 notion that it's different and it's so much different
11 that I'm curious why.

12 MR. HUDDLESTON: I just remember that the
13 discussion at the time, because we went through a
14 change on this design when we put the cross-tie valves
15 in so that we could operate both divisions cross-ties
16 open and that we could operate -- it gave us the
17 flexibility to do maintenance so that 30 days was
18 chosen as the time that would be required to do
19 maintenance.

20 MEMBER STETKAR: What I'm trying to
21 understand though, typically a lot of those
22 differences in times and LCOs are -- I'm trying to
23 stay out of the PRA world here as much as possible but
24 they're based on, for example, perceived safety
25 importance of a system where systems that have higher

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1 safety significance typically have shorter LCOs
2 because, you know, you don't want to have them out of
3 service, you know, for extended periods of time. Even
4 though you meet all of the design basis licensing, you
5 know, criteria with one train out of service, for
6 example, or even with two. And that's what I'm trying
7 to understand is for some reason this system more
8 important to safety than ESWS or CCWS which would
9 drive the fact that a single train has a shorter
10 allowed outage time and you do not allow two trains to
11 be out of service compared to the other systems that
12 have longer single train durations and the allowance
13 for having two trains out simultaneously.

14 MR. HUDDLESTON: I think your question is
15 does the PRA analysis drive --

16 MEMBER STETKAR: I don't want to, you
17 know, what I'm trying to probe is was this derived
18 from the PRA or what's the basis for this?

19 MR. GARDNER: Let me try. I think, one,
20 we'll go back and get an answer for you because our
21 tech spec guy is not with us but it's not PRA-based.
22 I would observe though that --

23 MEMBER STETKAR: You need to say that.

24 MR. GARDNER: -- trains that are tied
25 together and that the loads are different on the

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1 trains.

2 MEMBER STETKAR: There may be a very good
3 reason --

4 MR. GARDNER: -- influencing those times
5 but we'll get you a more specific answer.

6 MEMBER STETKAR: Yes, there may be a very
7 reasonable rationale and since this is not a risk-
8 informed application it's probably not based on PRA
9 results.

10 MR. GARDNER: Correct.

11 MEMBER STETKAR: Okay, thanks.

12 MS. LINDSTROM: I'm Jean Lindstrom,
13 engineering supervisor. I have a chemical engineering
14 degree from the University of South Carolina and a
15 master's from North Carolina State. I've worked in
16 power plants about 15 years, half of that being with
17 Duke and the other half being with AREVA. On the EPR
18 I probably worked about the last four years excluding
19 last year working on auxiliary systems. So I'm going
20 to go over the process auxiliaries in the --

21 MEMBER STETKAR: Jean, I'm sorry, I hate
22 to keep doing this. I'm starting to sound like
23 Columbo.

24 (Laughter)

25 MEMBER STETKAR: I'm probably starting to

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1 look like Columbo too. Now I'm starting to feel like
2 Columbo. I realize you're going into Section 9.3.
3 Back on Section 9.2 a system that you decided not to
4 discuss but as evidence that I may be dense but I do
5 keep good notes, back when we were discussing I think
6 Chapter 10 of the FSAR I started asking some questions
7 about the turbine building close cooling water system
8 and the auxiliary cooling water system. I was told at
9 that time not to worry my pretty little head because
10 we discussed those systems during our review of
11 Chapter 9. Here we are. So, now I'll ask the
12 questions within the context of Chapter 9 so I can get
13 them on the record here. The turbine building closed
14 cooling water system is a non-safety system and it's
15 characterized as being not important to safety. And
16 that term is used quite a bit to justify at least in
17 RAI responses why it doesn't need to meet certain
18 qualifications. My question is first of all does the
19 PRA contain the auxiliary cooling water system and the
20 turbine building closed cooling water system. And
21 when I say "contain" I don't mean by a single block
22 with a number in it, I mean does it have pumps and
23 pipes and valves in there for those systems with power
24 supplies. I would hope that it does. I don't know
25 that it does or does not. If it does I'm curious

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1 about what the Fussell-Vesely importance values are
2 and the Risk Achievement Worth values are for each of
3 those systems. The reason I ask that question is the
4 term "important to safety" is not safety-related but
5 it does have connotations in terms of maintenance rule
6 type issues. So I'm trying to discern whether or not
7 these systems meet the numerical criteria for example
8 being important enough to safety that they would be
9 treated under the maintenance rule. Because they are
10 relatively important systems, after all. They cool
11 everything out in the secondary side of the plant
12 which in design basis licensing I recognize is not
13 particularly important but it may be in terms of risk
14 significance. So that's one question that I have
15 regarding those systems and I recognize we don't have
16 the right people here today to answer that.

17 Why does the, at least rev 2 of the --
18 well, rev 2 of the FSAR includes no information
19 whatsoever about either of these systems other than
20 there's a flow drying of the circulating water system
21 that shows conceptually where the supply and return
22 lines come back in from auxiliary cooling water. But
23 there's no other information about these systems.
24 Now, I'm led to believe that perhaps in rev 3 of the
25 FSAR at least turbine building closed cooling water is

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1 described because there's quite a bit of discussion in
2 terms of RAIs about that system. Is the auxiliary
3 cooling water loop described at all in rev 3 of the
4 FSAR?

5 MR. HUDDLESTON: Yes, it is.

6 MEMBER STETKAR: It is, okay, okay. Then
7 I'll hold off on that until we see rev 3. Does rev 3
8 of the FSAR contain a complete list of cooling loads
9 for turbine building closed cooling water do you
10 recall?

11 MR. HUDDLESTON: I don't recall.

12 MEMBER STETKAR: I was going to say I'm
13 curious about that because in the RAI responses, again
14 I'm paraphrasing, it says cooling loads are primarily
15 in the turbine building. As required cooling loads in
16 non-safety related outdoor areas and in the electrical
17 switchgear building may be served.

18 MR. HUDDLESTON: Yes.

19 MEMBER STETKAR: So, you know, because of
20 the nature of kind of interconnected things, if
21 turbine building closed cooling water provides a
22 cooling function for either switchgear rooms or
23 transformers that may have a relationship to offsite
24 power availability or supplies to important loads.
25 That's why I'm asking about those loads. If they're

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1 in rev 3 that's fine. If they're not I'd like to know
2 what the actual cooling loads are. So you may want to
3 make a note of that. If it's in rev 3 I can read
4 tables pretty easily.

5 The only reason I bring this up, by the
6 way, is that some PRAs of other plants, pressurized
7 water reactors, have shown that things like turbine
8 building closed cooling water and secondary service
9 water, whatever you want to call it, can be relatively
10 important contributors to risk. Now, I don't know for
11 this particular plant because this plant has a lot
12 more redundancies of safety-related equipment than
13 some of the other plants but just because it's non-
14 safety related and out in the turbine building doesn't
15 mean it's not necessarily important. It's certainly
16 important to the operators. They don't want to burn
17 up stuff out there but given the design basis accident
18 they probably have other things to worry about.
19 Thanks. I'm sorry, Jean.

20 MR. GARDNER: So I just want to make sure
21 I recap this. I think what you're wanting to find out
22 is are these systems described in rev 3 --

23 MEMBER STETKAR: Yes.

24 MR. GARDNER: -- and what's their relative
25 importance in the PRA.

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1 MEMBER STETKAR: What's their relative
2 importance, yes. Are they, well first of all, are
3 they --

4 MR. GARDNER: -- modeled and then what's
5 their importance.

6 MEMBER STETKAR: Yes. And if they are
7 modeled, I'm assuming they are, but if they are
8 modeled what's their numerical importance measures.
9 I'll be quiet now, thanks.

10 MS. LINDSTROM: All right, we'll move on
11 to the sections I'll be presenting, 9.3.2 and 9.3.3
12 Process Auxiliaries. First, Section 9.3.2 is the
13 process sampling systems, nuclear sampling system
14 secondary and the severe accident sampling which is in
15 some of the U.S. plants known as the PASS system.
16 9.3.3 is the equipment and floor drain system,
17 recyclable and non-recyclable fluids. We refer to it
18 as the nuclear island vent and drain system. This is
19 just a nuclear island vent and drain system. Turbine
20 building drains will be -- discharges will be in
21 Chapter 11. So next slide, please.

22 So moving to the process sampling. And
23 the purpose, this is very typical of plants that you
24 see in the U.S. The sampling system is basically a
25 sampling system. It does not have any control

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1 functions. It's purely monitoring of the fluids,
2 physical and chemical properties. The nuclear
3 sampling system, active, slightly active, gaseous and
4 corrosion products. The secondary system of course is
5 the turbine island, steam generator blow-down and
6 steam condensate feedwater cycle. Severe accident
7 sampling is -- and these are all non-safety systems --
8 is containment atmosphere and the IRWST. Sometimes in
9 9.3 you'll see the hydrogen monitoring system which in
10 our FSAR is in Chapter 6 so we won't be discussing
11 that in 9.3.2. And also a subsystem to sampling is
12 the PERMSS in 11.5 which talks about the radiological
13 monitoring. So that's in 11.5.

14 The systems are non-safety but do have
15 containment isolation systems inside of them that are
16 safety functions. All three contain those. They will
17 shut and remain shut except for the lines on the RCS
18 which after a period of time can be reopened for
19 NUREG-0737 as needed to sample reactor coolant. So
20 they will shut automatically and then there is a
21 provision on the RCS to reopen.

22 MEMBER STETKAR: Jean, let me stop you
23 there. Something I didn't quite realize when we were
24 going through Chapter 5 I think it is, there's some
25 discussion that you don't have a separate steam space

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1 or gas space sample line from the pressurizer in this
2 plant.

3 MS. LINDSTROM: Yes.

4 MEMBER STETKAR: The pressurizer, it's
5 characterized as continuously vented to the reactor
6 coolant drain tank.

7 MS. LINDSTROM: Yes.

8 MEMBER STETKAR: How does that all work
9 and does -- are those -- is that vent line isolated
10 automatically on a safety injection? How does this
11 all work?

12 MS. LINDSTROM: That's a good question.
13 As far as the actual operations of the line I'm not
14 exactly sure of the I&C functions on it but I will say
15 it does vent to the nuclear island vent and drain
16 reactor coolant drain tank and there is two different
17 vents on it. One is for normal so it's a continuous
18 purge and the other one is for startup so it's a
19 larger purge line. The exact -- the valves on that is
20 not in the vent and drain system or the sampling
21 system. We'd have to go to the reactor coolant.

22 MEMBER STETKAR: Right and I indeed --

23 MS. LINDSTROM: I do not know the
24 operation of those.

25 MEMBER STETKAR: Okay. I made myself a

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1 blowup of the drawing so I could actually see the
2 valves. There's one line that's normally connected
3 and it's a 1-inch line, it's got two motor-operated
4 valves in it. There's another line that has two
5 manual valves in it that bypasses those motor-
6 operated. The size of that line is not shown. And
7 then there's, there's kind of a third branch that goes
8 through two motor-operated valves that's a 3-inch line
9 that goes out if you want to feed nitrogen in or if
10 you go to the vacuum, if you want to pull a vacuum
11 when you're de-gassing. Is that --

12 MS. LINDSTROM: We'll have to get
13 clarification on the actual pressurize because I don't
14 know the exact operation of it but one is an in-
15 operation purge line, the other one is a startup
16 purge. But we'd have to take that as an action item.

17 MEMBER STETKAR: I'm assuming the one to
18 the vacuum pump because the 3-inch line is the
19 startup, what you're characterizing as the startup
20 purge and the 1-inch is the normal operation line.
21 But how does -- I mean that line is pressurized to, I
22 don't remember the pressure on this plant, 2,500 some
23 odd pounds or so. What happens out in the reactor
24 coolant drain tank? I mean, does this go through a
25 sparger that --

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1 MS. LINDSTROM: It does go through a
2 sparger underneath the water and it is, and then that
3 tank I continuously purged for --

4 MEMBER STETKAR: That's continuously open.

5 MS. LINDSTROM: Yes.

6 MEMBER STETKAR: So you just --

7 MS. LINDSTROM: Yes, and that will be in
8 the vent and drain system.

9 MEMBER STETKAR: You just keep venting
10 that.

11 MS. LINDSTROM: It's -- we push air in,
12 pull air out.

13 MEMBER STETKAR: Okay, because I was
14 looking for it in the vent and drain and maybe I
15 missed it. I didn't see much on the reactor coolant
16 drain tank.

17 MS. LINDSTROM: It may not have been there
18 but that is a continuously purged tank.

19 MEMBER STETKAR: Okay. Well, what -- yes,
20 then even the question though about isolation of the
21 normal vent line is more important because I'm
22 assuming that the discharge from the reactor coolant
23 drain tank is isolated by containment isolation
24 signal, isn't it?

25 MS. LINDSTROM: Yes.

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1 MEMBER STETKAR: So I certainly don't want
2 to pressurize the reactor coolant drain tank and blow
3 it up and create a LOCA path --

4 MS. LINDSTROM: Correct.

5 MEMBER STETKAR: -- for example for a
6 plain vanilla safety injection.

7 MS. LINDSTROM: And we'll take that as an
8 action. We can get you a further --

9 MR. GARDNER: I'm not sure I totally
10 understand the question.

11 MEMBER STETKAR: The question is if you
12 have a normal vent line open to the reactor coolant
13 drain tank, let's call it a 1-inch vent and that vent
14 is connected to the steam space and the pressurizer
15 which is a high-pressure volume if you're normally
16 venting the gases I understand how pressure will not
17 increase in the reactor coolant drain tank during
18 normal operations, especially if you're going through
19 a sparger. If you isolate the discharge line from the
20 reactor coolant drain tank and keep the inlet line
21 open from the pressurizer I would suspect the pressure
22 in the reactor coolant drain tank would in some
23 reasonably short period of time approach pressure in
24 the pressurizer. I suspect the reactor coolant drain
25 tank is probably not rated for full system pressure

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1 which means I now open up a LOCA pathway from the top
2 of my pressurizer which is not a particularly good
3 place to have a LOCA for operator response for
4 example, especially if you use pressurizer level
5 signals for anything in the plant. So my question is
6 if the pressurizer vent line, the one that's normally
7 open, if that's isolated automatically by a safety
8 injection signal then I'm okay. Now the second
9 question is, you know, can the operators as you were
10 mentioning after some period of time override that
11 signal so you can indeed somehow get a steam space
12 sample from the pressurizer is sort of a follow-on.

13 MS. LINDSTROM: We'll come up with an
14 answer to that. I'm going to have to -- we'll have to
15 discuss it with the RCS people.

16 MEMBER STETKAR: I mean, you understand
17 the question that I'm asking.

18 MS. LINDSTROM: I do understand your
19 question but I don't know the answer.

20 MEMBER SKILLMAN: I'd like to pile on
21 because I had the same question. It's common for the
22 pressurizer to be vented directly to the waste gas
23 decay tanks or for the makeup tank to be vented to the
24 waste gas decay tanks as a way of peeling off whatever
25 isotopes you have either in the makeup tank or the

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1 pressurizer. Here you're going through the RC drain
2 tank on a continuous basis --

3 MS. LINDSTROM: Yes.

4 MEMBER SKILLMAN: -- and that raises in my
5 mind how do you cool that flow stream.

6 MS. LINDSTROM: In the drain tank.

7 MEMBER SKILLMAN: So it's just --

8 MS. LINDSTROM: The drain tank has a
9 cooler on it.

10 MEMBER SKILLMAN: So the drain tank cooler
11 takes care of that --

12 MS. LINDSTROM: And it will recirc itself
13 back to the drain tank. And it is set up for
14 pressurizer relief tank cooling, a 5-hour period.
15 Maybe I can go over that more.

16 MEMBER STETKAR: It's also isolated. It's
17 part of the non-safety loads that are isolated off the
18 component cooling water system. But that's --

19 MEMBER SKILLMAN: Okay.

20 MEMBER STETKAR: -- that's a different
21 question.

22 MEMBER SKILLMAN: Your pressurizer sample
23 is actually the sample of your RC drain tank.

24 MS. LINDSTROM: Well, we do take a liquid
25 pressure sample and we do take a sample off the

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1 reactor coolant drain tank. And I think we just
2 answered an RAI on that --

3 MEMBER SKILLMAN: That's correct.

4 MS. LINDSTROM: -- on how that method is
5 calculated to -- it's a calculated number. And we're
6 assuming, we have three different samples off the
7 reactor coolant and a fairly fast flow through them so
8 we're assuming that the hydrogen is very uniformed and
9 we can -- by taking the liquid and we can also do the
10 reactor coolant drain tank. We're assuming with the
11 calculation, there's some inputs from the reactor
12 coolant drain tank that it is calculated to the
13 numbers that are called into the calculation, that we
14 have the correct concentration.

15 MEMBER SKILLMAN: Okay, now you're running
16 hydrogen-rich in your RC drain tank. How do you
17 assure that that doesn't become a point of explosion?

18 MS. LINDSTROM: We can take that as an
19 action item.

20 MEMBER SKILLMAN: I'd like to offer that
21 question.

22 MS. LINDSTROM: As far as the sampling
23 system, it's just a monitoring system, it has no
24 control. So we'll have to take that as a control
25 question and we'll have to --

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1 MEMBER SKILLMAN: Well, you're pulling
2 hydrogen out of the pressurizer.

3 MS. LINDSTROM: The reactor coolant drain
4 tank.

5 MEMBER SKILLMAN: And you're building a
6 hydrogen over-pressure or a hydrogen partial-pressure
7 in the RC drain tank.

8 MS. LINDSTROM: And we're purging the RC
9 tank to the gaseous waste system. So we're pulling it
10 back off by continuously purging that tank. So what
11 comes out of the water and back into the void space
12 will be continuously purged out. So the tank is sized
13 to about a 40 percent purge space to allow for the
14 hydrogen gases to kind of settle or move to the top
15 and be re-purged out.

16 MEMBER SKILLMAN: Got a lot of hydrogen
17 moving around.

18 MS. LINDSTROM: And we do have fairly good
19 purge on it, so.

20 MEMBER SKILLMAN: Thank you.

21 MS. LINDSTROM: Okay. Any more questions?
22 I'll go back to in the severe accident sampling
23 system the valves are always closed. I should say on
24 the containment atmosphere it only will be opened in -
25 - after a period of time in a severe accident. Non-

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1 safety functions, I think I went through this.
2 Chemical, physical, microbiological and radiological.

3 Again, purely a monitoring system, not a -- there is
4 no control within this system. So it's just AD
5 operator.

6 I have a diagram of the severe accident
7 sampling system which I think -- refers to it in some
8 as the PASS. We are able to take three different
9 samples, the gaseous containment and the IRWST which
10 is the sump. The gaseous samples are taken by the
11 NaOH is put into the sample pools, the gas is bubbled
12 up through the NaOH which scrubs them of the iodines
13 and aerosols. So we'll get a sample of the
14 atmosphere. Then we'll sample the scrubbing fluid for
15 the iodine aerosols. The sump is directly a liquid
16 sample. They are, the modules are in a closed room
17 away from the sampling module and they're diluted to 1
18 to 1,000 for operator protection and radiological
19 reasons. And when we're done they're re-injected back
20 into the containment.

21 Again, these valves, it's a heat trace
22 valve if it's not clear on the picture. That's
23 because it's a gas sample. So when the operator will
24 access it in a field building the rest of the modules
25 are in the safeguard building. There should be no,

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1 the sample should be diluted before the operator pulls
2 a syringe off of it.

3 This is a non-safety system so it is taken
4 out of the tech spec and that was an option. So we
5 move it from the tech spec to make it a non-safety
6 system. What we left ourselves with was a monitoring
7 system, environmental monitoring system external to
8 the plant so this was allowed through the
9 requirements.

10 MEMBER SKILLMAN: Jean, you mentioned that
11 you're complying with NUREG-0737.

12 MS. LINDSTROM: Right.

13 MEMBER SKILLMAN: Can you speak to the
14 source term that might have been considered in
15 designing the SASS or the PASS?

16 MS. LINDSTROM: Yes. We're going to have
17 to take an action item on that, on the exact source
18 term of that.

19 MEMBER SKILLMAN: Do you understand why
20 I'm asking the question? Do you understand what the
21 source term could be post-accident?

22 MS. LINDSTROM: Yes. So we'll have to
23 formulate an answer for that. That's I think a longer
24 answer.

25 MEMBER SKILLMAN: Okay, thank you.

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1 MS. LINDSTROM: But we'll take that.

2 MEMBER STETKAR: It's especially pertinent
3 for this because it is the severe accident sampling
4 system.

5 MS. LINDSTROM: Yes.

6 MEMBER STETKAR: So it in principle could
7 be operating when your SAHRS --

8 MS. LINDSTROM: That has been done. I
9 don't want to -- I can't quote that answer off the top
10 of my head.

11 MEMBER SKILLMAN: Well, just getting to it
12 can be a real problem.

13 MS. LINDSTROM: So we will come up with
14 that, the correct wording and things. Again, this is
15 -- any questions on this? As far as -- this is a
16 typical post-TMI system.

17 Okay, I'll move to Section 3.3 if there's
18 no questions. Okay, this is the equipment and floor
19 drain system. We refer to this as the nuclear island
20 vent and drain system, NIDVS, and temporary storage
21 collects potentially radioactive fluids or radioactive
22 fluids on the nuclear island. And we can either
23 recycle which is the primary vent and drain, or we try
24 to recycle if we can back to the parent system we say,
25 or process drains, or our regular floor drains which

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1 are -- the difference are controlled and uncontrolled
2 areas. Those all go to the rad waste system. Let's
3 see. I think I mentioned before turbine islands in
4 Chapter 11, if you had questions on that, and we
5 define the nuclear island as the reactor building,
6 safeguard buildings, fuel building, access building,
7 auxiliary building and radioactive waste processing
8 building. So those are our definitions of the NIDVS.
9 Next slide, please. Okay.

10 This again is a non-safety system but does
11 contain safety functions contained in isolation. And
12 the flooding. Flooding in Safeguards Buildings, fuel
13 buildings, the reactor buildings. The reactor
14 building actually has -- is also the lowest level in
15 the sump is actually used also for the reactor coolant
16 leakage detection system. So that's maybe a dual
17 function on that one. And the Safeguards Buildings
18 and fuel buildings are purely flooding functions. And
19 we talked about the -- they're all just back to the
20 operator except the safeguard building which actually
21 does trip the pump and the valve. The fuel building
22 just sends in an alarm to the operator that a
23 potential for flooding.

24 The non-safety functions, I won't go over
25 them all but it's just, it's a holdup and we can, we

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1 have the ability to re-inject back into the
2 containment building from the auxiliary building if we
3 need to delay treatment. Rad waste maybe isn't
4 working or is being overworked. And this is also a
5 tool for -- to indicate maybe some leakages throughout
6 the plant. Next slide, please.

7 Okay. The way that the vent and drain
8 system is set up is that we try to classify them
9 according to whether they can be recycled or not and
10 that has to do with the boron. We do have, we have
11 leakages that are known like reactor coolant drain
12 pump leakages so those that we do know we will recycle
13 back to the parent systems. Also by origin. And the
14 piping, we've arranged the piping especially through
15 the safeguard buildings not to pipe from one safeguard
16 building to another safeguard building. It will go
17 from the safeguard building directly over to the
18 auxiliary building so we do not pick up any -- we do
19 not flood the next safeguard building or we don't pick
20 up any drains in the next building, potentially flood
21 the adjacent safeguard building.

22 We don't take any credit in the drain
23 system for a flooding event. There's no credit taken
24 in the system. And we do have temporary and permanent
25 connections on this. Most everything is gravity-

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1 drained. If it is in the bottom floor we still have
2 two layers of protection. It will be double-wall
3 pipe. It fits in the bottom floor concrete. Other
4 than that it's all just gravity-drained single pipe to
5 that lowest, to the tank that's closest.

6 MEMBER SKILLMAN: Jean, relative to
7 gravitational flow what is the specification, or what
8 will be the specification for the fall?

9 MS. LINDSTROM: The slope?

10 MEMBER SKILLMAN: Yes.

11 MS. LINDSTROM: Well, most of ours are
12 fairly vertical runs. Currently I do not know that we
13 have a specific number on what is enough slope or not.
14 I can check on that though.

15 MEMBER SKILLMAN: I'd like that question
16 on the record and it applies to many systems more than
17 just this system. But we've gone through the gas
18 collection and all the plants have gone through all
19 kinds of nonsense trying to get gas out of this header
20 or that header, this safety injection pump, that one.

21 MS. LINDSTROM: We do have guidelines. We
22 try to slope on piping.

23 MEMBER SKILLMAN: It really becomes an AE
24 function to -- for the licensee to enforce the fall
25 but if you don't do that you're going to end up with

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1 horizontal pieces of pipe that can't be drained, can't

2 --

3 MS. LINDSTROM: For low points?

4 MEMBER SKILLMAN: Yes. And you'll have
5 stuff down there that'll -- will give you a source
6 term or a field level where you say, you know what?
7 For a few minutes of thinking about this we would not
8 have this problem.

9 MS. LINDSTROM: Yes.

10 MEMBER SKILLMAN: There needs to be enough
11 slope that the lines clean themselves, that they flow.
12 And it almost always shows up in rad waste 2 feet
13 under concrete, you can't get to it.

14 MS. LINDSTROM: Yes. We have very few
15 pipes that are actually in concrete but we can't help
16 -- there's just a couple. But we have minimized most
17 of them. And that is a problem. We will get you the
18 sloping requirements. They're just, I think we have
19 them written in guidance for piping but we'll find
20 them. This one, no tech specs on this particular
21 system. Any questions? Okay, I'll move on to Fred.

22 MR. MAASS: My name is Fred Maass. I'm
23 the manager of EPR NI systems engineering. As they
24 said before I've got over 25 years of nuclear
25 experience. I am a graduate of Purdue University with

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1 a BS in mechanical engineering so I thought I'd
2 mention that since my compadres have.

3 CHAIR POWERS: This is a conspiracy. We'd
4 get a different crew if the football game had come out
5 differently.

6 (Laughter)

7 MR. MAASS: So yes, I'd like to discuss
8 the CVCS system and the extra borating system. The
9 CVCS system is fairly typical of existing plants. It
10 maintains the coolant inventory, the pressurizer level
11 control, source of water for purification, chemistry
12 control, seal injection, makeup water. It has four
13 safety-related functions. It provides RCS pressure
14 boundary integrity, boron dilution mitigation, RCS
15 overfill and provides containment isolation.

16 MEMBER SKILLMAN: Before you proceed I
17 would like to know why seal injection is not safety-
18 related.

19 MR. MAASS: Because we have component
20 cooling water available for termination of the event
21 so that's a safety-related system that provides
22 cooling to it.

23 MEMBER SKILLMAN: Are you comfortable with
24 that?

25 MR. MAASS: Typically I think that's

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1 fairly similar to existing plants.

2 MEMBER SKILLMAN: Not the ones I'm
3 familiar with.

4 MR. MAASS: Okay.

5 MEMBER SKILLMAN: Hey, it's your design.

6 MR. MAASS: Yes.

7 MEMBER SKILLMAN: And it's your seal LOCAs
8 that you're messing with but it seems to me that of
9 all of the things that you want to have, you want an
10 abundance of safety-grade seal injection backed up by
11 an abundance of safety-grade component cooling water
12 so that no matter what you get cool seals that are
13 fully sealing against whatever's going on in the
14 reactor coolant system.

15 MR. MAASS: I understand.

16 MEMBER SKILLMAN: Thank you.

17 MR. MAASS: Many non-safety related
18 functions for this system allows for boron control,
19 RCS boron control, makeup via -- for a water inventory
20 control, again seal injection, chemical and
21 radiological control and provides auxiliary spray of
22 the pressurizer to control pressure when we don't have
23 our seat pumps operating.

24 Unique features built for the EPR. We
25 have a hydrogenation station where we add hydrogen to

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1 the system. We have a volume control tank that
2 actually works more as a surge tank as opposed to
3 being in the primary flow path for letdown. We have a
4 high pressure reducing station where we control
5 letdown flow to maintain pressurizer level. And it's
6 powered as alternate power from the SBO diesel
7 generator.

8 MEMBER STETKAR: But the hydrogenation is
9 a little bit different. Is that typical for European
10 designs? I haven't seen that before either. This is
11 just a new --

12 MR. MAASS: I'm not exactly sure. I do
13 not know that.

14 MEMBER STETKAR: And about, if I read
15 correctly about 90, you know, only about 10 percent of
16 the letdown flow actually goes through the volume
17 control tank.

18 MR. MAASS: That is correct.

19 MEMBER STETKAR: It's just to basically
20 keep, you know, uniform boron concentration there.

21 MR. MAASS: Yes.

22 MEMBER STETKAR: And about 90 percent goes
23 through that -- and that's a continuous hydrogenation
24 --

25 MR. MAASS: Yes.

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1 MEMBER STETKAR: -- because you're
2 continuously venting the pressurizer, right?

3 MR. MAASS: Right.

4 MEMBER STETKAR: You just move a heck of a
5 lot more hydrogen in this plant than you do --

6 MR. MAASS: Yes.

7 MEMBER STETKAR: -- in other plants.

8 MR. MAASS: But we keep a lower
9 concentration so, a tighter control on our
10 concentration.

11 MEMBER STETKAR: Until you get the open
12 item resolved I guess.

13 MEMBER SKILLMAN: Fred, is there any OE
14 from Europe on use of the hydrogenation station?

15 MR. MAASS: Right now I do not know so I
16 would have to look that up for you.

17 MEMBER STETKAR: I'll let you finish
18 writing. I understand writing notes. What's the
19 cover gas in the VCT then?

20 MR. MAASS: Nitrogen.

21 MEMBER STETKAR: Nitrogen? Okay.

22 MR. MAASS: This is just sort of a busy
23 flow diagram. It's out of the FSAR, fairly, pretty
24 much. It identifies the flow path, various flow paths
25 in through seal injection and makeup and letdown. The

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1 regenerative heat exchanger, the HP cooler and the
2 various subsystems that it interfaces with such as
3 coolant supply, storage, coolant de-gas, coolant
4 purification and the reactor boron makeup water
5 system. So those are kind of subsystems of the CVCS.

6 MEMBER STETKAR: Fred, I hate to hit you
7 with this but this is another item that we were
8 requested to save until Chapter 9.

9 MR. MAASS: Okay.

10 MEMBER STETKAR: This is from March of
11 2010 for example. The de-boration protection function
12 of CVCS as I understand it, first of all the safety-
13 related part of that just to make sure we're clear
14 about safety-related versus non-safety related. What
15 happens is you close I think two valves in the letdown
16 lines, a valve from the volume control tank and that
17 is the safety-related function, those three valves.

18 MR. MAASS: Yes, I believe so.

19 MEMBER STETKAR: Then in parallel to that
20 you line up the suction of the charging pumps to the
21 IRWST but that's just to keep seal injection going and
22 so forth. On this drawing, I like this drawing. What
23 are those three valves? Are they the two containment
24 isolation valves in the letdown line in the upper left
25 corner and the volume control tank outlet valve? Are

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1 those the three valves that close?

2 MR. MAASS: I would have to look to
3 confirm. I do not remember exactly which of those
4 valves actually close but I do know it's more in the
5 suction lines as opposed to the discharge lines for
6 the other one.

7 MEMBER STETKAR: The reason I'm going to
8 ask is I brought this up during the Chapter 4
9 discussion. If I'm operating during shutdown I'm not
10 letting down through that normal flow path. I believe
11 I'm letting down through the line that's shown
12 vertically to the left of the containment isolation
13 from RHR and SI.

14 MR. MAASS: Right, yes.

15 MEMBER STETKAR: That's the low-pressure
16 letdown line. And under those conditions does the low
17 boron concentration signal automatically isolate that
18 line? Because at that point if it does not I'm within
19 only that single VCT outlet valve for isolation of a
20 potential dilution path.

21 MR. MAASS: Okay.

22 MEMBER STETKAR: So the question is you
23 know if I'm operating on low-pressure letdown during a
24 refueling outage when indeed there might be more
25 opportunity, by the way, for dilution of the primary

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1 system are the valves from the low-pressure letdown
2 line closed automatically by the low boron
3 concentration, whatever it is, low boron concentration
4 signal, whatever the de-borating actuation signal.
5 The tech specs require that system to be operable in
6 all modes of plant operation but they, I think they
7 just specify that the system, they don't specify
8 specific valves or things like that so I'm not quite
9 sure how it operates in shutdown.

10 MR. MAASS: Okay.

11 MEMBER STETKAR: You don't have an answer
12 for that?

13 MR. MAASS: Right off the top of my head
14 no, I don't.

15 MEMBER STETKAR: As I said, I brought it
16 up because we were asked to delay that until Chapter 9
17 so I did.

18 MR. MAASS: Okay. Yes.

19 CHAIR POWERS: You also don't have an
20 answer yet.

21 MEMBER STETKAR: No, but at least I asked
22 the question now in the right place. They can't tell
23 me to wait until Chapter, you know, like 3.

24 MEMBER SKILLMAN: Before you change this
25 image, for each reactor coolant pump --

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1 MR. MAASS: Yes.

2 MEMBER SKILLMAN: -- is it accurate that
3 seal injection flow rate per pump is 8 to 10 gallons a
4 minute and 6 to 8 or 9 enter the reactor coolant
5 system and 2 to 3 returns through the seal return
6 line? Is that how to think about it?

7 MR. MAASS: Yes, that's approximately how
8 it works.

9 MEMBER SKILLMAN: So your net inflow for
10 four reactor coolant pumps being fed seal injection is
11 roughly 4 times 6 or 4 times 8 gallons per minute, 36
12 to 42, something like that. And now my question about
13 your high-pressure cooler.

14 MR. MAASS: Okay.

15 MEMBER SKILLMAN: That is not cooled by
16 component cooling water because that is not an
17 essential or not a safety --

18 MR. MAASS: Right.

19 MEMBER SKILLMAN: -- service. So now I'm
20 sitting here, I have a casualty of some sort, I'm not
21 cooling that 32 gallons a minute. I'm continuing to
22 feed my reactor coolant pumps. What do I do with that
23 water?

24 MR. MAASS: Well --

25 MEMBER SKILLMAN: -- constantly increasing

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1 pressurizer level and now I'm going to have to do
2 something?

3 MR. MAASS: You're correct in the fact
4 that the letdown path would be isolated. I would
5 imagine that yes, you would have the increase in
6 pressurizer level. I'm not sure exactly what the
7 mitigation strategy is right off the top of my head.
8 So I would have to look that up for you to follow that
9 path through to the logical conclusion.

10 MEMBER SKILLMAN: It's not my purpose to
11 antagonize you.

12 MR. MAASS: Okay.

13 MEMBER SKILLMAN: I'm thinking of real
14 life casualty, a real life situation where the
15 operators are torn between continuing seal injection
16 and they're watching the pressurizer level go up. And
17 they're saying what do I do now. Clearly they're
18 going to figure this out in procedure space. Going
19 back to the young lady who started this, she said
20 we're going to solve this stuff right at the design
21 stage. It seems to me that this is an integrated set
22 of questions that deserve attention now because it's
23 easy to walk away and say we're just going to leave it
24 just the way it is but from my years of experience
25 keeping the reactor coolant pumps running, maintaining

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1 seal coolant and maintaining component cooling water
2 to the thermal barrier heat exchangers and also to the
3 letdown gives the operators flexibility in maintaining
4 normal pressure and temperature and pressurizer level
5 no matter what's going on.

6 MR. MAASS: Okay.

7 MEMBER SKILLMAN: Now it looks to me like
8 this is a potential hole in your armor. I mean,
9 you've got defense-in-depth redundancy, this is a
10 marvelous machine, but it seems like this is one of
11 those horseshoe nail situations. It's a little
12 wrinkle, if it's addressed on the front end -- and I
13 might say as it was with BMW in 1969, '70 and '71 we
14 unraveled this. It led to great flexibility in spite
15 of the TMI 2 event.

16 MR. MAASS: Okay.

17 MEMBER SKILLMAN: So the real issue is
18 that safety classification of seal injection to the
19 reactor coolant pump seals. The safety classification
20 of the component cooling water for your high-pressure
21 cooler for a letdown such that those two enable
22 unbridled use of your reactor coolant pumps,
23 particularly the seals.

24 MR. MAASS: Okay.

25 MEMBER SKILLMAN: Thank you.

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1 CHAIR POWERS: Dick, could you give me a
2 paragraph on that?

3 MEMBER SKILLMAN: Yes, sir.

4 MR. MAASS: All right. Extra Borating
5 System. It was in Section 6.8. It was deferred to
6 9.3.4. It's a safety-related source of concentrated
7 boron to support plant cooldowns. Safety functions
8 include reactivity control for non-LOCA events and the
9 steam generator tube rupture. Maintains RCS pressure,
10 boundary integrity and containment isolation. It has
11 no non-safety related functions. It's basically a
12 system that's only designed to borate the RCS.

13 MEMBER SKILLMAN: Question, please.

14 MR. MAASS: Yes.

15 MEMBER SKILLMAN: You've got your normal
16 boron which is your 1 in 5 to 20 percent B-10.

17 MR. MAASS: Right.

18 MEMBER SKILLMAN: Then you have this one
19 that has the elevated boron.

20 MR. MAASS: Right.

21 MEMBER SKILLMAN: How do you keep the
22 color of money separated?

23 MR. MAASS: Are you talking about the
24 boron enrichment?

25 MEMBER SKILLMAN: Yes.

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1 MR. MAASS: Okay.

2 MEMBER SKILLMAN: Here comes the boron
3 truck. Which one? I don't know, one goes over there,
4 the other one goes over there. Put them where they
5 belong.

6 MR. MAASS: I would have to check but I'm
7 pretty sure that we use enriched boron throughout.

8 MEMBER SKILLMAN: That's not what your
9 documentation says. You've got two different
10 enrichments onsite.

11 MR. MAASS: Okay.

12 MEMBER SKILLMAN: And that leads me to
13 wonder what controls are there to ensure that the
14 naturally occurring B-10 boron --

15 MR. MAASS: Right.

16 MEMBER SKILLMAN: -- is where it is
17 supposed to be and the enriched boron which is
18 approximately 50 percent more boron B-10 as per weight
19 mass is where it's supposed to be. And so here's an
20 element that physically looks identical. One has
21 significantly more B-10 and it's only B-10 that's
22 going to take a neut. So how do you keep that
23 chemical separated so the right chemical's in the
24 right place for the right use?

25 MR. MAASS: Okay.

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1 MEMBER SKILLMAN: That's my question.

2 MR. MAASS: Okay. I will have to get back
3 to you on that.

4 MEMBER SKILLMAN: Thank you.

5 MR. MAASS: All right. Another flow
6 diagram of the extra borating system. Basically feeds
7 all four loops, two train system, fairly simple. And
8 that's the end of my presentation.

9 CHAIR POWERS: I look through this,
10 Darrell, and I see we're about halfway through. It
11 might be an appropriate time to take a break here.

12 MR. GARDNER: I would agree.

13 CHAIR POWERS: So why don't we break
14 until, what, 10 after? Is that okay? Designated
15 federal official?

16 MR. WIDMAYER: Sure.

17 CHAIR POWERS: I'm not going anywhere this
18 evening so we've got lots of time.

19 MR. WIDMAYER: Apparently no one else is
20 either.

21 (Laughter)

22 (Whereupon, the foregoing matter went off
23 the record at 2:54 p.m. and went back on the record at
24 3:10 p.m.)

25 CHAIR POWERS: Let's go back into session.

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1 Darrell?

2 MR. GARDNER: Okay, we're ready to start
3 with Section 9.4. And we have Susan McConaty who's
4 going to be describing the HVAC systems. And again I
5 would say, not that this will preclude any questions
6 but that we prepared the presentation material on a
7 selected set of ventilation systems, not all of the
8 ventilation systems.

9 MS. MCCONATY: Okay. I'm Susan McConaty.
10 I got my degree in mechanical engineering at
11 University of Lowell. I've been in the nuclear power
12 industry since 1975. I was 15 years with Stone &
13 Webster mainly working on operating plants and was
14 with Yankee Atomic where I was a system design
15 engineer and was working on the Maine Yankee project
16 doing HVAC recovery of their design basis when the
17 plant was shut down. And then we -- it's sad.

18 MEMBER STETKAR: That solved that problem.

19 MS. MCCONATY: Right, right. And then
20 became -- worked with Duke Engineering and now AREVA
21 and started working on the EPR in 2005. Okay.

22 These are the buildings that are going to
23 be part of our presentation. Chapter 6 has already
24 been presented so it's not part of the presentation.
25 And the other systems in Chapter 9.4 are basically

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1 non-safety and typical so as Darrell had mentioned
2 they're not part of the presentation. Next slide,
3 please.

4 Okay, the control room air conditioning
5 system maintains the controlled environment in the
6 control room envelope for personnel and equipment
7 operation. It maintains control room habitability per
8 the guidelines of GDC 19 and Reg Guides 1.78 and
9 demonstrates control room envelope integrity to
10 provide radiation protection per the guidelines of Reg
11 Guide 1.197 and SRP 6.4, maintains the positive
12 pressure within the control room of greater than 0.125
13 inches water gauge with respect to adjacent areas
14 during DBAs and provides HEPA and iodine filtration of
15 the outside inlet air and the recirculated air from
16 the control room envelope to remove potential
17 contaminants and iodine during the DBA. And this is
18 per the guidelines of Reg Guide 1.52. And the control
19 room envelope is isolated from outside air upon
20 detection of a toxic gas. Next slide, please.

21 The non-safety functions are to provide
22 outside ventilation air for personnel, maintain
23 ambient conditions for personnel and equipment, and
24 maintain a slightly positive pressure within the
25 control room envelope with respect to adjacent areas.

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1 The control room envelope consists of the following
2 areas: the main control room, technical support
3 center, restrooms and kitchen, computer room and the
4 HVAC equipment room. Next slide, please.

5 This diagram shows the cracks during
6 normal operation with the ESF filters bypassed for the
7 outside air. It's mixed with recirculating air
8 distributed and either recirculated or exhausted
9 through the kitchen or restroom exhaust.

10 MEMBER SKILLMAN: Question, please. Back
11 to your slide 43, please, safety functions. I
12 understand control room habitability, maintaining the
13 positive pressure relative to the adjacent areas, the
14 iodine filtration, isolation on toxic gas. Is
15 maintenance of temperature part of this? It seems to
16 me that for the control room to be successful we've
17 all learned the digital equipment particularly has to
18 be at some cool temperature. If it's allowed to be
19 warm it's not functional.

20 MS. MCCONATY: Right.

21 MEMBER SKILLMAN: So I'm wondering is
22 there an additional safety function for temperature.

23 MS. MCCONATY: It -- I would have to look
24 and see what that safety-related temperature is. I
25 know in one of the instances where there isn't cooling

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1 provided it may get up to 104 degrees.

2 MEMBER SKILLMAN: Normally --

3 MS. MCCONATY: But that's for --

4 MEMBER SKILLMAN: Normally 104 is the
5 upper limit.

6 MS. MCCONATY: Right, yes.

7 MEMBER SKILLMAN: And there's a desire to
8 be much, much below the -- 104 is pretty testy for the
9 operators.

10 MS. MCCONATY: Right.

11 MEMBER SKILLMAN: But there is commonly an
12 equipment temperature limit where the equipment begins
13 to be questionable. And so I'm wondering if there is
14 a temperature safety function associated with the
15 control room.

16 MS. MCCONATY: Okay, I'm not sure on that.

17 MR. GARDNER: We can check. I would say
18 remember this is a non-traditional control room with
19 lots of panels and the heat loads coming from those
20 is, it's a different control environment.

21 MEMBER SKILLMAN: You control the plant
22 from the control room?

23 MR. GARDNER: Yes, but operator
24 temperature would not be something that would be a
25 safety-related consideration, it would be a personnel

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1 comfort.

2 MEMBER SKILLMAN: There's no safety-grade
3 electronics in the control room?

4 MR. GARDNER: Well, we can talk about that
5 tomorrow. You're here tomorrow? We're going to talk
6 about the control room tomorrow and the I&C system.

7 MEMBER SKILLMAN: I hope you're --

8 MR. GARDNER: Yes.

9 MEMBER SKILLMAN: It would seem to me it
10 ought to be. And I would think that there's a
11 temperature limit that we've all learned over the
12 years where digital equipment is happy at one
13 temperature and it's unhappy at a temperature higher
14 than that.

15 MR. GARDNER: I think it's a higher number
16 maybe than you're --

17 MEMBER SKILLMAN: Okay.

18 MR. GARDNER: We'll talk about it
19 tomorrow.

20 MEMBER SKILLMAN: Okay. Thank you.

21 CHAIR POWERS: What is the unfiltered in-
22 leakage from the control room?

23 MR. GARDNER: I'm sorry, Dr. Powers?

24 CHAIR POWERS: What is your unfiltered in-
25 leakage on the control room?

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1 MS. MCCONATY: The outside air that's
2 brought in?

3 CHAIR POWERS: When you isolate for an
4 accident you get, there's some air that's going to
5 come in unfiltered. What is it?

6 MS. MCCONATY: Unfiltered. Well, we
7 maintain the positive pressure in there so I'm not
8 sure where the in-leakage would be.

9 CHAIR POWERS: Just open the door. I mean
10 as soon as somebody walks through the door you're
11 going to get some in-leakage that's unfiltered.

12 MR. GARDNER: You're asking what's the
13 assumption for the unfiltered in-leakage for the dose
14 calculations. Do you happen to know that?

15 MS. MCCONATY: No, I don't.

16 MR. GARDNER: Okay.

17 MS. MCCONATY: Any other questions on this
18 slide?

19 MEMBER STETKAR: Yes. Now, I'm trying to
20 read notes from the last time we discussed this, so.
21 The only active, if I can call it that, exhaust path
22 in the control room envelope is through the kitchen
23 and whatever it is, the little line on the lower,
24 kitchen and restroom exhaust line out there. My notes
25 from the last time we discussed this in Chapter 6 was

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1 that line is isolated, I don't remember what signals
2 isolate that line. The question is that the control
3 room envelope contains both the main control room and
4 the technical support center, and the occupancy, kind
5 of the design occupancy for those areas can be up to
6 about 30 people I think, about 25 people in the
7 technical support center and a nominal 5 people in the
8 main control room itself. If that exhaust path is
9 isolated how do I have enough volume of air flowing
10 through the main control room envelope for normal
11 habitability? And I'm talking about not particularly
12 temperature now but carbon dioxide buildup for
13 example.

14 MS. MCCONATY: Right, right. I'm aware of
15 this question that is an open item from Chapter 6.

16 MEMBER STETKAR: It's still? Okay.

17 MS. MCCONATY: It's still open, yes.

18 MEMBER STETKAR: It's still open, okay.
19 Okay.

20 MS. MCCONATY: Right.

21 MEMBER STETKAR: I didn't know whether
22 you'd come to resolution on that yet. Okay.

23 MS. MCCONATY: Okay, any other questions?
24 Okay. Next slide, please. This shows the accident
25 alignment with the outside air and the recirculation

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1 air from the control room is passed through the ESF
2 filters and the isolation valves on the exhaust are
3 isolated. Any questions on that? Okay, next slide
4 please.

5 Okay, the fuel building ventilation
6 system. The safety functions are to maintain a
7 pressure in the fuel building less than -0.25 inches
8 water gauge. It provides exhaust filtration for
9 potentially contaminated airborne particles, part of
10 the discharge to the vent stack and maintains
11 temperature in the boron rooms using electric heaters
12 to maintain the minimum design temperature at above 68
13 degrees to prevent the crystallization of the boron
14 solution. And it maintains temperature in the fuel
15 pool and extra borating pump rooms using safety-
16 related recirculation coolers to maintain the maximum
17 design temperature below 113 for equipment operation.

18 Any questions? Okay, next slide please.

19 Okay, the non-safety functions are to
20 maintain ambient conditions in the fuel building with
21 the normal air supply is from the nuclear auxiliary
22 building ventilation and it's also exhausted by the
23 same system. It maintains a slight negative pressure
24 with respect to the outside environment via the air
25 supply and exhaust from the NABVS and it has filtered

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1 exhaust from the nuclear auxiliary, the NABVS through
2 HEPA and carbon filtration for the air exhausted
3 during normal operation.

4 CHAIR POWERS: On the carbon filtration
5 what, I mean what are you trying to achieve with
6 carbon filtration? Iodine?

7 MS. MCCONATY: Iodine removal, yes.

8 CHAIR POWERS: Okay. So it's merely
9 governed by an ASTM spec?

10 MS. MCCONATY: By an ASTM spec?

11 CHAIR POWERS: Yes. For carbon filtration
12 of iodine.

13 MS. MCCONATY: Well, okay. It's to, I
14 believe those filters are to Reg Guide 1.140 and it's
15 to 8(g)(1) ASTM.

16 CHAIR POWERS: Oh.

17 MS. MCCONATY: Right.

18 CHAIR POWERS: Yes, just an ASTM spec.

19 MS. MCCONATY: Right. Okay. And in the
20 event of a fuel-handling accident the fuel pool hall
21 is isolated and the air is filtered through the ESF
22 filters in the safeguard building ventilation system
23 filtration trains.

24 CHAIR POWERS: What kind of mass can those
25 filtration trains tolerate?

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1 MS. MCCONATY: Excuse me?

2 CHAIR POWERS: What kind of mass can those
3 filtration trains tolerate?

4 MS. MCCONATY: You mean flow rate? The
5 flow rate, the mass?

6 CHAIR POWERS: I mean, you're going to
7 have a fuel-handling accident, you're going to drop a
8 fuel load -- a fuel assembly on the floor. The air
9 oxidations can produce a lot of aerosol. What kind of
10 aerosol mass is going to go down that filtration
11 train?

12 MS. MCCONATY: Okay, I don't know. I'd
13 have to get back to you on that. So what's the exact
14 question, the mass?

15 CHAIR POWERS: Yes, I mean if you've got
16 HEPA filters you can probably tolerate a kilogram on a
17 HEPA filter. If they have roughing filters in front
18 of them, probably more. I just don't know.

19 MS. MCCONATY: Well I know we have an open
20 item on that from, it must have been from Chapter 6
21 for the 6.5.

22 CHAIR POWERS: Probably.

23 MS. MCCONATY: Right.

24 MEMBER STETKAR: Susan, before you flip
25 the slide the charging pumps are located in the fuel

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1 building, is that correct?

2 MS. MCCONATY: Yes. I think so, yes.

3 MEMBER STETKAR: They -- and the only
4 cooling for those, are they in separate rooms by
5 themselves or are they out in an open area? I have no
6 idea. If you answer you have to come up and tell us
7 who you are.

8 MR. MAASS: I will have to check on that.

9 MEMBER STETKAR: The only reason I was
10 asking is that the fuel pool pumps and the extra
11 borating pumps have separate, you know, room coolers
12 for them.

13 MS. MCCONATY: Right.

14 MEMBER STETKAR: But I don't see any of
15 that for the charging pump room. So I was curious,
16 you know, if you do have a loss of fuel building
17 ventilation system that these charging pump rooms are
18 going to heat up if they're in separate rooms. If
19 they're out in an open area obviously it'll take
20 longer. But I'm just thinking about survivability of
21 the charging pumps after loss of the bulk fuel
22 building ventilation system.

23 MR. GARDNER: For what function?

24 MEMBER STETKAR: Survivability of the
25 charging pumps. You know, how long. You know, you

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1 have provisions such that the charging pumps can be
2 powered from the station blackout diesels. You have
3 the ability of at least manually if not, you know,
4 automatically maintaining charging flows as long as
5 possible to reactor coolant pump seals and for makeup.

6 But if the pump rooms are going to heat up and the
7 charging pumps are going to overheat all of that long-
8 term capability for makeup and seal injection isn't
9 worth very much.

10 MS. MCCONATY: Okay.

11 MEMBER STETKAR: Recognizing that, you
12 know, I fully acknowledge that all of these functions
13 you know are quote unquote non-safety related but you
14 have made extra provisions for the charging pumps in
15 terms of power supplies and things like that. I was
16 just curious about whether or not thought has gone
17 into keeping the, you know, their locale cool.

18 MS. MCCONATY: Okay. Next slide, please.

19 This shows the LOCA alignment for the ventilation
20 system with the NABVS is isolated and is being
21 exhausted through the safeguard building ventilation
22 system filters. Next slide, please.

23 This is during a fuel-handling accident
24 with the fuel pool hall isolated and it's being
25 exhausted again by the SBVS. Normal ventilation is

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1 maintained to the rest of the fuel building using the
2 NABVS. Okay, any questions on the fuel building
3 ventilation system? Okay, next slide please.

4 Okay, now we're at the nuclear auxiliary
5 building ventilation system. It does not have any
6 safety-related functions. Its non-safety related
7 functions are to provide conditioned supply and
8 exhaust air to the nuclear auxiliary building fuel
9 building and annulus during -- to maintain ambient
10 conditions for personnel and equipment during normal
11 operation, and also to exhaust the safeguard building
12 controlled area during normal plant operation. It
13 maintains these areas at a slightly negative pressure
14 and provides exhaust filtration during normal
15 operation per the guidelines in GDC 60 and clean air
16 filtration guidelines of Reg Guide 1.140. It provides
17 conditioned supply and exhaust air to the containment
18 ventilation full flow and low flow purge system during
19 a plant outage, and provides conditioned supply air to
20 the low flow purge system during containment access
21 during normal operation.

22 Okay, this slide shows the exhaust of the
23 NABVS. The blue line is the normal path. It exhausts
24 four different areas and has seven different exhaust
25 lines coming in. If iodine is detected in one of

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1 these lines that flow path is diverted up through the
2 carbon filters for iodine removal and then exhausted
3 through the vent stack. Any questions on the nuclear
4 auxiliary building? Okay, next slide please.

5 Okay. All four of the safeguard buildings
6 are serviced by two different ventilation systems.
7 This one's the safeguard building controlled area
8 which is the potentially contaminated area. The
9 safety functions of the ventilation system are to
10 maintain the controlled area at a negative pressure of
11 -0.25 inches with respect to adjacent areas during
12 accident operation. And it provides HEPA and iodine
13 filtration for the exhaust air from the safeguard
14 building controlled area and fuel building prior to
15 being discharged from the vent stack per the
16 guidelines of Reg Guide 1.52 and controls the release
17 of radioactive materials from the containment
18 following an accident. It maintains ambient
19 conditions within the controlled area of the safeguard
20 building for equipment operation using safety-related
21 recirculation cooling units. Okay, next slide.

22 Okay, non-safety are to maintain ambient
23 conditions for personnel and equipment. It gets its
24 conditioned cooled or heated air from the safeguard
25 building ventilation electrical division which will be

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1 next and is exhausted by the NABVS. During a fuel-
2 handling accident in the fuel building it maintains
3 the pressure in the fuel-handling area at 0.25 inches
4 and provides exhaust HEPA and iodine filtration, and
5 meets the guidelines of GDC 61, 62 and Reg Guide
6 1.152. During normal operation it maintains the
7 pressure in the controlled area, a negative pressure
8 and provides exhaust filtration via the NABVS. Any
9 questions on that? Next slide, please.

10 This is the accident alignment for the
11 safeguard building ventilation system. Over on the
12 left the normal exhaust by the NABVS is isolated and
13 the exhaust is drawn through the ESF filter along with
14 the air from the fuel building. Any questions on the
15 controlled area ventilation system?

16 Okay, the electrical division of the
17 Safeguards Building ventilation system maintains
18 ambient conditions in the safeguard building
19 electrical and non-contaminated areas which include
20 the component cooling water, emergency feedwater and
21 safety chilled water pumps. It provides ventilation
22 air for the battery rooms to maintain hydrogen levels
23 less than 1 percent volume per the guidelines of Reg
24 Guide 1.128 and provides cooling to maintain ambient
25 conditions within the battery rooms. The non-safety

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1 functions are to provide ventilation and maintain
2 ambient conditions in the safeguard building
3 electrical area, provide ventilation and cooling for
4 the battery rooms and to provide ventilation air for
5 personnel.

6 Okay. This is a diagram of the system for
7 trains. Trains 1 and 4 are shown; 2 and 3 are the
8 same except for they do not have the maintenance
9 trains shown in green. The -- it's a typical system
10 where the air is brought in heated and cooled and
11 filtered and distributed to the various areas. The
12 exhaust from the clean areas can be recirculated. The
13 exhaust from the battery rooms and rooms containing
14 refrigerants is exhausted directly outside. And the
15 maintenance trains, the maintenance train in division
16 1 can also serve as the unit, the division 2 and 4 can
17 service division 3. Okay, any questions here?

18 MEMBER SKILLMAN: Yes. Is it accurate
19 that trains 2 and 3 simply do not have the green
20 marked equipment? Is that what you're communicating
21 with the line at the bottom?

22 MS. MCCONATY: Right. We have two trains,
23 we have two maintenance trains and over on the -- by
24 the supply shaft plenum, a little bit more over on the
25 left and down you see a connection that's going over

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1 to division 2. So it can be directly interconnected
2 to division 2. So any of the four divisions of the
3 ventilation system can be taken out for maintenance at
4 a time.

5 MEMBER SKILLMAN: So if we were looking at
6 trains 2 and 3 instead of 1 and 4, trains 2 and 3
7 would also have the green marked equipment?

8 MS. MCCONATY: They would not have the
9 green marked equipment. They would have a connection
10 showing, coming from division 1 and 4.

11 MEMBER SKILLMAN: Okay.

12 MEMBER STETKAR: But there's -- if I go to
13 the plant and I count up supply fans I can count a
14 total of five in the plant? One for each division
15 plus a maintenance or are there six?

16 MS. MCCONATY: There would be six.
17 There's two maintenance trains.

18 MEMBER STETKAR: There are two maintenance
19 trains.

20 MS. MCCONATY: There are two maintenance
21 trains, right.

22 MEMBER STETKAR: Okay.

23 MS. MCCONATY: One and 4 each have the
24 maintenance train in their building.

25 MEMBER STETKAR: Okay.

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1 MS. MCCONATY: Then it can be cross, you
2 know.

3 MEMBER STETKAR: But there's duct work
4 that goes over to the other building?

5 MS. MCCONATY: Right, yes.

6 MEMBER STETKAR: So essentially I can
7 substitute either of those maintenance trains
8 interchangeably for any one of the four divisions.

9 MS. MCCONATY: You could only use the one
10 in division -- in train 1 for train 2.

11 MEMBER STETKAR: I've got you, okay.

12 MS. MCCONATY: Right. So they're only
13 connected to one other division.

14 MEMBER STETKAR: I've got you. It's the
15 maintenance 1, 2 --

16 MS. MCCONATY: Right.

17 MEMBER STETKAR: -- and the maintenance 3,
18 4.

19 MS. MCCONATY: Three, 4, right, right.

20 MEMBER STETKAR: Okay, gotcha, thanks.

21 And they live in their respective buildings.

22 MS. MCCONATY: Right, yes.

23 MEMBER STETKAR: I've got you.

24 MS. MCCONATY: Right.

25 MEMBER STETKAR: Thank you.

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1 MS. MCCONATY: Okay, any other questions?
2 Okay. Containment building ventilation system. The
3 safety functions connected with the containment
4 building ventilation system are containment isolation
5 to meet the guidelines of GDC 56 for primary
6 containment and to provide HEPA and iodine filtration
7 for air exhausted from the containment to meet the
8 guidelines of Reg Guide 1.152 and GDC 41, 42 and 43.
9 And the non-safety functions are to provide a low flow
10 purge of containment for access during normal plant
11 operation, provide HEPA and iodine filtration of
12 potentially contaminated airborne radioactive
13 materials from the containment equipment and service
14 compartments during normal operation via the internal
15 filtration subsystem. And during a fuel-handling
16 accident it also provides the filtration for the fuel-
17 handling accident in containment using the low flow
18 purge subsystem.

19 The main cooling system provides cooling
20 for the equipment in service areas within containment
21 and the reactor pit fans supply air from the
22 containment cooling subsystem to the reactor pit and
23 to maintain the temperature of the concrete below 150
24 degrees to prevent degradation. It maintains
25 pressure, negative pressure in containment during

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1 fuel-handling and provides conditioned air to the
2 containment during plant outages via the full flow
3 purge.

4 MEMBER STETKAR: Susan, the low flow purge
5 can be operating during normal plant operation, is
6 that correct?

7 MS. MCCONATY: Periodically when personnel
8 need to access the containment.

9 MEMBER STETKAR: That's -- I was going to
10 ask you, do you have any operating experience to sort
11 of estimate the fraction of time that that would be
12 running?

13 MS. MCCONATY: I would say I don't have
14 the plant -- I'm not sure how often they would be
15 accessing containment.

16 MEMBER STETKAR: Okay.

17 MS. MCCONATY: Do you --

18 MEMBER STETKAR: I'm curious about it
19 because it's a large ventilation path that could be
20 normally open.

21 MS. MCCONATY: Right.

22 MEMBER STETKAR: And I didn't want to
23 bring it up earlier. It's the only set of air-
24 operated containment isolation valves that I could
25 come up with that would be normally open, could be

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1 normally open during plant power operation. I know
2 they're designed to fail closed on loss of air
3 pressure or loss of electricity but there have been
4 instances where contaminants in the air lines have
5 caused binding of the little spools in the solenoid
6 valves such that even though you de-energized the
7 solenoid air isn't vented and the valve stays open.
8 So, and because it's a large path --

9 MS. MCCONATY: Right.

10 MEMBER STETKAR: -- it's sort of
11 interesting. So yes, I'd be curious if you have any
12 operating experience from similar plants what fraction
13 of time they might be open. It's all, I mean it's
14 basically how they control operations and how often
15 people need to go in or whether or not you need to
16 operate the system for just basic air cleanup inside
17 the containment. I just don't know. The plant I used
18 to work in, we had it running constantly even though
19 nobody ever went in there. It just isn't necessarily
20 the best thing to do but that's the way it was
21 aligned.

22 MS. MCCONATY: Right. Yes, yes, the
23 containment system is one of those that's a little bit
24 different than a lot of the U.S. plants.

25 MEMBER STETKAR: Yes, that's right and

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1 that's why, you know, I was asking if there is any
2 operating experience from Europe where they would have
3 a similar basic inventory of equipment in containment
4 and probably requirements for personnel to go in there
5 periodically and make sure that things were still
6 where they're supposed to be, that sort of thing.

7 MS. MCCONATY: Right.

8 MEMBER STETKAR: I just don't know whether
9 that's a daily or weekly or monthly or, you know,
10 every now and then sort of activity.

11 MS. MCCONATY: Okay. All right. And this
12 is a diagram of the ventilation systems and it's
13 showing it with the full flow purge if you can discern
14 the green lines from the black lines there.

15 MEMBER SKILLMAN: Question, please. On
16 the right-hand side of the reactor building there is
17 what appears to be a rectangular compartment. What is
18 that, please?

19 MS. MCCONATY: Oh, that's showing the
20 annulus. You mean with the two isolation valves on
21 each side?

22 MEMBER SKILLMAN: Yes.

23 MS. MCCONATY: Yes, that's showing the
24 annulus. And we've got, you know, the isolation
25 valves on each side.

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1 MEMBER SKILLMAN: Thank you.

2 MS. MCCONATY: Okay. Okay, this now would
3 be the ventilation system for the emergency-powered
4 generating building. The safety function is to remove
5 the heat generated from the emergency diesel generator
6 building and maintain ambient conditions for the
7 operation of equipment during the design basis
8 accident including loss of offsite power. And non-
9 safety is to maintain ambient conditions in the
10 building for personnel and equipment during normal
11 operation. Okay, next slide.

12 This shows the system, it's typical for
13 all four trains. It's composed of three subsystems.
14 The diesel hall which is, you probably can't read
15 that. On the top we have the air intake and the air
16 exhaust compartment, and then below that is the diesel
17 hall. And so we've got the supply air coming in and
18 then it's exhausted. And the supply is slightly
19 higher because it maintains that area at a slight
20 positive pressure to keep dirt and contaminants and
21 that out. Then right below the diesel hall we have
22 the electrical equipment room and that room takes air
23 from the outside and also recirculated air and filters
24 it, cools it and heats it and returns it. That area
25 is maintained at a slightly positive pressure to the

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1 diesel hall. And over on the left we have the main
2 fuel tank room which the exhaust fan draws air in from
3 either the air intake or from the diesel hall. And in
4 both the, well the diesel hall and the main tank area
5 we have safety-related heaters to maintain the minimum
6 ambient temperature in those rooms.

7 MEMBER SKILLMAN: What is the basis for
8 the maximum temperature in your diesel hall? What is
9 it that would require cooling? What is it that drives
10 cooling?

11 MS. MCCONATY: Well, the electrical
12 equipment room of course is the electrical components
13 in that area. That's the only area that's really
14 receives cooled air. The rest of it's all on outside
15 air.

16 MEMBER SKILLMAN: Are there some specific
17 components that drive that design temperature?

18 MS. MCCONATY: In the electrical room?

19 MEMBER SKILLMAN: Yes.

20 MS. MCCONATY: I don't know. We'd have to
21 check on that.

22 MR. LITTLE: My name is Tony Little. I
23 was the system engineer for the dc design. I've been
24 involved with diesel generators now 38 years, with
25 commercial nuclear and nuclear Navy. As an EDG

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1 supplier I worked for EMD. In 1986 I started working
2 in commercial. I've been system engineer at Rancho
3 Seco, Palo Verde and Point Beach, and I've done other
4 modifications at numerous other plants. I worked for
5 E&S and AREVA. Currently I'm project manager
6 installing a diesel at Brunswick.

7 What's driving the temperatures in the
8 control room is this diesel has all digital controls
9 so they have a maximum temperature that they're
10 allowed top rate at. And in the diesel hall that's
11 where the temperature goes to add 115 ambient with the
12 heat load that these diesel's putting off and the
13 controls that are in there are qualified to that
14 temperature. It can get up to 140 I think.

15 MEMBER STETKAR: Local panels up in the
16 hall or are they downstairs?

17 MR. LITTLE: They're in a control room
18 downstairs.

19 MEMBER STETKAR: They're in the control
20 room downstairs.

21 MR. LITTLE: And it has HVAC control in
22 there.

23 MEMBER SKILLMAN: And their max is 115
24 Fahrenheit?

25 MR. LITTLE: I think -- I don't know if

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1 that's high, is it?

2 MEMBER SKILLMAN: My real question is what
3 is the limitation on temperature? I've been around a
4 lot of diesel engines for a long time --

5 MR. LITTLE: Well, the diesel engines, the
6 diesel engines, that will go up to 140 degrees in
7 those rooms with 115 ambient. And that's in --

8 MEMBER SKILLMAN: And so you've got some
9 equipment on the engines.

10 MR. LITTLE: Correct.

11 MEMBER SKILLMAN: Some instrumentation on
12 the engines.

13 MR. LITTLE: That's correct.

14 MEMBER SKILLMAN: But you also have a
15 control room near the engine.

16 MR. LITTLE: And the control room has HVAC
17 control in it and maintains the temperature I think at
18 --

19 MS. MCCONATY: Okay, at 95 degrees.

20 MR. LITTLE: Yes. Maximum.

21 MS. MCCONATY: Yes.

22 MEMBER SKILLMAN: Okay, thank you.

23 MEMBER STETKAR: These engines have
24 electronic governors on them? Or how do you run the
25 governor on the engine?

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1 MR. LITTLE: These do not have electronic.

2 MEMBER STETKAR: They do not.

3 MR. LITTLE: Oh, well they have like an
4 EBG, a Woodward type --

5 MEMBER STETKAR: They have a Woodward?
6 Okay.

7 MR. LITTLE: -- electronics on it. But
8 it's not a digital --

9 MEMBER STETKAR: Electronics in the
10 Woodward.

11 MS. MCCONATY: Okay, any other questions
12 on the diesel? Okay. All right. Then we have the
13 ventilation systems for the essential service water
14 pump building and that maintains ambient conditions
15 within the ESW pump room areas for operation of
16 equipment during the DBA and during normal operation
17 maintains ambient conditions for personnel and
18 equipment. Next slide, please.

19 And this shows the typical ventilation
20 system for all four trains. The room air is drawn in
21 through the cooler and a moisture separator and heater
22 and cooled or heated as needed and then distributed to
23 the pump area or the electrical equipment room. And -
24 - that was it. And then recirculated. Okay. All
25 right. Any other questions on any of the ventilation

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1 systems? Okay.

2 MR. GARDNER: Okay, we're going to move
3 from ventilation over to fire protection with John
4 Crowther.

5 MR. CROWTHER: My name is John Crowther.
6 I'm a graduate fire protection engineer from the
7 University of Maryland but I always wanted to go to
8 Purdue if that makes any difference.

9 (Laughter)

10 MR. CROWTHER: Kevin's my hero.

11 CHAIR POWERS: Purdue doesn't have nearly
12 as good fire protection program as the University of
13 Maryland, so.

14 MR. CROWTHER: I have 43 years of
15 experience in fire protection, 25 of which is in the
16 nuclear area. And my, the section that we're talking
17 about or sections that we're going to be talking about
18 here is 9.51 and Appendix 9A. And just a brief thing
19 on Appendix 9A. It's called the fire protection
20 analysis but what it really is is based on the fire
21 hazards analysis for individual fire areas. So -- in
22 there. So, next slide.

23 Topics we're going to discuss, fire
24 protection defense-in-depth, applicable regulatory
25 requirements, elements of the fire protection program,

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1 the FHA, the fire hazards analysis, fire protection
2 systems and their design features, and then finally
3 the post fire safe shutdown analysis. Next slide.

4 Defense-in-depth. This is nothing new,
5 this is industry definition so, you know, I could get
6 into it. Basically you try to prevent a fire from
7 occurring but if it does you detect it and control it
8 and extinguish it quickly.

9 CHAIR POWERS: It's the strangest
10 definition of defense-in-depth on the face of the
11 planet.

12 MR. CROWTHER: Well, yes.

13 (Laughter)

14 CHAIR POWERS: But we all know and love
15 it, so.

16 MR. CROWTHER: It's an industry standard.
17 Nothing new or fancy here. Next slide.

18 Applicable regulatory requirements.
19 Obviously we were trying to comply with the NUREG-0800
20 Standard Review Plan for 9.5.1. And I've listed there
21 the various regulatory requirements. Unique to new
22 plants is the fact that we're -- for complying with
23 Appendix A of the Standard Review Plan for Advanced
24 Reactors. We do address NFPA 804 requirements,
25 there's a lot of good information in there, but the

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1 NRC has not endorsed 804 because of some differences
2 of opinions on certain things in there so we're
3 basically following the 804 guidance except where
4 there's conflicts and the NRC regulatory guidance
5 takes precedence. And fire PRA has been developed
6 based on Appendix C of the Standard Review Plan.

7 And kind of unique to new plants is the
8 compliance with SECY-90-016. That's where you have,
9 you can't credit reentry into any fire area for any
10 kind of manual actions or repairs and you must have at
11 least one shutdown path and containment that's
12 available. And finally, slow caught gases suppression
13 system elements cannot adversely affect the ability to
14 shut the plant down.

15 CHAIR POWERS: That's a very short-term
16 issue of smoke transport and it is removed to digital
17 systems the corrosive nature of smoke. Raises
18 questions about what happens in the long term.
19 Contacts, pieces, things like that in the smoke. Have
20 you given that any thought?

21 MR. CROWTHER: It's been very difficult
22 getting any good information on survivability of
23 digital equipment so that's been a struggle. I don't
24 have a good answer for you.

25 CHAIR POWERS: Yes, but I mean that's the

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1 problem. I mean, we know the stuff's corrosive. How
2 does it affect the digital equipment you actually have
3 in the plant. And finding that data.

4 MR. CROWTHER: It's been a real challenge.

5 And we've checked with European as well as U.S. and
6 have not gotten a lot of information.

7 CHAIR POWERS: Yes, as far as I know
8 there's just some exploratory studies that said yes,
9 it has an effect. Or can't have an effect.

10 MR. CROWTHER: Yes, I don't disagree.
11 We'll have to take a --

12 CHAIR POWERS: It was not a design
13 consideration in this plant to -- aside from this
14 fairly short -- this short-term requirement means that
15 you don't have a whole hell of a lot of smoke in other
16 areas, that's all I mean.

17 MR. CROWTHER: Yes. Well, that's our
18 first line of defense is to provide barriers that will
19 first of all locate where redundant equipment is in
20 relationship to each other and then where necessary
21 provide smoke-tight separation between these areas
22 through special dampers, doors, et cetera. We
23 basically follow the guidance of Reg Guide 1.189 rev 1
24 and provide justification in the FSAR where we deviate
25 from this. Next slide.

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1 Elements of the fire protection program.
2 This is nothing really unique to us. This is industry
3 stuff, comprehensive identification, analysis of
4 hazards, your organization of your staff, fire
5 prevention program, suppression detection systems both
6 automatic and manual, building design and that's
7 basically your fire area, subdivision of the plant
8 into various fire areas and then your safe shutdown
9 analysis to demonstrate that you can achieve and
10 maintain safe shutdown in the event of a fire. Next
11 slide.

12 This slide and the next slide kind of
13 summarize what goes into a fire hazards analysis.
14 Again, this is nothing unique to our plant. It's
15 industry stuff. You talk about the physical
16 construction and layout of the buildings, talk about
17 the combustibles on a fire, generally on a fire area
18 basis but it might -- there's a couple of areas where
19 we subdivide into fire zones and that's the annulus
20 and then the containment.

21 Here we talk about the various fire
22 protection equipment, both manual and automatic, and
23 as well as the detection and alarm. And there's the
24 analysis of the postulated fire in each fire area
25 assuming that automatic manual fire protection is not

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1 functioning and the ability to shut down -- effect on
2 safe shutdown equipment. And then talk about concern
3 about life safety, release of contamination and
4 impairments of operations assuming the operation of
5 installed fire extinguishing equipment. Make sure
6 that the extinguishing agent doesn't affect your
7 safety-related equipment.

8 MEMBER STETKAR: John, when is it
9 appropriate to -- I was trying to look forward in your
10 presentation. I couldn't quite find it quickly. When
11 is it appropriate to ask you about how you dealt with
12 multiple spurious operations in your fire hazards
13 analysis?

14 MR. CROWTHER: Oh, I didn't think that
15 would come up.

16 (Laughter)

17 MEMBER STETKAR: I'm sure you didn't do
18 any prep work on that. Is it now or do you have
19 something later?

20 MR. CROWTHER: We do talk about fire safe
21 shutdown at the end. Just to give you a little more
22 of my background, I am what we call a classical fire
23 protection individual. I'm at best one question deep
24 on fire safe shutdown and multiple spurious, but Rich
25 Bashall is with us here and he can speak to that.

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1 MEMBER STETKAR: If it's appropriate to
2 discuss it now I'd prefer to do that. If you'd like
3 to wait until you get to the safe shutdown we can do
4 it then. The reason I bring this up is, and I'll
5 quote from the FSAR, the FSAR talks about the fact
6 that you have fiberoptic cables and things like that.

7 It says, "Therefore, fire-induced failures of
8 fiberoptic wiring leading to spurious component
9 actuations are not considered credible for the U.S.
10 EPR plant." Okay. I can perhaps, given what I know
11 about fiberoptic cables, I can perhaps support that
12 notion for cable fires. I can't support that notion
13 for fires that may affect digital instrumentation in
14 control system rooms. So my question is how did you
15 do treat multiple spurious operations that could be
16 initiated from fires in those locations.

17 MR. BASHALL: I'll introduce myself first.

18 MEMBER STETKAR: Sure.

19 MR. BASHALL: My name is Richard Bashall.

20 I've been in the commercial nuclear business for over
21 33 years. I would probably say that about 90 percent
22 of that was involved with post fire safe shutdown
23 analysis and I have the scars to prove it. I've been
24 with AREVA about almost five years. Prior to that I
25 was with another consulting firm for nine years

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1 involved with safe shutdown issues. And prior to that
2 I worked for Public Service Electric & Gas Company's
3 Salem and Hope Creek performing various duties
4 including being responsible for the island fire
5 protection program for about five or six years.

6 I have a BS EE degree from the Norton
7 College of Engineering now known as NJIT or New Jersey
8 Institute of Technology. I'm a registered PE in New
9 Jersey and prior to that I've got some experience
10 wiring switchgear and some conventional fleet Navy
11 experience.

12 The answer to your question is this
13 question's been asked in an RAI. At the time the way
14 the question was worded was basically rev 1 of Reg
15 Guide 1.189 and NEI 00-01 don't speak to multiple
16 spurious operations. What's your plan? I'm
17 paraphrasing. Our response to that was we will
18 utilize the NRC-endorsed guidance when our shutdown
19 analysis formally begins. Reg Guide 1.189 is now in
20 rev 2, discusses multiple simultaneous spurious
21 operations. We also have an open item on this. I
22 haven't seen the formal question from the staff, I've
23 seen a draft that basically asks us to update them on
24 what our position is.

25 MEMBER STETKAR: NEI 00-01 rev 2 also now

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1 speaks to multiple spurious --

2 MR. BASHALL: Yes.

3 MEMBER STETKAR: -- and doesn't limit the
4 number of multiple spurious operations that you need
5 to consider.

6 MR. BASHALL: Yes. We've also been asked
7 a question --

8 MR. TESFAYE: I'd like to make a
9 correction there. I mean, all the open items in this
10 SE we've sent you the final RAI. So there are no open
11 items based on draft RAI questions.

12 MR. BASHALL: Okay. I just, I personally
13 haven't seen the formal question. I know what it's
14 going to be.

15 MEMBER STETKAR: Okay.

16 MR. BASHALL: Okay, and we'll respond to
17 that.

18 MEMBER STETKAR: But I mean from what I
19 hear you say is that it's still in a state of flux and
20 your position is you'll comply with whatever guidance
21 is available.

22 MR. BASHALL: Correct. Whatever the NRC-
23 endorsed guidance is.

24 MEMBER STETKAR: Okay.

25 MR. BASHALL: Okay? Now we've been asked

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1 a question about spurious signals from digital
2 equipment due to smoke intrusion, et cetera. Our
3 position on that is that we're going to take credit
4 for the failure modes and effects analysis performed
5 by the I&C group which includes detectable and non-
6 detectable failures and spurious signals. That was
7 our answer to that RAI question.

8 MEMBER STETKAR: Okay, maybe we'll hear
9 more about that tomorrow because getting failure modes
10 and effects analysis out of digital I&C systems these
11 days, especially when you consider how thermal effects
12 might affect those systems, not by just flames but
13 high temperature is difficult.

14 MR. BASHALL: And we're also in these --
15 you know, the fiber eventually becomes copper through
16 transducers, et cetera, okay?

17 MEMBER STETKAR: Yes. I didn't want to --
18 I sort of just wanted to back you up to the digital
19 I&C rooms as there are other areas that might be
20 susceptible.

21 MR. BASHALL: This is a rather involved
22 analysis.

23 MEMBER STETKAR: Yes.

24 MR. GARDNER: You could ask this question
25 of the I&C folks tomorrow at least in part.

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1 MEMBER STETKAR: I may, yes. I just
2 wanted to get some feedback. Because it's just so
3 clear in the, at least rev 2 of the FSAR.

4 MR. BASHALL: We know, we're currently
5 doing a lot of work on the existing plants on NFPA 805
6 and plants that stayed with Appendix R and we know
7 where this is all going.

8 MEMBER STETKAR: Well but, you know, what
9 has happened or what is happening is that both Reg
10 Guide 1.189 and NFPA 805 at least in the area of
11 sensitivity to multiple spurious operations and
12 potential number are now, you know, fairly parallel.
13 How you deal with those, whether you deal with them
14 probabilistically or deterministically is different.
15 But at least, you know, current versions of the
16 guidance are more in line than they were a couple of
17 years ago let's say.

18 MR. BASHALL: Yes.

19 MEMBER STETKAR: Okay.

20 MR. MCCANN: This is Ed McCann. I was a
21 technical reviewer on this section. I'll get into
22 what experience I have later. But anyway, also on
23 that response it should be no credit is taken for
24 intended -- design features to preclude spurious
25 actuations.

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1 MR. BASHALL: Right.

2 MEMBER STETKAR: Okay.

3 MR. MCCANN: That's important.

4 MEMBER STETKAR: Okay, thank you.

5 MR. CROWTHER: All right, next slide.

6 This is a continuation of the previous slide. As I
7 say, it's a typical fire hazards analysis that you see
8 at all existing plants and we look at other hazards
9 such as earthquakes, storms and floods, post fire
10 recovery potential and et cetera. And also get into
11 emergency planning coordination and then we looked at
12 impact of fire suppression systems and smoke on the
13 ability -- migrating from one area to the other on the
14 ability to -- or the effects on safe shutdown
15 equipment. Any questions on that? Next one.

16 Fire protection program administration.
17 Again, nothing unique or unusual here. It's the same
18 thing you see at existing plants. Talk about the fire
19 protection organization, the administrative policies,
20 the controls that you have, quality assurance, access
21 and egress, fire brigade capability and emergency
22 response capability. The one caveat here is that the
23 COL applicant is responsible for writing site-specific
24 information on the fire protection program and also a
25 schedule for implementing it.

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1 Now we're getting into the systems
2 detection alarm. We provide detection in all areas of
3 the plant where you have safety-related SSCs. The
4 fire alarm system notifies the control room and also
5 the building occupants of a fire condition. And the
6 fire detection alarm is designed to comply with the
7 applicable NFPA industry requirements contained in
8 NFPA 72 which is the fire alarm code.

9 MEMBER STETKAR: John, I have to admit
10 ignorance here because I didn't have a chance to study
11 all of the material in the FSAR on this. Your fire
12 detection systems include individual cabinet sensors
13 or are they just area sensors? Thinking --

14 MR. CROWTHER: There are some cabinet
15 sensors anticipated in the control room but it's
16 mainly your --

17 MEMBER STETKAR: Only in the control room?
18 Not out in the Safeguards Building?

19 MR. CROWTHER: No, we've taken exception
20 to that. We provided area coverage in those but not
21 individual in cabinet.

22 MEMBER STETKAR: Okay.

23 MR. CROWTHER: Next slide. This is your
24 water supply. Once again, fairly typical requirements
25 that you have for existing plants. We have a minimum

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1 of two pumps, one electric, one diesel. We actually
2 have three pumps, one electric and two diesel. We
3 have water supply tanks, we have two tanks that are
4 designed to handle the highest demand. In this
5 particular case the minimum that's contained in Reg
6 Guide 1.189 applies which is 300,000 gallon. The
7 actual demand is a little bit less than that but we're
8 governed by the minimum of 300,000 so we have two
9 300,000 tanks. And it's all designed and arranged
10 such that if you have the loss of one pump or what's
11 commonly referred to as short leg out, but if you lose
12 one section of pipe that you can isolate it and still
13 supply the water you need to the -- to meet your
14 highest demand. And like with the detection alarm we
15 comply with the applicable NFPA codes which is 20 for
16 the fire pumps, 22 for the water tanks and 24 for the
17 underground fire mains. Next slide.

18 MEMBER SKILLMAN: John, before you change
19 that slide go back to 73, please. Forty-three years
20 fire protection, so you've seen a lot of high-end fire
21 protection systems and you've probably seen a lot of
22 Rube Goldbergs.

23 MR. CROWTHER: Yes.

24 MEMBER SKILLMAN: What is your view of the
25 standards for equipment, particularly for firefighting

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1 equipment, for this design?

2 MR. CROWTHER: Specifically your?

3 MEMBER SKILLMAN: Are commercial grade
4 fire pumps sufficient? Should the fire pumps be
5 beyond commercial grade? Should they be something
6 more than just a relatively high-quality component?
7 Should they be treated as if they're safety grade?
8 Judgment question.

9 MR. CROWTHER: Let me just answer in the
10 context of what we're doing here. And what we're
11 doing here is that we're taking commercial grade and
12 we're going to analyze them to make sure that they do
13 -- are capable of surviving a seismic event. Now,
14 we're not calling them safety-related, fire protection
15 isn't safety-related typically except where you go
16 through containment, but everybody's got that
17 exception. But we have not -- basically you're
18 dealing in a commercial grade world with fire
19 protection and I think in our opinion we could qualify
20 through analysis that the various elements, the pumps,
21 the tanks and the fire mains would remain functional
22 after a seismic event.

23 MEMBER SKILLMAN: Thank you.

24 MEMBER STETKAR: John, are the fire pumps
25 themselves on your D-RAP list? Design reliability

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1 assurance program.

2 MR. CROWTHER: I don't -- I'm not familiar
3 with that but I don't think so.

4 MEMBER STETKAR: Check. I'm not going to
5 speculate.

6 MR. CROWTHER: Sure. Anything else?

7 MEMBER STETKAR: The reason I ask is you
8 know there are additional reliability requirements
9 applied to that particular equipment that's on that
10 list that sort of between non-safety and safety-
11 related stuff.

12 MEMBER SKILLMAN: Well, we've dealt with
13 this for years and years and years early on. How do
14 you buy a safety grade diesel? You can't. How do you
15 get a safety grade fire pump? Well, we don't -- we
16 really want to go to ASME Section 3 Class 1 or 2, and
17 gee whiz, we'll just take what's available. But then
18 there's this other idea that -- this stuff is so
19 important and it really needs to be treated with a
20 unique focus on the amount of protection it requires
21 which is awesome. It's really important gear.

22 MR. CROWTHER: It's -- the rumor mill has
23 it that there may be some additional requirements
24 coming out of -- due to some incident over in the
25 Pacific Rim. I don't remember what that was, but.

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1 MEMBER SKILLMAN: Okay.

2 MR. CROWTHER: And we'll have to address
3 that.

4 MEMBER SKILLMAN: Thank you, John. I
5 wasn't trying to twist your design but I was just,
6 you've got a lot of years of this and I was just
7 curious in your opinion.

8 MR. CROWTHER: Yes.

9 MEMBER SKILLMAN: Thank you.

10 MR. CROWTHER: Fire suppression systems.
11 I'll go to the third bullet item and because of the
12 enhanced chain separation redundancy you don't see as
13 many suppression systems in the U.S. EPR as you would
14 in a typical existing plant. But we do have the
15 diesel halls, all four diesel halls have a sprinkler
16 system. The fuel oil storage tanks have what's called
17 a water spray system that is an automatic system and
18 we have the reactor coolant pumps each have a water
19 spray system which is a manual system. And then we
20 have a gaseous fire suppression system in the under-
21 floor area of the main control room which is a manual
22 system as well. And each of those systems is again
23 designed according to their applicable NFPA codes.

24 MEMBER SKILLMAN: Has there been any
25 operating experience where an under-floor gaseous

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1 suppression system has been inadvertently discharged?

2 MR. CROWTHER: You do -- there has been
3 some, not a lot, but there has been some.

4 MEMBER SKILLMAN: And what happens?

5 MR. CROWTHER: Well, in this particular
6 case we've taken that into consideration. First of
7 all, the agent we're using isn't like a CO2 which is -
8 - cause inhabitability problems, but we're also going
9 to look at maintaining a fairly tight enclosure so
10 that we don't see migration out of there. But the
11 particular agent we're talking about, the clean agent,
12 is not hazardous to your health in the concentration
13 we're even discharging under the floor let alone what
14 would leak out into the main control room or whatever.

15 MEMBER SKILLMAN: Thank you, John.

16 MR. CROWTHER: And plus it's a manual
17 system.

18 MEMBER SKILLMAN: Thank you.

19 MEMBER STETKAR: John, do you have
20 automatic suppression on your high-voltage
21 transformers outdoors?

22 MR. CROWTHER: Yes. That's not part of
23 the design certification, that's the COL.

24 MEMBER STETKAR: Oh, that's part of the
25 COL scope. Okay.

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1 MR. CROWTHER: Yes, because it's
2 completely separate from where the nuclear island is,
3 it's on the other side of the turbine where the
4 nuclear island is. Yes, it's separation and
5 suppression for those.

6 MEMBER STETKAR: Okay.

7 MR. CROWTHER: Next slide. Manual
8 firefighting capability. Again, nothing really unique
9 here. We've got standpipe and hose systems
10 throughout. We've got outside hydrants in the yard
11 area and we have portable extinguishers throughout.
12 And we've selected the type of extinguisher best
13 suited for what's in the operation so that we don't
14 create a problem with the type of extinguisher we put
15 in there. And like with the other systems there the
16 design of these systems is in accordance with their
17 applicable NFPA code. Next slide.

18 Building features, building layout.
19 Again, we're mainly talking about fire areas, plants
20 broken down into fire areas. And in a few places fire
21 zones, and that's mainly in the containment and the
22 annulus in the reactor building. And again, we use
23 various NFPA, applicable NFPA codes as criteria for
24 how to test for adequacy of the design as well as the
25 type of doors, dampers, et cetera, that we need to be

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1 placing in there. And then the general materials of
2 construction, try to as much as possible have non-
3 combustible and heat-resistant materials wherever
4 practical in the plant and use the NFPA guide as
5 guidance in specifying the requirements for these
6 materials.

7 Fire protection design, other building
8 systems. Electrical cabling, for the most part we try
9 to use, we've used cabling that's tested in accordance
10 with IEEE 1202. The cable is routed in electrical
11 raceways and then we provide separation between
12 redundant systems.

13 CHAIR POWERS: Are those cable
14 specifications just that? I mean, it just says meet
15 the flame criteria. Have they actually picked the
16 cabling materials?

17 MR. CROWTHER: I'm sorry?

18 CHAIR POWERS: Have they actually picked
19 the cabling materials or are they just, they'll meet
20 that?

21 MR. CROWTHER: Yes, these are flame-tested
22 requirements that they have to comply with in order to
23 be approved.

24 CHAIR POWERS: But they haven't actually
25 picked the cabling material?

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1 MR. CROWTHER: Again I --

2 MR. GARDNER: They haven't picked the
3 cable material yet.

4 MR. CROWTHER: No, not that I'm aware of,
5 no. And then in the fiberoptic it really doesn't
6 technically fall under IEEE 1202 but there is
7 comparable if not better test criteria that for the
8 most part that'll be used. So we'll minimize the
9 stuff that has not been tested, "stuff," the cabling
10 that has not been tested to make sure that it doesn't
11 propagate.

12 And the HVAC system, we look at the
13 consequences of fire in the HVAC system ability to
14 spread it throughout the plant. We will use it to
15 some extent in ventilating or exhausting in a fire
16 area. Also the fire brigade will have portable smoke
17 ejectors that they will use and we are also giving
18 consideration should there be a failure on the part of
19 the ventilation system to make sure that the -- it
20 doesn't communicate smoke and gases to other areas and
21 affect safety-related equipment.

22 Reactor coolant pumps. This is again an
23 industry, the same thing you'll find in most existing
24 plants. We have, we cover leak points with a little
25 collection system. Then it's seismically designed and

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1 it's designed so that it'll hold the total capacity of
2 all lube oil leaks. Next slide.

3 Talk a little bit about emergency lighting
4 and communication. Their communication is covered in
5 detail on 9.5.2 and emergency lighting in 9.5.3 but
6 our concern really with communication is the ability
7 of the fire brigade to communicate in the fire
8 conditions which pretty much is mainly through the use
9 of wireless communication and taking into
10 consideration certain vital areas. There will be low
11 voltage and we feel that that will take care of most
12 if not all situations but should we run into a
13 situation where the vital areas are maybe, where we
14 can't use the wireless equipment then we'll be looking
15 to have an alternative for a fixed system that'll
16 allow communication.

17 And then emergency lighting is provided as
18 necessary. Again, you're talking about being able to
19 ingress for the fire brigade safe shutdown operations
20 and then any emergency egress for plant occupants in
21 the case of a fire. And again, 9.5.2 and 9.5.3
22 address these in much more detail.

23 Post fire safe shutdown capability. What
24 you have is we have an analysis that demonstrates at
25 least one success path of system to be able to achieve

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1 and maintain safe plant shutdown and then the
2 performance goals which are based on Section 5 of
3 1.189. Our reactivity control, achieve and maintain
4 cold shutdown reactivity conditions. Reactor coolant
5 makeup functions, maintain primary system inventory,
6 decay heat removal, process monitoring, necessary
7 process variables and then support functions, cooling,
8 power, et cetera.

9 And the, as we talked a little bit before,
10 the U.S. EPR will follow the guidance of NEI 00-01.
11 And some of the advantages of the U.S. EPR is we've
12 got, we've subdivided a good part of the plant, for
13 example, four Safeguards Building, one per division.
14 We've got two diesel halls which are separated into
15 separate, two fire areas, one for each of the
16 divisions. The essential servicewater cooling towers,
17 those are again separated by distance and fire
18 barriers from each other. And then another advantage
19 is no 125-volt dc air-operated valves. That
20 eliminates concerns about hot shorts, shorts through
21 ground. And then we have a remote shutdown station in
22 accordance with Reg Guide 1.189 which is physically
23 and electrically independent of the main control room
24 to be able to shut the plant down should there be a
25 fire in the main control room. I believe that's it.

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1 MEMBER STETKAR: According to the guidance
2 if the operators need to abandon the main control room
3 they are always perfectly successful doing everything
4 that they're required to do from that remote shutdown
5 location, is that correct?

6 MR. CROWTHER: Absolutely. Yes.

7 MEMBER STETKAR: Okay. Is that the only
8 location that the safe shutdown analysis includes
9 credit for ex-control room operator actions?

10 MR. CROWTHER: The only place for ex-
11 control room, yes --

12 MR. BASHALL: At this time, yes.

13 MEMBER SKILLMAN: Every action is
14 successful 100 percent of the time?

15 MEMBER STETKAR: Yes, I mean that's
16 basically the rules for the deterministic fire
17 analysis is that if you have a defined alternate
18 control location the operators are 100 percent
19 successful from that location.

20 MR. CROWTHER: That's the design we put in
21 there.

22 MEMBER STETKAR: That's the only, the
23 alternate shutdown, whatever it's called in this
24 plant, the remote shutdown. That's the only location
25 that the current analysis accounts for ex-control room

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1 actions. No other local actions.

2 MR. BASHALL: Yes, using the pick system
3 they can control everything using that system.

4 MEMBER STETKAR: And that's -- I've
5 forgotten the layout of the plant. I know where the
6 control room is. Where's the remote shutdown?

7 MR. BASHALL: It's in the next adjacent
8 Safeguards Building, safeguards 3.

9 MEMBER STETKAR: So they're in the same 2-
10 3.

11 MR. BASHALL: One elevation down.

12 MEMBER STETKAR: Okay.

13 MR. CROWTHER: And there are separate fire
14 areas, 3-hour barriers around each.

15 MEMBER STETKAR: I couldn't remember
16 whether it was out in the 1-4.

17 MR. CROWTHER: You'd actually have to go
18 through more than one fire barrier to get from the
19 main control room to the remote shutdown station. The
20 floor and then multiple walls.

21 MEMBER STETKAR: Is that the same
22 ventilation system, or is it --

23 MR. CROWTHER: No.

24 MEMBER STETKAR: -- separate. Yes,
25 because it's separate, separate towers. Okay.

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1 MR. CROWTHER: That wouldn't work too good
2 anyhow. You wouldn't want that to happen.

3 MEMBER STETKAR: No.

4 MR. CROWTHER: Anything else?

5 CHAIR POWERS: That'll do it.

6 MR. CROWTHER: We've got one more slide.
7 I thought we were through. Okay, and these are kind
8 of the exceptions, control room separation, the
9 redundant trains isn't practical so that's where we've
10 got the alternate shutdown. And like I said, we've
11 got the remote shutdown station located physically and
12 electrically separate from the main control room. And
13 in containment it's a single fire within there so
14 we've used the guidance of Reg Guide 1.189 to justify
15 the ability to shut the plant down. We take into
16 account spatial separation, physical barriers, and
17 we've provided fire protection to the extent to
18 guarantee that we have at least one success path
19 available if we shut the plant down. And we have
20 automatic detection is provided in the containment in
21 various areas and we do have suppression systems
22 protecting the reactor coolant pumps. Now I think I'm
23 done.

24 MEMBER STETKAR: One last question, I know
25 we're woefully short on time here. The fire hazards,

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1 this is sort of a follow-on for the multiple spurious
2 operations. Did you look at spurious signals from in
3 containment instrumentation?

4 MR. BASHALL: We will be looking at that
5 when we do the analysis, yes.

6 MEMBER STETKAR: Okay.

7 MR. BASHALL: Oh yes.

8 MEMBER STETKAR: Okay. Thanks.

9 MR. GARDNER: Okay. Moving on to diesel
10 auxiliary systems with Bob Day.

11 MR. DAY: My name's Bob Day. I'm an
12 equipment engineer with AREVA. I've been specifying
13 installing starting up powerful plant equipment for 34
14 years. I have a BS in nuclear engineering from Penn
15 State.

16 CHAIR POWERS: But you wanted to go to
17 Purdue, right?

18 MR. WIDMAYER: Now he does.

19 (Laughter)

20 MR. DAY: I worked for Duke Power, Duke
21 Energy and then AREVA. And I've worked on both
22 nuclear and fossil plants from building them and
23 starting them up.

24 First system is the fuel oil system which
25 stores and pumps filtered fuel oil to the engine

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1 following a start signal. Each diesel generator has a
2 separate and independent fuel oil system. All fuel
3 oil system components are located inside the diesel
4 building with the exception of the outside fill-in
5 tank bed lines. Redundancy of the components allow
6 operation of the engine if maintenance is required.
7 The storage tank, day tank components and piping are
8 located aboveground, all accessible for inspection and
9 maintenance. The tanks are located in a separate room
10 adjacent to the engine room. The tank room barrier
11 provides missile protection for the tanks, is a spill
12 reservoir and serves as a three-hour firewall.

13 CHAIR POWERS: The three-hour firewall is
14 a product of a calculation or a product of a test?
15 Your assertion that you have a three-hour firewall, is
16 that the product of analysis or product of a test?

17 MR. DAY: I would expect it's -- where did
18 the fire protection guys go? I would expect it's from
19 analysis.

20 The volume of the storage tank and the day
21 tank are calculated using the guidance of ANSI/ANS
22 59.51. The usable capacity of the storage tank allows
23 seven days of uninterrupted operation of the engine at
24 rated load. Usable capacity of the day tank allows
25 two hours of uninterrupted operation of the engine at

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1 rated load. The storage tank is a vertical tank that
2 includes an internal sump and water draw-off
3 connection. The tank can be filled while the engine
4 is in operation and includes remote and local level
5 indication and sampling connections. The day tank is
6 located above the storage tank to provide positive
7 suction head for the fuel oil pump. This tank can
8 also be filled while the engine is in operation.

9 MEMBER STETKAR: Bob, the transfer pumps
10 from the storage tank to the day tank, you said that
11 the day tank normally contains nominal fuel for a
12 couple of hours of operation?

13 MR. DAY: It's got two hours.

14 MEMBER STETKAR: Two hours.

15 MR. DAY: The low level signal is about an
16 hour's capacity.

17 MEMBER STETKAR: Okay. When the transfer
18 pumps come on do they cycle on and off between high
19 and low level or do they just come on and you recirc
20 back?

21 MR. DAY: They come on at low level and
22 then turn off when you get to the high level.

23 MEMBER STETKAR: So if I'm going to run
24 this diesel for 24 hours those pumps are going to
25 cycle on and off a number of times.

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1 MR. DAY: Yes.

2 MEMBER STETKAR: Or a pump. You have two
3 pumps so whatever --

4 MR. DAY: Yes. So you can switch them
5 back and forth. It depends on which one you put in.

6 MEMBER STETKAR: But they do cycle. You
7 don't -- they don't just come on and you just recirc
8 the extra stuff back to the tank.

9 MR. DAY: No.

10 MEMBER STETKAR: Okay.

11 MEMBER SKILLMAN: Robert, is there a --
12 let me back up. Can you describe the fuel oil other
13 than oil that is in these two tanks? Was there an
14 underground reserve for the set-aside tank for
15 security reasons?

16 MR. DAY: No.

17 MEMBER SKILLMAN: This is all there is?
18 This is the oil that's available for the diesel
19 engines?

20 MR. DAY: Yes. There's a storage tank and
21 a day tank for each engine.

22 MEMBER SKILLMAN: Question, please, about
23 the fuel oil storage tank. I'm assuming with seven
24 weeks run time for a large engine this is a fairly
25 generous --

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1 MR. DAY: Seven days.

2 MEMBER SKILLMAN: Seven days. It's a
3 fairly generous tank.

4 MR. DAY: Yes.

5 MEMBER SKILLMAN: What provisions are in
6 the tank to enable cleaning goo cloud, other stuff,
7 off the bottom? What design provisions do you have
8 that you can actually clean this tank online?

9 MR. DAY: Well, the usable capacity
10 includes the space at the bottom that you would have
11 for water and for sediment buildup, and then you've
12 got another set of capacity, or outside the usable
13 capacity for suction head. And you can always recirc
14 out the tank out to like a temporary filtering station
15 if your samples start showing that you've got problems
16 in the tank. There are connections that you can --

17 MEMBER SKILLMAN: Is there installed
18 equipment to do that or will you have to hook up --

19 MR. DAY: You would have to hook up a
20 temporary filter station outside. Now, you can,
21 through the transfer pumps you could pump through the
22 filters and then recycle back to the tank.

23 MEMBER SKILLMAN: Thank you.

24 MR. DAY: But you would still be -- you
25 wouldn't be taking out, the pumps aren't going to take

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1 suction out of the immediate sediment layer. They're
2 going to be taking suction out above that.

3 MEMBER SKILLMAN: So if you wanted to go
4 after the sediment or --

5 MR. DAY: You'd have to take out the
6 temporary connection.

7 MEMBER SKILLMAN: You're going to have to
8 go to a temporary.

9 MR. DAY: And the other thing you can do
10 is there's a water draw-off connection. And what you
11 can do is just keep drawing off and draw off the dirty
12 oil too. Because there will be a sump in the bottom
13 of the tank with a pipe that goes down into it.

14 MEMBER SKILLMAN: Thank you.

15 MR. DAY: The next system is cooling water
16 which provides cooling for the engine turbine charger,
17 intercoolers, generator bearings and the governor.
18 The system dissipates heat from these components to
19 the essential service water system maintaining system
20 temperature within engine operating limits during
21 operation. Each diesel generator has a separate and
22 independent cooling water system located inside the
23 diesel building. System includes two subsystems,
24 jacket water cooling and the intercooler cooling.
25 Each subsystem has its own heat exchanger to dissipate

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1 heat to the essential service water system. The
2 jacket water subsystem includes the non-safety related
3 portion which provides heated water to the engine to
4 maintain the engine at a set temperature during
5 standby. The preheat system is used to reduce stress
6 on the mechanical portions of the engine during
7 emergency starts. The two systems are connected to a
8 common expansion tank which allows expansion of the
9 water due to temperature variations. The tank is
10 located above the rest of the system components to
11 facilitate air removal.

12 The expansion tank provides usable
13 capacity for seven days of engine operation at rated
14 load. The tank includes a fill connection which
15 automatically provides demin water upon low level. It
16 also includes a manual fill connection if the demin
17 water system is unavailable. It would essentially be,
18 you would have to mainly fill it during emergency
19 operations since the demin water system is non-safety
20 related. During operation the engine preheat system
21 is off and cooling water circulated by the engine-
22 driven water pumps. When the engine is in standby the
23 preheat pump circulates heated water to the jacket
24 water subsystem to minimize cold start wear.

25 The next system is starting air which

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1 provides dry compressed air to start the diesel
2 generator. Starting air is not required once the
3 diesel is running. The safety-related portion of the
4 system includes the air receiver inlet check valves
5 and isolation valve. The air receiver is used to
6 store the compressed air in the starting air valves.
7 The non-safety related portion of the system provides
8 dry compressed air to the receivers. Each diesel
9 generator has a separate and independent starting air
10 system located inside the diesel building.

11 The system includes two trains of
12 compressors, filters and air dryers which can be
13 operated separately or at the same time. Air from the
14 engine room is used as an intake to the compressors.
15 To pass the receiver tanks is sufficient for five
16 starts of the engine from the low air pressure alarm
17 point without recharging the receiver tanks. The
18 compressors are capable of recharging the air
19 receivers within 30 minutes after five starts.

20 The next system is the lube oil system.
21 The safety-related portion of this system provides
22 filtered lube oil to the moving parts of the engine
23 during engine operation. The non-safety related
24 portion of the system provides pre-lubrication to the
25 engine and maintain a minimum lube oil temperature

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1 when the engine is on standby. Each diesel generator
2 has a separate and independent lube oil system located
3 inside the diesel building. The system dissipates
4 heat from the lube oil to the essential service water
5 system, maintaining system temperature within the
6 engine operating limits during operation.

7 The keep-warm pump and heater circulate
8 lube oil and maintain a minimum oil temperature when
9 the engine is on standby. During engine operation the
10 keep-warm pump and heater are off and lube oil
11 circulated by the engine-driven pumps.

12 The system includes a lube oil makeup
13 tank. The volume of the tank is calculated using the
14 guidance of ANSI/ANS 59.52. Usable capacity of the
15 makeup tank allows seven days of uninterrupted
16 operation of the engine at rated load. Lube oil is
17 provided to the engine sump from the tank by gravity
18 through a solenoid valve which is activated by sump
19 level. The lube oil makeup tank can be filled while
20 the engine is operating.

21 The next system is the air intake and
22 exhaust system. The safety-related air intake system
23 provides filtered combustion air to the engine. The
24 exhaust gas system provides a safety-related path for
25 engine exhaust products to be discharged to atmosphere

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1 through a rupture disk. The system also includes a
2 normally used non-safety related exhaust path through
3 the emission controls equipment, a silencer and a vent
4 stack. Each diesel generator has a separate
5 independent intake air and exhaust gas system. All
6 safety-related components are located inside the
7 diesel building.

8 Combustion air is taken from outside the
9 diesel building through a louver in the building wall
10 near the top of the building. Combustion air is
11 routed through duplex filters, a silencer and an air
12 heater before entering the turbo charger.

13 MEMBER STETKAR: Bob, are the outside --
14 the combustion air intake louvers normally open? You
15 say it's, you know, I'm looking at the drawing. It
16 comes in through a louver and goes down through a set
17 of filters and some dampers and then you finally get
18 to --

19 MR. DAY: I think it's like a, it's not
20 really a movable louver, it's like a grill.

21 MEMBER STETKAR: Yes, I was going to -- if
22 it was movable I was going to ask about freeze
23 protection.

24 MR. DAY: Protecting for missiles.

25 MEMBER STETKAR: Okay, but it's just a

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1 normally open --

2 MR. DAY: Yes.

3 MEMBER STETKAR: -- hole in the wall.
4 Protected hole in the wall. Okay.

5 MEMBER SKILLMAN: Would you go back one,
6 please? Robert, say more about the rupture disk,
7 please? The rupture disk.

8 MR. DAY: That's the safety-related
9 exhaust path. Normally when the diesel's running the
10 exhaust gas goes out and it's going to go through an
11 emissions control equipment removal and an SER through
12 the exhaust silencer and then out, vented out a stack.
13 And that just, what kind of emission control
14 equipment is site-specific based on their air permit
15 and how long they can run the engine without it. The
16 safety-related exhaust path is, the rupture disk is
17 set by the diesel manufacturer from the standpoint of
18 if something goes wrong with the emissions control or
19 the silencer and you lose that path or it becomes
20 blocked or something then the rupture disk goes. And
21 that just goes out through a louver, out through
22 actually the room where the building exhaust air
23 exhaust was on that one figure. That room is actually
24 cut in half and half of it, the air exhaust from the
25 building goes out and the other half is where the

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1 safety-related exhaust, and it goes out through a
2 fixed louver out the side of the building on the
3 opposite side of the building from the intake.

4 MEMBER SKILLMAN: Okay, thank you. I
5 understand.

6 MR. DAY: And like I said, the combustion
7 air intake is located on the opposite side of the
8 diesel from the exhaust gas discharge point. Normal
9 flow path for the exhaust gas is through the emission
10 control equipment and a silencer before being released
11 to atmosphere. Mission control equipment may consist
12 of particulate removal and/or NOx reduction equipment
13 depending on the permanent requirements of the
14 installation site. The emission control equipment is
15 located outside the diesel building. The exhaust
16 rupture disk and vent stack provide a safety-related
17 exhaust path should the exhaust flow be restricted due
18 to a system or equipment failure downstream.

19 MEMBER STETKAR: Bob, just one quick one.
20 I'm still -- when the diesels start are the intake,
21 combustion air intake dampers also normally open?

22 MR. DAY: Tony, you want to?

23 MEMBER STETKAR: I'm -- they're, you know,
24 exposed to cold air basically because the intake air
25 heater isn't until downstream of the intake air

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1 silencer and the filters and everything. So what I'm
2 asking about is do you have any equipment in that
3 combustion air flow path that needs to move, you know,
4 to supply combustion air to the engine? And if so, is
5 that equipment exposed to potentially low temperatures
6 such that, you know, you could get ice formation or
7 binding on the equipment? And this actually happened
8 at places in really cold environments. That's why I
9 was asking about the exterior intake louvers, whether
10 they actually have to open or not.

11 MR. DAY: Those are --

12 MEMBER STETKAR: If those are fixed that's
13 fine, but the next thing I ran into were the
14 combustion air, you know, intake dampers basically, in
15 those lines.

16 MR. DAY: You want to help me out on this
17 one, Tony? There are essentially butterfly valves on
18 the intakes. They're inside the building. So there
19 is going to be some warming there.

20 MEMBER STETKAR: I don't know where
21 they're -- sometimes there are big air plenums, you
22 know, that are nominally in the building.

23 MR. DAY: The heater is downstream of the
24 first set of valves.

25 MEMBER STETKAR: Yes.

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1 MR. LITTLE: The valves that are in the
2 intake are normally open valves.

3 MEMBER STETKAR: They are normally open.

4 MR. LITTLE: They're there for emergency
5 shutdown to shut off the air supply to the engine.

6 MEMBER STETKAR: Okay. Fine. That's
7 fine. Thanks.

8 MR. GARDNER: Okay, well that's the last
9 of this but we did have a couple of quick go-backs to
10 answer some of your questions that you asked earlier.

11 I think one you asked just in the last couple of
12 minutes was the fire barrier?

13 MS. SLOAN: Let me make -- this is Sandra
14 Sloan from AREVA. Let me just make one comment. One
15 is we appreciate your time. I think we recognize at
16 this point that we perhaps misjudged the amount of
17 material we could present and maybe the level of
18 interest that we've gotten so I'll say that. I would
19 ask you to indulge us for a few minutes more. I will
20 say that you've asked a lot of really good questions
21 during the course of the meeting.

22 I will say for sure one of the things I'm
23 very proud of when I go anywhere with my AREVA
24 engineering colleagues is that they want to be very
25 sure that the answer they give you is the absolute

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1 right answer. So you've heard them on several
2 occasions qualify their answers a little bit or
3 indicate that they needed to follow up. So what
4 they've been doing is they've been following up and
5 double-checking what they knew to make sure that the
6 answer that they give you right now is the correct
7 answer. So what I would propose is to bring a few of
8 those folks back and address as many of the questions
9 as we have been able to follow up on from your earlier
10 questions. So if I could ask the people who will
11 answer the questions maybe to go back to the table.

12 MR. TESFAYE: He's ready.

13 MS. SLOAN: He's ready, okay. We'll
14 start.

15 MR. CROWTHER: This is John Crowther, fire
16 protection lead. Same resume as I had an hour ago.

17 (Laughter)

18 MR. CROWTHER: The -- do you have the
19 slide that the question came up on?

20 MR. GARDNER: Well, I think it was on the
21 diesel slide on whether or not the fire barrier --

22 MR. CROWTHER: Is it separation between
23 the tank room and the diesel hall, is that?

24 MR. GARDNER: The three-hour barrier.

25 MR. CROWTHER: Three-hour barrier. That

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1 is a three-hour barrier not be evaluation, but a
2 three-hour barrier between those. Is that what the
3 question was?

4 MR. GARDNER: It was whether it was by
5 analysis or by testing.

6 MR. CROWTHER: By testing. It's a
7 reinforced concrete wall between there. There is a
8 door on the upper level going in there but that would
9 be an approved fire door, listed fire door and the
10 wall, reinforced concrete wall would be per testing
11 and industry guidance.

12 MR. GARDNER: So does that answer your
13 question, Dr. Powers?

14 CHAIR POWERS: Well, it just provokes the
15 whose test and where.

16 MR. GARDNER: Like whether the wall itself
17 has been tested?

18 MR. CROWTHER: You mean physically?

19 CHAIR POWERS: Yes. Who tested it and
20 where?

21 MR. CROWTHER: Oh. It's a reinforced
22 concrete wall and basically based on industry code and
23 industry practice anything that's 6 and a quarter
24 inches thick gives you a three-hour rating on a
25 reinforced concrete wall and that is much more -- I

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1 don't know the exact --

2 CHAIR POWERS: Okay, well --

3 MR. CROWTHER: -- much more than --

4 CHAIR POWERS: That's what I mean by it's
5 the product of analysis. Which is fine. I mean, I'm
6 just curious. I know what you've done now and thank
7 you very much.

8 MR. CROWTHER: You're welcome.

9 MR. GARDNER: Did you have some questions
10 you wanted to respond to?

11 MS. LINDSTROM: Yes. One of the --

12 MS. SLOAN: Say your name.

13 MS. LINDSTROM: Jean Lindstrom. One of
14 the questions was on the severe accident sampling
15 system when you asked to -- the understanding of my
16 question is what is it designed to as far as.

17 MEMBER SKILLMAN: Source term.

18 MS. LINDSTROM: Yes. And it's -- we can
19 handle up to $-2.5 E^{+16}$ Bq per cubic meter. And we
20 dilute it down to 1 to 1,000 of that.

21 CHAIR POWERS: You can handle up to what?
22 Two times --

23 MS. LINDSTROM: $2.5 E^{+16}$ Bq's per cubic
24 meter. Becquerels per cubic meter.

25 CHAIR POWERS: Okay, like 1,000 curies per

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1 cubic meter.

2 (Laughter)

3 MS. LINDSTROM: Less than that. So that's
4 in the liquid --

5 CHAIR POWERS: It's slightly less than
6 1,000 curies per cubic meter which is --

7 MS. LINDSTROM: That is the design of the
8 system.

9 CHAIR POWERS: Okay. Now, let's see. The
10 AST or even the TID 14844 gets you 10,000 curies per
11 cubic meter.

12 MS. LINDSTROM: Does that answer your
13 question?

14 CHAIR POWERS: Well, it answers my
15 question but it just provokes the next one. If I have
16 a design basis source term you either used AST or TID
17 14844 and that only gave you 10,000 curies per cubic
18 meter and your system is designed to sample less than
19 1,000.

20 MS. LINDSTROM: Less than 1,000.

21 CHAIR POWERS: So now what do you do? I
22 mean the answer is wait two hours and then you're down
23 to less than 1,000 curies per cubic meter, but that
24 means you don't have any information for the first two
25 hours. So you're not going to use any of that

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1 information to make --

2 MS. LINDSTROM: But it is an on-safety
3 system.

4 CHAIR POWERS: So you're not going to use
5 any of that information for making any emergency
6 action or alert notifications.

7 MS. LINDSTROM: The system doesn't need to
8 be operable until 24 hours after an incident anyway.
9 So --

10 CHAIR POWERS: In which case it's fine.

11 MS. LINDSTROM: It's just a management
12 tool.

13 CHAIR POWERS: Now I know. Thank you.

14 MS. LINDSTROM: Okay. I have one more
15 question and one of your questions was on the controls
16 of the pressurizer. Going to the reactor coolant
17 drain tank. And the -- we do have an inch line which
18 is a high flow, a half-inch which is a low flow and
19 that is more of a normal and a startup indication or
20 flow path. The valve that you're talking about to the
21 reactor coolant drain tank, about it over-
22 pressurizing, on a high --

23 MEMBER SKILLMAN: I'm sorry. Let me stop
24 you there for a second. You said you have an inch
25 line which is the high flow --

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1 MS. LINDSTROM: Half-inch --

2 MEMBER SKILLMAN: -- and a half-inch line
3 which is the low flow.

4 MS. LINDSTROM: And then there's a vacuum
5 pump line.

6 MEMBER SKILLMAN: And there's a vacuum
7 pump line. I'm looking at the drawing right now and
8 as far as I can tell the inch line is directly
9 connected also. So I'm not sure.

10 MS. LINDSTROM: The high flow and the low
11 flow are teed together.

12 MEMBER SKILLMAN: Yes. So how does -- if
13 those valves are open how do the valves care whether
14 or not the flow is coming through the half-inch line
15 or the 1-inch line? They don't know.

16 MS. LINDSTROM: It's an orifice. There's
17 an orifice in those lines.

18 MEMBER SKILLMAN: Oh there is, okay.

19 MS. LINDSTROM: Yes. So there's an
20 orifice in the high flow and the low flow.

21 MEMBER SKILLMAN: Okay.

22 MS. LINDSTROM: The valve to the reactor
23 coolant drain tank will close on a high reactor
24 coolant hot leg pressure. So that's how we'll not
25 over-pressurize the reactor coolant drain tank,

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1 sending the flow to the pressurizer relief tank. And
2 there's an interlock between the valve to the reactor
3 coolant drain tank and the pressurizer relief tank.
4 One will close, one will open on a high pressure.

5 MEMBER SKILLMAN: On a high pressure.

6 MS. LINDSTROM: On the reactor hot leg,
7 reactor coolant hot leg.

8 MEMBER SKILLMAN: On a high pressure.

9 MS. LINDSTROM: High pressure.

10 MEMBER SKILLMAN: But not on a normal
11 pressure.

12 MS. LINDSTROM: No because the reactor
13 coolant drain tank can take a normal pressure.

14 MEMBER SKILLMAN: The reactor coolant
15 drain tank is --

16 MS. LINDSTROM: They purge during a normal
17 operation.

18 MEMBER SKILLMAN: No, no, no. Does -- let
19 me walk you through a scenario.

20 MS. LINDSTROM: Okay.

21 MEMBER SKILLMAN: I get a plain vanilla
22 safety injection for whatever reason. I'm not talking
23 about a design basis large LOCA here, I'm talking
24 about a safeguards actuation from let's call it a
25 feedwater line break. Maybe that's even too severe.

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1 Does the vent line from the reactor coolant drain tank
2 close on a, I think you guys call it a stage 1
3 containment isolation signal?

4 MS. LINDSTROM: That's -- we'll have to
5 get back to you on that.

6 MEMBER SKILLMAN: And if the answer to
7 that is yes --

8 MS. LINDSTROM: I think that's a question
9 on the --

10 MEMBER SKILLMAN: -- I now don't have a
11 high pressure in my hot leg, I've got a normal
12 pressure in my hot leg, like 2,500 pounds.

13 MS. LINDSTROM: I don't know that that's
14 going to be outside the scope of the drain system but
15 we can take it as an action item.

16 MEMBER SKILLMAN: Okay, but I'm still -- I
17 mean, that's sort of what I'm interested in.

18 MS. LINDSTROM: Correct. We'll have to
19 take that as a reactor coolant.

20 MEMBER SKILLMAN: I was hoping you were
21 going to say that those two lines to the reactor
22 coolant drain tank closed on any safeguards actuation
23 signal but from what you said that doesn't sound to be
24 the case.

25 MS. LINDSTROM: And it's a non-safety NSAQ

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1 signal.

2 MEMBER SKILLMAN: Okay, so it's not even a
3 safety signal.

4 MS. LINDSTROM: It's not a safeguards
5 signal, it's an NSAQ signal.

6 MEMBER SKILLMAN: Okay. I think you may
7 want to go back and think about those. You understand
8 the concern. The concern is if the normal gas event
9 line from the reactor coolant drain tank because it's
10 a containment isolation line, if that gets a signal to
11 close on any I'll call it plain vanilla safeguards
12 actuation where it's stage 1 containment isolation
13 signal you will now isolate the exhaust path from the
14 reactor coolant drain tank allowing the reactor
15 coolant drain tank to pressurize to whatever the
16 pressurizer gas space pressure is. Quickly. And if
17 it opens, you know, I suspect it's got a rupture disk
18 or a vent line or something that's going to open, you
19 now have a LOCA flow path and you're not going to get
20 any high pressure after that so you're going to have a
21 LOCA flow path out into the containment. Small, you
22 know, it's not a big LOCA flow path.

23 MS. LINDSTROM: So go to the IRWST.

24 MEMBER SKILLMAN: It'll go to the IRWST
25 but it indeed is --

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1 MS. LINDSTROM: It is a path.

2 MEMBER SKILLMAN: It is a pathway.

3 MS. LINDSTROM: Yes.

4 MR. GARDNER: So we still owe an answer.

5 MS. LINDSTROM: So we still owe an answer
6 for the pressurizer controls on that.

7 MEMBER SKILLMAN: Well, it's either the
8 pressurizer, but also look at the, you know, the vent
9 line from the reactor coolant drain tank. Because I
10 don't know whether those valves get a signal. I'm
11 assuming they do because they're non-safety related
12 containment penetration.

13 MS. LINDSTROM: On the reactor coolant
14 drain tank on a normal operation we can vent, not
15 through a safety valve but we can vent to the IRWST.
16 There's a normal vent path.

17 MEMBER SKILLMAN: Okay, yes, I didn't see
18 any drawings of the RCDT so I don't know how --

19 MS. LINDSTROM: Actually I think there is
20 one in the FSAR under the vent and drain system.

21 MEMBER SKILLMAN: Is there? Okay.

22 MS. LINDSTROM: And the other -- on the
23 relief valve it goes to the reactor building pool
24 overflow and the IRWST combined.

25 MEMBER SKILLMAN: Okay.

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1 MS. LINDSTROM: But we do have a direct
2 path that we can align to go to the IRWST.

3 MEMBER SKILLMAN: Yes. I saw -- yes, I
4 see that here.

5 MS. LINDSTROM: Okay.

6 MEMBER SKILLMAN: Set valve.

7 MS. LINDSTROM: Okay, so I think that's in
8 the first. Is that the reactor coolant system?

9 MEMBER SKILLMAN: It's actually -- it's a
10 blowup of the reactor coolant system from Chapter 5.

11 MS. LINDSTROM: Okay, there's also one for
12 the vent and drain system in Chapter 9.

13 MEMBER SKILLMAN: Okay, I'll look for
14 that. Thanks.

15 MS. LINDSTROM: Chapter 9 figures. Should
16 be the first drawing.

17 MEMBER SKILLMAN: That's fine. You know,
18 the piping arrangement at the moment is less important
19 than understanding how all of those valves may work.

20 MS. LINDSTROM: We still have the open
21 question for the slope.

22 MR. GARDNER: Steve?

23 MR. HUDDLESTON: This is Steve Huddleston
24 and I have some information to add to some of the
25 questions. Initially there was a question posed about

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1 the restart of the fans if they were in reverse
2 rotation. And as I understand it the question was
3 about the delay time on the fan, and whether that was
4 tested. It does turn out we have an ITAAC on the
5 delay time.

6 MEMBER STETKAR: You do. Okay.

7 MR. HUDDLESTON: Yes, we do.

8 MEMBER STETKAR: Thank you.

9 MR. HUDDLESTON: Further there was a
10 question about the fail position of the transfer
11 valves and the CCW system. And the fail position is
12 as-is.

13 MEMBER STETKAR: It is as-is.

14 MR. HUDDLESTON: But they're dual-powered.

15 MEMBER STETKAR: From different divisions?

16 MR. HUDDLESTON: Yes.

17 MEMBER STETKAR: Okay, I'll have to think
18 more about that. Thanks.

19 MR. HUDDLESTON: Okay. There was a
20 question about cooldown, if we had an issue with
21 cooldown if all four trains start in an accident. And
22 I would answer that the operators would have the
23 ability to selectively take out trains, adjust
24 equipment, adjust the fans, even stop the fans. So
25 there would be potential for operators to nullify any

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1 adverse conditions that might be caused by all four
2 trains cooling.

3 MEMBER SKILLMAN: Simultaneously.

4 MR. HUDDLESTON: Right.

5 MEMBER SKILLMAN: Thank you.

6 CHAIR POWERS: Have they trained on that?

7 MR. HUDDLESTON: I'm sorry?

8 CHAIR POWERS: Do they train on that?

9 MR. GARDNER: That would be something that
10 would be in the program of the -- versus the design
11 collection. One would be the owner.

12 CHAIR POWERS: Is somebody told to include
13 that in the training program?

14 MEMBER SKILLMAN: How do we capture that?
15 It sounds like maybe a simple question but I really
16 think it's somewhat complex. So if Dr. Powers'
17 question is the right question, how do we make sure
18 it's captured so that it does get incorporated in the
19 training when the procedures are written?

20 MR. GARDNER: Well, we talked about a
21 procedure generation package earlier, the whole series
22 of the way procedures get written.

23 CHAIR POWERS: That's how to do it. It
24 isn't what to do.

25 MR. GARDNER: I would say that's probably

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1 going to be the applicant addressing that question
2 versus the design certification. I understand the
3 question. I'm not sure we're the right party to
4 answer that question.

5 MEMBER SKILLMAN: I think we want to make
6 sure the item's captured so that it's not forgotten.

7 MR. HUDDLESTON: I have one more item
8 here. There was a question about the safety chilled
9 water system and the question was around if there was
10 a break in the safety chilled water system given that
11 it's cross-tied if operators were unable to secure the
12 break and pressure was lost in the safety chilled
13 water system would that mean that we lost our ability
14 to -- for cooling. We have an FMEA and a review of
15 the FMEA shows that scenarios similar to that were
16 looked at. And the answer in the FMEA is that under
17 the worst case circumstance were we to lose two
18 running trains, say 1 and 2, while we had either 3 or
19 4 in maintenance we'd still have one train that was
20 lined up to cool two divisions. So we would have one
21 train remaining to cool two divisions which is our
22 requirement.

23 MEMBER STETKAR: Okay.

24 MR. TESFAYE: If I may, can I go back to
25 the too much cooling? I think the staff will write an

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1 RAI to document the requirement for the operator
2 training.

3 MEMBER SKILLMAN: Thank you. That would
4 be fine.

5 MR. MAASS: All right. This is Fred
6 Maass. I've researched a couple of questions, one of
7 which was that I think I heard during another
8 presentation was, the question was where are the CVCS
9 pumps actually located, if they were in separate rooms
10 or in a large open area. They do have their own
11 rooms, each one. They're adjacent to each other in
12 the fuel building. Another question was --

13 MEMBER STETKAR: Well, if -- let me just
14 follow up on that. If you do lose a fuel building
15 ventilation system those rooms will heat up if the
16 pumps are running, or a pump is running.

17 MR. MAASS: I would imagine so, yes.
18 They're not safety-related pumps, so.

19 MEMBER STETKAR: Okay, thanks.

20 MS. MCCONATY: So do you -- oh, sorry.

21 MR. MAASS: Go ahead.

22 MS. MCCONATY: So is the question still
23 open you want to know?

24 MEMBER STETKAR: Well, it's, you know, in
25 terms of survivability of the CVCS pumps there has

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1 been quite a bit of discussion about power supplies to
2 those pumps and capability of aligning those pumps
3 under, you know, accident conditions to provide
4 assurance of makeup flow and things like that. On the
5 other hand, if the room is going to get real hot and
6 the pump motors are going to fail a lot of those other
7 assurances are somewhat -- seem somewhat moot. So the
8 question is, you know, if you're spending a lot of
9 effort in the design space to -- although the pumps
10 are non-safety related there's still a lot of effort
11 made to keep them available. They're sort of semi, if
12 I can use the term semi-safety related pumps. But if
13 you pretty easily do away with ventilation or cooling
14 for those rooms it seems that you may have defeated
15 some of that purpose. So I don't know if it's a
16 question. It just seems to be an observation that,
17 because there is some separate cooling for these rooms
18 perhaps powered from the station blackout diesel or
19 whatever, you know, taking credit for those pumps in
20 terms of some sort of long-term function under station
21 blackout conditions may not be feasible. Unless I'm
22 misinterpreting something.

23 MS. MCCONATY: Is there a heat-up for
24 those rooms in the station blackout period.

25 MEMBER STETKAR: I have no idea how big

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1 the rooms are or anything like that. That's the --

2 MR. GARDNER: We've got the question.

3 MEMBER STETKAR: That's the other part of
4 the question.

5 MS. MCCONATY: Right.

6 MR. GARDNER: Did you have any more, Fred?

7 MR. MAASS: One question about the boron
8 10 concentration is it's all enriched boron 10.

9 CHAIR POWERS: All enriched. There's only
10 one grade of boron.

11 MR. MAASS: There's only one grade of
12 boron.

13 CHAIR POWERS: Anywhere. They never get
14 lost. There's no chance you'll buy the wrong kind of
15 boron. You sure?

16 MR. MAASS: Yes. Now, depending on which
17 section of the FSAR you read I know some of our fuel
18 company does do analysis and references natural boron
19 equivalents when they do some of their analysis, so.

20 MEMBER SKILLMAN: Okay. I will research
21 and accept your answer but I certainly was led in a
22 different direction from the writeup. But I thank you
23 for your answer.

24 MR. MAASS: Okay.

25 MEMBER SKILLMAN: And I'll continue to

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1 follow up on my end. Okay.

2 MR. STACK: Darrell, excuse me. I've got
3 two other ones.

4 MR. GARDNER: Let me get Susan real fast.

5 MR. STACK: Okay.

6 MR. GARDNER: She's got just one.

7 MS. MCCONATY: Right, I've got one. I'm
8 Susan McConaty. You asked the question what was the
9 unfiltered in-leakage assumed in the dose calculation
10 for the control room envelope. And I've got that
11 here. That's 40 CFM boundary leakage plus 10 CFM for
12 ingress and egress from the control room.

13 CHAIR POWERS: What we have encountered
14 with the existing reactors of course is that the
15 unfiltered in-leakage progressively creeps up over
16 time. Is there any provision in the design for
17 alerting for this slow creep-up of unfiltered in-
18 leakage?

19 MS. MCCONATY: I would have to check the
20 dose calc and see the rest of their assumptions.

21 CHAIR POWERS: Some of the control rooms
22 had -- have or had over the course of operations
23 heroic increases in unfiltered in-leakage and I just
24 wondered if you made any provision in your design to
25 alert or avoid that.

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1 MR. GARDNER: This question may be
2 answered in the tech specs too, Dr. Powers, where they
3 test the performance of the system.

4 CHAIR POWERS: Yes. The problem is that
5 we had tech specs on the control rooms too and people
6 just forgot to run that test or something. I'm
7 familiar with the issue.

8 MR. STACK: I think if I understand your
9 follow-on question it's are we checking this.

10 CHAIR POWERS: Yes, I mean is there
11 anything that keeps it from -- I mean, this is a
12 pretty hefty in-leakage relative to where it's
13 specified in the PASS but very realistic in-leakage.
14 I don't have any troubles with the numbers. It's just
15 that you don't want them to get 10 times that and we
16 certainly have had control rooms with 10 times their
17 tech spec unfiltered in-leakage.

18 MR. GARDNER: Okay. Okay, Tim?

19 MR. STACK: Next up, Tim Stack from AREVA
20 again. Two items for you. First, on the question on
21 the fire water system whether it was in the D-RAP
22 program. It was evaluated for inclusion in the D-RAP
23 program. It was determined not to be risk-
24 significant. That included the tanks, the detection
25 suppression, all of it. It was determined to be not

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1 risk-significant, but it was in fact evaluated for the
2 purposes of the D-RAP program.

3 MEMBER STETKAR: I'm not even -- okay.
4 But the factual answer is is it was evaluated and
5 excluded --

6 MR. STACK: Determined to be not risk-
7 significant.

8 CHAIR POWERS: So we want to flag that one
9 for when we discuss D-RAP.

10 MEMBER STETKAR: Yes.

11 (Laughter)

12 MEMBER STETKAR: That's everything, pumps,
13 valves, tanks.

14 MR. STACK: Pumps, tanks, valves, deluge.

15 MR. WIDMAYER: You mean when we talk about
16 D-RAP again.

17 MEMBER STETKAR: Again, yes. We've
18 already talked about it once.

19 MR. STACK: And the second item, we had
20 discussion earlier with regards to cooling of the RCP
21 seals and the methods we've chosen to cool the seals
22 as well as managing RCS inventory. And for our
23 purposes for AREVA we've chosen to use safety grade
24 thermal barrier cooling of the RCP seals as the
25 mechanism we're choosing. We have not chosen to

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1 provide redundant safety grade seal injection. In the
2 case of seal injection if we had seal injection going
3 we can always terminate seal injection. There are
4 isolation valves in the seal injection path. We can
5 always turn off the CVCS pumps as needed and we have
6 safety grade isolation of the letdown paths so we can
7 manage RCS inventory. We're not in a position where
8 we would continuously add inventory to the RCS that we
9 can't manage.

10 MEMBER SKILLMAN: I understand your
11 answer. Thank you.

12 MR. STACK: And that's all I had. Kevin?

13 MR. CONNELL: Yes, there was one other
14 clarification too from this morning's GSI-191
15 discussion. The question was the refueling water
16 storage that we would have in the in-containment, the
17 IRWST.

18 MEMBER SKILLMAN: Yes.

19 MR. CONNELL: It just, our normal way of
20 flooding up the canal in this point would be through
21 the low pressure safety injection pumps, through the
22 RCS system. The RCS system would then flood the canal
23 and we would then do the refueling. Of course,
24 afterwards the cleanup of that water would be through
25 our fuel pool purification system before it would be

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1 then put back into the IRWST.

2 MEMBER SKILLMAN: So you actually pumped
3 it from the IRWST with -- up through the reactor
4 coolant system, flood over to your refueling level.

5 MR. CONNELL: Correct.

6 MEMBER SKILLMAN: When you're done you --

7 MR. CONNELL: Clean it up.

8 MEMBER SKILLMAN: -- back to your clean
9 water.

10 MR. CONNELL: And run it back to our
11 IRWST.

12 MEMBER SKILLMAN: Back to the basement.

13 MR. CONNELL: Correct.

14 MEMBER SKILLMAN: So you keep it in the
15 basement all the time.

16 MR. CONNELL: Yes.

17 MEMBER SKILLMAN: During refueling.

18 MR. CONNELL: Correct.

19 MEMBER SKILLMAN: Thank you. Okay, thank
20 you.

21 MR. CONNELL: Thanks.

22 MEMBER STETKAR: If the fire protection --
23 I have to go back and refresh my memory on criteria
24 for D-RAP because there's risk significance and then
25 there are separate issues that you look at for station

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1 blackout for fire protection and for ATWS. And under
2 none of those conditions?

3 MR. STACK: John, what I did is I've
4 looked back through our documentation and it was
5 determined to be not risk-significant. We can
6 obviously revisit that in the future when we look at
7 Chapter 18 in the future again.

8 MEMBER STETKAR: Seventeen. It's either
9 17 or 19, one of those two. Okay. But right now it's
10 not on the list.

11 MR. STACK: Right now it is not on the
12 list.

13 MEMBER STETKAR: Okay, thanks.

14 CHAIR POWERS: Gentlemen and ladies.

15 MR. TESFAYE: Thank you very much, Dr.
16 Powers, for letting us finish our presentation today.
17 That was extremely important to us.

18 CHAIR POWERS: Oh yes, I mean understand I
19 come from the early days of the ACRS where we often
20 went till midnight, so.

21 (Laughter)

22 MR. WIDMAYER: There's still time.

23 CHAIR POWERS: I'm sure we'll come up with
24 additional questions that Sloan has to stay here and
25 answer.

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1 MEMBER STETKAR: The latest in the last
2 four and a half years since I've been on the committee
3 as a newcomer was only about 9:30 to 10 o'clock at
4 night I think, so.

5 CHAIR POWERS: There was one time when I
6 was on the other side of the table that I got to
7 testify before the ACRS at midnight.

8 (Laughter)

9 CHAIR POWERS: I'm determined to get even
10 for that.

11 MS. CLARK: All right.

12 MR. TESHAYE: Go ahead.

13 MS. CLARK: Hi, my name is Phyllis Clark
14 and I'm the project manager for Chapter 9, Section
15 9.2.5 through -- I mean, well 9.2 through 9.5. I have
16 a BS in physics and a master's in nuclear engineering.
17 I've been in the industry about 21 years, been at the
18 NRC for about 3.

19 CHAIR POWERS: And you -- did you go to
20 Purdue?

21 MS. CLARK: No, I didn't go to Purdue.

22 CHAIR POWERS: But you wanted to, right?

23 MS. CLARK: Yes, I wanted to.

24 (Laughter)

25 MS. CLARK: All right. I'm going to make

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1 my section pretty brief. These are the technical
2 reviewers for these sections. And let's see, the next
3 four slides contain the number of questions and the
4 number of open items.

5 CHAIR POWERS: My goodness, you have a lot
6 of questions.

7 MS. CLARK: Yes, actually, yes, we did.
8 We had a total number of 480 questions and currently
9 we have 29 open items in several sections. Well, 29
10 total in the SE, Safety Evaluation. The next six
11 slides contain the open items, the 29 open items with
12 a brief description of each open item. I'm just going
13 to page through those real fast. And unless you have
14 any questions concerning the brief descriptions we're
15 going to proceed to the next --

16 CHAIR POWERS: I guess I'd like a little
17 more understanding of the issue associated with RAI
18 476. Clarify the differences between non-safety
19 related and safety-related portions of this system. I
20 can understand why the question came up. I wonder
21 what kind of answers are you looking for there?

22 MR. TESFAYE: Dr. Powers, can we discuss
23 that when the technical staff --

24 CHAIR POWERS: We can.

25 MR. TESFAYE: -- gets started? This is

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1 just for --

2 MEMBER SKILLMAN: We can go through the
3 sections one at a time then, pick up the RAI.

4 MR. TESHAYE: Yes. Any of this RAI stuff
5 that you would like to discuss I think the technical
6 staff.

7 MS. CLARK: Okay. So, we'll go to the
8 first presentation which will be Larry Wheeler for
9 Section 9.2.

10 MR. WHEELER: Good afternoon. I'm Larry
11 Wheeler, a reactor system engineer with the balance of
12 plant branch. I have over 30 years of nuclear
13 experience, been with the NRC just over 3 years.
14 Before the NRC I have over 27 years of plant
15 experience at a BWR/6 and a 3-loop PWR Westinghouse.
16 Between both plants I have over 10 years of on-shift
17 STA experience. I also have a PWR SRO certificate.
18 Pre-1981 I worked for Bechtel for three years as a
19 designer. I went to the University of Akron. I have
20 a mechanical degree. Next slide.

21 Essential service water system, component
22 cooling water systems, alternate heat sink, safety
23 chilled water systems, all have different SRPs but the
24 GDCs are the same. The staff review focused on these
25 SRPs, GDCs, including 10 CFR 20-14.06. Next slide.

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1 One of the main challenges was compliance
2 to GDC 4 and how water hammer is addressed for the
3 ESWS. FSAR revision 1 was silent on water hammer
4 design features and did not adequately address testing
5 for water hammer. In FSAR revision 1 the applicant
6 stated that the hydraulic transient analysis would be
7 performed to confirm the integrity of the ESW piping
8 to withstand the effects of water hammer. Through a
9 series of RAIs the applicant added to the revision 3
10 of the FSAR. Important design features for the
11 prevention of water hammer which includes air release
12 valves which provides a path to remove air during pump
13 starts and vacuum breakers that prevent vacuum
14 formation. And in addition, the non-safety related
15 keep-fill system was added at the cooling tower riser.

16 While the ESW system is in standby it is possible for
17 the water riser to drain. Thus the riser line is
18 monitored for proper water level. If the riser water
19 level is too low a main control room alarm will sound.

20 Then the operator is dispatched. He's directed to
21 refill the piping system. Chapter 14 testing was
22 added. Testing will verify there's no evidence of
23 water hammer. For example, pump starts, pump trips
24 with pump restart. Next slide, please.

25 Similar to the ESWS system the water

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1 hammer considerations for CCWS was reviewed also with
2 respect to GDC 4. The staff was concerned with the
3 10-second closure time of the fast-acting hydraulic
4 valves. The applicant stated in rev 3 of the FSAR
5 that the 10-second closure time of the common header
6 switchover valves and the valves -- excuse me, the
7 fast-acting hydraulic operated isolation valves for
8 the non-safety related CCWS users is not considered an
9 instantaneous closure that would create a large
10 pressure wave in the system.

11 The FSAR revision 3 added Chapter 14
12 testing. Pre-operational testing will verify no
13 noise, pipe movement, support damage, leakage,
14 pressure spikes or waves for 22 different system
15 sequences. For example, train swaps, pump starts and
16 stops, idle pump starts on SI-simulated signals and
17 containment isolation signals. Next slide, please.

18 The other CCWS challenge was related to
19 SRP 92 guidance on surge tank sizing and system
20 leakage. A seismic source of water makeup was needed
21 for the surge tank. When the surge tank needed to
22 accommodate system leakage for seven days without
23 makeup. The original design required manual operator
24 action with the water source being the fire protection
25 system to support seven days. Through a series of

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1 RAIs the applicant added to rev 3 of the FSAR boundary
2 valve seat leakage requirements. That's now defined
3 in Chapter 3. New design assumes no safety-related
4 water makeup for seven days, includes the 750 gallon
5 reserve for seven days per tank. This includes the
6 margin above the calculated system leakage. It has
7 the tech spec surveillance. This is a 31-day
8 verification that the system does not leak less than 4
9 gallons per hour and adds a connection via fire water.

10 That's a seismic cap too and that's for a post seven
11 days. Next slide, please.

12 MEMBER SKILLMAN: Larry, should we -- go
13 back to that slide, please. Should we assume from the
14 750, that's 750 gallons per surge tank?

15 MR. WHEELER: Yes, you have four surge
16 tanks, four divisions and each one is 750.

17 MEMBER SKILLMAN: Yes, sir. Got it.
18 Thanks.

19 MR. WHEELER: Okay. Challenge for the
20 ultimate heat sink are related to testing of the
21 safety-related cooling towers. Since the mechanical
22 draft cooling towers are required to operate post DBA
23 out to 30 days the staff needed assurance that the
24 cooling towers are able to remove the design basis
25 heat load without exceeding the maximum specified

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1 temperature limits. FSAR revision 3 states that
2 analysis will demonstrate that the cooling towers are
3 capable of removing the DBA heat loads and would be
4 documented in the cooling tower design report. That
5 report will include performance curves, recorded
6 temperatures for the worst case weather data, basin
7 water temperature trending for 30 days, effects of
8 concentrated impurities in the basin. It includes all
9 assumptions, the analytical methods and uncertainties.

10 Cooling tower testing is also addressed in
11 tier 1 ITAAC. Cooling water testing is addressed in
12 Chapter 14. It will test cooling tower performance
13 during hot functional testing along with the RHR
14 system, CCWS systems and ESWS system.

15 There is one open item related to the
16 ultimate heat sink and that's for the maximum wet bulb
17 temperature and whether the wet bulb temperature
18 should be addressed in tech spec 3.7.9. The concern
19 is if the site wet bulb temperature is exceeded which
20 is not directly monitored are the four trains of
21 ultimate heat sink still operable.

22 MEMBER STETKAR: Larry, before you leave
23 the ultimate heat sink something in the SER caught my
24 attention. There was a discussion about AREVA's
25 analysis and assumptions regarding the minimum level

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1 in the cooling tower basin to support 72 hours design
2 basis heat loads without makeup. And it's Section
3 9.2.5.4.1 of the SER concludes that -- with the
4 following quote, "The staff believes this margin is
5 sufficient based on operational experience." What
6 operational experience did you use? What specific
7 operational experience is there?

8 MR. WHEELER: I might need some help with
9 Ryan. Do you remember the basis for that?

10 MR. EUL: Yes. My name's Ryan Eul. I was
11 also a reviewer previously for this section. That
12 exact wording was chosen by the lawyers during chapter
13 day because --

14 MEMBER STETKAR: Okay. I'm not a lawyer,
15 I'm an engineer so I'm asking you an engineering
16 question.

17 MR. EUL: The experience -- the
18 operational experience we used was they have a 10
19 percent volume margin and why that's adequate was
20 based on the fact that we had looked at, we had taken,
21 looked at some of the cooling tower historical data
22 and some margins that we looked at that were non-
23 safety and safety-related cooling towers, and we felt
24 that having that much additional volume margin, you
25 know, is sufficient basically.

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1 MEMBER STETKAR: Let me ask you then a
2 non-adjudicatory but sort of uninformed engineering
3 question. Did the staff perform an independent
4 analysis of the cooling tower volume requirements
5 under design basis heat load input for 72 hours to
6 confirm that the AREVA minimum water level is
7 sufficient?

8 MR. EUL: Yes, we did.

9 MEMBER STETKAR: Okay.

10 MR. EUL: We did do the independent audit.

11 But at the end of the day we had to come up with what
12 was the sufficient number beyond that and that's where
13 the wording you saw came into play. If some would say
14 is 8 percent margin enough, is 10 percent margin
15 enough, is 12 percent margin enough I think that is
16 where the legal team decided that wording. But there
17 was an independent audit done and we did look at those
18 calculations.

19 MEMBER STETKAR: Okay. So thanks.

20 MR. TESFAYE: I want to add something
21 here. I think what the lawyers did was ask the same
22 question that you're asking.

23 MR. EUL: Yes, they did.

24 MR. TESFAYE: So we have to give a reason
25 why certain things are acceptable.

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1 MEMBER STETKAR: The answer I was looking
2 for is that you did do an independent audit of their
3 calculation to confirm.

4 MR. EUL: Yes, we did. We went to drift
5 losses, evaporation losses, all the standard
6 engineering assumptions that you would use from the
7 cooling tower performance data and we looked at those
8 calculations.

9 MEMBER STETKAR: I'm good with that. As
10 long as there's some margin above that and you
11 actually checked the calcs I'm fine. Thanks.

12 MR. WHEELER: Keep in mind that, you know,
13 their safety-related makeup that, you know, there's
14 safety-related makeup that is available before 72
15 hours. The operators at the plant aren't going to
16 wait 72 hours and one second and say oh, now I can
17 flip on my safety-related makeup.

18 MEMBER STETKAR: No, I recognize, but the
19 calculation that was done was to show that even
20 without that you had adequate margin, you had adequate
21 inventory for a minimum of 72 hours under design basis
22 heat loads.

23 MR. WHEELER: All right, next slide,
24 please? One of the safety chilled water system
25 challenges was compliance with GDC-4 and how water

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1 hammer is addressed. The applicant adequately
2 addressed water hammer in FSAR revision 2 which added
3 clarification. Design features included the
4 pressurized expansion tank with nitrogen. Specified
5 closing valve speeds are slow enough to prevent damage
6 pressure increases. And then similar to the ESW and
7 CCWS Chapter 14 testing, testings to verify no
8 evidence of water hammer. Next slide, please.

9 Another safety chilled water system
10 challenge was related to SRP 9.2.2 guidance on surge
11 tank leakage and system leakage. FSAR revision 2 and
12 3 was modified to add the 100 gallon water reserve for
13 7 days. This includes margin above the calculated
14 system of leak rights, assumes no safety-related water
15 makeup for seven days, tech spec surveillance 3.7.9.4,
16 surveillance requirements. That's a 24-month
17 surveillance, less than 0.5 gallons per hour. And
18 also defense-in-depth makeup from non-safety related
19 fire protection, that's a CAP 2 water supply.

20 CHAIR POWERS: Let me just clarify, you
21 meant -- you said 0.5 gallons per hour.

22 MR. WHEELER: 0.5 gallons per hour. I'm
23 sorry. Okay. So that concludes for the ESWS, CCWS
24 and safety chilled water. Applicable regulation
25 requirements are satisfied. The exception to that is

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1 the ultimate heat sink and we're still looking at the
2 response from AREVA on the wet bulb related to tech
3 specs.

4 MEMBER STETKAR: You're okay on safety
5 chilled water system with a pipe break out there
6 taking out two divisions?

7 MR. WHEELER: It meets the NRC regulations
8 and guidance, yes.

9 MEMBER STETKAR: Okay.

10 CHAIR POWERS: I personally would like to
11 thank you, Mr. Wheeler, for reminding me of the water
12 hammer issue.

13 MR. WHEELER: Okay.

14 CHAIR POWERS: Well, I mean it's just
15 something that's so easy to forget. I simply forgot
16 it and I'm glad -- his diligence reminded us of that.

17 MEMBER STETKAR: They did -- there was a
18 lot of stuff. I read all of that stuff and there was
19 a lot of really good questions on the water hammer
20 issues, draining lines.

21 MR. WHEELER: On these four systems that I
22 just mentioned we had close to 200 RAIs. So a lot of
23 dialogue between AREVA and the staff.

24 CHAIR POWERS: Good.

25 MR. WHEELER: That's it.

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1 CHAIR POWERS: You're up, Jim.

2 MR. O'DRISCOLL: Good afternoon. My name
3 is Jim O'Driscoll. I'm here to provide subcommittee
4 discussion on issues related to Section 9.4 air
5 conditioning, heating, ventilation and air
6 conditioning. I'm a graduate of the State University
7 of New York Maritime College with a BE in mechanical
8 engineering. I have a master's degree in mechanical
9 engineering from Manhattan College. I have seven
10 years' industry experience as a system engineer at
11 Indian Point Energy Center. In 2007 I joined the NRC
12 as a project manager in the Division of Policy and
13 Rulemaking in the Office of Nuclear Reactor
14 Regulation. And then I joined the Office of New
15 Reactors in 2008. In my current position as a reactor
16 systems engineer in the Division of Safety Systems
17 Risk Assessment, Containment and Ventilation Branch.
18 Next slide.

19 The EPR FSAR Chapter 9.4 contains 14
20 safety-related and non-safety related ventilation
21 systems. I used the standard AREVA plan Sections
22 9.4.1 through 9.4.5 to perform my review of the
23 subchapters 9.4.1 through 9.4.14 using the applicable
24 regulations and general design criteria shown. The
25 SER with open items is based on revision 2 of the FSAR

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1 and the RAI responses received before June 2011. And
2 there remain 13 open items discussed in the 9.4 SER.
3 Next slide.

4 I'm going to talk about a couple of issues
5 that I think are important out of those 13. This
6 first issue is related to the main control HVAC system
7 and other safety-related HVAC systems and systems that
8 are important to safety. The applicant provided
9 performance requirements for the safety-related HVAC
10 systems in regards to the room temperature range, the
11 design construction, inspection and maintenance.
12 However, detailed information regarding the sizing of
13 the systems and the design heat loads was not provided
14 in the FSAR. The staff found that during facility
15 operation the verification of important performance
16 requirements including the adequate sizing of safety-
17 related HVAC systems is assured via technical
18 specifications and surveillance requirements. For
19 example, surveillance requirement 3.7.11.1 verifies
20 the ability of each train of the control room air
21 conditioning system is able to remove the design heat
22 load. However, the staff found that there is no
23 verification of the ability of the HVAC system to
24 remove the as-built heat loads conducted as a
25 condition of the 10 CFR Part 52.103(g) finding.

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1 So, in question 9.4.1-1 the staff asked
2 for sufficient ITAAC to verify the capability of the
3 safety-related HVAC systems to remove the design heat
4 load. And the RAI applies to HVAC systems that are
5 safety-related and for non-safety related systems that
6 provide HVAC during normal operation to spaces that
7 contain safety-related equipment sensitive to
8 temperature. And these systems are the control room
9 air conditioning system, fuel building ventilation
10 system, the Safeguards Building ventilation system,
11 the safeguards building electrical division
12 ventilation system and the emergency power generation
13 building ventilation system, and the essential service
14 water pump building ventilation systems. Any
15 questions on that? Okay. Next.

16 Okay, the next issue is based on the
17 review of the safety-related and non-safety related
18 functions of the containment building ventilation
19 system. The staff determined that the safety-related
20 function of the low volume purge subsystem as
21 described in the FSAR was unclear. The staff issued
22 RAI 277 question 9.4.3-3 which requested the applicant
23 clarify the safety function of the subsystem. In a
24 June 30, 2011 response the applicant provided markups
25 of FSAR tier 1 and tier 2 to clarify the functions of

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1 the control building ventilation system. The staff
2 reviewed the response and the associated markups and
3 determined that more information was required. So we
4 have issued RAI 509 question 9.4.1.7 where we ask for
5 further clarification on the design basis accident
6 function and to also justify the physical arrangement
7 based on that function.

8 MEMBER STETKAR: Jim, this just prompted
9 something that I hadn't thought about before. You
10 said only the low flow purge exhaust system is
11 categorized as safety-related, not the high flow?

12 MR. O'DRISCOLL: That's correct. As far
13 as containment ventilation systems is concerned the
14 containment building ventilation system subsystem that
15 is associated with low flow is -- because that
16 consists of containment isolation valves and an ESF
17 filtration train as opposed to high flow which are
18 just large valves. It's really a containment
19 isolation system.

20 MEMBER STETKAR: But are the containment
21 isolation valves for the high flow safety-related?

22 MR. O'DRISCOLL: Oh, yes. Yes. Sorry.

23 MEMBER STETKAR: Okay, fine. I got you.
24 I understand, thank you.

25 MR. O'DRISCOLL: Next slide. Those are

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1 the only two issues I chose to speak about. If
2 there's any other questions, please.

3 MR. TESHAYE: Dr. Powers had a question on
4 one of the open items in your section, I believe.

5 CHAIR POWERS: Well, I think I understand
6 where he's going here so I think we can just go ahead.

7 MR. TESHAYE: Okay.

8 MR. MCCANN: My name's Edward McCann. I
9 went to Milwaukee School of Engineering with a BS in
10 electrical engineering. And then a master's in
11 physics from Stevens Institute of Technology. And I
12 had 18 years of systems experience in pipe stress and
13 hangers, and then I worked in Newport News ship-
14 building and I was a piping engineer there which is
15 the same kind of work. Then I started work at Calvert
16 Cliffs and I worked there for 15 years and was doing
17 electrical, fire protection and Appendix R engineer.
18 That's where fire protection came in. Thanks a lot.

19 A lot of these really we kind of touched
20 on already. These are the hot points I was going to
21 talk about, items of interest or unique areas. And
22 one is the communication exclusion zones. We're using
23 the radios and the low power so typically you wouldn't
24 have an issue but just in case you did they come up
25 with these exclusion zones. But you can get signals

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1 that will cause spurious actuations from communication
2 systems. Just in case, you know, a few steps would
3 make a difference they said that they would if they
4 had to have another system that would be free of fire
5 effects in case that the radios, you had to go so far
6 away to use them which is very unlikely.

7 Then for the emergency lighting the unique
8 issue was for the main control room and RSS they're
9 using a special emergency lighting system in lieu of
10 the 8-hour battery pack lights that you have. Here
11 it's, basically it receives power from redundant
12 emergency diesel generator backed uninterruptible
13 power supply. So it's got power, period. So that's a
14 pretty good thing.

15 And then we touched on the multiple
16 spurious. And there, basically they were saying as
17 they said before, AREVA said before that the intended
18 use in their latest guidance, and there's an RAI out
19 there. They asked them to commit to revision 2 of the
20 Regulatory Guide and the NEI document.

21 And then another hot item was digital
22 equipment. And I was worried about heat and fires and
23 smoke and essentially they were trying to come up --
24 they did say, AREVA did say that they had did this
25 analysis and it failed certain ways, right? But

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1 besides that they said they're not taking any credit
2 for additional equipment features to preclude any
3 fire-induced spurious actuation. So given the
4 situation they're going to take the spurious
5 actuations.

6 Now to limit the issue with smoke control
7 they have a smoke confinement system for various
8 credit for post fire safe shutdown. That's over and
9 above what most designs do. They're also going to do
10 a smoke effects analysis which is also over and above
11 what a lot of plants are doing. And the other two
12 bullets are just normal smoke dampers, fire barriers
13 type, smoke control procedures. This is normal type
14 stuff. And there's an ITAAC related to the mitigation
15 of propagation of smoke between structures, enforced
16 structures.

17 CHAIR POWERS: Do we have an understanding
18 of how optical fiber cables behave in fires?

19 MR. MCCANN: There was some testing done
20 by the Navy and Research was there to watch it. And
21 essentially it's extremely difficult to get hot
22 shorts.

23 CHAIR POWERS: I'm not surprised at that.
24 Is there anything else they do?

25 MR. MCCANN: Right, that's the main point.

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1 CHAIR POWERS: But they, I mean when we
2 first started testing copper cables we didn't think
3 hot shorts were very important either until we did the
4 tests and found lots of things.

5 MR. MCCANN: Yes, but at least we have
6 copper to copper. All you have to do is this. Now in
7 fiber you have to have a perfect joint.

8 CHAIR POWERS: Yes, I'm just wondering do
9 they do anything else that would surprise one.

10 MR. MCCANN: Not as far as I know.

11 CHAIR POWERS: Not as far as you know.
12 Okay.

13 MEMBER STETKAR: AREVA's answer regarding
14 the fire protection equipment on the D-RAP list quite
15 frankly was a bit surprising to me. I honestly
16 expected they would come back and say well, you know,
17 it's not safety-related but certainly it's on our D-
18 RAP list because it satisfies the criteria of
19 importance. Did you in your review look at that issue
20 or think about that issue?

21 MR. MCCANN: I know at Calvert Cliffs it's
22 a big contributor of fire, okay, of risk. But here --
23 okay.

24 MEMBER STETKAR: That's true, fire may be
25 a much smaller contributor to risk here but in

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1 addition to fires themselves, the fire, I believe
2 there are connections from the fire system that can
3 supply other functions. I'm not so much concerned
4 about a particular significant figure numerical risk
5 significance measure that may come out of the PRA.
6 I'm more concerned about the process for populating
7 the D-RAP list which is ostensibly used as the PRA as
8 one set of input but also input from an expert panel
9 of people who look at broader issues that may not be
10 explicitly quantified in a PRA model. Now, I was
11 curious whether in your review of the fire protection
12 system and its relative importance to the rest of the
13 plant looked at that process at all. It's not a
14 Chapter 9 process, it's more of a Chapter 17 or 19 or
15 whatever those chapters. It's 17 I guess is where the
16 list actually lives. I was just curious because I
17 quite honestly was a little bit surprised by their
18 response.

19 MR. MCCANN: I would say no.

20 MEMBER STETKAR: Okay, thanks.

21 MR. MCCANN: They look at testing, initial
22 testing in the ITAAC.

23 MEMBER STETKAR: We'll look at it, you
24 know, I guess and revisit it in Chapter 17. Thanks.

25 MS. CLARK: All right, that concludes the

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1 staff's presentation for Group 1 Section 9.2 through
2 9.5. Any further questions?

3 MEMBER SKILLMAN: Yes, I do. I'm curious
4 why we didn't explore at least several of the RAI 492
5 questions relative to the chemical volume control
6 system. There are several that have to do with
7 ammonia, with verification of boron. So I'm curious
8 why we didn't address those in this session, please.

9 MR. TESFAYE: We do have the technical
10 reviewers here if you want to discuss any particular
11 RAI.

12 MEMBER SKILLMAN: I would like to know why
13 the hydrogen control range is acceptable. It's
14 different from at least what I'm accustomed to. So
15 I'm curious to know about that.

16 MR. SASTRE: My name is Eduardo Sastre. I
17 was the technical reviewer for CVCS. I'm going to
18 pass it to our contractor which is the person that
19 rates the issue, Dr. Litman.

20 MR. LITMAN: Good afternoon, Bob Litman.
21 I had the same question. The EPRI guidelines are
22 pretty clear on what the hydrogen control limits
23 should be and they're operating, or they plan to
24 operate outside those control limits. And there's no,
25 they haven't presented any evidence that shows that

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1 that's an acceptable range to do it.

2 The EPRI control limits for hydrogen are
3 based on a couple of things, most of which is
4 suppression of oxygen but also those control limits
5 are set at 25 to 50 cc's per kg to potentially avoid
6 any oxygen intrusion events which could occur. And so
7 it's been industry practice and it's been reiterated
8 many times in the EPRI committee meetings. And I've
9 been part of the primary water chemistry guidelines.
10 In the first five revisions I was part of the
11 guidelines committee and that fact was reiterated.
12 And there's been a lot of evidence that the minimal
13 amount of hydrogen needed to operate the plant and
14 keep the oxygen level at a minimum is probably on the
15 order of two to three cc's per kg. However, and this
16 is the big however, you can't exclude the possibility
17 of an oxygen intrusion event in any time during the
18 operation of the plant, and that could be extremely
19 significant, liberating large amounts of crud into the
20 reactor coolant system, causing problems with control
21 rod drive, et cetera. So I had the same concern.

22 MEMBER SKILLMAN: So this is dispositioned
23 to an open item?

24 MR. LITMAN: Yes.

25 MEMBER SKILLMAN: And we're going to get

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1 more information later from somebody?

2 MR. TESFAYE: Yes, this is a Phase 4
3 activity. We'll ask the question. AREVA will provide
4 the response to this question and then when we come
5 back to the committee in Phase 5 we'll discuss all the
6 open items and how they are closed.

7 MEMBER SKILLMAN: Understand. Catch them
8 in Phase 5. Let them go until then?

9 MR. TESFAYE: No, actually we process them
10 in Phase 4 and the presentation will be in Phase 5.

11 CHAIR POWERS: It's when we get it next.
12 Yes, they're in their -- we're in Phase --

13 MR. WIDMAYER: Make yourself good notes
14 like Mr. Stetkar and --

15 MEMBER SKILLMAN: Catch them later.

16 MR. WIDMAYER: Yes.

17 MEMBER SKILLMAN: Thank you.

18 MR. LITMAN: My pleasure.

19 MS. CLARK: Any additional questions?

20 CHAIR POWERS: Members have any additional
21 questions they'd like to pose? Thank you very much.

22 MR. TESFAYE: Thank you very much for
23 finishing at 5:45. Now I can catch my carpool.

24 (Laughter)

25 CHAIR POWERS: Well, I thank everybody for

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1 extraordinary presentations and we'll gather again
2 tomorrow to discuss an issue of very limited interest,
3 probably no controversy at all, right? We are
4 recessed till tomorrow morning.

5 (Whereupon, the foregoing matter went off
6 the record at 5:44 p.m.)

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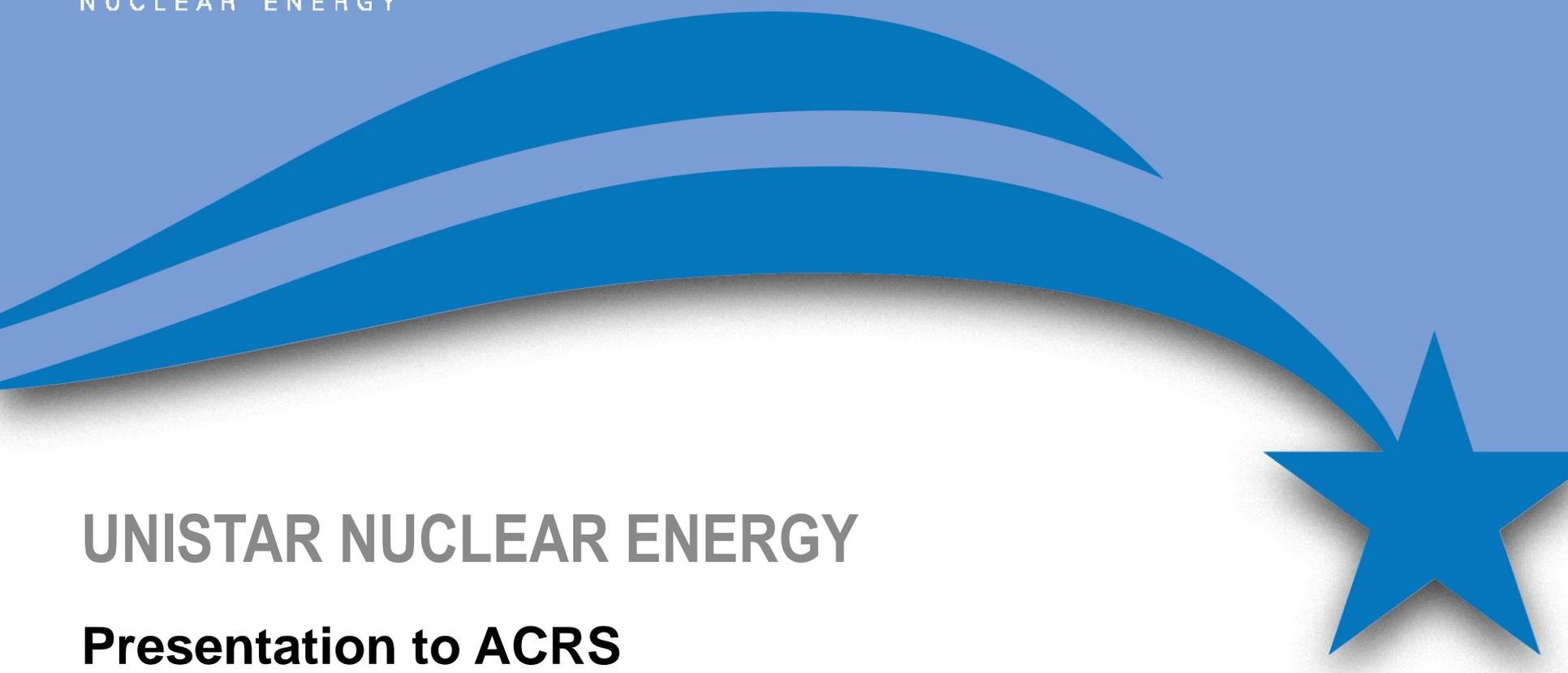
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UNISTAR NUCLEAR ENERGY

**Presentation to ACRS
U.S. EPR™ Subcommittee
Calvert Cliffs Nuclear Power Plant Unit 3
FSAR Chapter 18, Human Factors Engineering
November 14, 2011**

Introduction



- RCOLA authored using 'Incorporate by Reference' (IBR) methodology.
- To simplify document presentation and review, only supplemental information, site-specific information, or Departures/exemptions from the U.S. EPR FSAR are contained in the COLA.
- AREVA U.S. EPR FSAR ACRS Meeting for Chapter 18, Human Factors Engineering occurred on August 18, 2011.

Introduction



- One Human Performance Monitoring Program Departure and no Exemptions from the U.S. EPR FSAR for Calvert Cliffs Unit 3, Chapter 18
- No ASLB Contentions
- Five COL Information Items
- No Open SER Items
- Two Confirmatory SER Items

Introduction



- Today Cyril Roden, UniStar - Instrumentation & Controls Supervisor, will present the Calvert Cliffs Unit 3 FSAR Chapter 18.
- Today's Presentation was prepared by UniStar and is supported by AREVA (U.S. EPR Supplier).
 - Tom Roberts, UniStar – Director Operations, Maintenance & Services
 - Scott McCain, UniStar – Emergency Preparedness Engineer
 - Desmond Raymond, AREVA – Technical Manager
 - Robbie Hoke, AREVA – HFE Design Certification Lead
 - Dominick LoGalbo, AREVA – HFE Consultant Ops Analysis
 - The focus of today's presentation will be on site-specific information that supplements the U.S. EPR FSAR.

Chapter 18, Human Factors Engineering Agenda



Human Factors Engineering

- COL Information Items
- Human Performance Monitoring Program Departures

Conclusions

Human Factors Engineering COL Information Items



- Human Factors Engineering
 - UniStar Nuclear Operating Services, LLC will execute the NRC approved Human Factors Engineering (HFE) program as described in U.S. EPR FSAR Section 18.1.

Human Factors Engineering COL Information Items



- Emergency Operations Facility (EOF)
 - Modifications to the existing Calvert Cliffs Unit 1 & 2 EOF to accommodate an interface with Calvert Cliffs Unit 3 will be consistent with the U.S. EPR HFE Program described in U.S. EPR FSAR Chapter 18 and NUREG-0696.
 - Implementation of the Human Factors Engineering Program EOF design requirements will be verified by ITAAC 6.2 Part 10 Table 2.3-1 of the Calvert Cliffs Unit 3 COLA.
- Operational Support Center (OSC)
 - The OSC will be designed for Calvert Cliffs Unit 3 and will not be shared with Calvert Cliffs Units 1 & 2.
 - The OSC will be designed consistent with the U.S. EPR HFE Program Management plan referenced in U.S. EPR FSAR Chapter 18.

Human Factors Engineering

COL Information Items



➤ Staffing Levels and Qualifications

- Staffing levels and qualifications of plant personnel specified in the Calvert Cliffs Unit 3 FSAR Chapter 13 conform to regulatory requirements.
- Results of staffing and qualifications analysis shall be verified by the implementation of ITAAC 5 of Tier 1 Table 3.4-1 of the U.S. EPR FSAR.
 - The staffing and qualification analysis is based on Human System Interface (HSI) design features as described in the task analysis (TA) Implementation Plan.

Human Factors Engineering COL Information Items



- HFE Principles and Site Procedures
 - HFE principles and criteria are incorporated into the program for site procedures consistent with the guidance of the operational guidelines described in Section 13.5 of the Calvert Cliffs Unit 3 FSAR.
- HFE Principles and Training Program
 - HFE principles and criteria are incorporated into the development training program scope, structure and methodology consistent with the guidance described in Section 13.2 of the Calvert Cliffs Unit 3 FSAR.

Human Factors Engineering Human Performance Monitoring Departure



- Human Performance Monitoring (HPM) Program - Departure
 - The U.S. EPR HPM is replaced by the UniStar HPM Program entirely.
 - The key differences are summarized below:
 - An Operational Focus Aggregate Index is used to trend performance of key variables that can impact Operations Human Performance
 - ✓ Aligns with INPO 09-011, Achieving Excellence in Performance Improvement.
 - UniStar Corrective Action Program is utilized:
 - ✓ To track HFE issues in lieu of a separate program (HFE issue tracking system)
 - ✓ Operational feedback is utilized

Human Factors Engineering Human Performance Monitoring Departure



- Human Performance Monitoring Program - Methodology
 - The UniStar Nuclear Energy Human Performance Monitoring Program meets the requirements of NUREG - 0711.
 - The methodology for monitoring, tracking and trending human performance consists of:
 - Corrective Action Program and Issue Tracking
 - Design Change Control Process
 - Probabilistic Risk Assessment
 - Plant Maintenance and Inspection Programs
 - Operational Focus Aggregate Index

Chapter 18, Human Factors Engineering Agenda



Human Factors Engineering

- COL Information Items/
- Human Performance Monitoring Program Departure

Conclusions

Conclusions



- Five COL Information Items, as specified by U.S. EPR FSAR, are addressed in Calvert Cliffs Unit 3 FSAR Chapter 18.
- No ASLB Contentions.
- The Departure from the U.S. EPR Human Performance Monitoring Program implements the requirements of NUREG - 0711.
- No SER Open Items.
- All RAI responses have been submitted.
- There are two SER Confirmatory Items.

Acronyms

- **ACRS – Advisory Committee on Reactor Safeguards**
- **ASLB – Atomic Safety & Licensing Board**
- **COL – Combined License**
- **COLA – COL Application**
- **EOF – Emergency Operations Facility**
- **FA – Functional Allocation**
- **FRA – Functional Requirements Analysis**
- **FSAR – Final Safety Analysis Report**
- **HA – Human Action**
- **HFE – Human Factors Engineering**
- **HPM – Human Performance Monitoring**
- **HSI – Human System Interface**
- **IBR – Incorporate by Reference**
- **INPO – Institute of Nuclear Power Operations**
- **ITAAC – Inspection Test & Acceptance Criteria**
- **MCR – Main Control Room**
- **OSC – Operational Support Center**
- **RCOLA – Reference COL Application**
- **RG – Regulatory Guide**
- **SER – Safety Evaluation Report**
- **SME – Subject Matter Expert**
- **SSCs – Structures, Systems and Components**
- **TA – Task Analysis**



Presentation to the ACRS Subcommittee

**UniStar Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3
COL Application Review**

Safety Evaluation Report

CHAPTER 18: Human Factors Engineering

November 14-15, 2011

Order of Presentation

- **Surinder Arora** – Calvert Cliffs COLA Lead PM
- **UniStar** – RCOL Applicant
- **Tanya Ford** – Chapter 18 PM
- **Technical Staff**

Major Milestones Chronology

07/13/2007	Part 1 of the COL Application (Partial) submitted
12/14/2007	Part 1, Rev. 1, submitted
03/14/2008	Part 1, Rev. 2, & Part 2 of the Application submitted
06/03/2008	Part 2 of the Application accepted for review (Docketed)
08/01/2008	Revision 3 submitted
03/09/2009	Revision 4 submitted
06/30/2009	Revision 5 submitted
07/14/2009	Initial Review schedule milestones published
09/30/2009	Revision 6 submitted
04/12/2010	Phase 1 review completion milestone
12/20/2010	Revision 7 submitted
August 2011	ACRS Subcommittee review complete on Chapters 2 part 1, 4, 5, 6, 8,10, 11,12, 15, 16, 17 & 19

ACRS Phase 3 Review Plan

FSAR CHAPTERS BY COMPLETION DATES

Chapter(s)	Completion Date	Subcommittee Meeting
8	1/6/2010	2/18/2010
4	3/24/2010	4/20/2010
5	3/22/2010	4/20/2010
12	3/19/2010	4/20/2010
17	3/12/2010	4/20/2010
19	4/19/2010	5/21/2010
10	6/11/2010	11/30/2010
11	10/30/2010	
16	10/11/2010	
2 (Part 1)	10/29/2010	1/12/2011
6	4/1/2011	4/5/2011
15	7/22/2011	8/18/2011
7	10/17/11	11/14-15/2011
18	10/28/11	
1, 2 (Part 2), 3, 9, 13 & 14	Various	Meeting dates to be finalized

Technical Staff Review Team



- **Technical Staff**

 - ***Operator Licensing & Human Performance Branch***

 - ◆ Paul Pieringer
 - ◆ James Bongarra

- **Project Management Staff**

 - ◆ Surinder Arora
 - ◆ Tanya Ford

Overview of COLA Review

SRP Section/Application Section		No. of Questions	Number of OI
18.8	Procedure Development	1	0
18.12	Human Performance Monitoring	1	0
Totals*		2	0

*Note: Open Item count does not include the Generic Open Item RAI 222, Question 01-5, which was created to track changes to the U.S. EPR Design Certification.

Calvert Cliffs Unit 3 Site-Specific Items

- **Confirmatory Items (2)**
 - Procedure Development (Section 18.8)
 - Human Performance Monitoring (Section 18.12)

Topics of Interest

- HFE design for EOF conforms to NUREG-0696 guidance.
- ITAAC 5 verifies that staffing levels derived from task and staffing analyses remain bounded by regulation.
- Procedures and Training are Operating Programs and are addressed in SRP Chapter 13.
- Human Performance Monitoring program submitted as a deviation but it is consistent with EPR's monitoring program. Both are well described in their respective submittals.

Acronyms

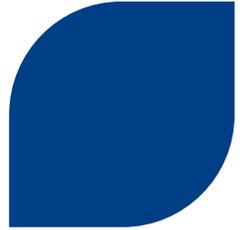
ACRS – Advisory Committee on Reactor Safeguards
COL – Combined License
COLA – Combined License Application
CCNPP – Calvert Cliffs Nuclear Power Plant
EOF – Emergency Operations Facility
EPR – Evolutionary Pressurized Reactor
FSAR – Final Safety Analysis Report
HFE – Human Factors Engineering
IBR – Incorporated by Reference
ITAAC – Inspections, Tests, Analyses, and Acceptance Criteria
OI – Open Item
PM – Project Manager
RAI – Request for Additional Information
RCOL – Reference Combined License
SAR – Final Safety Analysis Report
SER – Safety Evaluation Report
SRP – Standard Review Plan (NUREG-0800)



U.S. EPR Design Certification: Overview of GSI-191 Approach

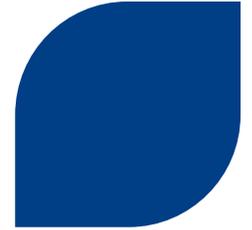
November 14, 2011





- ▶ **The objective of this presentation is to provide an overview of the U.S. EPR approach for addressing the issues identified in GSI-191, Assessment of Debris Accumulation on PWR Sump Performance**
- ▶ **This presentation consists of:**
 - ▶ **Overview of the plant design**
 - ▶ **Strainer head loss testing program**
 - ▶ **Fuel assembly downstream effects testing program**

Basic Design Approach



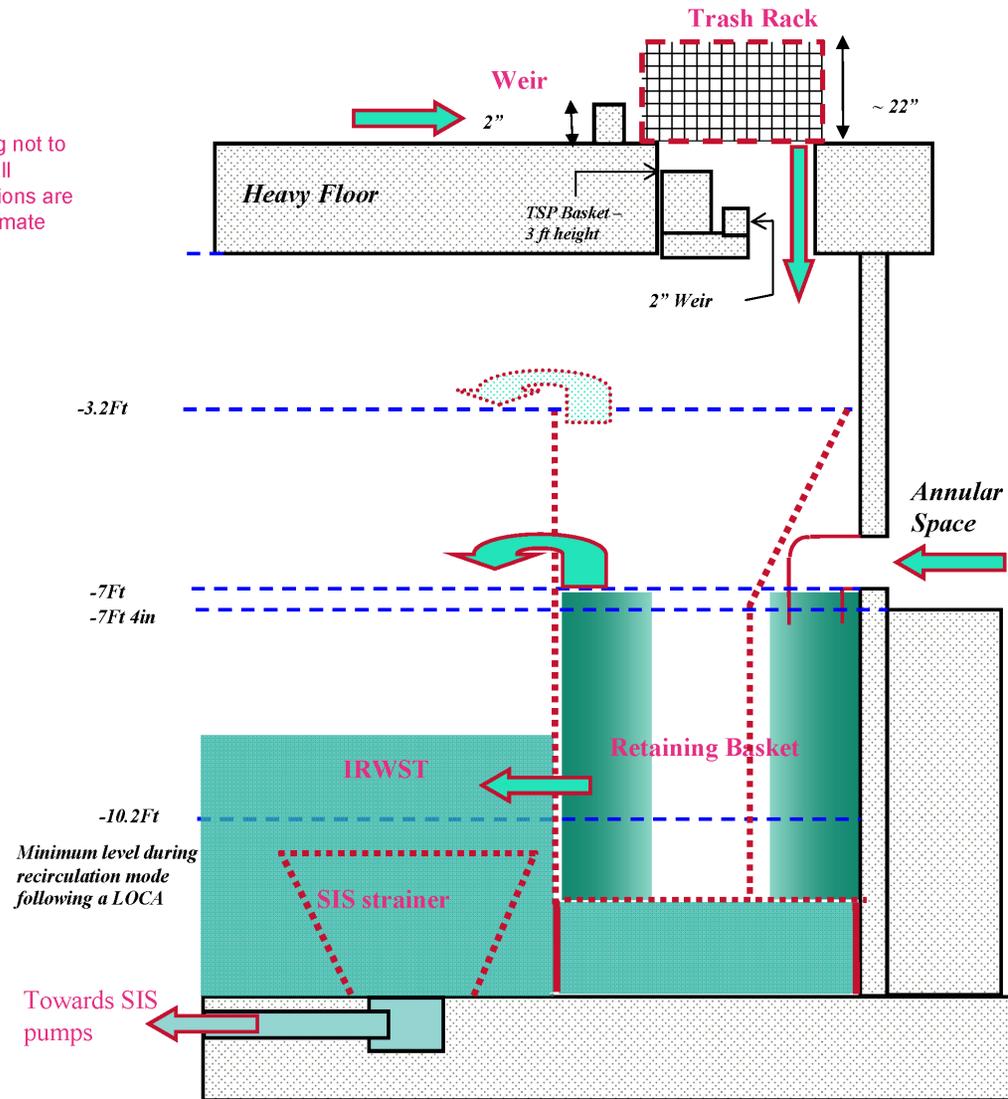
- ▶ **Design based on operating plant experience**
- ▶ **A key feature is the In-Containment Refueling Water Storage Tank (IRWST)**
 - ▶ **Functionally equivalent to the external refueling water storage tank (RWST) found in the current fleet of PWRs**
 - ▶ **Locating the IRWST inside containment and immediately below the RCS loop vaults permits an effective solution to the issue of post-accident debris blockage and ECCS (Emergency Core Cooling System) sump clogging**
- ▶ **Robust, three-tiered debris retention system**
 - ▶ **Weir**
 - ▶ **Retaining basket**
 - ▶ **Strainer**
- ▶ **Low fiber plant**
- ▶ **Cleanliness program**

Proprietary

Debris Retention System

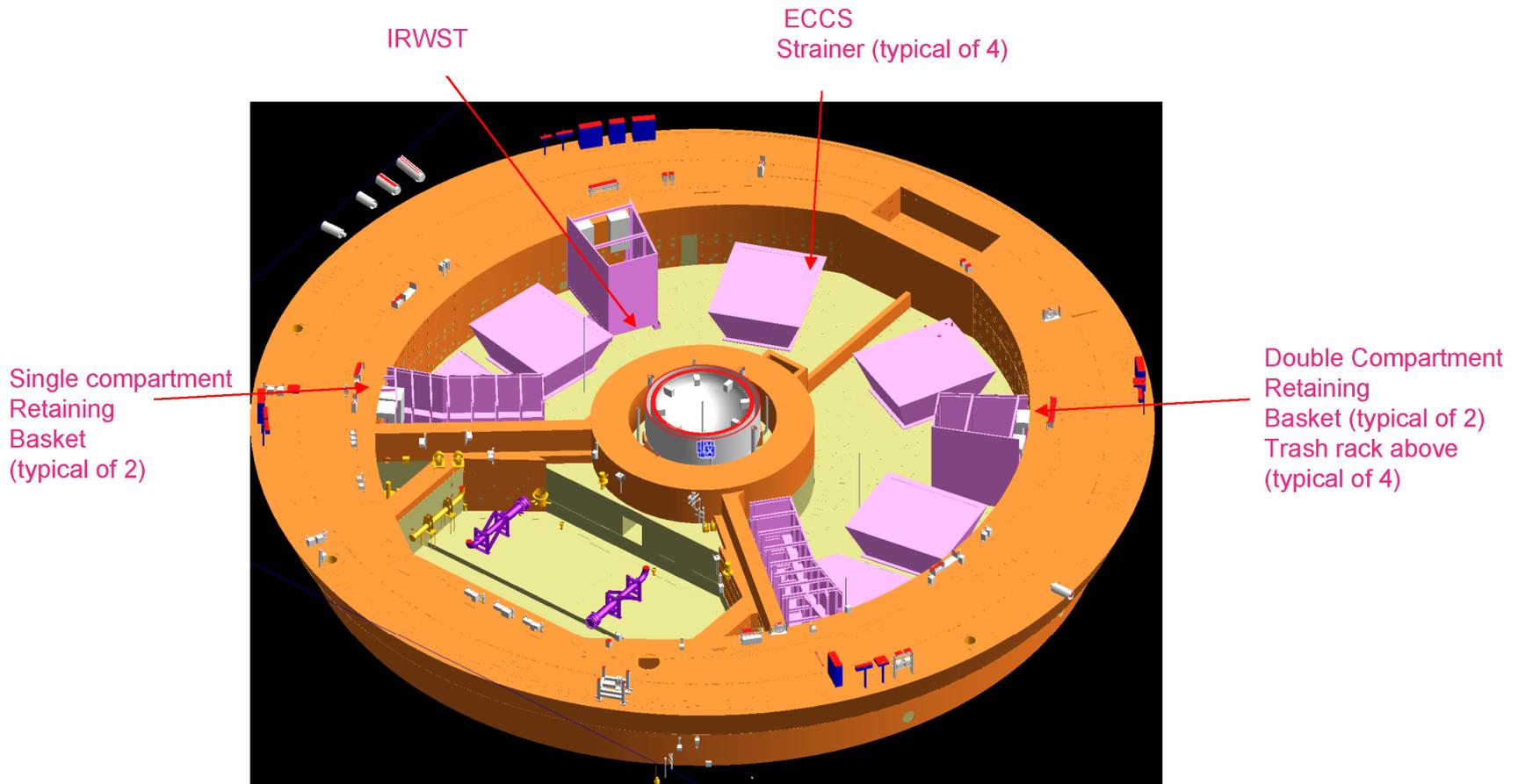
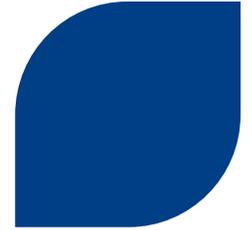


Drawing not to scale, all dimensions are approximate



Proprietary

Location of Strainers and Baskets in IRWST

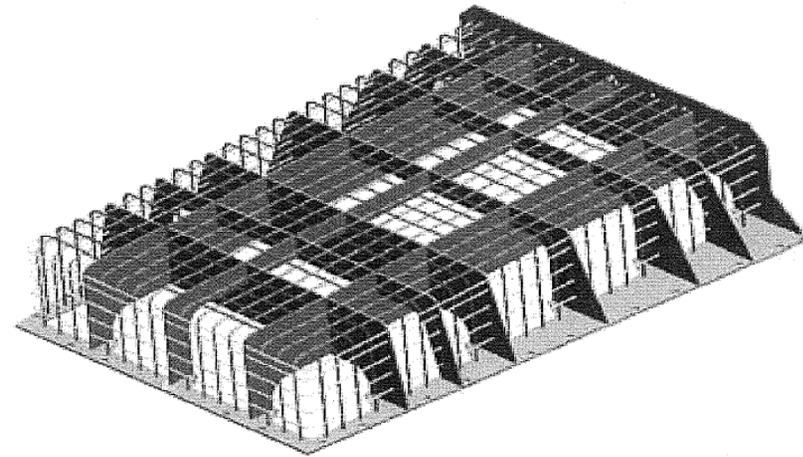


Defense-in-Depth: Flow from Heavy Floor



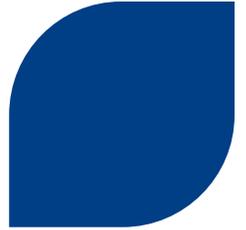
- ▶ A large area, low flow velocity region in each of the four RCS loop vaults that promotes debris settling.
- ▶ A set of four protective weir/trash rack structures to retain large debris in the RCS loop vault.
 - ◆ 4" x 4" grid structure
 - ◆ 2" weir

Trash Rack

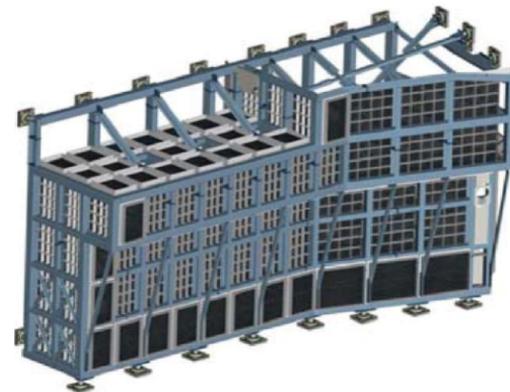


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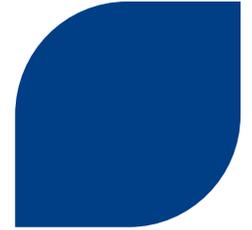
Defense-in-Depth: Retaining Basket



- ▶ **Four retaining baskets in the IRWST. Each retaining basket is located under each weir/trash rack port to catch and retain any small debris that is carried through the trash racks by ECCS recirculation flow.**
 - ◆ Two single compartment, two double compartment baskets
 - ◆ Minimum filtering area approximately 721 ft²
 - ◆ Minimum volume approximately 1589 ft³
 - ◆ 0.08" x 0.08" mesh screen



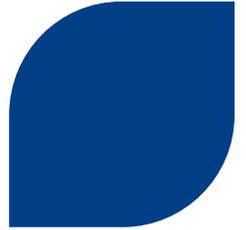
Defense-in-Depth: IRWST



- ▶ **Large area, low flow velocity region within the IRWST promotes settling of fine debris that passes through the retaining baskets.**
 - ◆ **Minimum inventory approximately 433,250 gallons**



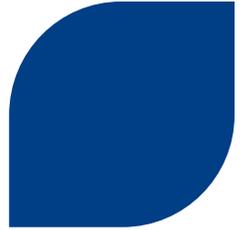
Defense-in-Depth: Strainer



- ▶ **Four large surface area three-dimensional flat screen sump strainers in the IRWST, each protecting one of the four ECCS pump suction sumps located in the floor of the IRWST.**
 - ◆ Minimum filtering area approximately 690 ft²
 - ◆ 0.08" x 0.08" mesh screen
- ▶ **Four 100% safety injection trains**



Strainer



▶ **Additional features that contribute to the overall effectiveness of the system include:**

- ◆ Retaining basket area sized to overlap trash rack portal area
- ◆ A gap between the top of the retaining basket and the bottom heavy floor
- ◆ Retaining basket screen mesh size is equivalent to the strainer screen mesh size
- ◆ Inverted side screens on the sump suction strainers
- ◆ Elimination of fibrous insulation in the zones of influence (ZOIs)
- ◆ Non-safety-related backflush capability

Comprehensive Test Program

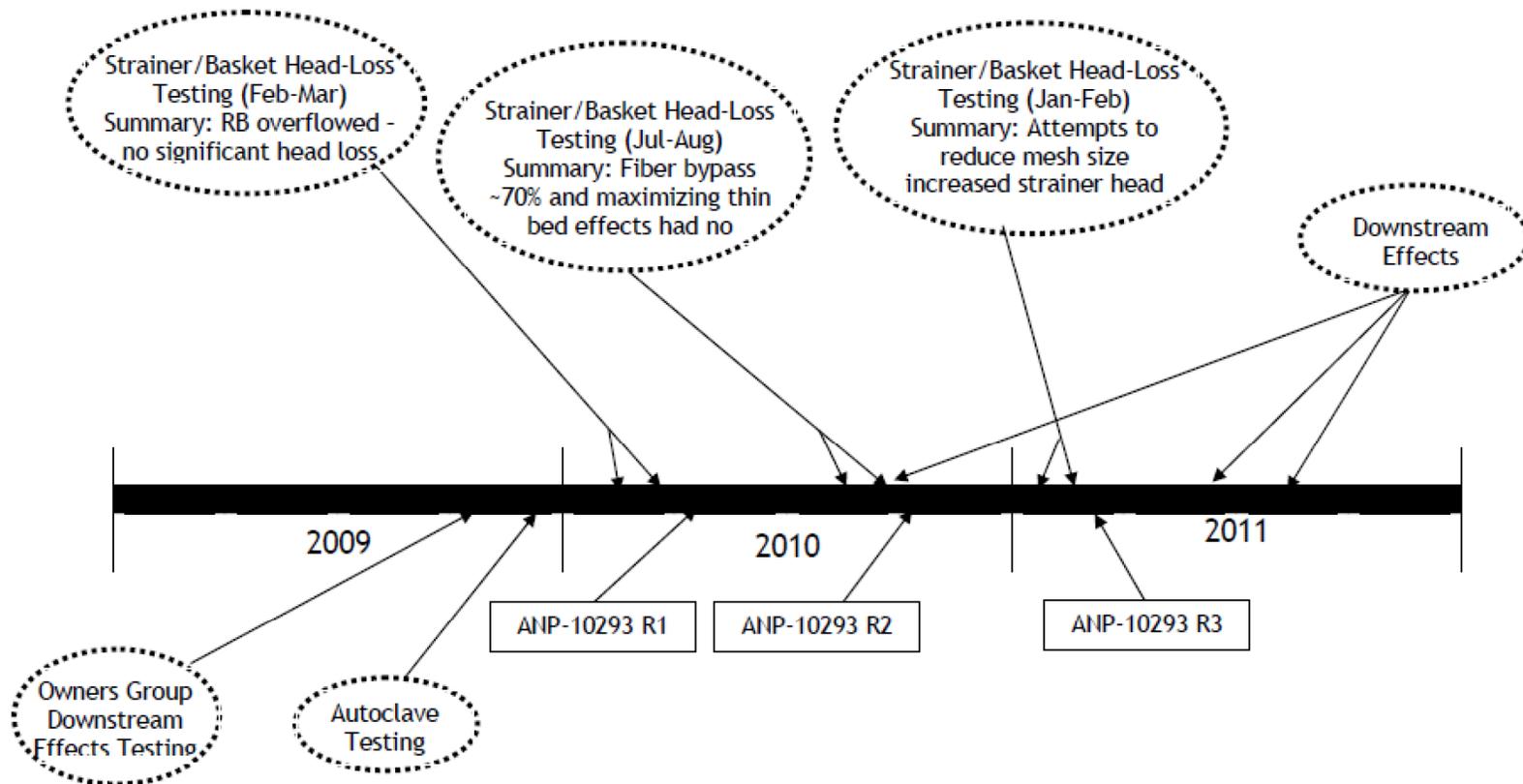


- ▶ **Chemical debris confirmatory testing**
 - ◆ Validation of chemical debris analysis
- ▶ **Strainer/retaining basket head loss testing**
 - ◆ Safety injection pump net positive suction head confirmation
- ▶ **Fuel assembly downstream effects testing**
 - ◆ Long term core cooling assurance

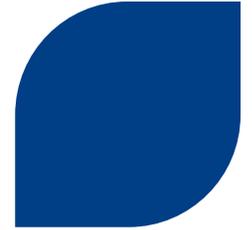


Test Timeline

AREVA GSI-191 Testing



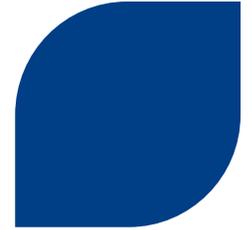
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Strainer/Retaining Basket Head Loss Testing



Strainer/Retaining Basket Head Loss Testing



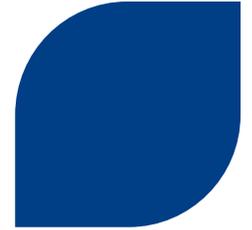
► Objective

- ◆ Ensure measured differential pressure (dp) across the strainer maintained adequate NPSH for the safety injection pumps
- ◆ Conservatively measure the amount of debris that reaches downstream components including the fuel assemblies

► Five types of tests were performed

- ◆ Debris transport
- ◆ Clean strainer head loss
- ◆ Design basis debris load
- ◆ Thin bed
- ◆ Fiber only

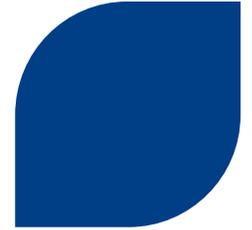
Strainer/Retaining Basket Head Loss Test Scaling



Scaling	
Vertical (e.g. test tub, retaining basket and strainer, screen approach velocity)	Full height
Flow area (e.g. volume and filter surface).	~1:10
Flow rate (e.g. recirculation flow)	~1:10

► **The main reasons for this scaling concept are:**

- ◆ **Screen surface approach velocity identical in test and plant**
- ◆ **Vertical direction: 1:1 scaling is necessary to model the phenomena during the tests because it gives similar dissipation and turbulence conditions for the test loop compared to the plant.**
- ◆ **Horizontal directions: a reduced scaling can be used provided that friction between debris in suspension in the water flow and the pool walls are negligible. Width of the pool must be large enough to avoid disrupting the debris transportation between the retaining baskets and the strainer.**



Test Purpose / Description

▶ Debris Transport Test

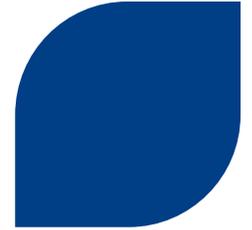
- ◆ Assess the ability of selected debris to transport
- ◆ Consists of RMI, tape, glove, plastic chain link, and other miscellaneous debris
- ◆ Results: no debris transport outside the retaining basket

▶ Clean Strainer Head Loss Test

- ◆ Measure dp across clean strainer as reference for other tests

▶ Design Basis Debris Load Test

- ◆ Measure dp across strainer
- ◆ 100% of the design basis debris
- ◆ Results: retaining basket overflowed, no significant dp measured across the strainer



Test Purpose / Description

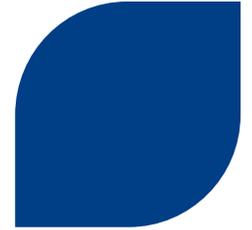
▶ Thin Bed Test

- ◆ **Historically: Ensure that a higher head loss across the strainer is not possible using less fiber to form a “thin bed”**
- ◆ **For the U.S. EPR: Change fiber batch sizes to defeat the retaining basket defense and load the strainer with as much debris as possible to maximize head loss**
- ◆ **100% of the design basis debris**
- ◆ **Results: retaining basket did not overflow, no significant dp measured across the strainer**

▶ Fiber Only Test

- ◆ **Quantify fiber that bypasses the retaining basket and strainer**
- ◆ **Maximizes fiber bypass to be used as input to fuels testing**
- ◆ **100% of the design basis fiber**
- ◆ **Results: determined bypass for fuel assembly downstream effects testing**

Debris Source Term



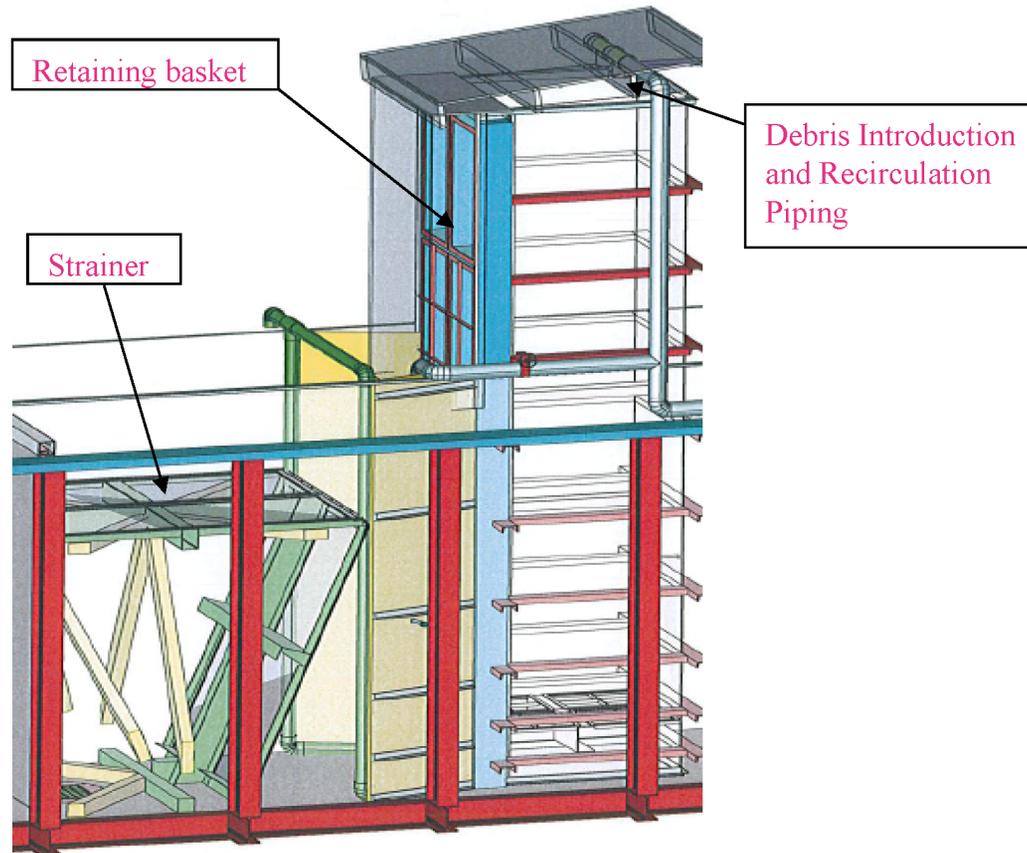
- ▶ **Zones of influence for insulation and coating types evaluated**
 - ◆ Reflective Metal Insulation (RMI) – 2D
 - ◆ Qualified coatings – 4D
 - ◆ Inorganic zinc coatings – 10D
 - ◆ Jacketed Nukon® with standard bands – 17D
- ▶ **The U.S. EPR design has eliminated the use of fibrous insulation in the zone of influence so only fiber is latent**
- ▶ **Chemical debris**
 - ◆ Used OLI StreamAnalyzer™ to predict aqueous speciation, pH, and precipitate formation vs. time for the materials entering the IRWST
 - ◆ Performed autoclave testing to validate analysis results
 - ◆ Yielded the following precipitates: aluminum oxyhydroxide, calcium phosphate, sodium aluminum silicate

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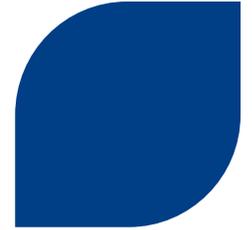
Strainer/Retaining Basket Test Facility



► Test set-up

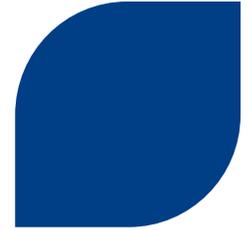


Summary of Strainer/ Retaining Basket Tests Performed



- ▶ **50 small scale sensitivity tests and 15 large scale tests were performed between Feb 2010 and Feb 2011**
- ▶ **Test acceptance criterion for strainer head loss remained within acceptable NPSH margin**
- ▶ **Recorded fiber bypass fraction from fiber only bypass testing**
- ▶ **Test results were reported in Technical Report ANP-10293P, Revision 3**
 - ◆ **No significant head loss across the strainer was observed during any test with the U.S. EPR design configuration (approximately the same as the clean strainer head loss)**
 - ◆ **Bypass fraction was measured at < 70%**

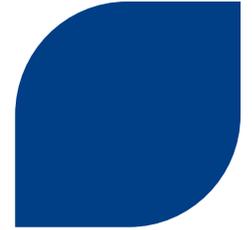
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In-Vessel Downstream Effects (Closed Session)



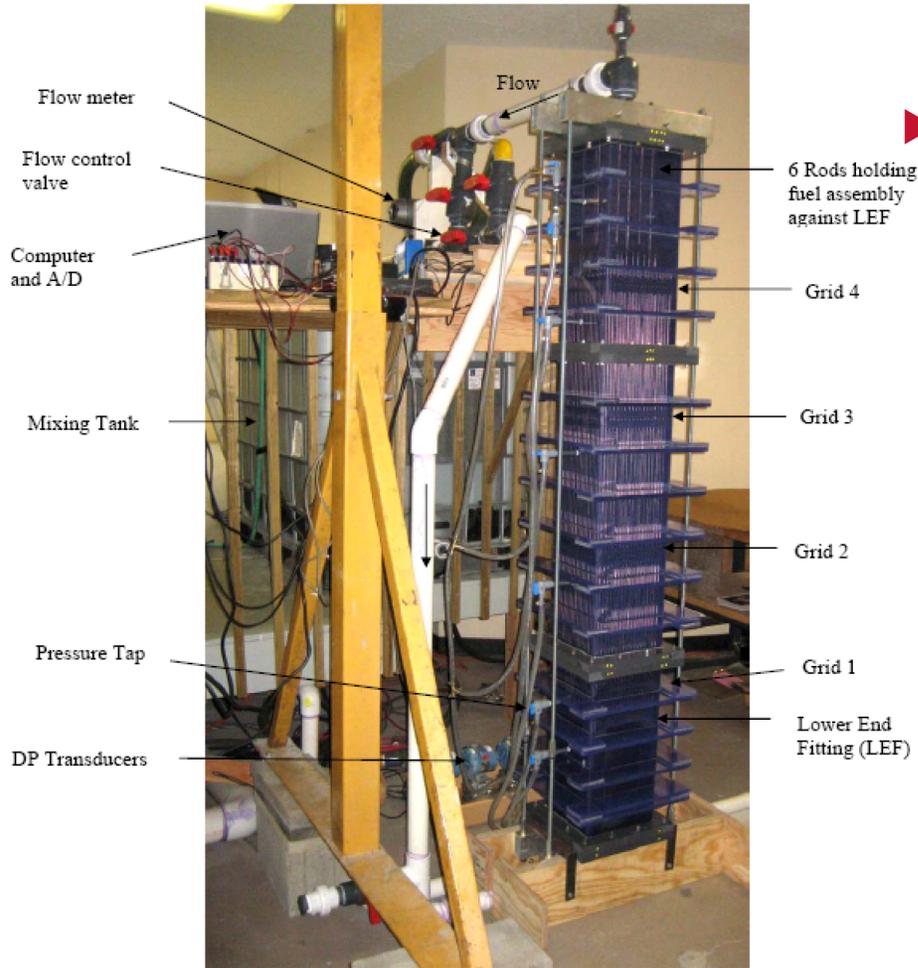
Testing Inputs



- ▶ **Strainer bypass fraction used was 70% based on testing**
- ▶ **Latent debris (design) is limited to 150 lbs**
 - ◆ 10.2 lbs of fiber (6.8%)
 - ◆ 139.8 lbs of dirt and dust (93.2%)
 - ◆ Sets requirements for COL applicant cleanliness program
- ▶ **Latent fiber debris tested was:**
 - ◆ []
 - ◆ []

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Fuel Assembly Downstream Effects Test Facility

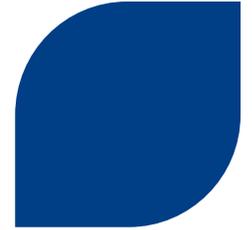


► Facility layout

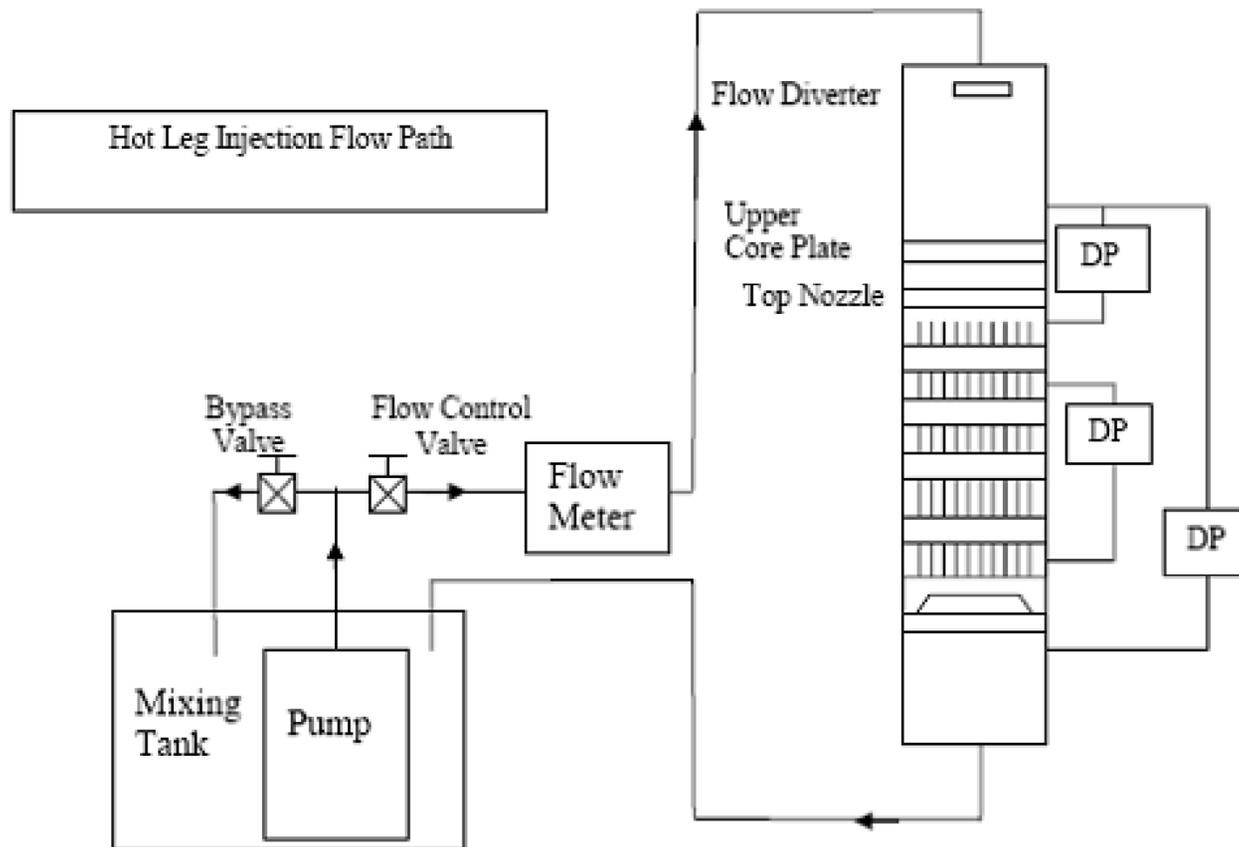


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Fuel Assembly Downstream Effects Test Facility



► Test set-up



Scenarios Considered



▶ **Four scenarios were considered in the testing matrix**

- ◆ Hot Leg Break (HLB) / Cold Leg Injection (CLI)
- ◆ Cold Leg Break (CLB) / CLI
- ◆ CLB / Hot Leg Injection (HLI)
- ◆ HLB / HLI

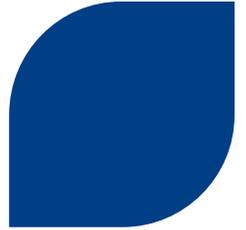
▶ []

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Acceptance Criterion



Acceptance Criterion



- ▶ Margin to acceptance criteria as a function of Darcy's equation exponent



Tests Performed



▶ **Testing was performed by:**

- ◆ **Introducing debris (particulate, fiber, and chemicals) in the mixing tank**
- ◆ **Monitoring flow**
- ◆ **Monitoring differential pressure across:**
 - Fuel assembly lower end fitting
 - Spacer grids
 - Entire fuel assembly

▶ **Test results will be reported in Technical Report ANP-10293P, Revision 4**

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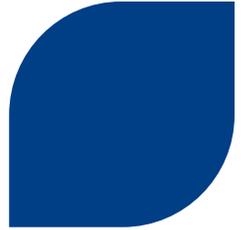
Tests Results



▶ [

]

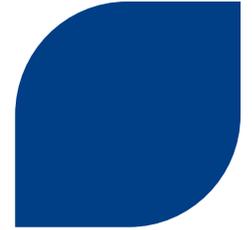
Conclusion



- ▶ **Robust, defense-in-depth, design that evolved from existing plant designs**
- ▶ **Used comprehensive and conservative test approach**
 - ◆ All debris into one strainer/basket
 - ◆ Actions taken to prevent settling
 - ◆ All fiber introduced as “fines”
 - ◆ No credit taken for filtering effect of strainer bed during FA testing
- ▶ **Obtained acceptable results with margin for both strainer head loss and fuel assembly downstream effects**

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Acronyms



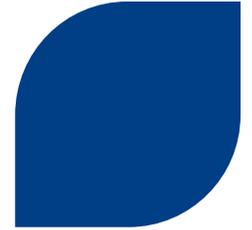
CLB	cold leg break
CLI	cold leg injection
COL	combined license
dp	differential pressure
ECCS	emergency core cooling system
FA	fuel assembly
FG	FUELGUARD™
FPC	fiber particulate chemical
GSI	generic safety issue
HLB	hot leg break
HLI	hot leg injection
IRWST	in-containment refueling water storage tank
NPSH	net positive suction head
RB	retaining basket
RCS	reactor coolant system
RMI	reflective metal insulation
SIS	safety injection system
ZOI	zone of influence

**Presentation to ACRS
U.S. EPR
Subcommittee
Design Certification
Application
FSAR Tier 2 Chapter 9
(excluding Section 9.1)**

November 14, 2011



Chapter 9 ACRS Meeting Agenda



- ▶ **Introduction and Overview of U.S. EPR
FSAR Chapter 9 Auxiliary Systems**
- ▶ **Water Systems (9.2.1, 9.2.2, 9.2.5, 9.2.8)**
- ▶ **Process Auxiliaries (9.3.2, 9.3.3)**
- ▶ **CVCS (9.3.4) and Extra Borating System (6.8)**
- ▶ **Air Conditioning, Heating, Cooling and Ventilation
Systems (9.4)**
- ▶ **Fire Protection (9.5.1)
(Including Appendix 9A Fire Protection Analysis)**
- ▶ **Diesel Generator Subsystems
(9.5.4, 9.5.5, 9.5.6, 9.5.7, 9.5.8)**

Darrell Gardner

Steve Huddleston

Jean Lindstrom

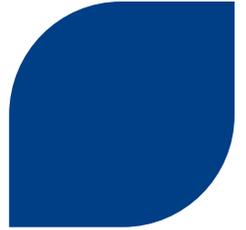
Fred Maass

Susan McConaty

John Crowther

Robert Day

U.S. EPR FSAR Water Systems

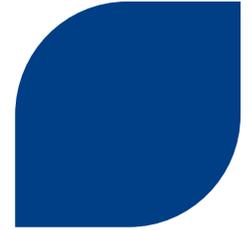


- ▶ **Essential Service Water System** 9.2.1
- ▶ **Ultimate Heat Sink** 9.2.5
- ▶ **Component Cooling Water System** 9.2.2
- ▶ **Safety Chilled Water System** 9.2.8

Steve Huddleston

Supervisory/Advisory Engineer
Mechanical Engineering

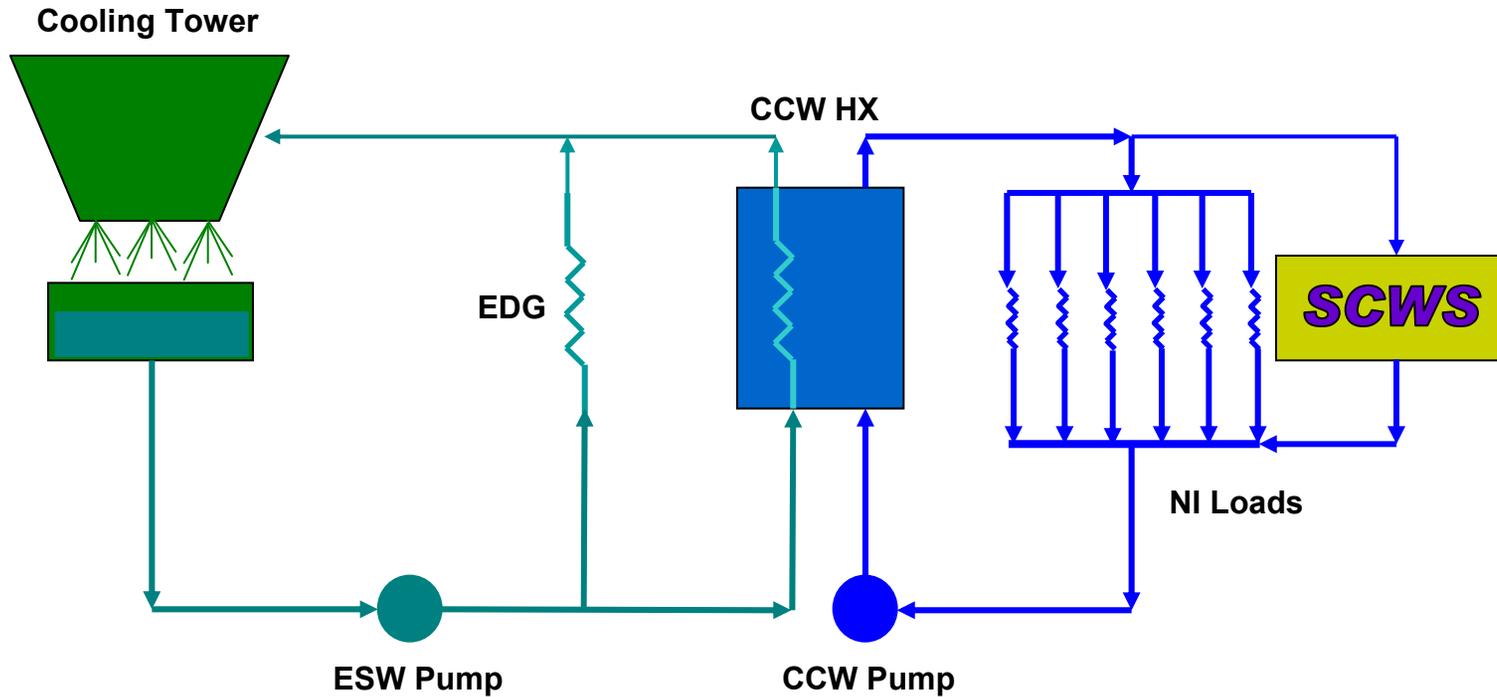
Chapter 9 Presentation Scope



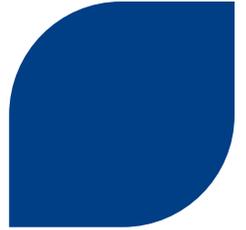
UHS

ESW

CCW

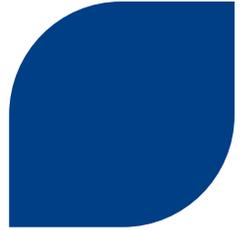


Section 9.2.1 - Essential Service Water



- ▶ **The essential service water system (ESWS) consists of**
 - ◆ four separate, redundant, **safety-related** trains, that operate during
 - normal operation
 - safe shutdown and cooldown of the reactor
 - following a design basis accident (DBA)
 - Two trains can achieve safe shutdown
 - ◆ one dedicated, **non-safety-related** train that removes containment heat from the dedicated cooling chain (SAHRS) during severe accidents

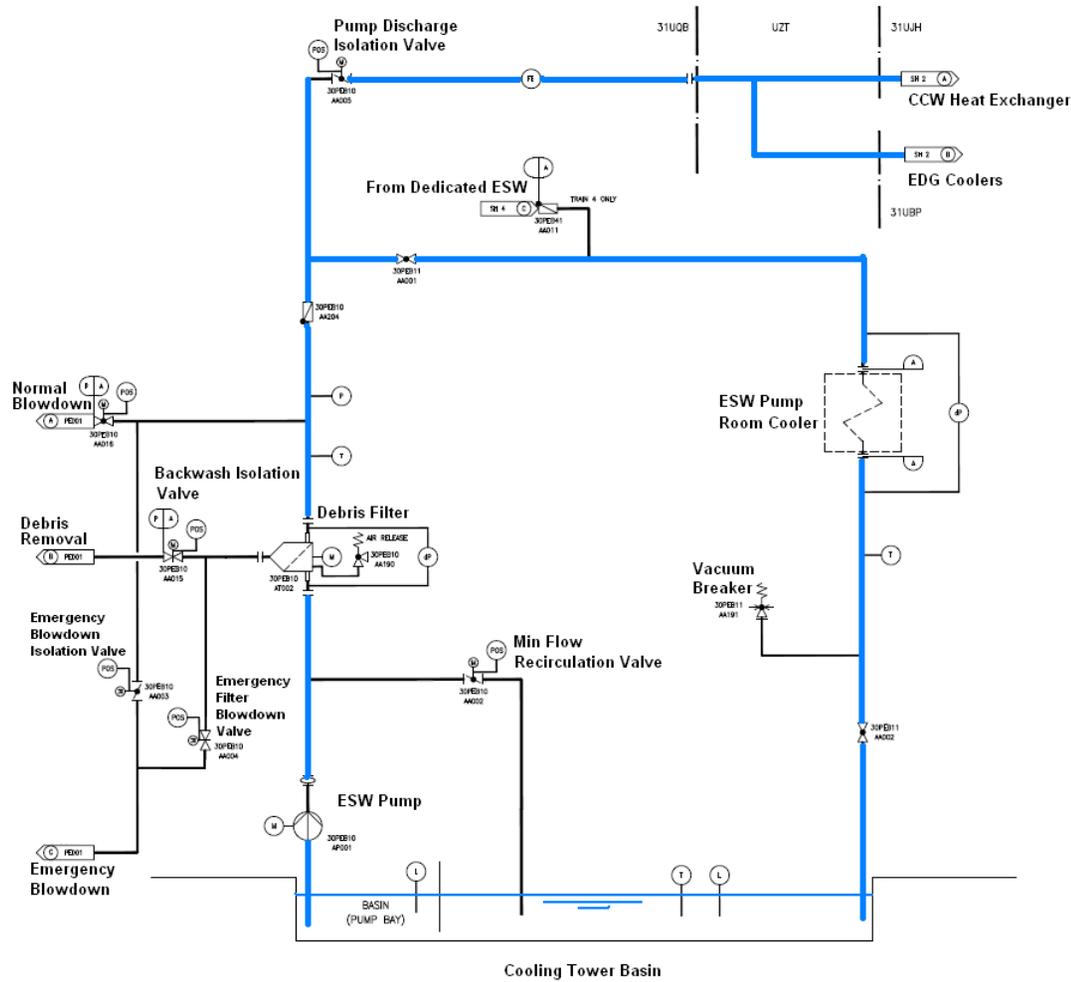
Section 9.2.1 - Essential Service Water



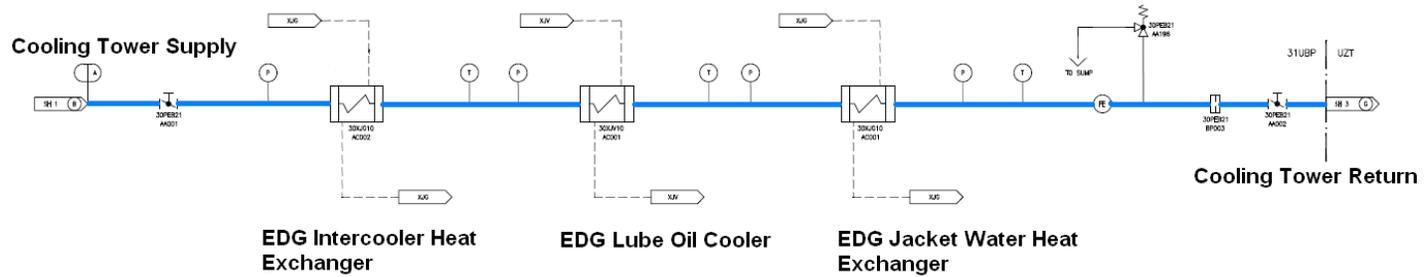
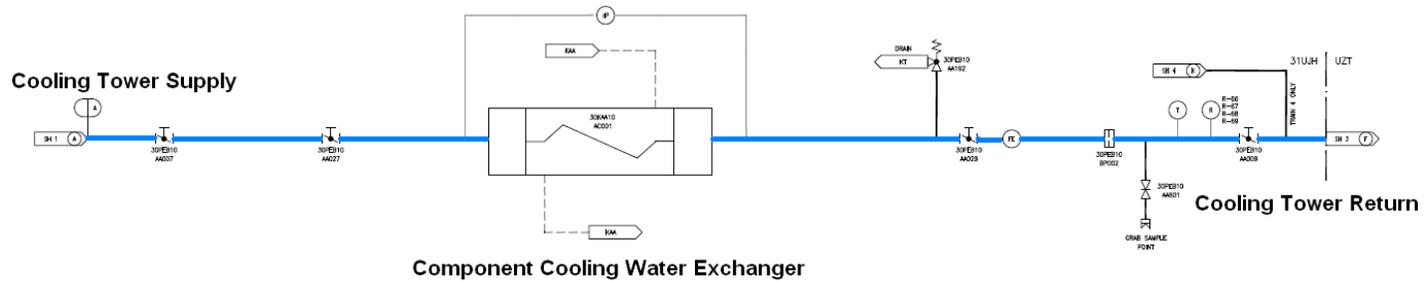
- ▶ **The safety-related ESWS receives cooled water from the Ultimate Heat Sink (UHS) cooling tower basin to cool:**
 - ◆ Component cooling water system (CCWS) heat exchangers (HXs).
 - ◆ Emergency diesel generator (EDG) HXs.
 - ◆ ESW pump room coolers.

- ▶ **The ESW heat load is released to the UHS cooling towers through evaporation and direct air to water cooling**

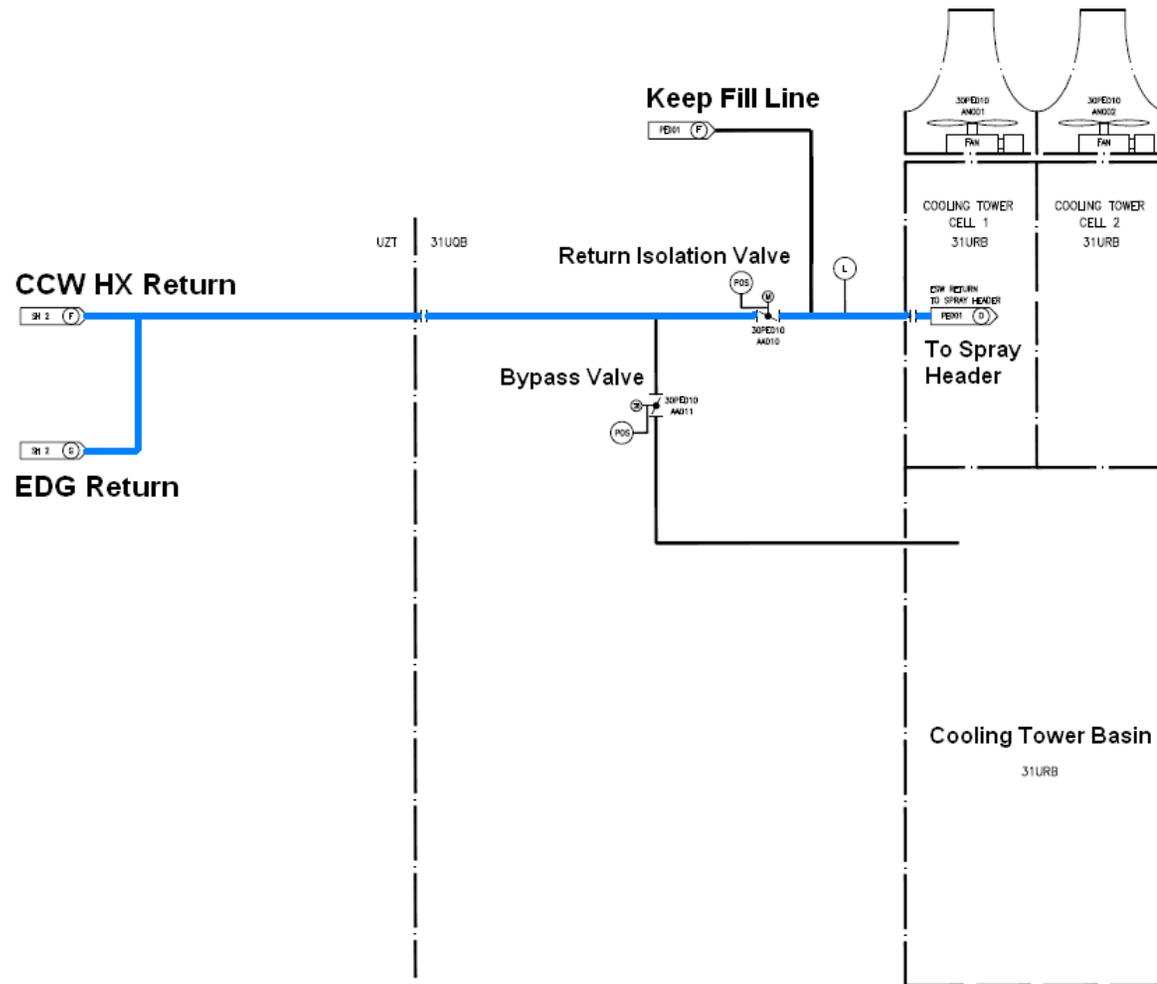
Section 9.2.1 - Essential Service Water



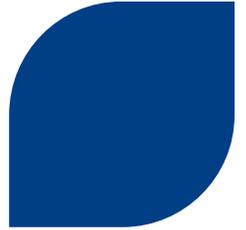
Section 9.2.1 - Essential Service Water



Section 9.2.1 - Essential Service Water



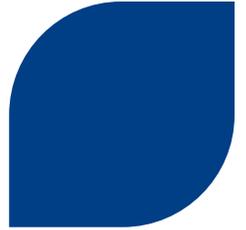
Section 9.2.1 - Essential Service Water



▶ Non-Safety Dedicated Train

- ◆ The non-safety dedicated train pumps water from the Train 4 UHS cooling tower basin during severe accidents.
- ◆ The Dedicated ESWS pump train is powered by Division 4 Class 1E electrical buses or by a station blackout diesel generator (SBODG).

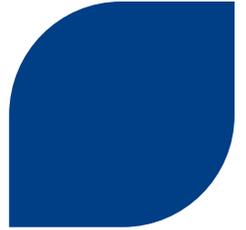
Section 9.2.5 - UHS



- ▶ **The ultimate heat sink (UHS) consists of four separate, redundant, safety-related trains that reject heat from the ESWS during:**
 - ◆ Normal operation
 - ◆ Cooldown / shutdown conditions
 - ◆ DBA post accident

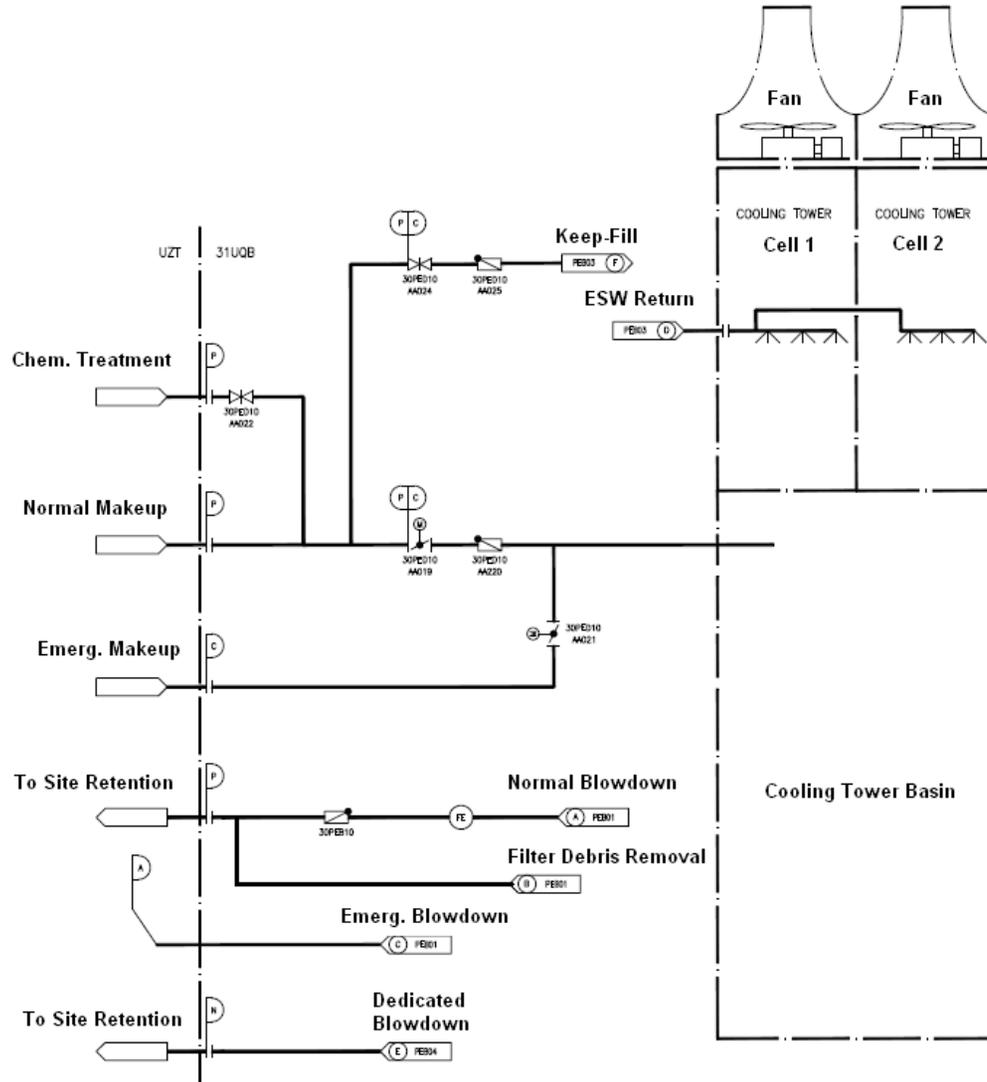
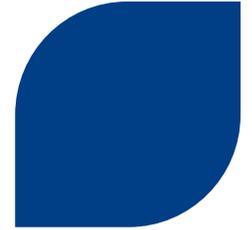
- ▶ **Two UHS trains are required to achieve a safe shutdown under DBA**

Section 9.2.5 - UHS



- ▶ **Each UHS consists of a mechanical draft cooling tower with two fans, spray nozzles, tower fill, drift eliminator, piping, valves, controls and a cooling tower basin.**
- ▶ **Each tower contains two 50% fans.**
 - ◆ **Powered from EDG during DBA**
- ▶ **The Train 4 cooling tower fans can be powered by an EDG or station blackout diesel generator (SBODG).**
- ▶ **Each cooling tower basin is sized to provide a minimum 72-hour supply of cooling water with sufficient level for pump NPSH to ESW under DBA conditions without makeup – COL applicant provides post 72 hour make-up source.**

Section 9.2.5 - UHS



Section 9.2.2 - CCWS



- ▶ Each train of the 4 train component cooling water system (CCWS) is a closed loop system that removes heat from safety and non-safety-related components.
- ▶ CCW transfers heat to the ESW system by a shell and tube heat exchanger.
- ▶ 2 CCW trains are required for DBA heat removal.

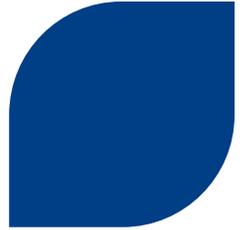
Section 9.2.2 - CCWS



▶ Safety-Related Loads

- ◆ Safety Injection and Residual Heat Removal System Cooling
- ◆ Reactor Coolant Pump Cooling Thermal Barrier Cooling
- ◆ Safety Chiller Cooling
 - The CCWS provides chiller heat removal to Trains 2 and 3 of the Safety Chilled Water System during normal operation and DBA conditions
- ◆ Spent Fuel Pool Cooling

Section 9.2.2 - CCWS

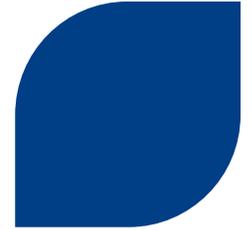


► Non-Safety-Related Loads

◆ The following operational loads are cooled by CCW:

- Containment Building Ventilation System Coolers
- Nuclear Island Drain and Vent System Primary Effluents Heat Exchanger
- Coolant Treatment and Storage System and Coolant Degasification System Coolers
- Operational Chilled Water System Chillers
- Liquid Waste Processing System Users
- Solid Waste Storage System Users
- Chemical and Volume Control System Charging Pumps
- Nuclear Sampling System Sample Coolers
- Steam Generator Sampling System Sample Coolers
- Chemical and Volume Control System High Pressure Heat Exchangers
- Reactor Coolant System Pump Motor Air and Bearing Coolers
- Steam Generator Blowdown System Second Stage Coolers

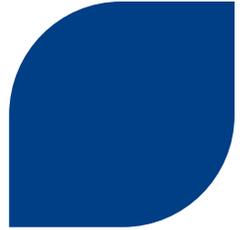
Section 9.2.2 - CCWS



► Dedicated CCWS for Severe Accident

- ◆ A single non-safety-related CCWS train that cools the severe accident heat removal system (SAHRS).
- ◆ Normally fed from offsite power by Class 1E electrical Division 4.
- ◆ Capable of receiving power from Division 4 EDG or the SBODG.

Section 9.2.2 - CCWS



▶ CCWS Safety-Related Main Trains

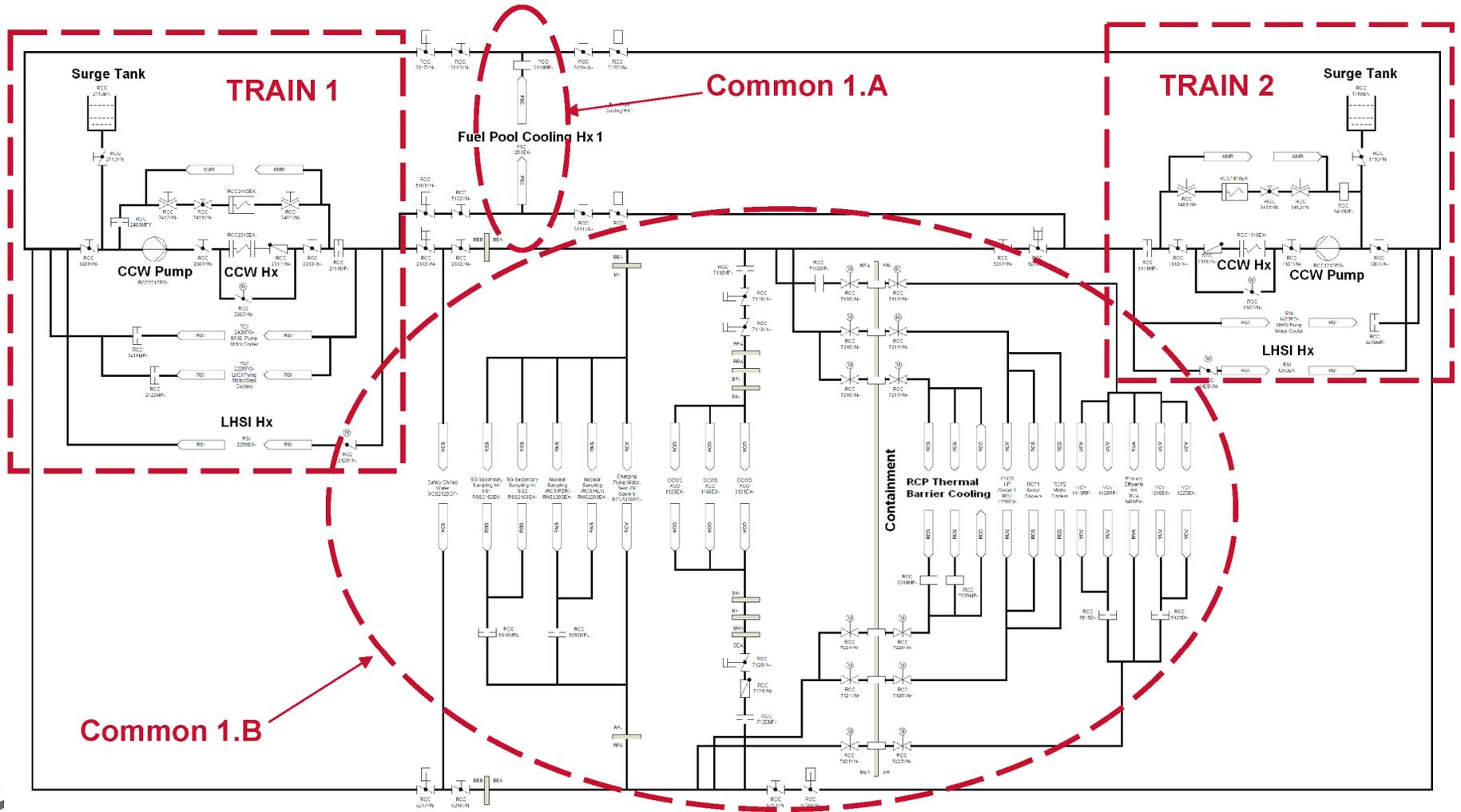
◆ Each physically separate CCWS Safety Train includes:

- CCW Supply Pump
- CCW Heat Exchanger (cooled by ESWS)
- Surge Tank – maintains level for pump NPSH
- Isolation valves for separation of the safety train from the Common Headers

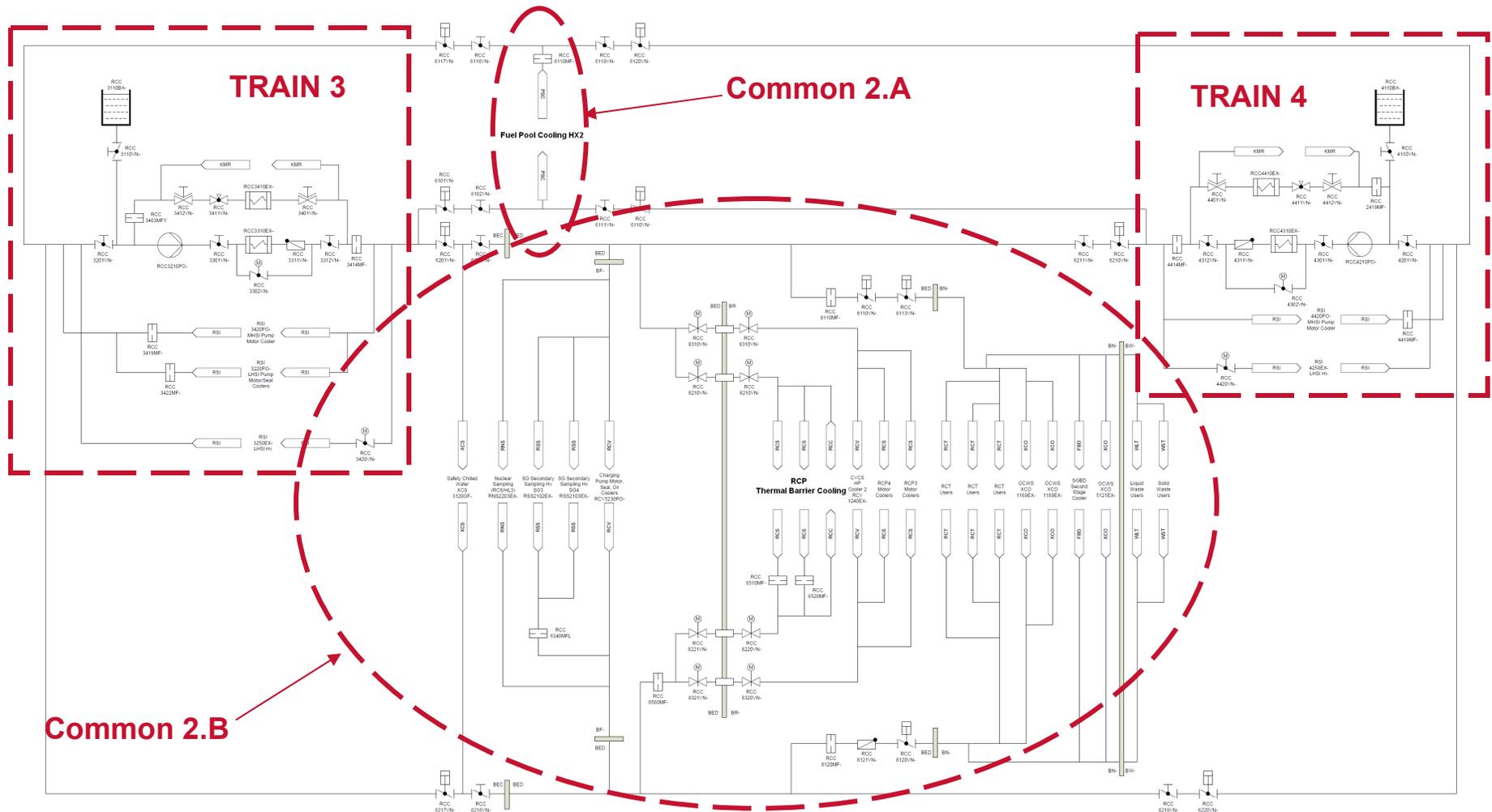
▶ CCWS Common Headers 1 and 2

- Common Headers 1 and 2 are further sub-divided into “a” and “b” headers
- Common 1.a and 2.a cools Fuel Pool Cooling (FPC) Trains 1 and 2, respectively
- Common 1.b and 2.b cools multiple safety and non-safety loads
- Either Common 1.b or 2.b can provide RCP Thermal Barrier cooling

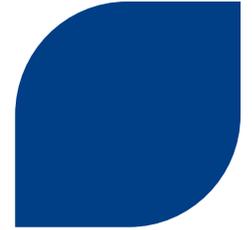
Component Cooling Water System Trains 1 and 2 (Side 1)



Component Cooling Water System Trains 3 and 4 (Side 2)



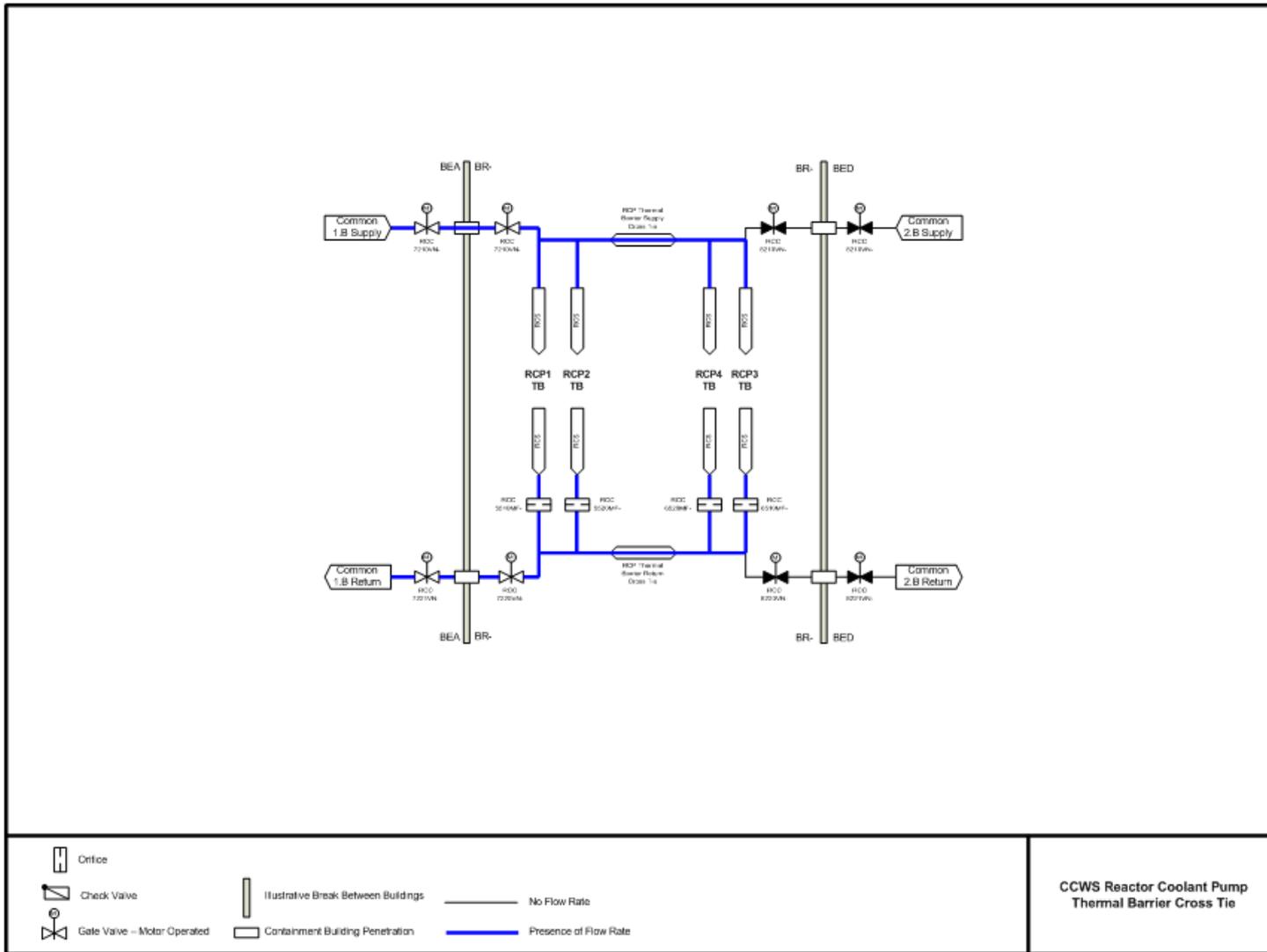
Section 9.2.2 - CCWS



▶ RCP Thermal Barrier Cooling

- ◆ All four RCP thermal barriers are supplied by either the Common 1.b or 2.b header.
- ◆ Containment isolation valve interlock ensures only one common header can be aligned to thermal barrier cooling at a time.

CCWS Reactor Coolant Pump Thermal Barrier Cross Tie



Section 9.2.8 - SCWS

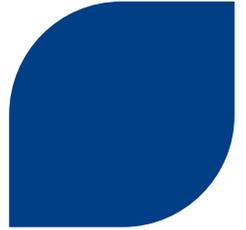


- ▶ **The 4 trains of the safety chilled water system (SCWS) supply chilled water to:**
 - ◆ Safety-related HVAC systems
 - ◆ Low head safety injection system (LHSI) pumps and motors in Trains 1 and 4
 - ◆ Fuel building ventilation system (FBVS)

- ▶ **Each train consists of a refrigeration chiller unit, two pumps and expansion tank.**

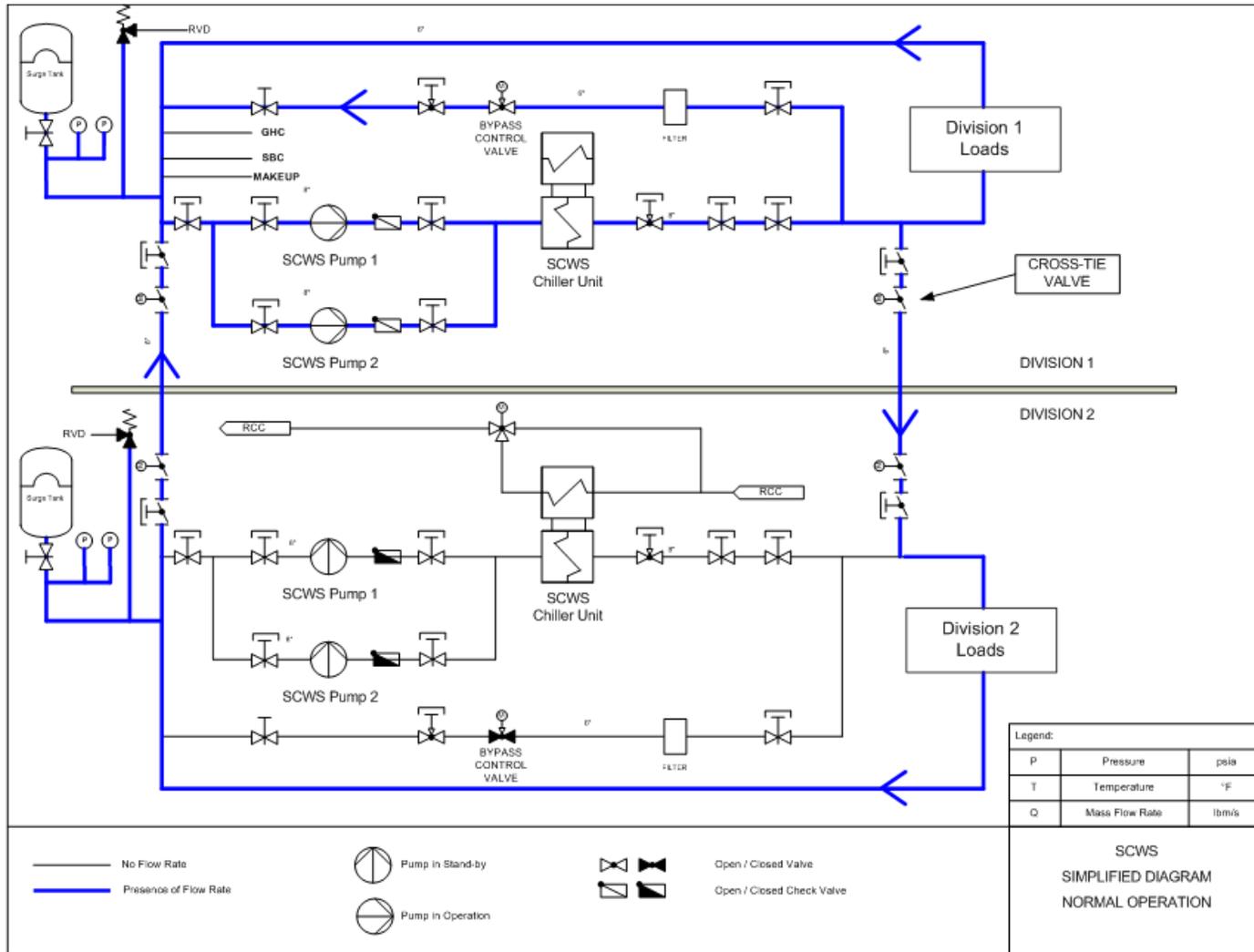
- ▶ **One chiller train is sized to meet the cooling load of two trains.**

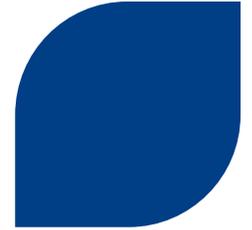
Section 9.2.8 - SCWS



- ▶ **Trains 1 and 4 use air-cooled chillers.**
- ▶ **Trains 2 and 3 use CCW cooled chillers.**
- ▶ **Each train is located within its own Safeguard Building.**
- ▶ **Pumps, refrigerating units and other electrical equipment within each train are backed-up by the corresponding 1E EDG.**
- ▶ **Divisions 1 and 4 are also backed-up by the SBODGs.**
- ▶ **Cross-Tie Valves**
 - ◆ **One SCW chiller operates cross-tied to supply two trains.**
 - ◆ **The valves are divisionally-powered.**

SCWS – Simplified Diagram Normal Operation





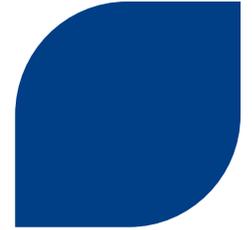
U.S. EPR FSAR Process Auxiliaries (9.3.2 and 9.3.3)

Jean Lindstrom

Engineering Supervisor

Mechanical Engineering

Sections 9.3.2 and 9.3.3 - U.S. EPR FSAR Process Auxiliaries



◆ 9.3.2 Process Sampling System

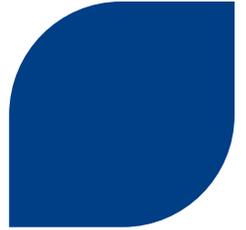
- Nuclear Sampling System (NSS)
- Secondary Sampling System (SECS)
- Severe Accident Sampling System (SASS)

◆ 9.3.3 Equipment and Floor Drainage System

- Recyclable Effluents
- Process Drains
- Type 1 Floor Drains
- Type 2 Floor Drains
- Type 3 Floor Drains

Note: SASS is similar to the Post Accident Sampling System (PASS) in current operating plants.

Section 9.3.2 - Process Sampling System



► Purpose

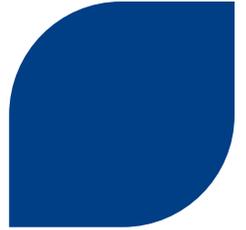
The process sampling systems provide centralized and local facilities for obtaining liquid and gaseous samples for the purpose of determining the physical and chemical characteristics and control parameters by measurements and analyses for:

- ◆ Nuclear Sampling System
 - Active systems (e.g., Reactor Coolant)
 - Slightly Active systems (e.g., Fuel Pool)
 - Gaseous systems
 - Corrosion products
- ◆ Secondary Sampling System
 - Steam Generator Blowdown
 - Turbine Island (i.e., steam-condensate-feedwater cycle)
- ◆ Severe Accident Sampling System
 - Containment Atmosphere
 - In-containment Refueling Water Storage Tank (IRWST)

Notes:

1. Hydrogen monitoring system is described in FSAR Chapter 6.
2. PERMSS (process and effluent radiological monitoring and sampling systems) are described in FSAR Chapter 11.

Section 9.3.2 - Process Sampling System



Safety Functions

◆ Nuclear Sampling System

- Maintains containment isolation (RCS samples)

◆ Secondary Sampling System

- Maintains containment isolation (Steam generator blowdown samples)

◆ Severe Accident Sampling System

- Maintains containment isolation (Containment atmosphere samples)

Non-Safety Functions

◆ Provides methods to sample process streams for analyses of:

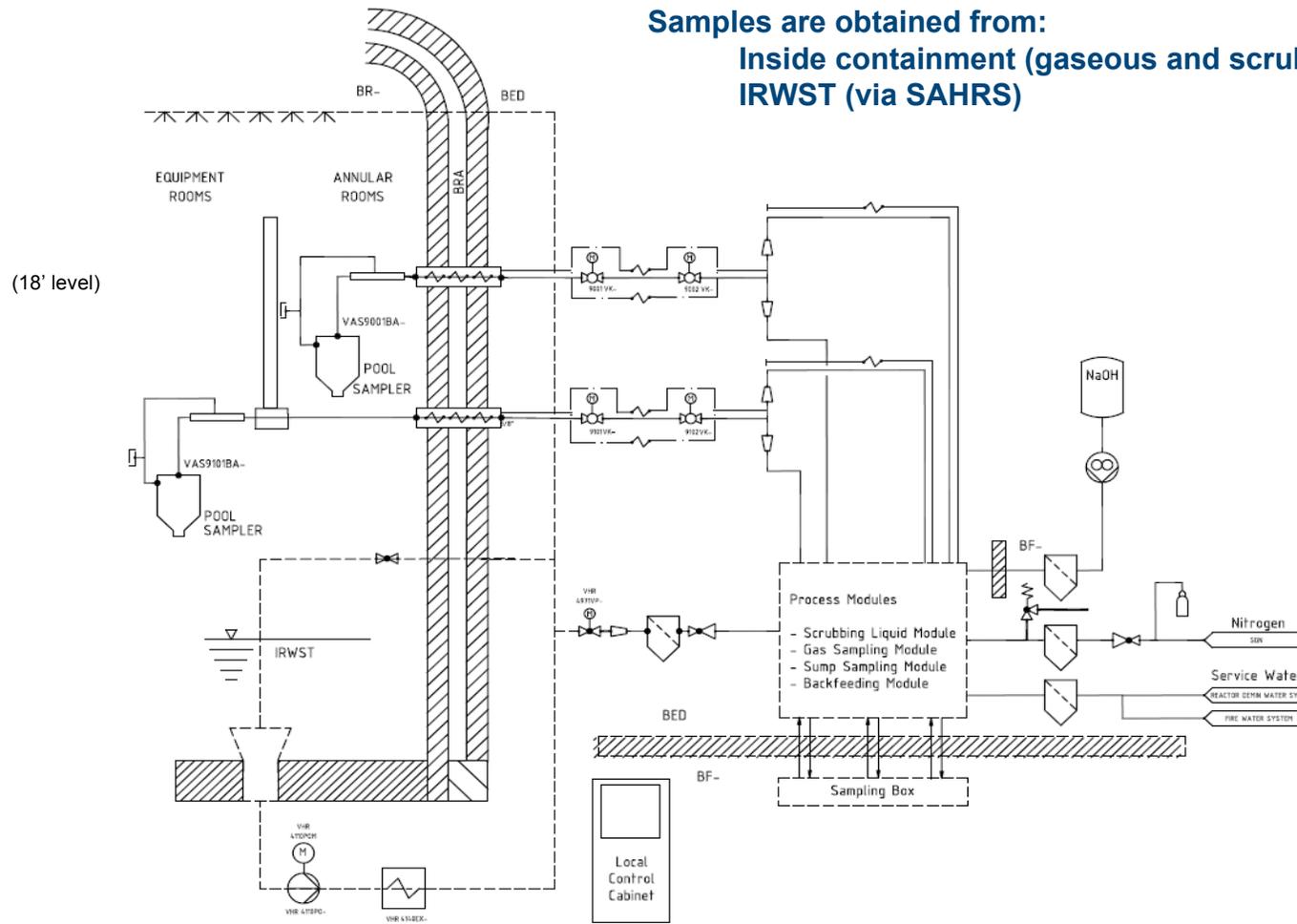
- chemical
- physical
- microbiological
- radiological properties

Section 9.3.2 - Process Sampling System

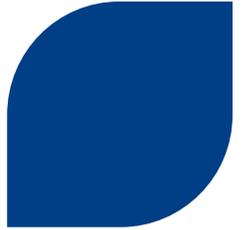


Severe Accident Sampling System (SASS)

Samples are obtained from:
 Inside containment (gaseous and scrubbing liquid).
 IRWST (via SAHRS)



Section 9.3.3 - Equipment and Floor Drainage System



► Purpose

Collects, temporarily stores and discharges radioactive fluids from the nuclear island (NI) area to other plant systems in a controlled manner. The NIDVS operates during normal power, start-up and shutdown conditions.

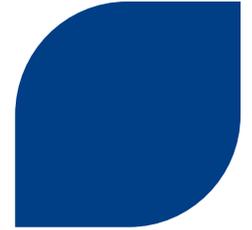
Subsystems include:

- **Recyclable Effluents (primary drains and vents)**
- **Process Drains**
- **Type 1 Floor Drains (controlled area, low boron concentration)**
- **Type 2 Floor Drains (controlled area, no boron)**
- **Type 3 Floor Drains (non-controlled area)**

Notes:

1. Equipment and Floor Drain System is referred to in the EPR as the Nuclear Island Drain and Vent System (NIDVS).
2. The nuclear island consists of: Reactor Building, Safeguard Buildings, Fuel Building, Access Building, Nuclear Auxiliary Building and Radioactive Waste Processing Building.
3. Flooding is addressed in FSAR Chapter 3.
4. Turbine Building discharge is addressed in FSAR Chapter 11.

Section 9.3.3 - Equipment and Floor Drainage System



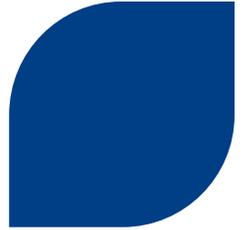
Safety Functions

- ◆ **Maintains containment isolation.**
- ◆ **Flooding detection inside the Reactor Building, Safeguard Buildings and Fuel Building.**
 - Trips the essential service water system (ESWS) pump and closes the ESWS pump discharge valve in the affected Safeguard Building (SB)

Non-Safety Functions

- ◆ **Provides hold-up of radioactive effluents to allow batch operations.**
- ◆ **Evacuates potentially radioactive gases in the reactor coolant system.**
- ◆ **Cools primary system effluent to avoid demineralizer resin damage in the coolant purification system (CPS).**
- ◆ **Re-injects contaminated liquid samples collected in the Nuclear Auxiliary Building (NAB) to the Reactor Building (RB) to delay their treatment.**
- ◆ **A tool to aid in identifying the location of reactor coolant leakage within the Reactor Building.**

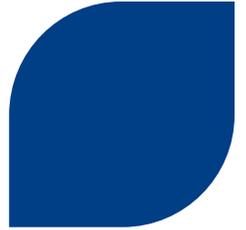
Section 9.3.3 - Equipment and Floor Drainage System



Design Features

- ▶ Effluents are classified according to whether or not they can be recycled.
- ▶ Effluents are collected according to their origin (primary drains, process drains, floor drains).
- ▶ Leakage to reactor containment from identified sources are collected and monitored separately from unidentified leakage.
- ▶ Piping is principally arranged for gravitational flow from the drain collectors to the drain tanks.
- ▶ Connected to a variety of systems by means of temporary or permanent connections.

U.S. EPR FSAR Process Auxiliaries (9.3.4 and 6.8)



Fred Maass
Manager, NI Systems
Engineering



Section 9.3.4 - CVCS



▶ **Chemical and Volume Control System**

- ◆ Maintains the reactor coolant water inventory via the pressurizer level control system.

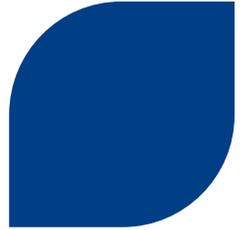
▶ **Operational Functions**

- ◆ The CVCS is the source of water for RCS purification, degasification, makeup and RCP seal water injection.

▶ **Safety-Related Functions**

- ◆ Provides RCS Pressure Boundary Integrity.
- ◆ Provides Boron Dilution Mitigation (Section 15.4.6).
- ◆ Provides RCS Overfill Protection (Section 15.5.2).
- ◆ Provides Containment Isolation.

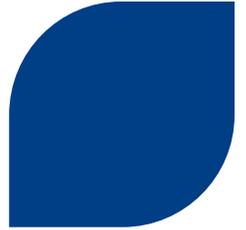
Section 9.3.4 - CVCS



► Non-Safety-Related Functions

- ◆ Provides reactivity control during normal plant operations by adjusting the RCS boron concentration.
- ◆ Provides RCS water inventory control by maintaining a constant charging flow and adjusting the letdown flow to account for RCS volume changes due to temperature variations.
- ◆ Provides RCP seal water injection to the #1 seal and provides a return path for RCP seal #1 leakoff.
- ◆ Provides cooled reactor coolant for chemical and radiological control.
- ◆ Provides for the addition of chemicals for pH control and hydrogen for oxygen control in the RCS.
- ◆ Provides auxiliary spray to the pressurizer to control RCS pressure when the RCPs are not operating.

Section 9.3.4 - CVCS



Unique Features

▶ Hydrogenation Station

- ◆ Reduces hydrogen concentration in coolant by direct injection into CVCS pump suction
- ◆ Allows use of nitrogen overpressure on volume control tank

▶ Volume Control Tank

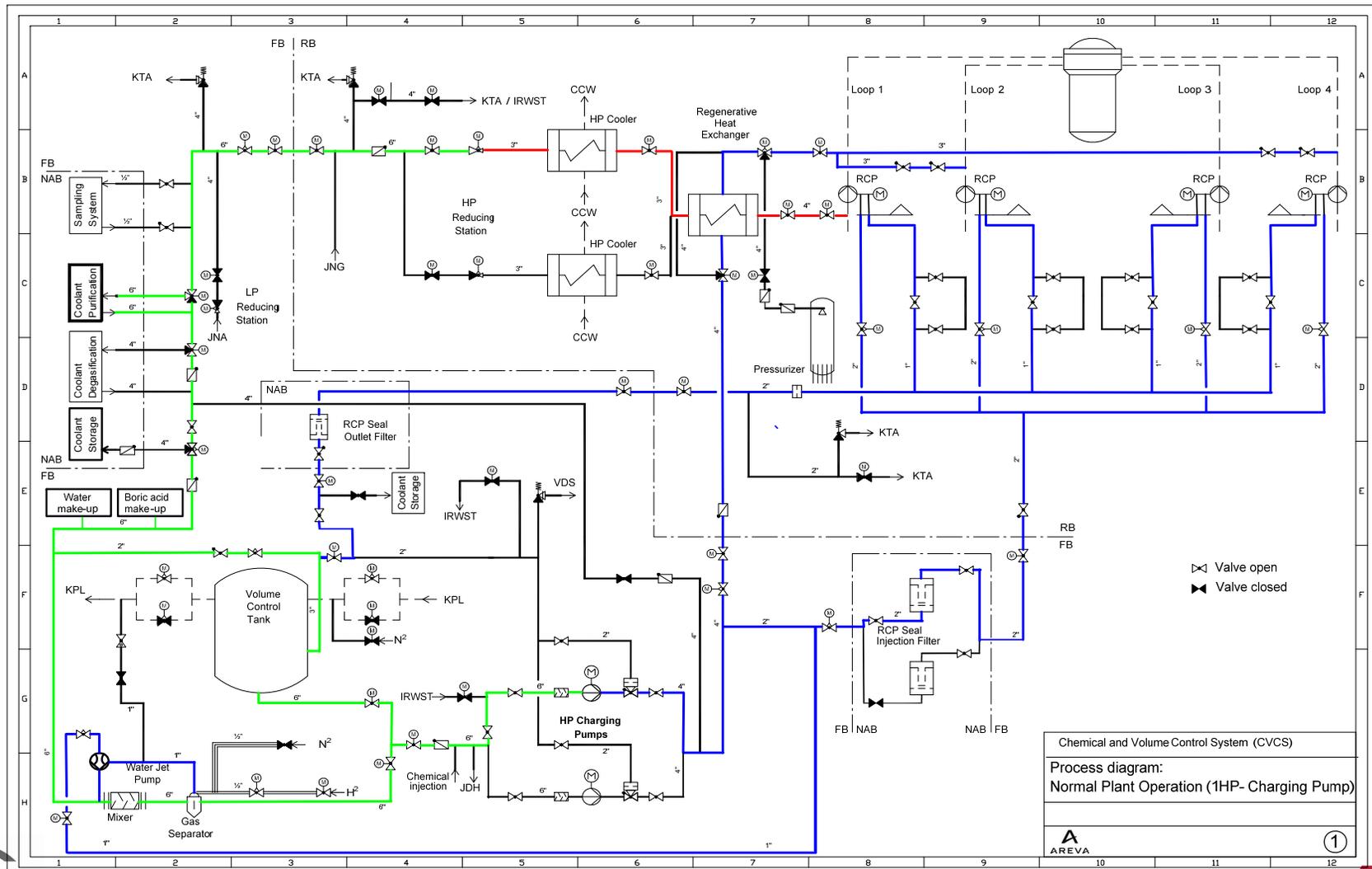
- ◆ Designed as surge tank and not in primary flow path

▶ High Pressure Reducing Station

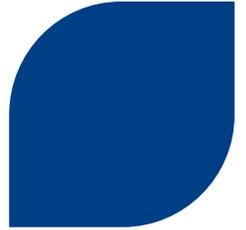
- ◆ Throttles letdown flow to maintain pressurizer level with constant charging flow

▶ Alternate Power for Charging Pumps from SBODGs during SBO Conditions

Section 9.3.4 - Chemical and Volume Control System



Section 6.8 - Extra Borating System (EBS)



▶ Purpose

- ◆ Provide a safety-related source of concentrated boric acid to support plant cooldown

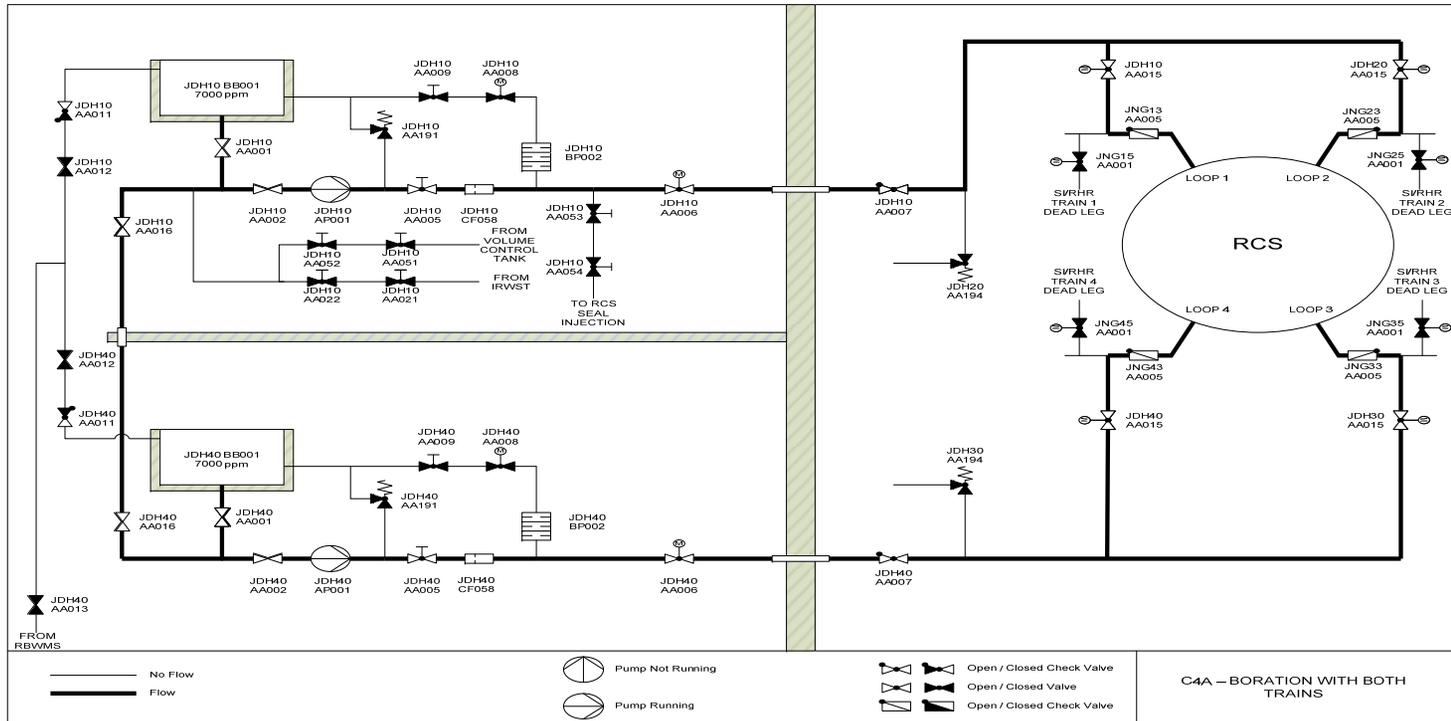
▶ Safety Functions

- ◆ Reactivity Control – For anticipated operational transients and postulated accidents, the EBS ensures that the RCS can be properly borated, regardless of RCS pressure, to reach a safe shutdown state, cold shutdown (Mode 5)
- ◆ Reactor Coolant Pressure Boundary Integrity
- ◆ Containment Isolation

▶ Non-Safety Functions

- ◆ None

Section 6.8 - Extra Borating System (EBS)





U.S. EPR FSAR

Air Conditioning, Heating, Cooling and Ventilation Systems (9.4)

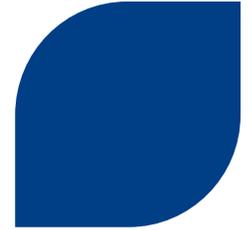
Susan McConaty
Advisory Engineer
Mechanical Engineering

Topics



- ◆ 9.4.1 Main Control Room Air Conditioning System
- ◆ 9.4.2 Fuel Building Ventilation System
- ◆ 9.4.3 Nuclear Auxiliary Building Ventilation System
- ◆ 9.4.5 Safeguard Building Controlled Area Ventilation System
- ◆ 9.4.6 Electrical Division of Safeguard Building Ventilation System
- ◆ 9.4.7 Containment Building Ventilation System
- ◆ 9.4.9 Emergency Power Generating Building Ventilation System
- ◆ 9.4.11 Essential Service Water Pump Building Ventilation System

Section 9.4.1 - Control Room Air Conditioning System (CRACS)



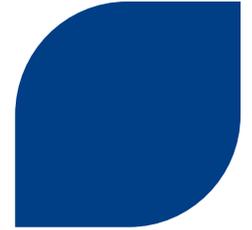
▶ Purpose

- ◆ Maintains controlled environment in the Control Room Envelope (CRE) for personnel and equipment operation.

▶ Safety Functions (Accident Operation)

- ◆ Maintains Control Room Habitability per guidelines of GDC 19 and RG 1.78, and demonstrates CRE integrity to provide radiation protection per guidelines of RG 1.197 and SRP Section 6.4.
- ◆ Maintains positive pressure within the CRE $\geq + 0.125$ in w.g., with respect to adjacent areas.
- ◆ Provides HEPA & Iodine filtration of outside inlet air and re-circulated air from the CRE to remove potential airborne radioactive particulate and iodine during a DBA, for clean air ESF filtration per RG 1.52.
- ◆ Isolates CRE from outside air upon detection of toxic gas (COL applicant is responsible for evaluating site-specific information).

Section 9.4.1 - Control Room Air Conditioning System



▶ Non-Safety Functions (Normal Operation)

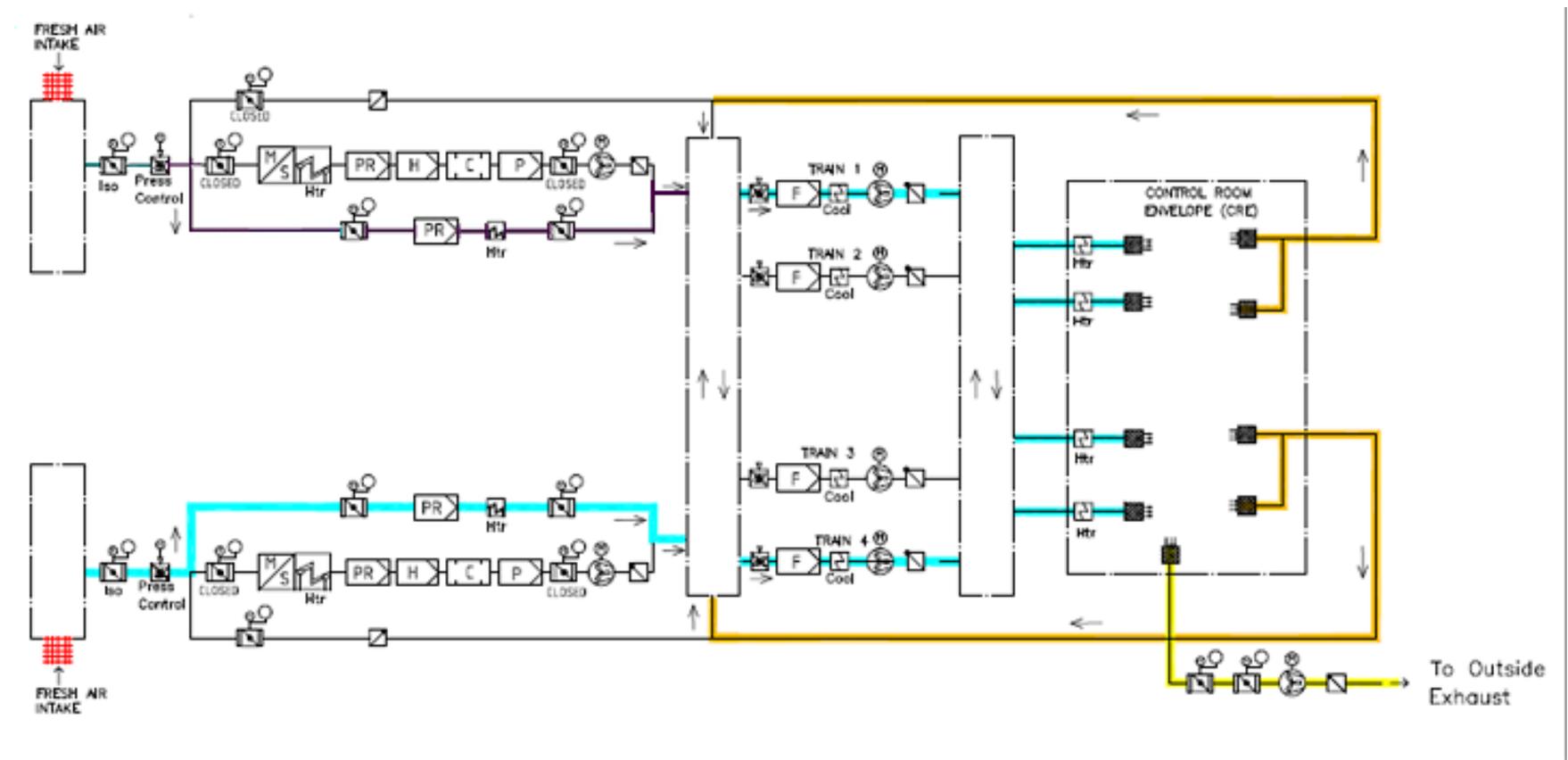
- ◆ Provides outside ventilation air for personnel within the CRE.
- ◆ Maintains ambient conditions for personnel and equipment within the CRE.
- ◆ Maintains pressure within the CRE slightly above that in adjacent areas.

▶ Design Features

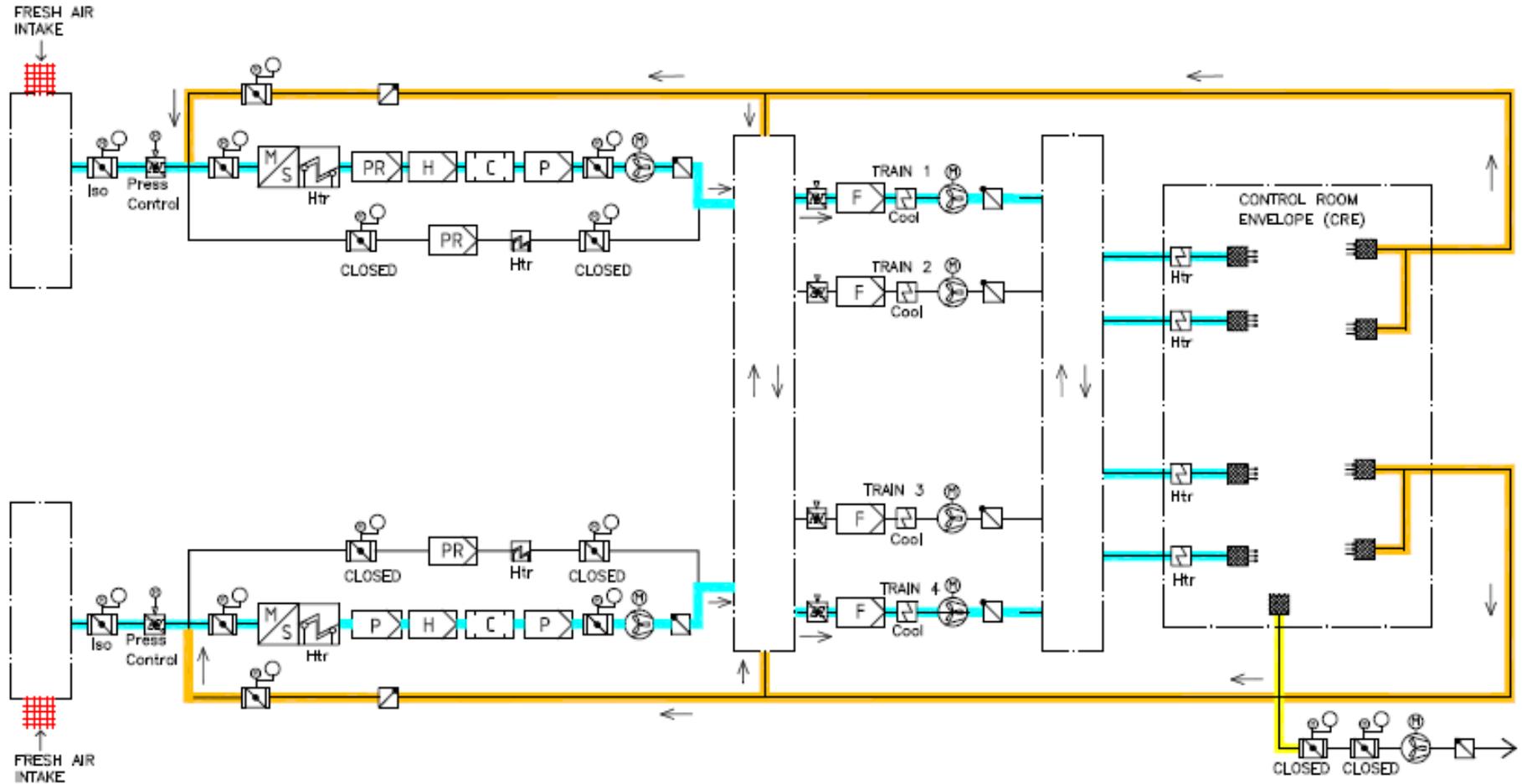
The Control Room Envelope consists of the following:

- Main Control Room
- Technical Support Center
- Restrooms and Kitchen
- Computer Rooms
- HVAC Equipment

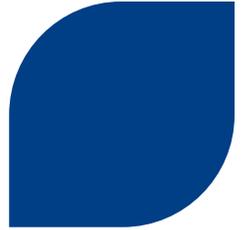
CRACS (Normal Operation)



CRACS (Accident Operation)



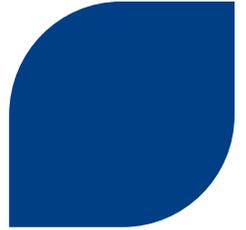
Section 9.4.2 - Fuel Building Ventilation System



► Safety Functions

- ◆ Maintains FB at a pressure $\leq - 0.25$ inch w.g., with respect to the outside environment.
- ◆ Provides exhaust filtration for potentially contaminated airborne particulate, prior to discharge to the vent stack, per guidelines of GDC 60.
- ◆ Maintains temperature in boron rooms using electric heaters, greater than minimum design temperature (68°F), to prevent crystallization of boron solution.
- ◆ Maintains temperature in fuel pool and extra borating pump rooms using recirculation coolers, less than maximum design temperature (113°F), for acceptable operation of equipment.

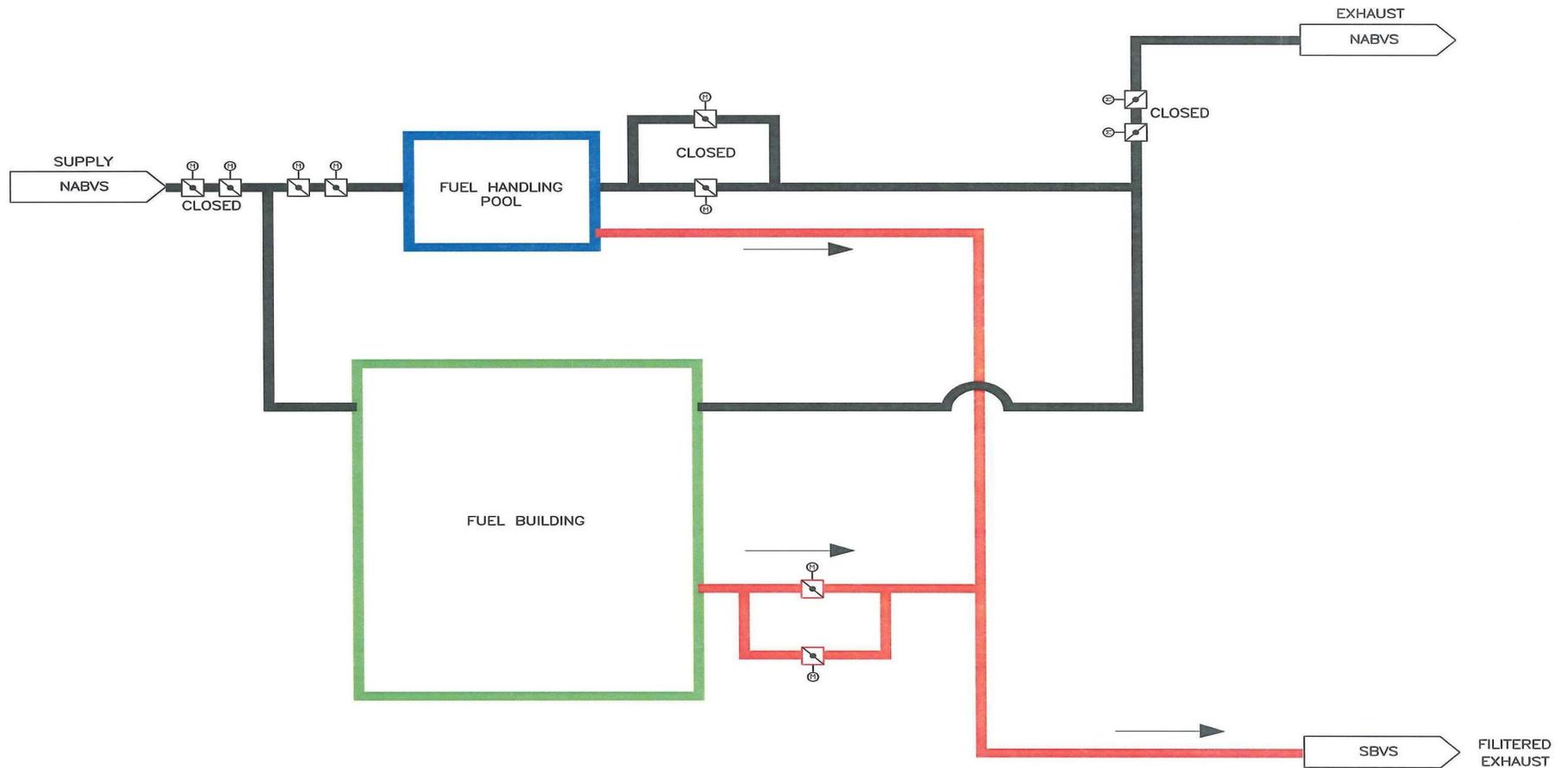
Section 9.4.2 - Fuel Building Ventilation System



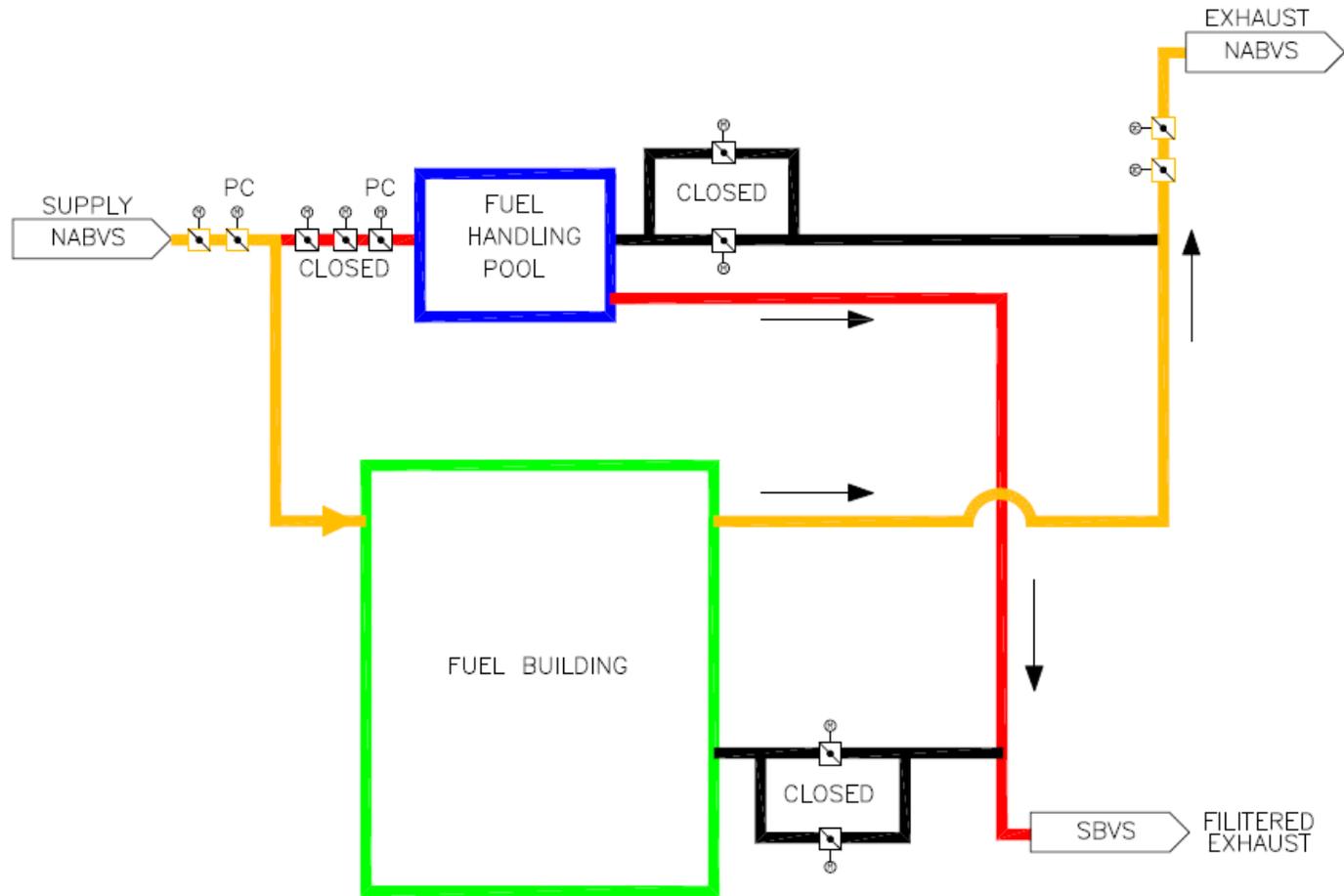
► Non-Safety Functions

- ◆ Maintains ambient conditions in FB, with air supplied and exhausted by the NABVS.
- ◆ Maintains FB at a pressure ≤ -0.25 inch w.g., with respect to the outside environment, with air supplied and exhausted by the NABVS.
- ◆ Along with filtered exhaust from the NABVS, the FBVS provides HEPA & Carbon filtration of air exhausted from the FB during normal operation, per guidelines of GDC 60.
- ◆ In the event of a fuel handling accident, isolates the fuel pool hall and filters the exhaust air through the SBVS iodine filtration trains.

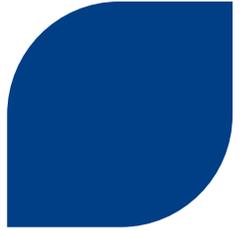
FBVS (LOCA Alignment)



FBVS (Fuel Handling Accident)



Section 9.4.3 - Nuclear Auxiliary Building Ventilation System (NABVS)



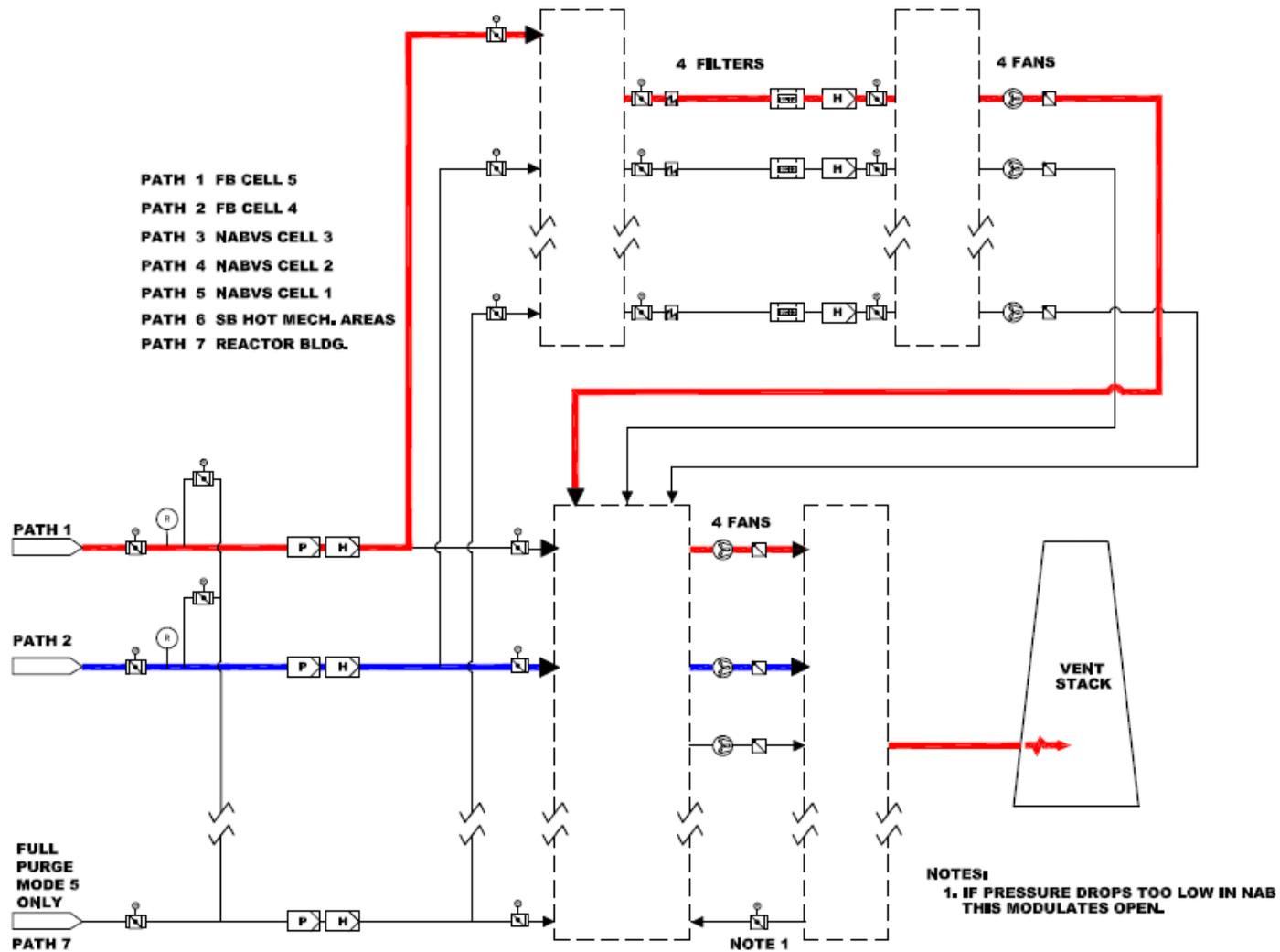
▶ Safety Function

- ◆ None

▶ Non-Safety Functions

- ◆ Provides conditioned supply and exhaust air to the Nuclear Auxiliary Building (NAB), FB and Annulus to maintain ambient conditions for personnel and equipment. Exhausts the SB Controlled Area during normal plant operation.
- ◆ Maintains NAB, FB, SB Controlled Area and Annulus at a pressure ≤ -0.25 inch w.g., and provides exhaust filtration during normal operation per guidelines of GDC 60 and clean air filtration guidelines of RG 1.140.
- ◆ Provides conditioned supply and exhaust air to the containment ventilation full flow and low flow purge system during a plant outage.
- ◆ Provides conditioned supply air to the containment ventilation low flow purge system during containment access.

Nuclear Building Exhaust Ventilation System (3 of 7 paths shown)



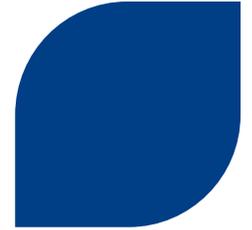
Section 9.4.5 - Safeguard Building Controlled Area Ventilation (SBVS)



► Safety Functions

- ◆ Maintains SB Controlled Area at a pressure ≤ -0.25 inch w.g., with respect to adjacent areas, during accident operation.
- ◆ Provides HEPA & Iodine filtration for air exhausted from the SB Controlled Area and FB prior to being discharged from the vent stack, per guidelines of RG 1.52 for post accident ESF atmosphere cleanup, and per guidelines of GDC 60 for control of releases of radioactive material from containment following an accident.
- ◆ Maintains ambient conditions within the Controlled Areas of the SB for equipment operation (recirculation cooling units).

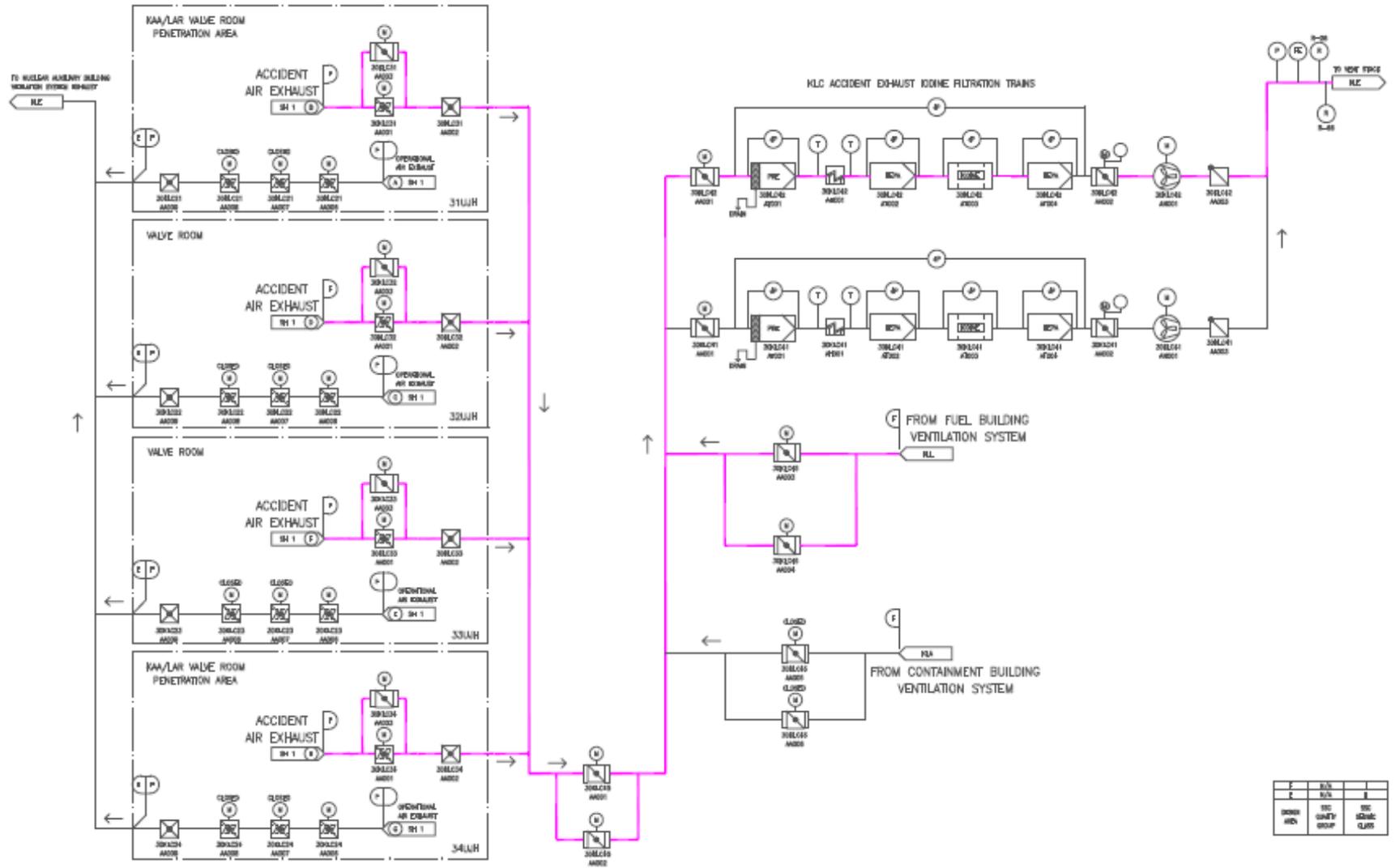
Section 9.4.5 - Safeguard Building Controlled Area Ventilation



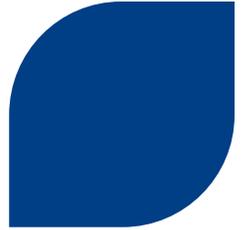
► Non-Safety Functions

- ◆ Maintains ambient conditions for personnel and equipment.
- ◆ During a fuel handling accident in the FB, maintains pressure in the fuel handling area ≤ -0.25 inch w.g., with respect to the outside environment, provides exhaust HEPA & Iodine filtration, and meets guidelines of GDC 61, GDC 62 and RG 1.52 for post accident ESF atmosphere cleanup.
- ◆ During normal operation, maintains pressure in SB Controlled Area ≤ -0.25 inch w.g., with respect to the outside environment, provides exhaust HEPA & Iodine filtration via the NABVS, and meets guidelines of GDC 60 for atmosphere cleanup.

SBVS (Accident Operation)



Section 9.4.6 - Electrical Division of the Safeguard Building Ventilation System (SBVSE)



► Safety Functions

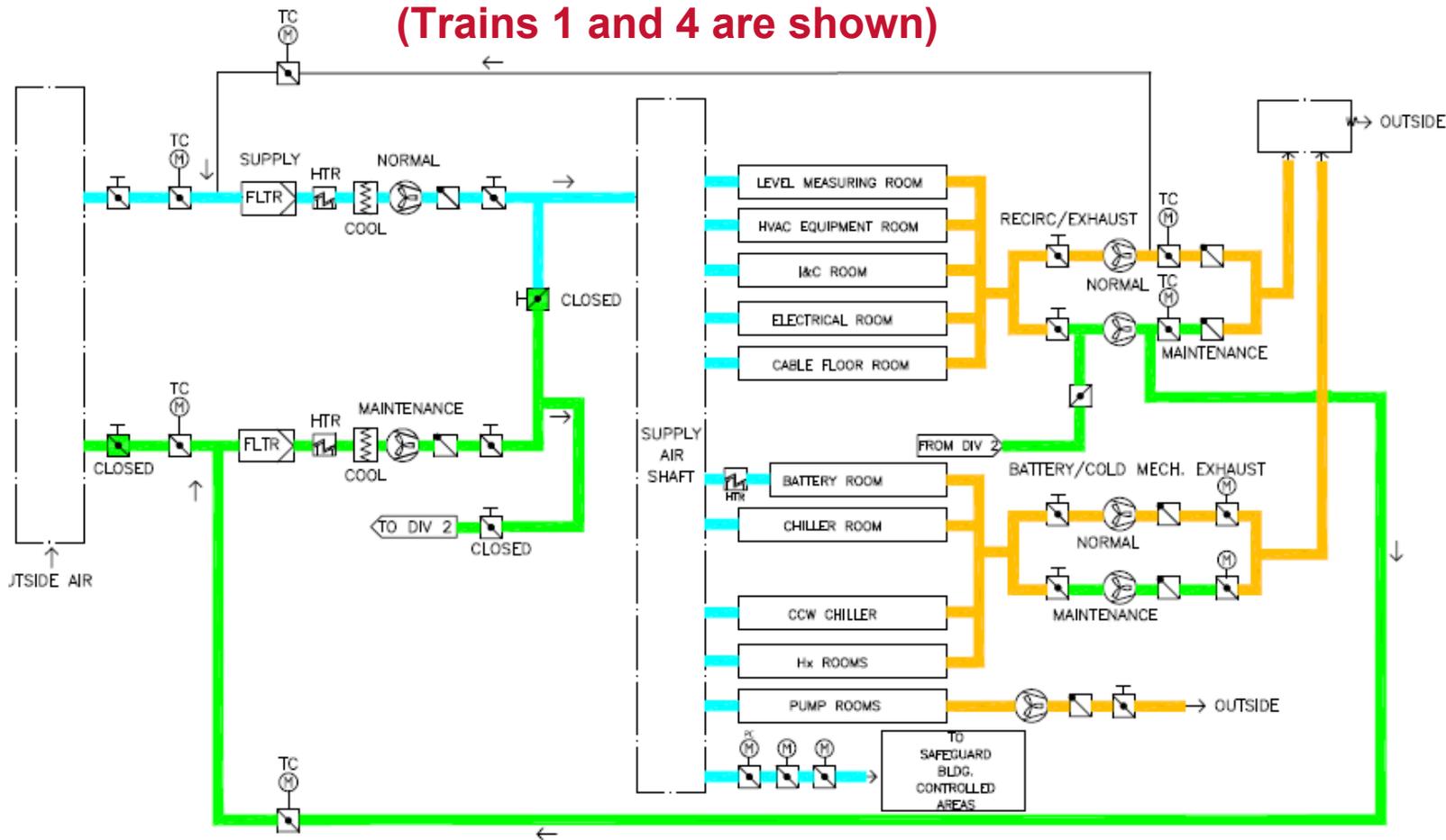
- ◆ Maintains ambient conditions in SB electrical and non-contaminated mechanical rooms (component cooling water, emergency feedwater pumps, safety chilled water) for equipment operation.
- ◆ Provides ventilation air for battery rooms to maintain hydrogen levels $\leq 1\%$ by volume per guidelines of RG 1.128.
- ◆ Provides cooling to maintain ambient conditions within battery rooms.

► Non-Safety Functions (Normal Operation)

- ◆ Provides ventilation and maintains ambient conditions in SB electrical and non-contaminated mechanical rooms for personnel and equipment operation.
- ◆ Provides ventilation and cooling within battery rooms.
- ◆ Provides ventilation air for personnel in SB Controlled Areas.

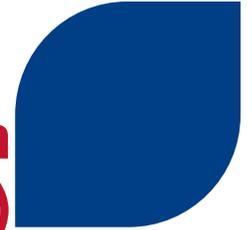
Section 9.4.6 - Electrical Division of the Safeguard Building Ventilation System

(Trains 1 and 4 are shown)



Note: Trains 2 and 3 are the same except for the maintenance train (Green).

Section 9.4.7- Containment Building Ventilation System (CBVS)



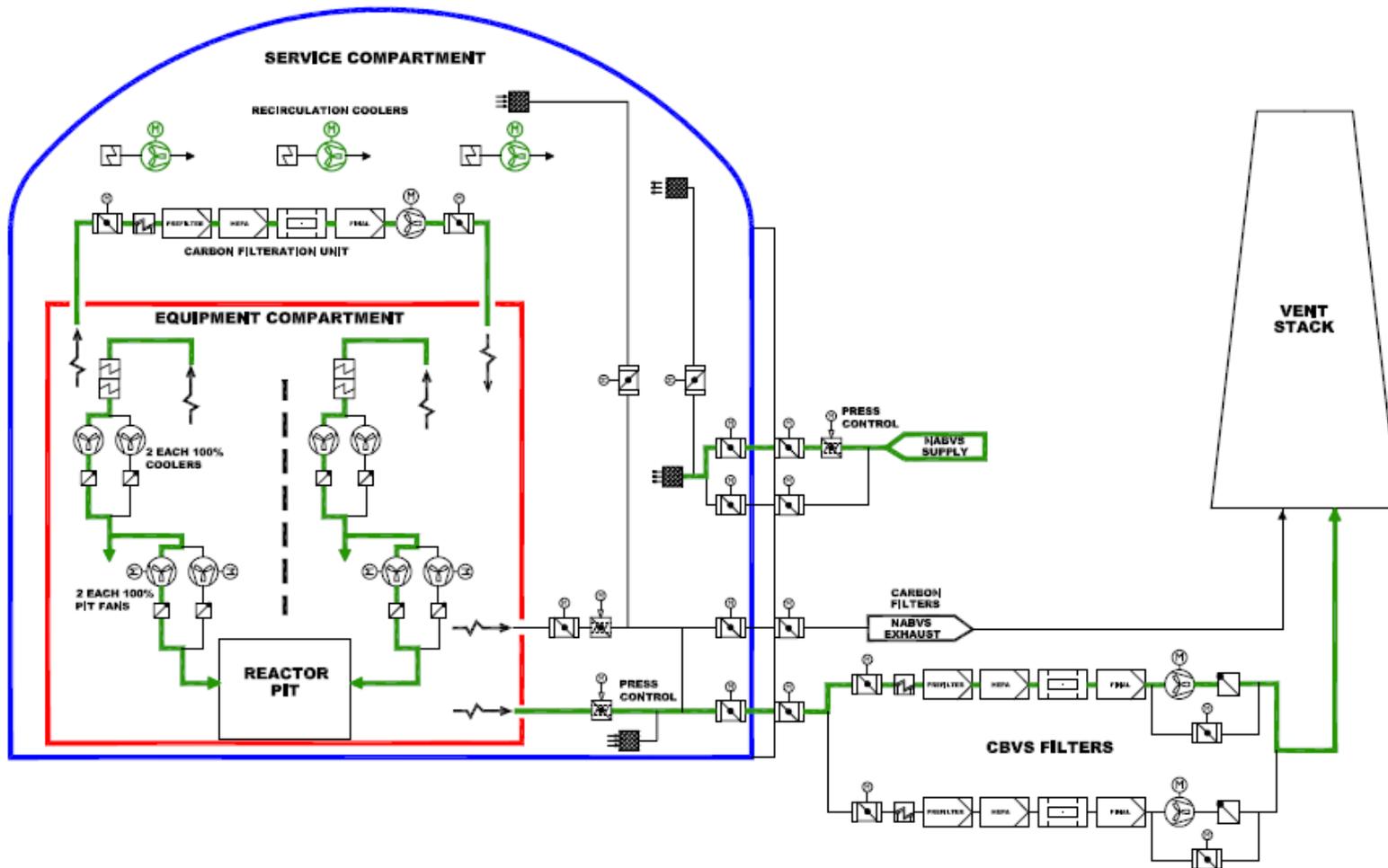
▶ Safety Functions

- ◆ Provides containment isolation and meets guidelines of GDC 56 for primary containment isolation.
- ◆ Provides HEPA & Iodine filtration of air exhausted from containment, exhaust air filtration meets guidelines of RG 1.52, and guidelines of GDC 41, 42 and 43 to reduce the amount of radioactive material released to the environment.

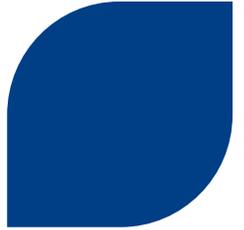
▶ Non-Safety Functions

- ◆ Provides a low flow purge of containment for access during normal plant operation.
- ◆ Provides HEPA & Iodine filtration of potentially contaminated airborne radioactive materials from containment equipment and service compartments during normal operation (internal filtration subsystem), and during a fuel handling accident in containment (low flow purge subsystem).
- ◆ Provides cooling for equipment and service areas within containment (containment cooling subsystem).
- ◆ Reactor pit fans supply cool air to reactor pit area to maintain temperature $\leq 150^{\circ}\text{F}$ to prevent degradation of the concrete.
- ◆ Maintains pressure in containment ≤ -0.25 inch w.g. during fuel handling.
- ◆ Provides conditioned air to the containment during plant outages (full flow purge).

CBVS Normal (Low Flow Purge)



Section 9.4.9 - Emergency Power Generating Building Ventilation System (EPGBVS)



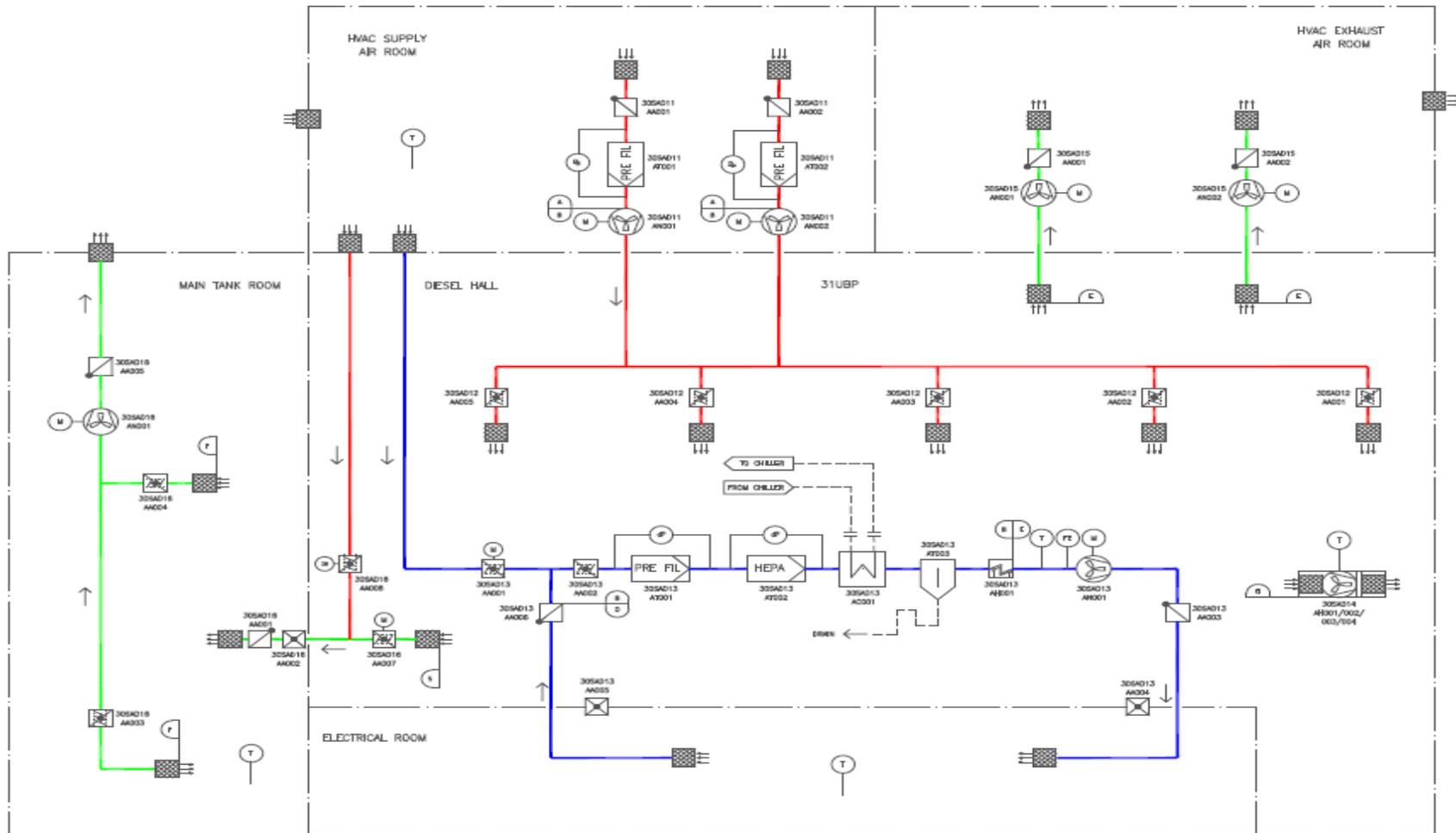
▶ Safety Functions

- ◆ Removes heat generated within the EDGB and maintains ambient conditions for operation of equipment within the EDGB during a design basis accident, including a loss of offsite power (LOOP).

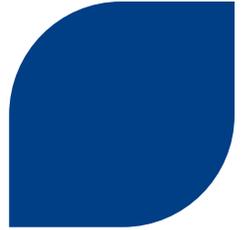
▶ Non-Safety Functions

- ◆ Maintains ambient conditions in the EPGB (diesel hall and electrical room) for personnel and equipment during normal operation.

Section 9.4.9 - Emergency Power Generating Building Ventilation System (Typical of all four trains)



Section 9.4.11 - Essential Service Water Pump Building Ventilation System (ESWPBVS)



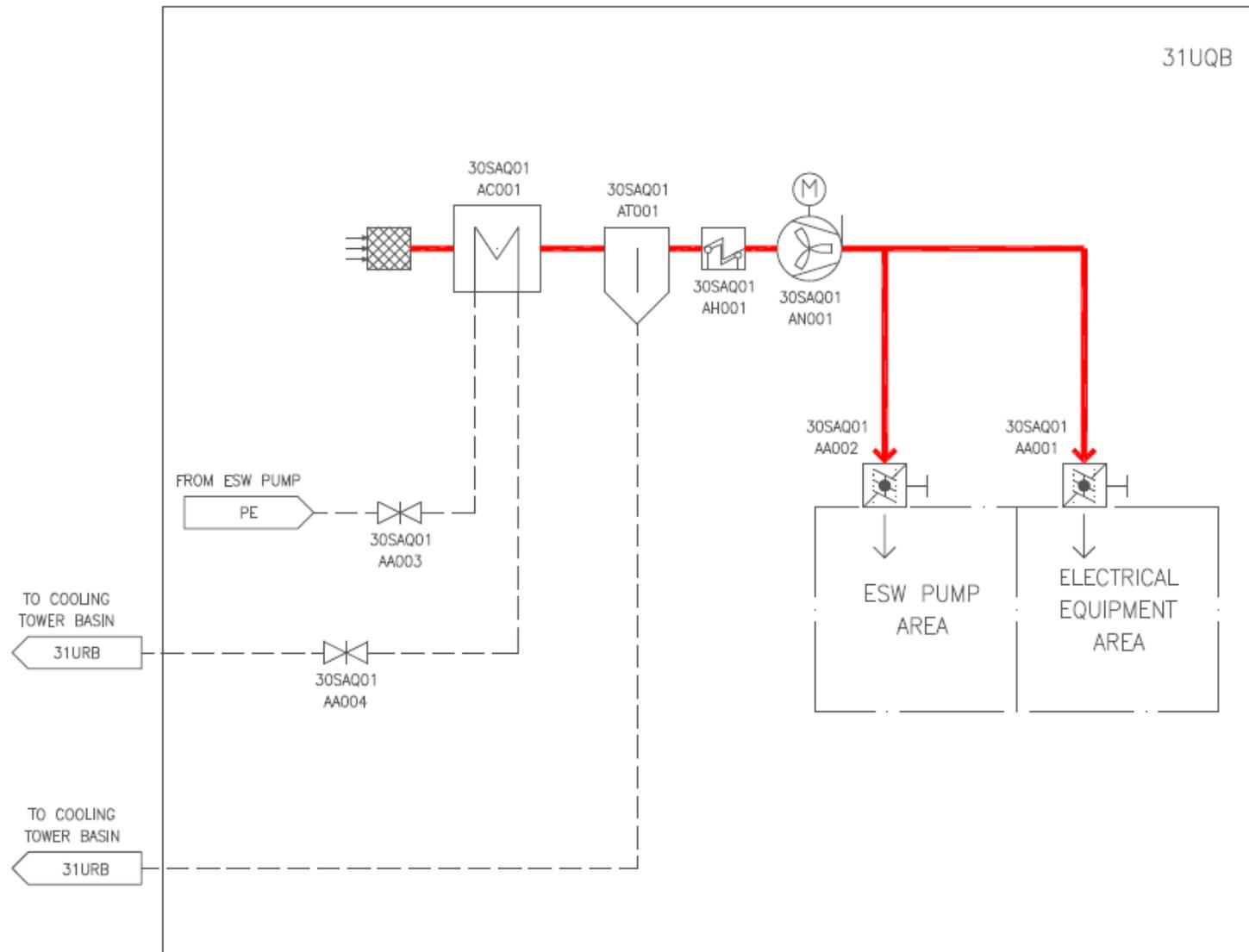
▶ Safety Function

- ◆ Maintains ambient conditions within the ESW pump room areas for the operation of equipment during a design basis accident.

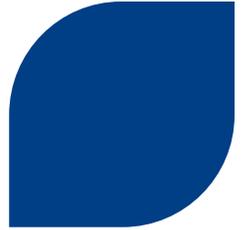
▶ Non-Safety Function

- ◆ Maintains ambient conditions for personnel and equipment within the ESW pump room area during normal operation.

Section 9.4.11 - Essential Service Water Pump Building Ventilation System (Typical of all four trains)



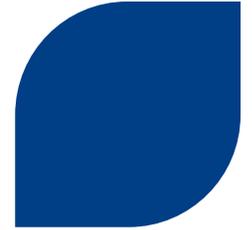
U.S. EPR FSAR Fire Protection (9.5.1 & Appendix 9A)



Overview of U.S. EPR Fire Protection Engineered Features

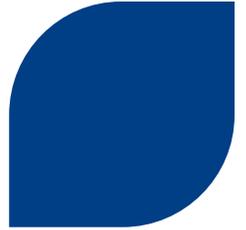
John Crowther
Project Engineer II
Fire Protection

Topics



- ▶ **Fire Protection Defense-in-Depth**
- ▶ **Applicable Regulatory Requirements**
- ▶ **Elements of the Fire Protection Program**
- ▶ **Fire Hazards Analysis**
- ▶ **Fire Protection Systems and Design Features**
- ▶ **Post-Fire Safe Shutdown Capability**

Fire Protection Defense-in-Depth



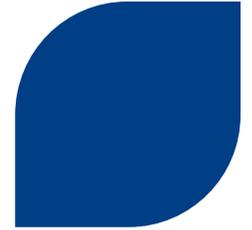
- ▶ **The fire protection program minimizes the potential for fires and explosions through a combination of design and administrative controls**
- ▶ **Detection and suppression systems are provided that will rapidly detect, control, and extinguish fires**
- ▶ **The fire protection program provides administrative controls and design features such that a fire cannot prevent the performance of necessary safe shutdown functions or significantly increase the risk of radioactive releases to the environment**
- ▶ **Fire protection systems are designed so that failure or inadvertent operation will not adversely impact the ability of SSC to perform their safety functions**

Applicable Regulatory Requirements



- ▶ **The fire protection program meets the requirements of NUREG-0800, Standard Review Plan 9.5.1 (including 10 CFR, Part 50, Appendix A GDC 3, GDC 5, GDC 19 and GDC 23)**
 - ◆ The program meets (SRP) the supplementary review criteria for Advanced Reactors contained in Appendix A of SRP 9.5.1.
 - ◆ The program meets the requirements contained in NFPA 804 except where it conflicts with NRC regulatory guidance.
 - ◆ The fire PRA meets the review criteria contained in Appendix C of SRP 9.5.1.
- ▶ **The fire protection program meets the criteria contained in SECY-90-016 and SECY-93-087:**
 - ◆ No re-entry into the affected fire area is credited for actions or repairs.
 - ◆ At least one shutdown success path in containment is available.
 - ◆ Smoke, hot gas & fire suppressant cannot migrate to other fire areas to the extent that they could adversely affect safe shutdown capability including operator actions.
- ▶ **Generally, the fire protection program meets the guidance in Regulatory Guide 1.189, Rev. 1. Justification is provided for alternate compliance.**

Elements of the Fire Protection Program (FPP)



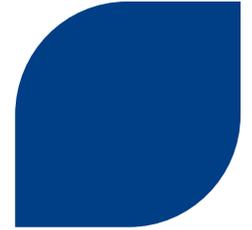
- ▶ **Comprehensive identification and analysis of fire and explosion hazards**
- ▶ **Organization and staff positions responsible for FPP management and implementation**
- ▶ **Fire prevention program**
- ▶ **Automatic detection and suppression systems**
- ▶ **Manual fire fighting capability**
- ▶ **Building design features minimize the threat of fires**
- ▶ **Safe shutdown analysis demonstrates that the plant can achieve and maintain safe shutdown in the event of a fire**

Fire Hazards Analysis (FHA)



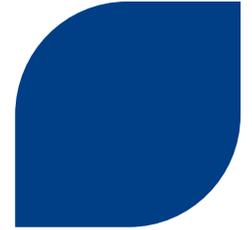
- ▶ **The U.S. EPR FHA document addresses the following:**
 - ◆ **Physical construction and layout of buildings and equipment, including ratings of fire area boundaries**
 - ◆ **Inventory of principal combustibles within each fire subdivision**
 - ◆ **Description of fire protection equipment, including alarm systems and manual and automatic extinguishing systems**
 - ◆ **Description and location of any equipment necessary to ensure a safe shutdown, including cabling between equipment**
 - ◆ **Analysis of a postulated fire in each fire area, including its effect on safe shutdown equipment, assuming automatic and manual fire protection equipment do not function**
 - ◆ **Analysis of the potential effects of a fire on life safety, release of contamination, impairment of operations, and property loss, assuming the operation of installed fire-extinguishing equipment**

Fire Hazards Analysis (FHA) (Continued)



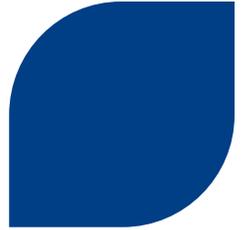
- ◆ **Analysis of potential effects of other hazards, such as earthquakes, storms, and floods, on fire protection systems and equipment**
- ◆ **Analysis of the post-fire recovery potential**
- ◆ **Analysis for the protection of nuclear safety–related systems and components from inadvertent actuation or breaks in a fire suppression system**
- ◆ **Analysis of the smoke control system and the impact smoke can have on nuclear safety and operation for each fire area**
- ◆ **Analysis of emergency planning and coordination requirements necessary for effective loss control, including any necessary measures to compensate for the failure or inoperability of any active or passive fire protection system or feature**

Fire Protection Program Administration



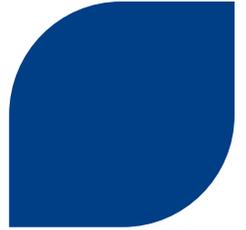
- ▶ **The U.S. EPR Fire Protection Program Administration addresses the following:**
 - ◆ **Fire Protection Organization**
 - ◆ **Administrative Policies**
 - ◆ **Fire Prevention Controls**
 - ◆ **Applicable Administrative, Operations, Maintenance and Emergency Procedures**
 - ◆ **Quality Assurance**
 - ◆ **Access to and Egress From Fire Areas**
 - ◆ **Fire Brigade Capability**
 - ◆ **Emergency Response Capability**
- ▶ **The COL applicant is responsible for providing site-specific information for the fire protection program and a schedule for implementation.**

Fire Protection Systems and Design Features: Fire Detection and Alarm



- ▶ **Fire detection systems are installed in all areas of the plant that contain or present an exposure fire hazard to safety-related SSCs.**
- ▶ **The fire alarm system provides notification to the Control Room and building occupants of fire conditions.**
- ▶ **Fire detection and alarm systems comply with applicable requirements established by NFPA 72 (National Fire Alarm Code).**

Fire Protection Systems and Design Features: Water Supply Systems



- ▶ **Fire pumps, water supply and fire mains are sized and arranged to ensure that:**
 - ◆ **100% capacity is available assuming a single active failure of a fire pump, water supply or fire main line (design includes one electric and two diesel driven fire pumps)**
 - ◆ **Water supply systems comply with applicable NFPA codes of record:**
 - NFPA 20 (fire pumps)
 - NFPA 22 (water tanks)
 - NFPA 24 (fire mains)

Fire Protection Systems and Design Features: Fire Suppression Systems

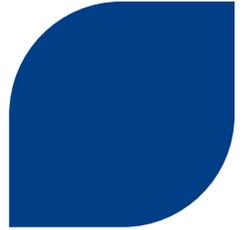


- ▶ **Automatic and manual fire suppression systems are installed based on the results of the FHA in the following areas:**
 - ◆ **Automatic actuated water based suppression in the Emergency Diesel Generator Diesel Engine Halls and Emergency Diesel Generator Fuel Oil Storage Tank Rooms**
 - ◆ **Manual actuated water based suppression systems for the RCPs**
 - ◆ **Manual actuated gaseous suppression system for the MCR under floor area**
- ▶ **Fire suppression systems comply with applicable NFPA codes of record:**
 - ◆ **NFPA 13 (sprinkler systems)**
 - ◆ **NFPA 15 (water spray systems)**
 - ◆ **NFPA 2001 (clean agent systems)**
- ▶ **Enhanced train separation and redundancy reduce the need for fire suppression systems to meet overall fire protection program objectives.**

Fire Protection Systems and Design Features: Manual Fire Fighting Capability

- ▶ **Manual fire fighting capability is provided throughout the plant to limit the extent of fire damage**
 - ◆ **Standpipes and hose stations are able to reach any location that contains, or could present, a fire exposure hazard.**
 - ◆ **Outside hydrants provide effective hose stream protection for onsite locations, where fixed or transient combustibles could jeopardize equipment.**
 - ◆ **Portable extinguishers are located throughout the facility and are the type needed based on the hazards in the area.**
- ▶ **Manual fire fighting capability complies with applicable codes of record:**
 - ◆ **NFPA 10 (fire extinguishers)**
 - ◆ **NFPA 14 (Standpipes and hose systems)**
 - ◆ **NFPA 24 (fire hydrants)**

Fire Protection Systems and Design Features: Building Design



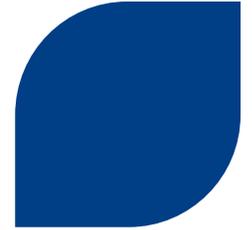
▶ Building layout

- ◆ Fire areas are established to minimize the probability and effect of fires and explosions by utilizing passive fire barriers to subdivide the plant into separate fire areas and zones (fire zones are located inside containment and the annulus).
- ◆ Structural fire barrier designs are based on:
NFPA 251/ASTM E 119 fire endurance test protocol.
- ◆ Fire door designs are in accordance with NFPA 80.

▶ Materials of construction

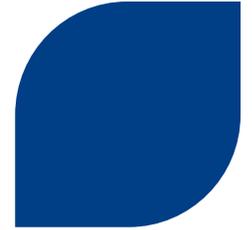
- ◆ Noncombustible and heat resistant materials are used wherever practical throughout the plant.
- ◆ NFPA 221 is used as guidance for specifying requirements for the design and construction of fire barriers.

Fire Protection Systems and Design Features: Other Building Systems



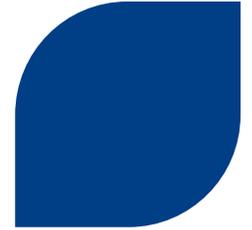
- ▶ **Electrical cable and raceway construction**
 - ◆ Cables meet the flame test criteria of IEEE 1202
 - ◆ Cables are routed in metal raceways and are separated so that a fire cannot damage redundant shutdown systems
- ▶ **HVAC systems are designed to:**
 - ◆ Limit the consequences of a fire by preventing the spread of the products of combustion to opposite/adjacent division areas
 - ◆ Provide a means to ventilate, exhaust, or isolate fire areas as required
 - ◆ Consideration is given to the consequences of fire induced failure of ventilation systems causing loss of control for ventilating, exhausting, or isolating a given fire area
- ▶ **The reactor coolant pump lube oil collection system is designed to:**
 - ◆ Cover all potential leak points
 - ◆ Remain functional after an SSE
 - ◆ Hold total capacity of any lube oil leaks

Fire Protection Systems and Design Features: Other Building Systems



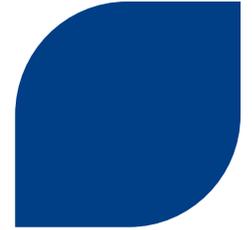
- ▶ **Emergency lighting is provided as necessary to support:**
 - ◆ manual fire-fighting
 - ◆ safe shutdown operations
 - ◆ emergency egress during a fire event
- ▶ **The communication system design provides effective communication capability between plant personnel to support fire-fighting efforts and safe shutdown of the plant.**
- ▶ **Communication is addressed in FSAR Section 9.5.2 and emergency lighting is addressed in FSAR Section 9.5.3.**

Post-Fire Safe Shutdown Capability



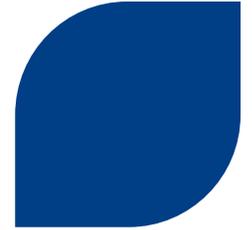
- ▶ **Analysis demonstrates at least one success path of systems is available to achieve and maintain safe plant shutdown**
- ▶ **Design Meets Reg. Guide 1.189, Section 5 Performance Goals**
 - ◆ **Reactivity Control – Achieve and Maintain CSD Reactivity Conditions**
 - Rx Trip, EBS, IRWST
 - ◆ **Reactor Coolant Makeup Function – Maintain Primary System Inventory**
 - EBS, IRWST
 - ◆ **Decay Heat Removal**
 - Emergency Feedwater, RHR, Fuel Pool Cooling (Non-Power)
 - ◆ **Process Monitoring – Necessary Process Variables**
 - RCS Temp. & Press, Pzr Level, SG Level & Press, Source Range, System Status
 - ◆ **Support Functions – Cooling, Power, etc.**
 - EDGs, CCWS, SCWS, ESWS, Ventilation Systems, etc

Post-Fire Safe Shutdown Capability



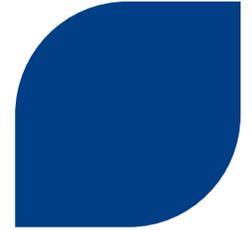
- ▶ **U.S. EPR Design Follows NEI 00-01 Safe Shutdown Analysis Guidance**
- ▶ **U.S. EPR Design Advantages**
 - ◆ **4 Safeguards Buildings – 1 Per Safety Division**
 - ◆ **No 125 VDC Air Operated Valves – Eliminates concerns associated with shorts through ground**
 - ◆ **Remote Shutdown Station – Central location to control SSD equipment**

Post-Fire Safe Shutdown Capability



- ▶ **Separation of redundant trains in the control room is not practical**
 - ◆ **An alternative safe shutdown capability is provided that is physically and electrically independent of the control room**
 - ◆ **Remote shutdown station meets guidance in RG 1.189 for alternate shutdown**

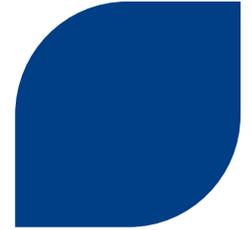
- ▶ **Containment fire area contains redundant function cables**
 - ◆ **Design meets the guidance in RG 1.189**
 - ◆ **Shutdown capability is demonstrated by a combination of spatial separation and physical barriers**
 - ◆ **Fire protection is provided to ensure that at least one shutdown success path is available.**
 - ◆ **Fire protection design features are provided for fire hazards in containment**
 - ◆ **Automatic fire detection as needed in containment and suppression for the reactor coolant pumps is provided**



U.S. EPR FSAR Diesel Generator Subsystems

- 9.5.4 – Diesel Generator Fuel Oil Storage & Transfer System
- 9.5.5 – Diesel Generator Cooling Water System
- 9.5.6 – Diesel Generator Starting Air System
- 9.5.7 – Diesel Generator Lubricating Oil System
- 9.5.8 – Diesel Generator Air Intake and Exhaust System

Bob Day
Advisory Engineer
Component Engineering



Section 9.5.4 - Fuel Oil Storage and Transfer System

▶ Purpose

- ◆ Provide the storage capacity and transfer of fuel oil to each EDG.

▶ Safety-Related Function

- ◆ Provides storage and transfers a quality fuel supply to the diesel engine following an emergency engine start signal.

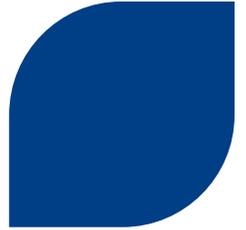
▶ Non-Safety-Related Function

- ◆ Transfers fuel oil from a bulk fuel oil carrier to the storage tank.

▶ Each EDG has a separate, independent fuel oil system, which is located inside the Class 1 emergency power generating building (EPGB), with the exception of the outside fill and vent locations.

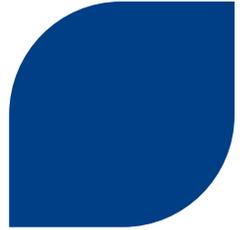
- ◆ The two fill connections on the building exterior are separated by distance and out of line of sight.
- ◆ The two vent paths from each tank are located on the upper level of the EPGB and separated by distance and out of line of sight.

Section 9.5.4 - Fuel Oil Storage and Transfer System



- ▶ **Layout allows accessibility for inspections, cleaning and maintenance. All piping and components are located above ground.**
- ▶ **Storage Tank and Day Tank both located adjacent to the respective division EDG, above grade, in a separate room located at each end of the EPGB. This separation:**
 - ◆ **Provides a missile barrier.**
 - ◆ **Serves as a spill reservoir.**
 - ◆ **Provides 3 hour firewall between fuel oil tanks and engine room.**

Section 9.5.4 - Fuel Oil Storage and Transfer System



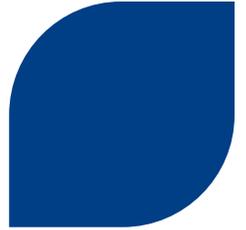
▶ Fuel Oil Storage Tank

- ◆ Inventory requirements determined in accordance with ANSI/ANS 59.51.
- ◆ Useable volume to ensure uninterrupted engine operation for 7 days of operation at rated power including allowance for periodic testing.
- ◆ Storage tank can be filled during engine operation.

▶ Fuel Oil Day Tank

- ◆ Inventory requirements determined in accordance with ANSI/ANS 59.51.
- ◆ Useable volume to ensure uninterrupted engine operation for 2 hours of operation at rated power.
- ◆ Day tank can be filled during engine operation. Tank is automatically refilled from storage tank on low day tank level indication.

Section 9.5.5 - Diesel Generator Cooling Water System



▶ Purpose

- ◆ Provide the necessary cooling for the engine and turbocharger, dissipating the heat to the Essential Service Water System.

▶ Safety-Related Function

- ◆ Provides cooling to dissipate heat from the diesel engine and lubricating oil to maintain temperatures within operating limits during engine operation.

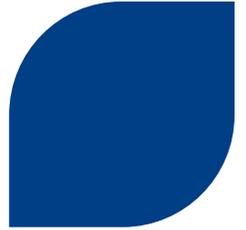
▶ Non-Safety-Related Function

- ◆ Maintains engine at a set temperature during standby to reduce stress on the mechanical portions of the engine during emergency starts.

▶ Each EDG has a separate, independent cooling water system, which is located inside the Class 1 EPGB.

▶ Two subsystems, jacket water cooling and intercooler cooling, which are connected to a common expansion tank.

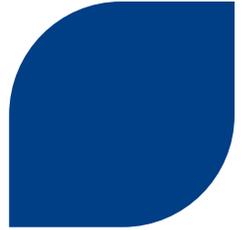
Section 9.5.5 - Diesel Generator Cooling Water System



▶ Cooling Water Expansion Tank

- ◆ Expansion tank provides sufficient reserve capacity for operation of EDG for at least 7 days at rated power with normal anticipated minor water loss.
 - ◆ Expansion tank located at a higher elevation than the rest of the system to facilitate air removal from the system. Tank allows for expansion of the cooling water due to temperature variations.
 - ◆ Expansion tank has an auto fill connection from the demineralized water system for non-emergency operation and a manual fill port for emergency operation.
- ▶ During engine operation, the cooling water preheater and preheat circulation pump are off. Cooling water is circulated by the engine-driven jacket water pump and engine-driven intercooler water pump.
- ▶ When the engine is in standby mode, the preheater and preheat circulation pump circulate cooling water to establish quick starting times and short load acceptance times to minimize cold start wear.

Section 9.5.6 – Diesel Generator Starting Air System



▶ Purpose

- ◆ Start the EDG by using compressed air to rotate the engine until combustion begins and it accelerates under its own power. Starting air is not required for continued EDG operation once the engine is running.

▶ Safety-Related Function

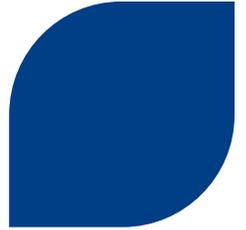
- ◆ Provides stored capacity of compressed air to start the EDG. System downstream of, and including the air receiver inlet check valves, is safety-related.

▶ Non-Safety-Related Function

- ◆ Provides dry compressed air to the starting air receivers. System upstream of air receiver inlet check valves, including air compressors, filters and air dryers, is non-safety-related.

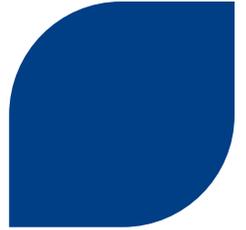
▶ Each EDG has a separate, independent starting air system, which is located inside the Class 1 EPGB.

Section 9.5.6 - Diesel Generator Starting Air System



- ▶ **System consists of:**
 - ◆ Two electric motor driven compressors.
 - ◆ Two sets of filters and air dryers.
 - ◆ Two starting air receivers.
- ▶ **Ambient air from the engine room is compressed, filtered, dried and stored in the starting air receivers.**
- ▶ **The starting air capacity for each EDG is sufficient for a minimum of five engine starts, from the low pressure alarm setpoint, without recharging the receiver tanks.**
- ▶ **Compressors capable of recharging the air receiver within 30 minutes following five start attempts.**

Section 9.5.7 - Diesel Generator Lubricating Oil System



▶ Purpose

- ◆ Store and supply clean lubricating oil to moving parts of the engine, provide pre-lubrication to the engine, and regulate the lube oil temperature.

▶ Safety-Related Function

- ◆ Provides essential lubrication to engine wearing parts during emergency operation and maintains lube oil temperature within operating limits.

▶ Non-Safety-Related Function

- ◆ Provides pre-lubrication to the engine and maintains oil in a warm condition when the engine is on standby to facilitate quick starting.

▶ Each EDG has a separate, independent lubricating oil system, which is located inside the Class 1 EPGB.

▶ The lube oil system relies on the Essential Service Water System to reject heat.

Section 9.5.7 - Diesel Generator Lubricating Oil System

- ▶ When the engine is in standby mode, keep warm pump and heater circulate the lube oil and maintain a minimum oil temperature.
- ▶ During engine operation, the keep warm pump and heater are off and lube oil is circulated by the engine driven lube oil pumps.
- ▶ Lube Oil Makeup Tank
 - ◆ Inventory requirements determined in accordance with ANSI/ANS 59.52.
 - ◆ Useable volume of the tank provides uninterrupted engine operation for 7 days at rated power including allowance for periodic testing.
 - ◆ Oil is transferred from the tank to the engine sump by gravity through a solenoid valve actuated by a level control switch in the engine sump.
 - ◆ Makeup tank can be filled during engine operation.

Section 9.5.8 - Diesel Generator Air Intake and Exhaust System

▶ Purpose

- ◆ Provide the EDG with combustion air from the outside and discharge the exhaust gas through the emission equipment and silencer to the outside.

▶ Safety-Related Function

- ◆ Provides filtered combustion air to the EDG and provides a path for exhaust products to the environment under emergency operating conditions.

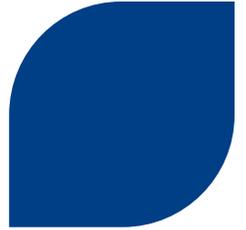
▶ Non-Safety-Related Function

- ◆ Provides emission and noise control of the engine exhaust.

▶ Each EDG has a separate, independent combustion air and exhaust system. Safety-related components and piping are located inside the Class 1 EPGB.

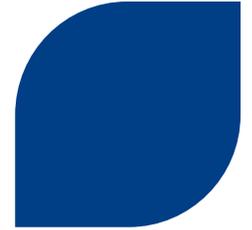
▶ Combustion air is taken from outside the EPGB near the top of the building through a louver in the building wall. Combustion air travels through a filter, silencer and heater before entering the turbocharger.

Section 9.5.8 - Diesel Generator Air Intake and Exhaust System



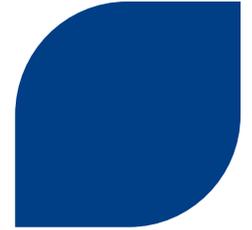
- ▶ Air intake louver located on the opposite side of the building from the exhaust discharge point to preclude mixing exhaust gas with the combustion air.
- ▶ Exhaust gas is directed through non-safety-related gas emission equipment and silencer before being discharged.
- ▶ Exhaust bypass rupture disc and bypass exhaust stack provide a safety-related exhaust path in the event a system failure downstream restricts exhaust flow.

Acronyms



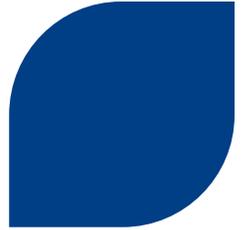
- ▶ **ANS** American Nuclear Society
- ▶ **ANSI** American National Standards Institute
- ▶ **CBVS** Containment Building Ventilation System
- ▶ **CCW** Component Cooling Water
- ▶ **CDS** Coolant Degasification System
- ▶ **COL** Combined License
- ▶ **CPS** Coolant Purification System
- ▶ **CRACS** Main Control Room Air Conditioning System
- ▶ **CRE** Control Room Envelope
- ▶ **CSSS** Coolant Supply and Storage System
- ▶ **CTS** Coolant Treatment System
- ▶ **CVCS** Chemical and Volume Control System
- ▶ **DBA** Design Basis Accident
- ▶ **EBS** Extra Borating System
- ▶ **EDG** Emergency Diesel Generator
- ▶ **EPGB** Emergency Power Generating Building
- ▶ **EPGBVS** Emergency Power Generating Building Ventilation System
- ▶ **ESF** Engineered Safety Feature
- ▶ **ESW** Essential Service Water
- ▶ **ESWPBVS** Essential Service Water Pump Building Ventilation System
- ▶ **FB** Fuel Building

Acronyms



▶ FBVS	Fuel Building Ventilation System
▶ FHA	Fire Hazards Analysis
▶ FPC	Fuel Pool Cooling
▶ FPP	Fire Protection Program
▶ FPPS	Fuel Pool Purification System
▶ GWPS	Gaseous Waste Processing System
▶ HEPA	High Efficiency Particulate Air
▶ HVAC	Heating, Ventilation and Air Conditioning
▶ HX	Heat Exchanger
▶ IRWST	In-Containment Refueling Water Storage Tank
▶ LHSI	Low Head Safety Injection
▶ LOOP	Loss of Offsite Power
▶ MCR	Main Control Room
▶ NAB	Nuclear Auxiliary Building
▶ NABVS	Nuclear Auxiliary Building Ventilation System
▶ NFPA	National Fire Protection Association
▶ NI	Nuclear Island
▶ NIDVS	Nuclear Island Drain and Vent System
▶ NSS	Nuclear Sampling System
▶ ORP	Oxidation-Reduction Potential
▶ PASS	Post Accident Sampling System

Acronyms



▶ PERMSS	Process & Effluent Radiological Monitoring and Sampling Systems
▶ RB	Reactor Building
▶ RBWMS	Reactor Boron and Water Makeup System
▶ RCP	Reactor Coolant Pump
▶ RCS	Reactor Coolant System
▶ RHR	Residual Heat Removal
▶ SAHRS	Severe Accident Heat Removal System
▶ SASS	Severe Accident Sampling System
▶ SB	Safeguard Building
▶ SBO	Station Blackout
▶ SBODG	Station Blackout Diesel Generator
▶ SBVS	Safeguard Building (Controlled Area) Ventilation System
▶ SBVSE	Safeguard Building Ventilation System (Electrical)
▶ SCW	Safety Chilled Water
▶ SECSS	Secondary Sampling System
▶ SIS	Safety Injection System
▶ SSC	Structures, Systems and Components
▶ SSE	Safe Shutdown Earthquake
▶ UHS	Ultimate Heat Sink





Presentation to the ACRS Subcommittee

AREVA U.S. EPR Design Certification Application Review

Safety Evaluation Report with Open Items

**Chapter 9: Auxiliary Systems
Group I – Sections 9-2 to 9-5**

November 14-15, 2011

Technical Staff Review Team



United States Nuclear Regulatory Commission

Protecting People and the Environment

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Overview of DCA

SRP Section/Application Section		No. of Questions	Number of OI
9.2.1	Station Service Water System	51	0
9.2.2	Reactor Auxiliary Cooling Water Systems	122	0
9.2.4	Potable and Sanitary Water Systems	1	0
9.2.5	Ultimate Heat Sink	38	1
9.3.1	Compressed Air System	7	0

Overview of DCA

SRP Section/Application Section		No. of Questions	Number of OI
9.3.2	Process and Post-accident Sampling Systems	17	2
9.3.3	Equipment and Floor Drainage System	10	4
9.3.4	Chemical and Volume Control System (PWR) (Including Boron Recovery System)	26	6
9.4.1	Control Room Area Ventilation System	7	6
9.4.2	Spent Fuel Pool Area Ventilation System	3	1
9.4.3	Auxiliary and Radwaste Area Ventilation System	6	4

*The safety evaluation for these Sections was not delivered in the Phase 2 SE for Chapter 6.

Overview of DCA

SRP Section/Application Section		No. of Questions	Number of OI
9.4.4	Turbine Area Ventilation System	2	0
9.4.5	Engineered Safety Feature Ventilation System	4	2
9.5.1	Fire Protection Program	88	3
9.5.2	Communications Systems	12	0
9.5.3	Lighting Systems	20	0
9.5.4	Emergency Diesel Engine Fuel Oil Storage and Transfer System	25	0

Overview of DCA (continued)

SRP Section/Application Section		No. of Questions	Number of OI
9.5.5	Emergency Diesel Engine Cooling Water System	7	0
9.5.6	Emergency Diesel Engine Starting System	12	0
9.5.7	Emergency Diesel Engine Lubrication System	11	0
9.5.8	Emergency Diesel Engine Combustion Air Intake and Exhaust System	11	0
Totals		480	29

Description of Open Items

- **RAI 518, Question 09.02.05-38:** Address possible technical specification surveillance for wet bulb temperature in Technical Specification 3.7.9.
- **RAI 223, Question 09.03.02-14:** Provide clarification of how tanks that were not part of the PSS would be sampled to comply with SRP Section 9.3.2 and provide specific information on the nature of decontaminating fluids used in the NSS.
- **RAI 185, Question 09.03.02-11:** Identify the system used to obtain containment gas samples in the event that the containment radiation monitor is out of service.
- **RAI 476, Question 09.03.03-7:** clarify the differences between non-safety-related and safety-related portions of the system.
- **RAI 476, Question 09.03.03-8:** Modify the FSAR to provide limit on ferrite in Mo bearing cast austenitic stainless steels to address thermal aging embrittlement.
- **RAI 476, Question 09.03.03-9:** Specify the “redundancy, location, and physical separation” being credited in the FSAR in order to comply with GDC 2.

Description of Open Items

- **RAI 520, Questions 09.03.03-10:** Update this SE with respect to compliance with Part 20.1406 during Phase 4 review.
- **RAI 492, Question 09.03.04-21:** Provide a more rigorous technical evaluation of this hydrogen control range that demonstrates why it is acceptable to maintain RCS hydrogen below the EPRI Guidelines Action Level 1 limit.
- **RAI 492, Question 09.03.04-22:** Describe the exact mechanism of how nitrogen purging of the VCT maintains hydrogen concentration in the RCS and what equations would be used to determine the theoretical hydrogen concentration in the RCS.
- **RAI 492, Question 09.03.04-23:** Describe how ammonia build up in the RCS will affect demineralizer performance.
- **RAI 492, Question 09.03.04-24:** Change the FSAR Tier 2, Section 9.3.4.2.1 to match the December 5, 2008, response to RAI 125, Question 09.03.04-15, Parts 1 and 2.
- **RAI 492, Question 09.03.04-25:** Describe the pre-operation functional test of the evaporator system in the FSAR.

Description of Open Items

- **RAI 492, Question 09.03.04-26:** Describe the method for determining the B-10 assay frequency in the FSAR.
- **RAI 277, Question 09.04.01-1:** Provide more detailed information for each safety-related ventilation system.
- **RAI 461, Question 09.04.01-3:** Revise FSAR Tiers 1 and 2 to satisfy the Tier 1 design commitment to maintain hydrogen control below a numerical criteria.
- **RAI 461, Question 09.04.01-4:** Clarify the description of the Smoke Confinement System (SCS).
- **RAI 461, Question 09.04.01-5:** Clarify what toxic gas sensor design functions and design features are to be reviewed by the staff in the design certification, considering COL Information Items 6.4-1, 6.4-2, and 6.4-3, where a COL applicant is to provide this information.
- **RAI 509, Question 09.04.01-6:** Clarify the FSAR Tier 1 mark up provided with the response to RAI 277 Question 09.04.01-1.

Description of Open Items

- **RAI 509, Question 09.04.01-7:** Clarify the role of the CBVS in a design-basis accident and justify why the physical arrangement of the CBVS low volume purge system satisfies single failure criteria if the CBVS low volume purge system is required to function to clean up the post accident containment atmosphere.
- **RAI 277, Question 09.04.02-1:** Clarify the safety classification of the FBVS heaters.
- **RAI 277, Question 09.04.03-2:** Clarify the inconsistency between the piping and instrument diagram and the FSAR design basis description for the main steam and feed water valve room ventilation system.
- **RAI 461, Question 09.04.03-4:** Clarify FSAR Tier 2, Figure 9.4.3-3 to indicate that the plant stack is SSC Seismic Category 1 and SSC Quality Group B. Also Clarify the Seismic and Quality Classification breaks for the vent stack as they are shown in the FSAR in the same manner for several Systems/ P&IDs.
- **RAI 461, Question 09.04.03-5:** Clarify how and when duct and housing leak tests will be performed on the NABVS and RWBVS.

Description of Open Items

- **RAI 461, Question 09.04.03-6:** Provide details of the access building and the ABVS to justify why the Supervised area of the Access Building is not subject to GDC 60.
- **RAI 461, Question 09.04.05-3:** Justify why the SBVSE is not subject to GDC 60 and Revise Figure 9.4.6.1 to include the missing air intake supply air fan.
- **RAI 461, Question 09.04.05-4:** State in FSAR Tier 2, Section 9.4.9.1 that the design is subject to GDC 17, and summarize how the requirements of GDC 17 have been met.
- **RAI 517, Question 09.05.01-86:** Document the use of RG 1.189 Revision 2 and the endorsed sections of NEI 00-01 Revision 2 in the FSAR for Post-Fire Safe Shutdown Circuit Analysis Methodology.
- **RAI 518, Question 09.05.01-87:** Revise FSAR Section 9.5.1 to be consistent with CCNPP3.

Description of Open Items

- **RAI 519, Question 09.05.01-88:** Revise FSAR Tier 1 Section 2.1.1.1 and Table 2.1.1-8 to provide the fire barrier ratings for the above structures or reference a figure that has the ratings and to ensure RG 1.189 Containment separation guidance is used properly.



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Presentation to the ACRS Subcommittee

SERIOI Chapter 9 Section 9.2

Water Systems

Larry Wheeler

November 14-15, 2011

9.2.1 Essential Service Water System (ESWS)
9.2.2 Component Cooling Water System (CCWS)
9.2.5 Ultimate Heat Sink (UHS)
9.2.8 Safety Chilled Water System (SCWS)

- **Applicable Regulations and Review Guidance:**
 - ◆ SRP 9.2.1, 9.2.2, & 9.2.5
 - GDC 2 - Design Bases for Protection against Natural Phenomena
 - GDC 4 - Environmental and Dynamic Effects Design Bases
 - GDC 5 - Sharing of Structures, Systems, and Components
 - GDC 44 - Cooling Water (heat transfer)
 - GDC 45 - Inspection of Cooling Water System
 - GDC 46 - Testing of Cooling Water System
 - 10 CFR 52.47(b)(1) - ITAAC
 - 10 CFR 20.1406 - Minimization of Contamination

ESWS-Challenges

- **ESWS Water Hammer Considerations**
 - FSAR Revision 1 silent on water hammer design features and testing
 - Applicant to perform hydraulic transient analysis, confirms ESWS integrity to withstand the effects of water hammer
 - Revision 3 added:
 - Description of air release valves & vacuum breakers
 - Keep fill system with mechanical draft cooling tower (MDCT) riser water level alarms
 - Chapter 14 testing – tests to verify there is no evidence of a water hammer

CCWS-Challenges

- **CCWS Water Hammer Considerations**
 - Staff concern; 10 second closure time of fast acting hydraulic valves for CCWS train cross connects
 - Applicant stated; fast valve closure time not considered to be an instantaneous closure that would create large pressure waves in the system
 - FSAR Revision 3 added Chapter 14 testing –tests to verify there is no evidence of a water hammer

CCWS-Challenges

- **CCWS Surge Tank Sizing and System Leakage**
 - FSAR original design had non-safety related makeup from Fire Protection to support 7 days of makeup
 - Revision 3 of the FSAR includes;
 - Valve seat leakage defined in FSAR Table 3.9.6-2
 - Assumes no safety related makeup for 7 days
 - 750 gallon water reserve for 7 day per tank
 - TS SR 3.7.7.2 – 31 day verification < 4.0 gallon per hour leakage
 - Defense in depth – connections via firewater (seismic II) post 7 days

9.2.5 UHS-Challenges

- **Uncertain verification of MDCT performance**
 - ITAAC and initial start-up testing added for FSAR Revision 3
 - Includes Cooling Tower Design Report
 - Performance curves
 - Recorded temperature – worst case meteorological data
 - Basin water temperature trending (30 days)
 - Includes effects of concentrated impurities in MDCT basin
 - Includes all assumptions, analytical methods & uncertainties
- **Open Item - Technical Specification 3.7.9; applicant to address possible TS surveillance for wet bulb temperature**

9.2.8 SCWS-Challenges

- **SCWS Water Hammer Considerations**
 - FSAR R/2 modified to add clarification:
 - Pressurized expansion tanks with nitrogen
 - Specified closing valves speed- slow enough to prevent damaging pressure increases
 - Chapter 14 testing – tests to verify there is no evidence of a water hammer

9.2.8 SCWS-Challenges

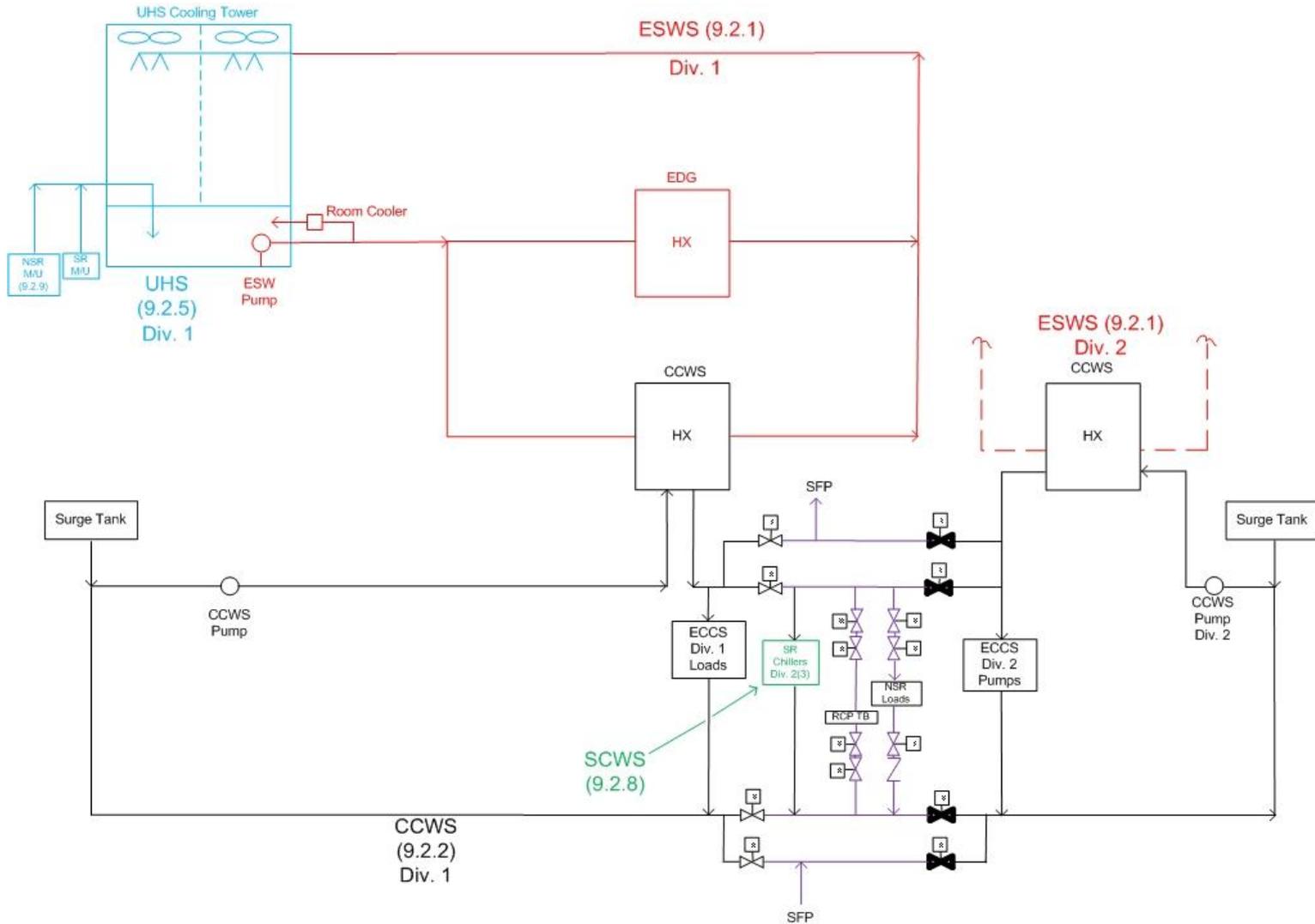
- **SCWS Surge Tank Sizing and System Leakage**
 - FSAR Revision 2 & 3 modified to add clarification:
 - 100 gallon water reserve for 7 day
 - Assumes no safety related makeup for 7 days
 - TS SR 3.7.9.4 leakage verification (24 months), < 0.5 gallon per hour
 - Defense-in-depth makeup from nonsafety-related Fire Protection (seismic Cat. II)

- **Staff Conclusions for ESWS, CCWS and SCWS**
 - Applicable Regulatory Requirements are satisfied

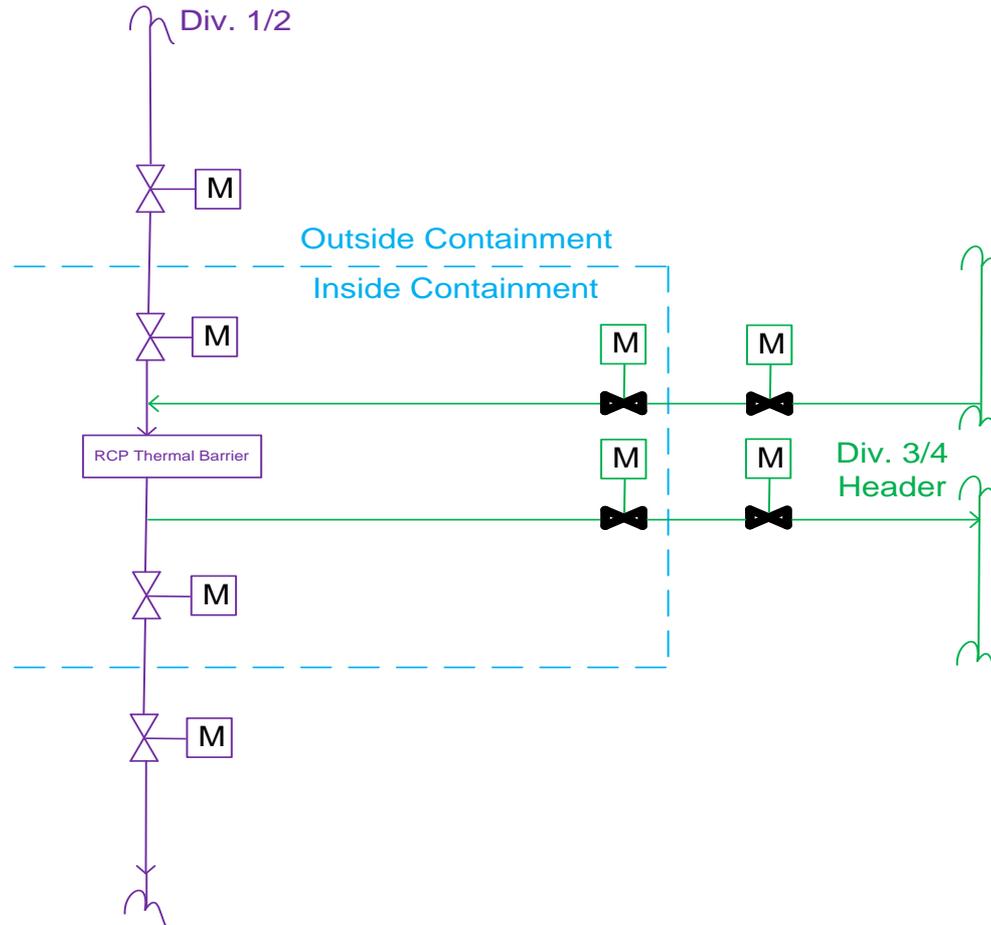
- **Staff Conclusions for UHS**
 - Applicable Regulatory Requirements are satisfied with the exception of resolution of open item related to TS and wet bulb considerations

- **Questions?**

Backup slide EPR ESWS, CCWS, UHS, SCWS Simplified Drawing



Backup slide CCWS Thermal Barrier Cross-tie





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Presentation to the ACRS Subcommittee

SERIOI Chapter 9 Section 9.4

Air Conditioning, Heating, Cooling and Ventilation Systems

James O'Driscoll

November 14-15, 2011

Area of Review

SRP Sections

- 9.4.1 Control Room Air Conditioning System
- 9.4.2 Spent Fuel Area Ventilation System
- 9.4.3 Auxiliary Building Ventilation System
- 9.4.4 Turbine Building Ventilation System
- 9.4.5 Engineered Safety Feature Ventilation System

- ♦ Applicable Regulations and Review Guidance
 - GDC 2 – Design Bases for Protection against Natural Phenomena
 - GDC 4 – Environmental and Dynamic Effects Design Bases
 - GDC 5 – Sharing of structures systems and components
 - GDC 17 – Electric Power Systems
 - GDC 19 – Control Room
 - GDC 60 – Control of Releases of Radioactive material
 - GDC 61 – Fuel Storage and Handling and Radioactivity Control
- ♦ 10 CFR 20.1406 – Minimization of Contamination.

Technical Topics of Interest

Section 9.4.1 – MCR HVAC

Clarify method by which the capacity of the safety-related ventilation systems are verified.

Staff Evaluation

- Adequate sizing of safety-related systems is assured through the surveillance requirements.
- There are no ITAAC that verify HVAC capacity to support the 10 CFR 52.103(g) finding.
- RAI applies to FSAR Sections 9.4.1,2,5,6,9, and 11.
- Open Item:
RAI 277, Question 09.04.01-1: Requests that the applicant provide sufficient ITAAC to verify that the safety related ventilation systems are designed with sufficient capacity to remove the design heat load for all modes of operation and environmental conditions within the site envelope.

Technical Topics of Interest

Section 9.4.3 – Non Safety-Related HVAC

Clarify The Safety-Related function of the Containment Building Ventilation System.

The description of the safety related function of the CBVS in Tier 1 and Tier 2 of the FSAR is unclear. The description of what portions of the CBVS are safety-related is unclear.

Staff Evaluation

- Based on the response to RAI #277 Question 09.04.03-3, the staff understands that only the low-flow purge exhaust subsystem outside of containment is designated as safety-related. The FSAR and Tier 1 remain unclear as to what is the safety related function of the CBVS low volume purge subsystem.
- Open Item
RAI 509, Question 09.04.01-7: Requests that the applicant clarify the safety- related function of the CBVS in Tier 1 and Tier 2. Clarify what Technical Specification Surveillance requirements are needed to verify operability of the CBVS low volume purge exhaust trains.



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Presentation to the ACRS Subcommittee

SERIOI Chapter 9 Section 9.5.1 Fire Protection System

Edward McCann

November 14-15, 2011

ACRS Subcommittee Presentation

SERIOI Chapter 9 Section 9.5.1

Issues of Interest

- Communication: Exclusion Zones - An alternative means of communications via one of the fixed communication systems is provided that is free of fire effects if needed.
- Emergency Lighting: Special emergency lighting system in the MCR and RSS
 - Receives power from redundant emergency diesel generator backed uninterruptible power supplies, thus providing continuous illumination.
- Multiple Spurious: It is the intent of the U.S. EPR design to follow the NRC endorsed/issued spurious actuation guidance in effect when the U.S. EPR post-fire safe shutdown analysis is formally initiated .
 - In RAI 517, Question 09.05.01-86 stated that the applicant should document the use of RG 1.189 Revision 2 and the endorsed sections of NEI 00-01 Revision 2 in the FSAR for Post-Fire Safe Shutdown Circuit Analysis Methodology.

ACRS Subcommittee Presentation

SERIOI Chapter 9 Section 9.5.1

Issues of Interest

- Digital Equipment: No credit is taken for digital equipment design features to preclude fire-induced spurious actuations . However, credit is taken for the lack of hot shorting for fiber optic cables.
- Smoke Control :
 - ♦ Smoke Confinement System for areas credited for post fire safe shutdown
 - ♦ Smoke Effects Analysis
 - ♦ Smoke dampers, fire barriers, manual smoke control procedures, and automatic sprinklers where applicable
 - ♦ There are ITAACs related to mitigation of the propagation of smoke for structures



Chapter 9 Group I Sections

Questions?