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1 UNITED STATES OF AMERICA

2 NUCLEAR REGULATORY COMMISSION

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4 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

5 (ACRS)

6 + + + + +

7 US-APWR SUBCOMMITTEE

8 OPEN SESSION

9 + + + + +

10 TUESDAY

11 OCTOBER 1, 2013

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13 ROCKVILLE, MARYLAND

14 + + + + +

15 The Subcommittee met at the Nuclear  
16 Regulatory Commission, Two White Flint North, Room T2B1,  
17 11545 Rockville Pike, at 8:30 a.m., John W. Stetkar,  
18 Subcommittee Chairman, presiding.

19 COMMITTEE MEMBERS:

20 JOHN W. STETKAR, Subcommittee Chairman

21 RONALD G. BALLINGER, Member

22 SANJOY BANERJEE, Member

23 DENNIS C. BLEY, Member

24 JOY REMPE, Member

25

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NRC STAFF PRESENT:

GIRIJA SHUKLA, Designated Federal Official

CLINTON ASHLEY, NRO

PERRY BUCKBERG, NRO

TUAN LE, NRO

GREGORY MAKAR, NRO

RUTH REYES, NRO

DIEGO SAENZ, NRO

JEFFREY SCHMIDT, NRO

STEVE SMITH, NRR

JAMES STRNISHA, NRO

CHRISTOPHER VANWERT, NRO

ALSO PRESENT:

NOBUO ISHIHARA, MHI

YUTA MARUYAMA, MHI

HIROSHI MATSUOKA, MHI

SHUHEI MIYAKE, MHI

TAKAFUMI OGINO, MHI

SHINJI OTANI, MHI

RYAN SPRENGEL, MNES

REBECCA STEINMAN, MNES

\*Present via telephone

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

8:30 a.m.

CHAIRMAN STETKAR: The meeting will now come to order. This is a meeting of the United States Advanced Pressurized Water Reactor Subcommittee. I'm John Stetkar, Chairman of the Subcommittee meeting.

ACRS members in attendance are Sanjoy Banerjee, Dennis Bley, Ron Ballinger, and Joy Rempe.

Mr. Girija Shukla of the ACRS staff is a designated federal official for this meeting.

The Subcommittee will discuss resolution of the long-term core cooling and Generic Safety Issue-191, assessment of debris accumulation on PWR sump performance and related documents associated with the US-APWR design certification. We heard 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. The rules for participation in today's meeting have been announced as part of the meeting notice previously published in the Federal Register.

Parts of this meeting may need to be closed

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1 to the public to protect information proprietary to  
2 Mitsubishi or MNES or other parties. I'm asking the  
3 NRC staff and the applicant to identify the need for  
4 closing the meeting before we enter into discussions  
5 and to verify that only people with a required clearance  
6 and need to know are present.

7 A transcript of the meeting is being kept  
8 and will be made available, as stated in the Federal  
9 Register notice. Therefore, we request the  
10 participants in this meeting use the microphones located  
11 throughout the meeting room when addressing the  
12 subcommittee. The participants should first identify  
13 themselves and speak with sufficient clarity and volume  
14 so they may be readily heard.

15 A telephone bridge line has also been  
16 established for this meeting. To preclude interruption  
17 of the meeting, the phone will be placed in a listen-in  
18 mode during the presentations and committee discussion.

19 Please silence your cell phones during the meeting.

20  
21 We'll now proceed. And I call upon Perry  
22 Buckberg.

23 MR. BUCKBERG: Good morning. My name is  
24 Perry Buckberg. I'm the lead project manager for the  
25 review of the US-APWR design certification. I'll be

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1 brief.

2 On behalf of the staff, I want to thank the  
3 ACRS for giving us the opportunity to answer your  
4 concerns and answer questions regarding GSI-191  
5 long-term core cooling. And I know from my experience  
6 with AP1000 and EPR that this is a complicated, there's  
7 some complicated issues, and they lead to some very  
8 interesting meetings. So we're looking forward to  
9 doing what we can for you. Thanks.

10 CHAIRMAN STETKAR: Great. Thank you very  
11 much. And with that, I'll turn it to Ryan Sprengel.

12 MR. SPRENGEL: Good morning. This is Ryan  
13 Sprengel with MNES. I'll keep it brief because I know  
14 we're aware of the amount of material to cover and our  
15 hopeful end timing for the day, so we'll be aware of  
16 that and try to go through material maybe as quickly  
17 but providing good coverage. As always, we'll take note  
18 of any follow-up items to provide to the members later.

19 We have taken a lot of input from other  
20 meetings going into this, so we hope to have addressed  
21 many of the previous items that were brought up for  
22 discussion in our material. And then we can expand upon  
23 that, of course, with any additional discussion.

24 There's also a large portion that is  
25 proprietary, so we'll cover that and address when the

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1 meeting does need to be closed for proprietary content.

2 CHAIRMAN STETKAR: Good. And if any of the  
3 discussion during the non-proprietary section drifts  
4 into the proprietary realm, just alert us and we'll  
5 postpone that discussion.

6 Regarding the length of the meeting, I  
7 certainly want to make sure that we cover all of the  
8 salient areas in these topics. So I don't want to quell  
9 or quash or whatever discussion. If we start to get  
10 into a lot of excruciating detail, I probably will cut  
11 it off and we'll take notes and address it later because  
12 I'd like to finish reasonably on time or not too much  
13 later. But as I said, I don't want to necessarily cut  
14 people off just because of indications of time.

15 MEMBER BANERJEE: Is that 5:00?

16 CHAIRMAN STETKAR: The agenda says five.

17 MEMBER BANERJEE: We like that.

18 CHAIRMAN STETKAR: I know you like that.

19 I'm sorry. The agenda says, the agenda says 3:30.  
20 That's silly. I should look at the agendas beforehand.

21 We'll target five, we'll hope for six. Rebecca?

22 MS. STEINMAN: Well, as you're aware, we  
23 were here about a month ago talking about Chapter 6,  
24 and several of the items that came up during that  
25 discussion we said we would talk about during today's

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1 meeting. So I hope that we adequately cover those  
2 questions. And if you have any additional follow-up  
3 questions related to those items, we will do our best  
4 to try to answer those.

5 With that, I would like to turn the  
6 presentation over to Yuta Maruyama from MHI.

7 MR. MARUYAMA: Good morning. My name is  
8 Yuta Maruyama from MHI. This is the MHI's presentation  
9 on US-APWR approach for the GSI-191 issue. I will  
10 introduce the contents of today's MHI presentation  
11 first.

12 The presentation consists of three parts.

13 Part one is the overview of the MHI approach for GSI-191  
14 issue, and this part is open to the public. And part  
15 two is the detailed technical discussion of the  
16 evaluation regarding GSI-191. And, therefore, this  
17 part is closed to the public. There are ten subparts  
18 in this part which explain the technical topics showing  
19 here. Part three, the summary, is open to the public  
20 again.

21 Here I present the overview of the MHI  
22 approach for the GSI-191 issue. There are mainly two  
23 perspectives of the GSI-191 approach: design and  
24 evaluation. Regarding the design, the US-APWR is  
25 designed to assure post-LOCA long term cooling by

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1 minimizing the debris source and optimizing the design  
2 of the recirculation flow path. Note that the design  
3 in this presentation is based on Revision 4 of the  
4 US-APWR DCD.

5           Regarding the evaluation, MHI performed the  
6 test to validate the design using the baseline approach.

7       The break selection, debris generations, and the  
8 conditions of the supporting tests are determined based  
9 on the approved methodologies and industrial  
10 guidelines. Risk informed approach is not used.

11           MEMBER BANERJEE: Could I just ask a  
12 question about the debris source? In your various  
13 reports, you say that there are, I think, very minimal  
14 sources of fiber debris in the containment. Yet, for  
15 purposes of flexibility, I think those are the words  
16 that I used, in the future, you actually take into  
17 account a certain amount of fiber, right?

18           MR. MARUYAMA: That's right.

19           MEMBER BANERJEE: This is beyond the latent  
20 debris, but this is actually fiber in insulation, right?

21       How do you arrive at that? What is this -- I was puzzled  
22 by the logic there. So you've cleaned up the  
23 containment now and, for future, you're giving some  
24 allowance. That's the sense I got reading your report.

25       But how do you arrive at that number? When you say

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1 minimize the debris source, why don't you just say we  
2 won't allow any fiber in the future? I mean, that's  
3 it. Other than latent debris. We understand the  
4 situation.

5 MS. STEINMAN: So the question is an  
6 explanation of why we have elected to allow some  
7 additional fiber debris in the design --

8 MEMBER BANERJEE: As a safety -- sort of  
9 like for the future flexibility or something of  
10 operation.

11 MEMBER BLEY: It almost sounds like you're  
12 allowing for bringing some equipment in later that comes  
13 packaged with fibrous insulation.

14 MEMBER BANERJEE: Whatever it is, I mean,  
15 I'd like to know the rationale.

16 MR. SPRENGEL: I guess it would also allow  
17 for any temporary fibrous insulation to be used. It  
18 really is truly flexibility for future COL applicants,  
19 and that would be evaluated at that time by the plant  
20 operators.

21 MEMBER BANERJEE: Do you then say that this  
22 is the limit that you can do this? It's just the debris  
23 source term, you know, that I want to get clarified.

24 MR. SPRENGEL: Yes, the details of the  
25 numbers we'll show later, and I think we can have a better

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1 discussion when you can look at the values. But,  
2 ultimately, the plant operator would have to evaluate  
3 what is in place in containment and then ensure that  
4 the testing that's been done thus far has covered or  
5 bounded the debris that's been introduced.

6 MEMBER BANERJEE: There would be some  
7 control that's set that --

8 MR. SPRENGEL: Yes.

9 MEMBER BANERJEE: -- you cannot have --  
10 okay. Let's revisit that. I was quite puzzled by that.  
11 Okay.

12 MR. MARUYAMA: All right. And page six,  
13 please. Yes, we just talked about the debris source,  
14 but the next couple of slides present the design prospect  
15 of MHI approach, including debris source.

16 The US-APWR has reduced their resources  
17 compared to the combination of plants. Fiber  
18 insulation is not used in the ZOI of the break area,  
19 and reflective material insulation, or RMI, is used  
20 instead. The coating in the containment is  
21 DBA-qualified coatings.

22 The aluminum materials in the containment  
23 is minimized and controlled. The pH of the water is  
24 controlled by sodium tetraborate, or NaTB.

25 MEMBER BANERJEE: You have some galvanized

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1 steel, I noticed, with the zinc galvanization; is that  
2 right?

3 MR. MARUYAMA: Yes.

4 MEMBER BANERJEE: Yes. You haven't  
5 eliminated galvanized material.

6 MR. MARUYAMA: Yes, we have zinc.

7 MEMBER BANERJEE: Yes, you have zinc. And  
8 is that at all exposed to boric acid when under, you  
9 know, before it is buffered, you know? Is there an  
10 opportunity for that zinc to be exposed to boric acid?

11 MR. MARUYAMA: Yes, yes.

12 MEMBER BANERJEE: There is, right?  
13 Because you have borated liquid in your RWSPs or whatever  
14 the reactor is called. So is there any zinc that is  
15 in contact with borated water, galvanized zinc?

16 MR. MARUYAMA: Yes, yes, that is correct.

17 MEMBER BANERJEE: Okay. So we got that.

18 Okay. It's sort of important. I've seen experiments  
19 in Germany where galvanized, you know, the zinc is a  
20 significant source of blockage. I'm not saying in your  
21 case because I noticed you did ICT, IT experiments.  
22 It's something to be noted. It's very important.

23 MR. MARUYAMA: We will revisit the chemical  
24 debris part in detail in part two.

25 MEMBER BLEY: Just a point of clarification

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1 where Dr. Banerjee was earlier. Your words here are  
2 the same as in your reports, no fiber is in the zone  
3 of influence; and then you have the statement that you  
4 have an allowance for, later, maybe some fiber coming  
5 in. But it sounds like you don't use any fiber anywhere  
6 right now; is that true?

7 MR. MARUYAMA: That is correct.

8 MEMBER BLEY: Inside or outside of the zone  
9 of influence right now?

10 CHAIRMAN STETKAR: Just for clarification,  
11 is there any fiber insulation anywhere on any system  
12 inside the containment?

13 MR. MATSUOKA: Yes, we have a plan to  
14 install no fiber insulation at this moment. But, but  
15 --

16 CHAIRMAN STETKAR: That's any piping  
17 system in the containment, even if it's a non-essential  
18 chilled water line to the fan coolers or anything? No  
19 fiber anywhere?

20 MR. MARUYAMA: Yes, that is correct.

21 CHAIRMAN STETKAR: In the design? In the  
22 design?

23 MEMBER BANERJEE: And no particulates, if  
24 I understand, as well, right?

25 MR. MATSUOKA: No particulate type

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1 insulation?

2 MEMBER BANERJEE: Yes.

3 MR. MARUYAMA: No, no.

4 MEMBER BANERJEE: None, yes. So I looked  
5 at that. So the only particulates are only coming from  
6 the epoxy or the coatings, right?

7 MR. MARUYAMA: Coating on those --

8 MEMBER BLEY: And all the coatings are  
9 epoxy in the design?

10 MEMBER BANERJEE: The only would be the  
11 erosion of the coating to form particles, right?

12 MR. MARUYAMA: Okay. The next slide,  
13 please. This slide summarizes the basic concept of the  
14 recirculation flow paths of the US-APWR. The US-APWR  
15 has RWSP on the lowest floor in the containment, which  
16 collects the stray water and blowdown water. The four  
17 strainer assemblies are installed in the RWSP, and each  
18 assembly has nine modules. The ECCS water must flow  
19 through the buffer areas before reaching the RWSP in  
20 order to prevent direct debris transportation.

21 The flow path is designed to assure  
22 sufficient flow. The debris interceptors are installed  
23 on the floor openings to trap large debris generated  
24 by water jetting. The floor openings and overflow  
25 piping have sufficient margin against clogging, and the

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1 layout is offset against each other. The strainer has  
2 sufficient surface area to prevent clogging and located  
3 with sufficient distance to the overflow piping in the  
4 RWSP.

5 This is the diagram of the recirculation  
6 flow path. As explained in previous slides, the spray  
7 water on the break floor are led through the floor  
8 openings, buffer area, and overflow piping to the RWSP.

9 The detailed discussion of the flow path design will  
10 be presented in section two.

11 The evaluations of the long term cooling  
12 were performed based on the baseline approach indicated  
13 in the associated industrial guidelines and NRC safety  
14 evaluations. For example, the break assumption is  
15 double-ended guillotine break, which is consistent with  
16 NEI 04-07. The coating on the latent debris amounts  
17 are also determined based on NEI 04-07 and additional  
18 fiber and coating debris are considered as operational  
19 margin, as we discussed. The chemical debris amount,  
20 on the other hand, is determined by the Chemical Effect  
21 Test performed before the US-APWR.

22 The supporting tests were performed using  
23 the aforementioned debris amount. We have mainly four  
24 tests for US-APWR. Fiber-only bypass test was  
25 performed to validate design fiber amount reached by

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1 both of the strainers. The strainer head loss test was  
2 performed to validate the design basis head loss for  
3 NPSH calculation. The core inlet blockage test was  
4 performed to validate fuel assembly pressure drop to  
5 meet the acceptance criteria required for minimum  
6 driving force. The Chemical Effect Test was performed  
7 to determine the chemical debris amount.

8 CHAIRMAN STETKAR: Maruyama-san, I'm  
9 assuming we're going to get into details of the NPSH  
10 analyses, but just, because this is public, I wanted  
11 to get it on the public record. This plant does include  
12 credit for containment accident pressure to support the  
13 NPSH evaluation; is that correct?

14 MR. MARUYAMA: This is correct.

15 CHAIRMAN STETKAR: Okay. Thank you.

16 MR. MARUYAMA: This is the table of the  
17 evaluation items and associated technical report. The  
18 latest revisions of the reports and the living design  
19 basis information was provided to the ACRS members  
20 beforehand.

21 CHAIRMAN STETKAR: By the way, just for,  
22 again, for the record, we have been provided and, in  
23 preparation for this meeting, reviewed the most recent  
24 revisions of the technical reports that are listed here.  
25 Those revisions, in some cases, are later revisions

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1 than were used to support Revision 3 of the DCD, which  
2 is the official version of the DCD that the staff used  
3 for their safety evaluation report. Now, I know some  
4 of the safety evaluation report conclusions have been  
5 based on RAIs that use more recent revisions, but we  
6 specifically requested, for the purposes of this  
7 meeting, to have the most recent revisions of these.

8 So we're looking at information that, in fact, may be  
9 a little bit ahead of some of the SER conclusions. The  
10 staff will, I'm sure, fill us in on that.

11 MEMBER BLEY: I thought last time they said  
12 that the RAIs had covered the technical details of  
13 anything that would show up in the --

14 CHAIRMAN STETKAR: That's what they said.

15 MEMBER BLEY: Yes, that's what I wanted to  
16 clarify.

17 MS. STEINMAN: And that is correct. I  
18 mean, I don't want to step on the staff. But, basically,  
19 we prepared tracking reports that showed the DCD  
20 changes, and the staff had those available for their  
21 SER, and that was incorporated in the DCD Rev 4. So  
22 you kind of got the clean version of what the staff had  
23 available to them to look at.

24 CHAIRMAN STETKAR: Okay, good.

25 MS. STEINMAN: If Ruth wants to add

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1 anything, please go ahead.

2 MR. BUCKBERG: This is Perry Buckberg. I  
3 think we agree with that completely.

4 MR. MARUYAMA: Then this slide concludes  
5 the part one overview of the US-APWR approach. The  
6 technical detail will be explained in part two  
7 following. And I will switch to Mr. Matsuoka in part  
8 two, outline of evaluations.

9 MS. STEINMAN: This portion of our  
10 presentation is part of the closed portion.

11 CHAIRMAN STETKAR: Okay. So what we need  
12 to do --

13 MEMBER BLEY: Let me ask one last question  
14 before we get there. It's an odd one, but I just started  
15 worrying about it. We have that, the refueling water  
16 storage pool where the blowdown water eventually goes.

17 And if there were hydrogen, some of it, at least, would  
18 end up down in there. None of this looks at the burning  
19 or possibility of detonation of hydrogen. I think  
20 that's because, under the design basis accidents, you  
21 generate too little hydrogen to be of concern; is that  
22 correct?

23 MS. STEINMAN: So he's asking about  
24 hydrogen control. And under the design basis, the  
25 hydrogen level is very small, and that's why it is not

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1 a concern; is that correct?

2 MR. MIYAKE: Yes. In a design basis  
3 accident, as you say, the hydrogen generation is very  
4 small.

5 MEMBER BLEY: But later, when we get to the,  
6 if we get to think about the PRA again, there there would  
7 be scenarios where there could be hydrogen occurring  
8 that might have some impact on the filters that aren't  
9 analyzed, I believe; is that true?

10 MS. STEINMAN: Under severe accident  
11 conditions, are there any conditions that we have not  
12 analyzed for the RWSP that would be impacted by hydrogen  
13 generation? So, in general, hydrogen is a topic under  
14 Chapter 19. We did discuss it some in Chapter 6. And  
15 you are correct that under severe accident conditions  
16 hydrogen can be generated, and that has been reviewed  
17 as part of the PRA. And in response to one of the  
18 questions or series of questions that was asked at  
19 Chapter 6, we are planning to prepare a short summary  
20 of our whole hydrogen design to try to pull everything  
21 together in just a couple of pages and to point the ACRS  
22 to the relevant portions of the Chapter 19 information  
23 that would answer those questions. But we don't have  
24 --

25 MEMBER BLEY: Okay. No, that's fine. I

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1 just want to know where that sits. I guess I will wonder  
2 if there's any way that can affect the performance of  
3 the filters.

4 MS. STEINMAN: Okay. We understand your  
5 concern. All right. Matsuoka-san, please go ahead.

6 CHAIRMAN STETKAR: Okay. Before we do  
7 that, we have to go into closed session, so there are  
8 a couple of administrative things I need to do. First  
9 of all, I'll ask MHI and the staff to make sure that  
10 there are no people in the room who should not be here.

11 And second of all, if we have a bridge line open to  
12 the public, we need to get that closed.

13 (Whereupon, the foregoing matter went off  
14 the record at 8:55 a.m.)

**NEAL R. GROSS**

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