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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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US-APWR SUBCOMMITTEE

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THURSDAY

AUGUST 20, 2015

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 8:30 a.m., John W. Stetkar, Chairman, presiding.

COMMITTEE MEMBERS:

JOHN W. STETKAR, Meeting Chairman

RONALD G. BALLINGER, Member

DENNIS C. BLEY, Member

DANA A. POWERS, Member

JOY L. REMPE, Member

STEPHEN P. SCHULTZ, Member

GORDON R. SKILLMAN, Member

DESIGNATED FEDERAL OFFICIAL:

GIRIJA S. SHUKLA

ALSO PRESENT:

ROBERT HALL, MHI

MIKE JUNGE, NRO

SAMUEL S. LEE, NRO

KENJI MASHIO, MHI

PAUL PIERINGER, NRO

RYAN SPRENGEL, MNES

WILLIAM WARD, NRO

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

8:35 a.m.

CHAIRMAN STETKAR: -- the Water Reactor Subcommittee. I'm John Stetkar, chairman of the subcommittee meeting. ACRS members in attendance are Steve Schultz, Dennis Bley and Ron Ballinger. We will be joined sometime this morning by Joy Rempe and Dana Powers, and perhaps Dick Skillman.

Mr. Girija Shukla of the ACRS staff is the designated federal official for the meeting. The subcommittee will discuss the safety evaluation reports associated with DCD Chapter 18, Human Factors Engineering, and Topical Report MUAP-07007-P, Human System Interface System Description. The DCD applies for the US-APWR design certification, and the topical report applies for the general HIS interface. We'll hear presentations from Mitsubishi Heavy Industries, Mitsubishi Nuclear Energy Systems, and the NRC staff.

The subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate, for deliberation by the full committee. Your rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the Federal Register. Parts of this meeting may need to be closed to protect proprietary information for Mitsubishi or other parties. I'm asking the NRC staff and the Applicant to identify the need for closing the meeting before we enter into such discussions, and then to verify that only people with the required clearance and need to know are present.

We'll work through that as we get into various topics. A transcript of the meeting is being kept and will be made available, as stated in the Federal Register notice. Therefore, we request that participants in this meeting use the microphones located throughout the meeting room when addressing the subcommittee. The participants should first identify themselves and speak with sufficient clarity and volume so that they may be readily heard. A telephone bridge line has also been established for this meeting.

To preclude interruption to the meeting, the phone will be placed in a listen-in mode during the presentations and committee discussions. We'll open the bridge line later to see if there any members of the public who want to make comments regarding the proceedings. Please silence your cell phones during the meeting. I'll also alert those of you who we've not seen for a while that we have a little bit of a different protocol. The microphones on your desk up front there, they're very, very, very sensitive. They cause problems especially with the bridge line when they're on. What we're doing is we're keeping them off unless you're speaking.

To turn them on, just press -- there's a little area right in front of you that says "Push," really isn't a push button, but if you push on it, the little green light will come on, so try to remember to do that. We'll chastise you appropriately if you don't do that. That helps both our recorder because it's not so much crashing in his ears, and in particular, folks on the bridge line because they're really sensitive. With that, we'll now proceed with the meeting. I call upon Bill Ward, from New Reactors, to open the proceedings.

MR. WARD: Thank you, John. Good morning, everybody. My name is Bill Ward. I'm the lead project manager for the US-APWR design certification. At this time, the review is in what we call the slowdown. MHI is focused on supporting a Japanese restart, so we're doing just a few chapters. Chapter 18 was the first that we wanted to move forward. We also are working on 7 and 18, so it's not a full review at this time. What we are reviewing is certainly very active. We'd like to thank the subcommittee for having us here today to present Chapter 18 on human factors engineering or HFE, and the reference topical report. This is the final technical chapter of the APWR design certification to go through Phase 3.

Although this is Phase 3, the SER for Chapter 18 was written with no open items. I think that's a measure of the success of the support image I provided in answering our questions throughout the long review. We hope we can answer all of your questions just as well today. Remaining in the review for Phase 2/Phase 3 is Chapter 1, Seismic and Fukushima Related, and some sections of Chapter 14. We have MHI and NRC HFE technical staff here this morning, as well as someone supporting I&C work.

They're here to answer your questions, as well as make presentations. I can introduce them later. We wanted to say that we find it particularly helpful, at the end of the session, to restate any specific actions or questions you may have, so we can write them down. We'll certainly review the transcripts when they become available. At this point, I think I'll turn it over to Ryan.

CHAIRMAN STETKAR: Bill, I don't know whether -- I know we're going to talk about, I think, the topical report first. I guess I'll ask you now, and maybe you want to postpone the answer until we talk about the DCD chapter review. The version of the DCD Chapter 18 that we received for review is Revision 4 --

MR. WARD: Correct.

CHAIRMAN STETKAR: -- of the design certification design control document. That version of Chapter 18 explicitly refers to both the topical report, but a much earlier revision of the topical report, and to several technical reports which were not included in the staff's review. The staff reviewed different technical reports and, indeed, much later revisions of several technical reports.

I got really confused about what the ACRS is being asked to review at this subcommittee meeting because the things that are cited in the staff's SER are not cited in the design control document chapter that we were asked to review, which leads us to a real disconnect, in terms of what is the supporting information? You may want to hold off -- so I'm really curious about what we, the subcommittee -- granted, we are only the subcommittee, but if this comes to the full ACRS, the full ACRS needs to have a coherent set of documentation and an SER written to that documentation, and we don't have that right now, quite honestly.

MR. WARD: Actually, Revision 4 of the DCD is the latest revision. Revision 5 is in process, and I have a working copy of that, MHI does. The various reference reports have been updated as we went through. They don't reflect in Revision 4 of the DCD, but they are being reflected in Revision 5.

CHAIRMAN STETKAR: That would be really good if we had Revision 5 of the DCD with that traceable (Simultaneous speaking).

MR. WARD: Because of the slowdown, it's not been issued, but what we could do is see if we can get a copy of what Revision 5 looks like at this point.

CHAIRMAN STETKAR: It's kind of late for this subcommittee meeting and the hundreds of pages of material that I know I read through to do that. I'm pretty annoyed that we're in this situation. For the subcommittee, we're focused on more technical information, and it's annoying that we're in a situation that we're in. But I will tell you that if it comes to the full committee, we need a coherent set of documentation. We need a version of the design control document that points to the operable supporting technical reports that indeed were used to support that version of the -- and we need a safety evaluation that points to that version of the design control document and the applicable technical reports (Simultaneous speaking).

MR. WARD: I understand the problem. Let me assure you that all the technical reports we provided are the latest versions.

CHAIRMAN STETKAR: Oh, they are, once I found them.

MR. WARD: The only thing that was not necessarily the latest version is the fact that it was Rev. 4 of the DCD, and it may refer to earlier versions of technical reports. But all the reports we provided, the topical report -- the safety evaluation was written to all the latest topical and technical report versions and to the RAI response, which provided where changes were being made in the DCD.

CHAIRMAN STETKAR: All right.

MR. WARD: I can work with MHI to provide a --

CHAIRMAN STETKAR: If you want an ACRS letter -- now the topical report, I believe, is consistent. We are working toward Revision 6 of MUAP-07007-P. That seems to be referenced consistently, in terms of the SER of the topical report, and obviously the topical report is that version. If that comes to the full committee, I think we're clear on what it is, in fact, the committee's being asked to review, but not right now, in the case of the information we have on the DCD itself, Chapter 18.

MR. SPRENGEL: Okay, this is Ryan Sprengel with MNES. I'll maybe bring that discussion up in more detail when we get to the Slide 4. It's near the beginning of the presentation.

CHAIRMAN STETKAR: I just wanted to get it out of the way at the beginning here because it sounds like it's procedural, and in my cases it is, but it's very, very important, especially for the ACRS as a full committee, to be very clear on what it is that the members are being asked to review, so there's no uncertainty about disconnects between supporting information in technical reports versus what's cited in the (Simultaneous speaking).

MR. WARD: I just want to emphasize that the safety evaluation reports were written to the latest versions of all the technical reports. They were provided. The only thing that was not necessarily the latest was the DCD Chapter 18. We were uncertain about whether or not we should provide a draft copy of Revision 5 of the chapter. We were relying on the REI responses to sort of bring Chapter 18 up to date.

CHAIRMAN STETKAR: You said, Bill, you provided them. I found them in ADAMS once I had the report numbers, but --

MR. WARD: I provided the DCD with all the reports.

CHAIRMAN STETKAR: Okay, maybe we had an internal problem.

MR. WARD: Okay.

CHAIRMAN STETKAR: Sorry. I found all of the technical reports. They were all in ADAMS, once I had the numbers and could go look up the revision numbers and things. Okay. We did receive the confirmation of Rev. 4 of the DCD. Anyway, it's difficult because it appears that some technical reports that are cited in the DCD have died and gone away. They were revised, and then they died and went away. It subdivided into other technical reports. It's pretty difficult (Simultaneous speaking).

MR. WARD: That's true. Some were formally withdrawn. I provided that letter withdrawing those, as well.

CHAIRMAN STETKAR: Okay. I didn't see that, either. Okay, we'll have to check internally. Maybe we have a problem. Sorry about that.

MR. WARD: That's fine.

CHAIRMAN STETKAR: But it is -- we still need to get it cleaned up and to the full Committee.

MR. WARD: It's part of the difficulty of being in the slowdown here.

CHAIRMAN STETKAR: By the way, while we're talking about programmatic things here, does the staff and MHI want a letter from the ACRS? Until this point, we have written letters -- they're interim letters because of the stage of the review that we've gone through, but we have written interim letters on all the other chapters that have come before us up to this point, with the exception of 1, and I think two sections of Chapter 3 that you mentioned that still haven't come before the subcommittee or the full committee.

Do you want letters from the ACRS on both this section of the DCD, Chapter 18, and probably, more importantly, the topical report? If you do, we'll need to work on a schedule to make that happen at some point.

MR. WARD: Yes, we do.

CHAIRMAN STETKAR: You do? Okay. We'll have to plan for that among ourselves. We'll do that offline, once we decide a little bit better what it may entail. So that we can get some of this procedural/programmatic things out of the way, at least, do any of the other members have any comments or questions that you want to ask/make at this time? With that, we'll let Ryan start. Ryan.

MR. SPRENGEL: Ryan Sprengel, MNES, again. I'm glad to be back. We've been going, just at a slower pace, as Bill mentioned. We are still definitely interested in getting an ACRS letter not only for Chapter 18, but also for the HFE topical report.

With me today, Kenji Mashio and Bob Hall, as well as Yamashita-san on the end, and some additional participants from Japan over the bridge line, as well as in the audience. A brief overview. Basically, we'll give some introductory information and the structure of our material, followed by the US-Basic HSI, covered mostly from the topical report, and then the HFE program management plan, which is focused more on the DCD application, as well as the implementation plans or technical reports that were mentioned. First section brings us to the area that was already brought up. We have been well aware of the potential for disconnect between a submitted DCD, which is kind of a fixed moment in time and does not necessarily happen excessively because that can create even more confusion by continually revising the DCD.

What we've done in the past is submit what we call update tracking reports, which pull together the markups that we've committed to in REI responses. Over some time, we have a number of REI responses, and we would submit an update tracking report pulling all those changes together. That, in turn, can lead to a potential confusion once those build up because they're just the changed pages. So the Item No. 2 is our update tracking report, the last one submitted, and that had just the changed pages.

To facilitate the review -- and the intent would have been to facilitate your review, as well -- we submitted Item No. 3 there in 2014. That was a little bit different, in that we submitted basically what would be future DCD Rev. 5. We cleaned it up, and it would look like the future DCD Rev. 5. It was submitted to the NRC, and it should be available to you. That would show basically the current state of the design certification document. That is the version that the staff's SER refers to.

CHAIRMAN STETKAR: Is that -- is it in ADAMS? Because if I searched on -- I don't remember the MUAP number of the DCD. The last revision I could find in ADAMS was Rev. 4.

MR. SPRENGEL: That is accurate.

CHAIRMAN STETKAR: I didn't have the UAP, but it's typically not filed in ADAMS under your UAP. It is?

MR. SPRENGEL: That's correct, sorry.

CHAIRMAN STETKAR: Your UAP (Simultaneous speaking).

MR. SPRENGEL: It is not logged into ADAMS using our UAP, but the UAP number is part of the document title, so it's also -- it is searchable.

CHAIRMAN STETKAR: If I knew what that was, I could've searched on that, but I didn't.

PARTICIPANT: Right, that would've been

helpful.

MR. SPRENGEL: My understanding of how the staff have incorporated this document is that it has become a confirmatory item to make sure that the changes that have been submitted as part of that -- a draft Rev. 5 actually get rolled into Rev. 5. It's part of our QA and document control process --

CHAIRMAN STETKAR: Even that's not documented in the SER for Rev. 4. There's nothing -- it is?

MR. WARD: Yes, I think there's a single confirmatory item.

MR. PIERINGER: There's a confirmatory. Paul Pieringer. There's a confirmatory item for the ITAAC, which is Chapter (Simultaneous speaking).

CHAIRMAN STETKAR: For the ITAAC. That's the only one.

MR. PIERINGER: There's not a confirmatory item in Chapter 18. Our thought was that every chapter has to update to Rev. 5, and that there was a generic confirmatory item. But I don't believe, from talking to Bill, that exists either, so we do not have the confirmatory item you were looking for.

CHAIRMAN STETKAR: The only confirmatory

item, you're right, is the one on the ITAAC. I didn't interpret that as -- it's a typical confirmatory item, closing out -- I think it's V&V or something like that in the ITAAC process.

MR. WARD: I stand corrected.

MR. SPRENGEL: So Item No. 3 should address your specific concern, in terms of how the technical reports, topical report, and the DCD all fit together. That should be available to you through some process.

MEMBER BLEY: As of today, I'm just -- it'd be nice to have something like this as we begin to get ready for the next meeting, so we know what's there. This would let us go back and do better this time.

PARTICIPANT: Agreed. Okay.

CHAIRMAN STETKAR: The fact of the matter is we are where we are today. You'll hear substantive feedback from us on, I believe, the reports that you're going to pull up on these next two slides.

MR. SPRENGEL: That last --

CHAIRMAN STETKAR: It was an ordeal.

MR. SPRENGEL: That last summary markup did not change anything. It was really just pulling together the other changes. All the information is still the same. It's just in an easier to process format. With that, you already did bring up about the shifting of use of technical reports. You are correct that some of the technical reports, in concert with the staff review, some of those reports were withdrawn as no longer necessary to support the review and application. So the list we have here on this page, and then the subsequent page, shows the complete set of topical and technical reports. The topical we'll look at separately next, and then the technical reports are numerous. The changes have been made.

This is a kind of very clean approach, we think, that has worked very well for the review, after a significant amount of effort on our part cleaning them up, organizing them. We'll go through some of how the format is very consistent within them to try to facilitate the communication and understanding of those documents. This page, and then the next, will list the number of technical reports, the implementation plans that we'll go through in some more detail, in terms of what those are and how they were created.

Then the last section is two internal

documents that we had, and we provided those for audit for the staff, one a number of years ago, and one last year, for the Style Guide and the OER. We've already touched on one of our areas, the topical report, 07007, looking for documentation of what the US-Basic HSIS is, and of course, looking for approval from the NRC on that. Through the development of it, we've documented the genesis of it, where the basic foundation came from in Japan on developing over to the US-Basic HSIS, including the simulator, which some have attended and gone through demonstrations at. That process will be gone over again, as well, here today and how we use the simulator in our development process.

Also, of course, this is the top point of our program, leading further down to the implementation plans that we'll discuss as part of the support of the design control document through some connections with all the documents. Technical reports, I'm mainly looking at the eight implementation plans, but we also have the HFE program management plan, as well. We'll kind of summarize all this information.

I know the staff, of course, will present their review and conclusions on it which, from our understanding, is a very positive result, in terms of the final work that we ended up with and submitted. I mentioned our cleanup process. Part of it was standardizing how the documents are formatted to, again, make it easier for the communication of information, and also the review of it. These sections are applied throughout the PMP, as well as the eight implementation plans, again, to standardize how we're communication information and getting that provided to the staff for review. There's two caveats. One of those is they tie into the changes that were already mentioned. Two areas, the procedure development and the training program, were shifted, in terms of the responsibility for review on the staff side.

So that review is credited as part of Chapter 13. As a reminder, Chapter 13 has gone through Phase 5, so that review is a little further along than most of our chapters. We're in a good position with that chapter. The other area that had a change was the HPM area. That became a COL item that would be the responsibility for the COL to submit. That's one that based on where we were, and through the process of going into a slowdown mode, that has not been pursued yet by a COL applicant.

CHAIRMAN STETKAR: Ryan -- I'll let you get through this before I ask. I have a leading question that you may not want to answer (Simultaneous speaking).

MR. SPRENGEL: Those are our favorite. I mentioned the two other areas. Of course, we had the Style Guide that we provided and the OER results. Those were two documents internal to MHI not submitted on the docket, but available for audit, and the staff's audit report is available. In terms of what is remaining, ITAAC has already been mentioned. We'll show that table. There were some changes to our ITAAC for this area. Then we have a number here, seven areas that we'll be submitting results summary report.

When we look back to the content of the IPs, one of the areas is the result summary report. There's detail contained within the IPs that we'll provide in a review that basically commit to what will be contained. It's very clear, in terms of what the process is and what will be provided in the future in these different areas.

CHAIRMAN STETKAR: That gives me an in to ask a leading question. I, personally, was misguided. I read the DCD chapter first, and I went and read the technical reports that were referred to in the DCD chapter before I went to the SER because that's just the way I do things. Should have done it reverse because I wound up reading a whole bunch of stuff twice. What I noticed, though, in some of the technical reports that are cited in DCD Rev. 4 that either have been withdrawn, or have been subdivided in some cases, there were some results available in those previous technical reports that I found interesting and useful. I'll talk about some of them later. Those seem to have been all purged from the current technical reports, which are, I think, wholly focused on implementation plans, as you mentioned. You said the format has been laid out such that there is a section for results, should they be available.

That obviously was a conscious decision to remove that information. Was it prompted by the staff, or did you guys make it? That's the leading point of my question. Because we've gone from something, in my opinion, that actually had some supporting technical content, to now something that is much more just programmatic and plan oriented, in terms of the material available, both for our review of the DCD and the supporting technical reports and the staff's review of those technical reports, in other words, signing off that yes, it sounds like the programs and plans are okay, but not looking at any actual results.

MR. HALL: Bob Hall, contractor to Mitsubishi. That change was done intentionally, and it was done intentionally because we got into confusion during a review cycle as to what we were supplying? We're living within the NUREG-0711 world, which has two sets of documents that get submitted, plans and results. When you saw that outline that we had up, where it talked about results, that was simply the content of the results report, not results of the analysis. The thought was to separate them because the results that were included in some of the implementation plans were illustrative examples, incomplete, and pull them apart and put everything into the results summary reports when, in fact, they're presented. An example of that would be the early OER report had results in it --

CHAIRMAN STETKAR: Yes, it did.

MR. HALL: -- but now it's two pieces. The implementation plan -- the documents you reviewed are exactly what 0711 asks for, the plan of how to do it. Those results were the audited document that Ryan showed up on his list of documents. It was into a results-type report, two separate documents. That was the intent of doing it, just to clearly distinguish process versus results.

CHAIRMAN STETKAR: What that does, from the ACRS's perspective, is that it removes the technical content from our review. We're now asked to review process, rather than content. Because, as I said, I was misguided. I reviewed the references in the DCD. I had a few questions on the operating experience and how it was relevant and things like that. Now I can't ask those questions because, for example, we don't have that operating experience. We will, in fact, never see it because it's not completed until after the COL is issued, as best as I can tell, in terms of the phased approach. That's apparently the way people want to run the process, and I guess we have to live within that. It's just annoying. You may hear about that.

MR. PIERINGER: Paul Pieringer, NRC. That's just one bad side effect of the DAC process. We're trying to change that. I'll go into more detail during my presentation.

CHAIRMAN STETKAR: See, Paul, but you're

introducing the DAC process, where it didn't exist previously. We had technical information available to support part of the design. We had it. You're now introducing stuff that will become, whether you want to call it DAC or ITAAC. You are now pushing things out into that world that, at least the ACRS has been trying to advocate, ought not to happen. If the staff is trying to do that, you're going to hear about it.

MR. PIERINGER: Okay.

MR. LEE: This is Sam Lee from the licensing group. Thank you for that comment. We appreciate the comment. Please understand, for the record, that this is a Commission policy that we're following. This is not a staff's unilateral decision to go this route.

CHAIRMAN STETKAR: Your turn.

MEMBER BLEY: Oh, come on. The whole business with DAC was put in place -- we've written a bunch of letters on this in the past -- as a stop gap because information wouldn't be available. If information's available, then putting it off until later isn't even in the spirit of where DAC came from.

CHAIRMAN STETKAR: Just for the record.

By the way, although I had questions, I found a lot of that stuff really useful because I could see -- although some of it was illustrative, some of it was identified as perhaps incomplete, you complete the process. It was pretty useful information.

MR. SPRENGEL: I think one of the challenges is the iterative nature. Some of the intent is not to just strip away that detail. It's to not present that detail as a final product, I guess, because it's not. We understand your challenge, and I think we'll continue to discuss that and hope to address maybe some of those concerns. ITAAC was mentioned. There was changes. I know the staff will present some more detail on those changes, so we've displayed the final two ITAAC for this related area coinciding with parts of the kind of staged process that we're following.

Finally, pulling all this together in kind of a graphical image here, we have the topical report, of course, that we've presented, as well as the DCD area, which includes the technical reports with the implementation plans, as well as the PMP. Following the licensing phase, we'll, of course, implement those plans and, ultimately, document the results in the results summary report, which will be available for staff through docketing, auditing, or inspection space. We will now transition into the topical report area, and Kenji Mashio will present.

MR. MASHIO: My name is Kenji Mashio, from MHI. I'm engineering manager. I'm going to go through the Basic HSI features described in --

CHAIRMAN STETKAR: Kenji, if you can either move to the microphone a little closer or speak a little louder, it will help our transcript.

MR. MASHIO: I'm going through the Basic HSI features described in the Topical Report MUAP-07007. The document structure includes the following document subject, which includes concept of operation and control room and display overview and display navigation, operational VDU display, safety VDU, alarms.

CHAIRMAN STETKAR: Kenji, please be careful to speak up because our transcript picks up off the microphones. We have a lot of trouble following it later.

MR. MASHIO: Okay. This subject continues on the next slide.

CHAIRMAN STETKAR: Before you get into the technical concepts, I want to make sure that I understand, at least. The US-Basic HSI that we're being asked to review under the topical report is not the US-APWR HSI. Is that correct?

MR. SPRENGEL: That is correct.

CHAIRMAN STETKAR: Thank you. That's important because it's too easily confused between are we accepting, in the topical report, the US-APWR HSI versus what I think, in my mind, as the HSI shell, if you will. I want to make sure that we're all clear that during the topical report, we're thinking about a generic framework or shell or however you want to characterize it, and not the US-APWR. When we get into Chapter 18, it then morphs from the shell to become somewhat more specialized to US-APWR. Is that fair, Ryan? If it's not, make sure we clearly understand it because it's a little bit -- there's a gray area in that transition.

MR. SPRENGEL: Yes. I think the only thing I hesitate about is the use of the word generic because it's a very detailed shell. There are a lot of pieces, I agree, that will be refined and specified for the US-APWR. There is a stage going on, but we have a pretty strong foundation, I think.

CHAIRMAN STETKAR: But I call it generic in the sense that you're asking for approval of the topical report, such that that -- if you have a better term, use it -- such that that shell --

MR. SPRENGEL: The generic application.

CHAIRMAN STETKAR: Thanks.

MR. SPRENGEL: That's correct.

CHAIRMAN STETKAR: The generic application could be used, for example, in upgrading the existing analog instrumentation control systems for an operating nuclear power plant in the United States with -- and it's clear that it is linked -- to the MHI digital I&C system that is implemented, from the operator's perspective, through this generic interface, if I've characterized that correctly.

MR. SPRENGEL: That is correct.

CHAIRMAN STETKAR: That's why I'm characterizing it generically. I could take the old analog stuff in Operating Plant X in the United States, provided that there is a topical report endorsing the supporting I&C framework, replace the relays and switches and whatever with that digital framework, and tear out the guts of the control room and put this new interface in the control room. I'd have to specialize it, obviously, for the parameters at that plant, but that's why I'm calling this a generic. It's not (Simultaneous speaking).

MR. SPRENGEL: Right. The only caveat

is right now, the application of the HSIS is connected to our digital I&C application, as well, which, as you know, is right now not being pursued for other applications licensing. You're (Simultaneous speaking).

CHAIRMAN STETKAR: There was an if.

MR. SPRENGEL: Yes.

CHAIRMAN STETKAR: There was an if in there, and it was an important if.

MR. SPRENGEL: There is some additional licensing work that would be needed on the digital I&C side to use this HSIS for operating plants.

CHAIRMAN STETKAR: But again, from the ACRS perspective, from our review perspective, it's important for us to think about MUAP-07007 in that generic context, that it isn't necessarily -- it is being proposed for use for US-APWR as part of the design certification, but we need to think about it, also, in its potentially broader context because it could be -- they're asking for that safety evaluation of the topical report that could, in principle, be used for other applications, other operating plants.

MR. SPRENGEL: Yes, that's correct.

CHAIRMAN STETKAR: If the digital I&C topicals were approved. It's subtle, but it's really important for us when we start thinking about asking questions because it's too easy to morph into what we know about US-APWR, rather than staying kind of one step back a little bit.

MEMBER BLEY: Does that imply for us that we need to look at this piece of what we're seeing today as something we might want to write a separate letter on?

CHAIRMAN STETKAR: We have to write a separate letter on it because there are two safety evaluations. There's a safety evaluation on the topical report, and there's a separate safety evaluation on DCD Chapter 18 for US-APWR.

MEMBER BLEY: So we should keep that separate (Simultaneous speaking).

CHAIRMAN STETKAR: That's why I asked earlier. There will be two letters written from the ACRS on these topics. That's because we get into technical details in the subcommittee. I wanted to make sure we're thinking about it that way. Sorry, get to your second slide now.

MR. MASHIO: So, the subject also includes computer-based procedures, large display panel, automatic checking of actuations, and diverse system panel, and also, as appendix, history of development of Japanese PWR main control room by Mitsubishi and the Japanese PWR power utilities, HFE V&V experience in Japan, which is described in Appendix B, and US-Basic HSI evaluation program, which is described in Appendix C.

MHI used the foundational elements of Japanese-Basic HSI as a starting point to create US-Basic HSI, applying the combinations of design review, redesign, and design validations through phased implementation. Appendix A contains information about Japanese-Basic HSIS and development history. MHI started developing digital HSI control room with Japanese utility from late 1980s. In development process, MHI also referred to oversee HFE regulatory industry requirement guidelines, including NUREG-0711, 0700. It is noted 0711 revisions was issued in 1994, and updated during the development. MHI checked the design in comparison with updated regulation industry requirement on the HFE guidelines. Iterative process of design, test and operation was applied in each development phase, and then I&C integration system variation was conducted as a final event process in Japan. The Japanese HSI has been introduced in the latest construction plant in Japan, Tomari Unit 3, and the MCR modernization at Ikata Unit 1.

CHAIRMAN STETKAR: Is that the extent of the actual applications of this? You have it installed only in Ikata Units 1 and 2?

MR. MASHIO: Ikata Unit 1 and 2 is MCR modernization. This is --

CHAIRMAN STETKAR: But those are the only units in Japan that have this system installed and operating, is that correct?

MR. MASHIO: Yes, and they're also --

CHAIRMAN STETKAR: When was --

MR. MASHIO: (Simultaneous speaking) new plant.

CHAIRMAN STETKAR: I understand, but the new plants are not operating yet. I'm trying to find out what actual operational experience we have for these.

MR. MASHIO: Actually, for the Tomari industry is a new construction, co-construction. This Tomari Unit 3 was applied using this type of HSI system.

CHAIRMAN STETKAR: I'm asking you how many unit years of operation do you have using this system -- actual unit years of operation -- operators sitting in a control room, with a plant operating at power, using this interface, how many unit years do you have?

MR. MASHIO: Okay, this is three -- Tomari Unit 3.

CHAIRMAN STETKAR: Is that operating?

MR. MASHIO: It was operating, yes.

CHAIRMAN STETKAR: It was operating?

MR. MASHIO: (Simultaneous speaking).

CHAIRMAN STETKAR: How long did it operate before March 2011 with this system in place?

MR. MASHIO: I don't -- you have to remember the Tomari Unit 3 starting date was --

PARTICIPANT: 2009.

MR. MASHIO: Yes, 2009 it ran from.

CHAIRMAN STETKAR: So about two years?

MR. MASHIO: Two-three years, yes.

CHAIRMAN STETKAR: When was it installed in Ikata Units 1 and 2?

MR. MASHIO: One year later.

CHAIRMAN STETKAR: Pardon?

MR. MASHIO: 2008 or '09.

CHAIRMAN STETKAR: I think it was 2008 to -- I actually know about it, but I wanted to get it on the record. Basically, we have about maybe six years of operating -- six unit years of operating experience with this system. Okay, thank you.

MR. SPRENGEL: Real quick, I do want to highlight one of our focuses is that we're discussing the development of the US-Basic HSIS, which is not the same as the Japanese-Basic HSIS. The development path is related, but they are not the same.

CHAIRMAN STETKAR: The only reason I bring this up is that the DCD, in particular, and to some extent the topical report, if I read the words and, in fact, I look at these screens, it leads me to believe that there is extensive operating experience with this system and, in fact, there isn't.

MR. SPRENGEL: I understand.

CHAIRMAN STETKAR: That's what I want to get on the record.

MR. SPRENGEL: Understand.

CHAIRMAN STETKAR: Thank you.

MEMBER BLEY: I have a much more general question. Although the development of this system, from your notes here, relied on guidance from the US, in terms of the new regs, it was developed specifically for the Japanese operators in Japanese plants. As we migrate that concept to the US-APWR, are we just translating labels, or is there any difference in the way -- cultural differences in the way we operate in the US compared to in Japan that would lead to other kinds of changes in the way this interface is designed and will operate?

MR. SPRENGEL: We will specifically address how the changes were made and put in place. I think a little bit later in the presentation we'll address your specific question related to how that (Simultaneous speaking).

MEMBER BLEY: Will that be in this presentation or somebody else's?

MR. SPRENGEL: In this presentation. That's correct. I think, actually -- let's put it off. We'll address that specific question, in terms of how the conversion happened and what happened.

CHAIRMAN STETKAR: Part of the difference is the Japanese plants are only two safety trains and (Simultaneous speaking).

MEMBER BLEY: I'm interested in what they have to say on this, yes.

CHAIRMAN STETKAR: I mean the bigger issues that you ask about are much more relevant.

MEMBER BLEY: Yes.

MR. SPRENGEL: Okay, I have that specific question.

MR. MASHIO: The next slide shows the structure of HSIS. The Japanese HSIS, as applied in United States, is comprised with the following: Basic HSIS and HSI inventory, which means controls, displays, alarms are features we developed as a part of the plant-specific analysis phase of the HFE design program.

MEMBER BLEY: Not to make you nervous, but I'm having trouble hearing you again, so if you could speak up a little bit.

MR. MASHIO: Yes. The Japanese HSIS, as applied in United States, is comprised of the following: the first is the Basic HSIS, and the second is the HSI inventory. The inventory means controls, displays, alarms, every contents. Those contents will be developed as a part of the plant-specific analysis phase of the HFE design program. This HSI inventory is developed as a part of the US-APWR DC, in accordance with the US-APWR HFE program.

CHAIRMAN STETKAR: Kenji, when you talk about the HSI inventory, I sometimes get confused about what that means. I understand that particular parameter values are a plant-specific design, so, for example, pressures and temperatures and flows. But, for example, in MUAP-0700-P, there is, in fact, a list of parameters that are displayed on the large display panel, which I consider the HSI inventory. Because those parameters are listed in the topical report, am I to believe that those, in fact, are fixed? In other words, that is the inventory, and only those parameters will be displayed on the large display panel. Is that correct, or is it not correct?

MR. MASHIO: Yes, basically -- for example, the LGP physical display area is defined what parameter is displayed from Type A and B is displayed using the unique combination, but the actual contents of that information may be changed, based on the plant specification. So this concept and the definitions such as Type A and B parameter will be displayed using the unique combination, is defined in the Basic HSI. But the actual number of the variable parameters may be changed, based on the plant-specific application.

CHAIRMAN STETKAR: I'm still a bit confused. What I'm looking for is -- I don't know if you're going to talk about this later, so I'll ask you now. Because I do want to get set of what is fixed, in terms of what we're reviewing under the topical report, and what is variable, that will be applied in a plant-specific application, whether it's US-APWR or Operating Plant X.

In the topical report, there is a list of variables that are displayed on the large display panel, for example. I don't want to read them off -- I can -- things that are -- RCS subcooling -- they're parameter values -- RCS subcooling, reference levels, pressurizer, so forth. Because they're in the topical report, I'm assuming that those, indeed, are the list of things that are fixed.

Because if they weren't fixed, we're not certifying it. The reason I ask is that list in Topical Report Rev. 6 is substantially different from the list that's cited in the US-APWR DCD, for example. I went through all of these. I've got two pages of these parameters. I've got questions about why things were added, why things were removed. So I need to understand, for my review of just the topical report, what is it that we're reviewing? What are we saying is okay? If you're telling me that we don't know what that is, I'm telling you that I can't review that.

MR. PIERINGER: This is Paul Pieringer.

CHAIRMAN STETKAR: I don't know how the staff did it, but that's the question to the staff later. I'm trying to understand what it is that we're being asked to review because there are certain things that are clearly documented in this topical report, that list of parameters being one thing that I personally interpret as part of the HSI inventory, but I want to understand what you mean by the HSI inventory.

MR. MASHIO: Again, LDP fixed-display contents is like an individual boundary area, but in general, the soft control looks at ---- is a basic function, what content is up here in the soft control, such as a --

CHAIRMAN STETKAR: I'm not -- sorry, we're not understanding one another. I'm not talking about soft controls or nameplates. I'll give you a specific example. A parameter that exists in MUAP-07007-P Revision 5 -- I do this for the transcript -- is, for example, main feedwater header pressure. That is a parameter. That parameter does not appear in Rev. 6. That's not a soft control. It is simply a parameter that is available for the operators to examine. It's a parameter. It's a value. I don't care whether it's ten pounds. I don't care whether it's 100 MPa. I don't care the value, but it is a parameter that's listed. My question is are we being asked to review, under the topical report, the adequacy of that list of parameters?

MR. MASHIO: No.

CHAIRMAN STETKAR: Okay, then what are we being asked to review, and what is fixed, and what is not fixed, in terms of this HSI? I honestly want to know what it is we're being asked to review.

MR. HALL: The way we're defining parameters is very similar to what you're talking about, the inventory. Can you hear me if I sit back?

CHAIRMAN STETKAR: You're fine.

MR. HALL: American. I'm sorry, but that's me.

CHAIRMAN STETKAR: I do it, too.

MR. HALL: When you start looking at -- and you've read it, but we'll try to make it clear as we go through the process -- this process of moving from the basic to the US, that basic, which is the topical, is how things are displayed, where they're placed, how they're accessed, not the content of what's in it, but how the HSI functions. The parameters are not simply -- the inventory is not simply changing the number, but what might be added or deleted from the basic design. Hopefully, it'll show later that the process we use to do that is all those topical, technical reports to modify the basic. So the basic design is looked at. The inventory on the basic design is looked at, and the task analysis does an independent evaluation. If, in fact, additional information is needed for the US-APWR, it is then added, but it's added to the template of what the basic design looks like. Did I confuse you more, or is that --

CHAIRMAN STETKAR: We're eventually going to converge, I think, here, but --

MR. HALL: Getting closer, I hope?

MEMBER BALLINGER: We're being asked to review the template?

MR. HALL: This generic, yes.

MEMBER SCHULTZ: The inventory we talk about here is an example? That is to say what's in the topical report as inventory is an example that is used and that will change?

MR. HALL: No, it's more than that because the basic HSI -- and perhaps we can just wait and go through what the process looks like. It comes back to your how do we go from Japanese to the US-Basic design? The process uses the inventory you see in the topical report as the baseline for doing the calculations and analysis of is it adequate, should things be added, should things be deleted to the generic HSI. That's what the Human Factors program tries to do, at least all those technical reports.

MEMBER BLEY: One could look at the details of what's in the basic as an example of what the designers of the basic thought would be a representative set --

MR. HALL: Yes.

MEMBER BLEY: -- of indications, controls that we might need, but as specific?

MR. HALL: Yes.

MEMBER SCHULTZ: That's what I was trying to get to, exactly.

MR. HALL: That, then, because of the process that was used, came from the Japanese design. It started with this Japanese design, moved through a process, which we'll talk about, which included testing in the US, to this basic design topical report, and then moves forward by application of the technical reports to the final US-APWR.

MEMBER BLEY: So we're really looking to say if the general layout, the way things work with each other, is a reasonable basic system for our operators to use in any application?

CHAIRMAN STETKAR: I understand that at that level. On the other hand, I look at -- and I will refer to you on the record -- in MUAP-07007-P Rev. 6, Table 4.9-1, which is a -- I believe it's five pages long -- that lists all of these parameters and, furthermore, lists the reasons -- or at least in terms of Xs and columns, the reasons why they particularly were selected, plant power operation, cause of reactor trip, ESFAS actuation, post-accident monitoring, OK monitor, bypassed inoperable status, SPDS, those different functions. This gives me a broad -- me a view saying do I believe that this is an adequate inventory to satisfy those functions?

Now from what I'm hearing you say, I can wipe this table completely blank and it doesn't mean anything because when I get to a specific application, somebody else can figure out what they want in there, so why do I have this in here, and what I am reviewing? If somebody adopts this saying, "I agree with this. This is a good table for me," should we be reviewing technically, now, the completeness of this table? Follow me? Because this table, indeed, has morphed, in terms of the content and the actual Xs in the boxes, which I'm a little less interested in, from revision to revision of the topical report in ways that I couldn't quite understand in details. I get the concept of having a framework to see whether all of the pieces, in general, kind of hang together and talk to one another.

I've got questions at that level. But I'm trying to understand whether we're being asked to review, or whether we, the ACRS, eventually write a letter saying, "Indeed, we accept the staff's safety evaluation of this topical report," are we buying, now, into that technical content in this five-page table, this list of particular parameters and the functions that they satisfy as being the list on the fixed portion of the large display panel? I recognize anything else is Applicant or customer specified, in terms of operational VDUs or anything on the variable part of the display.

MR. SPRENGEL: I think the answer is still -- our answer is still the specific parameter lists and the, I guess, technical adequacy of them is not the portion of the review that we're looking at. How those are displayed and, in the future, how we'll go through the process to identify that parameter list for the US-APWR, and then for any site-specific design --

CHAIRMAN STETKAR: We'll get into Chapter 18 for US-APWR, but the US-APWR doesn't make any changes to this. What you're saying is I can have technical comments on US-APWR Chapter 18 on this list because theoretically, it's been specialized to US-APWR. Is that correct?

MR. SPRENGEL: That's not correct.

CHAIRMAN STETKAR: That is not correct.

MR. SPRENGEL: We would apply the HFE process as defined from Chapter 18 perspective to develop the US-APWR HSI --

CHAIRMAN STETKAR: So the US-APWR list, this five-page table, basically looks like a blank matrix right now?

MR. SPRENGEL: No, that list would be a starting point. On that note, let us jump ahead to Slide 65 and go ahead and give a picture of this whole process. I think that'll give us some terminology to better discuss where these changes occur. Oh, 65 on my printed version. It is Slide 64 on the PDF version.

PARTICIPANT: It starts on 61.

MR. SPRENGEL: I think we can use this diagram.

MR. HALL: Okay, we've now jumped ahead to something I was going to present. You're going to see this described -- and Kenji, when we come back to the flow that we originally planned to do, he'll talk about this, too, but in different format. This represents the program of the HFE of what we've done and where we're going with it.

It addresses the question about inventory, and it addresses your question, Dennis, about how do we jump from Japanese to US? Before I look at the slide, let me address the first question, and then we'll see how it is in here. Moving from the Japanese HSI to the US-Basic design was a three-year process. It wasn't simply changing letters, numbers and Japanese to English and sizes of tables or touchscreens, etc., and saying that was the interface.

The basic HSI, which now represents the starting point from the US-APWR, was the result of a very extensive, human in the loop, simulator testing program. Mitsubishi built a simulator that was this simple conversation you're talking about, from

Japanese to US. They built it. It sits at MEPPI, outside of Pittsburgh. Some members of the ACRS --

MEMBER BLEY: That's the one I saw (Simultaneous speaking).

MR. HALL: Okay, so that simulator was used. We developed --

MEMBER BLEY: The one we saw six-seven years ago was -- oh, thank you, John. The one we saw six or seven years ago was really just a mirror of the Japanese.

MR. HALL: That's correct, other than these simple (Simultaneous speaking). Yes, I agree. So the machine was built. It was verified that it worked right and that all the changes that had to be made early on were made. Then, in fact, we brought -- we developed a testing program. That testing program -- we're stealing some of my thunder from my presentation later -- that testing program (Simultaneous speaking) is it okay?

PARTICIPANT: Yes.

MR. HALL: -- basically underscored and was the root of our ISV program in the HFE side of the house, in these implementation plans.

CHAIRMAN STETKAR: For those of us who aren't familiar with the acronyms --

MR. HALL: Sorry, integrated system validation.

CHAIRMAN STETKAR: Thank you.

MR. HALL: That's the last element of the HFE process, the big test, the final exam. I'm sorry. We developed this ISV program. We brought in operators. Those operators came from the then, at that time, COL applicant, Luminant. They were qualified, licensed ROs and SROs. We brought them in as those functions, RO, SRO, and STA. We brought them in and ran tests with scenarios, collected the data, etc., and we ran two sets of tests. The first set of tests was given the Japanese design, with just translation, how does it work? We produced findings, and those findings were very, very specific to the design. We spent about a year redesigning the system to meet those --

MEMBER BLEY: Was there a report on that testing?

MR. HALL: There is a report. I don't know if it was issued to the NRC, however.

MEMBER BLEY: I don't think we've seen it.

MR. HALL: There's a Mitsubishi report.

MEMBER BLEY: I haven't seen it.

CHAIRMAN STETKAR: I don't think we've seen anything on that first --

MR. HALL: Maybe it wasn't submitted (Simultaneous speaking).

CHAIRMAN STETKAR: It may have been submitted.

MR. HALL: No, I don't think we've --

(Simultaneous speaking.)

MR. HALL: I have to apologize. That's really between Mitsubishi and NRC.

CHAIRMAN STETKAR: Yes, that's fine.

MR. HALL: A very detailed report was developed. You have to understand that at the very beginning of these tests we started to use this HED process, as defined by 0711. What it is is a findings tracking system that says everything that's found that's deficient from the human are going to go into this database, and it's going to track from those early tests all the way through the final completion of the whole plant, not just the HFE.

That's one of the integrating processes that are used in here to get HFE into the rest of the design process. It's a problem talking from HFE to a system designer to I&C. You're shaking your head. You know what I mean, Dennis. It's one of those things. But those HEDs were generated starting with that first test. We ran the test, collected a lot of data. We can go into that later, if you want, how it was collected and what it is. We were not planning on doing that, so we could -- but I'll verbalize it, or Kenji can verbalize it.

CHAIRMAN STETKAR: We'll talk more about what's in Appendix D, which I think is the second --

MR. HALL: Yes. So a lot of HEDs, as you would expect, were developed. Those HEDs were then reviewed between the designers and an independent expert panel. The document talks about this. That independent expert panel had HFE people, I was on it, had utility people. Luminant people were on it, at that time, a potential client, designers. Kenji was on it. In fact, a Luminant person, their new plant startup manager, was the head of this independent panel, so it was really (Simultaneous speaking).

MEMBER BLEY: And you had operators on that panel?

MR. HALL: He was an SRO. He had an SRO background. He's the one that brought all the Luminant operators to the table. Those things were changed. Those things were redesigned, and then changes made to the simulator. The simulator was changed -- some hardware, lot of software, and then it became somewhat of a patchboard. It became more of an experimental facility. We didn't cast new steel to hang stuff on it. Wires were run, PCs were used to fix -- change some of the design. If you looked at it at the end of the second set of tests, it looked more like a university research facility. Then we ran a second set of tests again --

MEMBER BLEY: Under that condition?

(Simultaneous speaking.)

MR. HALL: Oh, yes. If this was a console, instead of building another piece of steel and putting a video display in it, we put a table with a PC on it, a laptop on it or something.

CHAIRMAN STETKAR: Just to be clear, that second set of tests is what's documented in Appendix C --

MR. HALL: Yes.

CHAIRMAN STETKAR: -- Charlie, of the (Simultaneous speaking).

MR. HALL: Yes, but in not great detail.

(Simultaneous speaking.)

CHAIRMAN STETKAR: No, but I just want to make sure that I understand the configuration.

MR. HALL: Yes, so we ran those tests and documented more HEDs. We decided which HEDs we fixed and, frankly, which ones we made worse, so what new ones were added. That second test with US operators -- and I'm talking about eight weeks long, ten hours a day, typical -- and the scenarios were training-level scenarios, so these were fairly detailed -- ended up in the design that is now being called basic HSI, so those tests. Now, let me come to the diagram.

PARTICIPANT: I learned a new word, by the way, in reading this. I had to look it up -- anthropometrics.

MR. HALL: Oh, okay.

PARTICIPANT: That's about time.

PARTICIPANT: It's about time (Simultaneous speaking).

PARTICIPANT: I wanted to ask one thing because --

MR. HALL: Does that answer your question kind of?

MEMBER BLEY: Almost there. One thing I thought you might have done, and it sounds like you didn't do, is look at what Japanese operating procedures look like, what US ones look like, what the practice look like, what the training look like, and the difference. Instead of that, you jumped to the guys and saw how they dealt with it.

MR. HALL: Dennis, I love you. That's a good leading question. The answer is your interpretation is wrong. The original procedures we had were written by a US procedure team. The first sets were (Simultaneous speaking).

MEMBER BLEY: So they were like US procedures?

MR. HALL: US procedures, rudimentary CBP, lots of paper.

MEMBER BLEY: I'm sorry, CBP?

MR. HALL: Oh, I'm sorry, computer-based procedure. So it wasn't, the first one, an integrated system like we're now talking about only because we weren't mature enough to do that. We, in fact, found substantial differences between the machine, the way it was used with the US procedures, and the way the Japanese machine was built for Japanese operation.

We, early on, started seeing US operators tripping over certain parts of the design. Tripping over meant HED-ridden, okay? So on the procedure side. We, in fact, got to the point of Mitsubishi brought over Mitsubishi operators to work on it. We sat and ran tests with the Mitsubishi operator, one, because that's the way it's run and our team and looked at the two and concluded that the way the Japanese run the machines is substantially different than the way we run the machine. A lot of -- not a lot, but a good portion of the HEDs and, therefore, changes in the things being displayed, how they're displayed, where they're placed, what the procedure does with them -- a lot of those changes from Test 1 to Test 2, each change in HED, basically represented not problems or deficiencies in the Japanese plant, but the fact that we run them different.

We have a different operational culture. We play with the machine differently. We think differently about them. The model we have in here is different than the way the Japanese run it. So the second set of tests then tested the changes to comply with our way of running it, and then became the basic HSI.

I may add we spent, independent of these full-scale tests, a lot of time testing with US operators, specifically the computer-based procedure scheme to make sure that the CBP in the basic, and as it moves into the US-APWR, handles both this interface, which is digital, and the way we're familiar with running it, which is paper based. There is a disjoint between those. The CBP takes that into account to optimize this new digital system with the way we typically run a PWR plant. So the procedure side of it was looked at.

MEMBER BLEY: This really helps me. You're not a philanthropic organization, but the researcher side of me says the stuff you've described would make a really useful paper for people who look at operations across different cultures because that's a problem they don't fully understand by a long shot.

MR. HALL: Dennis, and I say ---- there's a number of papers out there that -- conference papers that were presented -- Kenji and myself and the rest of the team. Of course, as in any team, who was on top changed, but there's a whole series of papers. One of them -- because at the time, the thinking in the international community was you could take a plant -- let's say a French plant -- pick it up and stick it here and it'll work. You could take a US plant, stick it in Turkey, it'll work. The answer is absolutely not. There is a paper out specifically based on these tests that talks to that.

MEMBER BLEY: If you guys could get us a key to some of those conference papers, that would be useful.

(Simultaneous speaking.)

MR. HALL: But Dennis, it's a conference paper. It's six pages long. So it gives some conclusions. It doesn't --

MEMBER BLEY: (Simultaneous speaking) some references?

MR. HALL: Yes, it does.

MEMBER REMPE: But to just make it more concrete to some of us who aren't in the field, could you give us one example that would -- a little more details about one example of a difference?

MR. HALL: Oh, sure, I can give you one --

MEMBER REMPE: Right now?

MR. HALL: Yes, one great example. The US operators, as you know, are rigidly locked into, in my interpretation, following the procedure. The procedure is it, Step 1, Step 2, Step 3. If what it says in Step 3 the plant doesn't achieve, you go into the second column of a PWR site chart and you do the recovery.

The Japanese use the procedure more the

way we did probably 30 years ago. It's recommended practice. That makes the embedment of that procedure and how you use the systems very different. In the US, if it doesn't say to do something, even though it's displayed up on the screen -- the LDP -- in a big, bold red letter, if the procedure says don't go there, you cook through the procedures pretty quickly, or else you've got to decide whether you want to keep your license or not for moving away from that procedure. The Japanese don't have that attitude. They handle the problems as they come in. Because of that, the interface in Japan is different than the interface here. Does that -- at least one significant difference?

MEMBER REMPE: It helps, yes. Thank you.

MR. HALL: The answer's yes, I can get you some papers. This first report, which is very detailed, I don't know if it's available.

CHAIRMAN STETKAR: This has been -- I need to be a little cognizant of time, but we have all day.

MR. HALL: I'm sorry.

CHAIRMAN STETKAR: No, this is really, really useful. I'm not trying to (Simultaneous speaking). We haven't seen, nor even had an inkling of any of this. What we've seen is something that says the Japanese-Basic design was examined for anthropometric -- differences in body sizes, differences in heights, differences, perhaps, in cultural use of procedures. A simulator was built. Eight crews were run through seven scenarios.

MR. HALL: That was Phase 1A, and you'll see that in what's coming up.

CHAIRMAN STETKAR: And they're documented in Appendix C of the -- that's all we've seen. We haven't heard about the Phase 1, if that was Phase 1, and all of the things that were changed. Now for the record, though, the -- and we see pictures of things. My sense is that the picture of the HSI that's published in the topical report, which I was led to believe is indeed the thing that the Phase 1A crews used for their scenarios, is not -- from what you said not quite exactly what they were actually using. Is that correct?

MR. HALL: Ask your question (Simultaneous speaking).

CHAIRMAN STETKAR: There's a photograph in there. It says --

MR. HALL: Of a clean panel.

CHAIRMAN STETKAR: -- of a nice, clean panel with displays, and not little PCs sitting on the side, and not wires running all over the place. The actual Phase --

MR. HALL: I know what you're saying. The photograph, not the sketches --

PARTICIPANT: (Simultaneous speaking.)

MR. HALL: The photograph of the simulator, itself, the hard photograph is of the one the ACRS saw initially, without all the wires and everything. The graphics of the displays and things like that, all the -- how figures are shown, how controllers are shown, that's the output of Phase 2 testing. The picture in there -- and you're going to see it a little bit later -- is the first simulator. You're correct.

CHAIRMAN STETKAR: I'm trying to understand if I'm a licensed Comanche Peak operator and I'm summoned to Pennsylvania to spend a week at a facility and run through seven scenarios, what am I sitting in front of? Am I sitting in front of that nice, clean thing with displays, or I'm sitting in things that's got some PCs sitting on a desk and some little things up in the rafters, or what am I sitting in front of?

MR. HALL: Going to show you. This photograph is the simulator in Pennsylvania, and it was what the system looked like for Phase 1A. This is when it was just simply converted to US standards. This is the first -- this is what the first series of operators sat in front of.

CHAIRMAN STETKAR: Right, I got that.

MR. HALL: The second set of operators sat in front of the same machine, substantial changes on what the displays looked like, you know, software changes. When I said a patchboard, there were not wires running all over the place, but let me give you an example, if I can. Please stop me when I run out of time.

CHAIRMAN STETKAR: You're fine. Don't worry.

PARTICIPANT: What phase does this represent?

MR. HALL: This represents the results -- the sketch -- of Phase 1B, which is the basic HSI.

CHAIRMAN STETKAR: If I was a licensed operator at the Comanche Peak Station and was summoned to Pennsylvania to sit in a room for one week and run through seven scenarios, did I see a display that looks like this, or did I see a display that looks like that?

MR. HALL: First test this, second test --

PARTICIPANT: Those were also operators.

MR. HALL: -- second test that.

(Simultaneous speaking.)

MR. HALL: There were changes.

CHAIRMAN STETKAR: But this was actually implemented in a nice, clean fashion or not? For example, the operating procedure VDU has moved around a bit. Was that sitting on a PC, on a table, off to the side?

MR. HALL: Let me give you an example of one of the big changes.

CHAIRMAN STETKAR: The reason I'm addressing this is it's important for us to understand what's documented in Appendix C. That's why -- I'm trying to short-change some of our questions (Simultaneous speaking).

MR. HALL: I don't want to give you the wrong impression -- talking about the second test now.

CHAIRMAN STETKAR: What's documented in Appendix C?

MR. HALL: Right, that this was so changed with wires around and paper and tape, and that it was a horrible thing to work on. That wasn't the case. For example -- I can't really point to it --

(Simultaneous speaking.)

CHAIRMAN STETKAR: No, you can use a mouse. We have mice. We have rats, too, but (Simultaneous speaking).

MR. HALL: In the back, this is the STA and SRO. The SRO you'll see under this, the Phase 1 testing. The simulator, as it came from Japan, has one, two, three screens, procedure, two system screens. One of the changes we found, a change that is significant to the industry testing again, when it comes to digital, sit-down control systems, is the SRO loses awareness of what the operator's doing. Think about this. In a conventional plant, the SRO says, "Do X." The operator stands up and walks over to Panel 3, whatever, where X is.

The SRO has an awareness of what the operator's about to do because she sees where it is. If the operator goes to Panel Y, instead of X, the SRO understands you went to the wrong place, please change. There's a check and balance in the conventional. You don't have it here. All the SRO sees is the back of the head of the RO. He has no idea what screens they're looking at.

We ran into problems with this wrong screen issue between the command of the SRO, even with three-peat being used -- everyone knows three-peat is? Even with it, we ran into problems every so often with the operator doing the wrong thing. HED was written. The solution for that was to give the SRO something for situation awareness. What we did was we put another screen right there.

PARTICIPANT: Point with your (Simultaneous speaking) Ryan's showing us.

MR. HALL: If you look at the picture, there's that other screen. We've put another screen right here. That other screen basically is a mirror of what screen the operator is on. So if the operator brings up Screen P32, it can be displayed on this new one. Remember, these are all touchscreens, so as the operator begins to touch on it, an X shows up showing is he on the right component or not? It's a beautiful check and balance for the SRO.

CHAIRMAN STETKAR: Bob, first I ever heard about that screen. It's not documented in the topical report.

MR. HALL: It's there.

(Simultaneous speaking.)

CHAIRMAN STETKAR: I didn't count the little things. My point is that the optical report describes very clearly the SRO and the STA has having three screens. Several of my questions, from an ex-operational perspective, on the topical report -- forget about US-APWR -- is the availability of displays to the control room team during an accident situation. Is there enough display capability available? Is there enough display and communications available among the nominal three people, or perhaps four people, who might be in there? In fact, I had questions, even before I heard this little story, about are there enough screens available to the STA and the SRO? Everything that I read, other than this little picture, which I guess I'll have to go find the figure number in -- said that the STA and the SRO had three screens in the topical report. I'll find it.

(Simultaneous speaking.)

MEMBER BLEY: That's not the issue. The issue is really understanding the tests that you did.

CHAIRMAN STETKAR: Understanding the

tests that they did is part of it, but also understanding what it is that we're reviewing in this topical report because we are reviewing that interface. If it's something important that they added ---- you can almost see it. It is, indeed -- I just found it. It's Figure 4.3-3. There is a little fourth one there. That's not the issue, though. I get lost between Phases 1A and 1B. I'll just call it the second round of tests that are documented in Appendix C. We now know that the STA and the shift supervisor -- the SRO consoles had four screens on them.

MR. HALL: For the second set of tests.

CHAIRMAN STETKAR: For the second set of tests, what other differences were made for that second set of tests? Still have the same complement of safety VDUs and --

PARTICIPANT: You said they changed the software, so the actual screens on the other screens --

MR. HALL: The actual screens changed, the controllers changed, color coding changed. The alarm prioritization changed.

CHAIRMAN STETKAR: But all of that -- I recognize there were a lot of soft changes, I'll call it that. I'm still trying to understand that if I walked into that facility as the operator, sitting down at the desk to run these scenarios, what I think I'm hearing you say, but I want to make sure that I understand it -- that I didn't have a little laptop sitting over on a corner that said look over here because we're eventually going to build this kind of display into the framework, or we haven't quite got this thing done, so you need to use a paper procedure for now, rather than the computer-based procedure, and you may have to toggle back and forth. I'm trying to understand it at that level, so I understand what the operators were facing.

MR. HALL: The principle changes were software driven, screen changes, etc. They were implementation of the CBP. Remember, I said the first time out we used a lot of paper procedures. We just weren't ready for the computer-based procedure yet. So the CBP was up and running.

CHAIRMAN STETKAR: It was up and running?

MR. HALL: It was up and running. In my memory -- and I've got to say in my memory because this is many years ago -- the only significant hardware change was the one I just completed describing, this extra screen. Rather than bending metal and changing the structure of that back SRO/STA console, the only physical change was next to it was a desk with a PC screen on it that represented this new screen. So it wasn't like they were sitting in front of ten PCs or something like that.

CHAIRMAN STETKAR: That was only for the SRO/STA?

MR. HALL: Yes, that's the only physical change.

PARTICIPANT: That exact text of what you said is actually here.

PARTICIPANT: Oh, okay.

MR. HALL: Thank you.

PARTICIPANT: Which document?

MEMBER BALLINGER: The MUAP-07007-P, Rev. 6. I read it last night. I'm looking for it, it just came to me ---- the desk, and rather than bend metal literally is in the text.

PARTICIPANT: Okay, thanks.

MEMBER BLEY: Just for clarification when I go back and look at the transcript, the story you told, I expect in the interim, before you brought the operators back the second round, maybe it was more like a bread-boarding exercise of playing with different things to experiment on how you got to where you did.

MR. HALL: It's in the documents, and you'll hear Kenji talk about it, too. We used what we refer to as a PC design tool. I forget the exact name of it. A lot of things were done on things like this, and then implemented on the big simulator.

CHAIRMAN STETKAR: Ron, can you help me out, please? Because you said literally you read the words bend metal --

MEMBER BALLINGER: I'm trying to find it right now.

CHAIRMAN STETKAR: Okay. I want to make sure because I just searched on that and I couldn't find it.

MEMBER BALLINGER: I'm trying to find it, as well. I read it somewhere.

CHAIRMAN STETKAR: Apparently you didn't read it here. Let's be clear, on the record, of what's in a document because I don't personally recall that. It's not in that document.

MEMBER BALLINGER: It was 1:00 in the morning.

CHAIRMAN STETKAR: That's okay, but if we're going to cite things on the record, let's cite the right reference so I can find it.

MEMBER SCHULTZ: Bob, I had a question on this process. You have it described in the middle for the transition to the US-APWR. How does that compare to what you have in the beginning of the chart there with the Japanese operator assessment? Did that also include the HSIS HED, and what does approximately 200 mean in the shorthand here?

MR. HALL: Again, Kenji can talk to more of that because it was done in Japan. I wasn't involved in it. But that series of tests were human in the loop tests that resulted in the Japanese HSI that are in Tomari, for example, and that were then imported and changed for our tests. What's listed there is -- Japanese operators, again, human in the loop tests that supported the original design of the HSI for the Japanese plant.

MEMBER SCHULTZ: With the outcome being the Japanese-Basic HSIS.

MR. HALL: That's correct.

MEMBER SCHULTZ: In that box is likely some of what is in the middle of the chart for the US-APWR?

MR. HALL: Yes, it is. That brings me -- I know I'm jumping a bit out of step, but can I --

CHAIRMAN STETKAR: I want to get five minutes and we're going to take a break. You do have thunder later.

MR. HALL: Okay, let me just say this is iterative, this process. We'll talk about it later.

MR. SPRENGEL: Be careful with this. The blue portion is complete --

MR. HALL: Yes, right.

MR. SPRENGEL: The blue is --

(Simultaneous speaking.)

MR. SPRENGEL: The HFE process, in general, is iterative, but we're now in the green phase.

MR. SPRENGEL: This comes back to what we are reviewing for the topical report. We're reviewing the blue guys.

MR. SPRENGEL: That is correct, which is complete.

CHAIRMAN STETKAR: The blue has that additional SRO/STA display?

MR. SPRENGEL: Correct.

CHAIRMAN STETKAR: For later, not for now. I want to understand because you said the purpose of that display -- because I didn't recognize it existed, so I'm going to be educated a bit. The purpose of that display is to monitor the RO is doing. Now we can configure this, and one of my questions eventually is going to be for two RO operations, so I don't know how that display monitors what the two ROs are doing, plural. Just keep that for later. I just want to make sure we address that later. The other thing that I do want to come back to a bit is what started part of this discussion is that list of parameters that are documented in the topical report for display on the large display panel.

I'll give you the first example that led me into this is that in a previous incarnation, in Rev. 5 of the topical report, I said there's several parameters that I have listed here, but one that started me from the back end was if I were an operator, I'd be really interested in safety-related DC bus voltage. That, to me, on this plant, is a pretty important parameter that I'd like to know about. It's not listed in Rev. 6 of the MUAP as being a parameter on the large display panel. It was in Rev. 5. So someone made a conscious decision to remove that parameter in the list, in the topical report, which is the starting point for, as you said, for doing the HFE.

That is what prompted my notion of what

it is that we're reviewing, in terms of an inventory, which is what started this discussion an hour ago, and how we, taking a snapshot of that topical report design, the blue stuff in this particular overhead -- how we should be thinking about that set of things. I can understand, at one level, if it's only a vague suggestion of what might be eventually settled on as part of the green part of the process, but at least in the US-APWR DCD, up until now, there was no evidence of any changes in the green, at least to that level of the inventory. You may want to address that later. You may want to think about it.

MEMBER BLEY: Two little things. One, although it's complete now, the blue, getting to US-Basic, was iterative to get there -- was an iterative process to do everything in the blue. Two, that first round of testing, the report that came out of that, I don't know if staff has it. If staff has it, we would love to see a copy of it. We're very interested. If they don't have it, if it's possible, we'd like to see it. I don't know how that works, but in any case, Girija, we'd like to get that if we can.

MR. SPRENGEL: We'll look into that.

CHAIRMAN STETKAR: I hesitate to ask,

but any of the other members have anything? Because eventually Kenji's going to get to Slide 3 (Simultaneous speaking) but actually all of this discussion, I think, has been very, very good because it has answered, for me, several questions that I would have brought up in the mainstream. Anything else from any of the other members? If not, let's recess until 10:30.

(Whereupon, the above-entitled meeting went off the record at 10:13 a.m. and resumed at 10:35 a.m.)

CHAIRMAN STETKAR: We are back in session. Eventually, Kenji will get to Slide 3, but did you guys have anything else that you wanted to say? I'm assuming you do.

MR. SPRENGEL: Yes. Yes. Follow-ups are my favorite, so we have a couple of things to touch back on and, hopefully, answer the questions. There's a few things that we'll push out.

In terms of the changes between Rev 5 and Rev 6, there was -- DC, bus voltage is an easier answer. The reason that that was a parameter on the list was because it was previously on our PAM list. That PAM List has been revised, or had been revised, and that's why it fell off. So that was a separate review ongoing. The PAM List had been revised and submitted, as part of Chapter 7.

CHAIRMAN STETKAR: Part, no, this is for the MUAP, for the Topical Report. I'm still keeping us on the generic topical.

MEMBER BLEY: Are you saying that's why they took it off of that one, is because they took it off of the Chapter 7?

MR. SPRENGEL: Yes. The reason that it was showing up as a parameter, was because it was previously a PAM variable.

CHAIRMAN STETKAR: So -- Okay. But, I use it, I mean, I don't want to get into specific parameters, because we're going to talk hours about specific parameters, but there was an active decision about removing that particular parameter, is what you're telling me?

MR. SPRENGEL: That's correct.

CHAIRMAN STETKAR: Okay. As, I'm sure, there were active decisions about removing others and adding, you know, there's, there are things that appear in Rev 6 that weren't in Rev 5. There are things in Rev 5 that don't appear.

There's a large, when I say large I'm, a few dozen parameters that are, that are different.

But after the decisions were made, I'm sure, for each one of them, some basis for changing them. That isn't my point.

MR. SPRENGEL: The question is still outstanding. And I have specific answers on these, so I think, let me continue to discuss and follow-up on the broader question, I think, is understanding what the current status of the inventory is for the Topical Report.

CHAIRMAN STETKAR: It --

MR. SPRENGEL: So let me --

CHAIRMAN STETKAR: Yes.

MR. SPRENGEL: -- defer that a little bit longer.

CHAIRMAN STETKAR: Yes, and how, the corollary to that is, I mean, there is a table that, for me, defines the inventory. It's that Table 4, whatever I sited, 4.9-1, I think it is, but don't, don't hold me to the number.

There is a table that lists, it's a long list of parameters and, I think, it's supposed to tell me both what the list is and why they're there, because there are the columns that says well, this is an SPDS function, or something.

And fine, I don't, at one level, I don't particularly care what that list is. On the other hand, if I'm presented with that list, and if that list is, indeed, part of what the ACRS is reviewing and approving, as a reasonable list, for this generic HSI that's, that's more important for me, because then I need to think about that inventory doesn't make sense that it's a generic list.

In some sense, I don't care what happened previously, because we're reviewing Rev 6 of the Report. I just happen to have Rev 5, because it's what's referred to in the DCD Chapter 4, so I noticed the changes.

But more importantly for us, I'd like to understand how we should interpret that list, as part of our technical review?

MR. SPRENGEL: Right.

CHAIRMAN STETKAR: Because I was interpreting it as something that, indeed, was part of the blue and it should not change. You might add things, as part of the green, if you will, but you wouldn't wind, you wouldn't delete things from that list because it, it was essentially, what formed the framework for the US-Basic HSI.

MR. SPRENGEL: You know --

CHAIRMAN STETKAR: If that's not the

case, we need to understand --

MR. SPRENGEL: Yes.

CHAIRMAN STETKAR: -- you know, that --

MR. SPRENGEL: I understand the question fully --

CHAIRMAN STETKAR: Okay.

MR. SPRENGEL: -- and we will defer that --

CHAIRMAN STETKAR: Okay.

MR. SPRENGEL: -- today, to continue that discussion today.

CHAIRMAN STETKAR: Okay.

MR. SPRENGEL: One other item to touch on, the discussion on the additional VDU screen at the SRO and STA --

CHAIRMAN STETKAR: You're going to find it, aren't you? Or you found it already?

MR. SPRENGEL: Oh no. It's not that good of an answer.

(Laughter)

CHAIRMAN STETKAR: I was, I sure, I sure hope not.

MR. SPRENGEL: Okay, so we -- this isn't the best picture. We discussed the starting point --

CHAIRMAN STETKAR: Yes.

MR. SPRENGEL: -- for Phase 1, the activities that went on, so that's clear.

CHAIRMAN STETKAR: Yes.

MR. SPRENGEL: Everyone's seen this, so the Topical Report is having a perspective after that, the Phase 1 testing.

CHAIRMAN STETKAR: Yes.

MR. SPRENGEL: So that happened, the improvements were made, documented, and submitted, as part of the Topical Report. One of the areas that resulted in change was this third VDU -- there's an alarm VDU and --

CHAIRMAN STETKAR: -- yes, just, in case you put one on this one --

MR. SPRENGEL: -- the third VDU, yes.

CHAIRMAN STETKAR: -- you applied one on the desk, it's actually the fourth, but --

MR. SPRENGEL: It's --

CHAIRMAN STETKAR: -- or the fifth, but anyway, so yes.

(Simultaneous speaking)

MR. SPRENGEL: So there's an additional VDU that was added and it is, it's a, it's a streaming image of what the RO screens are, so it's not an OVDU, as you would typically imagine, in terms of, you know, diving through the screens of the systems, it is simply an image of the RO screens. Now with that, there's confusion on the face, there's also toggles in place that, basically, the SRO and STA can toggle between whatever screens.

CHAIRMAN STETKAR: Yes, because I was going to say, when you're talking, I mean, in principle, even if you bring up the, you can either have four operational VDUs, or six, if you can include the procedure one, down below.

MR. SPRENGEL: Right. So the additional VDU is, again, just a screen image of any selected --

CHAIRMAN STETKAR: Yes, selected --

MR. SPRENGEL: -- RO screen.

CHAIRMAN STETKAR: -- only one screen.

MR. SPRENGEL: Correct.

CHAIRMAN STETKAR: Only one screen.

MR. SPRENGEL: Right.

CHAIRMAN STETKAR: So you should take RO Number 1 Screen, Number 2, bring it up, to see what that person --

MR. SPRENGEL: And you can select between any of those.

CHAIRMAN STETKAR: Got it.

MR. SPRENGEL: Okay. But then --

CHAIRMAN STETKAR: But that's not described in --

MR. SPRENGEL: Okay.

CHAIRMAN STETKAR: Sorry.

MR. SPRENGEL: You're getting ahead.

CHAIRMAN STETKAR: I'm sorry.

MR. SPRENGEL: So that was one of the changes. Although, not view the significant, because it's not even, it's just a screen image. I mean, it's like a little video camera just blind, it's not a video camera, but it's just showing that image --

MEMBER BLEY: That sounds --

MR. SPRENGEL: -- there's more control --

MEMBER BLEY: That sounds like an I&C person's --

MR. SPRENGEL: Right.

MEMBER BLEY: -- interpretation of what's significant. From a human factor's, or operational, point of view, I think it's --

MR. SPRENGEL: Okay. That's --

MEMBER BLEY: -- damn important.

MR. SPRENGEL: -- correct. That's correct. That's correct. So --

MEMBER BLEY: Right.

MR. SPRENGEL: -- with that, I want to recognize that we need to add that description.

(Simultaneous speaking)

CHAIRMAN STETKAR: You do, and the reason that I'm -- there are a couple of reasons that I'm whining about this so much. One, one reason is just what you just mentioned, is that the Topical Report should, in fact, accurately describe, and this figure is indeed in the Topical Report and it shows four little things up there.

I could argue that, maybe, I thought that the third one was the, was a different screen, but that's okay. It should accurately describe the configuration that, that we're being asked to review.

But, quite honestly, when I was reading through the Topical Report, from an operational perspective, as Dennis just mentioned, I still, and we'll talk about this later, had questions about the inventory of displays available to the control room team, especially in a configuration where you have an STA, an SRO, and one and only one RO.

Because when I thought about how people would be using the various displays, or could be using the various displays, from an operational and oversight perspective, supervisors trying to keep the bigger picture on what's going on, the operators being involved in trying to understand the plant evolution, as a function of time, and interfacing with the procedures and the systems, I started to quickly get, I thought, and may still be, limited in terms of the amount of displays available.

So for example, as Dennis said, from an I&C perspective, one more display sounds like a fairly minor change. To me, a couple more displays might be a big deal, because it might let me, as an operator, have a lot better confidence of things that I can glance over and have an understanding of what's going on. So that's one of the reasons why I'm personally kind of --

MR. SPRENGEL: Yes.

CHAIRMAN STETKAR: -- kind of invested in these numbers things here.

MR. HALL: A very quick response to your question. I've been told to keep it short, and I will. We did, in fact, look into that, and what you're describing is generally correct.

But rather than adding display surface area, a lot of what was done was create more efficient navigation tools, alarm tools, displays that combine things in the unique ways, so you don't need two displays you can do it on one. So I think some of that's going to be addressed when Kenji goes through some more detail on what the HSI looks like.

CHAIRMAN STETKAR: Okay. Let's wait for that, because I've got a comment, but rather than doing it let's, since he pointed to Kenji, let's let him do that and bring that up, because I'll just telegraph it, you may want to think of it, as he goes through his slides.

I have a real problem with requiring the operators to toggle actively back and forth and select things to bring up in the heat of battle. That's personal preference, but --

MR. HALL: I understand.

CHAIRMAN STETKAR: But I think we've seen problems where people are forced to do that.

MR. SPRENGEL: Okay, another change that we want to highlight, as a result of the phased process. We saw on the diagram -- I lost it.

Okay, so one of the other changes that shows up on the layout that we're displaying here is the safety VDUs.

CHAIRMAN STETKAR: Yes.

MR. SPRENGEL: And you'll notice that there's a different number than was in the initial implementation of the US-Basic simulator. So the additional two screens are the multi-divisional screens that we have specific section on, in the presentation and in the Topical Report.

CHAIRMAN STETKAR: Those I knew about and I was willing to, I understand what they are, why they're there, and I was willing to --

MR. SPRENGEL: Yes.

CHAIRMAN STETKAR: -- acknowledge the difference between the photograph and this picture, because this picture is clearly described and in the Topical Report.

MR. HALL: Yes.

MR. SPRENGEL: Agreed.

CHAIRMAN STETKAR: It was six screens off to the left.

MR. HALL: And those extra screens was result of the tests, when --

CHAIRMAN STETKAR: Yes.

MR. HALL: -- you're asking --

CHAIRMAN STETKAR: I --

MR. HALL: -- what unique changes --

CHAIRMAN STETKAR: Yes.

MR. HALL: -- were made, those were --

CHAIRMAN STETKAR: Yes, yes, yes that --

MR. HALL: -- resulting of the test.

CHAIRMAN STETKAR: Yes.

MR. SPRENGEL: Wrapping that up, the additional VDUs will be acknowledged in the Topical Report and described, in terms of their purpose and functionality.

CHAIRMAN STETKAR: That would be great.

MR. SPRENGEL: Okay. I don't know where we are --

CHAIRMAN STETKAR: If Kenji wasn't so long-winded, you know, we could let him get to those, like, his third slide. We're on --

MR. SPRENGEL: I think --

CHAIRMAN STETKAR: We've covered the whole presentation. We're on, we're on, I believe --

MR. SPRENGEL: Nineteen, or 20.

CHAIRMAN STETKAR: -- 19, or 20, from our package.

MR. SPRENGEL: Yes. Let me, yes he just finished that one.

CHAIRMAN STETKAR: Yes, I think you were just starting to talk about this one, when somebody interrupted you. Sorry.

MR. MASHIO: Yes, and so --

CHAIRMAN STETKAR: Is your mic on, Kenji?

MR. MASHIO: Oh. So we go back to the 2.4 our phase implementation. So Phase 1, more generally speaking, in that using that diagram, Phase 1 in this Topical Report scope, it translates Japanese-Basic HSI to the US-Basic HSI.

Under Phase 2, the developing of applications-specific program for the US-APWR inventory feature the combined with the Basic HSIS to yield an applications-specific design.

And the Phase 3 is our confirms the site-specific assumptions with the Phase 2 and/or make minor site-specific changes to finalize application design.

And then, this 2.5 slide split output, Phase 1 splits two ways, Phase 1a, Alpha, and Phase 1b, Bravo. Under Phase 1a, Alpha, incorporates email changes, which are necessary to apply U.S. standard design, as such as the language conversion.

Oh, I'm sorry. Yes, actually, this Phase 1a, Alpha, modifications we've already covered. And I'll just remark that in parallel to this conversion we made, we also made improvement identified from the completing OER program element of NUREG-711, which include U.S. nuclear plant and the additional, generic, digital HSI technology experience. So those are OER conducted under NUREG performance issue to the Basic HSI portion.

CHAIRMAN STETKAR: And, Kenji, as I understand it, some of that operational experience, it does say in that sub-bullet, it says additional generic. You also had operational experience from other types of industries --

MR. MASHIO: Yes.

CHAIRMAN STETKAR: -- not just nuclear plants, right?

MR. MASHIO: Yes.

CHAIRMAN STETKAR: Okay. Thank you.

MR. MASHIO: So one comment Phase 1b, Bravo, so we, just move to this next slide. And in --

Yes. Two separate Phase 1 testing main control room safety was used to support dynamic testing for US-Basic HSIS. Additionally, static portable HSIS analysis tool on the personal computer platform was developed to support this phase screen navigation verification.

CHAIRMAN STETKAR: Kenji.

MR. MASHIO: Yes?

CHAIRMAN STETKAR: I hate to hang up on this stuff, but the second bullet there talks about eight crews, 22 people, Phase 1a.

MR. MASHIO: Yes.

CHAIRMAN STETKAR: That's what, I believe, is documented in the Topical Report, is that correct?

MR. MASHIO: Yes, I believe this --

CHAIRMAN STETKAR: Because I don't remember hearing about the five crews, ten people.

MR. MASHIO: Yes, this answer, as I'm taking this number to verify --

CHAIRMAN STETKAR: Well I can tell you, in the Topical Report, Appendix C and indeed, in the documents I could find, this notion of eight crews, 22 people, I've even got the breakdown of number of ROs and SROs, seven scenarios, the thing that's called Phase 1a here is, is indeed, I believe, what's documented in the Topical Report. The five crews, ten people --

MR. SPRENGEL: Yes.

CHAIRMAN STETKAR: Oh yes.

MR. SPRENGEL: No that's --

CHAIRMAN STETKAR: The five crews, ten people, I don't know what that is. And if it's Phase 1b, is that for the US-Basic, or is that somehow now a mix --

MR. HALL: Right.

CHAIRMAN STETKAR: -- of morphing to US-APWR?

MR. HALL: No. The, remember, when I was speaking, I said there were two sets of tests done that got us to the US-Basic, which is the subject of the topical.

CHAIRMAN STETKAR: Yes.

MR. HALL: These are the two sets of tests.

CHAIRMAN STETKAR: So --

MR. HALL: This first one, this Phase 1a was the first test I was talking about. The Phase 1b that he's referring to --

CHAIRMAN STETKAR: Okay. Bob, you --

MR. HALL: -- is the second set of --

CHAIRMAN STETKAR: Now I'm suddenly, because I was trying to make pretty clear in my questions, and maybe I wasn't clear enough. So for the record, the thing that is documented in Appendix C of the Topical Report is Phase 1a.

MR. HALL: I think that's what Kenji's now checking, to find out what's in there.

CHAIRMAN STETKAR: Well that's what I'm trying to understand. Because what is documented in the Topical Report is important for us to understand how operating crews interface with something, and we need to know what that something is, or was.

MR. HALL: The Topical Report is referencing 1a.

CHAIRMAN STETKAR: Okay. What is 1b?

MR. HALL: 1b is the second test of tests that I described earlier, before the break, that took the findings, the results of this testing, 1a testing that was done on the Japanese conversion, all the things we found that we needed to change, all those HEDs, the 1b, the second test listed here, is the second test I described. It was those changes made and then we tested those changes.

CHAIRMAN STETKAR: Two questions. Two questions, let me -- where is that documented and what is the purpose of the 1b in relationship to the US-Basic HSI?

MR. HALL: I can't tell you where it's documented.

MR. SPRENGEL: The results of 1b became the US-Basic HSIS. And the note on the bottom of the slide I am showing. So it resulted in, basically, the updated Topical Report, because the design was modified, as a result of it. We've talked about the screen changed.

MEMBER BLEY: So just, but in Appendix C, which describes the testing, it only describes the Phase 1a testing. So there's nowhere in this document where we see the Phase 1b testing?

MR. SPRENGEL: That's an open question. So I can --

MEMBER BLEY: It looked very open.

CHAIRMAN STETKAR: The problem is, Ryan, I, up until right now, I thought -- and I had several questions about the phasing. I thought that I understood the phasing. I thought that the Phase 1a testing that's documented in the Topical Report brought us up to the US-Basic HSI, in the context of the picture that you had up earlier, what we can call now, the blue stuff. And that Phase 1b testing was part of the transition from that US-Basic to something that would eventually become the US-APWR.

MR. SPRENGEL: US-APWR.

CHAIRMAN STETKAR: That indeed, my interpretation was that Phase 1b was part of the green process, which is, has yet to be finished. I'm apparently wrong.

MR. SPRENGEL: You are wrong.

CHAIRMAN STETKAR: I'm willing to admit

that I'm wrong. But then, indeed, I don't think we have documented that Phase 1b. Because, the problem is that what's documented in the Topical Report, quite honestly, because we're all out of sequence now anyway, at the end of Appendix C I'm left with the impression that, essentially, all of the operating crews failed open on response to a tube rupture event, which quite honestly, in a complex scenario time sensitive actions is exactly where I was concerned about the configuration and number of displays available to operations.

And, indeed, they all failed open and it says we have a, we've created human engineering deficiencies and that's where it ends. So I'm, in the context of the US-Basic HSI, I was left with the opinion that there are fairly significant human engineering deficiencies that are yet to be resolved.

MR. SPRENGEL: Okay.

CHAIRMAN STETKAR: -- I was wrong.

MR. SPRENGEL: So let's review the slide displayed now. Phase 1 is the Topical Report scope. It is the blue. So --

CHAIRMAN STETKAR: It is the blue?

MR. SPRENGEL: The 1a, in terms of the, we reference iterative design, I mean, it was iterative in pieces, but we split 1a and 1b separately.

1a was, you know, right after the initial translation from the Japanese design to the US, we have some favorite terminology to refer to for that conversion. That is special because the, the additional changes needed were not necessarily expected.

I mean, maybe in hindsight we can say that a lot of those things, in terms of how the operators use the systems. You know, the hope is always like, like was said, the hope was let's, let's take the control room and just move it where ever and everyone use it the same.

Well, 1a, that testing and why it's kind of broken into two, was special in that we had to get over that hurdle of converting it to U.S. use. And then 1b got into, okay, now that it's usable we're going to continue to fine tune it and resolve the operating deficiencies separate from the country conversion.

The results of 1b then, were just integrated, in terms of the improvement to the HSI design and became what is the design that is presented in the Topical Report.

MEMBER BLEY: So all of what you just described is the blue stuff on Bob's flowchart?

MR. SPRENGEL: That's correct.

MEMBER BLEY: Okay.

CHAIRMAN STETKAR: But there's no documentation of, I mean, you say ten, five crews, ten operators. I think that's what it said.

Ten persons. Five crews, ten people. So obviously, some people were on multiple crews, because -- you need at least 15 for five crews. So I'm not sure how blind a test that was. Will they run through several scenarios each? I mean, what was done in that 1b? Because that, to me, is the proof that thing that we're asked to review has had some measure of dynamic testing on your vernacular.

MEMBER SCHULTZ: Simplifying the question is, why isn't that documented in the Topical?

MR. HALL: Now let me answer the technical question. The 1a test did, in fact, have failures of the crews that we did not anticipate going into the testing, but that's what testing is about. The changes to the design, all crews passed the success criteria. So the changes were successful on things like steam generator tube rupture.

The crews were broken down in Phase 1a, such that we had crews with a single RO and crews with this double RO. This, you know, because we wanted to see, did it make a difference in operating the plant.

CHAIRMAN STETKAR: Yes, I finally divined that. I didn't, you can't really understand that just reading it. But you can, if you read between the lines in many separate --

MR. HALL: Okay.

CHAIRMAN STETKAR: -- reports. But go on, that's --

MR. HALL: So that's what it was. And then, for Phase 1b, we only used two-person crews, because we saw no variation between the results of the two operators and the one operator.

So the first series of tests, some of them had --

CHAIRMAN STETKAR: I'm sorry. When you use the term operator, I think of individuals. So I have a shift technical advisor, a senior reactor operator, and a reactor operator, define what you mean by operator.

MR. HALL: The tests were Phase 1a SRO. Sometimes a single RO. Sometimes a double RO. We did --

CHAIRMAN STETKAR: Never and STA?

MR. HALL: We ran, now, I know we ran, at least, one with an STA, but I think that might be it. I'd have to go back and check the record. Phase 1 --

CHAIRMAN STETKAR: Is that the one that they won on, or the time that they succeeded?

MR. HALL: I can't answer the question, I don't know. The Phase 1b we tested really the minimum compliment, which is the SRO and RO. So it was one RO and the SRO. So Phase 1b only looked at the two people in the control room and --

CHAIRMAN STETKAR: Thank you.

MR. HALL: -- and both of them ran, the first one ran something like eight scenarios, the second one ran five, or seven, I'd have to go back into the record and pull out how many scenarios.

And these were full scope scenarios. Everything from something like a startup, which was a long duration, to typical type of accident response, including loss of oil, operational VDUs, and the need to move over to some of the other support systems.

It included things like, during scenarios having screens freezes. Because, you know, in a digital system that's one of the oh my Gods, is having a screen just freezing on you and you not know that the digits, the numbers you're looking at were not correct. So.

MEMBER SCHULTZ: The third bullet refers to the scenarios that were run in both Phase 1a and Phase 1b, the third bullet on this slide?

CHAIRMAN STETKAR: No. That's not what he said.

Certainly, it's Phase 1a, because that's what's documented in Appendix C, but Bob just --

MR. HALL: Yes.

CHAIRMAN STETKAR: -- told us that --

MR. HALL: This --

CHAIRMAN STETKAR: -- that not all seven scenarios were run through the other crews.

MEMBER SCHULTZ: Okay.

MR. HALL: Yes. That's 1a is the -- and we ran additional scenarios for 1b, so it wasn't just the same sets of scenarios --

CHAIRMAN STETKAR: Probably wouldn't get PhD for your --

MEMBER SCHULTZ: Different ones, yes.

CHAIRMAN STETKAR: -- for your testing

program, in terms of engineering a real test with this --

MR. HALL: Well, as I said, they're testing, this testing ended up coming into what the ISV is reported on in the Technical Report for ISV. So what's proposed there is the process refined here.

CHAIRMAN STETKAR: Yes, but the problem is, once you're set on a basic, I'll come back to this generic thing that's got a bunch of screens and a bunch of stuff on it, once you're set on that, it's pretty hard to make changes after that.

And if you haven't actively done some good testing on that, with real operators and real scenarios, it's hard to have confidence. Because, as I said, quite honestly, I didn't read Appendix C until I got to Appendix C.

And if you read some of the stuff that's written in here, I had many questions about the ability of the operators to use this interface, both with and without operational VDUs available in a real event.

And I got to Appendix C and everything that I was worried about was, indeed, fully corroborated. They had problems when they were faced with the only time sensitive complex scenario, the only one that was really time sensitive. They all failed. And now I'm being told here in this meeting that, okay, we fixed all of that and we ran, you know, five more crews on some subset of scenarios and they all did okay. There isn't a lot of confidence building here.

MEMBER BLEY: And we don't know, we don't know what those set of scenarios were. Were they the simplest straightforward ones, like we often see in a simulator, or were they more complex ones that would have challenged them and challenged the interface? So we're sitting here a little deaf, dumb, and blind kind of spot.

Just an aside, two recent things were the consideration, I think. There was a presentation at last year's RIC by the Halden folks, who did a series of experiments looking at different ways to engage the STA, and the results were maybe not surprising, if you have operational background. I think we're surprising to a lot of people. It's worth looking at those.

And the other one, if we talk about complex scenarios, we'd always throw out the Robinson fire. Think about that. There you had, for about the first half-hour, only two guys in the control room doing anything, and things got much harder with just having two people.

MR. SPRENGEL: We will take an action from the feedback. There was a sequence of events, and I think through our cleanup of the technical reports, one of them that was removed was a more detailed discussion of the Phase 1b. And I think there may -- 1b, yes.

So we'll take an action to review that information and consider how to add the detail, like 1a, detailing what was done for the 1b effort into the Topical Report.

MR. HALL: All of our recent comments said, I'd like to reiterate that I think the story you walked us through on how you took the Americanized panel and worked through it to find potential problems was a really good story. I'm glad you did all that. I'm glad you told us about it.

And the thing you found about the problem with supervision with having people sitting at the panels, I think, is a crucial one for everybody who's looking at these kinds of designs and we really appreciate that.

MR. SPRENGEL: Thank you. One other highlight. And I don't think it'll necessarily answer any questions, but I just want to state it that, that the US-Basic HSI was not started from nothing.

And in terms of the flexibility of the screen and what's displayed there, that portion of the development happened with the development of the Japanese-Basic HSI.

So some of the concerns, in terms of what information is available, how it's displayed, whatnot that had already taken place, as part of the Japanese HSI effort.

And we didn't necessarily -- So I, again, I don't know that it will resolve any of the concerns, or questions, but I also don't want to leave the impression that that kind of work didn't happen.

CHAIRMAN STETKAR: No, I understand that, Ryan.

MR. SPRENGEL: Okay.

CHAIRMAN STETKAR: And my perspective is from somebody who use to operate a nuclear power plant 35 years ago in the United States. And I've worked with operators, you know, since then. But not in Japan.

And I'm aware of those changes, but as I said, as I looked at the HSI from my perspective, a bit of my concern might have been a holdover from a different way that the Japanese operators are used to using those interfaces.

They may be more use to and more comfortable with toggling very, very quickly among several different displays and not feeling comfortable with continuous trend information, for example. A more rapid fire.

And I was, you know, I wasn't sure whether that might have been a holdover from Japan versus part, more of the consideration that Bob talked about, of really looking at the differences.

MR. HALL: Let me point out that, when Kenji gets through his slides, ask those questions.

CHAIRMAN STETKAR: Okay.

MR. HALL: Because, you got to remember in these machines, and it's not unique to the Mitsubishi design, they have these large display panels that show a lot of information and it removed, no, it removes a lot of the toggling you're talking about, requirement. It becomes a communication devise. So I would suggest --

CHAIRMAN STETKAR: All right.

MR. HALL: -- when Kenji gets to that slide of this quote LDP, large display panel, this might become clearer, or maybe ask that question again and we can walk through it.

CHAIRMAN STETKAR: And I really, like personally, this is subcommittee meeting, so I can say this, I personally like, very much, the idea of the large display panel and the information it conveys.

And it's a -- I also will acknowledge that it's not safety related. It's powered from non-safety related stuff and it might go away in the types of events where people can get into real trouble and that the operators will be left only with the safety-related displays. And I --

MR. HALL: And our tests --

CHAIRMAN STETKAR: And I tried to think about that, Paul.

MR. HALL: And our tests looked at loss of the large display panel in all operational systems gone, either frozen, or black, going to the safety panels.

Our tests also included safety panels going down. All digital loss and going over to the desk panel.

CHAIRMAN STETKAR: Yes, I feel a heck of a --

MR. HALL: So we had three, we had scenarios on --

MEMBER BLEY: Those tests would be really helpful for us, I think.

MR. SPRENGEL: We've captured the action.

MEMBER BLEY: Got you.

CHAIRMAN STETKAR: If you spoke more you'd remember, but we won't --

MR. MASHIO: No.

CHAIRMAN STETKAR: -- we actively won't let you speak.

MR. MASHIO: Okay, so -- yes. This our, this slide explains Operating Experience Review. And this resource include NUREG/CR-6400 and INPO database and also Japan Nuclear Technologies Institute, JANTI, Nuclear Information Archives, called NUCIA database, and also we, this also include our issues obtained from non-nuclear industries, similar HSIS technologies in U.S. and in Japan. Those findings were evaluated and included in the US-Basic HSIS.

And the concept of operation is addressed in the Section 4.1 in Topical Report. And the US-Basic HSIS addresses the following subject, crew composition, roles and responsibilities, personnel interaction with plant automation, use of control room resources by crew members, methods used to ensure good coordination of crew member activities, including non-licensed operators, technicians, and maintenance personnel.

Operating crew composition. The normal MCR staffing consists of one RO and one SRO. And this normal MCR staff is supplemented by one additional SRO and one additional RO that will be at the plant to accommodate unexpected conditions.

CHAIRMAN STETKAR: Kenji, let me, let me stop you there. I hate to, hate to do this. But, again, in terms of the Topical Report, this is, indeed, the, the minimum crew that we're being asked to think about, right? So I'll ask you in a real event, if I have, perhaps, two ROs and two SROs in the control room, what do the two SROs do?

MR. MASHIO: One SRO is a supervisor position. And the one additional SRO is, this is a lower STA.

CHAIRMAN STETKAR: Who takes care of being the emergency director and calling all of the off-site personnel and handling all of those functions, coordinating other people, who might be coming into the plant to help out during this event?

MR. MASHIO: We examine that HSI design inside the control room. And this, this scenario including those --

CHAIRMAN STETKAR: No, no, no, no.

MR. MASHIO: -- outside of the --

CHAIRMAN STETKAR: No, no. I'm sorry. I asked you, who among, I'll call them the two SROs, which one of those people handles all of those functions that are required, by law, in the United States, since we're, we're trying to get this implemented in the United States, which one of those two bodies performs all of those functions?

Off-site notification, performing the role of emergency director, looking at emergency action levels, coordinating with off-site responders, if I have a fire, if I have things like that, which one of those two people does that? Because one of them has to do it, by law. So I want to know, which one does it?

MR. HALL: Within the normal compliment there is, there are, the minimum crew, two in the control room, SRO and RO. There are these two additional individuals at the plant that are outside the plant that are expected, if needed, to come back into the control room, one to take the position of a second RO, if needed, and then the second SRO. There is a third SRO that's a roving SRO that --

CHAIRMAN STETKAR: No, I'm, I'm sorry. That's an US-APWR design. That is not in this report. Do not confuse US-A --

MR. HALL: Okay. You're right.

CHAIRMAN STETKAR: -- PWR with this.

MR. HALL: You are correct. You are correct.

CHAIRMAN STETKAR: Indeed I am. I'm pretty happy with the US-APWR, but we're not talking about that. We're talking about the Topical Report. And that's why I, very clearly, want to keep those two subjects different. So now, in the Topical Report, minimum staffing, how do I handle that function?

MR. MASHIO: Yes, I do.

CHAIRMAN STETKAR: Okay.

MR. SPRENGEL: We'll leave that --

CHAIRMAN STETKAR: Okay.

MR. SPRENGEL: We'll follow-up on that item.

MR. MASHIO: Okay. So the HSIS is designed to support minimum MCR staffing described above, and the space and the layout of the MCR are designed to accommodate the foreseen maximum number of operating and temporary staff.

And the staffing levels, staffing application IP, it handles further staffing levels for the US-APWR. And this slide shows a combination of who and where operator, crew, operator staff is sited in the, inside the control room.

ROs sit down at the operator console, and the SRO and the STA sit at the supervisor console and the STA console. And the feature located behind the operator console. And the MVP is located in front of the, both the members, crew members.

The computer-based HSI provide operational VDU, as the fundamental interface. So the operator monitors plant status and initiates actions from the VDU by touching or clicking on the appropriate sections of the screen.

The operators workload is significantly reduced by providing the relevant process control information in integrated displays on the VDUs and utilizing a compact console that minimizes required operator movement.

The HSI also provide operational support functions that utilize the computer to consolidate large amounts of date into meaningful displays. Section 4.5, or 4.1, identifies further specific interface.

And our next slide Control Room Crew coordination with the HSIS. Control Room Crew coordination with the HSIS is described in each HSI design feature.

The Large Display Panel, LDP, provides Spatially Dedicated Continuously Visible, SDCV, information to the operation personnel to enhance situation awareness. That helps operations, operators maintain continuous awareness of the overall plant status and the critical status changes.

And the secondary purpose is to help the operations staff coordination and communication by providing a common visualization of plant information. The Operator Console provide all monitoring and control functions that are, feature available in the MCR, so that ROs can perform all operation tasks using the Operator Console from a seated position.

The Supervisor Console are located behind the RO, provides the same display set as those on the Operator Console, without control functions. The STA console provides the same display set as those on the Operator Console, without control functions, as well.

Each console has paging phones and internal phones to communicate with local staff. The Maintenance console, which is temporary console, disconnect from the digital data communication bus during the normal plant operation, used to support an additional operator in MCR for tests during plant shutdown conditions and periodic inspections.

The tagging feature on the O-VDU and the physical tag for local component are also addressed to support maintenance activities between MCR crew and maintenance staff.

This picture, as we discussed, this is a US-Basic HSI simulator as noted. This picture shows our design feature in progress, during the phase of 1 Alpha and does not reflect the finer designs.

CHAIRMAN STETKAR: So just, just make sure, because we're having a little side conversation here about being able to count to four, four, or five, which is pretty good for us. In the, after the Phase 1 Alpha, the Phase 1 Beta, or the US-Basic HSI, at the Supervisor Console there will be another display, a fifth display? I count five, because --

MR. SPRENGEL: Yes. That is correct.

CHAIRMAN STETKAR: -- because the little flat thing on the bottom is the --

MR. SPRENGEL: Operating procedure, VDU.

CHAIRMAN STETKAR: -- is the operating procedure, VDU. So there'll be a fifth display off to the right. So the thing that you told me to count on before, actually should have had five on it?

MR. SPRENGEL: Yes.

CHAIRMAN STETKAR: Okay, thanks.

MR. MASHIO: Okay, the next topic is our Large Display Panel. And the first couple of slides gives LDP features. And LDP provide plant overview information to enhance MCR's staff awareness or plant status.

And LDP provides computer-aided operator support information, computer check-in, a relevant component status at reactor trip, ECCS containment activation, etc. And the second is the safety function status and bypass or inoperable status indication, BISI, along with safety signals, initiation single, such as a reactor trip, ECCS, or containment isolation signal.

CHAIRMAN STETKAR: I have a question, and I don't think I know the answer, because I get lost. The thing that Ryan was just pointing at, the bypass inoperable status indication. I know, I know that it is displayed, in fact, I know where it's displayed on the Large Display Panel. Is it available to the operators on the safety VDUs?

MR. MASHIO: The safety VDU, we, we don't know. Because we, this, our country's not implementing safety VDU, because this bypassing inoperable function is computer check-ins that are inoperable status. So computer --

CHAIRMAN STETKAR: Okay.

MR. MASHIO: -- plant computer is a no safety program, so it's not --

CHAIRMAN STETKAR: Okay, but I --

MR. MASHIO: -- our --

CHAIRMAN STETKAR: Okay, I'm a human being and an operator, and if all of my non-safety VDUs go dark, because the initiating event made it go dark, wouldn't the operators be interested in knowing what safety-related actuation signals are bypassed and inoperable, because those are safety-related signals that are bypassed, or inoperable, and why, why don't they have that information available to them?

MR. MASHIO: You --

CHAIRMAN STETKAR: For example, if Train

A didn't start, it would be useful for me to know that Train A didn't start because --

MR. SPRENGEL: Oh yes.

CHAIRMAN STETKAR: -- it was, it was bypassed and I can, maybe, do something to correct that, or maybe it didn't start because, oh, the pump broke. My response might be much different under either of those conditions.

MR. SPRENGEL: Okay, so we'll follow-up on that.

So just to clarify, the question is, one, we'll confirm that the BSIS information is not displayed on the safety VDUs and --

CHAIRMAN STETKAR: I could, I -- you know --

MR. SPRENGEL: -- the second follow-on question is --

CHAIRMAN STETKAR: Why?

MR. SPRENGEL: -- why?

CHAIRMAN STETKAR: I'm pretty sure that it's not, but I couldn't find anything justifying it.

MR. SPRENGEL: You --

CHAIRMAN STETKAR: Well no, I couldn't find anything definitive that said it's not, but I didn't, because I didn't find anything definitive --

MR. SPRENGEL: That said --

CHAIRMAN STETKAR: -- that said that it is, I'm --

MR. SPRENGEL: The second question is --

CHAIRMAN STETKAR: I'm pretty sure that it's not, and if it's not, why not, you know?

MEMBER BLEY: The happy answer would be, you missed it, it's there.

MR. SPRENGEL: We'll get back to you.

MR. MASHIO: Okay. So next slide show the display configuration in LDP. LDP contains pics on the variable display areas on 100 inches diagonal screens.

Three of these screens are dedicated to the fixed display area, and the fourth screen is variable area of where there's plant information and the plant display on the operational VDU display can be displayed.

The contents of the variable display can be selected from the Operator Console and from the Supervisor Console, thereby helping the operator staff command awareness on the communication.

CHAIRMAN STETKAR: Kenji, the variables display, I'm really, really critical. You guys, most of you know my personality by now, so we'll get over that.

The variable display area, anybody can bring up anything, any of the three, two, or three, bodies in the control room, can bring up anything on the variable display area. Are there, is that just done, as part of the crew operations dynamics, somebody says hey, bring up X?

One of the concerns I had is, if I'm the shift supervisor and I want to see something, and I think it's important to everybody, I throw it up there. And the RO says, whoa, I want to see something else and I throw it up there. Suddenly, you've got a bunch of stuff going up and down on the variable display area, again, in not normal operations, or slow trend, things where, where things are happening kind of fast and you might want to check on things.

Is there someone who has to actively take control over that area?

MEMBER BLEY: Or is it possible for someone, shift supervisor, to take priority, so that what they do sticks?

MR. MASHIO: Currently, this Basic HSI system does not have any priority between the Operator Console and the Supervisor Console.

CHAIRMAN STETKAR: Yes, and that's documented in there. The question that I came up was, these dynamics of, the last thing that I would want is having this large display panel suddenly flashing from trend information to some system, to something else, because then it could be really distracting to people.

MEMBER POWERS: Especially manually, or automatically.

CHAIRMAN STETKAR: Well, it doesn't come up automatically, somebody has to select it. But, but the question is, if I think I'm more important than you are and I want to see something and throw it up there, and you think you want to see something else, then you get these screens flashing on and off that could, indeed --

MEMBER POWERS: Well it appears that you get the screen flashing on and off, whether you take command, or not, from simple words.

(Simultaneous speaking)

MR. MASHIO: Yes, as long as I observed the operator coordination during the Phase 1 --

MEMBER POWERS: I thought automatically.

MR. MASHIO: -- testing. And --

MEMBER POWERS: Automatically.

CHAIRMAN STETKAR: You're right, Dana. I didn't ever remember reading the -- what's the automatically displayed on the variable display?

MR. MASHIO: Oh. Okay, yes. This automatically, this feature is if a random initiation, such as a hostile alarm or further reactor trip, then this also sets our screen. For example then, if our reactor trip initiates, the reactor trip verification screen is popped up on the variable area. So this --

CHAIRMAN STETKAR: Automatically?

MR. MASHIO: Yes, automatically.

MEMBER SCHULTZ: Based upon the plant action, it will be connected to --

MR. MASHIO: The plant, based on the conditions of --

MEMBER SCHULTZ: -- it will be connected to an automatic display.

MR. MASHIO: -- significant transaction, like initiating, then the associated -- once the associated information displays, automatically will pop up on that variable area. But then, the operator can override any information data. And they --

CHAIRMAN STETKAR: I thought that that,

Kenji, I thought that that type of information appeared on the upper part of the right-hand fixed display panel. What, what additional, I mean, you can't see it here, but in the photograph, if you go back to Slide Number 30. Go back to Slide 30.

There you go. Now, you see the red stuff on the upper right-hand panel of the fixed display, I thought that that was, effectively, the first out indication with priorities of what came in, am I wrong?

MR. MASHIO: Yes. For example --

CHAIRMAN STETKAR: I mean, it doesn't show up on this, which is, yes, kind of up in the air where you're --

MR. MASHIO: Yes, this top area is, this is the facade around the indication area.

CHAIRMAN STETKAR: Okay.

MR. MASHIO: And this include our ECCS from the left, our ECCS, our reactor trip --

CHAIRMAN STETKAR: Yes.

MR. MASHIO: -- and turbine trip and --

CHAIRMAN STETKAR: Yes.

MR. MASHIO: -- general trip.

CHAIRMAN STETKAR: Yes. Yes, and I thought that that was all over along the top of the fixed displays.

MR. MASHIO: Yes.

CHAIRMAN STETKAR: So what comes up on the variable display automatically?

MR. MASHIO: Yes, when you have a trip initiate on the fixed area on the facade around.

CHAIRMAN STETKAR: Okay.

MR. MASHIO: Then, as I said, our overview information, in that case, our operator -- reactor trip verification screen, such as a reactor trip breaker indication and an NIS indication, those are combined verification screens, which is installed in all the --

CHAIRMAN STETKAR: What does the OK monitor do for you, then?

MR. MASHIO: No, no, no. It's a specific dedicated screen overview.

CHAIRMAN STETKAR: Okay, I'll ask you, though, what does, I thought that the OK -- the so-called OK monitor, in the fixed display area, took care of all of that stuff.

That it looked at all of the stuff that was supposed to happen on a reactor trip, and you got, okay, reactor trip. Or, it looked at all of the stuff that's supposed to happen on a safeguard's actuation. You got OK safeguards actuation, or a Phase A containment isolation, I thought that that's the function that that part of the fixed display --

MR. MASHIO: Yes. That's what it -- but these OK monitors are checking the status, each status. For example, the reactor trip initiate every status to verify the reactor trip initiate, such as NIS monitoring reactor trip breakers and --

CHAIRMAN STETKAR: Okay, you just, I'll stop you right there.

MR. MASHIO: Okay.

CHAIRMAN STETKAR: You just said the word reactor trip breakers. Why do I need an automatic screen over in the variable display that shows me that the reactor trip breakers are open, if the OK monitor takes care of that?

MR. MASHIO: Yes. Yes, if our computer checking no good feature verified this one, its status is not working, then operators, ultimately, verify the cause of, cause of sequence. So this overview verification monitor helps fix the status, such as if a turbine breaker is noted open.

CHAIRMAN STETKAR: Kenji, it may help, from a computer systems designer, throwing a bunch of stuff up, flashing it in front of me, as an operator, oftentimes distracts me, especially if I'm now challenged to, what, if I'm trained that the OK, monitor is taking care of that function for me, throwing up something in front, additional, in front of me is just more information that can distract me.

MEMBER BLEY: Did this come up in any of the testing?

MR. HALL: Yes. And --

(Simultaneous speaking)

MR. HALL: Yes, no. This happened throughout the testing, because we were failing things. And having the OK monitor do the checking of the various components and saying, okay, here NG, is a summary. It says, yes, everything is functioning, or one train is out of service, or the system is, but just a summary. And then the added information helping diagnose what the problem is, pops up on the variable side. So the variable side gives you the ability to drill down on what's causing the NG, for example. And during the test, it was quite helpful. I mean, this is, was not the confusion that we're --

MR. SPRENGEL: It wasn't.

MEMBER BLEY: And you didn't get a second one coming in that would flip this to another screen?

MR. HALL: No, no, no, no. Could that just be scenario selection? If I remembered all the detailed scenarios, you know, I would tell you, you get a sense that no, it was not an issue.

Because the scenarios we used were things like, again, small break, large break, steam generator tube rupture with, at least, one up to three to four compounding failures thrown in it. So the answer is, it was helpful, not confusing.

CHAIRMAN STETKAR: Okay. That's, seems the test would help. It's just the first, I don't recall seeing anything, this one Dana said, automatic. I was more concerned about the operator's, you know, conflicts among the operators, in terms of manual selection of who wants to see what up there.

I got comfortable, and I kind of liked the concept of the his OK monitor, because as an operator, I like to look at something quick and everything is green, fine, I don't need to worry about this stuff. If I need to worry about this stuff, I'll go worry about it, but maybe I have to worry about four or five different things. I'll have to think about that. Okay. That's the only automatic display that flashes up on the variable display is this --

MR. MASHIO: Yes.

CHAIRMAN STETKAR: -- essentially a confirmatory status of the, whatever protection functions?

MR. MASHIO: Yes, as I said, when bypass initiates, then bypass of our permissive single initiates. Then this bypass permissive indication screen would metrically indicate on the variable area.

CHAIRMAN STETKAR: This is the status of the bypass --

MR. MASHIO: Variable --

CHAIRMAN STETKAR: -- also indicated on the left-hand side up here?

MR. MASHIO: Yes. Yes.

CHAIRMAN STETKAR: Okay. Just let me think.

MEMBER BLEY: I said, we'll need to think about that. I suspect on the manual side of this --

CHAIRMAN STETKAR: The manual --

MEMBER BLEY: -- it's no more of a coordination problem than we have in many other things that go on in a control room.

And the shift sup will have to just

takeover and --

CHAIRMAN STETKAR: And I kind of figure, you know, --

MEMBER BLEY: -- take control.

CHAIRMAN STETKAR: -- the fact of the matter is they're in there talking to one another, but I just want to make sure that there wasn't some sort of implicit priority, or things like that. The automatic stuff, it's just something new, report, at least, I didn't remember, if it's written down.

MEMBER BLEY: And we have seen something recently where there's multiple people controlling things and they can actually interfere with each other and they did have some prioritization to take care of that, but that was something altogether different. It's got our thinking going that way, though, a little bit.

CHAIRMAN STETKAR: Okay. Sorry.

MR. MASHIO: So let's continue on the next screen. The fixed display area provides the main plant parameter required for monitoring the plant status, during the normal operation enabling quick detection.

The main parameters required for monitoring plant status during our production and the parameters that may cause that reactor trip. And information required for verification reactor trip status information, which is associated to the reactor turbine and the generator immediately following. The engine -- the engineered safety feature component status on the process parameters indicating system performance.

Also this fixed screen indicates Type A, Type Alpha and the Bravo, parameter Reg. Guide 1.97. And also, alarm, all alarm. Some alarms, as grouped alarm, indicating that at the top of the screen. And the individual alarms and the associated alarms in the parameters are in the new graphic display.

And this safety system bypass inoperable status indication. This information is organized using the plant mix showing primary system, containment system, and toggling generator air quality system.

The next slide shows the left side fixed portion of LDP display. The --- in addition to measure pumps and parameter indication unique display, there are several special indication OK monitors, BISI Monitor, the system auto statistics emissions task monitor, Oak Ridge plant safety functions. Operator checks all the other function and indicates inoperable status by each function.

The LDP presents us, and you can monitor the information, but always within our construct. And the OK monitor provide status of automatic checks on all applications result in RPS, and ESFAS. And the Critical Safety Function Monitor provide the status, or automatic checks for each critical safety function status.

And the BISI Monitor presents bypass or inoperable status for each safety function, as each are in each signal. LDP maintains same operator conventions in the O-VDU display design, therefore, minimizing operator confusion moving between HSIS.

The next slide shows the Operator Console configuration. The Operator Console consists of Operational VDUs, Alarm VDUs, Operating Procedure VDUs, Safety VDUs, and System Level Safety function initiation safeties.

CHAIRMAN STETKAR: Kenji, let's go back to that.

MR. MASHIO: Yes.

CHAIRMAN STETKAR: The Hardwired Switch Area, I know, I don't know the individual switches, but I know the intent of those switches, how are they actually implemented in the design? Are they simply a manual input that bypasses the automatic signal comparison logic within the digital system, or do they go directly to the actuation interface for the various functions? In other words, how much do those hardwired switches bypass of the digital signal processing?

MR. MASHIO: This System Level Hardwired Switch is based on the safety requirement, they just wired to, as much as possible, to do that based on technology. So this hardwired switch is to the output of the digital LDP.

CHAIRMAN STETKAR: They are?

MR. MASHIO: Yes.

CHAIRMAN STETKAR: Okay.

MR. MASHIO: But this is HSI compilation, so this compilation how to integrating the I&N system described in Chapter 7.

CHAIRMAN STETKAR: Well yes, and that's why I went to Chapter 7 and I have these lines highlighted on this figure here. In particular, I see where manual reactor trip goes directly to the reactor trip breakers. But, the thing that's called manual ESF actuation seems to simply bypass the comparison logic in the reactor protection part of the PSMS, is that correct? So it still relies on a lot of the digital signal processing for safeguards actuation, is that correct?

MR. MASHIO: That's right.

CHAIRMAN STETKAR: Okay. Thank you. I wanted to make sure I understood that, because I had to go to Chapter 7, but Chapter 7 is just a big cartoon, so I wanted to make sure that I understood that. Thank you.

So my point is that for tripping the reactor, I can have reasonable assurance that it bypasses any digital faults for initiating other safeguards functions, it'll bypass some of the digital system, but not all of it.

Okay. Thank you.

MR. MASHIO: And so --

CHAIRMAN STETKAR: Recognizing that, for the record, we still have the diverse, the diverse panel over there.

MR. MASHIO: Okay, on the next slide, the VDU is the primary HSI for four functions, safety operation, integration monitoring and operation, automatic verification with company status and interactive screen because this ---- in the US-Basic HSIS, we use it providing four functions, which is installed at the operator console, supervisor console and the system's technical advisor console. The following tables describes these functions.

Each display has associated navigation system designed to provide the operator with easy access to each display. The Navigation consider usability, minimizing potential human errors and contributing to human performance improvement.

The plant information and controls are organized in fluid system mimic graphics and modulation controllers are integrated with associated trend graphs. I'll bring up some images as an example, later, right?

And dedicated displays to integrate associated parameters and the controllers from different systems to support emergency operation and/or specific tasks are pre-designed and assigned as different groups in the top menu screen.

The top level system display uses content unique to separate content in this system from others and it uses lines to illustrate function dependencies between systems.

With only three levels of information, this display has a plant information hierarchy simplifying that task over organizing where in the network the current displays are illustrated and thereby minimizing confusing navigation, or information location.

The emergency display request area over the top navigation display provide our immediate access to safety status information that would particularly be needed during the implementation emergency procedures. Example could include plant trip status, safety injection by an inside item, SI sequence, and containment isolation status.

The plant-wide request area also support operator to set a dedicated display, which as I said to plant management implements, such as our environmental screen.

The top navigation display screen explained on the previous slide's screen typically used to access information, but it's important that by selecting the screen list menu, operator can display system grouping in alphabetic or numeric order.

The emergency information category including the current process marked red, blue is used to maximize our visibility of this grid. A function at the bottom is our display RO's operator to easily change between the two top level disparates.

The next screens are second level screens. At the second level system that we've provided that containment system information and access to content. Later I'll move in between systems without returning to the Top Level Navigation Display supported by our functional bar at the right hand page of the display that mimic associated systems to be called up.

These displays consistently use our background with various bright colors representing the system unique communication. Active competence on the unique area, unique configured to look like convex shaped button, providing the operator with a simple, visible cue, or accessing the top level display network, which provides controls for associated components.

When the buttons touched or clicked on and the soft control becomes available, then your default control station is consistent, basically, like go outside and if the related information is hidden by pop-up window, the default pop-up station is ultimately set in the other corner of the screen. The operator can manually move the pop-up window in the unusual case that the information relevant to the operation may be hidden.

Function toolbars are also available on the display, allowing the operator to move back and forth between the menu display, and the menu buttons for returning to the top navigation display. This functionality provide for simple and efficient movement both secondary and primary in the display interact.

CHAIRMAN STETKAR: When was, don't change this. The so-called software cover on each controller, I understand it's -- no, no, no, no, go to the other.

Go to the right. Go to the right. See where the arrow is? Stop. Someplace, I don't know whether you touch the grey, or whether you touch the white, but you need to so-call open the software cover before you can actually operate the components, like an interlock. I get that. I understand that. I think it's a good feature.

Is that, anytime you pop-up a controller, whether it's from the operational VDU, or from a safety, or, is the software cover also functional from the safety VDUs?

Yes. Okay, good. Does the software cover automatically close when you navigate away from that --

MR. MASHIO: Yes, the --

CHAIRMAN STETKAR: -- that pop-up --

MR. MASHIO: -- that's what --

CHAIRMAN STETKAR: It does?

MR. MASHIO: Yes. If our --

CHAIRMAN STETKAR: Okay.

MR. MASHIO: -- soft control --

CHAIRMAN STETKAR: So for example, I touch the thing, I open the valve, and then I close that display.

MR. MASHIO: Then --

CHAIRMAN STETKAR: The software cover closes when the --

MR. MASHIO: Yes.

CHAIRMAN STETKAR: Okay. Good that's -- thank you.

MR. MASHIO: Okay, so next screen is an example of the modulation controller. The controllers and the modules are safe providing controller functions only available in fixed position on controller's screen operator display on the operation review. That displays a trend graph and related parameter required to monitor that changing trend.

And the next slide shows an example of

the dedicated display. And this screen is organized associated with the information on the controller screen for the specific orders. So this is an example of that reactor trip-dedicated screen, organizes front of plant status, such as reactor trip records, rod position and also NIS monitoring and also turbine status.

CHAIRMAN STETKAR: And this --

MR. MASHIO: And --

CHAIRMAN STETKAR: I don't want to interrupt this. Is that all you have to say about the operational VDUs?

MR. MASHIO: Yes.

CHAIRMAN STETKAR: Okay. We're going to break for lunch. But I have a couple of questions, quick questions, and you might want to answer them after lunch. Unfortunately, two of us have another meeting that we have to run to at 12:00 p.m., so we can't run over.

On the operational VDUs, there is something called a lock function, and I didn't quite understand how that works. It sounds like it's either a reset, or a block function, or some sort of safety actuation.

MR. MASHIO: Oh --

CHAIRMAN STETKAR: I got really confused, because I didn't know, it seems to talk about blocking, or inhibiting the operation of possible safety systems from this non-safety interlock and I don't know how it works, and I was curious about that. So you may want to, I mean, in particular, I could read you quotes, but they're from Section 4.5.3.1 and 4.6.3 of the Topical Report.

Talks about block, or interrupt the automatic actuation signal for testing and maintenance, or for deliberate operator actions, during emergency conditions.

That seems to tell me, from a non-safety-related operational VDU, an operator can jump in and stop safety injection, while it's being demanded, or something like that. And I hope I'm misinterpreting that, so if you could think about that.

The other thing is that it talks about, under continuous controllers, it talks about a normal fast and slow mode of operation and it says that you can, I don't know whether it's shown on here, but that the I --

(Simultaneous speaking)

CHAIRMAN STETKAR: Yes. It's shown here

on the right-hand side. That the operator can select whether the operator wants a slow, or a fast, mode. And it said, well the reason for the slow mode is that, you know, the electronics can respond so quickly that, that maybe you don't want to have it do it that quickly.

My concern is, I don't know how slow is slow, and if the software decides that it wants to be in the slow mode, and I would really like it to respond in the normal or the fast mode, can it somehow prevent me from doing that? I didn't, for the life of me, understand why I need a slow mode, in effect.

Because it seemed to be, the whole discussion seemed to be related to response of little electrons, rather than real fluid systems and human beings.

And the thing that bothers me is that it said the slow mode is one-tenth of the speed. So if I want to, suddenly, if I want to increase flow and it's only letting me increase flow at a tenth of the rate that I'd really like to, because the software has somehow decided that it wants to do that, could that be a problem? So I'd like a little bit better information about what the benefit of having that slow mode is why do I need that? Okay? We'll just leave that, you can pick it up after lunch. Anything else, quickly, from any of the, the operators, any of the members, whatever we are? If not, we will recess for lunch and reconvene at 1 o'clock.

(Whereupon, the foregoing matter went off the record at 12:00 p.m. and went back on the record at 1:10 p.m.)

CHAIRMAN STETKAR: We are back in session. And again I know that we threw you way off script this morning. In some sense, I apologize for that. In another sense, I think it was a really good discussion. I mean you may not feel that way, but it certainly was I think for us.

So unfortunately it's part of what we do in these Subcommittee meetings. And in the long run, I think it's helpful for all of us.

With that, I assume that you think you have a path forward for this afternoon. Let's see if we can embark on that path.

` MR. SPRENGEL: We're back where we started. I want to first address some of the questions that came up and, depending your response, there may likely be some additional written response that will expand upon whatever discussion we have here.

I will start -- I've got about five questions -- with the intent of the inventory list for the Topical Report. I think your basic understanding is correct. I'm not sure if you like it or not. But I think your basic understanding is correct that the inventory list in the Topical Report is not what we would consider the final inventory list for any plant. And the list that would -- I think the LDP comes up a lot, but it would really be for any of the HSI that the potential population would change. I think the main interest is the LDP.

CHAIRMAN STETKAR: The main interest only because I think that's the only place where there was a long list of very specific issues.

` MR. SPRENGEL: The table.

CHAIRMAN STETKAR: The table, that table.

` MR. SPRENGEL: So the intent with the Topical Report is for lack of a better word a sample. But it is really the starting point for the further use of the entire HFE program.

MEMBER BLEY: And as I understand it, you have updated it several times to be consistent with where that's headed.

` MR. SPRENGEL: That is absolutely correct. So the one portion that clearly will have an impact for the US-APWR application will be any evolution not foreseen, but any potential evolution with the US-APWR plant design. That impact, obviously, the US-APWR application. And the similar would be said for any other application. They'd have to reevaluate what the inventory is.

CHAIRMAN STETKAR: And that, just in terms of process, reevaluation would be completed essentially post COL. Is that correct?

` MR. SPRENGEL: That is correct. Would be completed, yes. The activity, you know, a lot of these are simplified and again we'll cover this again later this afternoon. Hopefully, not too much later. But we'll cover this in detail that they are somewhat parallel depending on the status of different activities. But it would not be completed until --

CHAIRMAN STETKAR: The only reason I bring that up is as you're fully aware the ACRS' role in this process for all practical purposes ends at the COL. So, for example, we don't have the opportunity, at least not easily anyway, to weigh in on technical issues that might be resolved post COL.

For example, if we saw a partial

inventory, which is exactly why I brought it up this morning, and had some fundamental technical issue with it, if we knew that that was just a state of flux, fine. We know that. If we knew that that partial inventory was in some sense cemented in place and could be supplemented, we could still comment at least before COL issuance on that portion that we knew was fixed which again is part of my wanting to understand what that table in the Topical Report how we should interpret that table.

` MR. SPRENGEL: Given that clarification, the current status of that table in the Topical Report would reflect the current status of the US-APWR design as you have been given. If there was a technical -- Like you had questions on the two specific items, there are answers for those as well as others. But that's the real for right now.

CHAIRMAN STETKAR: But again in terms of -- I'm trying to keep my mind separated -- the Topical Report, comments on the population of that list in some sense are irrelevant because --

` MR. SPRENGEL: The application.

CHAIRMAN STETKAR: -- from the purpose of the Topical Report, it's simply an example list that would be specialized for whatever application.

` MR. SPRENGEL: Correct.

CHAIRMAN STETKAR: Now in terms of how that Topical Report is used for the US-APWR application, what I'm hearing you is unless the APWR application at this point takes exception or supplements or changes that list, we can view it as at least a snapshot of the list currently for APWR.

` MR. SPRENGEL: Correct.

CHAIRMAN STETKAR: Got it.

` MR. SPRENGEL: Where do I want to go next? There was a question for the US-Basic HSI. Who would perform the roles of emergency director including various example activities? The answer from the US-Basic HSI perspective alone would consider that specific activity outside the scope of the US-Basic HSI and the Topical Report.

The program as a whole covers that. You know we got into some of the discussion of staffing and qualification and further activities. So the HIB program does encompass those type of activities. But the HSI design in terms of LDP and what kinds of displays are available does not get into those types of roles and activities.

CHAIRMAN STETKAR: Okay.

` MR. SPRENGEL: BISI, there is the BISI

indication on the LDP from a safety-related display alone perspective, the question was would there be indication available on the SVDU. And the answer is kind of there is indication of bypass parameters on the multi-divisional display.

CHAIRMAN STETKAR: There is? Okay.

` MR. SPRENGEL: It would indicate basically as a yellow alarm status. I don't think we've -- Have you shown this screen?

CHAIRMAN STETKAR: This is on a multi-divisional display.

` MR. SPRENGEL: Correct. So this is an example of a red level alarm. So a bypassed parameter would indicate as a yellow alarm.

CHAIRMAN STETKAR: But that's a parameter if I have that particular sensor out.

` MR. SPRENGEL: Correct.

CHAIRMAN STETKAR: It's not necessarily the channel bypass that I can implement.

` MR. SPRENGEL: Correct.

CHAIRMAN STETKAR: Train, whatever you want to call it.

` MR. SPRENGEL: Right. In terms of component functionality, there is train level indication on the hardwired switch area. There are four indications for the train level bypass.

CHAIRMAN STETKAR: The bypass isn't -- Ah, okay.

` MR. SPRENGEL: I think it's these four little --

PARTICIPANT: The switch bypass.

` MR. SPRENGEL: And that is indicated in the Topical Report. But it's a train level.

CHAIRMAN STETKAR: That is indicated in the Topical Report. I missed that.

` MR. SPRENGEL: So same source of indication, but it's being compiled for the entire train.

CHAIRMAN STETKAR: But I mean that's at least -- See, that's the kind of information I was looking for is can the operator -- if the large display panel goes black on me and it goes black at t0 because of whatever the problem is, can the operators somewhere on the information they have available off to their left I guess it is quickly glance over and see that they don't have the okay status, they don't have all of that stuff. But if a train isn't running, can they quickly determine that it isn't running because it was in bypass? That channel was in bypass for some reason.

` MR. SPRENGEL: Correct.

CHAIRMAN STETKAR: The answer to that is yes.

` MR. SPRENGEL: Is yes with an indication on the hardwired switch area and then the procedural indication would be again seeing the performance using the safety they use including the multi-divisional safety VDU. But that would be over time after actuation.

CHAIRMAN STETKAR: Yes. See, here it's more difficult because you have to look at individual sensors and stuff like that. And you have to wait.

` MR. SPRENGEL: And you have to wait for it.

CHAIRMAN STETKAR: You want something where the operators can just glance at something and say, "Okay. Train A, yes. I forgot Train A was in bypass. I have to deal now with Trains B, C and D all doing what they ought to do." Thanks.

` MR. SPRENGEL: We're doing good. The next one was the OVDU lock function which was acknowledged I think primarily for a maintenance purpose. And the question was would it block an SI signal. Do we want to clarify.

CHAIRMAN STETKAR: Yes. Let me find

my -- You're speaking much faster than I can write. So give me like 30 seconds to copy my notes here because you're way ahead of me. And unfortunately you're answering the questions right. So I have to write these things.

(Laughter)

` MR. SPRENGEL: So I should keep talking.

CHAIRMAN STETKAR: You can, but I'll force you to repeat yourself and that will just annoy both of us. Okay. Let me find my note then on it. The thing I stumbled over, Ryan, is that -- and I'll read the quote because I've got it oriented here.

In Section 4531, it says "Lock. This manual switch can block or interrupt the automatic actuation signal for testing and maintenance" -- got that -- "or for deliberate operator actions during emergency conditions. For soft controls of safety components, this function is enabled/disabled under permission from the Safety VDU. To avoid spurious blocking of safety signals from a single failure, the lock function is normally disabled for safety components or activating the lock disables the safety function at the division level. The bypass inoperable status indication is continuous displayed on the LDP."

So it's clear that part of the function is for maintenance bypass and that indeed you get the indications. But the thing that down in Section 4.6 .3, this thing that says "deliberate operator actions during emergency conditions" and then later in 4.6.3, it says "to manually initiate a maintenance bypass, operating bypass lock of a component, or an RPS ESFAS reset from the operational VDU, the bypass permission from that train must be enabled. Bypass permission is part of PSMS. There's one bypass permission for each train. Administrative controls ensure that the bypass permission for only one train is enabled at any time. Therefore, an erroneous signal from an operational VDU will affect only one safety train."

This still seems to tell me that in the heat of the battle and the reason I brought this up the operator could manually, quickly intervene and shut stuff off from the operational VDU despite the fact that there might be a demand for it from the safeguards. I hear these things about the operation can do stuff during an emergency situation.

And I hear things like administrative controls. We'll make sure they only do this on a single train. And I see alarms coming up. If I decide to shut the stuff off, of course, I'll get the alarm. But maybe I shouldn't have shut it off. And that's the reason I brought it up because I don't really know what it's doing.

I understand part of it, the intent for maintenance. But the operational part of it made me pause.

` MR. SPRENGEL: Okay. It's tricky. There's a couple questions I think in there.

CHAIRMAN STETKAR: Let me see if I can get the -- It might give you a chance to think a little bit. The fundamental question is if safeguards actuates automatically can the operator from the operational VDU intervene and shut the equipment off using this lock function, whatever that thing is.

` MR. SPRENGEL: Well, they would have had to have done it before.

CHAIRMAN STETKAR: That's not the question that I asked it. You're answering perhaps -- I'm asking a yes or no question.

MR. SPRENGEL: For one train, yes. So the safety VDU provides the bypass permissive to the OVDU. And it's at a train level. So they can only provide that bypass permissive to one train. From the OVDU in terms of the lock function, you could only use that lock function on one train.

CHAIRMAN STETKAR: Let's see if I can go back. Dr. Bley may have to help me here. Scenario, I have a LOCA. Safeguards actuates. I'm an operator now and for some reason I believe it's in my best interest to shut off all injection. Has it ever happened? I think of once.

It's in my best interest to do that. Can I go to the operational VDU and somehow enable this lock function for all four of the trains individually and do that without taking much extra active actions. Do you follow me?

` MR. SPRENGEL: That's okay.

CHAIRMAN STETKAR: Can I basically override that safeguards signal from the operational VDU using this lock function?

` MR. SPRENGEL: My first concern is in this scenario you're overriding it after the signal has been sent.

CHAIRMAN STETKAR: That's exactly my concern, yes.

` MR. SPRENGEL: Okay.

CHAIRMAN STETKAR: I don't care about before the signal because you have to rely on administrative controls and alarms and so on after the signal has actuated.

` MR. SPRENGEL: You'd have to be very quick, number one.

CHAIRMAN STETKAR: No, no.

` MR. SPRENGEL: To beat the signal.

CHAIRMAN STETKAR: No, no. I'm not beating the signal.

MEMBER BLEY: The signal is there.

CHAIRMAN STETKAR: The signal is in. According to the design criteria, the signal has to lock in.

MEMBER BLEY: Now can I override it?

CHAIRMAN STETKAR: But the pumps are all running and I suddenly decide that "Oh my God." I quickly want to shut these things off and I've got this lock function over here. And boom, boom, boom, they're all shut off.

` MR. SPRENGEL: Okay. I'll follow up on that answer.

CHAIRMAN STETKAR: That's the concern.

` MR. SPRENGEL: And but tied with that, I think we need to understand how it's used though because you would not be able to do that for all four trains at once. You would have to go to the safety VDU, enable the bypass permissive for one train, stop, lock the specific pump or whatever you're wanting to take action on and then go back to the safety VDU, take that bypass permissive off, put the other bypass permission on and go back to the OVDU.

CHAIRMAN STETKAR: I think what you're saying right now is what I'm looking for.

` MR. SPRENGEL: It is a tortured path to do that with all four trains.

CHAIRMAN STETKAR: To do that, I do need to go to the safety VDU to actively enable that lock function.

` MR. SPRENGEL: For A train.

CHAIRMAN STETKAR: For A train.

` MR. SPRENGEL: Yes.

MR. WARD: This is Bill Ward. I'd like to add something to the discussion. This is actually in an RAI still injection 7 space how this lock and bypass works. So when you're getting into the actual functionality and what's designed for the functionality and what you can and can't do, that's still in a question in Chapter 7.

CHAIRMAN STETKAR: Okay.

MR. WARD: So the fact that the HSI may allow you to do something or not do something, that's part of the HSI design. But whether or not you really want to do that is still in the logic that's being discussed in Chapter 7.

CHAIRMAN STETKAR: Bill, part of the reason I ask these questions is that whether or not the human being wants to do it I want to see what types of safeguards are installed such that -- I'll use the technical term -- software going nuts can't somehow do it. But something out there in the non-safety related part of this system because of this function can't somehow shut stuff off if it decides to do it. Now I might be part of that system as an operator or the software might be part of that system. And the requirement of having an active --

MR. WARD: Bypass permissive.

CHAIRMAN STETKAR: -- function let's say over on the safety VDU before this thing can be enable on the non-safety VDU may satisfy that.

MEMBER BLEY: At least makes you stop and think again.

CHAIRMAN STETKAR: It makes the human stop and think and it leads me to believe that perhaps the software might not be able to do it by itself over there.

MEMBER BLEY: Just in the non-safety.

CHAIRMAN STETKAR: Just in the

non-safety system because of some smoke getting into the panels or something.

MR. HALL: I remind you. It's more than the human stopping and thinking. The human gets out of his seated operating position, walks to a different part, does it and then comes back.

CHAIRMAN STETKAR: I'm sorry.

MR. HALL: It's not just stop and thinking. There's a time delay in there, too.

CHAIRMAN STETKAR: Bob, when I looked at the panel layout my arms are long enough to see the safety VDUs and the operational VDUs. I don't think I have to -- You'd better not tell me if I'm a single RO that I have to get up and walk the different panels.

` MR. SPRENGEL: You do.

CHAIRMAN STETKAR: This display here as best as I can tell is equally within an arm span of the person, right?

` MR. SPRENGEL: You would have to get up and physically move. This is an alarm VDU.

CHAIRMAN STETKAR: Yes.

` MR. SPRENGEL: To move from this location to this location, you could if the chairs were on wheels or something slide.

CHAIRMAN STETKAR: Yes.

` MR. SPRENGEL: But you couldn't do one thing or one thing.

CHAIRMAN STETKAR: Yes. Getting up and walking different places.

MEMBER BLEY: It's not the corner or next door.

CHAIRMAN STETKAR: It's not over on the diverse actuation panel or it's not around the back of the boards or anything like that.

` MR. SPRENGEL: So I don't want to -- I'm not going to claim victory on this discussion.

CHAIRMAN STETKAR: Check that. I mean you understand my concern.

` MR. SPRENGEL: Yes.

CHAIRMAN STETKAR: The concern is that can I strictly enable that lock function, whatever it is, if you want to call block, inhibit block, strictly from the operational VDU without an active intervention from the safety VDU. Obviously, you have to be able to reset safeguards eventually and things like that.

` MR. SPRENGEL: Right.

CHAIRMAN STETKAR: And again I'm the devil's advocate. I'm trying to read what's there in a short text description and infer what might be there in terms of actual logic.

` MR. SPRENGEL: I can confidently state that what we've discussed you will not be able to strictly enable the lock function without this repeated intervention of the safety VDU. The portions I want to follow up on and confirm before speaking is some of the use of the deliberate actions during emergency if we can provide any -- Or are we okay on that?

CHAIRMAN STETKAR: I can give you my personal feedback, but I'm only one of five of us here, six of us.

` MR. SPRENGEL: Okay.

CHAIRMAN STETKAR: There always needs to be -- The operators always needs to be able to take control in a deliberate fashion. The operator always has to be able to whether you want to use the term reset, actively intervene. And we can't design against people who -- We can make them hesitate at best.

So having that interlock for me is okay. But I don't know whether any of the other people thought about it. I don't need any more information from what you told me. But I don't know if any of the others do.

MEMBER BLEY: And there's no question about what you've told him.

` MR. SPRENGEL: No question.

MEMBER BLEY: No question.

` MR. SPRENGEL: Right.

MEMBER BLEY: And that's for sure.

` MR. SPRENGEL: The only other area I want to follow up on which I think is good is let me get back on the lock function being put in place after the signal. I just want to follow up on that today.

CHAIRMAN STETKAR: That's the whole idea.

` MR. SPRENGEL: I don't care about the answer, but I want to confirm what I understand first and then we'll come back to that.

CHAIRMAN STETKAR: Beforehand whether or not I can manually block or disable, inhibit all four channels is I can do that in any design. That's strictly administrative controls. One could wire in things. But most I'm not worrying about beforehand. Getting into a situation where I need safeguards actuation and all four trains are inhibited, I'm worried about active intervention after the fact.

` MR. SPRENGEL: Okay. Understand. So

we'll leave that open a little bit longer today.

The last question was on slow mode and we might need some additional discussion and clarification. The short answer is that the application or the inclusion of slow mode was a result of using conventional controllers and copying the same functionality or potential functionality over. So it truly does as you said just allow a slower modulation of those I guess valves is the best example.

CHAIRMAN STETKAR: Valve is a good example or whatever.

` MR. SPRENGEL: And my understanding would be that the selection of the speed would be a result of either operation decision or procedural control. The fast is as a good example in terms of how far something is moving and that's a little clearer to understand. The slow would be based on the operating condition and what is being controlled at the time.

CHAIRMAN STETKAR: The way it's presented is and it's another one of these things where there's a one paragraph short description. It says, "The normal and fast mode increase/decrease rates are comparable to that of conventional HSI devices." So whatever. "To accommodate software operation-based fine tuning, the controller is provided with slow mode in addition to the above two modes offering one-tenth of the increase/decrease rate of normal mode. Fast and slow modes are selected by touching or clicking the fast and slow button respectively. The normal mode is selected by selecting neither of the fast mode nor the slow mode."

I don't for the life of me understand why I need slow mode. And that's basically why do I need that because if I'm not careful maybe I select it and I didn't realize I selected it. Or maybe that software selects it for me and I really want to open that valve fast and it won't let me because it knows it's got to be in slow mode.

MEMBER BLEY: I'd like to see a little more detail about how it works.

CHAIRMAN STETKAR: Yes.

MEMBER BLEY: I mean just the way it's presented in that short paragraph makes me even --

CHAIRMAN STETKAR: There's some other discussion.

MEMBER BLEY: If it's 10 times faster in normal mode than slow mode, how can slow mode be replicating what a normal controller --

CHAIRMAN STETKAR: No, no. This says that the normal mode replicates the normal controller. I'll read you the quote.

MEMBER BLEY: Yes, but I was just reading as well. And if you go to slow mode or fast mode, it increases or decreases by a factor of ten over the normal mode.

CHAIRMAN STETKAR: Yes.

MEMBER BLEY: And is that the driving of the valve or is it the processing of deciding going through multiple steps? What exactly is slow mode controlling?

` MR. SPRENGEL: It's controlling -- There's a cycle that's occurring over the time period of the valve being open in this case. So the example here --

MEMBER BLEY: And there's a fast and slow on every controller for every valve when you pop up the valve controller.

CHAIRMAN STETKAR: If it's a continuous control valve.

MEMBER BLEY: Yes.

CHAIRMAN STETKAR: That's my understanding.

` MR. SPRENGEL: And so my understanding of the process would be that the operator selects the speed at which the valve will be controlled based on preference or procedure depending on the circumstance or I guess it would be experience or procedure. And then the valve indicates using the control buttons what level that valve needs to open to.

And then again this is where the language comes into play. There's the cycle of information of controlling that valve opening and also then getting the feedback not only from the sensors on the valve but also the I&C system as well processing that information and feeding it back to the HSI.

CHAIRMAN STETKAR: Ryan, if anything in a nuclear power plant is so sensitive to the milliseconds at which that information is processed, you have a big problem. I read all of that stuff and I'm thinking signal processing time in terms of finally knowing that the valve is only 37.86235 percent opened versus about 40 percent.

MEMBER BLEY: Let me change the question a little. It could be that in operation in Japan or in testing either in Japan or in the U.S. you found some things. The operator were to control it and the normal mode he was hanging around too long to get to get to where he wanted to do. And the fast mode looked like it would be very helpful.

Or in the normal mode it was real hard to set it precisely to the setpoint you wanted. So you go to slow mode to zero in on the setting.

I have the same question you asked earlier about the software lock. You go in here. I run it in normal mode until I get close. I put it in slow mode. I put it exactly where I want it. And now I go to do something else. This resets to normal or does it stay locked into slow or fast?

MR. MASHIO: It's going to reset. And so if our -- As a -- Also this slow mode resets.

MEMBER BLEY: It resets.

MR. MACHIO: Yes.

MEMBER BLEY: I guess I can see it on a valve with a lot of turns to get it opened you might want to go to fast mode to get there. And then as you approach the normal setting, you go back.

What did operators find? Why did we end up with this and how do operators really use it? And in the testing you did for the U.S. one, did people use it? Was it something that evolved out of operations in Japan? How did we get to it and how do people use it?

MR. HALL: The fast and slow came out of the testing program.

MEMBER BLEY: Over here.

MR. HALL: Yes. The original one had normal and we found going to the fast speed that there was a long time delay of the operator pushing the button, waiting to see the thing move. So we added the fast movement because of that, because of the --

MEMBER BLEY: Because it was driving the operators kind of nuts.

MR. HALL: Exactly.

MEMBER BLEY: Sorry.

MR. HALL: So we can up with a criteria where the operator should not take more than X while concentrating on this and the fast mode came up. The slow mode was also added because of one or two scenarios. I don't remember much more than that for justifying the slow speed.

MEMBER BLEY: Was it added to just a few things or to everything?

CHAIRMAN STETKAR: It's on everything.

MR. HALL: This is basically a standard template.

MEMBER BLEY: Yes. It's for everything.

But it came up on a few. That's kind of what I guessed it would have happened. But the fast mode was really to get the guy back looking at the whole plant and not sitting there with his hand on the switch to --

MR. HALL: Remember what we wanted to do was make sure the operator doesn't dwell on nonproductive things. And we found that the normal mode time was wasted and not needed since the machine is going up to a target anyhow.

MEMBER BLEY: Now the other piece of what John asked about, this makes sense to me. As an operator, I could see that.

MR. HALL: But I can't give you more details on that.

MEMBER BLEY: Especially on some kinds of valves and the like. But you also talked about software flipping in a normal mode or fast mode or slow mode. Is that right?

CHAIRMAN STETKAR: I'm not so much concerned about fast. I'm concerned about slow.

MR. HALL: Fast can get you in trouble, too.

CHAIRMAN STETKAR: Fast can also get me in trouble. Remember this is confused control function. These are not --

MEMBER BLEY: You have to have your hand on the switch.

CHAIRMAN STETKAR: They're not bi-mobile valves.

MEMBER BLEY: Right.

CHAIRMAN STETKAR: They're continuous control valves.

MEMBER BLEY: I remember that. But I can hold it on the switch and jam it onto the seat. It's going to overshoot. Depends on how much control fanciness they put on here.

CHAIRMAN STETKAR: The whole way these things are you get speed. You get a setpoint.

` MR. SPRENGEL: There might be a misunderstanding in the use of the controller. After the activation speed is set in terms of how fast the valve is opened or closed --

MEMBER BLEY: Can I talk to you right there before you get to the after? I did that with my finger or does the software ever do that? How does it get set? Only by the operator deciding to push fast or slow?

` MR. SPRENGEL: Yes. Only the operator.

MEMBER BLEY: Somewhere I heard.

` MR. SPRENGEL: The example of taking control, changing the valve position, then closing and coming back whenever you reactivate that control or that component, it would come back in normal mode.

MEMBER BLEY: In normal mode, yes. So nothing besides me ever puts it in fast or slow. That makes me more comfortable if I'm hearing that. And then the second half you're going to tell me that you put it to a setting and then it drives itself there. And that's alright. I misspoke.

` MR. SPRENGEL: Okay.

(Laughter)

CHAIRMAN STETKAR: And the concern was that in a normal mode you could quickly put the setting in there and the operators were concerned -- let's think about the fast part -- that they were not seeing the response fast enough because they wanted to go play with something else faster.

` MR. SPRENGEL: Right.

MEMBER BLEY: Or the evaluators thought they were not focusing on the rest of the plant and just staring at this thing.

MR. HALL: I think I interpret both comments as the same that the feeling was both from the operator point of view as well as the observers that too much time was being taken on this. Given the kind of controller we wanted them to move on. So we added the fast speed.

CHAIRMAN STETKAR: But why do we have the slow speed then? I get normal and fast. I really understand that. But why do we have slow?

` (Off record comments)

` MR. SPRENGEL: We're going to provide a written response.

CHAIRMAN STETKAR: Okay.

` MR. SPRENGEL: Ultimately I understand your confusion with the words you've been provided. And we'll provide a better explanation to expand upon the need for slow speed in terms of the control aspect in the system.

CHAIRMAN STETKAR: Again from an operational -- we been talking here -- perspective, I get the notion of normal and fast. I understand why it's there. I can see benefits to me as an operator to be able to quickly set and get something going here and have confidence that indeed it's going in the direction that I wanted it to go so I can go focus on something else. So the normal and fast I get.

In particular, I'm really interested in

why you need the slow primarily because if I can do it as a human being the software can do it to me. And if I think something is operating fast and walk away from it, I might be surprised that it indeed was only going slow if it has that possibility.

` MR. SPRENGEL: So you have concerns with the potential problem with the feature existing. So you want to understand why it's even there at all.

CHAIRMAN STETKAR: Exactly. Why would -- I think I understand why the fast mode was put in there as opposed to normal, not so much the slow mode.

` MR. SPRENGEL: Okay. Got it.

We are going to go slide -- I think it's 43, the Alarm System.

MR. MASHIO: So the alarm system dedicated alarm VDU organizes and manages all alarms, presenting the alarm list by chronological order, by functional grouping and the providing alarm acknowledge and reset functions. Alarm status is also integrated in graphical P&ID contents in O-VDU screens. All alarms are indicated in either LDP dynamic display areas or grouped alarm tiles in LDP. Alarm presentation has dynamic prioritized color coordination, red, yellow, green.

The alarm screen present one development of the information and contain connectivity to the operating procedure and the operation we use. It will use functional grouping of primary system in containment, primary system outside of containment, secondary systems and electrical system. And then within each of these categories, it uses characterization sequence to display around.

Alarm groups. Alarm caution status and alarm clear are segregated on the individual pages providing simple prioritization of the information to the operator. Operator on yellow, green, white and light gray background and white background provide contrast to easily read the information.

And the prioritized alarm system is provided to avoid information overload and facilitates the plant status indicated identification. The alarm function comprise of many simultaneous alarms and displays them on the alarm videos and on the LDP with alarm coordination identifying three priority levels.

The priority of the individual alarms has changed automatically depending on the importance of additional alarms. So that when important alarms are activated the overall plant status is easily organized.

CHAIRMAN STETKAR: Can I stop you right here?

MR. MASHIO: Okay.

CHAIRMAN STETKAR: Was this alarm system as it's described functional during the operator tests?

MR. HALL: Yes.

CHAIRMAN STETKAR: It was. Okay. As I read through this -- I want to see if I understand it -- the dynamic prioritization system constantly updates the three levels of priority of the alarms depending on what's happening. For example, if I have tank level going down, if it's normal level, I have no alarm. If it gets to let's say low I have maybe a priority three alarm. If I get to low-low, I'll get a priority two alarm. If I get a low-low-low level, I'll get priority one alarm. And those things will constantly update as the level drops down.

It also says that the operators are instructed to keep the things from stopping flashing. They have to go in and acknowledge actively all priority one and priority two alarms on a page by page basis. Is that correct?

MR. MASHIO: That's correct.

CHAIRMAN STETKAR: Okay. This is supposed to reduce operator overload. Does it increase operator overload where I suddenly start to see as my level starts going down stuff starts to priority, level two things flash. Okay, I acknowledge those. I go over here and wait a minute. Priority one, it's suddenly now a priority one alarm. I have to go acknowledge that. And maybe it's on the third page that I have to get to. That's why I was asking whether it was actually there in one of these time sensitive dynamic scenarios. I'm not talking about starting up the plant, but something where things --

MR. HALL: The answer is yes. And we did not see those problems.

CHAIRMAN STETKAR: You did not see those problems.

MR. HALL: No.

CHAIRMAN STETKAR: Did they just ignore them? I mean we've burned up a turbine at Unit 2 at the Zion Nuclear Power Plant because our computer system gave us so many alarms that the operators just got used to ignoring them. Sometimes they were worthy of attention.

But you didn't see any problems with it. And you really tested it under situations where levels and stuff were changing rapidly such that the priorities were -- You know you were going from three to two to -- from zero to three to two to one.

MR. HALL: Yes.

CHAIRMAN STETKAR: Okay. I can work with it. I get it for slow transients. You know it's a really good idea to keep people focused on what's important.

MEMBER BLEY: Yes, I guess I'd have to see it, too. I was worried about that. And I'd seen other plants when they'd first gone to alarm displays like this that list them all in one place instead of up on tiles where you can do some kind of pattern recognition where people had a lot of trouble with that.

MR. HALL: But I remind you that it's simply not just the list. The list is there, but the alarms are displayed on --

MEMBER BLEY: But you've got to deal with the list. You've got to shut the darn thing off because it's drawing your attention.

MR. HALL: That's true.

MEMBER BLEY: Then it didn't cause much

trouble. That kind of surprises me. I don't know how many you get, but you could get several hundred I would think.

CHAIRMAN STETKAR: It's limited to the number that will come up on a single page.

MEMBER BLEY: Yes, but there are a lot of them on there.

CHAIRMAN STETKAR: But there are several nested pages. I mean to get everything you might have four pages of priority two alarms, right? In principle, you could.

MEMBER BLEY: Well, what kind of numbers do you see?

CHAIRMAN STETKAR: I don't know. I actually don't know.

MR. HALL: I don't have an answer to that. I don't remember.

CHAIRMAN STETKAR: As I understand it, you have to acknowledge it. You do it on a page by page basis. So if the first page is displayed, you acknowledge it. And there might be priority two alarms perhaps that are down on the second page. You pull up the second page. You have to acknowledge those.

MEMBER BLEY: Right. And I'm thinking

with four or five people in the control room somebody is doing that. And with two people in the control room this could drive me off the wall.

CHAIRMAN STETKAR: Or you just ignore it.

MEMBER BLEY: I don't know what it sounds like. Sometimes ignoring it leads to confusion, too.

CHAIRMAN STETKAR: But do you think -- This is one of these things where I know your answer is going to be yes. But it's one of those things where I would have really tried to challenge the operators to see if during a rapidly evolving scenario involving pressures, temperatures, flows, levels and things like that they indeed responded. But their attention was not diverted to simply paging through this thing and acknowledging alarms because they were constantly coming in versus paying attention to the bigger picture. Again, if I only have one person to do this, it's a problem.

MEMBER BLEY: And I was thinking of a thing like we've seen in some simulators a loss of instrument AC or something which brings in all kind of alarms, low priority and high priority. Everything comes in as soon as you re-energize it.

I'm just surprised that it's not

problematic. In your first set of tests when you did write up a pretty thorough report, was there any significant discussion of the alarm VDUs and how people dealt with them?

MR. HALL: Let me try to answer your concerns. But I'll do it quickly. So dig deep earth needed. When we were looking at the scenarios in the first series of tests there was an early version of the prioritization scheme applied to all the alarms. And there was a significant amount of alarms still coming in.

The second series of tests had a more dynamic and a more robust screening going on or filtering of the alarms or I should say prioritization of the alarms is right. And those tests were very successful.

The data we collected on it included literally time on the alarms, measured time, how much time was spent here versus elsewhere. Measured situation awareness of the operator, figuring out did he know that there was an alarm going on in here and did he recognize it.

And then took feedback in the form of structured questionnaires from the operators. And this was a set of questions about each area of the

HSI, but the alarms were one of them. And there were no significant problems that were addressed.

And you keep kind of circling around the levels of scenarios. They were very complex. Some of them very, very fast from a human point of view. Some of them very, very slow because that could be very challenging, too.

And we superimposed over the objection of a lot of the I&C engineers as I said additional failures up to in some cases three or four independent failures on top of standard types of scenarios. So these were very, very complex scenarios that we were running.

MEMBER BLEY: Thank you.

MR. MASHIO: The next slide shows how alarm indication LDP and some examples of the indication in LDP. Additionally, in the present paragraph and when the alarm is -- the parameter exceeds the setpoint, then the alarm indicator with alarm color code. This example is showed.

And the group alarm indicates on the upper side of the area. The example shows engineering feature function actuation with yellow color code. The bravo charging pump indicator with the title of bravo as well as component's presented alarm information. And the clear alarm on VCT indicates with white color code. OK monitor indicates with green color code when plant computer checks the component status as everything working correctly.

Computer also checks critical safety function and indicates alarm as normal condition on PI. That means primary system integrated, for example. And we introduced a gray-form concept feature which means all information indicates gray in normal condition and indicates outstanding color code when abnormal status is initiated.

MEMBER BLEY: I'm going to interrupt you again just because my mind is still spinning on what we talked about thinking about it. When you watch the operators use this and when they made their comments, did they really use the alarm VDU very much? Or did they more focus on these kind of displays which are more historically like they've looked at and run the plant from that and just acknowledge those darn things and get them out of the way?

MR. HALL: My conclusion would be this was the primary directing force which it's supposed to be. That's what it's there for. And the alarm

VDUs were used as a secondary source. The list in other words was used as a secondary source.

MEMBER BLEY: If I wanted to dig a little deeper, I'd go over there which makes me wonder why you might not just have a single acknowledgment for all the screens. But that's a separate thing, especially if it wasn't causing problems.

MR. MASHIO: The next slide shows an example of the parameter diagram. This is a steam generator indication with alarm low-low. And general setpoint low alarm on steam generator regulator. The low-low on the alarm display or low alarm degrees are downgraded to low alarm with green highlights when low-low level alarm initiated with highest gravity color code that is red.

CHAIRMAN STETKAR: Has this display template changed from what's documented in the Topical Report? I had a real question about this and the problem is your picture here doesn't show the question I had.

There's a figure 4.9-4 in the Topical Report itself that got me thinking about things. And this picture that we see in front of us is different from that. But the picture in 4.9-4 doesn't have the little arrows off to the side which helps me.

MEMBER BLEY: I have a question about the arrows actually.

CHAIRMAN STETKAR: Okay. But let's just in 4.9-4 -- we all don't have it in front of us here -- there's an example that shows a low level in steam generator C that comes up with a red on the C with an (L) and it shows a different deviation in steam generator B which is shown as a red with a plus sign next to it.

But the meaning of that plus sign is that there is a positive deviation low level. Every time I have looked at this thing now three times reading this report every time I look at the plus sign it tells me the level is high. That there's a level deviation high and it's the description in the text and the note on this thing that says no, it's a positive level deviation low below the setpoint which to me really can confuse me.

The arrows may help me, but in a Topical Report they don't have the arrows. If I see a plus with an arrow pointing down maybe that reminds me that the plus doesn't mean plus. It means something --

MEMBER BLEY: And you see the numbers.

CHAIRMAN STETKAR: And I see the numbers.

See without the arrow if I just see the numbers I can glance away.

MEMBER BLEY: No, I had the same reaction when I looked at it. I wondered if the U.S. operators in the tests if those plus signs bother them or if they even saw them. Did they get those displays?

MR. HALL: The early displays, the phase 1A displays, didn't have plus signs or arrows. It was just the digital displays.

CHAIRMAN STETKAR: Just the numbers.

MR. HALL: Just the numbers.

CHAIRMAN STETKAR: Okay.

MEMBER BLEY: But it lit up red if it was alarming.

MR. HALL: Yes, it had the alarm.

MEMBER BLEY: But you had to read the numbers.

CHAIRMAN STETKAR: You had to read it was 20 and 30.

MR. HALL: And if you know anything about humans and digital systems, that's a no-no. And those are the exact comments we got back from the operators was "I can't tell" especially when procedures said is it increasing or decreasing and they were looking at flutter. And the time was consumed as to what's really going on to meet that.

MEMBER BLEY: Yes.

MR. HALL: Given the kind of display the LDP is, this gray board concept, putting graphs on it and stuff like that confuses it. It just gets it away from sparse density to highly dense. And that's not what we wanted to do.

So the arrows were a way of giving those trends. You didn't have to consume a lot of time when all you wanted to know was it going up, down or was it stable. And there are normalizing algorithms behind the arrows based on the parameter it's measuring as to what is simply flutter versus a trend occurring.

MEMBER BLEY: And with the arrows, are they just straight across, angled up, angled down or do they get taller?

MR. HALL: Just three.

MEMBER BLEY: Just three positions.

MR. HALL: Up, middle down. It's not graduated. Is it increasing, decreasing or is it consistent?

MEMBER BLEY: That's good. But you see that. And are the plus signs still in there for this positive deviation thing which is beyond most operators thinking about I&C system honestly?

MR. HALL: I can't answer that question. I don't know.

MR. MASHIO: Yes, we still have a plus and minus compared with the setpoint.

MEMBER BLEY: I mean in truth to me from my past experience that might be helpful to the I&C maintenance guy. But the operators probably will have --

CHAIRMAN STETKAR: But if you look at this figure here, I mean just the figure in the report that we're reviewing, it says "Deviation (-) means level is greater than the setpoint. Deviation (+) means level is less than the setpoint."

I'm sorry. To me that is just backwards. Now the arrows -- help me out. But it tells me I'll probably ignore those +s and -s. I sure hope so. Or get really confused.

MEMBER BLEY: And that didn't cause any confusion, the + and - stuff, even after you did the -- Were the arrows there when you did the second round of testing?

MR. HALL: Yes. The pluses were not.

MEMBER BLEY: They went away.

CHAIRMAN STETKAR: Oh, wait a minute. Kenji said they're in.

MR. HALL: The second set of tests, this is what the test looked like.

MEMBER BLEY: This one, okay. What's the now? Is it both arrows and plus and minuses? Or is it just what you did in the second set of tests which I hope?

MR. HALL: I don't have an answer to that.

CHAIRMAN STETKAR: Again, this is low level. So it's not a plus or minus thing.

MR. HALL: Remember, this is -- the arrows are communicating --

(Simultaneous speaking)

MEMBER BLEY: I'm not asking about the one up here. I'm asking about the pluses and minuses and when they are appropriate.

CHAIRMAN STETKAR: We heard from Kenji that they're in there. We heard from Bob that they're not.

MEMBER BLEY: Well, that they weren't on the second round of tests is what Bob said.

CHAIRMAN STETKAR: On the other hand, the second round of tests is supposed to be getting what we're reviewing.

MEMBER BLEY: Okay. There is a discrepancy there which perhaps they'll clean up.

MR. HALL: I was talking to Kenji and the basic HSI -- please make sure I'm saying it right, Kenji, includes the arrows as you see on the screen plus or minus as it describes in the document, correct?

MR. MASHIO: So again the basic design features are HSI. But the actual I&C setpoint of the division alarm before the low-low alarm initiate. So you have a divisional alarm, plus or minus alarm. Then we have a low alarm setpoint. And we have a low alarm. So we have three setpoints in this simulation.

But in the final phase one test, we need this point arrow helps to explain this parameter trend. So operator recognizes this alarm going down or increased.

MEMBER BLEY: If I kind of get it, if it's low, it will have a single valve and if it's low-low it will have a double valve. I'm guessing.

MR. MASHIO: Yes, that's correct.

MEMBER BLEY: That is correct.

MR. MASHIO: It means a low-low.

MEMBER BLEY: And if it's just beginning to deviate you'll get the thing in parenthesis that will either be a plus or a minus.

MR. MASHIO: That's correct.

MEMBER BLEY: And, boy, I would run that by your operators again because I agree with John. I think it's just backwards to what they think it meant.

CHAIRMAN STETKAR: I understand the need for an operator to get an early indication that level is starting to deviate. In general, most people think that plus means it's going up and minus means it's going down whether that's pressure or temperature or flow or level or whatever. And at least what I can read in front of me here is just contrary to the way normal people think.

And that's just basic human factors engineering. I mean if you read stuff that you ought not to have level decreasing in an upwards fashion on a gauge, ought not to have things getting faster by going leftwards. I mean that's paint, label and tape, but human factors engineering.

And what's in the report doesn't talk about the arrows. The arrows at least help me personally a little bit.

` MR. SPRENGEL: Let's take a little time and maybe revisit it. But for now we'll go ahead and continue on.

CHAIRMAN STETKAR: Okay.

MR. MASHIO: These couple explain safety VDU feature. The safety VDU must only be used when OVDU fails. The safety VDUs provide monitoring and component level controls for safety functions. And the safety VDUs are designed to satisfy class 1E requirements.

They are divided into two groups. First is the two multi-divisional safety VDUs and the four selectable train-based safety VDUs. The orientation and retrieval features of the safety VDU network are similar to the OVDU network, but there is significantly less information being managed. That is used with paper procedures only.

The next slide shows selectable train-based screen that third level of the information menu. And this screen contains the three level information hierarchy. The top level display is the organized system and the components present in the hierarchy order.

The second level, the next slide, the display are components associated with systems selected on the top level display, one page down display, 20 components in our order. The screen shows the example that operators select A-charge pump. Self-control alpha-charging pump will show up on the side of whatever display. The next slide.

The third level of the information hierarchy contains components of controls. These are grouped by system work by tasks. It is structured the same as the operation based level, but only contains safety related controls. Similar to the operation we use, we use contrast between light and dark color to maximize visibility of displayed group at both the first and second information levels.

The third level of safety controls uses black background with light color for controls associated with the information. The function is what's in the right-hand navigation toolbar. The information is operation of VDU output and the component control from a safety VDU toolbar.

CHAIRMAN STETKAR: Two questions. Why don't the safety VDUs or that part of the console contain flow mimics which the operators are used to using 99 plus several nines after that percent of the time?

MR. MASHIO: That is because as the safety software application requirement. This software application for safety should be simplified. So that's why we limited this graphics not using the graphics P&ID that we have used

CHAIRMAN STETKAR: All right. I'll have to think about that. Something I did think about. The scenarios that you ran, were they run for a two-train plant or a four-train plant?

MR. MASHIO: Actually, the testing is conducted for a current plant. So we have a whole VDU for a safety VDU.

CHAIRMAN STETKAR: Did the simulator have two trains or four trains?

MR. MASHIO: This simulation is from Japanese PWR. They have four loops.

CHAIRMAN STETKAR: Four loops?

MR. MASHIO: Four loops.

CHAIRMAN STETKAR: The number of safety trains, two or four?

MR. MASHIO: I'm sorry. I don't know anything about that trains.

CHAIRMAN STETKAR: I'll tell you why I'm asking. US-APWR has four safety trains. I got it. I understand that. Charging pump A is off train A.

Charging pump B (boy) is off Train D (dog). And there are other anomalies, but that's a good one.

If I have a flow mimic in front of me and I want to get this pump running, I go push that pump. I don't care what freakin' train it's off. If I have to now go and remember that I want to get B running so I have to go to safety VDU D (dog) and pull up three screens and finally get to this thing and get it running, that to me is really confusing. It's confusing to me.

If you ran your validation on a two-train plant and had something jimmied up with four trains of safety divisions because you can get signals out there to do things automatically, that doesn't test my ability to use the safety VDUs in a real four-train plant design that may have a symmetries or things like this B is off D. It has cross connect systems where I have like component cooling there's a whole bunch of A valves that are off different divisions forcing me to remember which the heck of these things I need to go to to then go down three levels and select the right valve.

MEMBER BLEY: Which seems to defeat the valve of an electronic system.

CHAIRMAN STETKAR: Yes. So have we now

invoked the need for simplicity to the extent that we've made it so simple that people are going to get in trouble with it because they're not really used to doing this and they're forced to remember some things that are not necessarily intuitive in the heat of battle?

MEMBER BLEY: I was going to ask something, but I guess there's no way to do it. If you could see a schematic of the whole system and say, "I want that one" and it told you which place to go, that would help. But you've got to go there to find it which makes it hard. And if that didn't make sense, forget it.

CHAIRMAN STETKAR: No, I understand what you said. I understand what you're saying that if you had a schematic in front of you that said I want to start that pump and it reminds you, although it's given a pump name A, all of this stuff is just off of text names of things.

MEMBER BLEY: Right.

CHAIRMAN STETKAR: And you have to remember the pump. You need to go to the CVDU to start pump A, yeah, that might help.

MEMBER BLEY: But most of them I've seen you point to the schematic and you could start the pump right there.

CHAIRMAN STETKAR: But that's what the operators are used to doing.

MEMBER BLEY: Yes.

CHAIRMAN STETKAR: And in some sense I suspect when you're on the schematic you don't care particularly that that pump on the bottom of the screen happens to be powered from bus C or something like that.

MEMBER BLEY: No, that's what you said earlier.

CHAIRMAN STETKAR: It's just you want to get that running because the one on the top of the screen is out of service or whatever.

MEMBER BLEY: Yes.

CHAIRMAN STETKAR: And you don't run into those problems on a two and only two-train plant because I've never seen a two-train plant that labeled the B train E or F or A. And that's why I was curious when you ran your tests. If it was run only on a two-train plant you don't run into this problem.

MR. SPRENGEL: In a moment we plan to present the other orientation or use of the SVDU. On the right side of the screen, there are different ways to ask it. One of the ways is a task control menu. And with that, the intent would be to have that task control menu on all four trains and to follow the steps so that you have access to the controls on those different trains with the process going on.

CHAIRMAN STETKAR: But let's get through that because for the life of me I couldn't understand what the task control menu was doing. So that may help.

` MR. SPRENGEL: Right. This section will be related to the question that was asked. We'll get to that portion and revisit the question.

MR. MASHIO: Let's continue. This displays monitoring site. And this display is an example of the safety monitoring navigation screen. The system category and request scheme of safety parameters are the same way as component control navigation screen. The top are safety monitoring and control navigation menu. It can be switched by touching the function menu on the right side.

And the next slide shows an example of the safety monitoring indication screen on the containment system. The green color code is used for fixed characters such as indication name and type number. The variable characters are indicated as a white color code with that indication as actual display. When parameter exceeds the setpoint, the parameter barrier time around indications with intuitive square character box appears.

There are two modes of operation, train-based mode and task-based mode. In train-based mode, safety function control and monitoring are arranged by system and provide separator for each train.

In the task-based mode, monitoring and controls are still provided with a separator for each train. However, monitoring and control functions are grouped so that a single screen supports pre-defined set tasks needed to execute emergency operating procedures.

This mode reduces the navigation task burden as well as we reach our A switches are located for train. This mode reduced. So this display is an example of the task-based mode. This is when the operator touches E-0, then as I said, then as a safety control and the parameters are aligned along with operating procedure steps.

The slide shows an example of E-0 step 28. In the step 28 the E-0 operator is required to control emergency feedwater flow using the EFW control panel. So the Alpha EFW flow control alarms and associated parameter. In this case, EFW and ECG level are located in the step 28 row. The operator selects the bar and monitors the parameter in accordance with the procedure steps.

CHAIRMAN STETKAR: Kenji, if I can make sure I understand so far what has gone into this. The task-based control menu if you go back to your previous slide 34, 54, whatever number it is, that one, it seems to me the same as I was understanding the computer-based procedure menu. If I popped up E-0, it would then give me the steps. I could go over and do it. Is this essentially a surrogate for that? I mean this doesn't do anything automatically, right. It just knows that in what you're telling me here is that it knows that, an E-0 part of that, I have to make sure that I have auxiliary feedwater control. It's not actually -- I still have to go next it manually down three levels to get to that valve, right?

` MR. SPRENGEL: Okay. First, a reminder, using the safety VDU you're using paper-based procedures. Just a reminder.

CHAIRMAN STETKAR: Yes, you're right.

Okay. Never mind.

` MR. SPRENGEL: So we're done.

CHAIRMAN STETKAR: Never mind. I'm sorry.

` MR. SPRENGEL: Now the other thing I do want to address, drilling down through the task-control menu, this next menu, selecting in this case A-EFW control valve would then pull up the controller for that valve.

CHAIRMAN STETKAR: Yes, I mean that's what he's showing.

` MR. SPRENGEL: So there is no further navigation.

CHAIRMAN STETKAR: There isn't when you say pass control. It's a selected set of tasks to achieve the functions in that base procedure.

` MR. SPRENGEL: Tied to the procedure, yes.

CHAIRMAN STETKAR: Tied to the procedure. Okay, got it. And this is train by train.

` MR. SPRENGEL: Train by train.

CHAIRMAN STETKAR: Okay. Got it. Now I understand. Wait. Back up. I understand now the intent of the task. Honestly, it didn't come across to me reading it. But I understand what that's doing.

How does this solve my problem of making sure that I remember charging pump boy is powered from division D (dog) so that if I now only have my safety VDUs available and I want to start charging flow I can remember that because you said this was going to help me understand that.

MR. MASHIO: I understand your question. Operator selects the same step on each train. So we have a Whole VDU safety train. In this case, operator selects this task-based screen of 28 steps on in each train. Operator knows which switches are located on each pitch arm review. Whole VDU shows all of controls inventory required in the 28 steps.

The EOP steps are required to identify which train switches are operated. So based on the E-0 step, operator selects which group for switches can control.

CHAIRMAN STETKAR: Let me ask you. Are the task control menus strictly limited to the emergency operating procedures? I mean I see buttons on this picture here that are related to the emergency operating procedures. Is it only the emergency operating procedures?

MR. MASHIO: Yes, that's correct.

CHAIRMAN STETKAR: Only the emergency operating procedures.

MEMBER BLEY: A function restoration guide on here. I don't know if there is one.

CHAIRMAN STETKAR: I don't know.

MR. MASHIO: EOP and also SAMG are in the accident management operating.

CHAIRMAN STETKAR: I'd really like to figure out how the heck this thing works because if I'm responding to a tube rupture it kind of makes a difference what's going on, which loop it's in. And I see a concept that boom I hit row seven, column six on all four of my safety VDUs. And four screens pop up and I see wait a minute. Over here on screen three I need to work this valve and on screen number one I need to work this other valve.

` MR. SPRENGEL: In all this discussion, the missing part though is the EOP guiding the actions. So the SVDU is providing information, not the farthest right, but the right column of information as well as providing control access. When you have all four trains up aligned in terms of the step that you're on, you're really following the EOP procedure.

And the procedure is telling you what to do. The VDU is just providing you ready access to that. So the EOP is actually telling you where to go to take action. The SVDU is just pulling those potential areas into the particular row for that step.

MEMBER BLEY: On the one you took us to, if you went down a step on these and you get down to auxiliary feedwater control valve. But by following the procedure you'd go to all the trains of aux feedwater one at a time and make sure they're all aligned properly. Is that it?

MR. SPRENGEL: Based on procedure, yes. Right.

MEMBER REMPE: Earlier today, didn't one of you mention that the difference between the Japanese response and the U.S. response and the fact that the procedure isn't always just followed immediately in Japan. Is this something you added for the American version or was this already there? I heard from you saying that you just did this.

MR. HALL: No, this was one of the additions after the first series of tests.

MEMBER REMPE: Okay. Thanks.

MR. HALL: For that reason.

` MR. SPRENGEL: Right. And what was brought up before, multiple jumping and back and forth in detail and then, right, this proves the access to those components and the control of them as part of your steps instead of having to navigate through the three levels. But having to continually navigate to those, it provides the information as well as the control readily available to the operator.

CHAIRMAN STETKAR: I'll come back to when you actually ran people through the simulator did they use this? I'm assuming in the second because you said this came out of the first.

MR. HALL: 1a didn't have it.

CHAIRMAN STETKAR: They didn't?

MR. HALL: 1a.

CHAIRMAN STETKAR: Yes, 1a. That's right.

MR. HALL: 1a didn't have it.

CHAIRMAN STETKAR: So 1b had it.

MR. HALL: 1b had it and performance was substantially enhanced because these follow the EOPs.

CHAIRMAN STETKAR: But did they only need to do this on two of two trains because that's all they needed to deal with? Did they need to deal with four trains of equipment?

MR. HALL: We had it set up so that it looked like four trains, but it was being driven by -- It was limited because it was driven by a two-train model. So the answer is they had to take action on the four screens, not two screens.

CHAIRMAN STETKAR: They had to take action on the four screens. Okay.

MEMBER BLEY: But two of them were for just observing them and two of them were driving the show, driving the simulator. It's hard looking at pages in the report or sheets of emails and trying to imagine how people are doing that. Wish you had a movie.

MR. HALL: We actually do.

MEMBER BLEY: With you?

(Laughter)

` MR. SPRENGEL: We'll get back to you on that.

CHAIRMAN STETKAR: Thanks.

MR. MASHIO: Next slide, the multi-divisional safety VDU screen. These screens are dedicated for monitoring of post-accident monitoring variables and the parameter supporting credit manual operator actions. All parameters are displayed as spatially dedicated and continuously visible as the SDCV and include alarm color coding. These we use and their design features minimize any navigation needs to monitor safety parameter and improve station awareness of total plant status particularly during loss of safety-related.

The next display gives an example of the multi-divisional safety VDU screen. The upper side alarm features the present color-coded safety parameters displayed with red color code. Also specific parameter features alarm setpoint are also indicated as red color code. That's all for safety VDU.

And the next couple of slides explains computer-based procedure system. The operating procedure VDU displays procedures that are structured in accordance and compliant with the textual images from the hard copy procedure. This provides a task sequence of which operator is review. It also retains the latest guide-formatting design to enhance the usability of procedure.

The procedures are presented in a standardized format with the title and a specific procedure index in the left column display, allowing the operator to move to the desired section of the procedure.

The function bar is available at the bottom of the page to allow interface with O-VDU where the control functions are initiated. As an alternative, by selecting hyper-link on the operating procedures, VDU, the related O-VDU display are automatically displayed.

The related switches or controller is not requested directly on the operating procedure VDU to avoid the operator's omission of the relevant information confirmation.

The procedure menu and the bookmarking controls are also provided. Arrows are simple that there is movement into the controls and/or the information needed to implement the procedures. A back-up of CBP system is the paper-based procedure.

The next slide shows an example of the -- I'm sorry. Continues the explanation of the CBP features. The alarm VDU supports similar lateral movement by using a function key to bring up alarm response procedures on the operating procedure VDU. In case of emergency such as a plant trip, the operators can request the emergency procedure for a reactor trip or ECCS operation by touching the first-out alarm on the alarm VDU.

Distinctive accident procedures such as LOCA, steam generator are requested from CBP menu screen after the operators identifies the accident condition.

CHAIRMAN STETKAR: Kenji, if I need to be in two or three procedures simultaneously, how do I do that with this display? Do I have to toggle back and forth between multiple windows?

MR. MASHIO: Yes. On this kind, we have bookmarking function. So we track the previous procedures which is different at different procedures. So we can back up by using the scroll function. Bookmarking scroll function, it locates at this screen.

` MR. SPRENGEL: As well as the bookmark tab. But to directly answer your question, yes. You would have to -- Multiple procedures would not be displayed simultaneously.

CHAIRMAN STETKAR: Okay. I asked about that because people have gotten into trouble needing to go back and forth among more than one procedure. And in the Topical Report, it says the CBP system allows the operator to easily move from one procedure to another at any time through the use of multiple operating procedure VDUs and multiple procedure windows within each VDU. As I understand it, it's multiple procedure windows within the VDU.

` MR. SPRENGEL: Yes, except for the ability to utilize the linking function out of the procedure which we haven't touched on.

CHAIRMAN STETKAR: The linking function out of the procedure.

MEMBER BLEY: You mean a branch point in the procedure where it branches to the next procedure in line.

` MR. SPRENGEL: Right. So in a way you are utilizing the multiple VDUs. But the operating VDUs, those are still maintaining their original function. But you're able to connect to specific systems from the operating procedure VDU.

CHAIRMAN STETKAR: That I understand. But what I'm talking about is I have a fire going on and I've lost offsite power and I have a leak out of the system. So it's not a good day in the electric factory, but I have procedures for all of those things. And I need to figure out how to coordinate my way through all of those procedures at the same time. That's not part of this linking function you're talking about because they're not, at the point I've gotten you into, linked to one another.

MEMBER BLEY: And they're progressing simultaneously.

CHAIRMAN STETKAR: Yeah. The plant is doing what it's doing.

MEMBER BLEY: And the fire.

CHAIRMAN STETKAR: And the fire, yeah, as part of the plant.

` MR. SPRENGEL: Which section were you reading from?

CHAIRMAN STETKAR: That quote is 4.8, General Review Criteria. But it's -- I don't want to dwell on that particular sentence although I quoted it. It does mention multiple operating procedure VDUs and I know that a single operator doesn't have that. The bigger concern is if the operators do get into a situation where they need to be in two or more procedures in parallel to cope with what's going on in the plant. It's my understanding that they need to basically toggle back and forth between those procedures on this display.

` MR. SPRENGEL: To try not and confuse matters, US-APWR application has some improvements in those specific areas for the US-APWR application.

CHAIRMAN STETKAR: Thanks. That will help later.

` MR. SPRENGEL: Right.

CHAIRMAN STETKAR: But right now.

` MR. SPRENGEL: For now the functionality to address your concern is the bookmarking feature.

CHAIRMAN STETKAR: Okay.

` MR. SPRENGEL: And the allowance -- the arrow control being controlled within -- It's like a back.

CHAIRMAN STETKAR: Yes.

` MR. SPRENGEL: As well as the upper level arrows are within that PDF document kind of idea. So that's the feature to address what you've identified.

MEMBER BLEY: In the current plant, we can put the primary system guide following the EOP, E-0, whatever. And if we've got a fire going on, take the plant guy, hand him the fire procedure and he gets on the phone with the fire team. And he's walking through the fire procedure. Can our second board operator, if you have one, pull up the fire procedure and walk through that with somebody while the other guy is in the EOP?

CHAIRMAN STETKAR: You've established -- let me make sure before you answer that -- the fact that there are two people who have reactor operator qualifications somewhere in the building.

MEMBER BLEY: The vicinity, yeah.

CHAIRMAN STETKAR: Will people buy -- Can people buy one of these things that has one and only one reactor operator console complement of displays? In other words, only one reactor operator procedure?

` MR. SPRENGEL: No.

CHAIRMAN STETKAR: It's always going to have two.

` MR. SPRENGEL: There will always be the two RO stations.

CHAIRMAN STETKAR: That is really important.

MEMBER BLEY: It gets you through part of the thing.

CHAIRMAN STETKAR: Thank you. The problem is if I read this it says it can configured for the maximum number of people. But nowhere does it say will always have that full complement of stuff. Honestly, for the purpose of the Topical Report, one of my big concerns is how many screens.

Even if it's only one reactor operator, does that person have available for them to pull up stuff like trend information, inactions along single procedures and systems and interactions among multiple procedures that I might be dealing with parallel? That's difficult for me to as a single person doing all of that stuff. But you have the other bodies someplace out there.

But the US basic -- I want to get this on the record -- HSI design will always come with the hardware that's available for both reactor operators. Is that true?

MR. SPRENGEL: Yes.

CHAIRMAN STETKAR: Thank you. It wasn't clear to me. I was assuming that you could buy one of these things with simply on this picture the safety VDUs, the hardwired stuff and the single set of VDUs for one RO.

MEMBER BLEY: While we're on -- Go ahead.

CHAIRMAN STETKAR: No.

MEMBER BLEY: While we're on this kind of specific thing, when we were up at the site many years ago and as you guys were talking today, everything is touch screen. Yet in the Topical Report it says touch screen or mouse click. Do you offer either one or have you decided it's got to be touch screen?

MR. MASHIO: Basically decided either technology are available.

MEMBER BLEY: Okay. So if I buy one, I can put either thing on it or either thing on each station if I want to.

` MR. SPRENGEL: Depending on the application of the rest of the HFE program.

MEMBER BLEY: Okay.

` MR. SPRENGEL: There was a buried question in there and I think the basic question was could there be different procedures on different operating procedure VDUs and the answer is yes.

MEMBER BLEY: That's where we started.

CHAIRMAN STETKAR: No and that's good.

` MR. SPRENGEL: I wanted to make sure we got an answer.

CHAIRMAN STETKAR: I've been operating under the notion misguided admittedly that indeed what we're being asked to review could in fact be purchased by a customer in a configuration that had only one RO set of screens. And that the other guy is available to kind of help out. But they both then would be dealing with a complement of the thing on this that says a set of VDUs for RO-1.

` MR. SPRENGEL: That understanding is incorrect.

CHAIRMAN STETKAR: And that helps me a

heck of a lot with a lot of things, the procedures being only one of them. Thank you. That's good. And I'm glad we have that on the record.

` MR. SPRENGEL: Okay. I think we've kind of already addressed the CPV screen, operating procedure VDU and some of the uses of it.

MEMBER BLEY: I had a question because I'm mixing up things I've seen in different places with different people and I don't see anything in the written document here. But on your procedure screens, are there any operator aids built into it such as something that tracks the two, made two of the three conditions and you got one more condition to do before you take the next step? Is there anything like that? Or is it just like the paper procedure like it looks like on this screen?

` MR. SPRENGEL: Well, I think the answer from the Topical Report perspective is different than US-APWR.

MEMBER BLEY: Okay.

` MR. SPRENGEL: So I think there has been some additional improvements in terms of the US-APWR application of this HSI where there would be those additional tools to help log or track. I don't know how best to phrase it. But, yes, there would be.

MEMBER BLEY: Not in basic, but maybe in the plant.

` MR. SPRENGEL: Correct.

MEMBER BLEY: Thank you.

` MR. SPRENGEL: Now we transition with the possible --

CHAIRMAN STETKAR: Before we take a break which we all need, let me do some difficult things because I need feedback from folks. My sense is that we're not going to have enough time today to get through both the Topical Report and Chapter 18 of the DCD. That's only my sense.

We also have the staff that needs to come. And I don't know how much discussion we're going to have with them.

If that's the case, I certainly want us to get through the Topical Report because that's the key element of everything here. If we're all convinced that we can get through both the Topical Report and the DCD by a reasonable time being no later than -- Let me ask our reporter. Do you have any time constraints?

(Off record comment)

Okay. I actually am a human being.

MEMBER BLEY: Tell me one element.

(Laughter)

CHAIRMAN STETKAR: If we can get through it by about 6:30 p.m. or so, I'm willing to try to tackle that. But I don't want us to get rushed at the 11th hour. So before we take a break -- and it's a good time to take a break -- I'd like the staff and MHI to sort of concur, discuss and see whether we can get through everything.

If we can get through everything, then it's probably okay for you to continue where you are. If we can't, I'm going to have the staff come up and talk about their review of the Topical Report.

` MR. SPRENGEL: Okay.

CHAIRMAN STETKAR: Okay.

` MR. SPRENGEL: We have already covered a significant amount of the Chapter 18 portion because we of course applied the US-Basic HSIS.

CHAIRMAN STETKAR: Yes, you have.

` MR. SPRENGEL: There is a small number of slides left which again a portion of those we have not only covered in general but specifically covered. And my understanding of the staff's presentation is finding no issues with our design as part of their review. I don't specific the presentation portion would be lengthy, but I'll let Paul address it maybe.

I don't think we have much time and we can definitely condense it, too, outside questions, yes.

CHAIRMAN STETKAR: Let's just leave it there. But again you thought you were going to be done with this by noontime, you know, the stuff that we've gotten to right now.

MEMBER BLEY: Would it make sense to go ahead and have the staff come up and do the Topical and see where we are.

MR. MASHIO: They have only eight slides.

MEMBER BLEY: Slides don't make the difference.

CHAIRMAN STETKAR: Slides don't make the difference. Rather than doing this on the record in real time, let's take a break and let people discuss offline what the path forward is. I just want to make sure that we don't get to the end of the day where we're shortchanging something because we're being too rushed. That's all.

So let's take a break until 3:10 p.m. please. We're recessed until then.

(Whereupon, the above-entitled matter went off the record at 2:56 p.m. and resumed at 3:13 p.m.)

CHAIRMAN STETKAR: We are back in session and to index people, we're going to hear from the staff on their review of the Topical Report, I hope.

Bill, Paul, I don't know who's going to kick it off.

MR. PIERINGER: This is Paul Pieringer, I'm the Technical Reviewer for Human Factors and I'll be presenting the review of the Topical Report.

The first slide tells you the main contributors.

Next slide?

And the next slide -- Just by way of overview, I'll focus on the Topical Report here, the first bullet.

The primary regulatory guidance we exercised was NUREG-0700.

And, the next slide talks about the Topical Report specifically.

It's the most detailed design that we've received. Because, as you know, most of the submittals have been deferred designs using the DAC concept. So, it took us some amount of time to figure out how to review actual design and what to review it against.

0700 was what we came up with as relevant and I divided into two parts. First, was the design process and when I looked at the design process, if you'll remember from the SER, it talks about the operating experience review, the testing program and the Japanese design precursor development.

My take on the Japanese precursor was that it used a NUREG-type strategy in developing the Japanese design and we asked for documentation of the process that was used. That documentation hadn't been translated and basically ended up not being available to us.

So, I used what you saw in the Appendices from 09019 as my background.

But, did give credit for the fact that operators and simulators were used to exercise the design.

I then looked at the testing program and was -- in particular attention to the -- just the use of the simulator and my take on that was that the two simulator sessions that have been describe, Phase 1A and Phase 1B were thorough. They didn't have the documentation that we would expect for an ISV, but I wasn't expecting that and I'll tell you that in a minute.

Now, I have seen the results of the Phase

1-Bravo testing.

CHAIRMAN STETKAR: You have?

MR. PIERINGER: I have.

CHAIRMAN STETKAR: Was that submitted or you have just seen it?

MR. PIERINGER: Well, the best I can reconstruct without going back through the documentation that was submitted under what we called MUAP-08014 which was the document that was withdrawn.

And, the pertinent information that was in there was supposed to have been moved to 09019, Attachment Charlie.

Now, I was -- I checked that and I thought that everything that was needed was there. I did not identify that the descriptions of the second test was missing.

But, and so, it -- I'm not absolutely sure that I saw that testing description in that document or whether through the various other discussions and demonstrations of the simulator and RAIs, I perhaps collected it a different way.

CHAIRMAN STETKAR: 09019 Rev 5 which is the most recent Rev which is --

MR. PIERINGER: I'd have to look.

CHAIRMAN STETKAR: And that's just

the -- but that's now called the Human Factors Engineering Program Management Plan which is simply the Plan. It's a 2014 document.

MR. PIERINGER: Well, it's the program.

CHAIRMAN STETKAR: I didn't look at the previous -- I have it here -- in the previous Rev. And I bet it might be in 09019 Rev 2, but you don't refer to that in the SER. You refer to the later 2014 version.

And, I didn't look here for it because I ignored this Rev because it wasn't referred to by anything.

MR. PIERINGER: Right. So, we've got to find out where that information -- where it was submitted and provide some better documentation. Because it was part of the essential argument that I was trying to put forward on the relevancy of the Japanese design as a starting point.

And then, this was the testing that translated that to the US-Basic design.

And then, the third leg on the stool, if you will, was the use of operating experience to update that Japanese design for current operating practice. Well, for operating experience up to the US-Basic design and then when you get into the ECD, there's another operating experience implementation plan that updated it to the USA PWR.

CHAIRMAN STETKAR: That's in there. That's where it is.

MR. PIERINGER: So, I use those three elements, the operating experience review, the simulator exercise with scenarios in an ISV-type setting and then the initial Jap development of the Japanese design via their program as the fundamental bases for this.

I then -- so that established my starting position.

The next point was that I wanted to make sure that the HFE design met the criteria in 0700.

Now, I had seen their style guide which they use generically for their designs and I knew that their style guide is consistent with 0700, but I was particularly concerned about whether the actual design as you view it on the simulator and in these slides actually implemented 0700, and by consequence, their style guide.

So, I chose not to do a restrictive sampling. I had to do some sampling, but the technique was to take all the major 0700 sections basically I read through every acceptance criteria in those sections and came to an understanding of both the detail and the larger concept within that section. And then, I went back into the design, the Topical Report specifically, and I evaluated it and reached the conclusion as to whether it met these criteria or didn't meet these criteria.

And, my general conclusion was that it did meet the 0700 criteria.

Now, there are a couple of specific points I want to address.

The description of the design in 07007 is just a description of the design. It's the control room layout and it's the physical characteristics of the HSIs.

The inventory, no matter how thoroughly it's described in 07007 I snot credited in that safety evaluation report.

In fact, there as a lot of RAIs back and forth asking for an explanation of whether these were real indication to be provided or not and the response, to my memory was, no, these are example. And, what we're telling is these are the functions that are displayed.

So, for example, you have safety functions across the top of screen 3 or 2 -- 2 or

3 -- well, we're not at the stage of the US-Basic HSI design, I'm not concerned with what specific safety functions are being used. That's something that's done in the COL review or in the operating plant review, depending on how this platform is used.

The same with the inventory. Reg Guide 1.97 parameters Type A and B are a function that has to be provided because they require specially dedicated continuously visible indication. BISI has to be up there because it's a function that was described in this.

And so, the concept was that these are the functions that the large display panel is going to contain. The inventory will be developed in the subsequent licensing submittals. And, to ensure that happens, we added an action item that you'll see on page 35 of the SER that says the Applicant that uses this platform must provide a statement of how the inventory is going to be developed.

And, the inventory is defined specifically as the controls, displays and alarms that are going to be wedded with this platform.

So, I wanted to make sure that there's no misunderstanding here. If we wrote it wrong, we need to fix it. But, the inventory is not -- that's described is only by example and is not credited in the SER.

Now, having heard the discussion, there's a problem with the SER, I think. And, I missed one action item and that action item is any time you change your inventory, you need to do, in my opinion, an integrated system validation test to demonstrate that the inventory is satisfactory.

And, not only that, but positions on that large display screen can change. We are not looking at the positions as described in these -- in the displays that you've seen as being the licensed positions.

And so, those positions, depending on what inventory is identified, may need to change.

And so, that's one element of why you need an ISV.

The second element is that those -- the ISV-type testing that they did was not controlled. It didn't have the test plan that an ISV, an Integrated System Validation, as described by NUREG-0711 contains.

And so, it's my fundamental belief that the most important thing you and do to certify an HFE design is to demonstrate that it's effective in an

Integrated System Validation setting. And, I would never write an SER that didn't require that as a final step in validating that the design works. And, unfortunately, I wrote an SER that did that and so, that needs to -- I need to go back and fix that.

CHAIRMAN STETKAR: For the Topical Report?

MR. PIERINGER: For the Topical Report.

CHAIRMAN STETKAR: Okay.

MR. PIERINGER: And, that's part of why I got confused is when I was working on Topical, I was thinking that, you know, the DCD followed naturally from that and I knew the DCD had an ISV.

CHAIRMAN STETKAR: And, honestly, Paul, that's why I've been militantly today trying to draw that line between the two because it's too easy to muddle the two.

MR. PIERINGER: Right. And, no matter how much Integrated System Validation type testing or a similar testing you did during the design phase, you can never do enough and I don't think you could ever control it enough to take total credit for that to basically certify the performance of your HFE design because HFE designs are too subjective for that.

They don't conform to a code like a mechanical system would. So, you can't predict performance that accurately. So, instead, you run the Integrated System Validation and you had a large number of tough scenarios with a variety of manning levels and all the rest that you read about in NUREG-0700 and you try and demonstrate it.

Now, I will tell you, I think we need some more work on what constitutes a good Integrated System Validation because I think, now that we've seen one, we realize there's some challenges to an Integrated System Validation that we didn't appreciate before.

MEMBER BLEY: Let me ask you a question, though. I agree with what you've said. On the other hand, what's your opinion of what you saw that they had done as a development tool for this moving the design from a Japanese design to a U.S. design?

MR. PIERINGER: Well, my take on their process, once I understood it, because I had the same problem you were with the Phase 1A, B and the multiple testing points.

But, once I got into those details, I thought it was the best program I've seen. And, actually, I think it's the model for a Phased

Integrated System Validation program. And, that's what I mean when I say we have work to do on the ISV is the type testing they did to get from Japanese to 1-Bravo needs to be part of the regulatory -- well, I don't know if it needs to be regulated, but definitely it needs to be part of the -- an industry standard that says this is how you develop an HFE design.

Because when you get to that final ISV, there's too many variables to control if you haven't done some ISV type testing previously.

And, with the unnamed predecessor who has done an ISV, that's what we're finding, they just had too many variables, too many problems they didn't know about and now it's placed a situation where you really have to ask the question, do we need another ISV?

Whereas, the MHI strategy gives me a high degree of confidence when they get to that final ISV, they will actually be testing a finalized design.

Now, in terms of specific controls and displays, I found them conforming to 0700. And, you've asked questions that have identified potential human factors issues that I didn't identify. 0700 didn't bring them to my attention nor did my experience.

And so, I didn't find --

MEMBER BLEY: When you asked about the slow-fast switch that says yes, that's a question that doesn't come up from the NUREG-0700 criteria, at least as best I could go through them and apply it.

But my position on that is that with an HFE design, I think there is the more you evaluate and the more you test it, the more you can find. I thought that this met some -- the minimum regulatory requirement for being applied as a basis for either a control room update in an operating plant or a new application in a COL type application, with the knowledge that, one, they're going to provide a description of how inventory is going to be developed and they're going to -- which means you have to do a task analysis. And they're going to do an Integrated System Validation.

So, those two contingencies are tightly woven into the logic for saying that this is an acceptable platform.

I think I just covered the next -- the Full Scope Simulator was used effectively in the design process. That's what I just spoke to.

If we put guidance into place that talked about a phased ISV, we'd probably ask for more documentation of like scenario types.

But, from an -- just in the industry meetings we have, there's -- an ISV is very expensive to do it right. And so, if we over regulate all these interim ISV type testing, then you get into this balance of what do you do because it's the right thing to do and how do you make it cost effective?

And so, we're, at least in my opinion, we don't want to over-specify what needs to take place in these interim tests. But, we do need to makes sure that everyone is focused on doing a final test that meets the testing criteria from the 0711.

CHAIRMAN STETKAR: And, Paul, you know, again, it's a subcommittee meeting, so I only speak as an individual.

I fully agree with that. I think that what MHI has done, I perhaps would have been a bit more aggressive, for example, at trying to test elements of the system that could challenge the operators to have a little bit better confidence.

But, in terms of a regulatory perspective, trying to codify what should be done in a stage process, I think that -- and I honestly think that would be very counterproductive.

I agree with you fully, at the end, you have to have some type of formal documented, well thought out ISV because that's the only way that you can essentially demonstrate to yourself and to regulators that you've achieved what you thought you were achieving, you know, all along.

But, trying to provide too much guidance for the -- I worry that trying to conform to that guidance at an intermediate stage would become an end to itself rather than the process that they used to actually challenge the design.

So, I don't know how to do that. I mean what they've done is right, as I said, I personally would have been a little more aggressive at trying to challenge the system but --

MR. PIERINGER: There were two areas I wanted to bring up and we're addressing them as part of the DCD, but I'm concerned that they may reflect back into the topical report and but we --

It's an interface between I&C and HFE. And the first is that they propose control of safety related equipment through the operational VDUs. And that challenges the independence as its currently applied in the Chapter 7 arena.

CHAIRMAN STETKAR: Right.

MR. PIERINGER: And, we're trying to make a judgment as to whether the HFE improvements offset the reduction in independence. And, right now, we have not reached a conclusion. And a big driver in that is I don't understand all of the I&C challenges to independence.

And so, it's hard for me to make a recommendation on how that balances. Where the control operational VDU is warranted at the expense of the loss of independence. But, that's one we're working through with RAIs right now.

CHAIRMAN STETKAR: And, I guess I have to be careful about commenting, but I -- some of the questions that I was raising touch on that but not in the design criteria sense. Because I just want to make sure that nothing can -- I don't -- quite honestly, I'd really like to have the safety VDUs be able to draw -- pull up a mimic diagram. That would be great for the operators. But, you know, they're constrained.

The problem is, can, you know, what can happen out on the non-safety related stuff that can make things go funny on the safety area?

And the answer is, I don't know, but

simply drawing a black solid block wall that say, okay, because we can't think of anything, you can't have it is probably counterproductive.

MR. PIERINGER: Well, and that's the exact question we're trying to answer.

CHAIRMAN STETKAR: Well, the question is then, how during the review process do you actively challenge, within the context of this design, those issues? That's not an easy answer. I mean that's not an easy question.

MR. PIERINGER: But that is the question we're trying to answer between I&C and HFE is what impact can it have.

And, part of the issue is different staff have different opinions on that. Some put more weight on independence and some put more weight on versatility and --

CHAIRMAN STETKAR: Sure.

MR. PIERINGER: -- just efficiencies.

CHAIRMAN STETKAR: But, I'd hate for us to ever melt a plant in this country because we made something so independent and so simple that the operators couldn't use it when they were really in dire straits. I'll just say that on the record.

So, this adherence to black brick walls

because that's the most expedient way to satisfy somebody's interpretation of some criterion doesn't necessarily make the world better or make it easier for the operators.

MR. PIERINGER: Now I've got your perspective.

CHAIRMAN STETKAR: And, again, that's just -- the good thing is we're a subcommittee here, so --

MR. PIERINGER: The second point I wanted to make, and this -- and I'm not sure I caught all the discussion, but the BISI function, I'm sorry, the block function that you were discussing, to the best of -- we've had some internal discussions and there's an RAI outstanding but it's to my understanding right now, correct me if I'm wrong, but this block function that we're discussing does not interface with the BISI function.

And so, when you go to override, you don't get notification via BISI that you used this override.

Now, that may be wrong, but there's a question that's outstanding to try and resolve that. Because I don't understand how an override could not, by regulation, could not input to that generic alarm on your large display panel.

CHAIRMAN STETKAR: And, in my state of knowledge, is from what I heard -- I couldn't figure it out which is why I asked the question.

From I thought I heard was that to do something over on the operational VDU to -- they use the term block, they use the term inhibit, they use the term of block, I'll use the term to make it not work. I needed to enable that function from a safety VDU and then go to the operational VDU and push on something that says make it not work.

MR. PIERINGER: But you --

CHAIRMAN STETKAR: And, when I did that, I would then get an indication that I had made it not work.

MR. PIERINGER: But, you were asking a question about post-actuation override.

CHAIRMAN STETKAR: And, that's part of it.

MR. PIERINGER: I'm asking the question about pre-surveillance support --

CHAIRMAN STETKAR: The alarm --

MR. PIERINGER: -- when you override the --

CHAIRMAN STETKAR: But the alarm

function shouldn't make a difference in my mind.

MR. PIERINGER: -- alarm function.

CHAIRMAN STETKAR: In the pre-action function, if I want to go in and I want to take Train A out of service, it's my understanding -- this is my understanding as a result of today -- that I go to the safety VDU for Train A. I enable -- take Train A out of service and I go over to -- I can on the operational VDU and block Pump A. Maybe it's only safety injection Pump A, maybe it's not the whole train. And I will get some sort of alarm up telling me that I've done that and that alarm will stay there as long as it's not operable.

Now, that's the pre. My understanding now in the post-world -- so I've got a LOCA going on and the operator, for some reason, wants to shut off Pump A that has been actuated, that the operator would have to go to the safety VDU, enable the block or lock or whatever it's called and then go to the operational VDU and stop it. And I'd get the alarm but, okay, I know I wanted to stop it in that case.

MR. PIERINGER: But I understand --

CHAIRMAN STETKAR: But that's state of mind.

MR. PIERINGER: -- the post-actuation.

I'm just not certain of the pre-actuation alarm yet.

CHAIRMAN STETKAR: Okay.

MR. PIERINGER: I'm sure you get an alarm somewhere, but I'm like regulatory --

CHAIRMAN STETKAR: You don't know whether it's regulatory on the BISI?

MR. PIERINGER: The regulation says BISI needs enunciate -- overrides block functions of safety actuations. And so, it may be acceptable to have other alarms, but you'd have to make the case that those were as good or better than having in the BISI alarm.

So, I just want to make sure we're clear from a regulatory standpoint. And, I just mention it here because it's an outstanding interface with I&C.

CHAIRMAN STETKAR: Because, I mean quite honestly, the reason I ask about the BISI, the ability for the operator to understand what was bypassed and inoperable strictly from the safety VDU complement of displays was precisely for those types of concerns.

MR. PIERINGER: Okay.

CHAIRMAN STETKAR: You know, I would hope that the operators would get used to glancing very quickly at some geographic area of their displays. If the non-safety stuff is available, it's on the large display panel in some geographic area up there, being able to quickly glance at it and, by pattern recognition or anything else, understand what's up and what's not up.

And, similarly, if that all goes away, if they only have safety stuff available by some other geographic pattern recognition, understand whether something's available or not.

And, I think we're saying the same thing, that if I have a safety train somehow, totally or partially disabled and it doesn't show up in that geographic area, that's a problem.

MR. PIERINGER: Yes.

CHAIRMAN STETKAR: Whether I do it pre or post, I mean I don't care about the timing of it.

MR. PIERINGER: The same --

CHAIRMAN STETKAR: Okay.

MR. PIERINGER: The same frame of --

CHAIRMAN STETKAR: And, you're not sure whether it will show up?

MR. PIERINGER: I just don't know yet.

CHAIRMAN STETKAR: Okay.

MR. PIERINGER: Right.

I did want to speak to alarms and alarm navigation. And, I understood it a little bit different than the way it was characterized earlier. Because, when I did the audit of the Style Guide, we went through a lot of the learnings that had occurred during the testing and one of the learnings was, there were way too many alarms and operators were getting confused by the number of alarms.

And, when I said well, what are you -- and, at the point it was volunteered to me, and this is our action plan for addressing that. And, the action plan was to go back in and look at the alarm logic that's being used to drive the prioritization and also the mode dependencies and accident dependencies.

So, you literally strip out those alarms that don't tell the operator anything meaningful and the condition that it's in.

I found that where they were, and this is kind of an interim stage in the development, there were too many challenges. But, this was by their own characterization. And, when I followed up on that later to get more feedback on how they managed it, they had done a considerable amount of logic identification.

Now, I will tell you that that doesn't make it okay. It just gives -- it just tells me that they're on the right track. What tells me it's okay is the integrated system validation when the operator has --

CHAIRMAN STETKAR: And, that's what I was going to ask you, Paul. Because both aspects of what you've been discussing bothered me as I read through this, both the issue that I raised in terms of three or four levels of priority of alarms flashing as you drop level and raise pressure and change levels or flows or whatever.

And the operating being faced with a continually evolving set of priorities of things that pop up and he needs to go check them and acknowledge them, which could divert his attention, to a prioritization logic that is now so smart that it knows precisely what the operator needs to know and only what the operator needs to know and tells him that information until he flies the plane into the ground because he doesn't realize that he's losing altitude because his pitot tube is blocked.

Where during the -- now, I understand from the Topical Report perspective that to have they functionality to develop that type of -- a type of prioritization logic that will achieve some sort of balance between those two extremes is something that, perhaps, all needs -- that statement or that functionality perhaps is all that needs to be established the fact that it's there for approval of the Topical Report for this thing.

When and where, though, does that actual logic get tested? From what I hear you saying is it gets tested and you wait until the final ISV. Is that --

MR. PIERINGER: That's the only place that I have confidence that there is enough complexity to put the system under a test.

CHAIRMAN STETKAR: I mean, in some sense, it's like there could be an example, you know, in the Topical Report submittal like that -- what I'm learning to understand now like that example table of the parameters for the HSI inventory, it's a nice example, but I don't necessarily accept that as anything --

MR. PIERINGER: Right.

CHAIRMAN STETKAR: -- right now.

MR. PIERINGER: How far are they on this scale of alarm --

CHAIRMAN STETKAR: But, I mean that

strikes me as a very, very fundamental and potentially really, really important part of the design process. Not hardware necessarily, but certainly integrated hardware/software operator --

MR. PIERINGER: It definitely is because in the ISV that's been done, it's not a hundred alarms, it's some scenarios had a thousand to two thousand alarms. And they were prioritized, but even with the prioritization, you were getting so many alarms that the operators either got lost trying to address them all and/or they stopped looking at --

CHAIRMAN STETKAR: In the Phase 1A or Phase 1B?

MR. PIERINGER: No, this was in the other real ISV that was done by somebody else.

CHAIRMAN STETKAR: Oh, oh, somebody else, okay. Okay, never mind. Okay.

MR. PIERINGER: Right. But, that's kind of the benchmark.

CHAIRMAN STETKAR: But, I mean that's symptomatic of these digital systems. You can have an alarm that, you know, a tenth of inch increment on level.

MR. PIERINGER: But, the difference being is that in this ISV that has been done, that feature of the design had never been tested before. They didn't know how many alarms they were going to get.

CHAIRMAN STETKAR: On the other --

MR. PIERINGER: On the other on.

CHAIRMAN STETKAR: Other one? Okay.

MR. PIERINGER: On the testing that MHI has done, they've done repetitive testing. They don't know the alarms for every scenario, but they've got a good feel for the number of alarms on complex scenarios.

So, when we look at the ISV, it will be with great attention to the diversity of the scenarios that they choose and with great attention to the number of alarms that are generated and whether -- and what categories are.

Because, not only did we see a high number of alarms generated, we saw alarms that were generated and needed priority one attention and didn't get it --

CHAIRMAN STETKAR: Oh, sure.

MR. PIERINGER: -- because they were --

CHAIRMAN STETKAR: Sure, sure.

MR. PIERINGER: And so, you get the inverse there, right? You get too many and then you get I didn't have the ones I needed.

So, I don't know any way to analyze that other than run scenario after scenario. And, that's why I credit their design program with the use of the, you know, with the integration of the simulator as being quite robust because they're testing alarm response on a very -- not -- well, I was going to say very frequent, but at least a more frequent basis than many of the others in the industry are doing that.

CHAIRMAN STETKAR: Provided that that testing program, as I said earlier, in my opinion, I would have kind of designed the ones that they did a little bit differently from a timing complexity perspective.

This is also timing complexity, but perhaps --

MR. PIERINGER: It's different.

CHAIRMAN STETKAR: -- different -- a little different to sort of challenge those things in particular to try to -- essentially to try to make the operators fail and see what threshold do you achieve that.

MR. PIERINGER: Well, actually, to that point, most -- the people who are testing are trying to test until failure right now. So they -- and that's why you hear about these scenarios that go -- are beyond design basis even with multiple failures imbedded within the scenarios is, they're trying to do that and it does put a little bit of a twist from a regulatory perspective and we're trying to make sure it works and they're trying to drive it to failure.

And, that's where you get back to you point as the regulator can't over-regulate in this kind of testing that's going on.

But, nonetheless, that scenario testing -- the simulator testing to me is so fundamental that, you know, just from my personal perspective is like how can you approve a design with any credibility that doesn't have imbedded simulator testing? I'm that far to the -- in support of the simulator testing now.

But, right now, our --

CHAIRMAN STETKAR: Be careful, you're on the record.

MR. PIERINGER: Yes. But, right now, our program only calls for an Integrated System Validation Test at the end. So, that's the position, the regulatory position and we're actively encouraging the use of the phased validation.

And so, we've had discussions with like, for example, NuScale who's still developing their program and I think they're looking carefully at how they can do similar simulator tests.

Those are the --

CHAIRMAN STETKAR: Hope you brought your walking shoes?

MR. PIERINGER: Pardon me?

CHAIRMAN STETKAR: I said, I hope you brought your walking shoes.

MR. PIERINGER: I did get it moved back 15 minutes.

CHAIRMAN STETKAR: But, you are still under a clock here, so -- okay.

MR. PIERINGER: So, those are the comments that I had, the comments that I heard that I wanted to particularly comment on. And so, I think now would be -- I'll field any questions that you have.

CHAIRMAN STETKAR: I did, just for the record, I have not read it. Indeed, Part 3 of Revision 2 of MUAP-09019-P purports to document the Phase 1B testing.

MR. PIERINGER: Okay.

CHAIRMAN STETKAR: Program and results, at least I -- and it's several pages. I didn't read that version of that report because it didn't seem to be used anywhere and in the version that's referred to in the staff's review of DCD Chapter 18, all of that information has been stripped out. It's strictly the programmatic elements of what would be done in the future.

MEMBER BLEY: Now that you've said that --

CHAIRMAN STETKAR: I said that purposefully to give you an in.

MEMBER BLEY: -- it sounds as if, to me, if we'd seen that, that would have led us to some of the same questions, but at least we'd have known it was there.

I suspect a few pages isn't quite what we're looking for, if we can get more to really understand that process.

MR. SPRENGEL: We agree. Yes, so we'll continue to maintain our action to provide additional detail in appropriate form as a result of this meeting.

CHAIRMAN STETKAR: That's all you have on the Topical Report, right?

MR. PIERINGER: Yes, sir.

CHAIRMAN STETKAR: So, let's --

MR. PIERINGER: I mean I weave that in to the DCD discussion in terms how they interface, but that's --

CHAIRMAN STETKAR: So, essentially, we're at the end of our discussion on the Topical Report.

So any Members have any comments or further questions in the context of the Topical Report, everything that we've heard?

If not, then you all know how much material you have. I know how much I have. I think we can probably get through a shot at the DCD.

Paul, I don't like to do this in reverse, but if you think you can get through your stuff in about the time you have left, it would be really useful to have you physically here.

MR. PIERINGER: Let me give a chance.

CHAIRMAN STETKAR: So, why don't you try that?

MR. PIERINGER: Because actually, the way we set this up is that NHI was going to talk about the design, physical design. They've submitted implementation plans and I'm on Slide 5 now. And those implementation plans have been reviewed and I'll just tell you, they meet all of the NUREG-0711 criteria as you would expect.

But, to get there, let me just comment that the design certification has very little information in it. It really is intended to point to the implementation plan and what we do is we make sure that the implementation plan is sufficiently described, that it is included by reference so that legally it takes the status of the design certification.

The -- all the implementation plans were rewritten in the beginning of 2014. And, I'll just be blunt and say the previous implementation plans were not of sufficient quality and we spent a lot of time to try and raise that quality to meet the quantification we needed under the deferred design concept and could not meet that and we issued a letter and said the quality is not sufficient. Here are the problems, you need to work on the implementation plans.

They were rewritten. We got brand new implementation plans almost basically from scratch on some of them. That's why you see some results in some of the early versions. But, those are partial results. We could draw no conclusion from partial results.

CHAIRMAN STETKAR: You know, I --

MR. PIERINGER: One, because --

CHAIRMAN STETKAR: But, you couldn't from a regulatory perspective, but it sure as heck helped me understand what they had done, what they had found, what information they were using. And now, officially, we've lost, we the ACRS has officially lost that because we don't --

MR. PIERINGER: And, that's not --

CHAIRMAN STETKAR: -- those things are not referred to anywhere anymore.

MR. PIERINGER: And, that's not a problem with what MHI did. And it's not a problem with how the reviewers are working under the regulatory guidance. It's a problem with the fact that we've got DAC in place and DAC is -- and now, I do have to be careful about what I'm going to say -- DAC is making every feature of a DCD review much, much more complex and it's making the implementation of the DCD from a COL perspective much more complex.

So, for example, you need a referenced plant simulator to train operators on. You don't have a referenced plant simulator until you have a design built into the simulator and you don't have a design until you've finished all elements of the HFE.

So, if you defer HFE design, in particular, the ISV doesn't get done until late, you have no simulator to train operators on until that's done. And, that's the condition in some other areas.

CHAIRMAN STETKAR: But see, Paul, it strikes me as -- and I don't know who's doing it, so I won't point fingers at individuals, but it seems like people are adopting an absolutely all or absolutely nothing approach. To say that it's okay, I have to have absolutely all and, otherwise, I can't say anything so, therefore, I have absolutely nothing. All I have is a program.

MR. PIERINGER: But, we made a step jump because before you never would have seen the material that's in this Topical Report. That design would not have been provided.

CHAIRMAN STETKAR: Yes, but, for example, I had operating experience that they cited that I don't see anymore. I have interim results that may be partial of things that they had done that I don't see anymore because somebody has decided that everything was necessary so, therefore, I have nothing.

MR. PIERINGER: I understand and --

CHAIRMAN STETKAR: And that, to me, is --

MR. PIERINGER: So, we need to change the process so that if it's your intent to look at results -- let me start over.

It's our intent to look at results because we think 52.47 says the design has to be sufficiently complete to support construction, inspection and procurement. Well, it's very hard to do that unless you have detailed specifications that describe your design.

So, our intent is to say you cannot use DAC unless you can provide a positive statement of how SECY 92-053 applies. It basically says that technology is moving so quickly that you can't produce a design that would not be obsolete by the time you went to construct it.

CHAIRMAN STETKAR: Yes, but see, these guys are the first guys you've approached that they really do have a design. And, you can't deal with that.

MR. PIERINGER: Yes, and --

CHAIRMAN STETKAR: That's the problem.

MR. PIERINGER: But it was a year and a half for us to figure out that they were giving us a design. Right?

CHAIRMAN STETKAR: Pretty obvious to me the first time I picked it up. It looked like a real design.

MR. PIERINGER: It sure did, but it was a paradigm the reviewers were in. We compare everything to 0711 and so, when they gave us a design we said, wait a minute, what do we do with this? It doesn't say anything on 0711 about this. So, it took us a while to figure out that, hey, you know what does apply? NUREG-0700.

So, once we broke the paradigm down, it's like you're saying, it became very transparent about how to do the evaluations and what we should be doing. But, a paradigm is a paradigm. So, I mean that's --

So, what we're finding now, though, is that we're spending a tremendous amount of time trying to quantify the process being used to make sure that it's going to end up in a design that's safe that we're always the -- we're the lagging chapter in any DCD review, even to almost behind seismic and some of the other complex.

MEMBER BLEY: I suspect we're going to end up saying something about this, but if you guys can think this through a little bit more before a full committee meeting, then and have something -- a position that you might want to go further than you've gone today. We would appreciate that.

MR. PIERINGER: Okay.

MEMBER BLEY: But, we're probably going to say something close to the last thing we said on DAC in recent years.

MR. PIERINGER: That will be good.

You know, from my perspective, it's just not working well. So, I'll just leave it at that.

CHAIRMAN STETKAR: It's certainly in this case and I'll -- I know you have to go, but I want to get this on the record.

I was reading the original set of technical reports that are referred to in Rev 4 of Chapter 18 of the DCD.

MR. PIERINGER: Okay, yes, Rev 4.

CHAIRMAN STETKAR: Those technical reports not, you know. They're also referred to in Rev 5 of the Topical Report but not in Rev 6.

I was reading through those things and I said, gee, this is great. I understand we have a real design. It's not finished, final because I don't have parameter -- maybe I don't have a full parameter set. Maybe I don't have, you know, values for level alarms and stuff like that. But, I can actually look at something. It's the first one I've had to look at.

And, indeed, I have some interim information on which I can develop some confidence. I know what people have done. I know what they haven't done. I know some basis for decisions that were made. Maybe I can raise questions about some of that, but I also recognize that that will be implemented going forward.

And, now that all of that information that made me feel really well has been removed from the process. I've essentially taken a step backwards in my mind from where this process was, where their approval process was because somebody wants to make it process oriented and not make a conclusion until everything is perfectly finished, which is after we get involved, as ACRS, which is in alignment, first of all. And it seems very unnecessary.

MEMBER BLEY: No, I think that's on the record.

The other thing is if staff is moving toward a position such as you indicated before, that at least in the future, you've got to really defend that it's moving too fast. That's absolutely consistent with the policy on DAC and that would make me very happy.

MR. PIERINGER: I mean, the problem --

MEMBER BLEY: But, I think we've got to let you go.

MR. PIERINGER: The problem as I see it is, in 2008 when we reviewed it, we started ESBWR and AP1000 was pretty much done, but had a lot of DAC imbedded in it.

But, when we started ESBWR we should have enforced SECY-92-053. And, I think if we had done that, we would have ended up with a results-based submittal and then everybody who's filed subsequently would have filed with that model.

Unfortunately, we allowed at least three more applications to come in following the same 0711 model which set a precedent which, to be honest, we didn't realize existed until we got the MHI submittal and it had design in it and then we started questioning, well, if they can do it, why can't others do it. And, that was the --

You know, so the paradigm of 0711 driving HFE into process space was broken when MHI submitted these. But, I tell you, it was -- I mean I was probably the most vocal advocate of this is an unacceptable submittal that MHI is providing because it doesn't follow 0711.

And now --

MEMBER BLEY: Which was put in place to enable DAC. So, go ahead.

MR. PIERINGER: So, it's -- there's a lot of internal I guess I'd call it old perspective that got carried forward that we had to unlearn.

CHAIRMAN STETKAR: Paul, in the interest of time, I really, you know, I think we've got stuff on the record related to DAC, related to kind of our concerns, I know that you did want to mention things about the ITAAC, your second bullet here and Slide Number 6, so before you run --

MR. PIERINGER: So, the Generic ITAAC process was implemented to identify, to streamline and simplify ITAAC so that people could actually implement them consistently and effectively.

And so, besides that spelling error in the first sentence, our perspective was that really there were two essential elements. The first is you have to do a V&V and the V&V has to be done in accordance with a detailed implementation plan, testing plan, and that the NRC's going to inspect the results of that ISV against that implementation plan.

And, our feeling is, is that that ISV actually tests all the precursor elements of the 0711 process to a sufficient degree. It doesn't hit some as hard as others. Like OER, sometimes you wouldn't be able to tell from the ISV whether it got every element of the OER review, but we still get a result summary report. And if we chose to or think there's reason to, we could look more thoroughly at any individual element.

So, because the ISV is really the measure of effectiveness, we wanted to focus the ITAAC on that.

Now, the other thing we do is we don't wait for the ISV to be completed and then inspect the results. We actually inspect the performance of the ISV.

So, for the ISV that was performed, we had a series of five inspections over, I don't know, three or four months I guess because we looked at the pre-ISV preps. We looked at three or four inspections of the actual ISV performance. We will go up in December and look at the post-ISV analysis work and then we'll go up subsequent to that and look at the HED closeouts. And that's directed by our inspection plan.

Now, if you read about these inspections, they would be Westinghouse inspections. You may see the word audit in there because this is done as a vendor inspection, vendor audit, but the work is actually done under an inspection.

And then, the last ITAAC is just the classic, once you construct the control room, you inspect it against the criteria that you validated in the ISV.

CHAIRMAN STETKAR: As part of those inspections or audits or whatever you want to call the of the ISV process, to me, a key element is indeed the selection of the scenario set that will be used in that whole process and how well it does things that I've been talking about earlier, challenges elements of the design that are new or conceptually different whether it's logical prioritization of alarms or whether it's a physical layout of displays of the ability to navigate or things like that.

Is that part of the staff's inspection or do you simply inspect that indeed they've selected scenarios?

MR. PIERINGER: It's neither one.

CHAIRMAN STETKAR: Okay.

MR. PIERINGER: We don't -- first of all, we make sure that the scenarios represent the scope required in 0711.

Now, some of that scope would include new technology, specialized systems, but the -- like we didn't explicitly go after alarm response and alarm support. It evidenced itself as part of the scenarios.

What we did make sure of is that the scenarios were complex enough that it would drive a, you know, high degree of interaction between the operator and the HSIs. And we weren't worried about operators failing because we didn't intend to test those. We really wanted to see HSIs failing so we could analyze whether there was a way to improve that.

So, a lot of our pass/fail criteria are pretty high levels at the thermodynamic requirements have been -- have you damaged the core is a classic one.

And, we allowed most of the criteria we inspected against were against the performance criteria which were geared at how can we make it better?

So, our best friends in the ISV are the operators because they don't tolerate things that don't help them. And so --

CHAIRMAN STETKAR: That's true. I mean that's easy to say, but on the other hand, if they're put into a situation, they don't get to select the scenarios by and large.

MR. PIERINGER: Right.

CHAIRMAN STETKAR: Right? They don't get to look at it and say, hey, please put me through the ringer on this particular set of things because I don't think it's going to work very well.

MR. PIERINGER: Right.

CHAIRMAN STETKAR: The people designing the ISV program do that, but, in many cases, those people may just be following guidance and yes, I have to have one of these. I have to have one of these over here, I have to have one of these over here so I have the right complement of things so that the inspectors can come in and say do you have one of these and yes, you do.

MR. PIERINGER: Just my opinion, but I think we're probably more closer to the we have to have one of these and one of these and one of these than we are of specifically formulating the worst case scenarios to test a certain feature of the design. I don't think we've matured to that point, but I'm just speaking of the scenarios I observed during ISV testing and the scenarios as they were written.

I will tell you, though, that every scenario I've seen exercised is extremely challenging beyond what you'd test an operator to. It's just as you're alluding to, John, does it focus on a specific challenge area that you perhaps think exists or maybe does exist? We're not that sophisticated in identifying those from a regulatory perspective and I don't think that -- MHI may have a different opinion, but I didn't see that in the development of the ISV that's been completed. It was more of the way you described it.

CHAIRMAN STETKAR: Okay.

Do you have anything more?

MR. PIERINGER: No, sir. In fact, I've covered a lot of the other points on the next slide in the discussions we've had.

The implementation plans I thought were very good once it was understood what needs to be in an implementation plan.

We talked about prompting alarms and alarm logic, detailed process discussion in the phased validation process. Those were the three elements that I thought MHI brought new perspective and I would say energy to the design for the APWR that we hadn't seen in previous designs.

So, we found some weak areas but my take on it is just from having reviewed a number -- all the other -- all the previous design certifications, they had a much more disciplined approach or maybe they just described it better once we got the good descriptions.

And, the other thing I would say is they didn't keep their implementation plans to the regulatory minimum. So, you'll see the regulatory objectives listed in their criteria, but then you'll see they added some that they thought were needed and necessary.

And, from a reviewer standpoint, it's all the difference in the world. It's like, okay, they're not just trying -- you know that if they missed something it's not because they're trying to minimize the work they're doing, they just missed it because they've already embellished and built on the regulatory minimum.

So, that's really what I mean by detailed process descriptions there.

CHAIRMAN STETKAR: And, you did note that in the SER.

MR. PIERINGER: I would think, yes.

CHAIRMAN STETKAR: You did.

MR. PIERINGER: Good. And, that's all I have.

CHAIRMAN STETKAR: Thank you.

MR. PIERINGER: Sure.

CHAIRMAN STETKAR: Do any of the Members have any questions or comments for the staff?

If not, Paul, I'm really sorry. I hope you don't have to walk too much, scurry off. Thanks very much for accommodating us.

MEMBER REMPE: May we could -- if you're leaving to say thank you also. I thought your insights were very helpful.

MEMBER SCHULTZ: Yes, I agree, Paul. You've brought a lot forward and it should be very meaningful for not only the review but also the process issues that we need to address. Thank you.

CHAIRMAN STETKAR: Okay. And, Bill will fill you in later on what you need to do in the next week.

We'll have MHI come up and do whatever you need to do for Chapter 18. Pick up where we left off and continue from there.

Ryan, while you're getting set, I noticed the first screen up here is not particularly where we left off, whether you're doing that intentionally -- never mind. Thank you.

One of the things I'd like you to do if not - and I haven't skimmed through your slides yet and I know that this is now very much oriented toward implementation plans and programs, but if there are elements of the design that have been enhanced in particular for the US-APWR application, I think would be compared to what we spent most of today -- all of today so far talking about, we'd be particularly interested to hear about that, in addition to your plans.

MR. SPRENGEL: Okay.

CHAIRMAN STETKAR: Okay?

MR. SPRENGEL: For logistics, what is our plan? We have some restrictions on our staff at some point, so what is the meeting logistics?

CHAIRMAN STETKAR: I don't want to run any later than about 6:30.

MR. HALL: I'm going to have to leave here latest 6:00.

CHAIRMAN STETKAR: Okay. Well, you know, we have --

MR. HALL: Only because of a flight.

CHAIRMAN STETKAR: No, that's fine. We've got an hour an three-quarters. I am not clear that there's all that much to go through, but let's see if we can do it.

MR. SPRENGEL: Well, are you going to start the presentation?

MR. HALL: I was going to.

MR. SPRENGEL: Okay. I have a few follow-up items.

MR. HALL: Go ahead.

MR. SPRENGEL: Okay.

CHAIRMAN STETKAR: Good to see you all again. If you have -- Ryan, if you have follow-up --

MR. SPRENGEL: Or we can put them at the end.

CHAIRMAN STETKAR: -- put them at the end because I really would like to not press Bob too much on his time. So, let's see if we can get through the straight line stuff and then do follow-up at the end.

MR. SPRENGEL: Okay.

CHAIRMAN STETKAR: And, even if we don't get to that, we can always communicate that some other way.

MR. SPRENGEL: Not a problem.

CHAIRMAN STETKAR: Okay?

MR. HALL: Okay, what we're going to do now is shift focus a bit. We're going to shift to the DCD and we're going to start talking about process rather the design.

Just want the NRC's discussion just said is maybe not the most important thing. The design was one of the critical paths.

The key is that the process we're going to talk about has been really fine-tuned to address the review criteria within 0711, and that's what Paul was talking about as well.

However, it's been applied throughout the basic HSI design as well as being applied and will be applied to the US-APWR.

So, we're going to start going through process now. Some of these are the documents where, you know, some of the details were stripped out, the results, and what we agreed to with discussions with the staff a few days ago is my slides do not go through each and every process.

I don't have slides on task analysis, how we're doing it or whatever. So, if you have questions will address that in an open forum.

What we're going to do is just talk about the HFE program management plan. That's the first overarching plan that all the other implementation plans fall into. It's the management scheme for the human factors program. It summarizes the human factors program.

And, what I'll do since we've talked somewhat about a number of these slides already is I'm going to quickly jump through them so you stop me when I say I think we've covered this if you need more information and I'll try to, based on the questions, elaborate a little bit more than I was planning to on some of the things that has and will be done. Make sense?

So, there's a little bit of a change from where I was headed. So, let's go to the first one.

Okay. We talked about that we did, in fact, do the basic design and are working on the US-APWR design and all the implementation plans, NUREG-0711, Rev 2. The process meets that.

What we've intended to do is to basically take Rev 2 and where we saw it needs in the process to expand it, we've added additional parts to Rev 2. So now, Paul was talking about specifics and methodology we did such as goals and objectives, but we've also gone beyond what the 0711 Rev 2 requires because we felt it was needed.

So, I'm going to touch on those. I think it might be in the next slide.

So, the next two bullets on this are kind of just generic statements so I'm going to slip to the next slide.

You've seen this before. It's been presented to you up in the very beginning. These are the elements of 0711 so there is a technical report on each of them.

The first one is the PMP, the rest of them are the implementation plans.

0711 calls the PMP, the Project Management Plan Implementation Plan 2, but you get tongue tied with so many plans in a sentence.

So, this is the HFE program. We talked about -- I'm going to jump now to operating procedures and training. Right here, then we wrote that out because it's important to note that early on, we had implementation plans for both of them.

During the maturing of the thinking on this and discussions with the NRC on RAIs, they were then withdrawn and bounced over to the review of Chapter 13.

However, by withdrawing them, that does not mean the human factors program does not address training and procedures.

And, the way we've addressed it is within the other implementation plans, when information comes out of the plan as a result, we talk about the process by which it gets to the training development people when it needs to and how it gets to the procedural development people and how the human factors people then review it and make sure those findings from these various pieces of the program were addressed in the final procedures and final training.

So, when we look at this, remember that the review process isn't here. There aren't documents in Chapter 18 related to this, but within the documents we do point to how human factors brings its information in the robustness of the analysis into that process and then how it reviews it at the back end.

The next thing I'll mention on this, and this is some of the expansion I think I'm doing that I wasn't planning on doing, is the OER, we said has been done once during the basic analysis. It was done prior to that within the Japanese analysis.

It will be done again and is being done again during the US-APWR analysis and that's because it's constantly changing and this process is occurring over years and we want to make sure we get the most current information into the process. And, it was answered earlier today that that information is nuclear as well as non-nuclear. And the reason we brought non-nuclear to the table is we don't in this industry have a lot of highly automated digital systems experience, but other industries do.

So, we've searched databases and brought that information in where we looked -- that where it looked like it was applicable.

I'm going to jump down --

MEMBER BLEY: Before you jump down.

MR. HALL: Okay, I'm sorry.

MEMBER BLEY: What I wanted to tack on was just to draw the tie back to the basic HSIS. As you progress through the evolution of the HFE elements and move toward fully developing the procedures and all of that sort of stuff.

Will you be bringing the simulator that's up at Cranberry into the US-APWR realm and is that going to be the base place where you do all this testing or is that going to happen somewhere else with some other?

MR. HALL: I don't know the answer to that.

MR. MASHIO: So, Cranberry, just basically was tested in Cranberry -- it was Pittsburgh but --

It depends on the whether application of -- if we have a Comanche Peak, proceed. So, this, based on this, this is tied with actual data. So, if Comanche Peak in progress, at least to construct the use there. This is the Comanche Peak area.

So this kind --

MR. SPRENGEL: The basic answer is there is no current plan --

MR. MASHIO: There's no current plan.

MR. SPRENGEL: -- for how we would proceed. So, there are intentions based on --

(Simultaneous speaking)

MR. SPRENGEL: Correct. Right. As we noted at the beginning, the US-APWR design review is in a slower pace and the Luminant Comanche Peak site has suspended their COL application.

So, right now, there's no clear path to anything. The intent, obviously, would be to continue to refine and iterate, I think Paul mentioned some of that activity. But, the intention would be to continue to refine and implement and iterate and continue to develop over time rather than waiting until the end.

CHAIRMAN STETKAR: Let me ask a couple of questions here because you mentioned operating experience, so let me -- I want to make sure that by the time all of this stuff comes to the ACRS full committee that we had a coherent set of information.

So, now, I'm going to start talking about US-APWR DCD Chapter 18, in particular, and in the current version of the US-APWR Chapter 18 DCD, it makes reference to operating experience. And, indeed, it makes reference to a technical report that apparently doesn't exist anymore, but, you know, I read it.

And it says, well, we took credit for all of this Japanese operating experience. And I looked at all of that Japanese operating experience and there were ten events in there that dated from 1978 to 1993 which strikes me as being perhaps somehow relevant to digital system, but maybe not so much.

So, I'm curious when you say going forward you're going to include operating experience, it -- I don't know what you're going to do there.

Now, from the staff's perspective, and because of the timing this afternoon, I'll just beat them up here. In the SER on operating experience, there's a quote that says the staff performed a complete element level of review as described in NUREG-0711 in Section 18.0.4 of this report in operating experience. Hard for me to now understand how you performed a complete element review of that operating experience where, (a) it's incomplete and will be completed in the future.

So, now I don't understand how I interpret the staff's conclusion that the operating experience is perfectly acceptable for the design certification because it can't be because we just heard it's incomplete.

So, now I don't know how the SER lines up with the thing that the SER is even supposed to be reviewing which is not the thing that is submitted in Rev 4 of the DCD.

Can you -- I don't know, somebody help me here?

MR. WARD: Yes, I was going to say that the review is on the plan, not necessarily on all the details. So --

CHAIRMAN STETKAR: I'm sorry, if it was

on the plan, it would be an implementation plan level of review. It would not be a complete element level of review. There were only a couple of parts where you said you did a complete level of review, operating experience being one of those.

MR. WARD: Okay, I will get back --

CHAIRMAN STETKAR: The other ones are carefully couched in the phrase that we did an implementation plan level IP level of review and you conclude that the plan looks like it's okay going forward.

But, in this one in particular, you did the complete review. And it's documented as such and it's acceptable.

MR. WARD: There may be a question as to how much was acceptable, whether or not the amount of OE that was provided was considered acceptable or -- but we'll have to take it back.

CHAIRMAN STETKAR: I didn't see any dangling things there saying it didn't seem completed. The staff was pretty happy with it. I don't have the quote from it, but there were two items and I don't want to belabor it here.

One was operating experience it was -- where it was one other element of the HFE program that was characterized as a complete element review. And, obviously, that can't be complete either because none of it's complete yet. It was almost there, but we backed away from that.

So, by the time it comes to the ACRS full committee, it would be nice to have the SER, even though the current SER purports to be timely and consistent with the 2014 level of documentation, it's not clear that it is either.

I'm done.

MR. HALL: Okay. Let me then continue and what I wanted to mention is the FRA and FA and the task analysis two limitation documents are very extensive process oriented implementation plans.

The approaches we're using start from scratch. It doesn't start from a predecessor plant that doesn't make the assumption that the FRA/FA was done with the Japanese plan. It starts from ground zero.

And, both of those methodologies and both of those IPs are quite extensive. And, what we chose to do was to, in those documents, include directions to the people that were going to use the tables.

These tables, if you looked at it, are, you know, multi-pages long almost and we wanted to put enough information in it for our own use, but also for the review as to understand how this methodology would be applied and how, in fact, you would fill out the tables, make the numerical estimate, do the averaging, et cetera, et cetera.

So, those two documents are implementation plans, but they do, in fact, go to more detail because we wanted to make sure that we documented how we propose to use the tabular-type of analysis.

Another interesting thing in what we did is the HRA. Rev 2 of 0711 asks for the process to make account for important or risk-important human actions from Chapter 19, basically.

And, we decided that, yes, we would do that. In fact, we're extracting, have extracted the important, risk-important human action as a critical sequences, et cetera, et cetera from the PRA, from the HRA.

But, we also decided that there are other parts of the design process that are important when you're talking about important human action, not risk-important human actions necessarily.

So, the HRA IP and the process that'll be used by Mitsubishi looks at risk-important as well as deterministically-important human actions.

So, the human actions that come out of that element and feed into the rest of the analysis come from Chapter 19, Chapter 15 and Chapter 7. So, another example of where we felt we needed to go further than what the guidance is in Rev 2 of 0711.

And that's what it should -- and that's the discussion in the IP. I believe the IP still says HRA, but when you read the text, you'll see that the deterministic has been added to that.

CHAIRMAN STETKAR: And, I did it and it's very clear in there.

MR. HALL: Okay.

CHAIRMAN STETKAR: And the reasons for it --

MR. HALL: Okay.

CHAIRMAN STETKAR: -- being rolled in there is very clear.

Just to make sure, that element of the human factors engineering is not yet complete, is it?

MR. HALL: That's correct.

CHAIRMAN STETKAR: You're an excellent straight man.

The other element of the SER that received a complete element review was the human reliability analysis. And I will quote here because I have the quote.

The staff concludes that the important HAs are appropriately identified and integrated into the HFE design process. Human error mechanisms are adequately addressed in the HFE design and provides reasonable assurance -- reasonable assurance -- that the likelihood of personnel error is minimized and that errors are detected and recovered from.

The staff concludes that the HRA considerations with respect to HFE have been adequately addressed and that the requirements in 10 CFR 50.34(f) and 10 CFR 52.47 related to this technical area are satisfied.

Interesting. This is the SER that's done to the 2014 Implementation Plan that hasn't done anything yet. But the staff is satisfied that what was done was complete and I have adequate assurance that operators are not going to make any errors with this design.

So, I'd strongly suggest that the staff go back and look at the SER and see what conclusions you can draw about these areas where a complete level of review of something is done when that something doesn't exist.

MR. WARD: Understood.

MEMBER BLEY: I'd go back to what Bob was talking about and make two comments.

The first one is, the HRA can't be real good at this point because we haven't got the other things to support it like the procedures and the operators and the simulator, which is a good reason to look more broadly.

The language, we found them deterministically leaves me wanting a little bit. I don't know what the heck that means. I hope that means that you've thought about things that might not have been reflected in the HRA and expanded your thinking. And that isn't quite deterministic but it's a search kind of idea.

MR. HALL: It is a -- it's a soul searching. You're right about the HRA, but remember, all of these, and that's one of the strengths but also confusing parts of this process go around.

I mean if you're looking at the HRA or important human actions, or OER was another question, you've got to decide when you snap the camera because it's that ongoing process.

And, the HRA -- I'm sorry --

MEMBER BLEY: I was actually

complementing you on what you've done, but just fussing about that one word.

MR. HALL: Oh, thank you, thank you, thank you.

CHAIRMAN STETKAR: Part of this --

MR. HALL: I won't answer a question that was not asked.

CHAIRMAN STETKAR: -- though is, the HRA and the PRA are not -- right now, they are what they are. I'll just leave it at that.

The PRA has not done a seismic risk assessment. It's done a very simplified assessment of low power and shut down modes. It has not factored in what may be plant and site-specific types of design features, for example, ultimate heat sink cooling water systems, interfaces with electric power supply, flooding mitigation, external flooding mitigation and so forth.

The list of important human actions that are derived from a Capability Category 1 PRA that's done largely for internal events during full power operation may morph very significantly if you did a full scope PRA as is required before you load fuel, accounting for all of the contributors.

So -- and you might discover something

in the human system interface design that you didn't think about for all of those operator actions that are now much less important than the things that popped up.

So, this, again, reinforces the notion of the fact that it is an evolving, you don't want to use the term iterative of evolving process, but you don't know what that inventory of important human actions is even from the risk assessment until you really have a risk assessment and you don't have one yet.

MR. HALL: It should also be noted that --

CHAIRMAN STETKAR: You have something called a risk assessment right now, I don't want to imply --

MR. SPRENGEL: We understand your concerns.

CHAIRMAN STETKAR: You don't have the risk assessment that is required sometime between COL and fuel of --

MR. SPRENGEL: Yes.

MR. HALL: And, part of this process, and I'm talking about the overall human factors process, is to attempt to take -- let me back up a minute.

Paul talked about some of the limitations of 0711 and, having been one of the authors of the original 0711, I think it's only justice that I'm now trying to figure out how to meet 0711. I think that's critical. The old what comes around or whatever.

CHAIRMAN STETKAR: Your children will come back to haunt you.

MR. HALL: What we tried to weave into this is 0711, because it's an engineer's view of this, makes all these separate little categories when really this is an integrated process.

The difference between an FRA, FA and a TA, you've got to kind of draw a line. It kind of flows from one to the other.

So, and what you have to do to meet 0711, is you've got to pull them apart which is really not the best thing to do, but we've attempted in the IPs to make it so that we clearly defined how these various elements communicate.

And, in the important human actions, or what's called HRA, part of that is to confirm what is included in Chapter 19, included in Chapter 15 and Chapter 7.

And, what I mean by that is, the output

of the TA, for example, are going to be lots of detail, not only on inventory, but on operator-type events for the types of scenarios we just said might be missing in the current PRA.

The process is that the HFE program then is going to feed that forward into the PRA team to start looking at some of these things that come out of the analysis of task analysis, for example.

So, this truly is iterated into the overall process and we've attempted in the PMP to build in the management rules that enforce this interlocking of the various elements and this design process into the rest of the design process, you know, the I&C, the systems design, et cetera.

What I wanted to do now is jump quickly down to V&V and, again, just to go into a little bit more detail based on the interest of the committee and say that I mentioned earlier that the testing as it's described in the implementation plan grew out of what we did for that Phase 1A, Phase 1B testing.

So, it was a lessons learned and, as Paul described, those tests, especially the first one, a little bit less the second one, weren't quite as controlled as an integrated system validation is because we weren't claiming they were.

This V&V standard, the IP now, attempts to put those controls in place that allow us to get to this completion of the ITAAC that Paul was talking about.

Within the V&V we also, although the NUREG-0711 does not request or require the idea of what scenarios will look like, we've learned very quickly from the tests we ran that the tires of this car, the rubber meets the road piece of the V&V program of the ISV, is really buried into the scenarios. What's there, what data are you collecting? What is the detail? Who's doing what? What should you be looking for as observers, et cetera?

So, we included, although it's not asked for by the NUREG, we included three example scenarios in the back just to give you a sense of the level of detail of what we would have in these.

This is not one-page long. It's quite extensive just to, again, give you the flavor of when all these other things in the V&V implementation plan are done, this is what they end up looking like.

And, in that, it clearly identifies events that were deemed to be significant for this design that come out of OE. It clearly identifies events that have come out of the important human actions.

And, there is a table in the document, in the IP, that shows all the various selection criteria that are used to go into the scenarios and the testing and almost a check list for the people developing the scenarios as to whether or not OERs were, in fact, looked at down the line.

So, there is the attempt to capture this stuff in scenarios imbedded in the ISV. And, in fact, identify where we feel, or the team that does this, the various important actions or actions coming out of OE are, in fact, being tested within the scenarios.

It may not be perfect, but we are trying to make it so it's trackable and we don't miss anything.

Referring to missing anything, and again, I'm taking more time in this, but I'm going to go very quick on the other slides, each of these documents has an appendix. I don't remember the appendix number. But, I'm sorry, it's actually a section of the document which I think it's called a compliance matrix.

What we did as we were developing these, because, again, 0711 is very explicit with the criteria one has to meet, we used the check list to make sure that we had everything addressed and addressed adequately when we did the independent reviews of each of these IPs.

That check list was part of the process or the methodology we used to build the IP, turned out to be of, we felt, enough importance to clarify what was in the document that they're now included in each of the IPs.

So, if you looked at that original list that Ryan pointed out of the outline of each of these, you'll see a section, I think it's called compliance matrix, and that's basically what that is. That was our internal tool to make sure we didn't miss something that, in fact, we put in there to help to review the documents that we put forth.

Okay, so that being said about the individual elements, I'm going to move on to the next one and it'll go a little bit more into the management plan.

We put this up -- yes, we put this up earlier so you've seen it. We kind of talked around it a lot. I think you understand what happened, so I'm going to talk to it at little bit about where the

HFE program fit and where it fits as we move forward.

But, I'm going to do it fairly quickly, so, again, if you have more questions, drill me down harder, please.

The program's been developed. The program has been applied to the basic HSI. The program is and will be applied to the US-APWR and the program is applied to the US-APWR with a basic assumption, we start with the design from the basic HSI. So, that's the starting point of this design and we're going to change it as we finish up all these analyses.

And, the reason was we did not want to wait until the end to have a design to look at and then apply all this stuff to.

During the design of the basic HSI, we talked, I believe, enough about the Japanese design input to it. The table -- an early version of tabletop task analysis was done to go into the testing program.

OER was done to go into -- the early version of OER was done to go into the testing program.

We did, in fact, look at the early and risk important human actions. They are by no means completed. And that's how we developed this center box which talks about the operator assessment.

Those are the tests and those are the -- those are the tests that were conducted in the first series of tests we ran, that 1A testing scheme.

As I said earlier, everything that has been done and will be done will result in an HED which is another example of going beyond what 0711 says because, to change how you report data on these tests and on these analyses, we felt didn't make much sense later in the game so we wanted to develop the database early and track it through the design.

Those HEDs were, in fact, processed. They were processed as described in the documents you have. That second large box is the second series of tests that were done. That's the Phase 1B testing which then rolled out to the basis HSI.

Now, that's what we talked about this morning. Those tests were done as close to the early versions of the V&V, for example, as possible. Those tests not only included dynamic testing, it included verification. I said we did early because the task analyses were not done at that time.

We did early, with operators, tabletop walkthroughs of the simulator looking at what a task would look like. And, I'm by no means saying it's reported as final results. And, in fact, did the task level evaluation of what would be needed by an operator, the kinds of data that needed, showed up either on LDPs or on the screens.

And, we took the Style Guide that we had and used the style guide to, again, evaluate that the screens we had, the displays we had, met the Style Guide.

I must admit we did it to about 25 percent of the screens but when you look at the number of screens that was a large number we did. So this testing we talked earlier about was -- we talked about the dynamic testing, the testing using operators and a simulator, we also sat down and looked at colors and made sure they met color charts, looked as sized of text and that kind of stuff on a sampling basis.

So, that's what went into the basic HSI and, again, what helped us write the V&V implementation plan.

Now, we're in that green element on the bottom and the human factors program fits in that center box. The OER, the FRA, FA and, by the way, the OER, FRA, FA and TA are started. The OER is I believe significantly done. I think the thing that's left is the documenting of the report but we'd have to check on that.

So, that work has started. That's where it fits in that bottom process. I may add, like with all flow charts, we make a lot of simplifications so that we don't have a spider diagram up here. So, please, there are feedbacks and loops and, you know, lots of lines are missing from this just to show more of a linear type process.

That then ends up, especially at the task analysis, with this HSI inventory that's missing from the basic that we talked about. Remember, the task analysis is where we identify whatever's been assigned to the human. Can the human do it? Is there enough time for them to do it? Are they under too much load to do it? And if they do it, what do they need to do it? What are the displays and what are the control systems they need to perform those things?

I may add that that task analysis again, feeds back to the system designers, if you understand the way a large plant is designed, through the HED process. If a system is being designed and we find instrumentation is being proposed that's not used from the task analysis or instrumentation is not being proposed for a system, the task analysis says is needed, well HEDs are written and then there's a compliance-type review to see how the system design might be changed.

That, between the US-APWR inventory and any site specific changes that might be needed and this would, again, require a COL applicant to the table, moves forward and becomes what we would call the final HSI US-APWR HSI.

It's that final design that then goes into the V&V and the ITAAC -- and the ITAACs of the V&V and the design implementation as described in those two implementation reports.

Now, across the board on these, we are living to the 0711 requirements that we're supplying the implementation plans for review and when the work is done will, in fact, submit to the docket the result summary reports. Those are the two pieces of information that 0711 require.

So, each of these elements, with the exception of the management plan will, in fact, have a results report submitted when the work is completed.

CHAIRMAN STETKAR: And, just for my

curiosity, when in process will that be done? Will it be done prior to certification of the design? Will it be done prior to issuance of the COL? Or will it be done prior to fuel load?

MR. SPRENGEL: Prior to fuel load.

CHAIRMAN STETKAR: Thank you.

MR. HALL: Okay, now, we had a lot of discussion on this earlier and, hopefully, I didn't confuse anything, but that's kind of what it looks like.

Okay, I said the program plan, the management plan, attempts to put forth how we're going to run this thing? How is Mitsubishi going to run this thing? And will the human factors program have enough clout to get anything changed in the plan?

And, I've got to admit, historically, one reason why we at Brookhaven moved forward on the early 0711 was really to drive having human factors looked at seriously and really considered in an overall design. That's my little sidebar statement.

MEMBER BLEY: We had John O'Hara in here a few years ago telling us the history.

MR. HALL: Okay, that's fine. Yes, John used to work for me.

So, that's what it's all about.

So, we wanted to make sure in the plan that we could demonstrate how this team functioned, how it was organized because there's multiple company organizations, if a Mitsubishi organizations are fit together, an what the roles and responsibilities.

And, if I was to rewrite this view graph today, I would put comma and authority of the team is because the document clearly talks about who within this team has the ability when the design is maturing to, and I'm going to use the term, stop work on the design, or hold the design because the human factors input hasn't showed up in the design, hasn't been looked at seriously, has been ignored, whatever.

So, there's the ability of this team at the management level that has the ability to direct this design to consider human factors. Okay?

So, I think that's an important issue here.

It also, I mentioned HEDs, and therefore, we wanted to make sure at this level that we got the HED processed, the database and all this other stuff, what's contained in an HED, how it's evaluated, who evaluates it, documented.

So the PMP also has a relatively lengthy section on what this data looks like, how is it tracked, who initiates it? More importantly, how is it , in fact, closed to say that, yes, we made a change or no, we don't need to make a change because?

It then addresses, I'm just going down the list, the technical program. And what I mean by that, all the IPs. But it gives a brief kind of summary of all the IPs in it and then the combined license type information.

This activity is, I said, broken down to the implementation plan and, by the way, ReSR is because when -- that's our Results Summary Report. In the industry, that's referred to as RSR, but that conflicts with the Remote Shutdown Room in the acronyms of the Mitsubishi design. So, we stuck the little e in there. So, that's the Results Summary Report.

And, basically, the document, each of the IPs in it has a detailed description of what will be contained in the Results Summary Report. Because we wanted to make sure that when we were all done and submitted the Results Summary Report that it didn't contain less information that's needed to give the staff an understanding of what, in fact, had been done.

An example would be, each IP describes the team that will do it generically. There will be human factors expertise. There will be operational expertise. There will be an I&C engineer.

And then, it describes what does human factors expertise mean? What degree? How many years' experience? Et cetera, et cetera.

The Results Summary Report goes further as an example that it's -- we're planning in it to not only say the types of people, but by definition describe the individuals by name and their little resume bead or how they meet the criteria.

You've seen these assumptions and constraints before, so I was going to go quick past them very, very quickly.

So, as you're reading, I'm going to slide to the next one and then we'll come back if there are questions.

This is the assumption of minimum staffing. The SRO and RO, we talked about that.

We also talked about the other SRO, RO and in the US-APWR, there's this floating SRO. So, I'm not going to go over that.

But, those are assumptions going into the design.

CHAIRMAN STETKAR: I'm sorry, I'm sorry. Let me --

MR. HALL: Please stop me.

CHAIRMAN STETKAR: Yes, I'm going to stop you because, finally, I want to talk about real things.

MR. HALL: Ouch.

CHAIRMAN STETKAR: We are now talking about US-APWR.

MR. HALL: Yes.

CHAIRMAN STETKAR: And US --

MR. HALL: This is --

CHAIRMAN STETKAR: It's -- let me finish here.

In the Design Certification Chapter 18, it's my understanding that the complement will be an RO and an SRO continuously in the control room. Another RO and another SRO somewhere in the plant. And a third SRO available that can be shared among multiple units that will -- can fulfill the STA function or, among the three SORs, you've got an STA, an emergency director and an actual operationals director.

Is that correct for the US-APWR certified design? That's a yes or a no question.

Because what you have up on the screen there that says US-APWR HFE assumptions and constraints is not my understanding of the US-APWR. It is my understanding of the thing we talked about 90 percent of the time today which is the Generic Topical Report.

And, I want to make sure that I'm real clear on this because now we're talking about the US-APWR. So, if I need to go back, Ryan's looking at me like I --

MR. SPRENGEL: Well, I just want to understand the alternative. I don't understand -- is this your new understanding or your previous understanding or --

CHAIRMAN STETKAR: No, no, no from reading through DCD Chapter 18 because I want to make sure that this is clear because what Bob said is inconsistent on this slide.

And my understanding of the certified design that the certified design complement from US-APWR will be one SRO continuously in the control room -- eventually it will die -- one RO continuously in the control room another somewhere in the plant assigned to that unit. Another RO somewhere in the plant assigned to that unit and now, a third position in the plant with, and this is a quote, SRO or STA qualifications. This person is intended to assume the main control room SRO or STA function during plant upsets but need not be in the main control continuously. This person can be shared among multiple units.

So, for the certification going forward, is that the minimum staffing?

MEMBER BLEY: And that's, by the way, consistent with something Bob told us earlier today.

CHAIRMAN STETKAR: That is what he told us earlier, but we were mixing earlier versus later and now we're later. So, I just want to make sure it's --

MEMBER BLEY: And he was talking about later at the time he said it.

MR. SPRENGEL: Yes, we can confirm that for US-APWR.

CHAIRMAN STETKAR: And, the intent is that this third -- this additional body can be shared among multiple units so that if I have a two unit site, I can have four SROs plus an additional body who might have an SRO license or might be STA qualified but I need five of those types of folks, not six.

MR. SPRENGEL: At a minimum, that's correct.

CHAIRMAN STETKAR: On site? Okay.

MEMBER BLEY: I mean, this slide is correct as it's written. It's in the control room --

MR. HALL: Yes, this is --

MEMBER BLEY: -- but it doesn't have those other people on it --

MR. HALL: That's right, it doesn't.

MEMBER BLEY: -- who are not necessarily inside the control room.

MR. HALL: And that's why I verbalized it.

CHAIRMAN STETKAR: Okay, okay.

MR. HALL: So, again, the design constraint is for the minimum staffing. So, we're working on the HFE, but in the control room, these two people exist and we can run the plant with it.

And this is my last slide. As I said, I had no plans on really going into all the IPs. But, I did a little bit earlier.

And, the applicable facilities are, obviously, main control room. The HFE program reflects the remote shut down room which basically another main control room, it's basically the same interface. The tech support center and limited applications to local control stations and the EOF and the limitations are described in the documentation.

MEMBER BLEY: Now, I think we have good understanding on this but I want to add one little glitch to it to make sure you folks agree and that the staff eventually we get them to agree.

If, in fact, a customer should build two of these, number one, it doesn't look like there's a revision to have a shared control room, so there would be separate control rooms.

And, number two, this fifth guy is shared among them such that if you have a multi-unit event caused by a loss of offsite power or a major earthquake or something of that nature, we won't have enough STAs to go around so we'd have one in every plant.

CHAIRMAN STETKAR: We don't have enough bodies to go around to fulfill --

MEMBER BLEY: All those functions in every unit.

CHAIRMAN STETKAR: -- each unit --

MEMBER BLEY: And every unit.

CHAIRMAN STETKAR: -- an operational

control, an emergency director and an STA in each unit.

MEMBER BLEY: Yes. Sorry, that's more precise, yes.

MR. HALL: From an analysis point of view, remember, those first slides that brought us into these design constraints, these were constraints or assumptions going into the human factors program.

If the human factors program moves forward and says things within those constraints aren't doable, more automation is needed, less automation is needed, different layout is needed, then, in fact, this process I described of reviewing the compliance of the design as it stands gets reviewed and proposed to be changed.

MEMBER BLEY: Yes, but I think what we're hearing is it's likely to go forward on the basis of thinking about a single unit.

CHAIRMAN STETKAR: And the staff -- remember, the staff has approved -- has written an SER that's approved this. The staff --

MEMBER BLEY: Oh, that's right.

CHAIRMAN STETKAR: -- has written an SER that has approved the concept of a shared -- if I have a site that looks like Palo Verde with three units, I have to have one body who runs back and forth among the three units because that's all I need to have. And the staff has written an SER that approves that concept.

MEMBER SCHULTZ: But, you've got --

CHAIRMAN STETKAR: At the stage of their review.

MEMBER SCHULTZ: - you've got two units, two control rooms, four chairs in each control room and one other SRO. That's nine. Nine operators and SRO you'll have. I just hope we're counting consistently.

CHAIRMAN STETKAR: In each unit, you will have two ROs, you will have two SROs, period. So, between them that's eight bodies.

MR. HALL: Right.

CHAIRMAN STETKAR: ROs are -- and one more. And, if I had ten units, I would have 40 bodies plus one more. I mean by extrapolation.

Clean up stuff, I don't know what the plan, but we need to talk a little bit about the plan going forward by the time we finish here.

But, as I was reading through at least the version of DCD Chapter 18 that we have, there are several references in there that go back to the standard Japanese-Basic human system interface design compared to the US-APWR HSIS.

And because of my prior confusion on the US-Basic design, I highlighted, for example, it says one of the differences is arrangement of the main control room operator console to accommodate the change from one to two reactor operation stations.

Now, what I learned earlier today is that two reactor operator stations, I think I was told, is a fundamental feature of the US-Basic design, correct?

MR. HALL: That's correct.

CHAIRMAN STETKAR: Okay. And there are a few places in at least Rev 4 of the DCD that draws the distinction between what's being proposed for the US-APWR system but distinguishes it from the so-called Japanese-Basic. And it strikes me that it ought to be distinguishing it from the US-Basic and it might not be a difference anymore. Follow me?

And, I didn't -- I don't know if I caught all of those but it's something that if you're submitting Rev 5 of the DCD Chapter 18 --

MR. SPRENGEL: Yes, we'll say that the significant changes to the implementation plans and the PMP that were mentioned, there was also coordinating significant changes to the design certification.

CHAIRMAN STETKAR: Yes, so a lot of the verbiage is going to change?

MR. SPRENGEL: Right.

CHAIRMAN STETKAR: Okay, okay.

MR. SPRENGEL: Which it has, again, submitted as on the docket.

CHAIRMAN STETKAR: It has already?

MR. SPRENGEL: Yes.

CHAIRMAN STETKAR: Rev 5?

MR. SPRENGEL: No, the --

CHAIRMAN STETKAR: Oh, I'm --

MR. SPRENGEL: The changes have been submitted.

CHAIRMAN STETKAR: Right.

MR. SPRENGEL: Right.

CHAIRMAN STETKAR: By the process you described?

MR. SPRENGEL: Right. So, we have officially submitted those changes. We have not officially published a new DCD revision.

CHAIRMAN STETKAR: Yes, okay. Okay.

A couple of things that I did come across here, and I'll skip the standard Japanese stuff, there's something called -- and this, again, it's -- maybe I just misunderstood it, it's cast in the contrast with the standard Japanese-Basic design, but it says, addition of automatic data checking to computer-based procedure system, it's noted that this is a US-APWR-specific change from the computer-based system of the US-Basic HSIS described in reference whatever.

Automated data checking has been added to specifically reduce human performance errors when executing procedures.

So, what is -- I mean we didn't -- this, to me, says it's something different from what we talked about this morning. So, what is that?

MR. HALL: Okay. What we found when we were inputting data into the computer-based procedure system that there started to become concerns that was the data, in fact, correct or not? Was it updated? Was the data correctly displayed in it?

So, now, the US-APWR has a process of confirming that the data that's imported into the CDP is correct.

And, what I mean by that is the CBP, for US-APWR will say check that the pressure is greater than X and it will have imbedded in it what the pressure is now being measured at.

CHAIRMAN STETKAR: In where? I mean I understand if I pull up on the operational VDU that I know what pressure is --

MR. HALL: It'll be imbedded in these computer-based procedure systems.

CHAIRMAN STETKAR: That's a much different construct from what I understood -- much different construct.

MR. HALL: And the -- can I go further?

CHAIRMAN STETKAR: Isn't it? Because, as I understood it, the computer-based procedure -- as I understood, maybe I was wrong -- for the generic design, for the Topical Report, you'd bring up procedure sections. It's essentially a replicate of the paper-based procedures. You push on a procedure task that opens up a screen or over on your operational VDU with the stuff that you need to operate in there.

It didn't have this interaction of --

MR. HALL: No, it didn't in the basic. And, again, we're now venturing into this design process as we're moving forward.

On the new CBP, it has the ability when it asks the operator to check a number, rather than having the operators look around either the LDP or go into the displays on his side to basically have that value that says check this pressure. The pressure value's sitting next to it on the CBP, on the computer so you don't have to look for it.

And, again, design process now, so this is not completed design, please. I'm --

CHAIRMAN STETKAR: No, no, no, but it's functionally different from what I understood the --

MR. HALL: It's an enhancement of what was there and it's one of these, you know, when you run tests there are certain changes you can make that are quick and there are certain changes like this one that take a lot of design effort to do it. It requires -- starting to entertain larger computer-based procedure screens, multiple procedures on it. But, these are -- this is that process.

And, when the US-APWR is done, it will be in that document. So, you know, I'm venturing into soft areas now.

MEMBER BLEY: When we say in that document, we mean? I know it'll be in the computer, but when you just said when it's all done it'll be in that document?

MR. HALL: Oh, no, I'm sorry.

MEMBER BLEY: What document?

MR. HALL: What did I mean?

MEMBER BLEY: Maybe you didn't mean to say what you said?

MR. HALL: No, I didn't. I'm sorry, no.

MEMBER BLEY: What did you mean to say? It'll be in the computer?

MR. HALL: In the computer, yes. I'm sorry.

MEMBER BLEY: So, it'll be on the screen so that'll all be one integrated --

MR. HALL: But, please, the last few things I said are design process.

MEMBER BLEY: Now, this process will go on after you get --

MR. SPRENGEL: After certification.

MEMBER BLEY: After certifications?

MR. SPRENGEL: Correct.

MEMBER BLEY: So --

MR. SPRENGEL: Following --

MEMBER BLEY: You can't --

MR. SPRENGEL: -- the implementation.

MEMBER BLEY: You can't keep Chapter 18 up to date with the design process, period, until you get done sometime later?

MR. SPRENGEL: We keep in alignment with Chapter 18, yes. So, that's why he's kind of alluding to the specific implementation of it and why there's not necessarily a graphic or anything because the actual implementation is much more involved and much more detailed.

And that will definitely take some time and any other improvements that may be found, you know, could be implemented over time as well in accordance with what's been given in Chapter 18.

MEMBER BLEY: The plans that are in 18 --

MR. SPRENGEL: Right.

MEMBER BLEY: -- essentially? Okay.

CHAIRMAN STETKAR: Tell me about GOMS. In -- that didn't even get a rise from anybody, it's getting late.

In the task analysis methodology, there is reference made to the use of the Goals Operators Methods and Selection Rules, GOMS, theory of cognitive skills involved in human computer tasks.

And, somehow that process is used in the task analysis to determine that, indeed, everything is fine.

And, as best I read through all of that, and there are things like it says, well, I breakdown all of these tasks into I need to look at a display and that takes me 50 to 200 milliseconds, so I can use 200 milliseconds of that and I have to do that seven times so, I have to assign 1,400 milliseconds for those things and I'm okay. And I --

This strikes me as something I've never heard about. It's from something that was published in 1983 and it strikes me as it would be nice in terms of thinking about human beings as calibrating instruments with tolerances and taking an upper bound on the uncertainty of a tolerance, but it's not clear how it, to me, how that supports a task analysis.

So, could you explain how all of that supports a task analysis? And, I couldn't, for the life of me, figure out how it's actually being used -- going to be used.

MR. HALL: Okay. I'm going to have difficulty giving you the level of data you want because of my preparation at this time. But, I can say the following, that the operational sequence diagrams and the GOMS fit together.

CHAIRMAN STETKAR: Yes, they do.

MR. HALL: Both of those are standard approaches in the human factors industry.

CHAIRMAN STETKAR: I'm sorry, I understand operational sequence diagrams, I guess I'm not a standard human factors guy because I don't know about this counting up milliseconds.

MR. HALL: Okay, let me finish then.

CHAIRMAN STETKAR: Okay.

MR. HALL: GOMS was used originally in the military and it was used for human computer-type activities. It was not used for going out and calibrating necessarily a valve or something like that. But, it was an attempt to get a handle -- the original concept was of, not ours, but the original developers of it, an attempt to get a handle on how does one develop the time it takes to see an indication, process it, determine an action and take an action?

CHAIRMAN STETKAR: I get a push a button, eat a banana-type response. I'm talking about a complex task analysis in evolving scenario.

MR. HALL: That's correct.

CHAIRMAN STETKAR: All right.

MR. HALL: But, that complex task analysis is broken down to very, very, very simple steps such as how long does it take to determine that I have this kind of event going on in the plant?

And, if you look at the chart, that table in the task analysis is how it does it.

The GOMS associated with the diagrams is the starting point for the SMEs to then determine timing of an event. And then, later on in the task analysis, that timing, because we're trying to work out workloads, and later on in the task analysis, basically, situational factors or multiplication factors are added to the amount of time that's needed so we can compare the time we feel is going to be required to do something versus the time the plant has to take that action. And that lets us work out the workload.

So, it's this cascading set of tools to come up is this is a high workload, medium, low workload situation?

And, then we have rules in the task analysis that say depending on whether it's high, medium or low should this be relegated to automation? Should it stay as a human activity? Et cetera.

And, that's the process.

CHAIRMAN STETKAR: You do, and it's almost impossible to get -- you do have those rules and I can't find them right here and it's kind of irrelevant of what the actual numbers are.

But, to me, it's impossible to get a medium workload because there's only a very, very, very narrow window of a couple of numerical increments to get medium. So, you either determine that manual is fine or you need to automate it.

And, there's a bias toward automation and I just don't know what this is doing for me because I'm counting up, I think, milliseconds under things and inferring that a task is simple because this thing tells me I can do it in 2,780 milliseconds and I have two hours to do it because all I need to do is push a button and eat a banana 17 times.

I don't know how this relates to actual task analysis in the context of a scenario is what I'm really confused about. And, maybe it all works out okay, but I'm just a bit worried because the task analysis is a really important part of the process.

MR. HALL: I can't answer better than I just did.

CHAIRMAN STETKAR: I don't know, maybe the staff -- is the staff -- we're kind of thin on staff people, but is the staff familiar with the process? I mean have you had experience? Have you audited task analyses that have actually been done this way and come out with reasonable conclusions?

MR. WARD: I'm not aware of any. But, I've personally have not been involved in that.

CHAIRMAN STETKAR: Okay. Well, maybe we need to think about it a little bit.

MEMBER POWERS: Well, it is used in the military applications.

CHAIRMAN STETKAR: Is it used in military applications for complex evolving scenarios or is it more of a, I hate to use the term, push a button, eat a banana or the gunner, you know, giving some indication how long do I have before I press the trigger.

MEMBER POWERS: You're asking me about combat situations, I don't know. But I do know in a nuclear weapons position --

CHAIRMAN STETKAR: Okay.

MEMBER POWERS: -- about activities there. And now, our experience base in people trying to take away nuclear weapons from us and use them in a purloined basis is substantially thinner than our database on severe accidents.

So, you ask me how good are the estimates and I struggle to do that very much. They do run red head exercises and things like that with it and it is used as an input into how to refine responses.

What the manpower that you need to up standoff design basis threats and whatnot.

CHAIRMAN STETKAR: Okay.

MEMBER POWERS: And, the quality of those things, I mean a lot of that is in the eyes of the beholder, if you're looking. I mean, as with all human activities, looking for three decimal point accuracy, you're just not going to get it.

CHAIRMAN STETKAR: Well, the thing that -- I mean I read through it, I'm not at all familiar with the methodology, had never heard of it and I didn't have enough time to go do a lot of self-education.

But, there's an example that's worked out in one of the documents that I read that says, well, here's a task analysis for reactor operators to confirm safety injection, reactor trip and turbine trip. Okay? Typical, you know, kind of things.

You go through the process and he gets nine of number one type things, 18 of number two type things, one of number three type things and you add them all up and it's 2,230 milliseconds or 2.23 seconds to do that.

Okay, under what conditions? What kind of scenario? Two point two-three seconds is kind of fast given the fact that I was sitting there and nothing is happened in the last 30 years of my life and suddenly something happens, I guess maybe none of you have been in that situation.

So, I'm curious about what value-added this apparently quite complex and numerically precise 2,230 milliseconds gets me in terms of a real task analysis kind of challenging how much time in a scenario is required to accomplish these tasks?

MEMBER BLEY: But, your concerns --

CHAIRMAN STETKAR: The diagrams help me because they help me understand the combinations of identification cognitive response manipulation type things. How many of those types of things do I need to do in a series in parallel action.

So, laying out those diagrams is -- seems to be a really useful function. But then, parsing it down into nine things of a hundred milliseconds a piece --

MEMBER BLEY: But, where were the examples? I didn't see them.

CHAIRMAN STETKAR: Okay, yes, you had to ask. So, I'll dredge it up.

They are in -- they happen to be in MUAP-07007-P, Revision 5. The previous revision of the Topical Report. They're in Section 5 point --

MEMBER BLEY: That's good enough.

CHAIRMAN STETKAR: I can find it here -- Section -- but a section that has been removed because it was part of the human factors engineering part of that formal report, Section 5.4.3.2 or something like that. It's in Section 5.10 basically.

MEMBER BLEY: I didn't see that. I've seen sometime in the past, you know, the way it's talked about in Chapter 18 is just in terms of the GOMS operators selection which kind of you see they're laying out in basic things in the task analysis but --

CHAIRMAN STETKAR: And the --

MEMBER BLEY: -- if they're claiming that kind of accuracy --

CHAIRMAN STETKAR: The current version of the task analysis --

MEMBER BLEY: I don't know what this example was that's in one of your previous documents.

CHAIRMAN STETKAR: The current version of the task analysis implementation program does not have those examples. It just says we're going to use -- I checked it to see, oh, are they still going to use this GOMS approach or not and it says, yes, we are and just gives you a reference to the original 1983 research that's done. And it's extracted this numerical example that was useful to me earlier.

MR. HALL: In the task analysis, GOMS is a starting point and your concerns about stress levels, other things going on, competing activities the operator may have are all very, very well taken and are not handled by GOMS.

CHAIRMAN STETKAR: Okay.

MR. HALL: GOMS is a starting point and there are rating factors and adjustment factors that scale those numbers, usually in the upward direction, to come up with the final times of time required to take action, not time available, but time required.

So, that's why the matrices are relatively complex when you get into -- continue?

CHAIRMAN STETKAR: Yes.

MR. HALL: When you get into the waiting factors, we start introducing expert opinion because these are, I think we talk about three operators that are licensed operators with experience that have to start saying, is this highly complex, is this highly challenging and they scale the values of timing in the upward direction to account for things like that.

CHAIRMAN STETKAR: But, I think, Bob, a

little bit of what I'm concerned about is it does sound to me like a very, very (a) complex process that, (b) derives numerically very precise values that are then examined and weighted and scaled and things.

And, I think the concern is by implying that this is a very precise process and giving people weights and criteria that if something comes up with -- in two values then it might be manual or it might be automatic. Or, if it's outside one is manual, one is automatic implies a heck of a lot of precision and a heck of a lot work and I'm concerned about maybe missing something that a less numerically focused add, multiply, divide, count, count, count process might actually capture better.

MR. HALL: I don't believe the documents attempt to imply that this is a highly accurate down to X decimal point activity.

CHAIRMAN STETKAR: Okay.

MR. HALL: So, I think that might be a misunderstanding or misinterpretation of the methodology.

The methodology does bring to the table in what we attempt to do a very, very structured way expert opinion, people that have been there and done it to be able to evaluate what the important tasks are and how human handle those tasks. That's all I can say.

CHAIRMAN STETKAR: Okay, okay, thanks.

Bear with me now because I have finally gotten to the point where I can't find anything anymore, so I need to --

And, there's a statement in here, again, under task analysis, and this in the implementation plan document for task analysis that says staffing. If the task is executable within the defined minimum operator staffing for plant operating modes and for stabilization after abnormal conditions, with the exception of conditions that lead to severe accidents, and within the assumed maximum operating staffing for shutdown modes, stabilization for beyond design basis conditions and to achieve stabilization for conditions that lead to severe accident record acceptable and document the basis for this conclusion.

Why, I get the minimum operating staff, I have no problems with that for plant operating modes and abnormal conditions. Why do I, when I'm doing this evaluation, get to assume that I have the maximum number of people available when I'm in shutdown modes or beyond design basis conditions or conditions that are progressing to the severe accident? Like, why do I get to -- in fact, I'm instructed to do that?

MR. HALL: The maximum number is talking about for modes 3 through 6, I guess go beyond the minimum assumptions coming in of one RO and one SRO.

The staffing analysis, that's one of the implementation plans, has an incoming assumption of what -- how many people will be available in the control room during those other activities, not modes 1 and 2.

When that's referring to the maximum number, it's talking about the values coming out of the staffing analysis that are above the operating crew of one and one, one SRO, one RO.

CHAIRMAN STETKAR: Okay, those words are on the record, I don't understand what you said. So, let's try this again.

During power operation, I understand that the minimum staffing is one RO and one SRO in the control room with another RO and another SRO floating around there some place.

During shutdown, there will also be a staffing analysis and, in many plants, that staffing analysis justifies fewer bodies in the control room.

But, you're saying I can credit the maximum number of bodies that I can find for this analysis. Why is that? I mean the analogy would be why can't I credit you like 12 people or something like that during power operation because I can count up the maximum number of people that might be around during power operations?

I don't get why I get to credit the maximum number of bodies simply because I'm in shutdown modes or stabilization for beyond design basis conditions.

For example, if I have a beyond design basis earthquake during power operation, if I have a design basis earthquake, I have to do the analysis for one and one. But, if I have a beyond design basis earthquake, I can credit a whole bunch of other people for being there. I don't get it.

MR. SPRENGEL: We'll follow up on that question.

CHAIRMAN STETKAR: Okay, thanks.

And these are things that I kind of ask you to highlight between what I understood for the standard stuff and what I can read referenced in US-APWR.

Under, and this is in the DCD under the HSI change process, it says configuration of operator managed trend displays and operator managed alarms. Operators can configure new trend displays, and I know that, that's a really good feature, and new alarms that are not pre-configured in the HSI design.

Is that -- because I had not heard about operators configure -- what is the operator configured alarm function and is that a US-APWR something specific or is that the Topical Report US-Basic function?

Because I hadn't heard about it until I came to here that the operators could configure alarms. Like I want an alarm when it's time to go to dinner or something like that. I mean, you know, being --

But --

MR. SPRENGEL: We'll follow up on that question.

CHAIRMAN STETKAR: Follow up?

The only reason I bring this up is if the validation process is supposed to test the adequacy of the HSI inventory and part of that is the alarms and part of that is the prioritization function. And then, we're giving the operator the ability to go in and muddle with all of that stuff, it's not at all clear to me that the operator muddling, if they can do that, might somehow perturb all of those really, really sophisticated algorithms that are doing all of that smart things to take me down from a thousand alarms to the key 25 or so that I need to be careful about.

MS. SPRENGEL: So, the impact to the priority logic?

CHAIRMAN STETKAR: That's the primary thing that I'm concerned about is, if the operators are given the ability to establish new alarms and, in principle, to set their priorities, does that somehow perturb all of that built in logic that the operators probably are not intimately familiar with in terms of how the algorithms set those priorities.

MR. SPRENGEL: Okay. And, one of your questions, that's definitely part of the US-APWR scope.

CHAIRMAN STETKAR: It's the only place I could find it was in DCD Section 18.7.3.3 under the change process. And that is US-APWR. I found no mention of it in the Topical Report whatsoever.

MR. WARD: There is a statement in that paragraph, the operator configured HSI does not change any pre-configured HSI.

CHAIRMAN STETKAR: It does not change any pre-configured HSI. I don't know -- you're right. But I don't know what that means.

So, if the operator says, well, I think because of the plant status these days, I think an alarm on whatever ought to be really important, so I'm going to now establish -- I need an alarm on what -- I don't have an alarm on whatever. Or, I need to somehow change a priority on the whatever alarm. I don't know what it says its meaning that it doesn't change any per-configured HSI.

MR. SPRENGEL: We can check on that. I think this is limited to the trend displays. So, if you have a trend display --

CHAIRMAN STETKAR: Trend displays, I have no problem at all.

MR. SPRENGEL: And I think it's a setting like an alarm here if you're watching a trend, not an overall, it's only in that aspect.

CHAIRMAN STETKAR: I don't know. I mean I looked at this, obviously, in the context of the alarm VDU and the prioritization that's gone on with all of those alarms.

I have no problem at all with trend, you know, I'd really like the ability for the operators to configure their own different trend displays and set what they wanted to.

MR. SPRENGEL: I think that was the intent.

CHAIRMAN STETKAR: Okay.

MR. SPRENGEL: And then, it would go away when you got rid of the trend display. But, we'll check.

CHAIRMAN STETKAR: Okay.

MR. SPRENGEL: In the most recent submitted DCD rooted in the information material, not actual --

CHAIRMAN STETKAR: Whatever it is, yes.

MR. SPRENGEL: -- it does not have that feature.

CHAIRMAN STETKAR: It does -- thank you. I would not have asked the question with new -- whatever that new thing is. Thanks, thanks.

Trend -- it does still have the trend display configuration, though, right?

MR. SPRENGEL: We'll follow up on that information.

CHAIRMAN STETKAR: Well, I mean if -- I sure hope --

MR. SPRENGEL: I'll follow up on the whole package of discussion that we're -- let's keep capturing.

CHAIRMAN STETKAR: Okay, okay.

And I think I only have one more. No, I don't have any more. I'm not going to belabor that, I'm done.

And, serious, I mean I have a lot of picky things here, but they were answered pretty much.

Do you folks have anything more? You want to follow up --

MR. SPRENGEL: I will risk bringing, I think, two items up.

CHAIRMAN STETKAR: Okay.

MR. SPRENGEL: Well, the first one, it's an answer, it's a response and I think it is how it is.

I just want to revisit, I think your understanding is correct in terms of the plus/minus alarm indication. So, there is new logic as a say a level is dropping, you know, as it reaches a set point and then a margin -- the deviation --

CHAIRMAN STETKAR: Well, I mean it'd typically be called a deviation --

MR. SPRENGEL: Right.

CHAIRMAN STETKAR: -- on the set.

MR. SPRENGEL: And so, with that deviation, you're either on the positive side of the set point or the negative side of the set point.

CHAIRMAN STETKAR: Yes.

MR. SPRENGEL: So, as the level is dropping, you would first hit the positive side of that deviation and then you would fall below the set point and you'd be in the minus portion of the deviation. And, if it continues to drop, obviously, now we have trend indication.

CHAIRMAN STETKAR: Yes.

MR. SPRENGEL: Continues to drop, you'd hit your low level and then your low, low level.

CHAIRMAN STETKAR: The L would pop up and then the LL would pop up.

MR. SPRENGEL: So, although I understand, you know, the negative/positive implying rising, lowering, there is logic in terms of the progression and why a plus and a minus is there. And I guess the best answer would be that the operators would also become familiar with those symbols.

And now, there's the added feature of the trend indication on to I think clarify the package of information.

CHAIRMAN STETKAR: The trend indication helps me a lot. But, the way it helps me is that sitting here at a table having this discussion with a static thing with arrows on it, I can say, yes, that's going to help me.

And, basically, I'm going to ignore anything that's plus and minus because that's confusing to me and I'll look at arrows.

Not clear to me when things are actually changing and I've got four steam generators with a couple levels swinging up and down and a couple of levels going down and I need to make decisions about what I need to do with main or emergency feed water or things like that.

MR. SPRENGEL: Right. And it's fair --

CHAIRMAN STETKAR: Then, I might get tricked.

MR. SPRENGEL: Right, but in that circumstance, I think the focus is, again, on the alarm and the trend, you know, and whatever other information is going on --

MEMBER BLEY: I'd throw --

MR. SPRENGEL: -- and not necessarily the detail of the plus and the minus specifically.

MEMBER BLEY: I'd throw in something just for you to think about because it's easy to sit here and say, well, the detail of the plus and minus, I'll throw that away. But when --

MR. SPRENGEL: Oh, no, no, no, don't throw it away.

MEMBER BLEY: When we're tossed into a situation where we're responding, funny things tend to happen and I'm recalling just as an anecdote, a case where in a plant I was involved in and a major change in the design and in some of the instruments --

Somebody's phone is going off.

CHAIRMAN STETKAR: Who has their phone on the table?

MEMBER BLEY: Major change which led to major changes in procedures and our very -- the problem occurred afterwards with our very best operators, the ones who really knew the plant.

And, what would happen because I was then standing watch as an oversight place where you can see all the different things going on in different places. When you'd have an emergency, despite a year's worth of training on all the new procedures in the simulator, everything where we knew how this stuff worked, something would go wrong and you'd watch the guy and the new ones had no trouble.

The guys that were deeply trained and really knew it beforehand, somehow their brain would flip back to the old plan and you'd watch a minute and you'd call up and you'd say, hey, Dave, why'd you do that? And he'd tell you and you'd say, you're operating the old plant. And he'd say, oh my God.

So, these things get in your head and they don't go away very easily. So, just think about it.

MR. SPRENGEL: Okay. I think it's fair and usable feedback.

CHAIRMAN STETKAR: Yes. There have been -- I mean there have been studies done that people say that, you know, going clockwise gets more because everybody is trained that a clock, the numbers get bigger this way, so you don't, for example, make clockwise things get less.

That, as I said, if you're, you know, this is obvious that you don't make -- invert a level gauge so that the thing goes up as the level goes down. And people are used to seeing plus as meaning bigger and minus is meaning smaller. And they're not used to thinking about changes in a trend of a deviation getting lesser or bigger in the direction --

MR. SPRENGEL: But, it's not a change in the trend, it's within the upper portion of the set point.

CHAIRMAN STETKAR: Yes. And --

MR. SPRENGEL: So, within the deviation of the measurement, so it's not a trend at all.

CHAIRMAN STETKAR: But, it's reversed because if you look at the way it's laid out, it says that if level is deviating low, your example is actually wrong.

MR. SPRENGEL: If the level is within the lower deviation --

CHAIRMAN STETKAR: If level -- I have a set point.

MR. SPRENGEL: Right.

CHAIRMAN STETKAR: And if level is above that set point, I'm fine.

MR. SPRENGEL: Plus.

CHAIRMAN STETKAR: And, no, it's not plus.

MR. SPRENGEL: That's what I'm explaining, it is --

CHAIRMAN STETKAR: It's minus there. It's minus there. Level -- actual level is greater than the set point gives you a minus, actual level is less than the set point gives you a plus.

MR. SPRENGEL: Okay.

CHAIRMAN STETKAR: At least according to the --

MEMBER BLEY: The notes on that, yes.

CHAIRMAN STETKAR: -- the notes on that display.

MR. SPRENGEL: Okay. For the example in the --

CHAIRMAN STETKAR: In the DCD.

MR. SPRENGEL: -- in the report? Okay.

CHAIRMAN STETKAR: In the report.

MR. SPRENGEL: Okay. The other --

CHAIRMAN STETKAR: I don't know whether it's the DCD or the -- it's the Topical --

MR. SPRENGEL: Right. I think it's --

CHAIRMAN STETKAR: It's the Topical Report.

MR. SPRENGEL: I think it's, yes, the Topical, correct.

CHAIRMAN STETKAR: Because it has those examples.

MR. SPRENGEL: Lock.

CHAIRMAN STETKAR: Lock?

MR. SPRENGEL: And there's a question of -- we've gone through the tortured path of the operator taking those actions and that it forces thought on -- we have confirmation that lock will override and stop the pump.

CHAIRMAN STETKAR: Okay, good. It --

MR. SPRENGEL: Because it would have priority over like the ECCS signal --

CHAIRMAN STETKAR: Yes.

MR. SPRENGEL: - to protect operators or --

CHAIRMAN STETKAR: But, you do also, just for the record here, you do also -- do you also have confirmation that to enable that function on the operational VDU, the operator must actively enable it from the safety VDU?

MR. SPRENGEL: Absolutely, yes.

CHAIRMAN STETKAR: Okay.

MR. SPRENGEL: Yes.

CHAIRMAN STETKAR: I just -- I wanted to make sure we had that on the record.

MR. SPRENGEL: Okay. The other thing I'd like to do, not necessarily enjoyable, but I do want to review what I have captured, just so that we're clear, in terms of actions that we have taken.

We will plan -- we will work with the staff, of course, on this in terms of revising the Topical Report or other documentation to be clear about the Phase IB testing that was done.

Understanding that there is some information out there which may or may not be adequate, that will be reviewed and supplemented as an active submittal.

We will also update the Topical Report with the information as discussed today about the SRO and STA VDU to bring the images and the description of the Topical Report into alignment with what was discussed today.

We will provide information on a more -- we'll provide information on the reason behind the slow mode control.

We will provide information -- we'll need to work with the staff and continue, I think, discussion on the discussion about the block override BISI, the outstanding RAI on the I&C side. So, that's not --

CHAIRMAN STETKAR: Yes, I understand there's an RAI on that.

MR. SPRENGEL: That's an ongoing discussion.

CHAIRMAN STETKAR: Yes, that's not particularly focused on that part of it.

MR. SPRENGEL: And then just this final portion, we will provide information on the reason behind differences in evaluating against the minimum staffing versus maximum for the different operating modes in the task analysis.

And then, also, we will follow up and confirm in relation to the HSI change process in terms of the operators configuring new alarms. It appears that has been removed. We'll follow up on that in more detail.

And then, also, the confirmation of operators being able to configure trend information.

CHAIRMAN STETKAR: Yes, because that part of the process, I thought was pretty cool and I really like that because operators tend to like to see how fast and the directions things are going. And so, I hope that hasn't been somehow sort of lost.

MR. SPRENGEL: And that --

CHAIRMAN STETKAR: And, there may be other things as you go through the transcript, but I think you've probably captured --

MR. SPRENGEL: I'm pretty confident in capturing this.

CHAIRMAN STETKAR: Yes, you are. I think everything else was resolved, clearly.

Now, before we -- we have a couple of things to do here and I'll do them on the record and then we'll go off the record and discuss a little bit more of logistics.

First thing that I need to do is ask if there is -- we need to get the -- I don't know if there's anyone on the bridgeline, but we need to at least find out whether there is, Girija, if you can do that.

Is there anyone in the room who has any comments that you'd like to make? If you want to, come up and do so now.

We'll see if there's indeed anyone out there on the bridgeline who might have weathered all of this and would like to say anything. Is it open, Girija?

If there's anyone on the bridgeline, can you do me just a favor, if you're out there, just say hello or something so that we confirm that the line is open?

Okay, it sounds like the line is open, I hear rumbling. So, if there's anyone out there who would like to make a comment, please identify yourself and do so.

Okay, hearing none, we'll presume that no one wants to.

What I'll do, this is a little bit of a departure, but only because of the order that we did things.

Bill, do you have anything to say from the staff because we beat you up a little bit here and didn't give you a chance to come back up and defend yourself? So, is there anything else you'd like to supply on this?

MR. WARD: No, I think Paul acknowledged that there were some things he'd like to change in the SER and we'll just look at what we've heard today and see what we might change.

CHAIRMAN STETKAR: Okay. Is there -- now, as we typically do, we'll go around the table and see if any of the Member have any final comments you'd like to make and I'll start with the unusually quiet but every esteemed Dr. Powers. Steve?

MEMBER SCHULTZ: I thought the discussion was excellent today and really did appreciate the presentations as well as the dialogue that we have had. So, I think a lot was accomplished with all of the effort that has gone before the meeting and also in the meeting today. Thank you very much.

CHAIRMAN STETKAR: Joy?

MEMBER REMPE: I don't have any additional comments, but I also appreciated the presentations.

CHAIRMAN STETKAR: Thank you.

Ron?

MEMBER BALLINGER: Yes, this was the first time I've read anything like this. I'm a metallurgist, so and I --

CHAIRMAN STETKAR: Hence the quote on bending metal. You will never live this down.

MEMBER BLEY: But it had to be there.

MEMBER BALLINGER: Actually, my name is Roland.

But, I found it remarkable. I mean I was up until 1:30 in the morning reading this stuff and everything. It's the first time I have had exposure to this. And so, in spite of the fact that it'll probably take me the next 25 years to live down the metal part, I found it a fantastic experience. It was a great presentation.

I have been present at some of the

earlier ones from MHI which I did not find so interesting, but actually I didn't find them so good, but this was great. So, thank you very much.

CHAIRMAN STETKAR: Dr. Bley?

MEMBER BLEY: I had a lot of things that I learned today that I probably couldn't have learned any other way. No further comments, though, thank you. It was good day.

CHAIRMAN STETKAR: And, in summary, this has been probably a really painful day for the folks up front here.

I think, I'll act with Dennis, I think that, for me, it was really, really useful. I did -- I learned technical things that I certainly, obviously, did not understand from all of the stuff that I read, regardless of, you know, whining about the vintage of different documents and things like that, I think it was really useful.

And, it certainly helps me to understand the design and how it evolved to where it is right now. So, I know it was painful, but I thank you very, very much for putting up with our questions and comments, and, in fact, being, you know, really, really open and honest and answering this stuff for us.

After we close, I'd like to get together with Ryan and Bill and figure out, you know, a path forward in terms of schedule and process and things like that, but we don't need to do that on the record.

So, if there is nothing else, miraculously, before 6:00, we are adjourned.

(Whereupon, the above-entitled matter went off the record at 5:55 p.m.)

Presentation to ACRS Subcommittee Chapter 18 & HFE Topical Report

August 20, 2015

Mitsubishi Heavy Industries, Ltd.

Presenters

Lead Presenters

Ryan Sprengel, MNES

Kenji Mashio, MHI

Robert E. Hall, MHI/RTS

Technical Experts

Takae Yamashita, MHI

Katsuhisa Takaura, MHI (over bridgeline)

Takayuki Mori, MHI (over bridgeline)

Contents

1. Structure of the submittals

Document Lists (1/2)

DCD

#	No.	Rev.	Document Title	Issue Date	Submittal Date	MHI Ref.
1	-	4	DCD	Aug. 2013	Sep. 10, 2013	UAP-HF-13212
2	-	0	DCD Revision 4 Update Tracking Report	-	Mar. 14, 2014	UAP-HF-14025
3	-	-	DCD Markup - DCD Tier 1 Section 2.9 Markup - DCD Tier 2 Chapter 1 Markup - DCD Tier 2 Chapter 18 Markup	-	Jun. 4, 2014	UAP-HF-14042

Topical Reports and Technical Reports (1/2)

#	No.	Rev.	Document Title	Issue Date	Submittal Date	MHI Ref.
4	MUAP-07007	6	Human-System Interface System Description	May 2014	Jun. 4, 2014	UAP-HF-14042
5	MUAP-09019	5	Human Factors Engineering Program Management Plan	Aug. 2014	Aug. 22, 2014	UAP-HF-14047
6	MUAP-13005	1	Operating Experience Review Implementation Plan	May 2014	Jun. 4, 2014	UAP-HF-14042
7	MUAP-13007	1	Functional Requirements Analysis and Function Allocation Implementation Plan	May 2014	Jun. 4, 2014	UAP-HF-14042

Document Lists (2/2)

Topical Reports and Technical Reports (2/2)

#	No.	Rev.	Document Title	Issue Date	Submittal Date	MHI Ref.
8	MUAP-13009	1	Task Analysis Implementation Plan	May 2014	Jun. 4, 2014	UAP-HF-14042
9	MUAP-10008	4	Staffing and Qualifications Implementation Plan	May 2014	Jun. 4, 2014	UAP-HF-14042
10	MUAP-13014	1	Human Reliability Analysis Implementation Plan	May 2014	Jun. 4, 2014	UAP-HF-14042
11	MUAP-10009	4	Human-System Interface Design Implementation Plan	May 2014	Jun. 4, 2014	UAP-HF-14042
12	MUAP-10012	4	Human Factors Verification and Validation Implementation Plan	May 2014	Jun. 4, 2014	UAP-HF-14042
13	MUAP-10013	4	Design Implementation Implementation Plan	May 2014	Jun. 4, 2014	UAP-HF-14042

MHI Internal Documents

#	No.	Rev.	Document Title	Issue Date	Submittal Date	MHI Ref.
14	JEJC-1763-1001	2	HSI Design Style Guide	May 2008	-	
15	7DS-UAP-20140002	0	Operating Experience Review Results	Aug 2014	-	

Topical Report

Human-System Interface System Description,

MUAP-07007, Revision 6, May 2014

Purpose/Key issues

- Document and obtain an approval of the US-Basic Human-System Interface (HSI) System (HSIS), incorporating HEDs identified through testing performed with U.S. licensed operators
- Introduced US-Basic HSI simulator
- Formed the foundation of the HFE Implementation Plans (IPs)

Technical Reports

The US-APWR HFE submittals prior to design certification cover the HFE program management plan (PMP) and 8 HFE element IPs;

- HFE Program Management Plan
- Operating Experience Review (OER)
- Functional Requirements Analysis and Function Allocation (FRA/FA)
- Task Analysis (TA)
- Staffing and Qualifications (S&Q)
- Human Reliability Analysis (HRA)
- HSI Design (HD)
- Verification and Validation (V&V)
- Design Implementation (DI)

1.2 Technical Reports (2/3)

- The PMP and IPs address specific HFE activities and provide detailed methodologies for addressing review criteria
- The PMP and IPs each follow the same outline as defined below;

  Section 1: Purpose

  Section 2: Scope

  Section 3: Methodology Overview

  Section 4: Methodology

  Section 5: Implementation Team

  Section 6: Results Summary Report Content

  Section 7: NUREG-0711 Compliance Evaluation

  Section 8: References

1.2 Technical Reports (3/3)

- HFE activities related to procedure development and training program development are addressed by programs discussed in Chapter 13, Conduct of Operations

COL Items

- COL Applicants address the HFE requirements associated with Human Performance Monitoring

For audit

Following supporting documents were not docketed but audited by NRC staff;

- HSI Design Style Guide
- OER Results

1.4 Future Submittal & ITAAC (1/2)

Results summary reports will be submitted following the completion of each HFE activity;

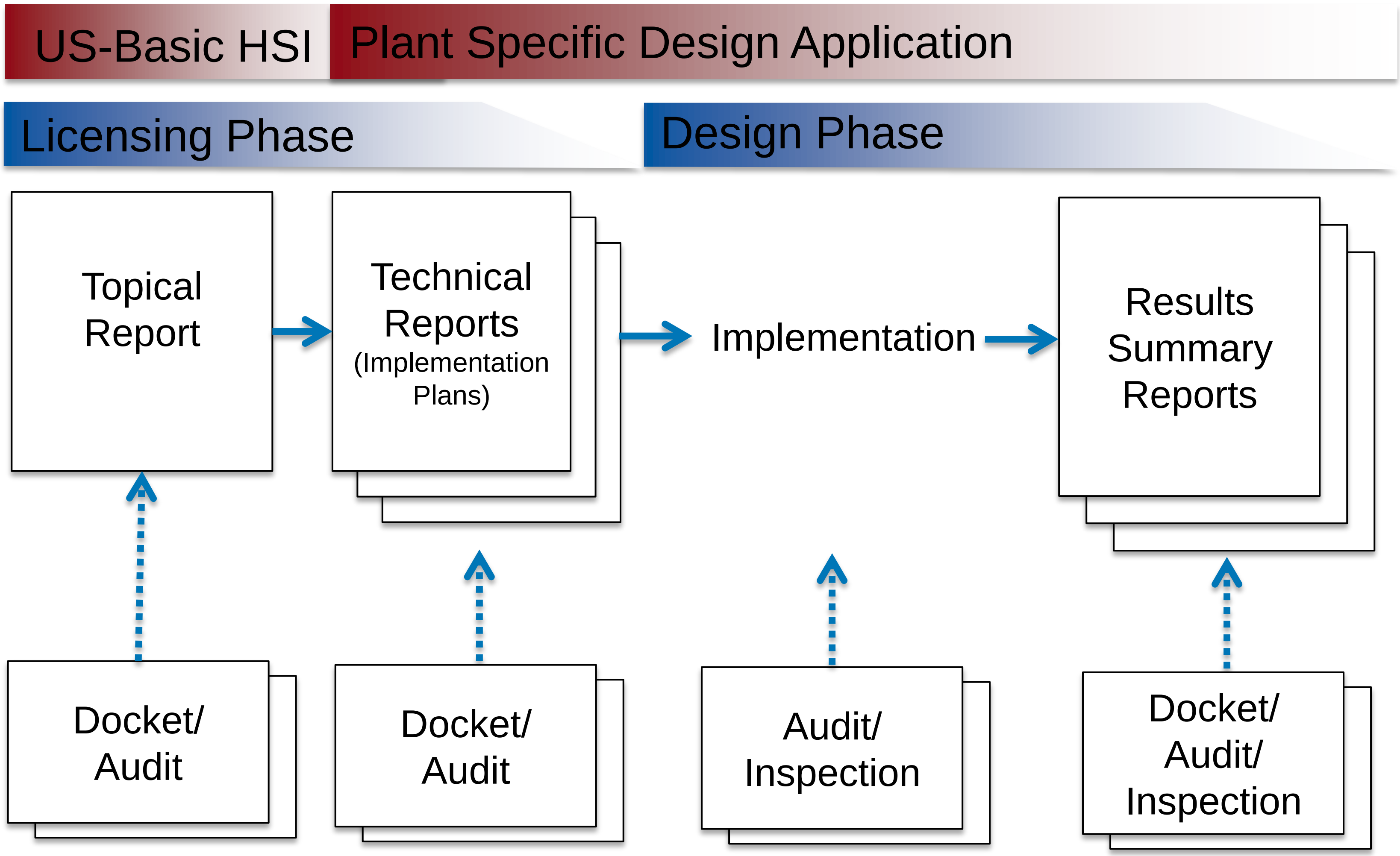
- OER (The Basic HSIS OER completed)
- FRA/FA
- TA
- S&Q
- HD
- V&V
- DI

1.4 Future Submittal & ITAAC (2/2)

ITAAC, DCD Tier 1 Section 2.9 Table 2.9-1 (UAP-HF-14042)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The Control Room design incorporates human factors engineering principles that minimize the potential for operator error.	1. An Integrated System Validation (ISV) test will be performed in accordance with the Human Factors Verification and Validation implementation Plan.	1. All pass/fail criteria associated with each test scenario are passed either on initial performance of the scenarios or following remediation of failures.
2. The as-built Control Room Human-System Interface is consistent with the final validated design specifications.	2. An inspection of the as-built Control Room Human-System Interfaces will be performed.	2. The as-built Control Room Human-System Interface conforms to the validated design with no configuration deviations.

1.5 Summary of Document Structure



2. US-Basic HSI

Documentation of US-Basic HSI features and functions

- Submitted as a topical report, MUAP-07007

The document structure:

- Concept of Operation
- Control room layout
- Display overview and display navigation
- Operational VDU display
- Safety VDU
- Alarms

2.1 Documentation (2/2)

- Computer-based procedures
- Large Display Panel
- Automatic Checking of Actuations
- Diverse HSI Panel
- History of Development of Japanese PWR Main Control Room by Mitsubishi and Japanese PWR Power Utilities (Appendix A)
- HFE V&V Experience in Japan (Appendix B)
- US-Basic HSIS Evaluation Program (Appendix C)

2.2 Background/Development Basis

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Background

- MHI used the foundational elements of the Japanese-Basic HSIS as a starting point to create the US-Basic HSIS, applying combinations of design review, redesign, and design validation through a phased implementation
- Appendix A contains information about the Japanese-Basic HSIS & development history
  - Developed Japanese-Basic HSIS with Japanese utilities from 1987 to 2003 with guidance from NUREG-0711 and NUREG-0700
  - Japanese operators were involved in conducting V&V
  - Introduced Japanese HSIS to Japanese latest plant design and MCR modernization
  - No performance issues identified

2.3 Structure of the HSIS

- The Japanese HSIS, as applied in the U.S., is comprised of;

  - The Basic HSIS

  - The HSI Inventory (i.e., controls, displays, alarms) which will be developed as a part of the plant-specific analysis phase of the HFE design program

- The HSI Inventory is developed as part of the US-APWR DC in accordance with the US-APWR HFE program

2.4 Phased Implementation

Phase 1 (Topical Report scope)

Translated the Japanese-Basic HSIS to the US-Basic HSIS

Phase 2

Develop an application specific (e.g. US-APWR) inventory, which will be combined with the US-Basic HSIS to yield an application specific design

Phase 3

Confirm the site-specific assumptions of Phase 2 and/or make minor site specific changes to finalize the application design

Phase 1

Translated the Japanese-Basic HSIS to the US-Basic HSIS

Phase 1a

- Addressed language, engineering units, anthropometric changes to the consoles for American body types
- Adopted the US-style step-by-step operating procedures
- Made improvements identified from completing the OER program element from NUREG-0711 which included U.S. nuclear plants and additional, generic, digital HSI technology experience

Phase 1b

- Resolved deficiencies from Phase 1a, validated design changes, and updated Section 4 of the topical report (Revision 2) to reflect these changes

- In Phase 1a and 1b, the tests were implemented using the
  - US-Basic HSIS simulator
  - Static portable HSIS analysis tool
- U.S. licensed operators participated in dynamic testing: 8 crews (22 persons in total (Phase 1a)) and 5 crews (10 persons (Phase 1b))
- Went through seven scenarios that included normal and emergency events under normal as well as degraded HSI conditions
- Phase 1a results identified difference between Japan and U.S. operation style and identified design improvements documented via HEDs
- An expert panel (HFE, I&C, plant operations, US-APWR systems engineers) was organized to resolve HEDs
- Phase 1b tested design changes

2.7 The US-Basic HSIS OER

- OE Sources include;
  - NUREG/CR-6400, “HFE Insights For Advanced Reactors Based Upon Operating Experience,”
  - INPO database
  - Japan Nuclear Technologies Institute (JANTI) Nuclear Information Archives (NUCIA) database
  - Issues obtained from non-nuclear industries (similar HSIS technologies) in U.S. and Japan
- Findings were evaluated and included in the US-Basic HSIS

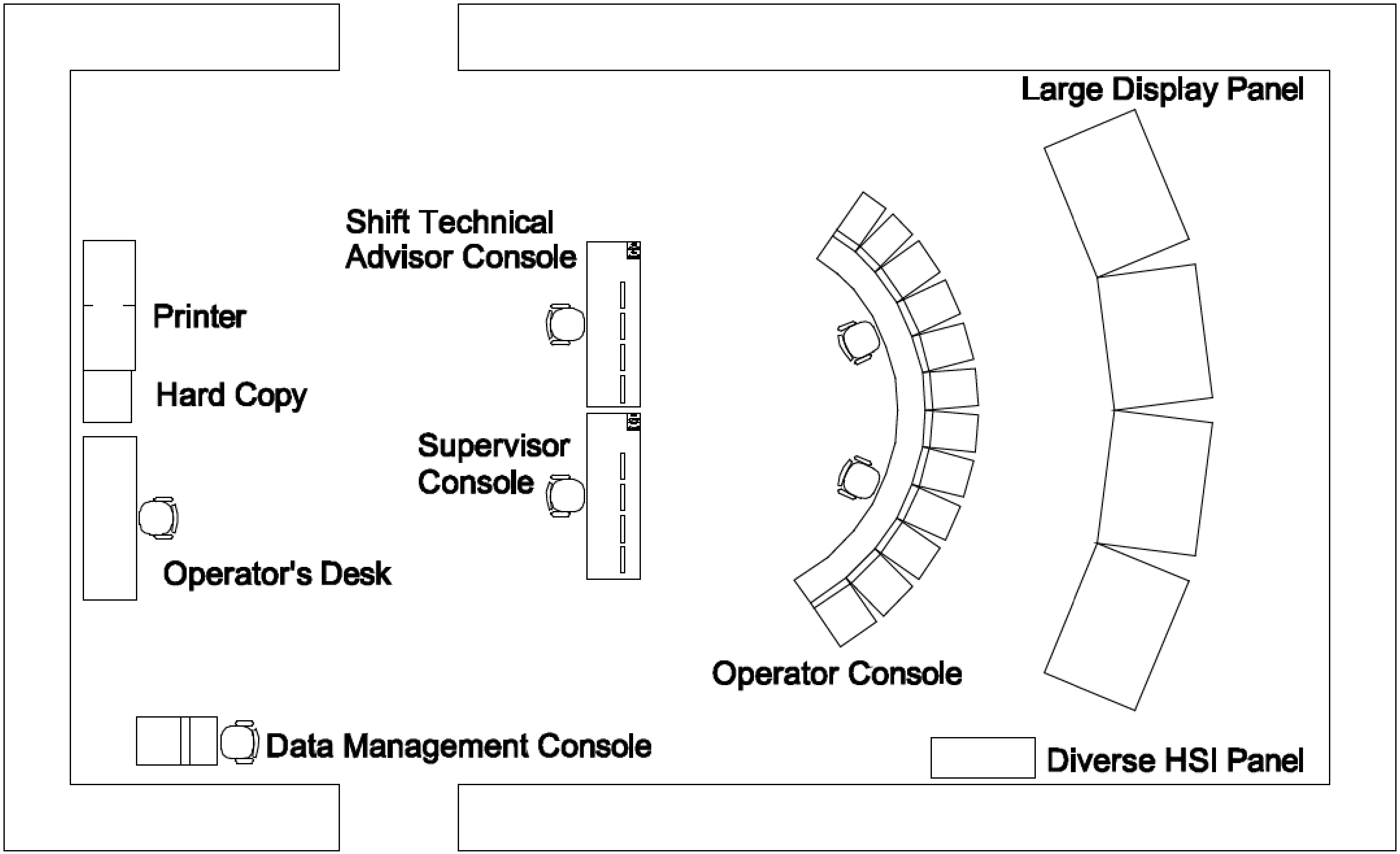
- The concept of operation is addressed in Section 4.1

- The US-Basic HSIS addresses the following subjects:
  - Crew composition
  - Roles and responsibilities
  - Personnel interaction with plant automation
  - Use of control room resources by crewmembers
  - Methods used to ensure good coordination of crewmember activities, including non-licensed operators, technicians, and maintenance personnel

- Operating crew composition
  - The normal MCR staffing consists of one RO and one SRO
  - The normal MCR staff is supplemented by one additional SRO and one additional RO that will be at the plant to accommodate unexpected conditions
  - While the HSIS is designed to support the minimum MCR staffing described above, the space and layout of the MCR are designed to accommodate the foreseen maximum number of operating and temporary staff

The S&Q IP handles further staffing levels for the US-APWR

MCR personnel allocation



2.8.1 Concept of Operation (4/6)

- The computer-based HSIS provides operational visual display units (VDUs) as the fundamental interface. The operator monitors plant status and initiates actions from a VDU by touching or clicking on the appropriate sections of the screen
- The operators workload is significantly reduced by providing relevant process control information in integrated displays on the VDUs and utilizing a compact console that minimizes required operator movement
- The HSIS also provides operational support functions that utilize the computer to consolidate large amounts of data into meaningful displays
- Section 4.1 identifies further specific interfaces and responsibilities between the crew and the HSIS

- Control Room Crew coordination with the HSIS
  - Control Room Crew coordination with the HSIS is described in each HSI design feature
  - The Large Display Panel (LDP) provides Spatially Dedicated Continuously Visible (SDCV) information to the operation personnel to enhance situation awareness
    - Helps operators maintain continuous awareness of overall plant status and critical status changes
    - The secondary purpose is to help the operations staff coordination and communication by providing a common visualization of plant information
  - The Operator Console provides all monitoring and control functions which are available in the MCR so that ROs can perform all operation tasks using the Operator Console from a seated position

2.8.1 Concept of Operation (6/6)

- The Supervisor Console, located behind the RO, provides the same display set as those on the Operator Console, without control functions
- The STA console provides the same display set as those on the Operator Console, without control functions as well
- Each console has paging phones and internal phones to communicate with local staff
- Maintenance console, which is a temporary console (disconnected from the digital data communication bus during normal plant operation) used to support an additional operator in the MCR for tests during plant shutdown conditions and periodic inspections
- Tagging feature on the O-VDU and physical tag for local component are also addressed to support maintenance activities between MCR crew and maintenance staff

US-Basic HSI prototype simulator

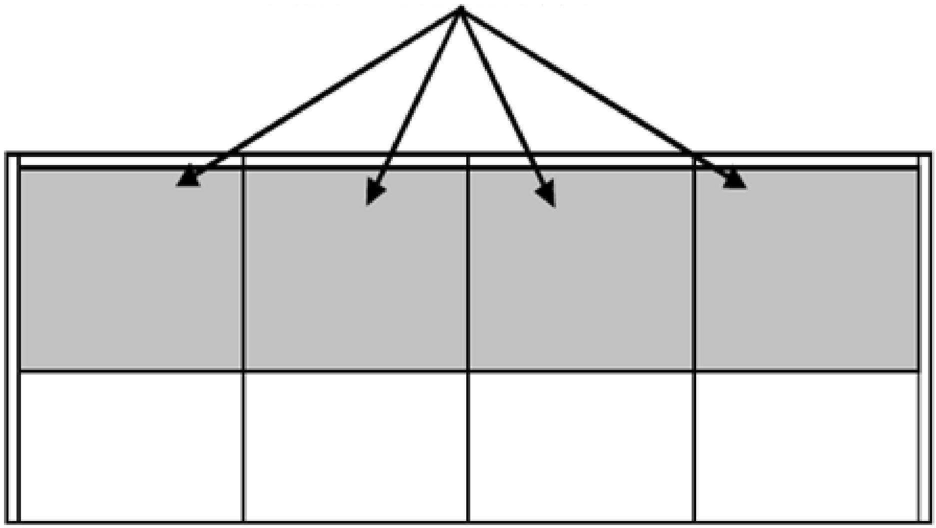
2.8.3 Large Display Panel (1/4)

- LDP provides plant overview information and alarms to enhance MCR staff awareness of the plant status (i.e., presents spatially-dedicated continuously visible (SDCV) critical safety and power production functions with supporting component status and parameters and is the apex of entire HSI information hierarchy)

- LDP provides computer aided operator's support information;
  - i) OK monitors (computer checking relevant component status at Reactor Trip, ECCS, CV isolation, etc.,)
  - ii) Critical safety function status
  - iii) Bypass or inoperable status indication (BISI) along with safety signals (e.g., Reactor Trip, ECCS, CV isolation)

  Additional detailed information is displayed in the O-VDU screens

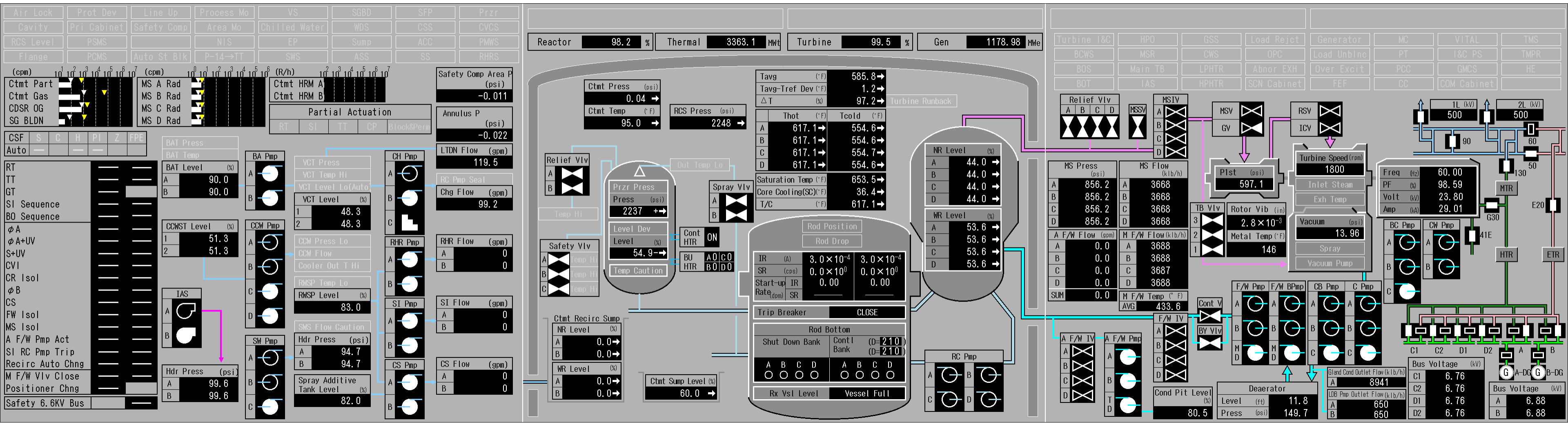
Large Display Screen Panel
(100 inches ×4)



LDP screen display features;

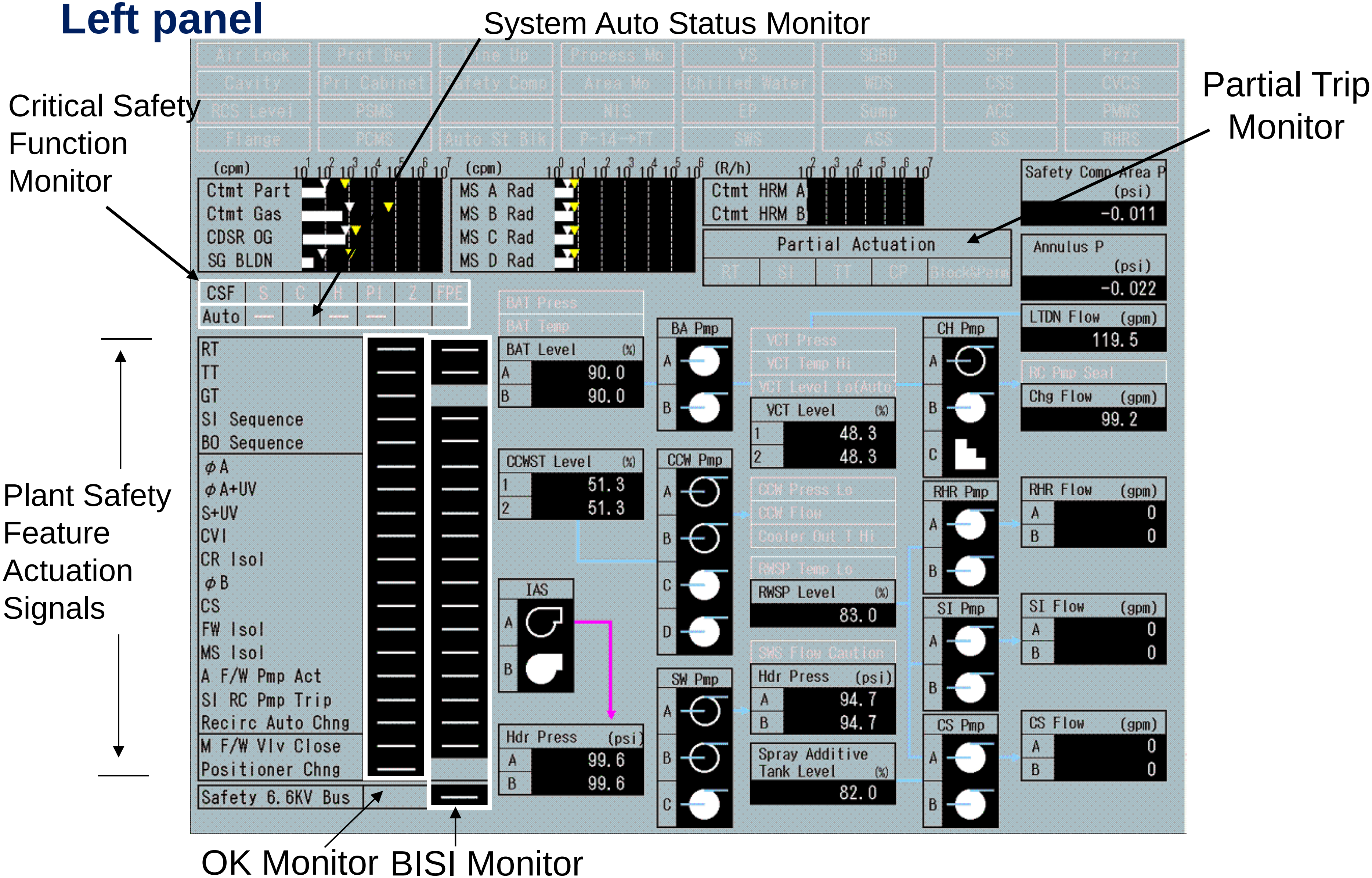
- ➢ Four 100-inch diagonal screens
- ➢ Three screens are fixed
- ➢ One screen is variable and the information displayed can be changed manually or automatically

LDP screen display features (fixed screens)



2.8.3 Large Display Panel (4/4)

Left panel

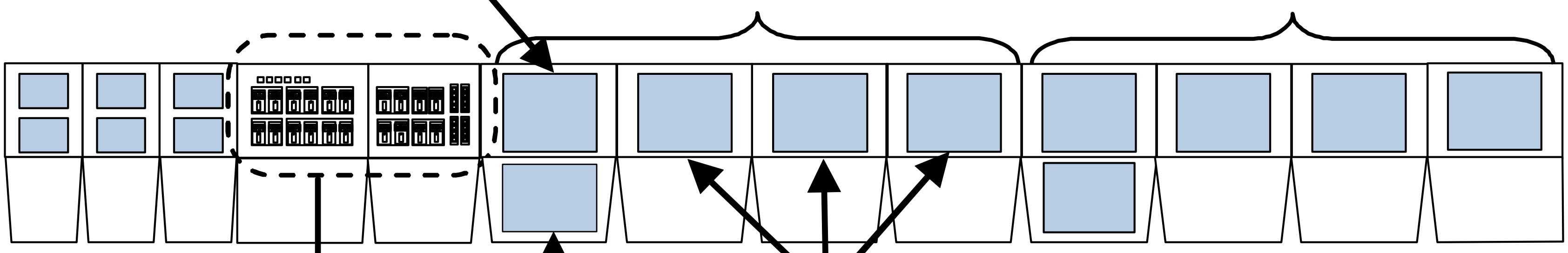


2.8.4 Operator Console Layout

Alarm VDU

A set of
VDUs for RO-1

A set of
VDUs for RO-2



Safety VDU

Executes safety related control & monitoring functions

Operating

Procedure VDU

Operational VDU

Executes all plant control & monitoring functions, including both safety and non-safety systems

System Level Hardwired Switch Area

Used for manual initiation of protective functions
(e.g., Reactor Trip, ECCS, MS Isolation)

2.8 US-Basic HSI Design Features
2.8.5 VDU Configuration

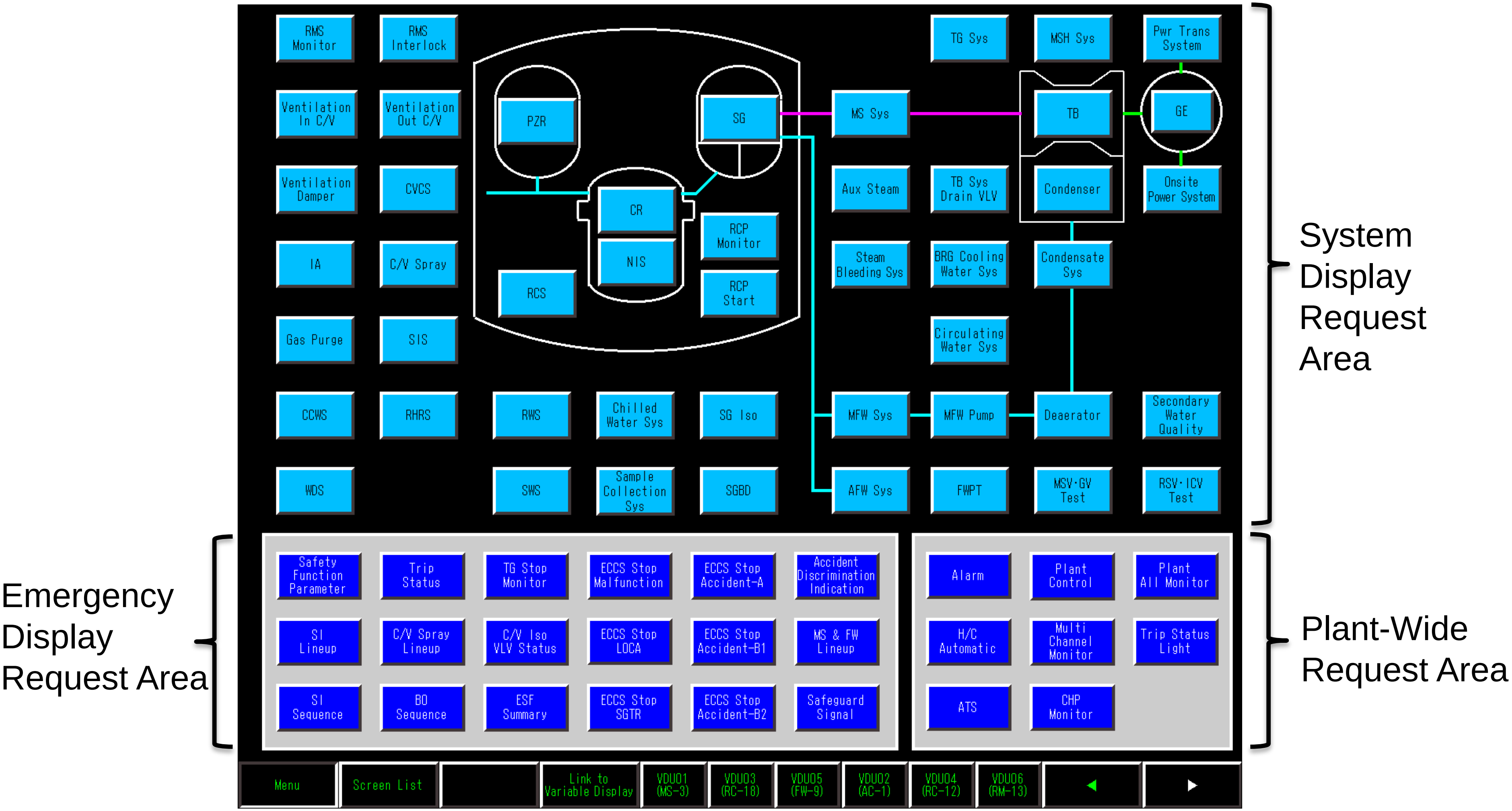
VDU application	Main purpose
operational VDU	To execute all of the plant control and monitoring functions, including control of the safety systems.
safety VDU	To execute the safety-related control and monitoring functions as a backup for the Operational VDU. It can control operation signals from the Operational VDU.
alarm VDU	To acknowledge and display individual alarms using prioritization color codes. Alarm VDU also provides the alarm confirmation/non-confirmation information to the operator.
operating procedure VDU	To provide computer-based operation procedure displays near the operational VDU and the alarm VDU in order to facilitate and simplify the performance of operation procedure.

2.8.6 Operational VDU Screen and Navigation (1/7)

- Navigation considers usability, human errors and human performance improvement
- Plant information and controls are organized in fluid system mimic graphics and modulation controllers are integrated with associated trend graphs
- Dedicated displays to integrate associated parameters and controllers from different systems to support emergency operations and/or specific tasks are pre-designed and assigned as different groups in the top menu screen

2.8.6 Operational VDU Screen and Navigation (2/7)

Top Menu (System-based)



Top Menu (Screen List Menu)

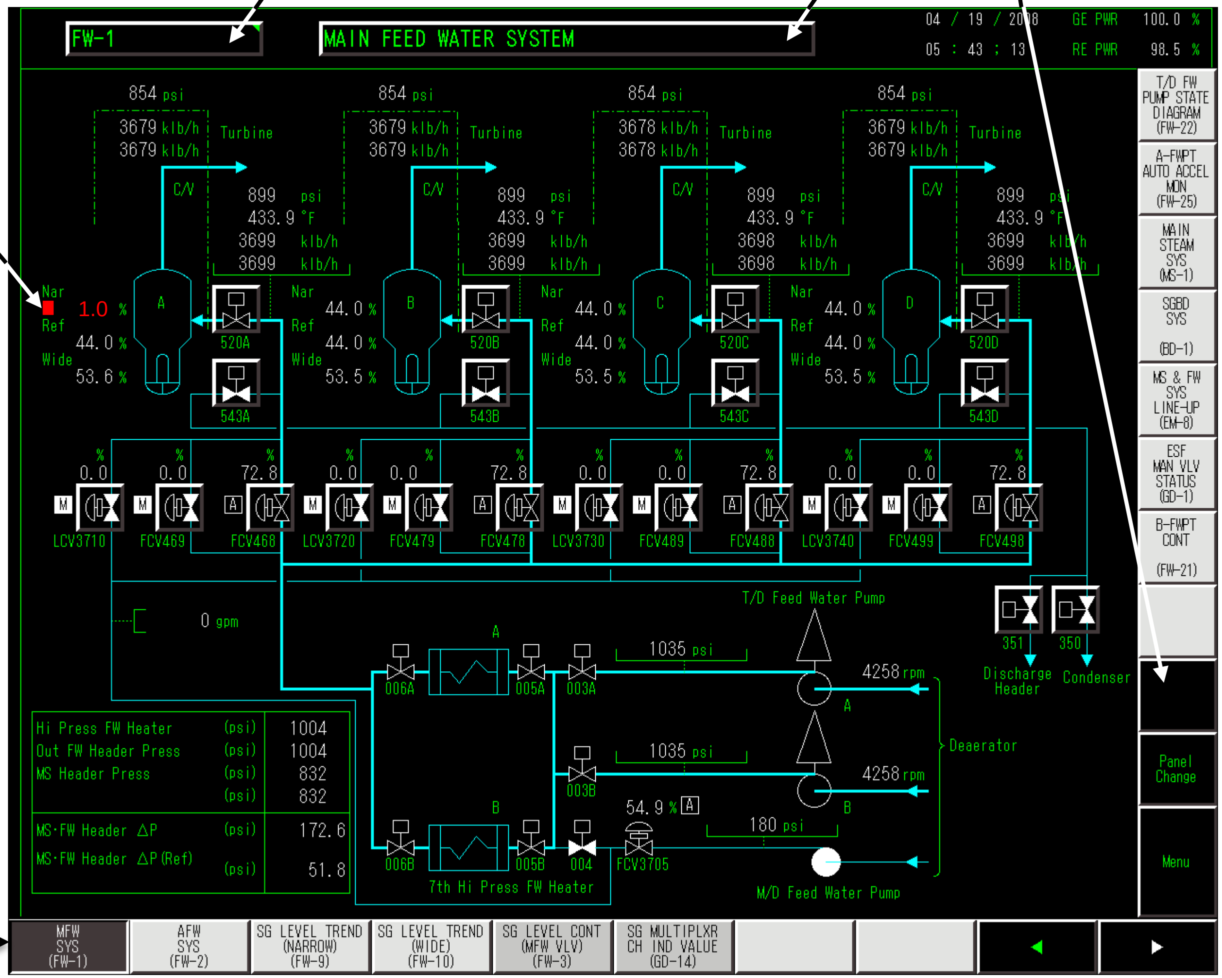
2.8.6 Operational VDU Screen and Navigation (4/7)

Links current screen to Variable LDP

Links screen to sidebar

Alarm Condition

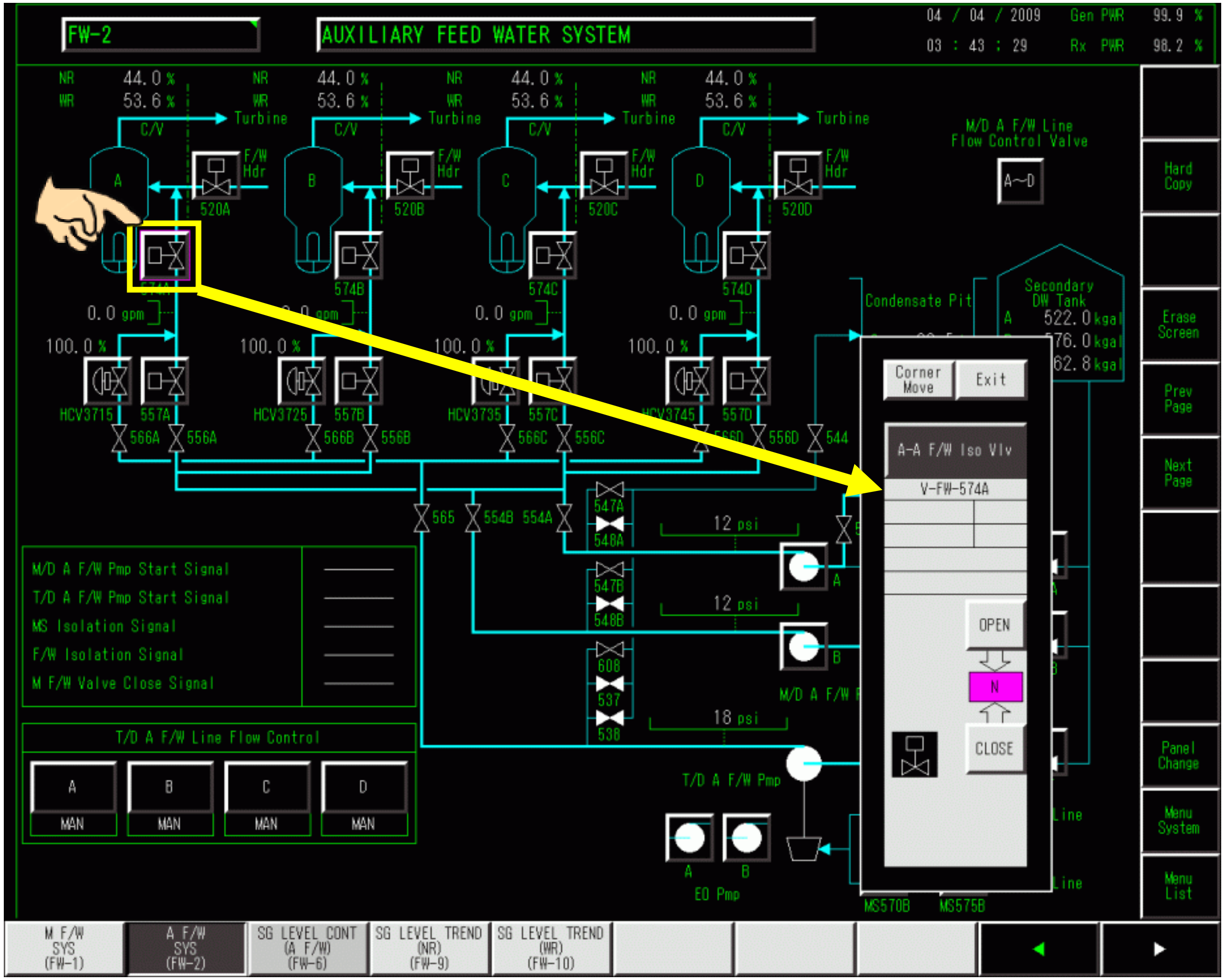
Related select screens not included in the same group from the current screen



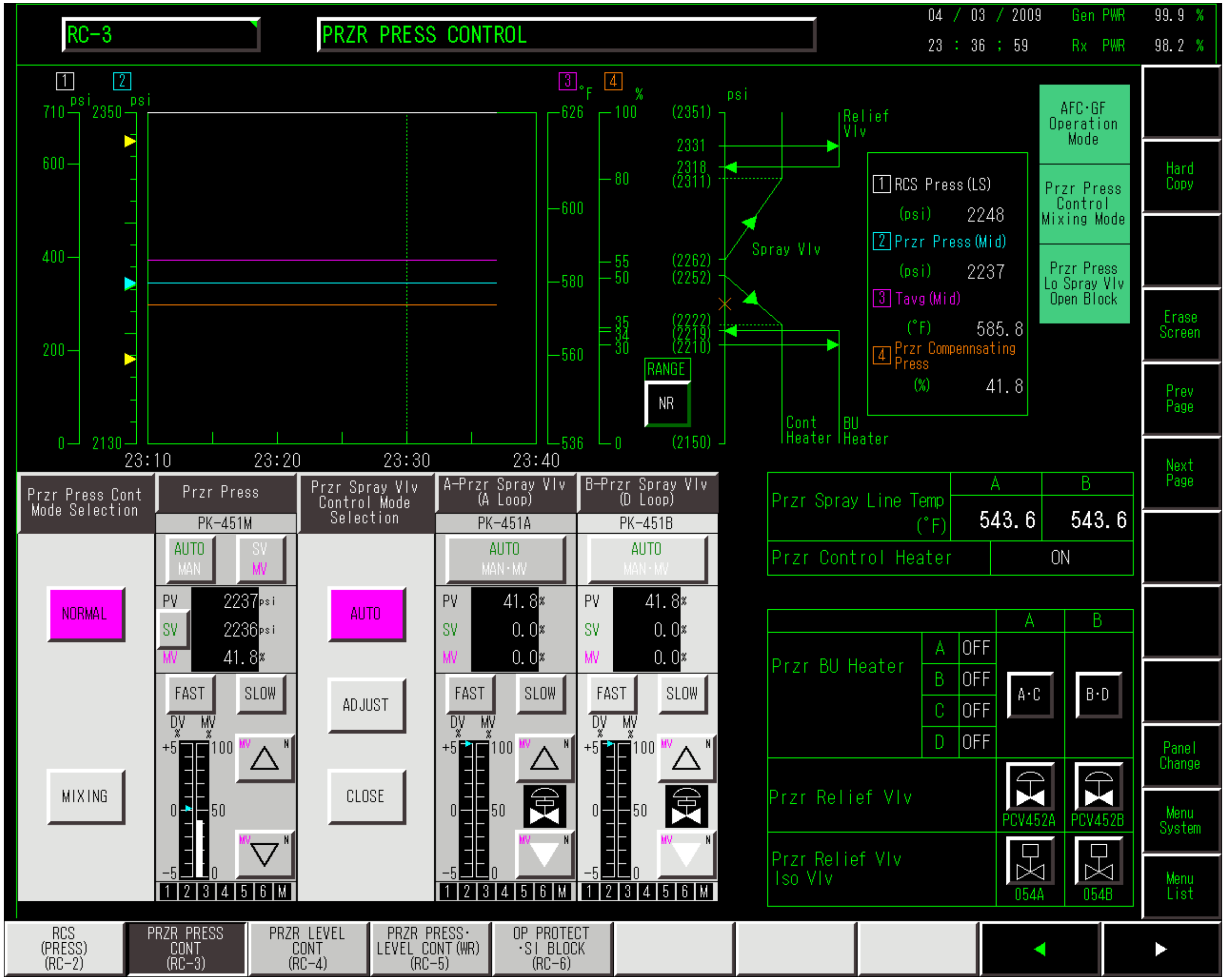
Screen request area for the same display group

Previous/Next screen

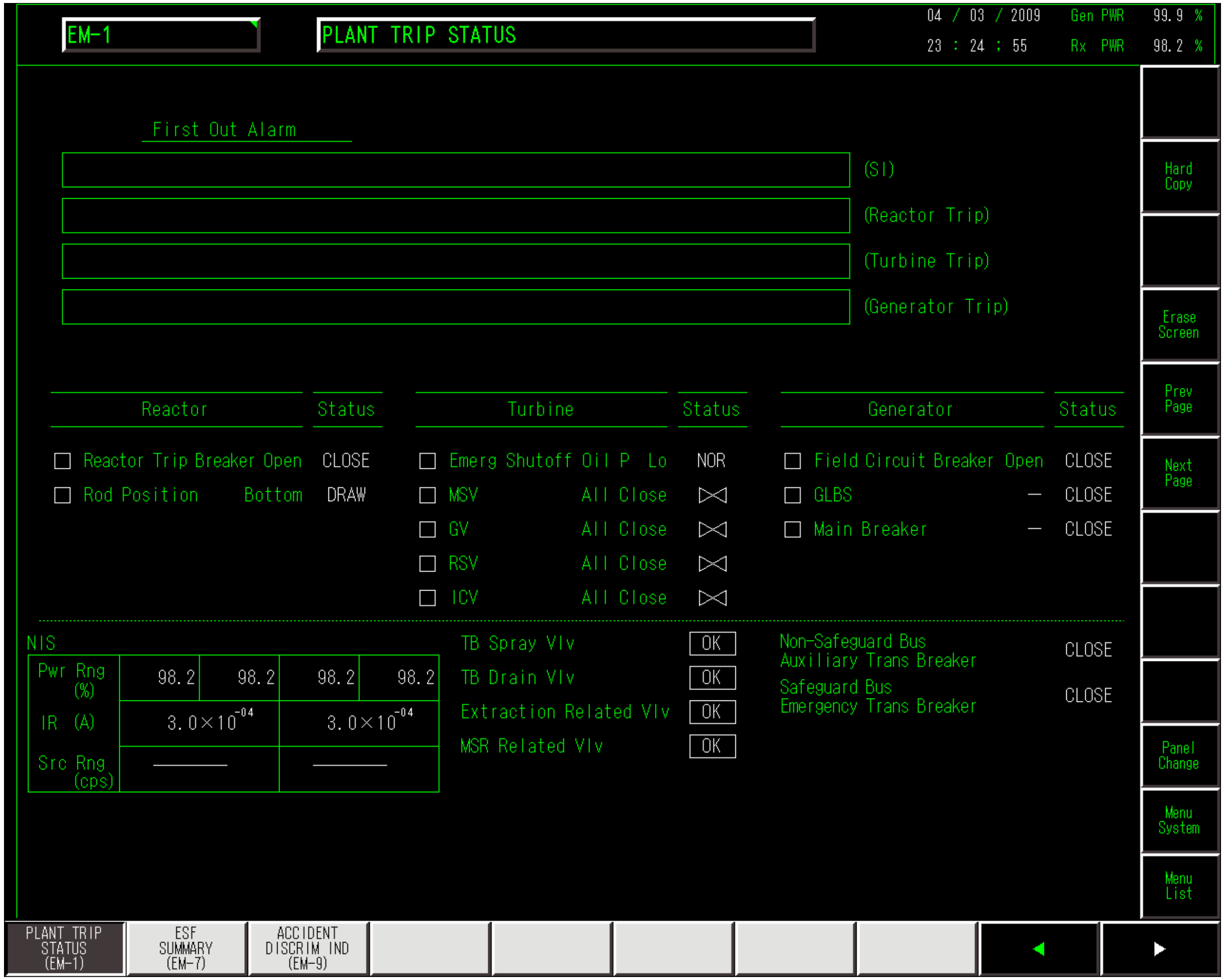
Control station "pop-up"



2.8.6 Operational VDU Screen and Navigation (6/7)



Dedicated Display



Alarm System

- A dedicated alarm VDU organizes and manages all alarms, presenting the alarm list by chronological order, by functional grouping, and providing alarm acknowledge and reset functions
- Alarm status is also integrated in graphical P&ID contents in O-VDU screens
- All alarms are indicated in either LDP dynamic display areas or grouped alarm tiles in LDP
- Alarm presentation has dynamic prioritized color coordination
  Red – Yellow - Green

Alarm VDU Screen

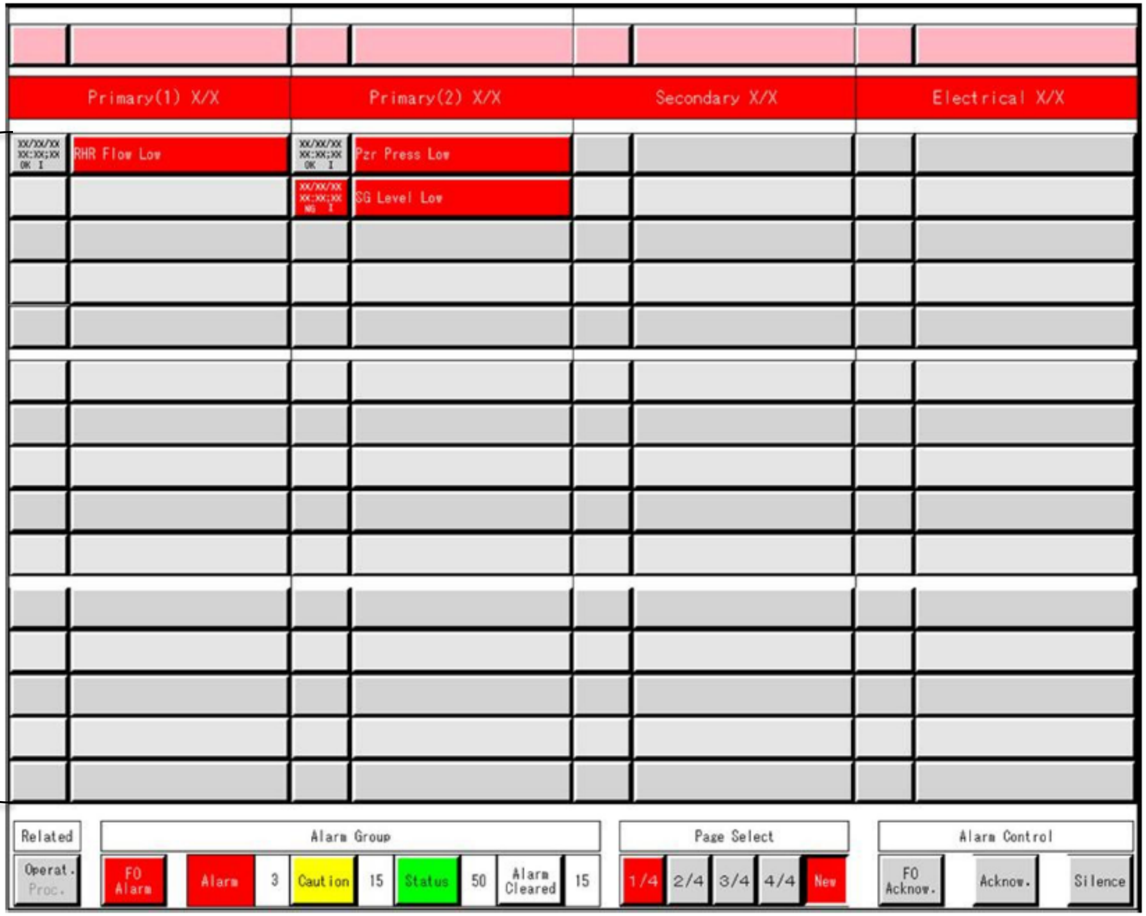
First-out alarms display area

Alarm title area

- "Primary (1)": Primary systems besides (2)
- "Primary (2)": Reactor/NSSS systems
- "Secondary": Turbine system
- "Electrical": Electrical and transmission system

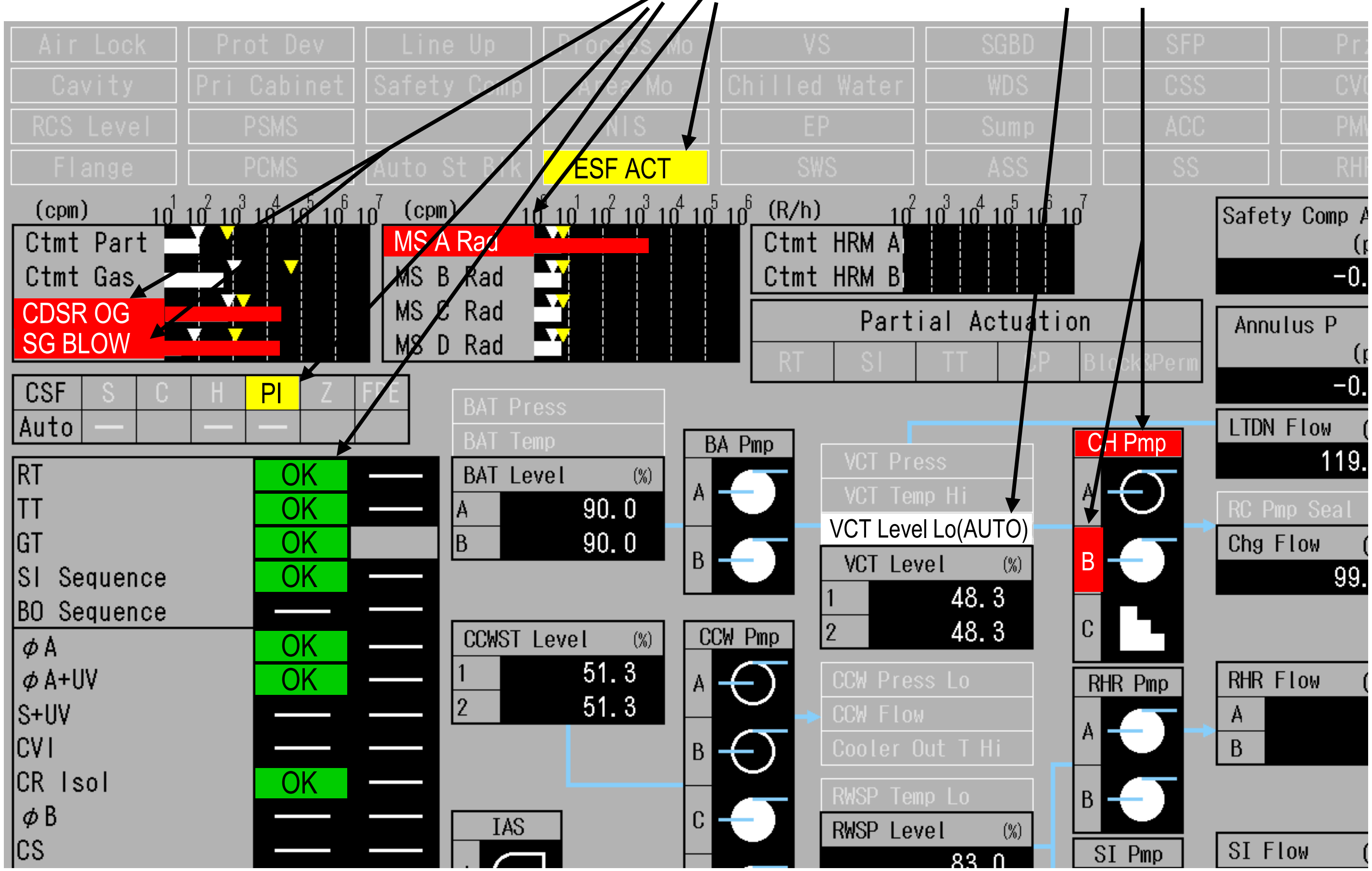
Alarm message display area

Alarm acknowledgement/reset and screen request buttons area



LDP Display

All plant alarms appear in either group alarm tiles or individual parameter titles



- Normal = "Gray Board"
- Icons/tiles typically represent multiple conditions and therefore they display highest priority with re-flash for new alarms

2.8 US-Basic HSI Design Features
2.8.7 Alarm System (4/4)

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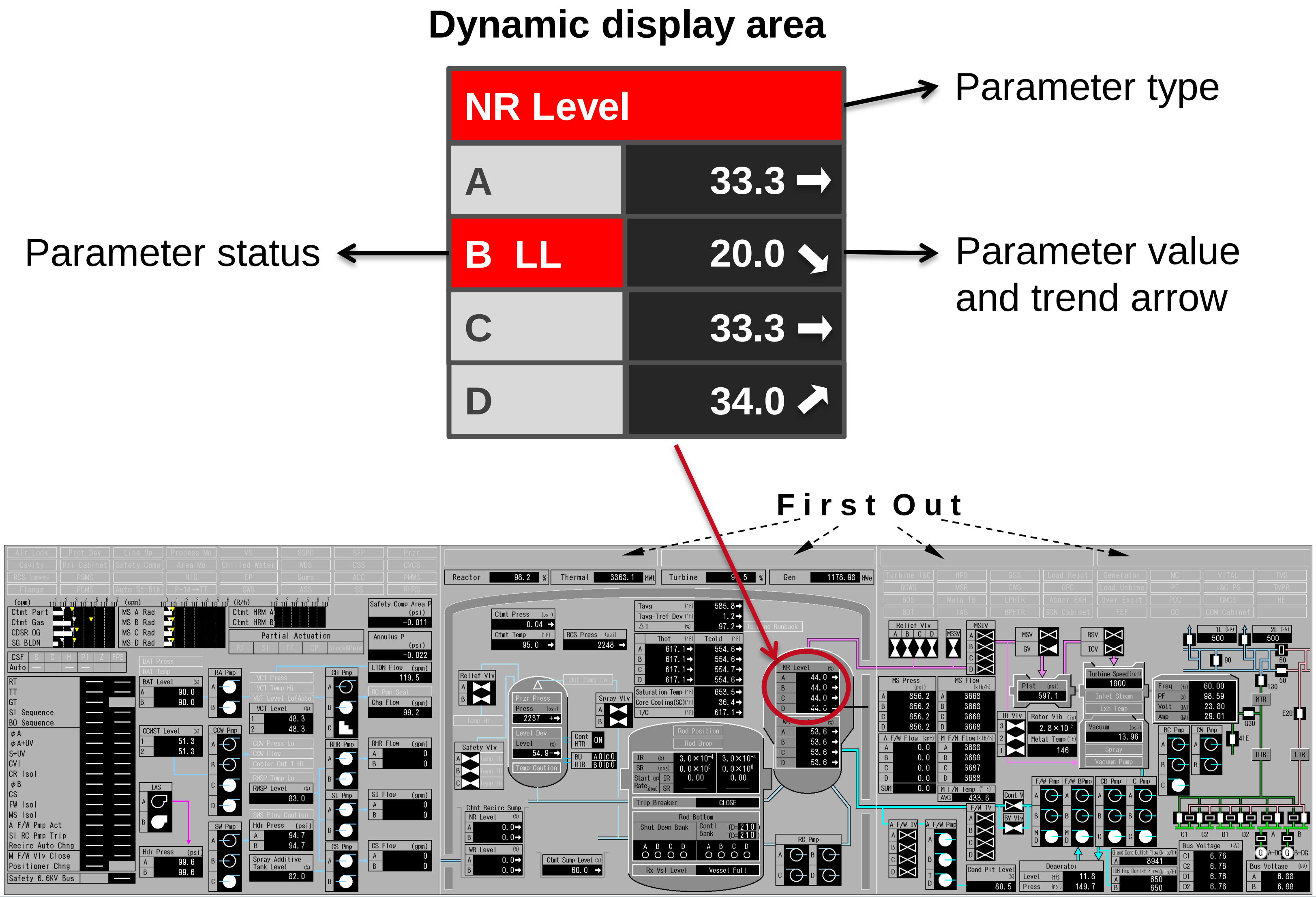
Alarm Display on the LDP

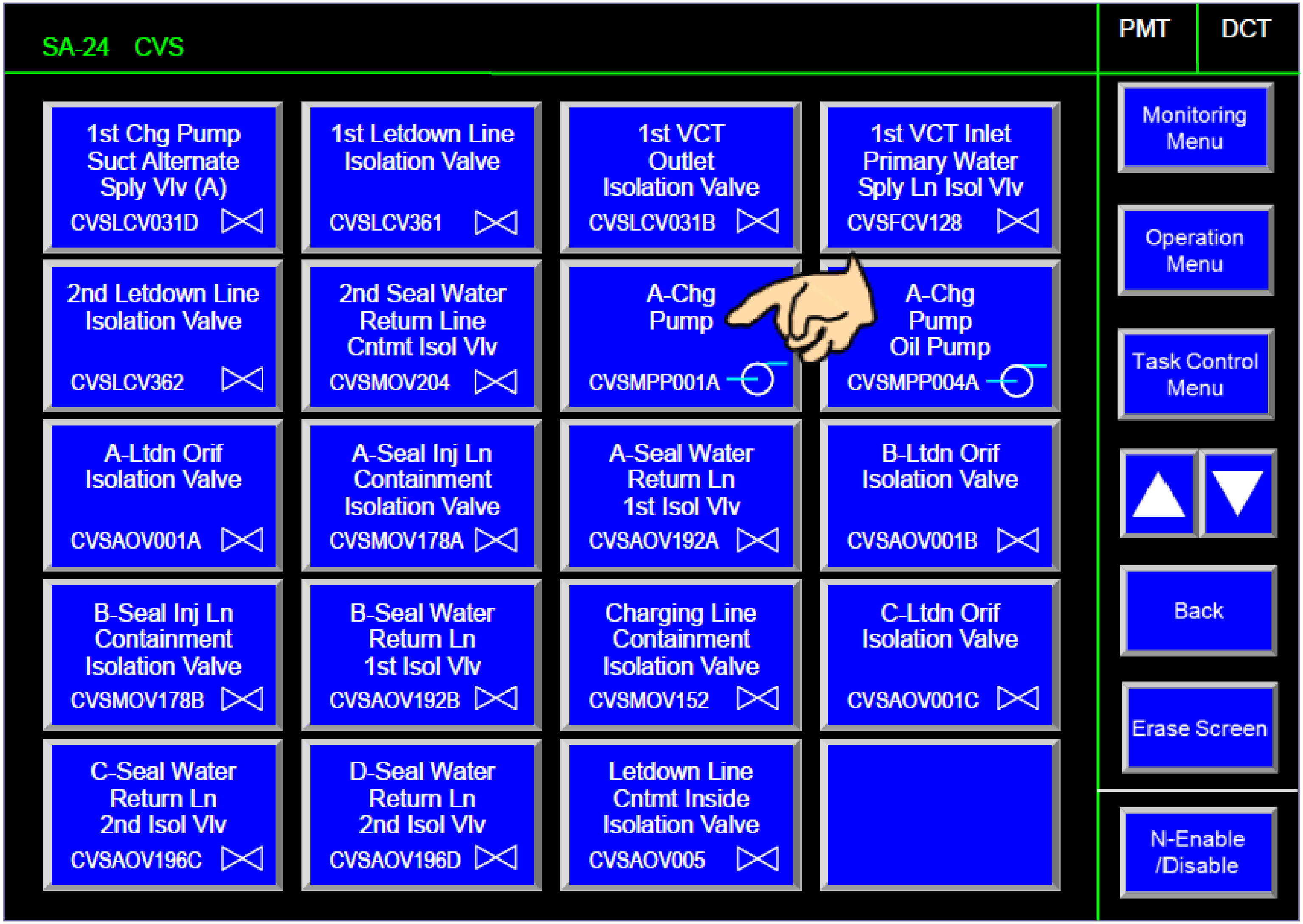


Safety VDU Features

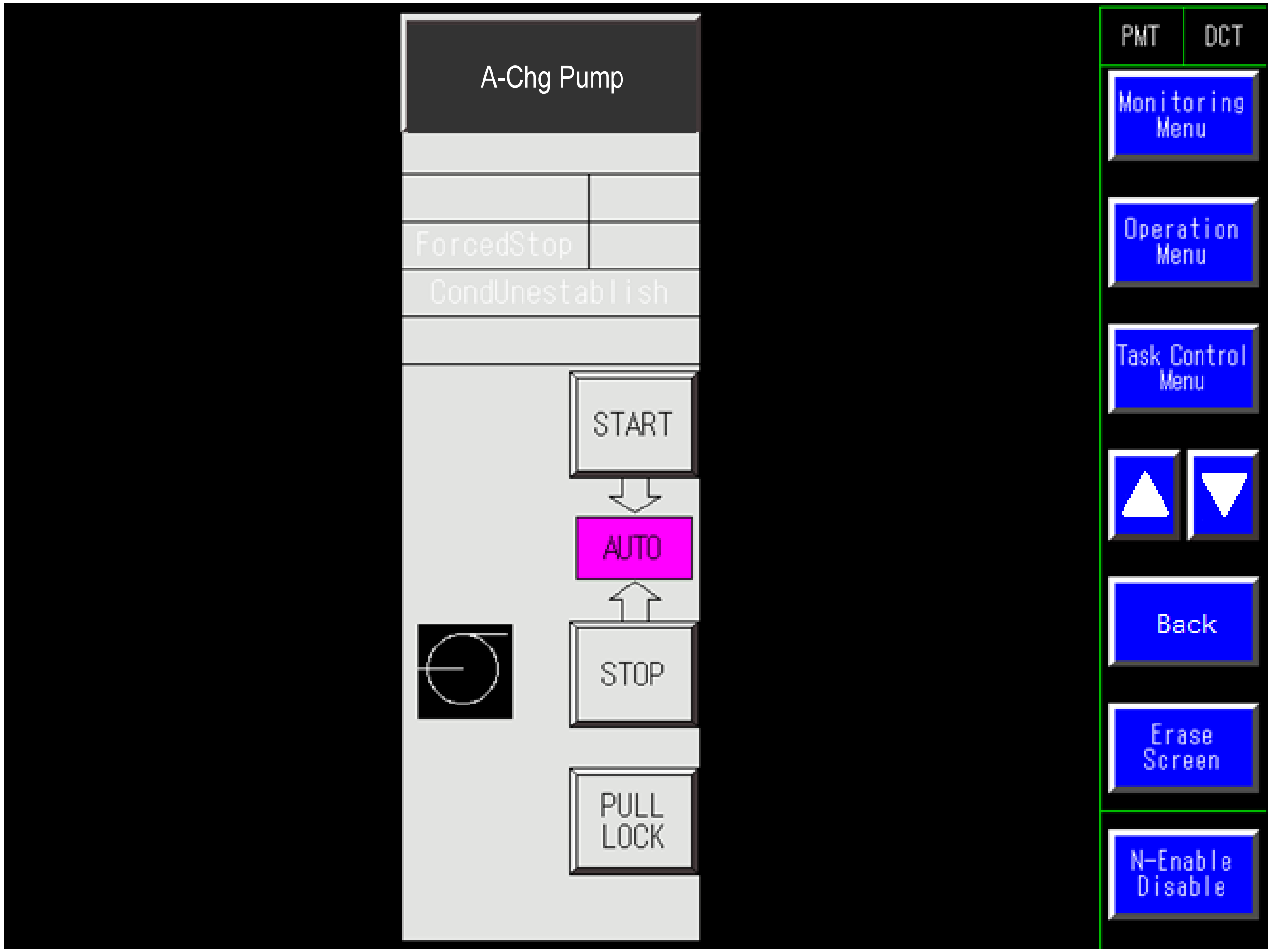
- The safety VDUs provide monitoring and component level control for safety functions
- The safety VDUs are designed to satisfy class 1E requirements
- They are divided into two groups:
  - Two multidivisional safety VDUs
  - Four selectable train-based safety VDUs
- The orientation and retrieval features of the safety VDU network are similar to the O-VDU network but there is significantly less information being managed
- Used with paper procedures only

Selectable Train-based Screen (Top level operation menu)

Selectable Train-based Screen (The second level layer)



Selectable Train-based Screen (Soft control Screen)



Selectable Train-based Screen (Top level monitoring menu)

Selectable Train-based Screen (The second layer)

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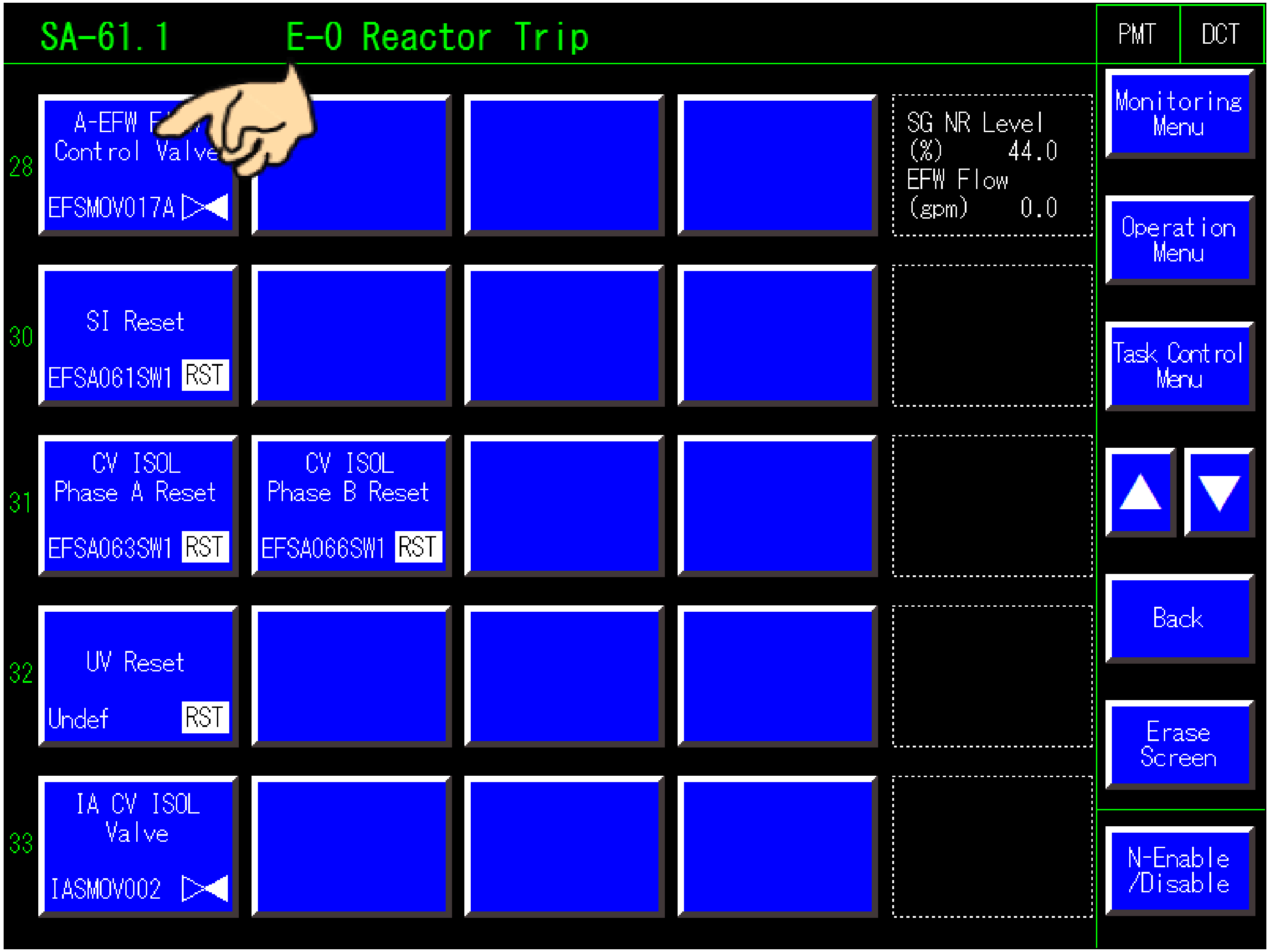
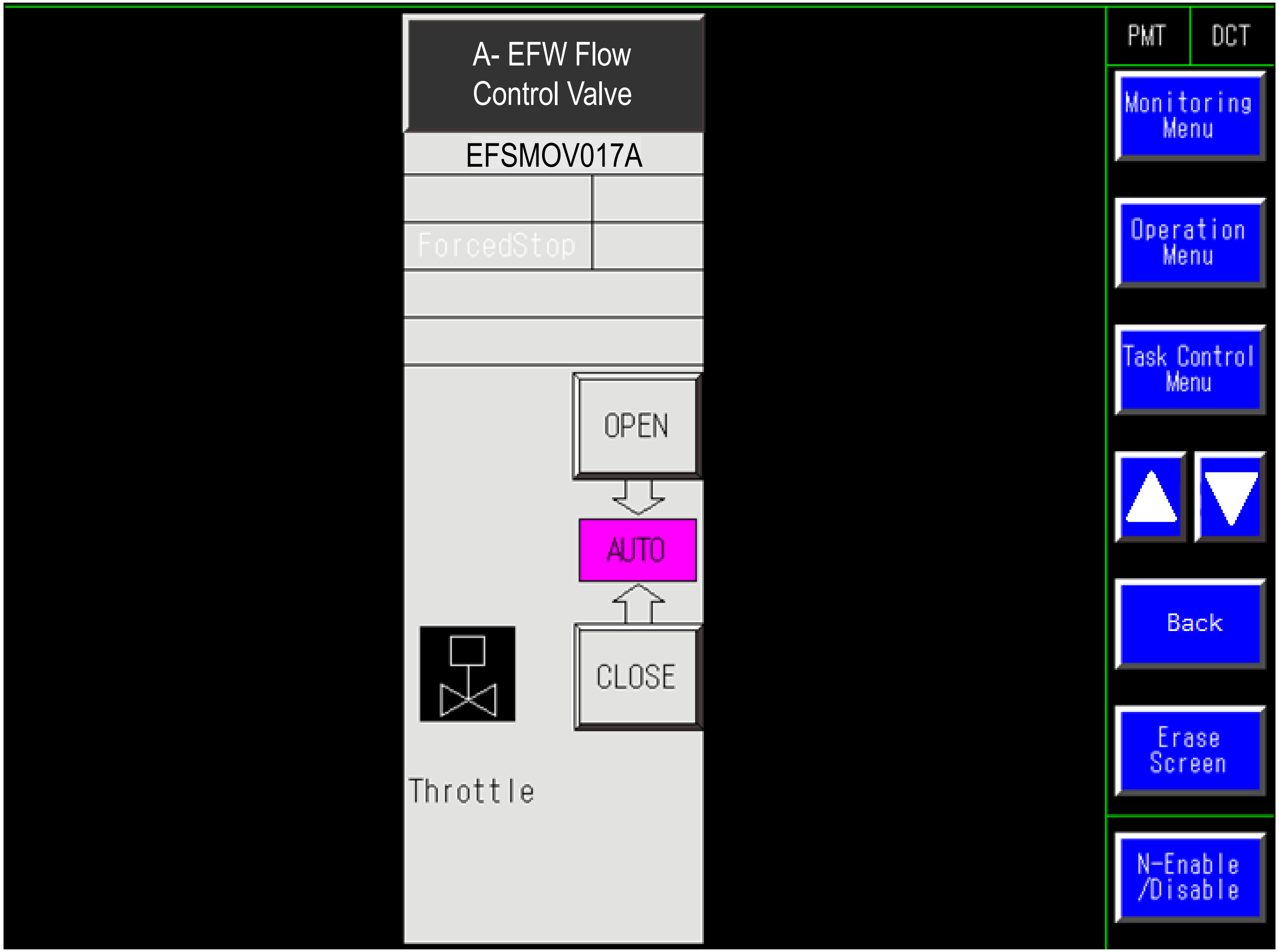
Selectable Task-based Screen

Per operating procedure



Operating Procedure Step Number

2.8.8 Safety VDU (9/11)



Multidivisional Safety VDU screen;

- Spatially dedicated, continuous visible (SDCV) screen on two redundant multidivisional safety VDUs
- Alarms and parameters for Credited Manual Actions and CSF monitoring
- Alarm color coding
- This information is especially useful in case of loss of the O-VDUs

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Multi-divisional Safety VDU (SDCV Screen)

CR Ins Limit	PMWS	Przr Level	HS MSL Rad	CV Rad	VCT Level	CHG Flow
LO	HIGH	LO	HIGH	HIGH	LO	HIGH

WR NIS (cps)	N-33			5.1E-11	N-34			5.1E-11
IR SU Rate (dpm)	N-35			-5.7E-02	N-36			-5.7E-02
Przr Level (%)		0.0						
RCS Thot (°F)	A	255.7	B	255.7	C	255.7	D	255.7
RCS Tcold (°F)	A	536.0	B	536.0	C	536.0	D	536.0
RCS Pressure(psi)		18.7						
Core Ex Temp (°F)	trnA			255.7	trnD			255.7
Subcooling (°F)	trnA			0.0	trnD			0.0
Rx Vessel Level	trnA			VESSEL FULL	trnD			VESSEL FULL
SG Level (NR) (%)	A	0.0	B	0.0	C	0.0	D	0.0
SG Level (WR) (%)	A	68.0	B	68.6	C	68.1	D	68.7
MSL Pressure(psi)	A	945.2	B	944.0	C	944.9	D	943.8
EFW Flow (gpm)	A	224.8	B	226.0	C	225.1	D	226.3
EFW Pit Level (%)	A trnA	70.9	trnD	70.9	B trnA	0.0	trnD	0.0
RWSP Level (%)	NR trnA	95.0	trnD	95.0	WR trnA	95.0	trnD	95.0
CS/RHR Pmp	trnA	START	trnB	START	trnC	START	trnD	START
CV Pressure (psi)		18.726						
CV Rad (mR/h)		1.87E+01						
CV Isol. (Ph A)	trnA	OK					trnD	NG
CV Isol. (Ph B)	trnA	—	trnB	—	trnC	—	trnD	—
CV Isol. (Purge)	trnA	NG					trnD	NG

PMT DCT

Monitoring Menu

Operation Menu

Task Control Menu

▲ ▼

Back

Erase Screen

N-Enable /Disable

2.8.9 Computer-Based Procedure System (1/3)

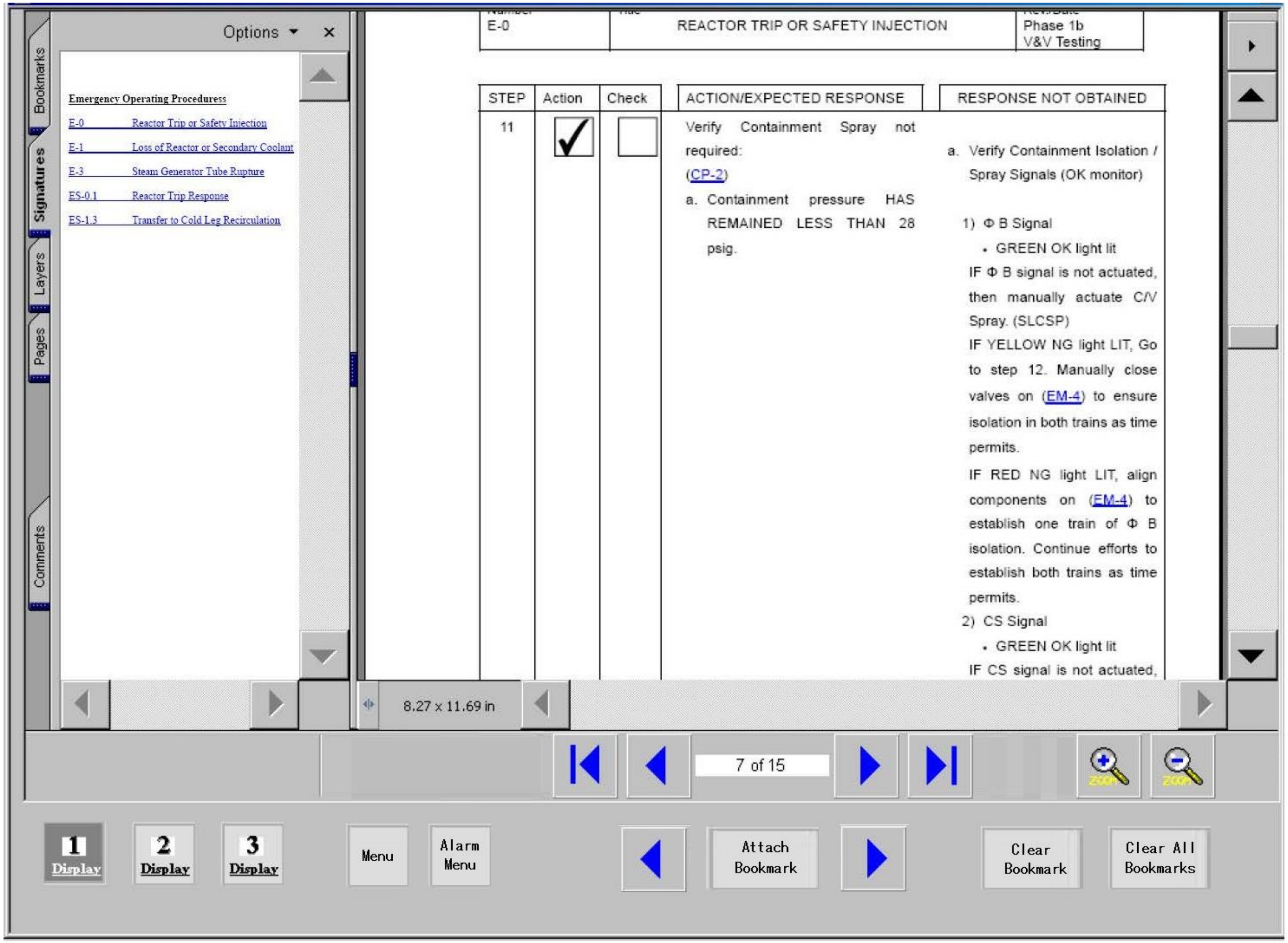
CBP Features

- The operating procedure VDU displays procedures that are structured in accordance and compliant with the textual images from the hardcopy procedure
- Procedures are presented in a standardized format with the title and a specific procedure index in a left column display, allowing the operator to move to the desired section of a procedure
- The function bar is available at the bottom of the page to allow interface with the O-VDU. Alternatively, by selecting hyper-links on the operating procedures VDU, the related O-VDU display is automatically displayed
- The procedure menu and bookmarking controls are also provided
- Back-up of CBP system is the paper-based procedures

CBP Features

- The alarm VDU supports similar lateral movement by using a function key to bring up alarm response procedures on the operating procedures VDU
- In case of emergency, the operators can request the emergency procedure for a reactor trip or ECCS operation by touching the first-out alarm on the alarm VDU
- Distinctive accident procedures (e.g., LOCA, SGTR) are requested from the CBP menu screen after the operator identifies the accident condition

CBP Screen



Options
Bookmarks
Signatures
Layers
Pages
Comments
Emergency Operating Procedures
E-0 Reactor Trip or Safety Injection
E-1 Loss of Reactor or Secondary Coolant
E-3 Steam Generator Tube Rupture
ES-0.1 Reactor Trip Response
ES-1.3 Transfer to Cold Leg Recirculation
E-0
REACTOR TRIP OR SAFETY INJECTION
Phase 1b
V&V Testing
STEP
Action
Check
ACTION/EXPECTED RESPONSE
RESPONSE NOT OBTAINED
11
Verify Containment Spray not required:
(CP-2)
a. Containment pressure HAS REMAINED LESS THAN 28 psig.
a. Verify Containment Isolation / Spray Signals (OK monitor)
1) Φ B Signal
• GREEN OK light lit
IF Φ B signal is not actuated, then manually actuate C/V Spray. (SLCSP)
IF YELLOW NG light LIT, Go to step 12. Manually close valves on (EM-4) to ensure isolation in both trains as time permits.
IF RED NG light LIT, align components on (EM-4) to establish one train of Φ B isolation. Continue efforts to establish both trains as time permits.
2) CS Signal
• GREEN OK light lit
IF CS signal is not actuated,
8.27 x 11.69 in
7 of 15
1 Display
2 Display
3 Display
Menu
Alarm Menu
Attach Bookmark
Clear Bookmark
Clear All Bookmarks

3. US-APWR HFE Program Management Plan

3. US-APWR HFE PMP (1/7)

- ✓ The US-APWR HFE program implementation is in accordance with NUREG-0711, Revision 2, “Human Factors Engineering Program Review Model,” issued February 2004.
- ✓ The HFE program assures that the HSI reflects modern human factors principles and satisfies the applicable regulatory requirements.
- ✓ The resulting HSI supports safe, efficient and reliable operator performance, test, maintenance and surveillance tasks

3. US-APWR HFE PMP (2/7)

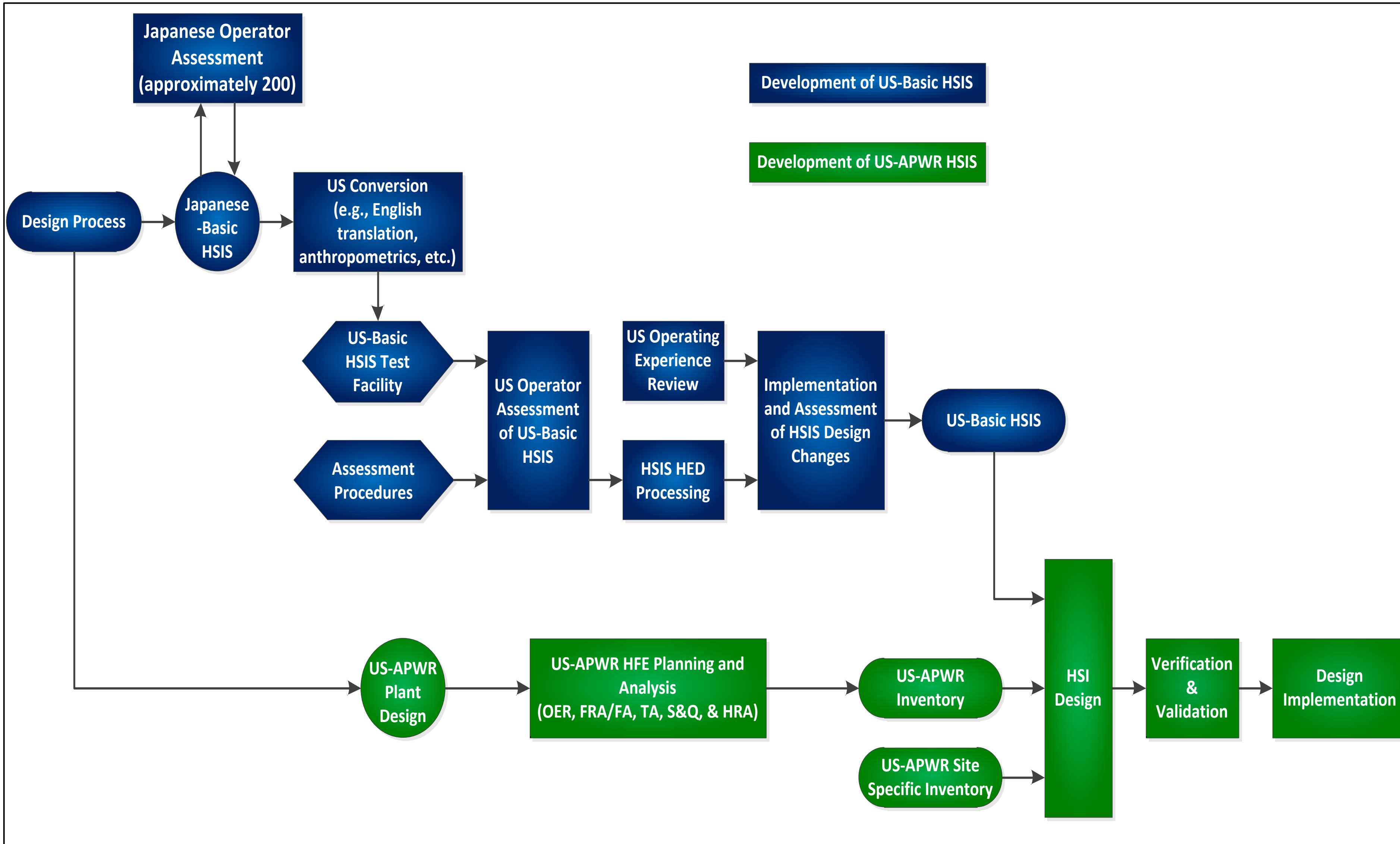
✓ The following HFE elements (as defined in NUREG-0711, Revision 2) are covered by the US-APWR HFE Program:

- HFE PMP
- OER
- FRA/FA
- TA
- S&Q
- HRA
- HD
- Operating Procedure Development*
- Training Program Development*
- V&V
- DI
- HPM**

* Procedure Development and Training program development will be reviewed in Chapter 13, Conduct of operation

** COL applicants will develop HPM program

3. US-APWR HFE PMP (3/7)



3. US-APWR HFE PMP (4/7)

- ✓ The scope of the HFE PMP includes:
  - HFE design team and organization, roles and responsibilities
  - HFE process and procedures
  - HFE issues tracking (HED process)
  - HFE technical program
  - Combined license (COL) information

- ✓ For HFE activities completed within the scope of the US-APWR design, the program element methodology is described within an implementation plan (IP) and the element is documented in a results summary report (ReSR) as per the IP.

Assumptions and Constraints Identification

- ✓ The US-APWR HSIS is based on application of the US-Basic HSIS, which establishes the generic monitoring, alarm, control, and computerized procedure technologies to be employed in the MCR for all plant systems.
- ✓ The generic HSI technologies of the US-Basic HSIS are combined with the specific HSI inventory needed for the US-APWR plant design to create the US-APWR HSIS.
- ✓ The development process for a US-APWR site-specific HSIS confirms or changes the HSI inventory to reflect a site-specific plant.

➢ Assumptions and Constraints Identification (Cont.)

- ✓ A fundamental design assumption and constraint of the US-Basic HSIS that also applies to the US-APWR HSIS is that the plant can be operated with minimum operation staff, one RO and one SRO in the MCR during postulated plant operating modes.

Applicable Plant Facilities

- ✓ MCR
- ✓ Remote shutdown room (RSR)
- ✓ Technical support center (TSC)
- ✓ Local control stations* (LCSs)
- ✓ Emergency operations facilities* (EOFs)

* Portion of stations or facilities

Acronyms (1/2)

AL	administrative workload
AOO	anticipated operational occurrences
AOP	alarm operating procedure
BISI	bypassed and inoperable status indication
CBP	computer-based operating procedure
CSF	critical safety function
CCF	common cause failure
COL	combined license
CV	containment vessel
D3	defense-in-depth and diversity
D3CA	defense-in-depth and diversity coping analysis
DC	design certification
DCA	design change analysis
DHP	diverse human-system interface panel
DI	design implementation
DIHA	deterministically important human action
EFW	emergency feedwater
EOF	emergency operations facility
EOP	emergency operating procedure
ECCS	emergency core cooling system
FA	function allocation
FL	critical function workload
FRA	functional requirements analysis
FWS	main feedwater system
GOP	general operating procedure
HED	human engineering discrepancy
HF	human factors
HFE	human factors engineering
HPM	human performance monitoring
HRA	human reliability analysis
HD	human-system interface design
HSI	human-system interface
HSIS	human-system interface system
I&C	instrumentation and control
IHA	important human action
IP	implementation plan
ISV	integrated system validation
LCS	local control station
LDP	large display panel
MCR	main control room

Acronyms (2/2)

MHI	Mitsubishi Heavy Industries, Ltd.
MNES	Mitsubishi Nuclear Energy Systems, Inc.
MS	main steam
NASA	National Aeronautics and Space Administration
NI	nuclear island
NOP	normal operating procedure
NSSS	nuclear steam supply system
OCS	operational conditions sampling
OER	operating experience review
O-VDU	operational-visual display unit
PA	postulated accident
PAM	post-accident monitoring
P&ID	piping and instrumentation diagram
PCMS	plant control and monitoring system
PMP	program management plan
PRA	probabilistic risk assessment
QA	quality assurance
RCS	reactor coolant system
RIHA	risk-important human action
RO	reactor operator
ReSR	results summary report
RSR	remote shutdown room
RT	reactor trip
S&Q	staffing and qualifications
SDCV	spatially dedicated, continuously visible
SG	steam generator
SME	subject-matter expert
SRO	senior reactor operator
SRP	Standard Review Plan
STA	shift technical advisor
TA	task analysis
TAA	transient and accident analyses
TI	turbine island
TLX	Task Load Index
TSC	technical support center
US-APWR	U.S. advanced pressurized-water reactor
V&V	verification and validation
VDU	visual display unit

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Mitsubishi APWR Design Certification Review

SER Chapter 18
Human Factors Engineering Program

Presentation to the ACRS Subcommittee
August 20, 2015

Chapter 18 Review Team

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Overview

- The HFE design described in the Topical Report conforms to NUREG-0700
- DCD Scope conforms to NUREG-0711, revision 2; implementation plans are complete and level of detail is sufficient to assess implementation effectiveness
- One confirmatory item to verify DCD, chapter 18 is updated to reflect latest revisions in the implementation plans
- Final design results are provided for the following HFE elements: HFE Program Management, Operating Experience, Human Reliability Analysis

Topical Report Comments

- The US-Basic Human-System Interface (HSI) System is the most detailed design description we have reviewed.
- Through an audit and review of the HFE design descriptions, the “hardware” design was verified to conform to NUREG-0700.
- Full scope simulator was used effectively in the design process

Issue:

- Control of safety related equipment through the Operational VDUs vice the Safety VDUs

Design Certification Comments

- Reviewed to ensure the appropriate Implementation Plan was included by reference and there were no inconsistencies with the Implementation Plan.

Issue:

- DAC introduces complexity.

Significant changes in regulatory strategy:

- Two ITAAC verses an ITAAC for every element submitted at the Implementation Plan level

ITAAC

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. Thee Control Room design incorporates human factors engineering principles that minimize the potential for operator error.	1. An integrated system validation (ISV) test will be performed in accordance with the Human Factors verification and validation Implementation Plan.	1. All pass/fail criteria associated with each test scenario are passed either on initial performance of the scenarios or following remediation of failures.
2. The as-built Control Room Human-System Interface is consistent with the final validated design specification.	2. An inspection of the as-built Control Room Human-System Interfaces will be performed.	2. The as-built Control Room Human-System Interface conforms to the validated design with no configuration deviations.

Implementation Plan comments

- NUREG-0711, revision 3, addresses “Important Human Actions” which adds credited manual actions to risk important human actions. MHI chose to expand their scope to “Important Human Actions.”
- Procedure and training elements are addressed in Chapter 13 to avoid duplication of work.
- Prompting alarms, alarm logic
- Detailed process descriptions
- Phased validation process

Conclusions

- The topical report describes an acceptable main control room and HSI configuration. It is an acceptable generic platform on which to add specific HFE design requirements identified through the implementation plans contained in Chapter 18 of the APWR DCD.
- DCD Chapter 18 and the associated ITAAC provide reasonable assurance that acceptable HFE practices will be incorporated into APWR design.

Backup – Nureg-0711 information

Planning and Analysis	Design	Verification and Validation	Implementation and Operation
HFE Program Management Operating Experience Review Functional Requirements Analysis and Function Allocation Task Analysis Staffing and Qualifications HRA	HSI Design Procedure Development Training Program Development	Human Factors Verification and Validation	Design Implementation Human Performance Monitoring

Backup – Program Management

✓ The scope of the HFE program management plan includes:

- HFE design team and organization: roles and responsibilities
- HFE process and procedures
- HFE issues tracking (HED process)
- HFE technical program
- Combined license (COL) information

Backup – Program Management

- **Assumptions and Constraints Identification**
  - ✓ A fundamental design assumption and constraint of the US-Basic HSIS that also applies to the US-APWR HSIS is that the plant can be operated with minimum operation staff, one reactor operator (RO) and one senior reactor operator (SRO) in the MCR during postulated plant operating modes.
  - ✓ The US-APWR HSI System (HSIS) is based on application of the US-Basic HSIS, which establishes the generic monitoring, alarm, control, and computerized procedure technologies to be employed in the main control room (MCR) for all plant systems.

Backup – Program Management

- **Applicable Plant Facilities**
  - ✓ MCR
  - ✓ Remote shutdown room (RSR)
  - ✓ Technical support center (TSC)
  - ✓ Local control stations (LCSs)
  - ✓ Emergency operations facilities (EOFs)

Backup – Program Management

➢ HFE Team and Organization

- ✓ The HFE team's areas of responsibility with respect to the HFE program (including scheduling of activities and milestones)
- ✓ HFE team is positioned within the design organization so there is reasonable assurance it will have authority to accomplish its areas of responsibility and to identify problems in the implementation of the overall plant design
- ✓ Design team composition and expertise is described

Backup – Program Management

- **HFE Issues Tracking**
  - ✓ HFE issues and concerns that are not immediately resolved are entered in the HFE issues tracking system.
  - ✓ These issues are referred to as Human Engineering Discrepancies (HED). The HFE design team members are responsible for issue logging, tracking, resolution, and resolution acceptance.
  - ✓ The HFE issues tracking system is integrated with the existing tracking system used for the US-APWR design effort as a whole.

Backup – Operating Experience

Sources

- ✓ Nuclear and non-nuclear sources of OE information to be evaluated.
  - Predecessor/related plants and systems
  - Recognized industry HFE issues from NUREG/CR-6400
  - Similar technology (i.e. Touch screens operation) issues corrected from the other industries
- ✓ Issues identified through interviews conducted with plant operators during the development of the US-Basic HSIS.

Analysis

- ✓ Evaluate to determine whether the issue is applicable to the US-APWR, and resolved by the US-Basic HSIS or by the US-APWR (plant design, HSI inventory, or HFE process).

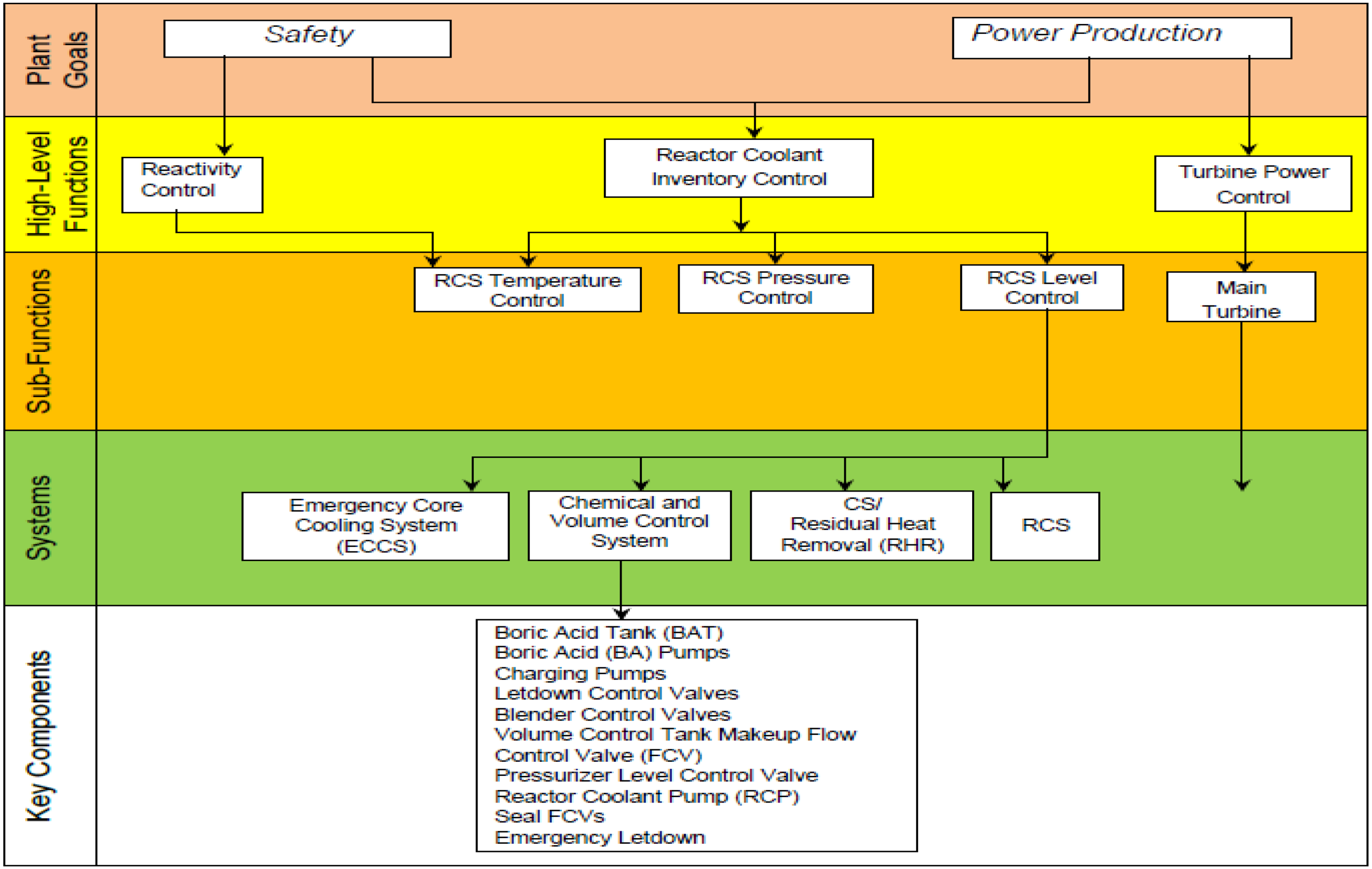
Backup – Functional Requirements Analysis

Specification of functional requirements

- ✓ Development of success paths for each mode and condition includes: Identification of sub-functions, systems, components and actions
- ✓ Conditions indicating high-level function is needed
- ✓ Parameter indicating the high-level function is available, operating, achieving purpose, and can or should be terminated
- ✓ Ensure Success Paths for Postulated accidents and anticipated operational occurrences

Performed by subject matter experts

Backup – Functional Requirements Analysis



Backup – Functional Allocation

- ✓ FA is a systematic method of allocating the success path actions identified in the FRA. These success path actions are allocated to machine (automated), human (manual), or shared (combination of machine and human) controls
- ✓ FA identifies the following characteristics which are obtained from IEC 60964 and 61839, and uses them to discern actions best suited for machine or human:
  - Load
  - Time Available
  - Rate
  - Complexity of Action Logic
  - Decision Types and Complexity

Backup – FRA/FA

- ✓ After the initial FRA and FA, the SMEs perform the following review:
  - IHAs are reviewed to ensure that success paths exist to address events associated with these actions and that they are appropriately allocated to the operator.
  - OER issues, related to high-level functions or success paths are identified and then reviewed to ensure FA adequately addresses the OER issue (i.e., verify that allocation expectation from OER matches the FA results to avoid similar issues)

- ✓ Compare the FRA/FA allocations with allocations extracted from design document, then generate HEDs if mismatches are found.

- ✓ Resolve, reevaluate and verify FRA/FA

Backup – Task Analysis

Task Selection:

- ✓ Tasks which are needed to execute operating procedures (normal, abnormal, emergency, and alarm response) are gone through by a basic task analysis.
- ✓ Additional tasks, from surveillance, test, inspection, and maintenance procedures conducted by operations personnel, are also identified by plant operation SMEs who review and understand the US-APWR design and US-APWR OER report (i.e., IHAs, and tasks causing negative consequence, and plant transient)

Backup – Task Analysis

Basic Task Analysis:

✓ Task Narrative specifies:

Overview, IHA, Actions, HSI Inventory, Staff, Time Constraints, Procedures, Decision making, Communications, Support, Situation, Workplace Factors and Hazards, Plant Condition, Critical Functions, Precursor Human Actions, HEDs

✓ HSI Inventory:

<u>Process Indications:</u> Measured Parameter, Range, Units, Resolution, Refresh/Update Rate, Display Characteristics, Trend, Automated Calculations, Alarms

<u>Controlled Components:</u> Equipment, Control Function, Indications, Alarms, Interlocks/Blocks/Overrides

Backup – Task Analysis

Task Evaluation:

- Time Constraint – Record the operational time constraint
A detailed TA is conducted for all tasks with operational time constraints
- OER – Identify a similar task identified in the OER
A detailed TA is conducted for tasks with unresolved OER concerns
- FRA/FA – Identified task, associates to “success path” in the FRA/FA;
A detailed TA is conducted for tasks with allocation concerns
- IHA –Record the IHA; A detailed TA is conducted for IHAs
- Precursor Human Actions – A detailed TA is conducted for tasks that include human actions that, if performed incorrectly potentially have negative consequences (such as precursors to plant transients)
- Task Burden – Identify “questionable” tasks which may cause task burden based on SME’s judgment. A detailed TA is conducted for all “questionable” task burden results
- Staffing – Identify “questionable” tasks which may be regarded as difficult to be execute with minimum or maximum operator staffing

Backup – Task Analysis

Task Evaluation:

- Communication –A detailed TA is conducted for tasks requiring communication with personnel outside the control room for plant operating modes
- Local Actions –Identify task involves local actions in areas with accessibility limits (e.g., hazardous areas, potential concerns for personnel safety, special security restricted areas, accessible only with special equipment)
- Support Actions – Identify support tasks undertaken by operators during maintenance, tests, inspections, and surveillances, which may cause task burden.
- New or Unique Actions – Identify tasks, are unique (not consistent with predecessor plants)
- HED – Identify HEDs, should be evaluated in the TA for their resolution

Backup – Task Analysis

Detailed Task Analysis:

- A detailed TA uses a time analysis to confirm the acceptability of the operator actions, workload, and HSI inventory evaluated in the basic TA or to identify HEDs that must be resolved to achieve acceptable results.
- Analyze in detail operator action times constructed with OSDs (Operation Sequence Diagrams) and assessments of additional duration required for decision making, communications, workplace factors and hazards, task support requirements, and situational and performance-shaping factors.
- These factors are used to determine the timeline for operators to perform the task.
- Task difficulty, complexity, frequency, and accuracy are used to adjust the time line for stress induced mental workload

Backup – Task Analysis

Backup – Staffing and Quals

✓ The S&Q employs two distinct methods for determining the personnel staffing and qualifications

- The first method applies to the operating crew
- The second method applies to non-operations personnel that directly support plant safety

Step1 Establish a staffing baseline (i.e., initial staffing level):

a. For the operating crew this baseline is established based on inputs from the previous HFE program elements (i.e., design constraint in PMP, OER, FRA/FA, TA, HRA, US-APWR basic design concept)

b. For non-operations positions this baseline is extracted from a predecessor plant

Step2 Evaluate the baseline to establish the final US-APWR S&Q

Backup – Staffing and Quals

Step 1 - Initial staffing baseline settlement

- ✓ For operations personnel, the staffing baseline reflects the minimum operating crew design constraint for plant operating modes, and the output of TA for plant shutdown modes. The operating crew staffing baseline also reflects the resolution of staffing related HEDs from development of the US-Basic HSIS and from the US-APWR OER, FRA/FA, HRA and TA. These initial baselines for staffing levels comply with 10 CFR 50.54.

- ✓ For non-operations personnel, the staffing baseline reflects the staffing levels of predecessor four-loop PWR plants for non-operations positions.

- ✓ The qualifications requirements for the US-APWR staff are consistent with current U.S. four loop PWR plants and are reflected in personnel job titles.

Backup – Staffing and Quals

Step 2 - Evaluation

- ✓ The S&Q for the plant operating crew is conducted by plant operations SMEs, with support from HFE SMEs and SMEs on the design of the US-APWR technology and systems.

- ✓ The S&Q team evaluates the staffing baseline through an aggregate overall job assessment that compares this US-APWR operating crew baseline to the operating staff at predecessor U.S. four-loop PWR plants.

  Specifically,
  - The S&Q implementation team reexamines the scenarios selected from the previous program elements within the context of GOPs, NOPs, AOPs, and EOPs.
  - The evaluation is conducted using tabletop walkthroughs of the appropriate sections of the procedures for the identified scenarios.

Backup – Staffing and Quals

Step 2 - Evaluation (Cont.)

The SMEs assess the design differences in the plant and the design differences in the HSI, compared to the predecessor, to ensure they are sufficient to facilitate the staffing reduction reflected in the baseline, as compared to the operator staffing for the same scenario in the predecessor plant

Backup – Human Reliability Analysis

- ✓ The HRA establishes the process for identification and treatment of IHAs in the HFE program.
- ✓ IHAs comprise the:
  - Risk-important human actions (RIHAs) contained in the PRA; from Chapter 19, Probabilistic Risk Assessment and Severe Accident Evaluation
  - Deterministically important human actions (DIHAs) from;
    - Transient and accident analysis (TAA) described in Chapter 15, Transient and Accident Analyses
    - Defense-in-depth and diversity coping analysis (D3CA) described in Chapter 7, Instrumentation and Controls

Backup – Human Reliability Analysis

Treatment of IHAs in the other HFE programs:

✓ OER

The OER confirms that the PRA has adequately considered operating experience documented in the OER in establishing the potential for human performance errors.

✓ FRA/FA

FRA/FA verifies that the IHAs identified in HRA are appropriately allocated.

✓ TA

TA confirms the assumptions about HFE characteristics used in the PRA to determine HEPs and the assumptions used in the TAA and D3CA to conclude that operators can execute DIHAs within the time available.

Backup – Human Reliability Analysis

Treatment of IHAs in the other HFE programs (CONT):

✓ S&Q

The staffing defined by TA is used as the operating crew baseline for further evaluation in the S&Q program element. the S&Q implementation team reexamines IHAs as they are aggregated in abnormal and emergency operating procedures.

✓ HSI Design (HD)

The HD ensures that the assumptions about HSI characteristics for all IHAs are implemented in the HD (e.g., control availability from the MCR, prompting alarms to reduce time required for HAs).

✓ Operating Procedure

Plant design specifications include basic operation sequences and/or guidance, which comply with task performance requirements for IHAs as plant design assumptions. The operating procedures are developed to meet the operation sequences and guidance in the plant design specifications.

✓ Training Program

Training materials and the training program include guidance and special annotations for IHAs, which are verified by the training program developers.

Backup – Human Reliability Analysis

Treatment of IHAs in the other HFE programs (CONT):

✓ V&V

The adequacy of the HD in supporting operator performance for IHAs is confirmed in the integrated system validation (ISV) process. The scenarios addressed in the ISV address the IHAs, dominant sequences, systems, and events.

✓ Design Implementation (DI)

One objective of DI is to demonstrate systematically that the HD that is implemented (i.e., the as-built design) accurately reflects the design that has been verified and validated in the V&V program element. This includes the HSI employed for IHAs.

Backup – HSI System Design

HSI development process

- ✓ The development of the US-APWR HSIS starts with the evaluation of design inputs, including personnel task requirements, system requirements, and regulatory requirements, that lead to a concept of operations, HSI functional requirements specification, and, ultimately, to an HSI design concept.
- ✓ This process has culminated in the US-Basic HSIS and was documented in the Topical Report
- ✓ The US-APWR HSI design focuses on creating the specific HSI inventory that encompass the alarms, indications, controls, and procedures needed to operate the US-APWR. This development process uses the HSI inventory requirements defined by the US-APWR plant system designs and by input of analysis of personnel task requirements, as extracted from predecessor HFE elements (i.e., OER, FRA/FA, TA, S&Q and HRA)

Backup – HSI System Design

HSI Detailed Design and Integration

The HSI detailed design and integration is performed based on the following:

- Any changes to the US-Basic HSIS that may result from US-Basic HSI HED resolutions (including OER)
- The output of US-APWR FRA/FA, TA, HRA, and S&Q, including resolution of any HEDs pertinent to the US-Basic HSIS and US-APWR HSI inventory

HSI Test & Evaluations (T&Es)

✓ Performance test for the basic HSIS has been performed.

✓ Additional performance test integrating HSI inventories are to be performed for the complex elements of HSI inventory.

Backup – Verification and Validation

- Operational conditions sampling (OCS)

  (1) Sampling dimensions
  - Plant conditions
  - Personnel tasks
  - Range of situational factors known to challenge human performance
  - HSI features

  (2) Identification of scenarios

- Design verification

  (1) HSI Inventory and Characterization
  (2) HSI task support verification
  (3) HFE design verification

Backup – Verification and Validation

- Integrated system validation (ISV)

  (1) Test objectives
  (2) Validation test beds
  (3) Plant personnel
  (4) Scenario definition
  (5) Performance measurement
  (6) Test design
  (7) Data analysis and interpretation
  (8) Validation conclusions

- HED resolution
- The V&V methodology is based on lessons learned from the V&V program conducted during the HSI design phase

Backup – Verification and Validation

➢ Design verification

(1) HSI Inventory and Characterization

- A unique identification code number or name
- Associated plant system and subsystem
- Associated personnel functions/sub-functions
- Type of HSI component
  - Computer-based controls (e.g., touch screen, keyboard)
  - Hard-wired controls (e.g., J-handle control, push button, automatic controller)
  - Computer-based displays (e.g., text, digital value, analog representation)
  - Hard-wired displays (e.g., dial, gauge)
- Display characteristics and functionality (e.g., plant variables/parameters, units of measure, accuracy, precision of display, dynamic response, display format (bar chart, trend plot, trend arrow, digital value))
- Control characteristics and functionality (e.g., continuous versus discrete settings, number and type of control modes, accuracy, precision, dynamic response, control format (touch screen, keyboard, hard switches))
- User–system interaction and dialogue types (e.g., navigation aids, menus)
- Location in data management system (e.g., screen identification number)
- Physical location in the HSI (e.g., panel identification number)

Backup – Verification and Validation

(2) HSI task support verification

- *Criteria identification:*
  Criteria extracted from the TA result,
  - Task requirements identified by the TA

- *General methodology:*
  - Conducts a detailed comparison of the personnel task requirements identified by the TA with the available alarms, displays, information sources, and control capabilities in the HSI inventory; the use of a procedure is one way to control bias and assure consistency in the individual reviews
  - Assessment of the CBP system design (e.g., display design, display content, navigation links, and recordkeeping) and the procedures completeness; a checklist method is used in this task support verification.
  - The checklist is developed by extracting the HSI inventory and characteristics from the TA
  - A documented list of each team members findings that is used to develop a team consensus

Backup – Verification and Validation

(3) HFE Design Verification

The HFE design verification is conducted to confirm that the characteristics of the US-APWR HSIS and US-APWR local HSIs conform to HFE guidelines as presented in the HSI Design Style Guide.

In order to simplify the application of the guidelines and results reporting, the guidelines are applied to the HSI based on level of feature;

- *Global features*

  Features that relate to configurational and environmental aspects of the HSI

- *Standard features*

  Features that are generically designated for plant wide application by the US-APWR HSI Design Style Guide and are applied across the controls and displays

- *Detailed features*

  Features that are aspects of a specific HSI are not addressed by the US-APWR HSI Design Style Guide and must reference either NUREG−0700 or industry-accepted guidance

Backup – Verification and Validation

- **Design validation**

(4) Integrated System Validation (1/4)

- ✓ The ISV is the process by which an integrated system design (i.e., hardware, software, and personnel elements) is evaluated using performance-based tests to determine whether it acceptably supports safe operation of the plant.

- ✓ The ISV is considered complete when the HSI has achieved the acceptance criteria for each validation scenario by and the data analysis from the ISV, including an evaluation of the extent of the HEDs, is completed. If the HSI does not successfully achieve the pass/fail criteria with all three crews, based on the initial assumption of a minimum of three crews as stated above an HED is generated, the HED resolution is implemented, and that scenario is repeated with an additional crew.

Backup – Verification and Validation

(4) Integrated System Validation (2/4)

- ✓ The ISV also results in the identification of performance improvements. HEDs are also generated for performance improvements, but these are clearly distinguished from HEDs related to pass/fail criteria. HEDs for performance improvements can be resolved after the ISV is completed but before any site-specific as-built implementation is evaluated in DI.

- ✓ The ISV applies specific tools:
  - PC Tool
  - Dynamic Simulator
  - Mockups

Note: HSI design elements that can not be tested using the tools are identified and tested on the as built plant

Backup – Verification and Validation

(4) **Integrated System Validation (3/4)**

✓ **Validation Conclusions (Section 4.3.8)**

(1) Document the statistical and logical bases for determining that the performance of the integrated system is acceptable.

(2) Document that the limitations of the ISV are considered in terms of identifying their possible effects on validation conclusions and that the impact on DI is considered, including the following:

• Aspects of the tests that were not well controlled

• Potential differences between the test situation and actual operations, such as absence of productivity–safety conflicts

• Differences between the ISV design and the as-built US-APWR

• Potential differences, based on the V&V results, between the validated design and the as-built plant

• Effects of bias and remaining uncontrolled bias that have been identified during the testing

• Unforeseen events that occurred during the V&V that affect the results

Backup – Verification and Validation

(4) **Integrated System Validation (4/4)**

Human Engineering Discrepancy Resolution (Section 4.3.9)

The HED* process has four steps:
(1) Discrepancy identification and problem statement
(2) Discrepancy evaluation
(3) Discrepancy resolution
(4) Discrepancy closure

* The HED process was applied throughout the US-Basic HSI design test program to track findings and their resolutions

Backup – Design Implementation

- ✓ The DI demonstrates that the design that is implemented (i.e., the "as-built" design) accurately reflects the design that has been verified and validated in the V&V.
- ✓ The DI identifies and evaluates aspects of the design that were not addressed in the V&V.
- ✓ The DI employs four distinct methods to evaluate the implementation of the HSI and confirm conformance to the verified and validated design:
  - Configuration control
  - As-built HSI design conformance review
  - Plant walkdowns
  - Design change analysis (DCA)