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2 NUCLEAR REGULATORY COMMISSION

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4 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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6 US-APWR SUBCOMMITTEE

7 MEETING

8 + + + + +

9 OPEN SESSION

10 + + + + +

11 TUESDAY,

12 November 4, 2008

13 + + + + +

14 The Subcommittee met at the Nuclear
15 Regulatory Commission, Two White Flint North, Room
16 T2B3, 11545 Rockville Pike, Rockville, Maryland, at
17 8:30 a.m., Otto L. Maynard, Chairman, presiding.

18 MEMBERS PRESENT:

19 OTTO L. MAYNARD, Chairman

20 DENNIS C. BLEY, Member

21 CHARLES H. BROWN, JR., Member

22 WILLIAM J. SHACK, Member

23 JOHN D. SIEBER, Member

24 JOHN W. STETKAR, Member

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1 STAFF PRESENT:

2 NEIL COLEMAN, Designated Federal Official

3 LARRY BURKHART

4 MIKE MAGEE

5 TERRY JACKSON

6 MICHAEL JUNGE

7 JEFF CIOCCO

8 ALSO PRESENT FROM MITSUBISHI HEAVY INDUSTRIES AMERICA,

9 INC. :

10 KEN SCAROLA

11 AKAGI KATSUMI

12 MASAFUMI UTSUMI

13 MAKOTO TAKASHIMA

14 SHINJI KAWANAGO

15 TOM WILSON

16

17

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

(8:30 a.m.)

CHAIRMAN MAYNARD: This is a meeting of the Subcommittee for the Design and Certification Review of US-APWR, the event PWR. I am Otto Maynard, Chairman of the Subcommittee.

And members in attendance today, we have Jack Sieber, John Stetkar, Bill Shack, Dennis Bley, and Charlie Brown. The Federal Designated Representative for today's meeting is Neil Coleman.

Today's meeting is an informational meeting only. We have four topical reports associated with INC, Human System Interface, Human Factor Engineering, Diversity and Defense In-depth that we will be going over.

Portions of the meeting will be closed to the public due to the discussions being proprietary. There are designated times on the agenda for public comment to give the public an opportunity to provide input, if they so desire.

As a reminder for the members, this is information only. The reports are still under review by the staff. We are not being asked to write a letter or to make any final conclusions or anything. This is for our information. So if we get hung up on

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1 a point, it is not that critical that we get
2 everything resolved. We will be moving on so we can
3 keep the agenda moving. However, our discussions
4 benefit the staff. They can listen to some of the
5 items of interest to us and factor that into our
6 review. And then at some future date we can discuss
7 what we do.

8 And so with that, I am going to turn it
9 over to Larry Burkhart, let him introduce it from the
10 staff's perspective and then we will move on to
11 presentations.

12 MR. BURKHART: Thank you Mr. Maynard.
13 Yes, I am Larry Burkhart, the chief of the US-APWR
14 projects branch. And I would like to thank you, the
15 ACRS Subcommittee for hosting this meeting and thanks
16 to MHI for coming as well as NRC staff and any members
17 of the public.

18 Just a little introduction to make sure
19 you know some of the folks here. To my left is Mike
20 Magee who is one of our chapter project managers
21 specifically for the Instrumentation and Controls
22 area, and Human Factors area. Our lead design project
23 manager is Jeff Ciocco and we have a few of our key
24 technical folks here. Mike Junge in the Human Factors
25 area and Terry Jackson who I know here but he might

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1 have stepped out, from the I and C area. So, I would
2 like to welcome them, too.

3 Yes, we think that these meetings are very
4 beneficial and we definitely saw that two weeks ago
5 when we met on fuel design. Because the staff gets
6 some insights and some perhaps help in formulating
7 some RAIs, MHI gets to hear your perspective, as well
8 as any member of the public. So we think these are
9 very important meetings.

10 Just getting into these areas that the
11 topical reports address, Instrumentation and Controls,
12 on Human Factors, Human System Interface. These are
13 probably two of the most challenging areas with
14 respect to level of detail, what we think we need to
15 see to satisfy the safety requirements. And
16 specifically because in the past in these areas for
17 design search, we have used, applicants have used what
18 we call design acceptance criteria in lieu of
19 providing detailed design information. And that, in
20 general, not to get too deep, but design acceptance
21 criteria tell us how they are going to implement the
22 design, rather than giving us a 100 percent complete
23 design. They gave us enough information for us to
24 make a safety finding.

25 But these designs that are coming in now

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1 and Mitsubishi has told us that they do not intend to
2 use any design acceptance criteria. So, we are on the
3 spectrum of determining where and we will wait to see
4 if that actually happens. We will wait to see. And
5 we are on the spectrum of determining what is the
6 level of detail we need to have 100 percent complete
7 design and to support our safety finding. So, we
8 think these meetings are going to be very useful in
9 helping us get to that answer. So, I know there is a
10 lot of effort on the staff's side in determining that.

11 Another interesting aspect to these
12 topical reports are that Mitsubishi has asked for most
13 of these topical reports to be applicable to operating
14 reactors as well as new reactors. In general, there
15 should be no difference in the requirements but as we
16 get more into the review, we are seeing perhaps there
17 is a different perspective on that. So, just
18 something to throw out there, some unique aspects to
19 these topical reports.

20 So, I would like to sum up again by
21 thanking everybody for supporting this meeting. We
22 think they are very important for everybody involved.

23 And with that, I would like to turn it over to Mike
24 Magee, our chapter PM to start a discussion, a very
25 brief discussion of where we are in our reviews.

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1 MR. MAGEE: Good morning everyone. As
2 Larry introduced, I am Mike Magee, Project Manager for
3 Chapter 7 and Chapter 18. And these topical reports
4 are referenced heavily in both of those chapters.
5 Today, I am going to give you an overview of where the
6 NRC staff is in the review of each one of these
7 topical reports.

8 The purpose of today's meeting. Provide
9 the status of the review on the following topical
10 reports. The Safety I and C Description and Design
11 Process, the HSI System Description and HFE Process,
12 the Safety System Digital Platform, MELTAC and the
13 Defense-in-Depth and Diversity. In addition, we will
14 also address any questions that the committee may
15 have.

16 Again, this presentation is not, it is
17 specific to the review status and the not the
18 technical material. We do have technical staff
19 available to answer any questions. However, Mr. Ken
20 Scarola is going to give us an in-depth presentation
21 on each topical report. And at that point, it would
22 be an opportune time to ask the technical questions.
23 However, if any questions come up, we will attempt to
24 address them.

25 Topical report Defense-in-Depth and

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1 Diversity. The topical report requests approval of
2 the D3 approach to US-APWR. The staff's review
3 focused primarily on MHI's design-based approach to
4 D3, including the Diverse Actuation System for I and C
5 system applied to its US-APWR nuclear power plant
6 design.

7 We are currently in revision two in
8 response to RAIs. RAIs have been reviewed and we are
9 preparing a safety evaluation report, which we expect
10 in late November.

11 CHAIRMAN MAYNARD: Just to make sure we
12 are all on the same page. Could you just briefly
13 describe the D3 option? You say the approach to D3.
14 I'm sorry to D3. Just explain a little bit what that
15 is.

16 MR. MAGEE: I would ask Terry or Royce, if
17 you guys could give a good, better --

18 MR. JACKSON: Basically -- this is Terry
19 Jackson with the staff. And basically in this topical
20 report, with regards to the D3, it is a Defense-in-
21 Depth and Diversity methodology. It doesn't include
22 all of the components for a Defense-in-Depth and
23 Diversity analysis, which would include other aspects.

24 But this is basically where MHI is proposing certain
25 ways to address Defense-in-Depth and Diversity,

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1 including architecture for their Diverse Actuation
2 System and how they plan on using automatic and manual
3 means to address a software common cause failure.

4 CHAIRMAN MAYNARD: Okay. That's fine.

5 MR. MAGEE: Are there any other questions
6 on Defense-in-Depth topical report or the review
7 status?

8 MR. BURKHART: So this is the most near-
9 term safety evaluation report that we will complete
10 before that we are talking about today.

11 MR. MAGEE: The next topical report,
12 Safety System Digital Platform MELTAC. This topical
13 report requests approval of this platform for an
14 application to the safety systems of the US-APWR and
15 for replacement of current safety systems in operating
16 plants.

17 Staff are reviewing both aspects. Review
18 is focused on the design of the Mitsubishi Electric
19 Total Advance Controller MELTAC Platform and its
20 conformance to safety requirements. Revision two has
21 been received. RAI responses are under review by both
22 offices for new reactors and operating reactors. We
23 expect a safety evaluation report on this topical
24 report in June of 2009.

25 MEMBER SHACK: Now this wouldn't be a

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1 stand-alone report for the replacement. Right? I
2 mean, they would have to deal with, presumably, the
3 Diverse Actuation System sort of argument also on
4 their own, if an operating plant came in and wanted to
5 adopt this platform.

6 MR. BURKHART: That is something very
7 interesting. There are, of course, other topical
8 reports that are associated with what would be needed
9 to replace an existing operating plant. And we are
10 working with NRR to determine what kind of different
11 processes/steps/requirements there might be for
12 operating plants.

13 MEMBER SHACK: I am just sort of wondering
14 what you approve when you approve this.

15 MR. BURKHART: That is a very good
16 question. And are probably not 100 percent clear
17 exactly what we are going to approve. I will let
18 Terry discuss that.

19 MR. JACKSON: Terry Jackson again. The
20 multi-platform is, essentially, the computer platform
21 that they are planning on implementing some of the
22 safety INC systems, for example, reactor trip and
23 engineering safety features actuation using this
24 platform. So, it is a key component but, like you
25 said, it doesn't fully address all of the aspects for

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1 a safety-related INC system. So there are other
2 aspects that have to be addressed, either if it is an
3 occurring operating plant at the time that the
4 licensee comes in with the license amendment request
5 or even for US-APWR, the design certification will
6 address aspects that the MELTAC Platform doesn't
7 cover.

8 MR. BURKHART: It is usually from a
9 process standpoint. The question that I am concerned
10 with is, as NRO, our priority is finishing the review,
11 getting the information we need for the design
12 certification. There may be an instance, and let me
13 back up by saying that there is no licensee who has
14 referenced this platform to be replaced in an
15 operating plant. Not like Oconee with the AREVA
16 system.

17 So, and I only say that because there may
18 be a divergence.

19 MEMBER SHACK: But if you guy write an SER
20 on this one, it might.

21 MR. BURKHART: Well, our SER could --

22 MEMBER SHACK: It would depend on how you
23 --

24 MR. BURKHART: Good point. Our SER though
25 could be limited to only the US-APWR. So, I throw

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1 that out there as when you do see an SER on this, we
2 don't know exactly what it is going to apply to. We
3 may have one SER for the US-APWR. There might be
4 certain different requirements for operating plants.
5 There might be a supplement to the SER or a different
6 SER for our operating plant. So, we haven't gotten
7 there yet.

8 I can say that from this office's
9 perspective, we are focusing on what we need to do to
10 write an SER for our operating reactors. Right now,
11 we want to do them together, consolidate SER for
12 operating reactors -- I'm sorry. We want to focus on
13 new reactors. Right now the plan is to address it
14 together with NRR. We are working with them to try to
15 do that.

16 MEMBER BROWN: Question. Brown. Are we
17 supposed to give our names today?

18 CHAIRMAN MAYNARD: You don't need to.
19 You've got a name tag on.

20 MEMBER BROWN: All right. I just want to
21 make sure I am clear today. I have several questions.

22 In a couple of these reports, this
23 platform was referred to in two different ways. One
24 is MELTAC. Then there was another listing of it is
25 called MELCO. That was in the INC system description.

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1 Are they the same thing or are they different?

2 MR. BURKHART: I think MELCO is the
3 company.

4 MEMBER BROWN: But they call it a MELCO
5 platform.

6 MR. BURKHART: Okay.

7 CHAIRMAN MAYNARD: We are going to have an
8 opportunity. They are going to be up presenting --

9 MEMBER BROWN: Oh, okay. Do you want me
10 to wait?

11 CHAIRMAN MAYNARD: --the company will.

12 MEMBER BROWN: Okay, that's fine.

13 CHAIRMAN MAYNARD: So, wait until they get
14 up and present.

15 MEMBER BROWN: All right. I'm happy.
16 I've got 20 pages of questions.

17 MR. BURKHART: Okay. Again, we are
18 focused on just the status. I kind of went off base
19 so I apologize. We are focusing on just the status of
20 where we are in our reviews, which is pretty much
21 almost the beginning on most of these.

22 MR. MAGEE: Thank you, Larry.

23 The next topical report HSI System
24 Description and HFE Process. This topical report
25 requests approval of the HSI System design and its

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1 design process for the application to HSI System of
2 the US-APWR and replacement of current HSI Systems in
3 operating plants.

4 This review has been focused or it was
5 conducted using the elements of NUREG-0711, Human
6 Factors Engineering Program Review Model. Review
7 emphasis was placed and is placed on the six planning
8 and analysis elements, as these elements are used as a
9 basis of the HSE's design of the control room. We are
10 currently in revision two in response to RAIs. RAI
11 responses have been received and they are currently
12 under review.

13 Safety Evaluation Report for this topical
14 report due date is under evaluation. Some of the RAI
15 responses have requested additional documentation.
16 And until we received that additional documentation
17 that we are expected sometime the second half of next
18 year for a safety evaluation report.

19 MEMBER BLEY: So in this case, you have
20 decided that the single SER will cover both operating
21 plants and --

22 MR. MAGEE: That is the way we are
23 reviewing it, yes.

24 MR. BURKHART: Yes, I would just throw out
25 there, not being a technical expert but a process

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1 expert, I think that is the intention. But I think,
2 depending on what happens in the reviews, it could
3 diverge. That is my opinion from having worked here
4 on these very difficult issues for a while. But the
5 intention right now is address them together.

6 MEMBER BROWN: And the US-APWR and other
7 plants where this may want to be applied?

8 MR. BURKHART: Yes.

9 MEMBER BROWN: Cover them both in one?

10 MR. BURKHART: That is what they have
11 asked us to do and that is what we were intending.

12 CHAIRMAN MAYNARD: There are several of
13 the topical reports where they have asked for both.
14 Our focus for our meetings need to be on the design
15 certification review for the US-APWR. The staff is
16 going to have to struggle with some of these as to
17 whether that gets all done in one SER or whether it
18 gets --

19 MR. BURKHART: We are interested in
20 hearing if you have any thoughts on the issue of
21 operating reactors and new reactors, too. Because
22 right now, that is our plan is to address them
23 sufficiently for both. So, we are interested in
24 hearing.

25 MEMBER SIEBER: Oh, I think if we write a

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1 letter though, we ought to address the way that the
2 staff intends to certify as opposed to restricting
3 ourselves to the APWR.

4 MR. BURKHART: I would agree with that.

5 MEMBER SIEBER: If those incidents come
6 up, we have to think about them and, if necessary,
7 comment on them.

8 MR. BURKHART: Yes, and if we think this
9 warrants us coming to you for this SER by itself, you
10 will certainly have a very good heads up on where we
11 are going on that. So, we will keep communications
12 open on that.

13 MEMBER SIEBER: I think we can handle it
14 either way.

15 MR. BURKHART: But we are really
16 interested in getting your feedback and any thoughts
17 you might have on the, might there be any differences
18 in operating reactors and new reactors, definitely.

19 CHAIRMAN MAYNARD: Okay.

20 MR. MAGEE: Any other questions?

21 For the fourth topical report, Safety I
22 and C System Description and Design Process. This
23 topical report requests approval of the MHI design and
24 design process for application to the safety systems
25 of US-APWR and replacement of current safety systems

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1 in operating plants. This review is focused on the
2 design of the MHI digital safety systems and the
3 design process used for the application of these
4 systems to specific nuclear power plants.

5 Revision one has been issued. RAI
6 responses are being received and reviewed by both
7 offices for new reactors and for operating reactors.

8 Safety evaluation. This topical report
9 and the MELTAC Platform topical report are closely
10 linked and its safety evaluation report is also due at
11 the same time in June of 2009.

12 Are there any questions on the safety I
13 and C review status?

14 To summarize, the topical report, the
15 review status --

16 MEMBER BLEY: I'm sorry.

17 MR. MAGEE: Yes?

18 MEMBER BLEY: Can I back you up --

19 MR. MAGEE: Absolutely.

20 MEMBER BLEY: -- to the HSI one.

21 MR. MAGEE: Absolutely.

22 MEMBER BLEY: I have two questions on that
23 one. Is NUREG-0711 the one that was developed at
24 Brook Haven that talks about process rather than
25 detailed review?

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1 MR. JUNGE: I'm sorry.

2 MEMBER BLEY: Was 0711 the NUREG, the one
3 that was developed at Brook Haven that looks --

4 MR. JUNGE: Yes.

5 MEMBER BLEY: -- at a review of process?

6 Well, if they are not coming in for DACs
7 on this and they are going to have the complete
8 program, would that be the right basis for the review?

9 MR. BURKHART: Well remember, this is
10 their topical report that lays out their approach.
11 And the detailed design information would come in
12 those part of the --

13 MEMBER BLEY: Okay, so that will come
14 later. That makes sense. Thanks.

15 MR. BURKHART: So, that is a good question
16 because that is where we are in this review. So, in
17 theory yes, we should see all the detailed design
18 information.

19 MEMBER BLEY: Eventually, okay.

20 MR. BURKHART: In my opinion, having dealt
21 with designs that have used DAC before, having only
22 experience with using DAC before in these areas, I
23 really want to see how we get to 100 percent complete
24 design in these areas. Because I don't, again, I am
25 not a technical expert, really don't see how that can

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1 happen. Is it going to be more detailed that what we
2 have seen before? Yes, that is for sure. Is it going
3 to be what we consider 100 percent detail? MHI says
4 yes. So I would say, we will see. So, that is just
5 an opinion from having worked in this area before.

6 MR. BURKHART: Okay, Mike.

7 MR. MAGEE: You had two questions. So,
8 your second question?

9 MEMBER BLEY: I did, yes. Thank you for
10 reminding me. The other one was the HSI is the only
11 one that you don't have a planned date yet for
12 completion. Is that due to some details of what they
13 have submitted or you haven't reached that point yet?

14 MR. MAGEE: We haven't. We need to
15 address, this week we are addressing some
16 documentation that we need in order to complete the
17 review.

18 MEMBER BLEY: Okay.

19 MR. MAGEE: And when that documentation
20 comes in, we will have a much better framework for
21 which to establish a schedule to complete.

22 MEMBER BLEY: Okay.

23 MR. MAGEE: But we are anticipating that,
24 in conjunction with some technical reports that are
25 being submitted, that we will be able to get an SER

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1 out in the second half of next year but this is as
2 close as I can approximate right now.

3 MR. BURKHART: And you will hear more
4 about the basis of their HFE, HSI program in their
5 presentation. And we just had some questions about
6 how they did their up-front and basically using their
7 Japanese plant as some experience in their HSI/HFE
8 development. So, right now we are just asking some
9 questions on how did they plan and design that, you
10 know, the original plant and then to get to where they
11 are with their US-APWR HFE program. So, you will see
12 that in their presentation.

13 MEMBER BLEY: Okay.

14 MR. BURKHART: But there is just some
15 information we need. And once we get that
16 information, we can establish a more concrete
17 schedule.

18 MR. MAGEE: To continue with the summary,
19 we are actively reviewing these four topical reports.
20 Currently the safety evaluation report is being
21 prepared for Defense-in-Depth and Diversity topical
22 report. The MELTAC and Safety I and C SER reports are
23 due in June of 2009. And as we just discussed, the
24 due date for the HSI/HFE topical report is under
25 review.

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1 MR. BURKHART: And just to throw something
2 out there, this issue of these topical reports and
3 platforms being applicable to operating plants and new
4 reactors is not unique to Mitsubishi. AREVA has some
5 similar requests into the staff. In fact, referenced
6 in an Oconee license amendment request to replace the
7 I and C System for an I and C System with a digital I
8 and C System. So, you may not have heard a lot of
9 details about that but just don't go away from here
10 that MHI is the only one who has asked us to do this.

11 AREVA has also. There may be different issues but,
12 in general, there is --

13 MR. JACKSON: Terry Jackson again. Just a
14 little clarification point. On the Oconee, they
15 initially did come in with one of the AREVA topical
16 reports referenced but then they subsequently removed
17 it.

18 MR. BURKHART: Oh, I thought they had
19 submitted another request. No?

20 MR. JACKSON: No, they removed it.

21 MR. BURKHART: Okay. I stand corrected.

22 MEMBER STETKAR: I have a question just
23 for my own personal knowledge, because I haven't been
24 through much of these.

25 I have a TRA background, guys, so I tend

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1 to be sensitive when I see the letters PRA in
2 documents. And I noticed in several of the topical
3 reports, without going into detail, there are several
4 issues that the topical reports refer to the PRA as a
5 basis either for allowed outage times or justification
6 for levels of redundancy, or independence and
7 diversity, or minimum inventory of alarms and
8 indications and things like that.

9 How does the review of the topical reports
10 mesh with reviews of the PRA? In other words, if you
11 approve the topical report in the SER, is that
12 implicitly approving the quality of the underlying PRA
13 where it used as a reference document and analysis? I
14 was a little bit confused about how that process
15 worked.

16 MR. BURKHART: From someone from our
17 process standpoint, I would say no, it doesn't
18 implicitly approve anything about the PRA. From
19 approving that topical report it may say your approach
20 in this topical report is approved but we are
21 reviewing, and Mitsubishi has submitted the generic
22 PRA for the US-APWR. So, I would say, in general, no,
23 we are not approving necessarily the quality of the
24 PRA.

25 I know that you probably know more details

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1 about a PRA than I do --

2 MEMBER STETKAR: No, no. I don't want to
3 get into the details. I was trying to keep this at
4 the kind of higher level process area, in the sense
5 that there are specific, in the topical reports, there
6 are specific numbers in there for allowed outage
7 times, frames of equipment and things like that are
8 ostensibly derived, somehow from the PRA analyses or
9 at least justified by them.

10 So, if you approve the topical report,
11 including those times as a generic basis for the
12 licensing of that design, does that -- how does that
13 work with that underlying analytical basis?

14 MR. JACKSON: I think as we go through in
15 our reviews and stuff, we will need to really consider
16 closely where MHI is proposing the basis for certain
17 designs or techniques and so forth based on PRA. And
18 if there is a sufficient basis here, then we can
19 recognize that. But if there is not, then that is
20 something we would need to call out in safety
21 evaluation.

22 MR. BURKHART: And maybe for the purpose
23 of this meeting we can ask MHI when they give their
24 presentation to highlight those areas.

25 MEMBER STETKAR: I was going to but as I

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1 said, in terms of the general process, I wanted to
2 look at --

3 CHAIRMAN MAYNARD: But aren't the
4 applicants also required to if you find information
5 about availability that you are no longer covered by
6 what was assumed in the topical report? To use a
7 topical report, you have to demonstrate that you fall
8 within the criteria in the topical report.

9 So, I think if they found out later, they
10 are either going to have to improve the availability -
11 -

12 MR. BURKHART: That is an important thing
13 is that we have to address that in the SER, that
14 aspect of use of PRA, however we think that is
15 appropriate in the topical report.

16 MEMBER SIEBER: Could you give me an
17 example where in these four topicalals that there is a
18 reference to the PRA?

19 MEMBER STETKAR: Yes, there are several.
20 And I was going to bring them up during the --

21 MEMBER SIEBER: Yes, just give me one.

22 MEMBER STETKAR: Identification of minimum
23 inventory of alarms and displays for the HSI/HFE. So
24 there was --

25 MEMBER SIEBER: Well, let me ask you a

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1 question. I am at the head table now. Most PRAs that
2 I have seen do not get to the details to what the
3 inventory of instruments needs to be from a risk
4 standpoint. So, it is not clear to me how you get
5 from those instances. And I thought about this.

6 MEMBER STETKAR: Oh, that is -- yes.

7 MEMBER SIEBER: How do you get from the
8 PRA to that?

9 MEMBER STETKAR: I agree with you, Jack.
10 And that is why I asked the question because, indeed,
11 there are examples in that HSI/HFE topical report that
12 have a relatively detailed, a summary but a relatively
13 detailed summary of a THERP-type HRA PRA analysis that
14 evaluates the quality of the indicators and things
15 like that.

16 So, you are led to the belief that they
17 actually did it. And if they did it, then it comes
18 back to the second part of how did they do it and how
19 well it was done.

20 MEMBER SIEBER: My rudimentary knowledge
21 of PRAs sort of told me that standard PRAs don't get
22 to that depth. Maybe they did something special.
23 Those are good questions.

24 MEMBER STETKAR: They usually don't but
25 there are methods.

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1 CHAIRMAN MAYNARD: I think that those are
2 good questions for discussion.

3 MEMBER STETKAR: Yes. I just didn't want
4 to get into the detail. I was more curious about the
5 --

6 CHAIRMAN MAYNARD: I just think it is
7 important for the staff, it is going to be important
8 on the SERs clearly what they do address and don't
9 address.

10 MR. BURKHART: I agree and this is a great
11 example of why we are here early to get these inputs.
12 So, thank you.

13 CHAIRMAN MAYNARD: Any other questions for
14 the staff?

15 MR. MAGEE: I wanted to -- Ken Scarola,
16 did you have a comment that you wanted to share?

17 MR. SCAROLA: Ken Scarola, MHI. I just
18 wanted to say that the entire minimum inventory
19 subject will be addressed. And I think we can hit
20 that PRA issue when we address that.

21 MR. MAGEE: Okay, thanks.

22 CHAIRMAN MAYNARD: Okay. Any other
23 questions for the staff? Did you have any other --

24 MR. MAGEE: No, I did not, sir.

25 CHAIRMAN MAYNARD: Okay. Well I think we

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1 are ready to transition then. Ken are you going to be
2 leading the next discussion?

3 While they are transitioning, I want to
4 remind the members, this next segment is an overview
5 that is open to the public. And it will be an
6 overview that covers all four of the topical reports
7 but it is going to be a public version of it.

8 We are then going to go through each one
9 of the topical reports individually in closed session.

10 So, some of your questions may be more appropriate to
11 wait for the closed session. If you have general
12 questions and stuff, I think that is fine. But if it
13 is going to get into a level of detail that gets into
14 the proprietary information, we will probably be
15 asking to save that until that portion.

16 MEMBER BROWN: You mean you want us to be
17 quite?

18 CHAIRMAN MAYNARD: No. Just don't push
19 them for proprietary answers in this part of it. We
20 won't get into that one.

21 MR. SCAROLA: Well let me just say that we
22 will certainly do our best to answer all of the
23 questions during the open session. But if we feel
24 that we are getting into more detail than is
25 appropriate with, then we will simply ask you to save

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1 your questions.

2 While they are bringing up the
3 presentation, let me just introduce myself. My name
4 is Ken Scarola. I am a technical advisor in the I and
5 C, the Instrumentation and Control, I and C, and Human
6 Systems Interface, HSI, areas for MHI.

7 I will be, over the next two days, the
8 lead presenters on all of the material on these four
9 topical reports. But as you can see in our room, we
10 have brought many people that are much more capable
11 and knowledgeable than I am and they will support us
12 where we need to get more detailed answers.

13 I would like to thank the ACRS for giving
14 us the opportunity to make these presentations. As
15 was stated before, the I and C and HSI areas tend to
16 be very complex areas. This is the basic reason why
17 we submitted these four topical reports about nine
18 months in advance of the US-APWR DCD. Our hope was
19 that we would get a longer period of time for the
20 staff to review these, due to the complexity. And, I
21 think we are getting that review. So, we are very
22 happy about that.

23 Okay, we have the slides up. We will be
24 presenting first an overview in this open session.
25 Then we will go into closed session and present the

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1 details of each one of the reports.

2 I do want to, I would like to introduce
3 the key players that are here or will be here
4 throughout the day. The first one is Shinji Kawanago.

5 Shinji is actually not here this morning. He will be
6 joining us this afternoon. But he is the MHI
7 representative for I and C licensing.

8 We do have Makoto Takashima here. Makoto
9 is responsible for all of the I and C design in the
10 HSI design areas for MHI.

11 We have Masafumi Utsumi, who is
12 responsible for safety systems. And we have Akagi
13 Katsumi, who is our lead representative from MELCO.
14 MELCO is Mitsubishi Electric Company. MELCO builds
15 the MELTAC Platform. So hopefully we can avoid that
16 confusion. And if we do confuse those two in our
17 topical reports, then we will fix it.

18 But very clearly, MELCO is the name of the
19 company.

20 MEMBER BROWN: But will you use them
21 interchangeably? That is all I wanted to know.

22 MR. SCAROLA: You know, we try to use
23 MELTAC Platform. In some cases we have probably said
24 the MELCO Platform. It was certainly not intended to
25 confuse you in any way but we will fix it.

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1 MEMBER BROWN: At my age, I am easily
2 confused.

3 MR. SCAROLA: Okay. Oh, just a little bit
4 on my background. I was the lead I and C and HSI
5 designer, manager, whatever you call us, for the
6 System 80 Plus certified design. So for me, this is
7 very much dé-jà vu. The last time I presented to the
8 ACRS, you were in Bethesda in a very, very tiny
9 building many, many years ago.

10 But what is very interesting is that the
11 US-APWR and the I and C systems for the US-APWR that
12 are the subject of these four topical reports are
13 very, very similar to what the staff certified for
14 System 80 Plus. So, there is a lot of background here
15 that is applicable here. And I will be bringing some
16 of those points up as we go through this presentation.

17 The purpose of these topical reports is
18 first and foremost to describe MHI's I and C and HSI
19 System designs. In addition, the intent is to
20 describe the design process past, current and future.

21 Now, what that means is the design process that was
22 used for the development of the designs as you see
23 them today in the topical report, the design process
24 that we are now applying to apply those designs to the
25 US-APWR so that is current, and the design processes

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1 that we expect to apply if we are fortunate enough in
2 the U.S. to get a U.S. operating plant to select these
3 platforms or these designs for a digital upgrade in
4 the U.S.

5 So the design processes, in many cases are
6 written in present tense. And they are written that
7 way because they are applicable to both past, present,
8 and future.

9 Finally, we are seeking NRC approval of
10 both the designs and the design processes.

11 Now, we talked about the four topical
12 reports. And when they were introduced, the staff
13 said that three of the reports are applicable or that
14 MHI has requested approval for both the US-APWR's
15 operating plants. But the D3 report, the review
16 process is only for the US-APWR.

17 I do need to clarify that a little bit.
18 The D3 report, as it is written, states that it is
19 applicable to both new plants and operating plants.
20 But there was an interaction with the staff that
21 basically said that was probably impractical and would
22 likely delay the US-APWR. So, MHI has accepted that
23 the staff's review, at least initially, right now,
24 would be exclusively for the US-APWR.

25 It is very likely that MHI will come back

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1 sometime in the future and say, okay, would you now
2 conduct the same review for an operating plant on the
3 same topical report because the topical report is
4 written generically. So, just a point of
5 clarification.

6 MEMBER STETKAR: When I think about the
7 general, the Safety I and C Design topical report,
8 that does indeed make reference to the DAS design, to
9 some extent, at least as far as the interface.

10 Does that mean that when we think about
11 the Safety I and C, whatever it is called, the topical
12 report on Safety Systems Design and Process, when we
13 think about the D3, the Diverse Actuation System
14 impact within the context of that topical report, we
15 should think about it in some generic term when we are
16 thinking about operating plants.

17 MR. SCAROLA: Yes. Very clearly --

18 MEMBER STETKAR: Because when I was
19 reading the two, I had to bounce back and forth
20 between the two to think about it is going to work.

21 MR. SCAROLA: It would never be HMI's
22 intent to apply the Safety System Design, which is a
23 digital design, to an operating plant without a
24 strategy for Defense-in-Depth and Diversity to address
25 common cause failure.

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1 So, it is very, very difficult to unlink
2 these two. You clearly must have a Defense-in-Depth
3 strategy. That is reference in the safety system. It
4 does reference the D3 report. So, I think we have a
5 disconnect.

6 MEMBER STETKAR: But your message is that
7 at the moment the D3 report is strictly for the US-
8 APWR.

9 MR. SCAROLA: Well, at the moment it is
10 written to be applicable to both. The staff is
11 reviewing it only for the US-APWR.

12 CHAIRMAN MAYNARD: What I intend -- what
13 you believe will probably come out is an SER that is
14 applicable only to the US-APWR, at this point. But
15 the topical report, you believe, can be applied with
16 further review to all of them.

17 MR. SCAROLA: Right. I think what would
18 happen here is the SER for the safety system is going
19 to have to say that this safety system can only be
20 used with an appropriate D3 strategy. Because that
21 would only make sense. You have a digital safety
22 system, you must have some strategy for common cause
23 failure.

24 So, I think it is going to have to be an
25 open item in the safety system SER that would have to

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1 be addressed for operating plants, either by an LAR
2 referencing that D3 topical report and having it
3 reviewed during the LAR process. But hopefully we can
4 just come back in and put that open issue to bed
5 before an LAR comes in because we would clearly like
6 to see it done generically.

7 So, we have a little bit of a schedule
8 problem here but I think we have addressed it. Okay,
9 next slide.

10 The intent of this meeting is to provide
11 the ACRS a better understanding of what the content
12 is, to provide details of what we call the key
13 technical issues, to focus on some of the key issues.

14 We obviously, there is probably 400 or more pages of
15 topical report. We can't get into everything. We are
16 going to discuss what we think are the key issues.
17 Clearly, if you have questions in any areas, we are
18 here to answer those questions. But recognize that we
19 had to select certain things for this meeting.

20 MEMBER BROWN: Will you be able to make
21 reference to certain sections of your topical report,
22 in response to questions if they reference those?

23 MR. SCAROLA: I will try.

24 MEMBER BROWN: For instance, a question
25 that says, hey, on this page in this section, whatever

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1 it is that addresses this function, --

2 MR. SCAROLA: I think so.

3 MEMBER BROWN: -- will you be able to
4 answer that question?

5 MR. SCAROLA: I think between me and all
6 the people here, we should have enough knowledge of
7 the topical reports. So on that level --

8 MEMBER BROWN: Well sometimes that is a
9 little hard if you don't have a copy of -- I hate to
10 read the words. I am prepared to do that.

11 MR. SCAROLA: When we get into the closed
12 sessions --

13 MEMBER BROWN: One of the --

14 MR. SCAROLA: -- I will have my computer
15 here. I just didn't set it up now. So I will be able
16 to go right to the paper.

17 MEMBER BROWN: Well, I have got them also.

18 MR. SCAROLA: Okay.

19 MEMBER BROWN: So, it is just a matter of
20 if other people want to see them. And that's just a
21 methodology question. That is all.

22 CHAIRMAN MAYNARD: I think wait until we
23 see if we get into those questions and see.

24 MEMBER BROWN: Okay.

25 MR. SCAROLA: And of course, finally, we

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1 are anxious to hear your feedback. We welcome the
2 opportunity to present to the ACRS and to hear what
3 you think about these designs.

4 I think one of the things that I have seen
5 in working with MHI is it's a pleasure to work with
6 them. There is no sense of "not invented here, we are
7 not doing that." They are open to discussion, open to
8 comments, and very clearly open to change, if that is
9 necessary. So, we welcome your feedback.

10 Okay. The way we will do this is we will
11 provide an overview of the topical reports, rough
12 design description, key issues. And again, this is an
13 overview.

14 What we thought we would also do,
15 depending upon timing, is if we have the time, we
16 would like to present actually something that is not
17 in the topical reports. And that is the way we see
18 operations and maintenance in power plants today
19 changing because of this digital technology. Now, if
20 we don't have the time for that, we won't do it. But
21 it is something we are always asked. So, we thought,
22 if we had the time, it might be worthwhile to go
23 through some of these things. Because it will help
24 you get a better perspective on why we think this
25 digital technology is so valuable and why we are

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1 trying to get it approved.

2 Okay. Then, of course, we will go through
3 the closed sessions and we will present each one of
4 the topical reports in detail. We will present the
5 four topical reports in the following sequence.

6 First, the Safety I and C System
7 Description. The reason is that really presents an
8 overview of the entire MHI design.

9 Then we will present the HSI. Again, the
10 HSI is from a broader perspective. It really helps
11 you understand what we are trying to achieve in both
12 the architecture underneath the HSI and what we are
13 trying to give to the operators themselves.

14 Then we will talk about the MELTAC
15 Platform. The MELTAC Platform is the fundamental
16 building block that makes all this work. It is the
17 digital controllers, the IO, etcetera.

18 Once you get an understanding of how all
19 of these pieces are arranged, then we can get into
20 Defense-in-Depth and Diversity because, in order to
21 understand D3, you really need to look at the entire
22 design in aggregate. So that is why we plan to
23 present these in this order.

24 Okay. Just a little bit about what MHI is
25 doing in the licensing arena. A very important part

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1 of digital I and C licensing are the recent task
2 working groups that the staff has organized and which
3 NEI is leading the industry participation. MHI
4 participates in all of these task working groups,
5 cyber security, D3, risk informing, digital I and C,
6 data communications, human factors, licensing process,
7 and also new reactor operator licensing. These are
8 all related to digital I and C or digital HSI. MHI
9 participates in all of these and we believe that the
10 topical reports reflect the interim staff guidance
11 that has come out of all of those task working groups.

12 Now of course, the staff is going to
13 review against that. But at least it is clearly our
14 intent to comply with the interim staff guidance and
15 we think we have done that.

16 CHAIRMAN MAYNARD: I take it in some of
17 your discussion, you have talked a little bit about
18 your simulator facility.

19 MR. SCAROLA: Yes, absolutely. We will
20 talk about it. And so let me just say right up front,
21 we would like to give you an open invitation if you
22 haven't gotten one already to come visit our
23 simulator. We would love to have you there and see
24 what we have done.

25 CHAIRMAN MAYNARD: Yes, we have received

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1 one and we will be talking about that.

2 MR. SCAROLA: Okay. So, let me go on to
3 the first topical report, which is the Safety I and C
4 System Description and Design Process Topical Report.

5 This slide simply presents the table of contents. We
6 will get into this certainly section by section when
7 we go through the details. Let me just say that the
8 purpose of all of these topical reports is certainly
9 to achieve an SER from the staff that is applicable,
10 as we said, either to both operating plants and US-
11 APWR or, in some cases as we pointed out before,
12 possibly only to the US-APWR. But as documented in
13 all of them, it says both.

14 We get into the scope of what is in the
15 topical report. For example, in this one, the scope
16 is primarily the safety systems but we do talk about
17 the interface of the safety systems to the non-safety
18 systems. Because certainly those interfaces and the
19 isolation, the data communication between safety and
20 non-safety is significant.

21 Section three identifies all of the
22 applicable regulatory criteria. And we will go
23 through some of the key criteria later. Section four
24 is really the meat of the document in terms of
25 describing the design. Section five addresses the key

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1 design basis issues. Section six speaks to this idea
2 of design process. What is the process that was used
3 for developing this? What is the process? What are
4 the key points of the process that we need to apply
5 going forward, when we apply this safety system to any
6 specific power plant? Things like qualification
7 analysis, response time analysis, etcetera, we will
8 get into that.

9 Section seven really is intended to help
10 the staff understand what we are asking them to
11 approve here and what is not there and must be
12 addressed in plant-specific licensing documents. So
13 this is what we call future submittals. So, in the
14 case of the US-APWR, the US-APWR is a plant-specific
15 application of this safety system design. So what
16 this section, section seven says is these are all the
17 things you should expect to find in the US-APWR
18 documentation that you are not finding in this topical
19 report. Things like the response time analysis. That
20 is a plant-specific thing. It would be done on a
21 plant-specific basis.

22 So these are, it is really intended to
23 help the staff understand what we are expecting
24 approval for and what we are saying you are going to
25 see later.

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1 CHAIRMAN MAYNARD: And they basically have
2 an example of that right now. They have the topical
3 report. They have the DCD and actually even a COLA
4 now.

5 MR. SCAROLA: Right.

6 CHAIRMAN MAYNARD: So, they can say what
7 you are saying is in here and what should be in the
8 DCD.

9 MR. SCAROLA: Correct. Now, in addition
10 to those topics, we have some very detailed
11 appendices, one focusing on IEEE-603, the other
12 focusing on IEEE-7432. These two IEEE standards are
13 essentially what the industry thinks about as the
14 bible for safety system design requirements. They are
15 the key requirements. 603 applies to all safety
16 systems, whether they are digital or analogue. 7432
17 essentially supplements 603 for computer-based safety
18 systems. In the appendices, we go through each
19 paragraph and we address how we comply with each
20 paragraph of these issues.

21 Appendix C gives more detail on something
22 that we call spurious actuation, which is a very
23 important issue when we look at non-safety systems and
24 what they can do regarding causing plant transients
25 that are either within or possibly outside the bounds

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1 of the safety analysis. So, Appendix C essentially
2 gives our position on spurious actuation. And we will
3 talk more about that because it is an important issue.

4 Okay. This is a drawing that I will use
5 several times throughout the next two days. It
6 provides an overview of the overall I and C System. I
7 will walk through it at a high level now and then we
8 will get into it in more and more detail as we go
9 through each one of these topical reports.

10 The layout of this drawing is that the
11 bottom of the drawing represents the I and C interface
12 into the plant. This would be the instrumentation
13 that is monitored by the I and C and the pumps and
14 valves, heaters, breakers, that the I and C controls.

15 So, these are all, the plant interfaces are at the
16 bottom. The very top of the drawing represents the
17 human systems interface.

18 This section of the drawing is what we
19 call the PSMS, the Protection Safety Monitoring
20 System. This is really the key subject of the safety
21 system topical report. The safety system topical
22 report describes the architecture of the reactor
23 protection system, which is a key component of safety
24 systems in nuclear power. It describes the
25 architecture of the engineered safety feature

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1 actuation system, another key component, and the
2 architecture of what we call the safety logic system.

3 The safety logic system is where we do the
4 combinational logic, combining manual signals,
5 automatic signals, process interlocks for the
6 actuation of each individual pump and valve in the
7 plant.

8 So, if this valve gets manual control
9 signals from the main control room, manual control
10 signals from the remote shutdown panel, automatic
11 signals from engineered safety features, interlocks
12 from sensors, all of those things that are typically
13 combined in relay logic, in existing power plants, are
14 now combined in digital control logic in this design.

15 So, the topical report focuses on this
16 boundary. Now, in understanding that boundary, the
17 topical report also describes all of the interfaces
18 into the non-safety system, what we call the Plant
19 Control Monitoring System. The PCMS is where you will
20 find systems such as reactivity control systems,
21 pressurizer level, pressurizer pressure, steam
22 generator water level control, turbine control
23 systems. All the non-safety systems in the plant
24 exist in this boundary.

25 When we move up in the hierarchy, we get

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1 to the human systems interface. Now, the human
2 systems interface has both safety components, which
3 are part of the PSMS, as we see here. These are
4 safety-related ESF actuation and reactor trip system-
5 level manual actuation switches that interface from
6 the main control room down into the safety systems.
7 We also have on this other side safety video display
8 units which are part of the HSIS but are in an
9 extension of the protection and safety monitoring
10 system.

11 Similarly, we have non-safety man-machine
12 interfaces that you see here in this pink color. And
13 these are an extension of the PCMS. These are all of
14 our non-safety man-machine interfaces. This will make
15 a little more sense when we go to the next slide,
16 where we show the control room.

17 MEMBER SIEBER: I have a simple question.

18 I see you have a manual reactor trip that bypasses
19 all the digital systems. As far as pump starts and
20 stops, valve opening and closing, do manual switches
21 override the digital?

22 MR. SCAROLA: For individual pumps and
23 valves, we do not have, in the normal man-machine
24 interface, we do not have the same type of bypass of
25 the digital systems as we do for reactor trip. But we

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1 do have reverse actuation.

2 MEMBER SIEBER: Well --

3 MR. SCAROLA: Let me explain that.

4 MEMBER SIEBER: Let me just refine my
5 question just a little bit.

6 This probably would never happen but the
7 digital system may say start that pump and open the
8 suction and discharge valves. And the operator would
9 say, I don't want to start that pump. If he trips it,
10 will the automatic system try to start it again?

11 MR. SCAROLA: Inside existing control
12 rooms, manual switches have functions such as pull-to-
13 lock on pumps.

14 MEMBER SIEBER: Okay.

15 MR. SCAROLA: Are you familiar with a
16 pull-to-lock function?

17 MEMBER SIEBER: Yes, I was an operator.

18 MR. SCAROLA: We have a software-based
19 pull-to-lock that an operator can actuate from the
20 VDUs. So, if the safety system were to actuate, the
21 operator can decide, no, I don't want that actuated.
22 I can go through a series of steps and put that pump
23 in the pull-to-lock mode so it shuts off.

24 MEMBER SIEBER: And he does it through the
25 digital system --

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1 MR. SCAROLA: Through the digital system.

2 MEMBER SIEBER: -- as opposed to locking
3 it out by hand.

4 MEMBER STETKAR: Through the operational
5 digital system.

6 MR. SCAROLA: The operational digital
7 system. Now, --

8 MEMBER STETKAR: The non-safety.

9 MR. SCAROLA: -- let's take the case --

10 MEMBER SIEBER: So if it did fail, you may
11 not --

12 MR. SCAROLA: Let's take the case where
13 the digital system has actually failed --

14 MEMBER SIEBER: Okay.

15 MR. SCAROLA: -- and I go to pull to lock
16 and I can't do it.

17 MEMBER SIEBER: Right.

18 MR. SCAROLA: Okay. Now we rely on what
19 we call the Diverse Actuation System. The Diverse
20 Actuation System is our analogue backup to address
21 common cause failure. The Diverse Actuation System
22 has both an automated part that will automatically
23 actuate systems and it has a manual part that allows
24 operators to manually actuate systems. This manual
25 part is conventional hard-wired switches and hard-

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1 wired controls.

2 MEMBER SIEBER: Does it override the
3 digital system?

4 MR. SCAROLA: It does not override the
5 safety directional commands of the digital system.

6 MEMBER SIEBER: Thank you.

7 MR. SCAROLA: We'll talk about that. But
8 we will talk about that more as we get into the
9 details. What we have is what we call state-based
10 priority. And we will talk about state-based priority
11 as we get into this in a little more detail.

12 So now we have addressed the three major
13 parts of the I and C architecture. The safety side,
14 the PSMS, the non-safety side, the PCMS, as well as
15 the interfaces into the man-machine interface or what
16 we call the human systems interface. And we have
17 addressed our Diverse Actuation System, which is the
18 analogue part of the system to address common cause
19 failure. Those are the three major echelons that we
20 have in this design.

21 Let's go to the next slide. Here we show
22 the architecture of the human systems interface. And
23 we do describe this in the safety system topical
24 report only to give a perspective of where safety
25 interfaces are inside the control room. We have a

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1 large display panel, which is a non-safety function.
2 We have VDUs for both alarming as well as operational
3 VDUs that allow you to monitor instruments and take
4 control. The operational VDUs are all non-safety.
5 The alarm VDUs are non-safety.

6 But on the right side of the panel here --

7 MEMBER BROWN: Could you say that again?

8 MR. SCAROLA: The alarm VDUs are non-
9 safety --

10 MEMBER BROWN: Not that part. You ran
11 through a series of statements. You said that they --
12 you ended with the alarm VDUs. Something was safety,
13 something was non-safety.

14 MR. SCAROLA: Everything I spoke about so
15 far is non-safety. If I said safety, I am sorry.

16 MEMBER BROWN: Including the alarm VDUs?

17 MR. SCAROLA: The alarm VDUs, the
18 operational VDUs, the large display panel are all non-
19 safety --

20 MEMBER BROWN: I understood the large
21 display panel part. I guess I didn't realize the
22 alarm VDUs were non-safety.

23 MR. SCAROLA: These are all non-safety
24 devices. Now, later I will talk about a capability of
25 the operational VDU, which is what we call multi-

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1 division control, where we will use a non-safety man-
2 machine interface to control both non-safety and
3 safety components. But the interface itself is a non-
4 safety interface.

5 And the backup for that non-safety
6 interface is the safety interface inside the control
7 room, which is what we call the safety video display
8 units. The safety VDUs are part of the protection and
9 safety monitoring system.

10 MEMBER BROWN: But do they include the
11 alarms as well?

12 MR. SCAROLA: No. The alarm system --

13 MEMBER BROWN: The alarms are on a system
14 that is non-safety.

15 MR. SCAROLA: The alarms are on a non-
16 safety.

17 MEMBER BROWN: It is non-1E.

18 MR. SCAROLA: Non-1E, which is consistent
19 with all operating power plants today and consistent
20 with all of the regulatory guidance.

21 The alarms are, typically, aids to the
22 operators. They are not credited in any of the safety
23 analysis.

24 MEMBER SIEBER: They don't do anything.
25 They are just there.

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1 MR. SCAROLA: We will use them to the
2 extent that they are available but we do not take
3 credit for them. The EOPs are essentially written --

4 MEMBER BROWN: Yes, I understand that,
5 except from the standpoint just I am not saying one
6 way or the other, it is just that the standpoint now,
7 the operator doesn't, something may be going on and
8 yet he doesn't have an indication of what may be
9 triggering that. So, he is blind, in a manner of
10 speaking.

11 Now, I don't want to go into detail. It's
12 just when I read this and I thought I had -- you just
13 clarified something that I had read. So I appreciate
14 that.

15 MR. SCAROLA: It just seems to be a little
16 bit out of sorts to have the operator somewhat blind
17 relative to what is going on. Why is it happening?
18 What parameter triggered it? What did this? What did
19 that? Because all he sees is some stuff starting or
20 some actuations occurring.

21 One thing I will --

22 MEMBER SIEBER: -- are not safety but the
23 indications are.

24 MEMBER BROWN: But if you know. I mean,
25 all of a sudden, you have got to start flipping your

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1 eyes all over the place instead of something saying,
2 hey, this system didn't work.

3 CHAIRMAN MAYNARD: The U.S. emergency
4 operating procedures are not based on -- the operator
5 doesn't have to know what the accident is. The EOPs
6 are lined up to go by the --

7 MEMBER STETKAR: Be careful because these
8 are event-based emergency operating procedures in this
9 plant. So, as I understood it, we will probably get
10 into that when we talk about the --

11 MR. SCAROLA: Well actually, we have both
12 types of operating procedures, as do all Westinghouse
13 CE Plants and PWRs in the U.S. have both function-
14 based operating procedures as well what was call the
15 optimal recovery, which are event-based. We have two
16 types of operating procedures.

17 MEMBER STETKAR: And stop me if this gets
18 into more of the proprietary stuff. Probably not but
19 I was going to bring this up when we talked about the
20 HSI/HFE.

21 As I understand it, what you classify as
22 your function-based -- if I go back to the early 1980s
23 in the United States, your function-based procedures
24 are the function restoration guidelines. Your
25 emergency operating procedures are strictly event-

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1 based. They are not symptom-based procedures. They
2 are not integrated, symptom-based procedures. Are
3 they?

4 MR. SCAROLA: Function-based procedures
5 are considered part of the EOPs. As you execute an
6 optimal recovery EOP and you get to a point in the EOP
7 where the EOP or where the symptoms cannot be clearly
8 diagnosed, the EOP directs the operator to go to the
9 functional-based recovery procedures.

10 MEMBER STETKAR: I understand that.
11 Although there is in newer plants, not in the United
12 States, necessarily, but internationally a move toward
13 fully symptom-based procedures where you are, you
14 start out with symptoms of plant response and
15 eventually fall out into a specific emergency. It is
16 a different philosophy. It is a different hierarchy
17 compared to what I understood for your procedural
18 philosophy, if we want to call it that.

19 MEMBER BROWN: Let me, I wanted to ask for
20 a clarification because my background is more on the
21 symptom-based response. If you look at our operators
22 in the Naval Nuclear Program, our procedures are
23 fundamentally-based on UC. There is a set of symptoms
24 to which the operators respond. There may be alarms
25 going off or an indication doing something. So, I am

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1 not familiar with the term that you used event-based
2 or function-based aside from symptom-based. So I am a
3 little bit off track relative to that.

4 MEMBER SIEBER: Well one of the keys to
5 the U.S. plants, the alarms aren't safety-related.
6 They are using the indication, the actual plant
7 parameters not an alarm that went off.

8 MEMBER SIEBER: There is a methodology
9 that you go through to tell you what indicators to
10 look at.

11 It seemed to me when I read this that it
12 was consistent with U.S. PWR practice today, as
13 opposed to the boilers who are symptom-based.

14 MEMBER STETKAR: Well, and internationally
15 most plants are going to a more integrated system.
16 Granted, we are in the United States. The difference
17 is the operators need to decide that they have a steam
18 generator tube rupture and they go to a steam
19 generator tube rupture procedures, as opposed to the
20 fully symptom-based procedures are that you start out
21 with making sure that you have all of your critical
22 safety functions satisfied. The reactors trip, you
23 have core coolant. You don't care whether it is a
24 LOCA, you don't care whether it is a tube rupture.
25 You don't care whether it is a reactor trip. You do

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1 the same thing for everything.

2 MEMBER SIEBER: That's not the practice.

3 MEMBER STETKAR: That is not the practice
4 here.

5 MEMBER SIEBER: Okay.

6 MEMBER STETKAR: I just wanted to make
7 sure.

8 MR. SCAROLA: And it's important. It is
9 not the practice by PWRs in the United States.

10 MEMBER STETKAR: That's true. That is
11 correct. Current PWRs.

12 MR. SCAROLA: This design is an
13 evolutionary design that follows the practices of the
14 PWR owners group. So there are both event-based
15 procedures as well as function-based procedures.

16 MEMBER BROWN: What is an event? Tell me
17 what an event is as opposed to --

18 MR. SCAROLA: And event is something you
19 can actually diagnose. So therefore you take -- in CE
20 plants, they call them optimal recovery versus
21 functional recovery. The optimal recovery is more
22 efficient. It works faster and it puts the plant in a
23 safe condition with less investment challenge.

24 Functional recovery is when you can't
25 diagnose the event and, therefore, you are only

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1 worried about critical safety functions. And you can
2 end up pouring a lot of aerated water into the plant.

3 You can end up venting water onto the floor of the
4 containment. So, it is an investment challenge. Not
5 a safety challenge, but it is an investment challenge.

6 So, PWRs today try to avoid going to
7 functional recovery by using optimal recovery. They
8 always will attempt to use optimal recovery first.

9 MEMBER SIEBER: In PWRs in the U.S., I was
10 going to say today but when I was in there isn't
11 today, you actually ran both symptom and event-based
12 procedures at the same time. The operating crew would
13 do event-based and the engineering staff on duty would
14 do the symptom-based. The engineering staff would say
15 to the operating staff, you have this issue and your
16 recovery is not quite working. You may have two
17 faults in the plant, for example.

18 CHAIRMAN MAYNARD: Well, today's U.S.
19 procedures, it is a symptom-based. You start out, you
20 don't care what the accident is. You care but the
21 procedure leads you down a path based on your
22 indications. And then you get to a point where it
23 leads you into either the optimal recovery for a steam
24 generator or optimal recovery for LOCA or whatever.
25 But it is based on the symptoms that you get there by.

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1 On the side, you have function restoration
2 procedures that if you have got things going on
3 outside of that, then it will lead you into a
4 functional restoration there. But it is kind of a
5 combination. But you start out in a symptom-based to
6 get you let into the optimal recovery procedure.

7 MEMBER SIEBER: Yes, we might see better
8 as we go on. Why don't we go on?

9 MEMBER BROWN: And we are interested in
10 keeping submarines and aircraft carriers operating, as
11 opposed to shutting the plants down. So there is a
12 slightly different mind set when you have got 25 and
13 55 million dollar jets in the air, that you really
14 want to keep that carrier moving.

15 MEMBER SIEBER: Well, we have got 55
16 million people living around --

17 CHAIRMAN MAYNARD: Now, let's move on
18 because we will probably come back to this again later
19 anyway. Let's go ahead and move on.

20 MR. SCAROLA: One of the man-machine
21 interfaces that you don't see in this photograph is
22 the diverse HSI panel which I will show you later in
23 other photographs when we get into the simulator that
24 we have here in the U.S.

25 MEMBER STETKAR: Just a quick question

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1 because you had the pretty picture up here.

2 When I was reading the topical report, you
3 talk about the whole plant is designed for one RO, one
4 SRO and this is a single RO station. But I thought
5 there was a discussion that there could be a two RO
6 version that essentially, I don't know whether it
7 duplicates everything that you see within the operator
8 console there. Is this the standard? And the two RO
9 is for, or is this the two RO?

10 MR. SCAROLA: I can understand your
11 confusion.

12 MEMBER STETKAR: Because it seemed to be
13 like the operational VDUs were duplicated.

14 MEMBER BROWN: Two chairs.

15 MR. SCAROLA: Two chairs but this
16 photograph that is in the safety system topical report
17 is intended only to be representative of the control
18 room to show the distinction between safety man-
19 machine interfaces and non-safety.

20 When we get to the HSI topical report,
21 that is where you will see the actual U.S. control
22 room that has the capability for two ROs.

23 MEMBER STETKAR: So it is duplicate sets
24 of at least the operational VDUs.

25 MR. SCAROLA: And it has got more VDUs.

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1 MEMBER STETKAR: Okay.

2 MR. SCAROLA: It duplicates these VDUs --

3 MEMBER STETKAR: Okay.

4 MR. SCAROLA: -- in a second RO station.

5 MEMBER STETKAR: Okay. Thanks. Thanks.

6 MR. SCAROLA: I'm sorry for that
7 confusion.

8 MEMBER STETKAR: No, that's fine. That's
9 -- thanks. Thanks.

10 MR. SCAROLA: I can understand why you are
11 confused. Okay, so let's move on.

12 Now, this slide just summarizes what I
13 have already said. So we can move on from that.
14 Okay, the next slide.

15 Now these next few slides talk about some
16 of the key INC features that allow us to achieve some
17 of the key goals of this design. We are using plant-
18 wide digital technology. We use digital technology
19 everywhere, with the exception of addressing common
20 cause failure, which we say we use analogue
21 technology.

22 The reason for digital technology is to
23 achieve goals of maximum reliability, maximum
24 stability, minimum maintenance. Maximum reliability
25 is basically because digital components have

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1 demonstrated higher reliability than analogue
2 components. It is essentially because they are less
3 heat producing. As a result, they have more
4 longevity.

5 In digital systems, we also have a
6 significant amount of redundancy, even in the non-
7 safety system. So when we do get failures, those
8 failures essentially don't manifest themselves to
9 system-level plant disturbances. So we can have an
10 alarm for a failure. We can repair it before it
11 causes any sort of transient.

12 Stability is the issue of all of our set
13 points. Constants are all in digital values. Digital
14 values don't drift. So we have more stability. All
15 of this leads to less frequent need to touch the
16 equipment by humans, which ultimately is an
17 enhancement to reliability as well. Because what we
18 find historically is that we have more problems
19 because of maintenance errors than we actually have
20 because of equipment failures.

21 MEMBER SIEBER: How do you address the
22 issue of processing speed? For example, at TMI, the
23 alarm monitor was about an hour behind in processing
24 and printing out alarms at one point and guaranteed
25 that that was a 1960s system. How do you demonstrate

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1 in this system that the processing units can keep up
2 with all the stuff that is going on?

3 MR. SCAROLA: The simple answer is that
4 this system uses a method of monitoring and data
5 transmission where all of the instruments are
6 monitored every cycle and all of the data is
7 transmitted every cycle, whether it changes or not.

8 So every cycle, we are sending pressurizer
9 level okay, pressurizer level okay, pressurizer level
10 okay. Then all of a sudden some time later we send
11 the same signal but it says pressurizer level not
12 okay. So, the bus loading, the CPU loading, the bus
13 loading, the loading of the alarm VDU processor, is
14 constant at all times.

15 MEMBER SIEBER: It is not okay. It goes,
16 the computer goes into some subroutine that says this,
17 this, and this. That is where the bottleneck occurs.

18 MR. SCAROLA: But in this system, we
19 actually process those subroutines all the time
20 anyway, even when things are okay. We execute all of
21 those subroutines.

22 MEMBER BROWN: Okay, that was one of my
23 questions I had later. So, I will just ask it now,
24 since you guys brought it up. You talked about, I
25 forgot what the words were, a cyclical deterministic,

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1 I have forgotten what the exact words were. And I
2 wanted to translate that into my language from my past
3 experience where it was all done on what we called a
4 main operating loop. Every function was, every
5 calculation, every data from every sensor was sampled,
6 every calculation was done, every alarm was generated
7 or not generated within every operating cycle, whether
8 it be 50 milliseconds or ten milliseconds, however
9 fast you could run the thing to do all of that, such
10 that, and you had a timer, watchdog timers both
11 hardware and software to monitor that all of those
12 functions were done and you didn't overrun your sample
13 time.

14 MR. SCAROLA: Correct.

15 MEMBER BROWN: And is that what this does?

16 MR. SCAROLA: That is what this does.

17 MEMBER BROWN: I mean everything. I mean,
18 I am talking about in the MELTAC Platform now. I am
19 not talking about the distribution bus. That is --

20 MR. SCAROLA: Even the distribution bus
21 sends all of the data all of the time, every cycle.

22 So, what I would like to do, since that
23 gets into a lot of detail, I would like to hold that.

24 MEMBER BROWN: That is fine. I just
25 wanted that momentary clarification.

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1 MR. SCAROLA: You have summarized the
2 method of addressing his problem. But I would like to
3 wait and get into it in more detail later.

4 MEMBER BROWN: Not good enough? Jack's
5 still not happy with me.

6 MEMBER SIEBER: Let me ask one question
7 and I will hold a question for later. What is the
8 cycle time?

9 MR. SCAROLA: Cycle time varies depending
10 upon the requirement. Some things have a cycle time -
11 -

12 MEMBER SIEBER: Oh, okay.

13 MR. SCAROLA: -- of 100 milliseconds.

14 MEMBER SIEBER: Okay.

15 MR. SCAROLA: But that 100 milliseconds is
16 repetitive every cycle. Some things have a cycle time
17 of two seconds. For example, there is no reason to
18 monitor temperature, RTDs faster because they just are
19 slow things.

20 MEMBER SIEBER: Okay.

21 MR. SCAROLA: So we can have varying cycle
22 times.

23 MEMBER SIEBER: Well that broaches some
24 additional discussion. Okay. Never mind.

25 The statement that you know every routine

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1 and scan every instrument every cycle is not correct.

2 You have a lot of different cycles going on inside
3 and it is all timed out, to give you a relatively
4 constant CPU.

5 MR. SCAROLA: Right.

6 CHAIRMAN MAYNARD: Why don't we go ahead
7 and move on because I think we will discuss this
8 later, too.

9 MR. SCAROLA: Okay. We also use digital
10 technology to achieve --

11 MEMBER BROWN: Can I make one more -- you
12 talk you one of the reasons. I don't disagree with
13 going to digital microprocessor type technology.
14 Don't take my question any other way. That is all I
15 did for the last 22 years or 32 years.

16 MEMBER SIEBER: 52 years.

17 MEMBER BROWN: Pardon? Since 1978. You
18 talked about one of the reasons because you get less
19 heat. And I don't know how you all do it in the
20 commercial world, okay, in this world but all I know
21 is when I went from analogue cabinets that performed a
22 specific function to the same size digital base,
23 microprocessor-based cabinet, I had more heat that I
24 had to deal with in the microprocessor-based systems
25 than I did in the analogue systems.

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1 Now, I performed more functions. I took
2 advantage of the microprocessor technology, ran them
3 harder, but they were hotter and I had to deal with
4 that. And it was a lot more heat relative that we had
5 to deal with.

6 So, I take it, maybe if you have got
7 bigger cabinets and you have fans running, that is a
8 different issue. You can get rid of, we didn't have
9 any fans, all that kind of stuff.

10 MR. SCAROLA: We have fans.

11 MEMBER BROWN: But that is a touchy --

12 MR. SCAROLA: And of course, it depends on
13 the digital technology that you are using. If you are
14 using bipolar digital technology, it is very heat
15 producing. If you use CMOS or NMOS technologies, --

16 MEMBER BROWN: It was all CMOS.

17 MR. SCAROLA: -- it is much less heat
18 reducing.

19 MEMBER BROWN: I don't disagree with that.

20 MR. SCAROLA: I can tell you that
21 certainly we have to get rid of whatever heat is in
22 it.

23 Yes, all right. I just, it was just the
24 same, that was a basis. There is a lot of other bases
25 and reasons for using the digital technology, other

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1 than because it is cooler.

2 MEMBER BLEY: And we do have a little more
3 room.

4 MEMBER BROWN: And you have got lots of
5 room. Absolutely, relatively.

6 CHAIRMAN MAYNARD: Why don't we move on.

7 MR. SCAROLA: I think the realty is that
8 we are using it because it is demonstrated higher
9 reliability.

10 MEMBER BROWN: I don't disagree with that.

11 MR. SCAROLA: And that is really the key.

12 MEMBER BROWN: I don't disagree.

13 MR. SCAROLA: We also use it because we
14 can get very high coverage of self-diagnostic testing,
15 which means it can automatically test itself to a very
16 large degree. That doesn't mean that we can eliminate
17 all manual tests. There are some manual tests. We
18 still retain them. We will talk about them.

19 MEMBER BROWN: Sorry I asked the question.
20 Go ahead.

21 MR. SCAROLA: Okay. In this architecture,
22 we have a four train architecture. And in terms of
23 what is required, the tech specs, you will see this
24 for the US-APWR. In most cases, there are a couple of
25 exceptions, but in most cases, the tech specs require

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1 only three divisions to be operable, even though we
2 have four divisions. So, if we lose a division,
3 unlike operating plants today, the tech specs do not
4 have LCOs on loss of those divisions.

5 So, that facilitates online maintenance
6 which essentially leads to shorter outages. So rather
7 than doing a lot of testing during outages, we can do
8 that testing with the plant online because we can take
9 divisions out of service, put them into tests, run
10 them, put them back in service. And that is really a
11 fundamental key in compressing refueling outage times.

12 MEMBER SIEBER: Short question, short
13 answer. To what extent do you still use independent
14 analogue control rooms like a feedwater heater level?

15 None?

16 MR. SCAROLA: Essentially none.
17 Everything is in the digital controllers.

18 MEMBER SIEBER: You don't have anything
19 that runs separately?

20 MR. SCAROLA: Well, we have nothing that
21 runs separately that is within the context of the DCD.

22 There may be some things --

23 MEMBER SIEBER: Yes, --

24 MR. SCAROLA: -- that are in the balance
25 of plant that we haven't gotten to the detailed design

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1 yet that we may conclude we will have a single loop
2 controller but we just have not gotten to that part of
3 the design. But within the scope of the DCD, no.
4 Everything is in the control rooms.

5 MEMBER SIEBER: You have not made an
6 effort to limit the amount of wiring going back by
7 using independent channels.

8 MR. SCAROLA: We will talk about wiring in
9 the next slide.

10 MEMBER SIEBER: Okay.

11 MR. SCAROLA: Because we certainly have
12 made an attempt to limit wiring.

13 MEMBER SIEBER: Okay.

14 MR. SCAROLA: In addition to a four train
15 safety INC architecture, we have a fully redundant
16 non-safety INC architecture. So one of the concerns
17 about well what happens when the alarm VDU fails is
18 addressed by the fact that we have several alarm VDUs
19 in side the control room. They are all running with
20 redundant processing, redundant data communications.
21 So even though things are non-safety in this design,
22 we build in redundancy, self-testing, etcetera, so
23 that there is no single component failure that can
24 challenge plant operation either because it might
25 cause a transient or because it could result in loss

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1 of HSI.

2 There is no single component failure that
3 can challenge plant operation. Now, that is a pretty
4 broad statement but it is a statement that MHI adheres
5 to very rigorously.

6 Moving on. This next slide is going to
7 talk about remote multiplexing. And this is a key to
8 minimizing cabling. We do use remote multiplexing to
9 minimize the amount of field cables coming back into
10 the central control room. This not only reduces
11 cables but it benefits us with regard to aging issues,
12 as well as fire issues. There is just less cable that
13 we have to worry about.

14 Multiplexing also improves reliability.
15 Now, some people think that hard wire is more reliable
16 than multiplexing. But the problems with hard wires
17 is you don't know that your connections have failed
18 until you put a demand on those connections. So,
19 until I try to start the pump, I don't know that I
20 have a bad cable. Until I try to open the valve, I
21 don't know that I have a bad terminal block
22 connection. Whereas, with digital multiplexing, we
23 are continuously testing that data communication all
24 the time.

25 MEMBER SIEBER: So when everything goes

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1 blank, you know you have got a problem. All your
2 digital readouts and --

3 MR. SCAROLA: I would hope that we know we
4 have a problem before everything goes blank. Because
5 every place we have multiplexing, we have redundancy.

6 So we can fail one day to communication path --

7 MEMBER SIEBER: You have multiple
8 channels.

9 MR. SCAROLA: We have multiple channels.

10 MEMBER SIEBER: Okay.

11 MR. SCAROLA: We have multiple data
12 communication paths. So, if we fail one, we will get
13 an alarm but we won't have a plant upset condition.

14 MEMBER SIEBER: Okay.

15 MR. SCAROLA: In that picture that I
16 showed you before, where we have the safety systems
17 and the non-safety systems, it is important for me to
18 emphasize that all of those systems utilize the MELTAC
19 Platform that we will be talking about later.

20 So we do have a common digital platform.
21 The reason for that is that we want to minimize
22 engineering so that the engineers in the plant can get
23 trained on one technology. They don't have to be
24 trained on multiple technologies. The maintenance
25 people can be trained on one technology not multiple

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1 technology. And the spare parts industry can be
2 carried once for all systems in the plant. So, we
3 have the same spare parts for both the safety system
4 and the non-safety systems and then people say, well
5 does that mean that your non-safety parts meet all the
6 Appendix B requirements? And the answer is for this
7 plant, yes. We are using the same hardware
8 everywhere.

9 So, again, when we talk about reliability
10 of the alarm system, even though this alarm system is
11 non-safety, we do have safety quality components in
12 the non-safety systems, which is very important.

13 MEMBER BROWN: Well, actually your
14 document stated that the same platforms are used but
15 they would use lesser standards of QA methods for
16 design and manufacturing than used for the safety
17 platforms. And so that is mentioned, that is stated
18 several times on the document.

19 MR. SCAROLA: It is meant to refer to the
20 software quality process. It is not meant to refer to
21 --

22 MEMBER BROWN: So is it a less quality
23 software in the --

24 MR. SCAROLA: In the non-safety system.
25 In the non-safety system, we do not apply IEEE-7432

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1 quality standards to the software development process.

2 We have non-safety software and safety software. On
3 the hardware side, we are using the same equipment
4 across the board.

5 So, from a spare parts perspective, it
6 makes the hardware interchangeable. From a software
7 perspective, no. You have to load safety software and
8 safety controllers and non-safety software and non-
9 safety controllers.

10 MEMBER BROWN: So that is another
11 management problem with software.

12 MR. SCAROLA: Well, not a frequent
13 management problem. Certainly something that you
14 would have to have under control --

15 MEMBER BROWN: Is it only a software issue
16 or just, in other words, in the hardware itself is
17 designed, manufactured, tested, etcetera, to the same
18 standard and that the only -- because that is not
19 stated in the documents in any of them.

20 MR. SCAROLA: I think we need to clarify.
21 We could probably clarify that.

22 MEMBER BROWN: But I would think that that
23 would just, the idea of having non-safety software
24 utilized for non-safety of whatever, a lower standard
25 of verification or validation that that software is

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1 satisfactory, I know, that is hard to swallow. But I
2 mean, I understand what you are doing. And I
3 understand. I mean, I read several statements where
4 you all provided a basis for that but it was not
5 overwhelmingly satisfying as to why we would.

6 MR. SCAROLA: Well --

7 MEMBER BROWN: I'm not asking you to
8 justify it right now.

9 MR. SCAROLA: We'll talk about it a little
10 bit more later but let me just say that the standards
11 for software testing coverage and software
12 documentation requirements, traceability, etcetera,
13 for safety-related software are extremely rigorous.
14 For us to try to apply those same standards to non-
15 safety software is not economically practical due to
16 the complexity of the non-safety software. What it
17 would force us to do is make the non-safety software
18 as simple as the safety software.

19 MEMBER BROWN: What is wrong with that?

20 MR. SCAROLA: Because then we would have
21 very unfriendly man-machine interfaces. We would have
22 very primitive automated control systems. But
23 remember, safety system automation is very primitive.
24 I monitor level. When I get to a set point, I
25 actuate. Whereas non-safety control systems have

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1 proportion interval derivative controllers inside.
2 There are lead lags. There are many, many feedback
3 networks in non-safety control systems. To attempt to
4 verify and validate that software to the same degree
5 that we verify and validate the simplistic safety
6 software is just beyond the capability of the industry
7 today.

8 MEMBER BROWN: So my control of a turbine
9 generator or my control of reactivity addition devices
10 like control rods or my control of any other feedback
11 type control system is less important than the
12 reactor's safety function.

13 MEMBER SIEBER: Yes.

14 MR. SCAROLA: Well, it is less important
15 from a safety perspective. It is extremely important
16 from an economic perspective. So utilities do
17 encourage suppliers to demonstrate high reliability of
18 their non-safety standards.

19 MEMBER BROWN: Let me expand on that a
20 little bit. I used the TG set as an -- because I can
21 look at your picture. Say that is a little box down
22 here that is controlling a throttle or a valve or
23 something like that. But there is a lot of other non-
24 safety hardware. A software up in some of these other
25 systems that interface with the safety software from

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1 your displays, alarms, etcetera, that is all non-
2 safety software also.

3 So, I wouldn't really argue with you or
4 disagree -- not argue. That is the wrong word. I
5 would not disagree with you relative to a supervisory
6 instrument for the TG or some other feedback control
7 system or continuous control system that you would
8 have to utilize. But from the standpoint of
9 interfacing the safety system with its operating
10 display, alarm, and indication functions, that
11 software and having that non-safety grade --

12 MR. SCAROLA: Well realize we do have --

13 MEMBER BROWN: -- that is just a problem.

14 MR. SCAROLA: -- safety grade human
15 systems interfaces with very simplistic screen
16 designs, very simplistic control designs and we will
17 be showing those. Simplistic to the point that we can
18 put them through the 7432 V and V process. That is
19 why they are simplistic.

20 MEMBER BROWN: Yes, but you are not going
21 to be using those all the time.

22 MR. SCAROLA: Well that is why --

23 CHAIRMAN MAYNARD: I think we are going to
24 have to move on. First of all, I don't think the key
25 issue is whether it is safety or non-safety. It is

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1 what level of controls are put on. Just because it is
2 non-safety doesn't mean that there are absolutely no
3 controls or anything put on it. So, I think we need
4 to get into that.

5 MEMBER BROWN: Well, I understand that.

6 CHAIRMAN MAYNARD: But we are running
7 behind and I think we need to move on because we are
8 going to revisit some of these subjects later, too.
9 So, let's go ahead.

10 MR. SCAROLA: Okay. Finally, as I spoke
11 about a common digital platform, we do have to
12 consider that that common digital platform that is
13 used throughout this has some hidden software defect.

14 A hidden software defect can lead to a common cause
15 failure. So we address that by the Diverse Actuation
16 System.

17 And within the Diverse Actuation System
18 again we really strive for simplicity. We have simple
19 analogue comparator functions, manual actuation
20 functions so that this results in a design that is
21 simple to test and simple to maintain. Again,
22 striving for simplicity so that we can reduce O and M
23 costs. So that is a fundamental basis of that Diverse
24 Actuation System as well.

25 And we will talk later about our drive to

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1 keep that system as simple as possible and some other
2 drivers that would encourage us to make it more
3 complex. So, we will talk about these issues.

4 Okay, next slide. Here is some history of
5 this whole design. This design in Japan started out
6 in its application to non-safety systems. The MELTAC
7 Platform was originally applied to non-safety systems.

8 What you see on the right side of that architecture
9 drawing, the PCMS functions, reactivity control,
10 turbine control, steam generator, water level,
11 etcetera.

12 We have been operating now in non-safety
13 systems for about ten years in five operating plants,
14 50 different applications of non-safety functions,
15 over 20 million hours of operating experience. And to
16 date, there has been no system malfunction. System
17 malfunction. There have been component failures,
18 board failures, etcetera, but because of the
19 architecture of the design, the redundancy, none of
20 those have become system failures that have impacted
21 the plant.

22 MEMBER STETKAR: But your 20 million
23 operating hours you use, this is just sort of a
24 comment, use that in several places to justify the
25 very high reliability of this system. And yet, if I

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1 do the math, you actually have something on the order
2 of probably 400,000 system operating hours. You might
3 have 20 million individual function operating hours.
4 If you do the math, if you multiply five plants times
5 ten years, --

6 MR. SCAROLA: Times 50 applications.

7 MEMBER STETKAR: -- times 50 applications,
8 you get 20 million operating hours.

9 But many of those applications --

10 MR. SCAROLA: Well, at least our math is
11 good.

12 MEMBER STETKAR: Well, it is a little
13 misleading --

14 MR. SCAROLA: Okay.

15 MEMBER STETKAR: -- because you say you
16 have never had a reactor trip from a system
17 malfunction and more than 20 million operating hours.

18 Well, I think a lot of those functions --

19 MR. SCAROLA: Oh, okay.

20 MEMBER STETKAR: -- wouldn't lead to a
21 reactor trip, if you really had a failure of the
22 function.

23 MR. SCAROLA: Okay.

24 MEMBER STETKAR: So I am curious how many
25 hours you have with no function malfunctions, if you

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1 will, or channel malfunctions that caused an
2 alternate, you know, switch-over to the alternate
3 feedwater control, you know, the redundant feedwater
4 control or something like that. That is a more, you
5 know, you have two parallel processors. So for
6 feedwater control, for example, and have you ever had
7 any malfunctions that demanded the alternate feedwater
8 control function to take over, which it did
9 successfully, did not result in a plant trip. But you
10 know, if you are using this 20 million function
11 operating hours as a basis for your reliability, you
12 have to be a bit careful about what that means.

13 MR. SCAROLA: When we say system
14 malfunction and we say we have never had a system
15 malfunction, what we are saying is we have never lost
16 a function in the plant.

17 MEMBER STETKAR: Oh.

18 MR. SCAROLA: Feedwater control is a
19 function. Feedwater control is a system. Yes, we
20 have failed some of the components within feedwater
21 control but we have never had a system-level
22 malfunction for feedwater control. That is what we
23 refer to as a system.

24 MEMBER STETKAR: A failure does not cause
25 a system to stop.

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1 MR. SCAROLA: Right. The failure has not
2 caused loss of function of that system.

3 MEMBER STETKAR: But did it invoke the
4 standby control? You know, you have the parallel
5 standby controllers.

6 MR. SCAROLA: Sure.

7 MEMBER STETKAR: So that is --

8 MR. SCAROLA: We have had CPU failures
9 that have forced --

10 MEMBER STETKAR: Okay.

11 MR. SCAROLA: -- to fail over to the
12 redundant CPU.

13 MEMBER STETKAR: We should keep going. I
14 just wanted to try to understand what the 20 million
15 applies to.

16 MEMBER BROWN: But the point here, John,
17 is that the flexibility of the microprocessor-based
18 systems allow you to build in automatically
19 transferred functions that aren't achievable very
20 easily with analogue functions. This really adds to
21 plant reliability.

22 MEMBER STETKAR: I understand that. It is
23 just if we are doing reliability analysis, we have to
24 be careful about consistently understanding what the
25 numerator and the denominator mean.

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1 MR. SCAROLA: Now, we are now extending
2 the application of this technology to safety systems,
3 reactor protection and engineered safety features.
4 And over the next several years, there will be several
5 safety systems coming online in Japan, the first of
6 which will be the digital safety system upgrade at
7 Ikata 1 and 2, which will be operational the summer of
8 2009. Then we have an -- that is a digital upgrade
9 project.

10 Then we have a new plant that is under
11 construction that will go into commercial operation in
12 November of 2009. And then from that point moving
13 forward all the way to about 2013, there are several
14 digital upgrade projects that will apply this to the
15 reactor protection systems. And then ultimately the
16 Tsuruga project which is an APWR that is under
17 construction, that is a 2015 commercial operation
18 date.

19 So, we started in non-safety applications,
20 had very good success and have now moved into safety
21 applications. So what you see in our topical report
22 represents everything.

23 Okay. I am going to go on to the next
24 topical report, although maybe we --

25 CHAIRMAN MAYNARD: I am not familiar with

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1 the Japanese regulatory process. Have these been
2 approved for safety related applications in these
3 plants or do you have to get approval? I am not sure
4 what your process is.

5 MR. SCAROLA: Has there been Japanese
6 regulatory approval?

7 MR. TAKASHIMA: It is approved. The first
8 one is the Tomari number 3. That plant will start
9 commercial operation next year. We are already
10 approved by --

11 CHAIRMAN MAYNARD: Okay.

12 MR. TAKASHIMA: -- Japanese.

13 CHAIRMAN MAYNARD: Very good. Thank you.

14 MR. SCAROLA: Okay, we will move on. We
15 are now going to talk about -- oh, excuse me. I just
16 wanted to list for this topical report, I am not going
17 to go through these now. I will be going through each
18 one of these key issues when we get into more detail
19 later. But I wanted to point out that each of these
20 topical reports does identify key issues and we get
21 into them in a little more depth than we get into
22 anything else. So, that is the point of this list and
23 we will be hitting all of these later.

24 Now we will go on to the HSI System
25 Description and HFE Process Topical Report. This

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1 topical report is structured very similar to the
2 safety topical report, a purpose section, a scope
3 section. In section three, we identify the codes and
4 standards that are important to the design of HSI
5 systems. Section four describes the HSI design.

6 Now before during the NRC's presentation,
7 somebody was talking about DAC and design process.
8 And that shouldn't we, excuse me, I think it was --
9 I'm not sure where the question came from. But the
10 point was, shouldn't we be reviewing the design, if
11 there is no DAC and not just the process. And that is
12 exactly what we have provided within section four is
13 the actual design of the HSI systems.

14 We break the HSI systems down into
15 building blocks. A building block is the large
16 display panel. A building block are soft touch
17 controls. A building block is the alarm system.
18 Section four describes each one of these building
19 blocks in a generic sense. And of course, we have to
20 apply those building blocks to each specific plant,
21 such as the US-APWR and that is a design process for
22 the US-APWR that is addressed in the US-APWR HFE
23 program. But the intent of the topical report is to
24 describe the building blocks and we have requested
25 staff approval of those building blocks. We will get

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1 into that a lot more later.

2 Section five then describes the design
3 process. And again here, we talk about past process,
4 which is how did we develop those building blocks.
5 The current process for the US-APWR and the future
6 process would be the application of those building
7 blocks to any future operating power plant as a
8 digital upgrade project.

9 Section six has additional references that
10 go beyond regulatory criteria. And then section seven
11 again tries to present the perspective okay of this is
12 what we are asking you to review now. We are not
13 asking you to review these things that will come
14 later. And please understand what these things are.
15 So again, it is kind of the roadmap.

16 MEMBER BROWN: You made the statement in
17 all of these that what is presented in here is
18 typical. And I presume then that the DCD would
19 provide the specifics --

20 MR. SCAROLA: For a particular plant.

21 MEMBER BROWN: -- for -- all right.

22 MR. SCAROLA: Right.

23 MEMBER BROWN: Now, I think you said that
24 once before and it kind of went in and exited out the
25 other side. So I thought I wanted to make sure I

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1 understood that.

2 MR. SCAROLA: What is not typical is the
3 design basis for each one of these elements. We
4 define the design basis for the large display panel.

5 MEMBER BROWN: I understand that.

6 MR. SCAROLA: We do give an example of how
7 that design basis results in a design. So we put a
8 typical large display panel in the topical report,
9 simply to help the staff understand what that means
10 and what the content is.

11 But clearly, each large display panel
12 would meet the same design basis but may have some
13 slightly different content, depending upon the plant
14 that it is being applied to.

15 There are three appendices in this
16 document. Appendices A and B focus on what we call
17 the reference design, which is the Japanese standard
18 HSI design. This is the same design that is being
19 applied in Japan. Appendix C basically explains the
20 process we are using to take the Japanese design,
21 phase by phase an apply it to the U.S. And we will
22 talk about that entire process.

23 CHAIRMAN MAYNARD: I hate to break it here
24 but I think -- I am going to go ahead and break, take
25 a short break here. I look at the schedule and we

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1 weren't scheduled for a break until almost right
2 before lunch. And I would rather take a 15 minute
3 break here. We will come back and finish up.

4 So we will come back at 10:25.

5 (Whereupon, the above-entitled matter went off
6 the record at 10:13 a.m. and resumed at 10:26 a.m.)

7 CHAIRMAN MAYNARD: Okay, let's go ahead
8 and get started. We will resume. We have a member or
9 two that will join us when they -- let's go ahead and
10 get started.

11 MR. SCAROLA: Very good. Okay, whereas
12 the Safety INC Topical Report focuses on the digital
13 architecture behind the control room, the HSI Topical
14 Report focuses on the functional design of all of
15 these man-machine interface building blocks.

16 These basic HSI design features are
17 expected to improve operator performance and
18 efficiency. And I will just say that we have just
19 completed Phase 1(a) of our U.S. V and V Program using
20 our simulator that has been built in Pittsburgh. And
21 we are, in fact, seeing that, that operator
22 performance has been very good. Operator efficiency
23 looks good.

24 All of these things are to enable staff
25 reduction compared to conventional control rooms.

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1 Although the US-APWR will accommodate the staffing
2 that we have in existing control rooms, excuse me, the
3 basic HSI will accommodate the existing staffing,
4 which is essentially two ROs inside the control room
5 and an SRO, it enables the reduction down to one RO in
6 the control room.

7 These are through features such as the
8 large display panel, which is a fixed display to
9 enhance overall plant situation awareness, soft
10 controls that allow us to bring all of the information
11 to the operator, rather than have operators walking
12 around the control room to get information and take
13 controls.

14 That reduces task burden as well as it
15 allows a more functional or a more cohesive
16 distribution of functional responsibilities when you
17 do have multiple operators. Because in existing
18 control rooms today, we often divide responsibilities
19 by okay, you take that side of the control board, you
20 take that side. Well, you know, the inventory control
21 functions exist on both sides. Well, wouldn't it make
22 more sense to give one guy inventory control? Well,
23 now we can do that.

24 And lastly, we computerize the data
25 processing, to just help the operator understand what

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1 is happening in the plant. A big part of that is
2 distinguishing I and C failures from real plant
3 problems.

4 In the old control rooms, if I got an
5 instrument failure, well it shows up as pressurizer
6 low pressure. Well now, through my computer
7 processing, I can look at that and say well what are
8 the other instruments doing? The other instruments
9 are not telling me that I have a low pressure. So now
10 I tell the operator that he has an instrument failure,
11 rather than a low pressurizer pressure, which is a
12 huge improvement in the way we present data to the
13 operator and allow that data to help him prioritize
14 his actions.

15 So the whole point of this topical report
16 is to address these building blocks and explain,
17 essentially, how they enhance the performance inside
18 the control room.

19 CHAIRMAN MAYNARD: You may have mentioned
20 that the control room staff you were using at the
21 simulator in Pittsburgh, was that a U.S.-staffed
22 operators?

23 MR. SCAROLA: Yes, U.S. staff. We will
24 talk about that in more detail. You can flip slides.

25 Now, while all these enhancements improve

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1 operator performance, the design also needs to
2 emphasize and does emphasize coping with degraded HSI
3 conditions. Because all of these things are wonderful
4 when they are functioning but we need to train the
5 operators for the cases, the situations where they are
6 not functioning correctly. And that, very honestly is
7 the major challenge of advanced digital main control
8 rooms.

9 So, included in our design process and
10 included in our V and V Program is the consideration
11 of failures such as complete non-safety VDU freezing
12 or blackout. That means an operator loses that large
13 display panel. He loses all of the non-safety glass
14 in front of him and he is faced with managing the
15 plant and managing accidents with just the safety
16 related things.

17 We even go beyond that and address common
18 cause failure. All of these MELTAC controllers that
19 are behind the control room, that are doing all the
20 data acquisition, we must assume that we have a common
21 cause failure, they freeze, and therefore we don't get
22 any of that information into the control room anymore.

23 So now we have to rely on the Diverse Actuation
24 System, the diverse HSI panel. So we need to design
25 for that condition, as well as train the operators for

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1 that condition.

2 Finally, we have to deal with evacuation
3 of the main control room. Fire in the control room
4 forces the operators to go to the remote shutdown
5 facility and safely shut down the plant from the
6 remote shutdown facility.

7 MEMBER BLEY: I'm sorry. Go ahead and
8 finish what you were saying.

9 MR. SCAROLA: Well I was just going to say
10 that while this computerized HSI is a huge
11 enhancement, we can't forget that we might be putting
12 ourselves in a comfort zone that operators may not be
13 fully prepared for when these things fail. So we have
14 focused our design process to specifically address
15 that concern.

16 MEMBER BLEY: The kind of things you
17 mentioned here, and it is good to see you are doing
18 that, are kind of, from my point of view, the easier
19 things for an operator to deal with compared to cases
20 that have occurred, and I can't say in the nuclear
21 business but in other places with automatic control,
22 where input data or something else takes things out of
23 the expected and tested range and all of a sudden
24 maybe you register overflow somewhere, and you just
25 start getting anomalous behavior.

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1 MEMBER SIEBER: It sounds like a refinery.

2 MEMBER BLEY: It has happened there. It
3 has happened in electric power control. It has
4 happened in medical applications.

5 Have you thought about that and is there
6 any way that you have thought of trying to deal with
7 that to help the operators?

8 MR. SCAROLA: It happens in analogue
9 control systems as well and we train operators very
10 well for those conditions today. And so we will
11 certainly continue to train with them. And we will
12 continue to do task analysis for those situations.
13 But those are not new situations imposed by digital
14 systems.

15 The new things imposed by digital systems
16 are the more catastrophic global types of problems
17 that we didn't have before. Because before we had all
18 these individual instruments and individual loops. So
19 failures might affect pressurizer level but they
20 wouldn't effect pressurizer pressure. Now we have the
21 potential for a failure on our data communications
22 network. That means none of the displays are getting,
23 or none of the non-safety displays are getting
24 refreshed. Or a common cause failure that says none
25 of the displays are getting refreshed.

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1 MEMBER BLEY: Let me give you an analogue
2 to what I am concerned about. And it is in between
3 the case you are talking about and the case we used to
4 have. And the only place I have seen it happen with
5 old style systems are with instrument air systems.
6 And there you thought of global failures if you lose
7 all air for some reason.

8 But the ones that were really difficult
9 were the things where you got moisture into a system
10 or something. And now all of a sudden there are
11 multiple things, kind of widespread but not global,
12 going wrong. Things moving in wrong directions that
13 are linked in a way nobody understands for a while.
14 And that can happen through a system like this. So
15 they are wider spread than you used to have but they
16 are not the complete, it is there, it is gone, kind of
17 thing. It is all of a sudden hunks of it are behaving
18 differently. And I am just wondering if, I know that
19 is really hard to address. I am wondering if you have
20 given that kind some thought.

21 MR. SCAROLA: Clearly we have, we view it
22 as a problem with analogue systems that we will
23 continue to have in digital systems. We don't
24 necessarily view that digital systems expand that
25 problem. We clearly have that problem.

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1 MEMBER BLEY: But integrated systems
2 expand that problem. But go ahead.

3 MR. SCAROLA: Okay.

4 MEMBER BLEY: I mean, somehow I am not
5 communicating the kind of problem I thinking of.

6 MEMBER SIEBER: Well, let me ask a
7 question that goes all the way back to slide eight.
8 And slide eight, don't go back, but it shows seven
9 CPUs doing different things. Alarm monitors, plant
10 procedures, non-safety systems and so forth.

11 Since all of the computers in the CPUs
12 have access to the same data, they could operate
13 independently. But I would think that what you want
14 to do is coordinate some of these things.

15 MR. SCAROLA: Absolutely not.

16 MEMBER SIEBER: So, one of them has to be
17 in charge. Right? Which one is in charge?

18 MEMBER BROWN: There are multiple opinions
19 on that.

20 MEMBER SIEBER: Well, I would like theirs.

21 MEMBER BROWN: I agree with you but I
22 don't think they are going to answer it the way you
23 think they ought to answer it.

24 MEMBER SIEBER: Yes, well, if you aren't
25 going to give me a good answer, then we can move on.

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1 MR. SCAROLA: I think for the most part,
2 we see them as parallel processors with nobody in
3 charge.

4 MEMBER SIEBER: Okay, thanks.

5 MEMBER BROWN: They run asynchronously.

6 MR. SCAROLA: They all run asynchronously.
7 They all operate on the same data. They all do
8 different functions with that data.

9 MEMBER SIEBER: Okay, that answers my
10 question.

11 MR. SCAROLA: To the extent that the
12 output of an algorithm in this one is an input to an
13 algorithm in another one, yes, there are functional
14 dependencies. But --

15 MEMBER SIEBER: You mean, they don't
16 calculate the same algorithm independent of one
17 another. They will pass data?

18 MR. SCAROLA: Well, the redundant parts
19 do. For example, we have redundant alarm VDUs. One
20 is running, one is basically in a hot standby mode.

21 MEMBER SIEBER: And is all represented in
22 the same box.

23 MR. SCAROLA: It is all represented in the
24 same box in that picture.

25 MEMBER SIEBER: Yes, I got that part.

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1 MEMBER BROWN: But the four RPS trains
2 have four separate computation platforms.

3 MEMBER SIEBER: There is one box.

4 MR. SCAROLA: No.

5 MEMBER BROWN: No.

6 MR. SCAROLA: That is four boxes.

7 MEMBER BROWN: That is four boxes.

8 MR. SCAROLA: Well, in the RPS, you have
9 four different divisions. Right? A, B, C, D
10 divisions.

11 MEMBER SIEBER: Right. Got it.

12 MR. SCAROLA: We will talk about that more
13 later.

14 MEMBER SIEBER: Right.

15 CHAIRMAN MAYNARD: Yes, we need to be
16 moving on.

17 MR. SCAROLA: All right. Go to the next
18 slide, please.

19 The HSI system design features that we
20 described in the topical report are directly
21 applicable to the main control room, the remote
22 shutdown room, and the technical support center.

23 The HSI design process extends to the EOF
24 and local areas of safety significance. So, we are
25 not trying to say that all the building blocks that we

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1 are using in the main control room are the same things
2 we are going to use locally. Locally we may, in fact
3 we will, use conventional hand switches and in some
4 cases local analogue meters. The design process will
5 extend to those. The HSI building blocks that we
6 describe in section of this topical report will not.
7 I just want to make sure that is understood.

8 The reference design for the U.S. basic
9 HSI system is the Japanese standard HSI system. We
10 are extending that with additional consideration for
11 U.S. operating methods and procedures. We found out
12 through engaging U.S. operators in our V and V program
13 that U.S. procedures are quite different from Japanese
14 procedures. And as a result, we are having to make
15 some design changes. And we would have not seen that
16 until we brought U.S. operators into this V and V
17 program, which has been very effective.

18 Of course we have ergonomic differences
19 between the populations. We have cultural differences
20 in the way we structure things like alarm messages.
21 Very simple things like deviation from set point in
22 Japanese culture is actually written exactly opposite.

23 Set point deviation. Well we say, well gee, the set
24 point should never deviate. The process deviates from
25 the set point. So we have had issues where the

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1 operators read alarm messages and they don't get it
2 because we did a direct Japanese translation and now
3 we have to massage those. These are very simple
4 things.

5 We are also updating the operating
6 experience review that was originally conducted for
7 the Japanese system. We are now extending that for
8 U.S. operating experience. So we are going through
9 U.S. LERs and event reports and making sure that we
10 have everything covered.

11 Finally, we take what we call the basic
12 HSI, which are the basic features of the design and we
13 apply those on a plant-specific basis through the
14 analysis methodology and the design process that is
15 defined by NUREG-0711. So, this is basically what we
16 start with and where we take it to.

17 The Japanese standard HSI system is the
18 foundation. It is the foundation of everything that
19 is in this topical report. That was developed using
20 the NUREG-0711 design process. Everything from
21 function analysis to human reliability analysis, V and
22 V activities, including approximately 200 Japanese
23 operators. The same process that is defined as the
24 standard in the U.S. was used for Japan.

25 And this Japanese HSI system will be

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1 operational in nuclear power plants in Japan in the
2 near future. First Tomari Unit 3, which is a new
3 construction plan, Ikata Unit 1 and 2, which is a main
4 control room modernization program, and it will also
5 be operational in the Japanese PWR training center,
6 which is a new facility. So this is the foundation of
7 what is done in the US-APWR. That foundation is
8 described in this topical report.

9 Now, when we take that reference design
10 and we apply it in the U.S., we are applying it in a
11 three-phase program. Phase 1 demonstrates overall
12 human performance improvement from the Japanese HSI
13 system compared to conventional HSI. We are also, in
14 Phase 1, demonstrating conformance to U.S.
15 requirements.

16 Ultimately, the goal of Phase 1 is to
17 identify any changes from the Japanese HSI system that
18 might be needed for the U.S. We are doing this by
19 evaluation using both U.S. HFE experts, Human Factors
20 Engineering experts, and U.S. operators. The Phase 1
21 report will be submitted for NRC review December of
22 this year. And all of the Japanese development
23 documentation that is the basis of all of this is
24 available for NRC audit.

25 And I know we are having discussions with

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1 the staff now with regard to what Japanese development
2 documentation should be translated, so that the staff
3 can do a more rigorous review of that.

4 Phase 1 is intended to take that Japanese
5 design and put it through a rigorous V and V program
6 with U.S. personnel, both U.S. HFE experts and U.S.
7 operators. To do that, we are using a dynamic
8 simulator facility that we have built in Pittsburgh,
9 and I will be showing a picture of that next. So,
10 when we get back to this idea of are we asking the
11 staff to approve a design process or a design, we are
12 clearly asking the staff to approve a design, not just
13 a process.

14 Extending this further. The end of Phase
15 1 is expected to result in some revisions to this
16 topical report that we are talking about. If we find
17 that some of the basic HSI features need to be
18 modified for U.S. operators, we will reflect those
19 modifications in the revision to this topical report.

20 At the end of Phase 1, we will say this is our U.S.
21 basic HSI design. This is what will be applied to the
22 US-APWR. This is what will be applied to all future
23 applications in the United States.

24 The application process is what we call
25 Phase 2. Phase 2 applies this HSI system to the US-

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1 APWR. And what we mean by application, it means we do
2 all the function analysis, all the task analysis, all
3 the human reliability analysis that is specific to the
4 US-APWR that will result in the specific display for
5 the large display panel. The specific displays for
6 the 250 displays that are in the display inventory.

7 In other words, the displays will reflect
8 the piping mimics for the US-APWR. The displays will
9 reflect the specific alarms for the US-APWR. Whereas,
10 Phase 1 describes the method of navigating, Phase 2
11 describes what you are navigating to. It gives you
12 the inventory of all of the pictures. Phase 1
13 describes the method of alarm presentation. Phase 2
14 identifies the actual alarms that are applicable to a
15 US-APWR.

16 All of the Phase 2 activities are
17 conducted over the next several years. Some of the
18 analysis reports, function allocation, task analysis,
19 and human reliability analysis will be submitted to
20 the staff in June of next year. Subsequent reports
21 after that will be submitted over the next two years.

22 So, we go from Phase 1, which is a basic
23 HSI design to Phase 2, which is the application of
24 that to the US-APWR. Phase 3 then becomes the site-
25 specific design. So when we go from a generic US-APWR

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1 to a site-specific Comanche Peak Units 3 and 4, there
2 may some additional changes. For example, in Phase 2,
3 we would design what we think is the ultimate heat
4 sink but the ultimate heat sink is a site-specific
5 system. So Phase 3 may adjust that ultimate heat sink
6 for the site-specific applications.

7 MEMBER BLEY: Let me ask a question about
8 that process. When that happens, is there a resulting
9 update to the DCD or amendments to the Tier 1 or
10 something or it is all --

11 MR. SCAROLA: No.

12 MEMBER BLEY: What is it?

13 MR. SCAROLA: These are site-specific
14 activities. So they would not affect the DCD at all.
15 They would not affect Tier 1 in any way.

16 All of the basic HSI features, the method
17 of navigation, the icons that we use throughout the
18 system, the way we present alarms, are generically
19 applicable. Now we are applying them to the ultimate
20 heat sink, which is a site-specific design system.
21 So, I would see no upgrades or no revisions to
22 anything in the DCD. I actually think that this is a
23 level of detail that is not even addressed in the
24 COLA.

25 MEMBER BROWN: Are the icons consistent

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1 with what other type stuff that U.S. operators are
2 used to looking at? I mean, you --

3 MR. SCAROLA: Does a pump icon look like a
4 pump?

5 MEMBER BROWN: Well I don't know. You
6 said you were translating them from -- I don't know.
7 I have never seen a screen that showed some icons for
8 the Japanese-style systems. You know, whether they
9 use circles with little lines or whether they use a
10 box with a pipe coming in, I have no idea.

11 So, you get used to see certain icons and
12 all of a sudden your mind connects to them when you
13 are an operator. And that I just wondered if they are
14 the same or whatever --

15 MR. SCAROLA: They are the same --

16 MEMBER BROWN: -- or close enough.

17 MR. SCAROLA: -- thus far. They are the
18 same. Okay? But I also have to say --

19 MEMBER BROWN: I would think they would be
20 universal but --

21 MR. SCAROLA: -- that there is no U.S.
22 standard for what icons have to look like for
23 different things.

24 MEMBER BROWN: I understand that.

25 CHAIRMAN MAYNARD: That is what I was

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1 going to say. They are all different and even like
2 colors mean different things and stuff.

3 MEMBER SIEBER: They all look like P and
4 IDs.

5 CHAIRMAN MAYNARD: We need to move on
6 here.

7 MR. SCAROLA: Okay.

8 CHAIRMAN MAYNARD: Again, this is an
9 overview of the overview. We are going to be going
10 each one of these topics again, here.

11 MR. SCAROLA: This is the Pittsburgh
12 simulation facility that we are using in Phase 1, will
13 use in Phase 2. Phase 3 is somewhat up in the air as
14 to whether or not that might be at the Comanche Peak
15 site versus a central facility. But this is a fully
16 dynamic simulator. It models all of the basic HSI
17 features. The plant model that is actually behind
18 this is a conventional Japanese PWR. It is not the
19 US-APWR. We don't have the US-APWR plant models yet.
20 So this is actually representative but it will become
21 the US-APWR plant-specific over time.

22 MEMBER SIEBER: He gets them back at
23 Costco.

24 CHAIRMAN MAYNARD: We'll move on.

25 MR. SCAROLA: The topical report addresses

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1 many things. A number of key issues. We will be
2 hitting all of these when we get to the proprietary
3 section. But you will see things in here like
4 computerized procedures, which is a generic TWG issue.

5 You will see soft controls, another generic TWG
6 issue, multi-division VDUs, as we talked about before.

7 So there are a number of issues that we address in
8 the topical report that are essentially generic
9 industry TWG issues and we try to address each one of
10 them.

11 That's all I had on the HSI. We will hit
12 it in more detail later. If there are no questions,
13 we will move on to the MELTAC Topical Report.

14 MEMBER BLEY: One quick question on the
15 slide you had before. In a Phase 1, and I guess that
16 is where it be, it sounds as if there is thorough
17 documentation of the delta between the Japanese
18 version and what is going on in the U.S. design. But
19 some of the detailed underlying design documents are
20 only for the Japanese design and not all of them have
21 been or probably will be delivered to NRC and maybe
22 unless they ask for it. Is that right? That is what
23 I think I heard you say.

24 MR. SCAROLA: Okay. Let me take a good
25 example. At the end of this year, we will generate an

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1 operating experience review report that takes the
2 Japanese, that takes the OER that was done for the
3 Japanese and now extends it for U.S. applications.
4 That report will have a section that summarizes all of
5 the Japanese OER activities and the key things that
6 came out of that.

7 It is our intent for every one of these
8 reports that we produce, and there are about 12
9 reports, the first one is OER, then we do function
10 allocation, task analysis, staffing, HRA, etcetera,
11 every one of those reports, we intend to include in
12 those reports a summary of all of the Japanese
13 activities and how those are pertinent to the US-APWR.

14 That was our intent.

15 The staff has recently asked us to make
16 submittals of some of that Japanese documentation. So
17 what we are now doing is we have to meet with the
18 staff, get some neutral agreement on what they really
19 need to see, and then we have to go through a
20 translation process.

21 MEMBER BLEY: Fair enough.

22 MR. SCAROLA: Okay, any other HSI
23 questions? We will move on to MELTAC.

24 Okay. The MELTAC Topical Report is
25 entitled Safety System Digital Platform MELTAC. It

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1 has a similar table of contents, purpose, scope,
2 relevant codes and standards.

3 Section four, as in other topical reports,
4 is the description of the platform, including before
5 we talked about HSI building blocks, now these are the
6 building blocks for the digital systems behind the
7 HSI. So, we have the digital building blocks such as
8 input modules, output modules, central processors,
9 data communication building blocks, etcetera.

10 Section five describes all of the
11 equipment qualification that has been done.
12 Environmental qualification, seismic, electromagnetic
13 interference qualification, etcetera.

14 Section six describes the lifecycle
15 process which, for digital systems is essentially a
16 description of how the software was developed and the
17 overall quality program for that software.

18 Section seven describes equipment
19 reliability. The reliability of the individual
20 components and how we take component reliability and
21 ultimately develop system reliability numbers. So it
22 describes the processes for analyzing equipment
23 reliability.

24 Appendix A provides the hardware
25 specifications for each one of the modules in the

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1 design. The input modules can handle zero to ten
2 volts at so many milliamps and those types of
3 specifications. Appendix B describes all of the
4 software building blocks that are available to the
5 designer for building-specific applications.

6 So, for example, in Appendix B you will
7 find that there is a building block which is an AND-
8 gate, another building block which is an OR-gate, or a
9 flip-flop, or a latch, or a counter, whatever it might
10 be, all the building blocks. The whole library of
11 building blocks are described in Section B.

12 MELTAC stands for Mitsubishi Electric
13 Total Advance Controller. So when we say MELCO, that
14 is what we mean. Mitsubishi Electric Company. MELTAC
15 is -- I think you know.

16 MEMBER BROWN: Can I answer the question?

17 MR. SCAROLA: The basis, there are two
18 fundamental principals in the design of the MELTAC
19 Platform, simple design and high quality. And we will
20 be talking about both of those as we get into this.

21 This slide simplistically represents all
22 of the building blocks of the MELTAC Platform. The
23 most fundamental one is the controller. And here we
24 blow up the controller and we see that inside
25 controllers we have CPUs, which are the brains, and

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1 I/O chassis which are the data acquisition and results
2 outputs. There are, in any system there are, multiple
3 controllers. Here we see four represented. The
4 multiple controllers intercommunicate via something we
5 call the control network. This is a data
6 communication network that allows one controller to
7 send and receive data from any of the other
8 controllers that are in the system. We also have --

9 MEMBER BROWN: Excuse me. A MELTAC is the
10 controller box.

11 MR. SCAROLA: MELTAC is the aggregate.
12 Let me explain. MELTAC includes the controller. It
13 includes the control network. It includes the safety
14 VDU processor which drives the safety VDUs inside the
15 control room. The safety VDUs are part of MELTAC.
16 All of the things that you see on this are all part of
17 MELTAC, with the exception of the operational VDU.
18 We don't actually -- I don't think we consider that
19 part of MELTAC. Am I right in saying that?

20 MEMBER BROWN: Well, no, the reason I ask
21 the question is that I go into reactor protector --
22 the RPS train. It says it has a MELTAC Platform. But
23 if I look within the train, it has got the controller
24 but the safety VDU is outside. It is somewhere else.
25 It is after the distribution bus.

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1 MR. SCAROLA: Yes, but it is train,
2 though. If you look at one division of an RPS, of a
3 train, you will see a safety VDU division A, a safety
4 VDU processor, --

5 MEMBER BROWN: Okay, thank you. That
6 wasn't clear from looking at the pictures.

7 MR. SCAROLA: Okay. Okay. We will have
8 to try and clarify that through the presentations.

9 All of these components, including, for
10 example, here we see what we are trying to represent
11 here as inter-division data communication.

12 MEMBER BROWN: Is that --

13 MR. SCAROLA: So this might be the
14 controller in one train talking to a controller in
15 another train. And we do that via data links.

16 MEMBER BROWN: In your little picture, you
17 show one giant bus going across all RPS, all PCMS.

18 MR. SCAROLA: That is this guy, what we
19 call the control network.

20 MEMBER BROWN: Okay but is that part of
21 MELTAC?

22 MR. SCAROLA: Yes, it is part of MELTAC
23 also.

24 MEMBER BROWN: But there is not ten of
25 those. There is just one.

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1 MR. SCAROLA: Well, there is five of these
2 control networks, division A, B, C and D. No, excuse
3 me. Four of those, A, B, C, and D.

4 MEMBER BROWN: So that is the bus --

5 CHAIRMAN MAYNARD: You have five fingers.

6 MEMBER BROWN: That is the bus within the
7 train.

8 MR. SCAROLA: Within the train.

9 MEMBER BROWN: Okay.

10 MR. SCAROLA: Now we have the intertrain
11 bus, which is this one. Same technology.

12 MEMBER BROWN: And that is the bus up
13 here?

14 MR. SCAROLA: That is the bus up there.

15 MEMBER BROWN: Okay.

16 MR. SCAROLA: Same technology. Still the
17 control network but used at a different hierarchical
18 level in the architecture.

19 MEMBER BROWN: There is only one of those.

20 MR. SCAROLA: Only one of those that goes
21 across the entire plant. Non-safety, safety.

22 MEMBER BROWN: Okay. All right.

23 MR. SCAROLA: Okay. Now, in addition to
24 all of those, we also have this dotted line here that
25 we call the maintenance network and the engineering

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1 tool, which basically allows us to do more detailed
2 diagnostics of failures and also, if we need to,
3 upgrade the software. So, we will talk about all of
4 these features of the MELTAC Platform.

5 Moving on. A fundamental part of the
6 MELTAC Platform is the basic software architecture.
7 What we are trying to simplistically represent in this
8 picture is that the software executes one function
9 block at a time deterministically. It never changes.

10 And we will get into this in a lot more detail as we
11 get into the proprietary section.

12 This slide summarizes the operating
13 history as well as projections. Ah, I needed my
14 proprietary information for this. Let me just say
15 that the development began in 1985. As I said before,
16 we started in non-safety applications and moved to
17 safety applications. The first installations of non-
18 safety were in 1991. The first safety installations
19 will be occurring next year, 2009.

20 To date, refresh me with the memories,
21 with the numbers, we have approximately 80 controllers
22 in operation, 70 or 80 controllers? Excuse me, 70
23 controllers that are in operation today doing various
24 functions. By 2011 we will have about 200 controllers
25 and by 2015, which will be when the US-APWR goes into

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1 operation, help me with the number, over 2000? Over
2 1000. Over 100 controllers.

3 All of these controllers utilize the same
4 basic software. The application software in every
5 controller is, of course, unique. But the important
6 thing is we are rapidly gaining operating experience
7 with this Platform. And as you gain more and more
8 operating experience with the same basic software, you
9 get more and more confidence that you don't have
10 hidden software defects. And that is an important
11 point that we will be raising as we go through this
12 whole discussion.

13 MEMBER BROWN: So you don't integrate the
14 application code with the operating, --

15 MR. SCAROLA: Absolutely not.

16 MEMBER BROWN: -- the fundamental loop
17 operating system. You don't --

18 MR. SCAROLA: They are completely
19 independent. Actually in separate read-only memory.

20 MEMBER BROWN: That was another question.

21 MR. SCAROLA: We use different types of
22 memory for the --

23 MEMBER BROWN: I will ask you that
24 question later.

25 MEMBER BLEY: In these, and I think you

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1 called them now I forget what you called them but
2 operating experience reports that it sounds like you
3 are doing every year from, as you gather more and more
4 experience. It sounds as if those will be available
5 to NRC to read. And do they go down to explain where
6 you have had problems and failures functionally what
7 went wrong, what were the modes of what happened so
8 that they can understand what problems have existed
9 and how they have been --

10 MR. SCAROLA: Let me clarify what I think
11 is a misunderstanding.

12 MEMBER BLEY: Fine.

13 MR. SCAROLA: OER, Operating Experience
14 Review, is a program element of NUREG-0711 applicable
15 to the HSI. It is not applicable to the operating
16 experience of the platform, of the digital platform.
17 It is an HSI/HFE function. Okay?

18 The way we manage operating experience in
19 the digital platform is through the Appendix B quality
20 program, which requires problem reporting and then
21 corrective action documentation. So, the end result
22 is essentially the same but it is done through a
23 different process. It is done through the Appendix B
24 quality program, as opposed to a NUREG-0711 program
25 element.

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1 MEMBER BLEY: Okay.

2 MR. SCAROLA: But clearly, we do record
3 all of our operating experience. When we have
4 operating problems in the field, we document those
5 problems. We evaluate the problems. If the problems
6 are related to something that requires a design
7 change, then we document that design change through
8 the corrective actions program. And the topical
9 report does describe that corrective actions program
10 as part of the process. Part of the lifecycle
11 process.

12 MEMBER BLEY: Okay. And these Appendix B
13 reports, even though right now they are not for
14 experience with failures in the U.S., are those going
15 to be available for the review process?

16 MR. SCAROLA: Yes. I think we actually
17 had some of those available in the audit that was
18 recently conducted by the staff. The staff recently
19 did an audit on the MELTAC Platform. And I believe we
20 had corrective action reports in that audit. Maybe
21 the auditors can tell me. Do you recall seeing any
22 corrective action issues?

23 MR. WILSON: No, I don't Ken.

24 MR. SCAROLA: All right.

25 CHAIRMAN MAYNARD: You need to stand up

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1 and identify yourself for the record. And you need to
2 come to a microphone, too.

3 MR. WILSON: I'm Tom Wilson, Oak Ridge
4 National Lab. I participated in the staff audit that
5 Ken is describing. Now, I don't recall seeing that
6 particular thing but that was not the area I was
7 looking at. I don't think we actually audited that
8 particular feature of it.

9 MR. SCAROLA: If the staff would like to
10 see that, we could make it available to them.

11 MEMBER BLEY: Thank you.

12 MR. SCAROLA: It's not a problem. Okay,
13 let's move on.

14 In this topical report the key issues that
15 we address are in this list. We will be talking about
16 all of those when we get to the proprietary section.

17 CHAIRMAN MAYNARD: Let's stop here just a
18 minute. I just want to check. Is there anybody in
19 the audience from the public that is going to want to
20 make any comments? Okay, let's go ahead and move on.

21 MR. SCAROLA: Finally, the last topical
22 report is the Defense-in-Depth and Diversity Topical
23 Report. We have a similar table of contents here.

24 When we get to section four, we basically
25 present the I and C overview similar to what has

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1 already been presented in the safety system topical
2 report. It is simply repeated here for convenience.

3 Section five talks about the basic
4 principles of our Defense-in-Depth strategy, which we
5 will talk about. We have a strategy that looks at the
6 risk significance of the events, basically the event
7 frequencies and provides Defense-in-Depth in
8 accordance with the frequency of that event. And we
9 will be talking about those things as we get into
10 this.

11 Section six describes specifically the
12 design of the Diverse Actuation System. Now, we do
13 describe specific functions of the diverse actuation
14 system and specific sensors that it monitors. But we
15 explain that these are typical. The actual functions
16 and actual sensors are in plant design documentation,
17 which is for the US-APWR, it is all described within
18 Chapter 7.9 of the DCD.

19 Section seven analyzes the diversity
20 between the analogue Diverse Actuation System and the
21 digital PSMS, which is kind of a trivial analysis
22 because it is kind of hard to find a lot of
23 commonality between an analogue system and a digital
24 system. But nevertheless, we analyze it because it is
25 a requirement of NUREG-6303.

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1 Section eight describes the analysis
2 methods that we use for demonstrating that we can cope
3 with a plant accident concurrent with a common cause
4 failure. BTP-719 calls this best estimate analysis.
5 Well, best estimate is not well defined in BTP-719.
6 So, we define it. We say this is what we mean by best
7 estimate and we explain the analysis methodology.
8 Now, we don't provide the analysis in this document.
9 The analysis for the US-APWR is actually in a separate
10 technical report for the US-APWR. Every plant will
11 have its own D3 coping analysis but every plant will
12 use this same methodology. So we are asking the staff
13 to approve the methodology, not the specific analysis.
14 The analysis is done separately.

15 Section nine has the key technical issues.
16 We will be going through those. And then of course,
17 section ten is like all of the other documents. It
18 gives the map of what we are asking the staff to
19 approve versus what we expect to have in future
20 submittals. One of those, for example, being this D3
21 coping analysis.

22 MEMBER SIEBER: The D3 coping analysis
23 method description, do you set out what is acceptable
24 and what is not?

25 MR. SCAROLA: We define the acceptance

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1 criteria, yes.

2 MEMBER STETKAR: Can I just make sure? We
3 have the technical report for the --

4 MR. SCAROLA: US-APWR?

5 MEMBER STETKAR: -- US-APWR. So that
6 technical analysis, in combination with this topical
7 report should cover everything that we need to know
8 for certifying the US-APWR. Is that correct? Each
9 plant is different.

10 MR. SCAROLA: Yes.

11 MEMBER STETKAR: Now, I was wondering
12 where the interface between because I haven't read
13 this technical report yet.

14 MR. SCAROLA: Okay. If we look at the
15 topical report as kind of the mother document, this is
16 the representation of the functionality. Now, a sub-
17 tier to that is the technical report for the US-APWR.
18 Another sub-tier is section 7.9 of the DCD.

19 MEMBER STETKAR: Okay.

20 MR. SCAROLA: But the 7.9 describes the
21 specific DAS functions for the US-APWR. The analysis
22 then takes credit for those functions.

23 MEMBER STETKAR: What I was trying to get
24 to and probably not being very clear is that I don't
25 need to worry about specific COL ITAACs for example.

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1 MR. SCAROLA: Not --

2 MEMBER STETKAR: Because the level of
3 detail and scope of information for understanding how
4 you satisfy the D3.

5 MR. SCAROLA: You are correct.

6 MEMBER SIEBER: For the topical report.

7 MEMBER STETKAR: Okay. Thanks.

8 MR. SCAROLA: Now, there may be some
9 construction ITAACs.

10 MEMBER STETKAR: Yes, okay. Yes.

11 MR. SCAROLA: But not designs. But not
12 DACs.

13 MEMBER STETKAR: Okay. Not DACs.

14 MR. SCAROLA: Not DACs.

15 MEMBER STETKAR: Not DACs.

16 MR. SCAROLA: Okay, let's move on.

17 MEMBER SHACK: You have many ITAACs.

18 MR. SCAROLA: Yes. But -- okay.

19 MEMBER STETKAR: People tend to use DAC
20 and ITAAC interchangeably a lot. I have somehow
21 gotten into that.

22 MR. SCAROLA: What we are talking about in
23 this topical report is essentially this section of
24 this big architecture drawing, where we call this the
25 Diverse Actuation System. The Diverse Actuation

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1 System has a diverse HSI panel, which is a
2 conventional panel, switches, analogue indicators
3 inside the main control room. It has a cabinet that
4 interfaces to that. The cabinet also supplements the
5 manual actuations with automated actuations for
6 certain functions. And then finally the interface
7 into the plant.

8 In our Pittsburgh simulator facility, the
9 diverse HSI panel is this panel that is on the side of
10 the control room. We were not able to get that panel
11 fully instrumented and tied to the simulator for our
12 Phase 1 activities. It will certainly be tied to the
13 simulator for Phase 2.

14 Phase 1 actually has two parts, 1(a) and
15 1(b). 1(b) is starting in March of next year. I
16 think the jury is still -- are we going to have it?

17 MR. REMLEY: The operational.

18 MR. SCAROLA: Wonderful. So we will have
19 that DHP for what we call Phase 1(b). And we will be
20 talking about 1(a) and 1(b) in more detail later. So
21 we will have it shortly, which will be very helpful to
22 us.

23 MEMBER SHACK: Given its own picture, I
24 mean, all I can see is a corner of it behind.

25 MR. SCAROLA: Yes, well, let me explain to

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1 you why.

2 MEMBER SHACK: It's cardboard.

3 MR. SCAROLA: The reason it doesn't have a
4 picture is right now it is a cabinet with sheet metal
5 on it. It doesn't have switches and indicators. It
6 won't have that until March. So that is why it -- we
7 didn't want to give you a close-up.

8 CHAIRMAN MAYNARD: Do you also have a
9 remote shutdown panel?

10 MR. SCAROLA: Yes.

11 CHAIRMAN MAYNARD: And that may not be the
12 topic of these but is it more similar to your diverse
13 panel or is it --

14 MR. SCAROLA: The remote, if you go back
15 one, I will just hit it very, very quickly. The
16 remote shutdown panel essentially looks like this
17 right corner of the reactor console. It has got
18 safety VDUs and a couple of operational VDUs. It
19 assumes the digital system is functioning. We do not
20 take a common cause failure with a fire in the control
21 room, with evacuation of the control room. Common
22 cause failure is an event unto itself.

23 MEMBER STETKAR: Okay. Just to make sure
24 that I understand it. That means the DAS has no
25 controls at the remote shutdown panel. Is that

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1 correct?

2 MR. SCAROLA: Correct.

3 MEMBER STETKAR: Okay.

4 MR. SCAROLA: Correct. Because again, the
5 design basis for common cause failure is not
6 concurrent with fires or not concurrent with
7 evacuation of the control room.

8 MEMBER BROWN: Okay. Let me make sure I
9 understand exactly. So, the DAS is a function that
10 only can be utilized within the main control room.

11 MR. SCAROLA: Correct.

12 MEMBER BROWN: There is not a DAS, a
13 remote DAS similar to the remote control station --

14 MR. SCAROLA: Correct.

15 MEMBER BROWN: -- or unit or whatever.

16 MR. SCAROLA: Correct.

17 MEMBER BROWN: Okay, I didn't quite
18 understand that. Thank you.

19 MR. SCAROLA: Okay. Let me just an
20 overview of our strategy for D3. First and foremost,
21 we do everything we can to minimize the potential for
22 common cause failure in the PSMS. Our key strategies
23 there are both functional diversity and design
24 simplicity. So, the first and foremost is to minimize
25 the potential for common cause failure. We believe we

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1 have actually eliminated the potential for common
2 cause failure but, of course, you can never prove
3 that. It can never be proven so all we can say is we
4 have done everything that industry technology allows
5 us to do. We have taken every precaution that we know
6 how to take. And we will talk about all of these
7 things, simplicity, diversity, etcetera.

8 Then, despite all of that, we assume we
9 have a common cause failures and now we demonstrate
10 that we can cope with that common cause failure. We
11 provide a Diverse Actuation System which is immune to
12 that common cause failure. And the immunity comes
13 through this diverse analogue technology. Now, we
14 look at --

15 MEMBER SHACK: Well actually, in you
16 diversity report, it could be a diverse digital
17 system.

18 MR. SCAROLA: Well, that is very true. If
19 you look at the D3 report, is it the D3, yes. If you
20 look at the D3 report -- no. I'm sorry.

21 If you look at the safety system report,
22 it simply says that the diversity is defined in the D3
23 report.

24 MEMBER SHACK: Yes.

25 MR. SCAROLA: Okay? It doesn't say what

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1 the technology is. It could be analogue or digital,
2 as long as you demonstrate sufficient diversity. But
3 the D3 report that we have submitted describes an
4 analogue system. So that is all we are asking the
5 staff to approve.

6 MEMBER SHACK: It does. Yes, you are
7 right. It does.

8 MR. SCAROLA: The D3 clearly states it is
9 an analogue system. So that is all we are asking.

10 MEMBER SHACK: Clearly, the APWR intends
11 to have an analogue system.

12 MR. SCAROLA: APWR references that D3 and
13 it will have an analogue system.

14 We just wanted to leave the door open in
15 the safety system so that if a future customer who is
16 doing a digital upgrade decides they don't want an
17 analogue system, they could design a separate DAS. It
18 meets all the same functional requirements but they
19 would have to demonstrate adequate diversity for
20 whatever technology they select.

21 As the staff often tells us, you can take
22 the easy path or the hard path. The easy path would
23 be use an analogue system. The harder path would be,
24 okay, use something else but you have to demonstrate
25 diversity.

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1 Okay, so now we get back to our strategy.
2 And our strategy looks at the frequency of these
3 events and we provide commensurate Defense-in-Depth
4 based on the frequency.

5 For example, for anticipated operational
6 occurrences, we have automated DAS functions in
7 accordance with the ATWS rule. The ATWS rule says you
8 must have the following automated functions. For
9 different PWR types, we basically follow the
10 Westinghouse PWR type because this is, essentially, an
11 evolution of a Westinghouse-style plant.

12 For postulated accidents of moderate
13 frequency, we have automated or manual DAS functions
14 to achieve the acceptance criteria defined in BTP-19,
15 which is the most fundamental one is no offsite
16 releases that exceed the 10 C.F.R. 100 limits. And we
17 demonstrate that through best estimate analysis.

18 So, we look at each one of these events.
19 We do a best estimate. We say we have met the
20 criteria.

21 Lastly, we have large break LOCA. Large
22 break LOCA is where we have looked at this the same
23 way it was looked at for System 80 plus during that
24 design certification process. We analyze the
25 potential frequency of the common cause failure. The

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1 frequency of the postulated accident. And we conclude
2 that the best thing that we should do here is to
3 balance prevention and mitigation. So we do what we
4 can to prevent the accident based on leak detection,
5 where we have diverse leak detection capability. We
6 have diverse manual shutdown controls such that if we
7 detect a leak, we can diversely shut down the plant.
8 And we ultimately have diverse ECCS actuation
9 capability. In the event that there really is a large
10 break, now we give the operator the ultimate defense.

11 So, depending upon the frequency of the
12 accident, our strategy varies. And we will talk more
13 in depth about that varying strategy.

14 CHAIRMAN MAYNARD: We have about ten
15 minutes to go over about 20 slides. So --

16 MR. SCAROLA: Okay. I understand. Okay,
17 if we can move to the next slide.

18 This basically is a simplified
19 representation of the safety system, which is the
20 normal half from sensor all the way to actuation. In
21 this case, we are showing the reactor trip breaker.
22 And here you see we isolate those sensor signals, take
23 them in their analogue form over to the diverse
24 actuation cabinet. Here we have conventional logic
25 where we monitor that same set point in an analogue or

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1 that same parameter in an analogue bistable. The
2 output of the analogue bistable is used to trip, in
3 this case, the motor generator sets. So, we basically
4 have a parallel function but diversity all the way
5 from the output of the sensor, all the way down to the
6 actuation. And that is fundamentally how the DAS
7 works throughout.

8 The DAS design is based on conventional
9 analogue technology that is currently operating in
10 analogue protection systems in Japan. So the DAS
11 technology is well proven. Its analogue technology
12 has been around for years. And the same strategy that
13 we are applying in the U.S. is the strategy that is
14 being applied to all of these plant in Japan that will
15 have digital reactor protection systems.

16 The topical report addresses all of these
17 key issues, including our strategy for each one of the
18 event frequencies.

19 Okay, that is much as I had to say about
20 the topical reports. The next section which I said we
21 would address if time permits, it looks like time does
22 not permit. So we could stop right here, unless there
23 are specific things in this following section that you
24 have looked at previously because you had a draft of
25 this that you would like me to address. But I was

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1 hoping we would have time. It looks like we are not
2 going to have time for it.

3 CHAIRMAN MAYNARD: About how much time do
4 you think it would take to do it right?

5 MR. SCAROLA: I can hit the high points in
6 probably ten minutes and then we could go back if we
7 want to get into any specific areas.

8 CHAIRMAN MAYNARD: I think that might be
9 worthwhile.

10 MR. SCAROLA: Okay.

11 CHAIRMAN MAYNARD: If that is not enough
12 time, then we will just put it off. But before you do
13 that, let me check one more time and make sure there
14 is no members of the public that are here that want to
15 make any public comments.

16 Okay, go ahead.

17 MR. SCAROLA: Okay. Now this section is
18 intended to give an overview of how this digital
19 technology will impact plant personnel. The first one
20 speaks to the issue of information and control
21 accessibility. In existing control rooms, we send the
22 operator to the information. He has to traverse a
23 large real estate of boards. In this design, we bring
24 the information and the controls to the operator.
25 This is the fundamental thing that enables staff

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1 reduction. And I will just leave it at that. We will
2 move one.

3 This is just an example of the navigation
4 scheme. This is a high-level screen menu that allows
5 the operator to access roughly 250 displays. This is
6 the highest level in the information hierarchy. There
7 are various levels. So, by making a touch on this
8 screen, the operator can get to any information in the
9 plant. Let's move on.

10 Another important feature, before I
11 touched on it very briefly, and that is computerized
12 data processing. One of the things that we use this
13 computer for is to continuously cross-check redundant
14 instruments. Existing control rooms do that once a
15 shift, once every eight hours, the operators are
16 required to manually compare all of the instruments in
17 the redundant safety channels. This system does it
18 continuously and automatically. Operators don't have
19 to do it. If the computer sees a problem, it sounds
20 an alarm.

21 MEMBER STETKAR: I hope when you talk more
22 about the detailed system design you are going to talk
23 about the, I have forgotten, there is an acronym SSA,
24 the signal select --

25 MR. SCAROLA: The signal selection

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1 algorithm. SSA.

2 MEMBER STETKAR: Is there part of -- okay
3 thanks.

4 MR. SCAROLA: We'll talk about it later.

5 Next one, automated actuation checks. One
6 of the most time consuming things for operators to do
7 during the execution of the emergency operating
8 procedures is the verification that if the ECCS was
9 demanded, that all of the components of the ECCS
10 actually responded and lined up correctly.

11 Containment isolation. I get a
12 containment isolation signal, have all 150 valves
13 actuated correctly. Extremely time consuming tasks,
14 something that takes a matter of seconds for the
15 computer. We automate it. Simply tell the operator
16 everything is okay or something is not okay and then
17 they can drill down to see what is not okay.

18 MEMBER BLEY: Do any of the operators you
19 have run through this get a little uncomfortable with
20 that?

21 MR. SCAROLA: Actually the operators have
22 responded extremely well to this. They think this is
23 great. This is the greatest thing since sliced bread.
24 Because this information is shown on our large
25 display panel. It is one of the highest level

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1 situation awareness features that we have. And at a
2 glance, the operators can see every safety function
3 that is actuated and whether the actuation was
4 successful or the degree of degradation. We display
5 things like "not okay" in various colors. Red color
6 means it is really not okay. Yellow color means, some
7 things didn't go but don't worry about it. Move on
8 and do something else. You can worry about this
9 later.

10 So, the operators seem to have adapted
11 extremely well to it. And I think it is because if
12 they want to drill down, they can drill down. If they
13 want to look at every pump and valve and they have the
14 time to do that, they can look at every single pump
15 and valve and they can see where it has gone. We
16 automate the process.

17 MEMBER STETKAR: Ken, is that -- I missed
18 it. Is that display one of the ones that you can
19 pull up on the safety VDUs? Is the okay, whatever you
20 call it --

21 MR. SCAROLA: No. No, it is not.

22 MEMBER STETKAR: It is not. Okay, thanks.

23 MR. SCAROLA: And this all gets back to
24 the complexity of the software.

25 MEMBER STETKAR: I know there were some

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1 things that you can pull up on the safety VDUs.

2 MR. SCAROLA: What we try to do on the
3 safety VDUs --

4 MEMBER STETKAR: That's okay. --

5 MR. SCAROLA: -- is keep it as simple as
6 possible.

7 MEMBER STETKAR: We will get into it.
8 That's --

9 MR. SCAROLA: Okay.

10 MEMBER STETKAR: I just didn't -- thanks.

11 MR. SCAROLA: Similar to verifying
12 automated actuation, we also want the operators to be
13 continuously aware of the availability of their safety
14 system. So, there is an acronym in the industry,
15 bypassed or inoperable status indication or some
16 people refer to it as BISI.

17 BISI is automated in this design. We use
18 the computers to continuously look at the availability
19 of the things that may need to be actuated in the
20 future. And if something is not available, we have
21 logic that determines the effect at the system level.

22 And if the system function of ECCS or the system
23 function of containment spray is not available, then
24 we say not okay. And the operator can drill down.

25 Again, we use the computer for the --

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1 MEMBER SIEBER: Does it check the tech
2 specs for operability requirements and say you have
3 got to shut down, for example?

4 MR. SCAROLA: When you say does it --

5 MEMBER SIEBER: Or does it just say not
6 okay?

7 MR. SCAROLA: Well the tech specs will
8 often go beyond lineups.

9 MEMBER SIEBER: Right.

10 MR. SCAROLA: It basically checks the
11 ability to actuate and the ability to achieve the
12 lineup.

13 MEMBER SIEBER: Right.

14 MR. SCAROLA: If the tech spec goes beyond
15 that, no. It may not be checking all of the tech spec
16 parameters.

17 MEMBER SIEBER: But does it tell the
18 operator that, based on what it knows, whether it is
19 complying with tech specs? Like if some system is
20 unavailable and tech specs say it has to be available?

21 MR. SCAROLA: Oh, okay. This is very
22 interesting. This system will tell the operator that
23 the system is available or not available.

24 MEMBER SIEBER: Right.

25 MR. SCAROLA: Whether or not that is a

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1 tech spec violation may be mode dependent. It may be
2 the tech specs require two divisions in this mode but
3 four divisions in this mode. No, the system does not
4 go that far. But I believe there is an offline
5 system. Maybe you can --

6 MR. TAKASHIMA: Maybe some will be some
7 way of checking of the tech spec or a checking system
8 will be provided but it is not fix it.

9 MR. SCAROLA: Yes, but we don't describe
10 that in the topical report because --

11 MEMBER SIEBER: That's not a bad feature.

12 MR. SCAROLA: -- it is not a standard
13 feature of the design. It is clearly something
14 Luminant has asked for. They said, look, your system
15 tells us the availability of systems but would you
16 take it the next step and tell us whether we are
17 violating a tech spec or not. Yes, that might be
18 something we do in the plant computer but we don't
19 think it is critical to the staff safety determination
20 of this design because --

21 CHAIRMAN MAYNARD: I would be a little
22 cautious about integrating that into the program.
23 Running computerized tech specs may be fine but you
24 may want to consider running that.

25 MR. SCAROLA: Which is exactly what is

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1 being considered. This is something we would run in a
2 separate IT computer, an information technology
3 computer, not the online system that we are running in
4 the plant.

5 MEMBER STETKAR: I am assuming, I didn't
6 see it in there but I am assuming that the bypass
7 inoperable status indication extends down to all of
8 the support systems for each train. So, if you have a
9 ventilation fan out of service or a cooling water
10 valve shut, it will fold back up in. So you have got
11 the full end-to-end.

12 MR. SCAROLA: Right, end-to-end.

13 MEMBER STETKAR: Okay.

14 MEMBER SIEBER: Well, BISI usually doesn't
15 got to ventilation. It goes to cooling water.

16 MEMBER STETKAR: That is why I wanted to
17 ask.

18 MR. SCAROLA: But it will go to cooling
19 water and ventilation if those are required for the
20 operation of this RHR pump or this safety injection
21 pump.

22 MEMBER STETKAR: Required functionally or
23 administratively?

24 MR. SCAROLA: No, functionally.

25 MEMBER STETKAR: Because sometimes they

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1 are different.

2 MR. SCAROLA: Functionally.

3 MEMBER STETKAR: Well --

4 MEMBER SIEBER: Yes, there is a
5 difference. Air conditioning is administrative.

6 MR. SCAROLA: Okay. Another important
7 feature of the design is alarm management. We do a
8 number of things to minimize nuisance alarms. We will
9 be spending more time on that later. Let's go on from
10 that.

11 And lastly, I think we spoke a little
12 about this before, all of these advance features are
13 very good in helping the operators perform better,
14 perform more efficiently. But we really need to
15 recognize that the failure modes can be different and
16 we need to train operators to respond to those failure
17 modes. And we need to design so that we have
18 accommodated those failures modes.

19 So, in this new control room, we employ
20 redundancy everywhere so that we minimize the
21 frequency of large catastrophic integrated failures
22 but we still have to recognize that they can happen.

23 So, for example, some of the things that
24 we did in Phase 1 for the operators from Luminant is
25 we put them through degraded HSI conditions and we

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1 looked, we monitored how they responded. And some
2 responded better than others. And we have some things
3 we have to do in the design to improve it but we
4 clearly have good data now. I would say that the
5 biggest challenge we have for operator training is
6 degraded HSI in these control rooms.

7 If we look at this next picture -- oh, did
8 I miss one? Okay, let's just go to channel
9 calibration. That is fine.

10 Okay, everything that we talked about so
11 far pertains to the operators. Now, we are going to
12 talk a little bit about the technicians. A big thing
13 that technicians do is calibrate instruments and all
14 of the modules that relate to the instrument loop, for
15 example, signal conditioners, filters, computational
16 lead lags. Technicians calibrate these things every
17 30 days. And it is a tremendously labor-intensive
18 activity.

19 In the digital system, the calibration is
20 limited only to the field instrument. When we
21 calibrate the field instrument, we calibrate the
22 entire loop right up to the HSI as one string. Once
23 we see the appropriate digital values at all of the
24 various measurement levels, we typically do five
25 levels across the entire range of the instrument. We

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1 know that everything is calibrated. So that
2 encompasses the signal conditioning, the A to D
3 conversion and, once we see a digital value on one
4 VDU, we can be confident that the same digital value
5 is going to show up on every VDU. So, all of the
6 calibration is greatly simplified.

7 The next one is operability testing. In
8 existing analogue designs, we have an enormous amount
9 of segmented tests. We will test each segment of a
10 loop separately with overlap. We test both the
11 interfaces to the analogue I and C systems, as well as
12 what is going on inside the systems. In the digital
13 system, we rely on self-testing for everything that is
14 inside the digital boundary. The manual tests are
15 limited to verifying that the analogue signal gets
16 into the digital system correctly. And then we have a
17 manual test that verifies that the signal from the
18 digital system will, in fact, move the valve or start
19 the pump.

20 So, that is effectively where we do manual
21 tests on each end but what is inside the digital
22 system, we test automatically.

23 MEMBER STETKAR: Are you going to talk
24 more about that this afternoon? Thanks.

25 MR. SCAROLA: I think I actually spoke

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1 about the last slide already. The same subject.

2 So, finally, since we have a lot of extra
3 time, I will go through each of these acronyms one-by-
4 one. No.

5 (Laughter.)

6 MR. SCAROLA: I noticed you looked up.

7 CHAIRMAN MAYNARD: You can do that with
8 your colleagues over lunch.

9 MR. SCAROLA: I don't know that we
10 clarified the acronym list in the presentation. I'm
11 not sure where it came from.

12 CHAIRMAN MAYNARD: You can go over those
13 at your lunch table today while you are at lunch.

14 One of the challenges, I think, for the
15 operators is all of the advantages of this is one
16 thing but what are they going to be doing when nothing
17 is going on. And I think one of the challenges for
18 the plants is keeping the operators awake and not
19 complacent and stuff like that. But that is a topic
20 for another discussion.

21 But anyway, let's go ahead. I want to
22 take a break. But before we do here, though, I'll
23 make sure one more time nobody from the public.

24 When we come back, we will come back and
25 go into closed session. The next open session for the

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1 public will be tomorrow at 12:00, I believe it is, at
2 noon. So with that, let's go ahead and we will break
3 for lunch and come back at 12:30 and we will come back
4 into closed session.

5 Thank you.

6 (Whereupon, the above-entitled matter went
7 off the record at 11:34 a.m. for a closed session,
8 adjourning the open session to continue on Wednesday
9 November 5, 2008.)

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