

# **Official Transcript of Proceedings**

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

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623rd MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

+ + + + +

FRIDAY

APRIL 10, 2015

+ + + + +

ROCKVILLE, MARYLAND

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The Advisory Committee met at the Nuclear  
Regulatory Commission, Two White Flint North, Room  
T2B3, 11545 Rockville Pike, at 10:30 a.m., John W.  
Stetkar, Chairman, presiding.

COMMITTEE MEMBERS:

JOHN W. STETKAR, Chairman

DENNIS C. BLEY, Vice Chairman

MICHAEL CORRADINI, Member-at-Large

RONALD G. BALLINGER, Member

SANJOY BANERJEE, Member

CHARLES H. BROWN, JR. Member

DANA A. POWERS, Member

JOY REMPE, Member

PETER C. RICCARDELLA, Member

MICHAEL T. RYAN, Member

STEPHEN P. SCHULTZ, Member

GORDON R. SKILLMAN, Member

DESIGNATED FEDERAL OFFICIAL:

EDWIN HACKETT

ALSO PRESENT:

PHIL AMWAY, Exelon Corporation

RANDY BUNT, Southern Nuclear Operating Company

JEFFREY GABOR, Erin Engineering

STEVEN KRAFT, NEI

JOHN MCHALE, NRR

\*Present via telephone

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

10:33 a.m.

CHAIRMAN STETKAR: The meeting will now come to order. This is the second day of the 623rd Meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting, the Committee will consider the following: Development of Interim Staff Guidance in Support of Order EA-13-109, Reliable Hardened Vents and Preparation of ACRS Reports.

This meeting is being conducted in accordance with provisions of the Federal Advisory Committee Act. Dr. Edwin Hackett is the designated Federal Official for the initial portion of the meeting.

We have received no written comments or requests to make oral statements from members of the public regarding today's sessions. There will be a phone bridge line. To preclude interruption of the meeting, the phone will be placed in listen-in mode during the presentations and Committee discussion.

A transcript of the meetings is being kept. And it is requested that the speakers use one of the microphones located throughout the room, identify themselves and speak with sufficient clarity

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1 and volume so that they can be readily heard. And I  
2 ask everyone to please check and silence all of your  
3 little electronic devices.

4 By the way, I thought I heard the phone --  
5 is the phone line open in the incoming direction? If  
6 it's not, it should be on mute. Unless you folks have  
7 someone out there.

8 Given the -- we're done with the  
9 administrative things, I'll turn the meeting over to  
10 Dr. Steve Schultz will guide us through the Interim  
11 Staff Guidance on the hardened vents. Steve?

12 MEMBER SCHULTZ: Thank you, Chairman  
13 Stetkar. What this meeting is discussing is the Phase  
14 Two of the Guidance in Support of Order EA-13-109.

15 The Committee provided a letter on Phase  
16 One of the Guidance in the fall of 2013. Phase Two  
17 involves providing additional protections for severe  
18 accident conditions to the installation of a reliable  
19 severe action capable drywell vent system, or the  
20 development of a reliable containment venting strategy  
21 that makes it unlikely that a licensee would need to  
22 vent from the containment drywell during severe  
23 accident conditions.

24 We had a Subcommittee meeting on this  
25 topic on March 20. There we reviewed the NEI

1 document, NEI 13-02 Revision 0E2 and the draft ISG.  
2 Since then we've received other drafts of those  
3 documents.

4 And today we're going to hear from the  
5 industry and the staff relating to those documents,  
6 and the interactions that the industry has been having  
7 with the staff related to them. And so, we're please  
8 to have both the industry and the staff with us today  
9 to make those presentations.

10 To move forward with the discussions I'd  
11 like to call upon Jack McHale from the Japan Lessons  
12 Learned Directorate. He is the Associate Director of  
13 the JLD. Jack, welcome and please provide your  
14 introduction for the Committee.

15 MR. McHALE: Thank you, Dr. Schultz. Good  
16 morning and again, my name is Jack McHale. I'm an  
17 Associate Director in Japan Lessons Learned, a  
18 division of our Office of Nuclear Reactor Regulation.

19 Today we'll have the industry and staff  
20 discussion of the proposed Guidance in support of  
21 implementing Phase Two requirements of NRC Order EA-  
22 13-109 or BWRs with Mark I and II containments. As  
23 Dr. Schultz mentioned, we presented draft Guidance to  
24 the ACRS Fukushima Subcommittee on March 20 of this  
25 year.



1           And today we will plan to go through a  
2 similar, though shorter, presentation focusing on the  
3 issues that were highlighted at the Subcommittee  
4 meeting as needing additional discussions with the  
5 industry working group. And again, how those issues  
6 were resolved.

7           When the staff's presentation after the  
8 industry, we'll focus on seeking ACRS endorsement for  
9 issuance of the proposed Guidance. And I'll introduce  
10 the staff members at that time.

11           And again, before we start, I would like  
12 to thank the ACRS for its flexibility and patience in  
13 supporting the staff with our efforts to provide the  
14 materials to the Committee. As the ACRS knows, we're  
15 on an aggressive schedule which has been typical of  
16 our post-Fukushima actions.

17           And with that, I'll apologize for the  
18 earlier reliance on the preliminary draft type  
19 information. Which, actually, you know, making its  
20 way to a final state even this week.

21           So, I just wanted to acknowledge that.  
22 But that hopefully, the discussions will show that  
23 we've, you know, achieved a path forward from those  
24 open items which were previously discussed.

25           So again, very much appreciate the support

1 of the Committee. And at this point I'll turn it back  
2 over for the industry presentation.

3 MEMBER SCHULTZ: All right. With that I  
4 would like to introduce Steve Kraft from NEI who would  
5 introduce the panel from the industry today.

6 MR. KRAFT: Thank you, Dr. Schultz.  
7 Steven Kraft, NEI, Senior Technical Advisor. A great  
8 pleasure once again to appear before the ACRS.

9 To my left is Phil Amway from Exelon. He  
10 is the Corporate Lead for FLEX and a bunch of other  
11 stuff post-Fukushima.

12 To my right is Jeff Gabor, Vice President  
13 of Erin Engineering. Erin Engineering is the key  
14 engineering support firm for both NEI and EPRI in this  
15 area and the related CPR rulemaking.

16 They're also accompanied by Randy Bunt in  
17 the audience. Randy was unable to join us on the 20th  
18 of March for the Subcommittee.

19 Randy, in addition to being southern  
20 company lead for all-Fukushima is also the Chairman of  
21 the BWR Owners' Group Fukushima Committee. So, brings  
22 a great wealth of understanding in this area. And if  
23 necessary will come to the mic to answer questions.

24 And with that, let me turn it over to  
25 Phil.

1 MR. AMWAY: Okay. Good morning. My  
2 name's Phil Amway, Exelon Corporation. I'll be  
3 leading you through the presentation that we have this  
4 morning. Focusing particularly on those topics of  
5 significance between the Subcommittee on March 20 and  
6 today's meeting.

7 At particular points throughout this  
8 presentation, I will ask my colleague Jeff Gabor to  
9 walk us through some of the slides. Particularly with  
10 the various plots and drawings that we'll see in the  
11 presentation.

12 I may actually ask Randy Bunt to provide  
13 input at particular time. Maybe to answer questions  
14 as well as we go through the presentation.

15 So start off with this slide of the  
16 general characterizations. We have revised NEI 13-02  
17 to include Phase Two Guidance. We have the Rev 0  
18 issued back in 2013 for Phase One Guidance.

19 And consistent with the approach that we  
20 took in Phase One, we are working towards common  
21 design elements for implementation of the Order. So  
22 we'll try to establish some consistency across the BWR  
23 fleet in implementing both Phases of the Order.

24 This version of NEI 13-02, which will  
25 ultimately become Rev 1, will be informed by ACRS

1 insights. We certainly appreciate the valued feedback  
2 that we receive through these ACRS meetings.

3 As a result of the Subcommittee on March  
4 20, we have made some modifications to the Guidance  
5 documents. Particularly with respect to HCVS out of  
6 service times and check valve testing. We'll see  
7 those slides later in this presentation.

8 We do expect limited exceptions and  
9 clarifications in the final ISG. In the Subcommittee,  
10 the drafted ISG that was issued had a number of items  
11 that we were still working with the staff to close  
12 out.

13 We have made substantial progress since  
14 the Subcommittee to close those items. And with that  
15 additional exchange of information and modifications  
16 to the Guidance documents, we expect that final ISG  
17 will be very closely aligned with, with limited  
18 exceptions and clarifications necessary in the final  
19 ISG.

20 MEMBER SKILLMAN: Phil, you said that  
21 you're working your way through Phase One. I can  
22 imagine it's very complex administratively because the  
23 different owners might approach this differently.

24 Could you comment on how well that is  
25 going or how difficult that is going, please?

1 MR. AMWAY: I would characterize it so far  
2 that it is going well. We have a number of workshops  
3 that we have done for Phase One to try to establish  
4 that alignment and consistency.

5 We are going to do that going forward with  
6 Phase Two as well. We'll have another series of  
7 workshops to work through design details and  
8 implementation for the Phase Two requirements.

9 Within our own particular fleet, Exelon  
10 having a number of boiling water reactors, we're  
11 looking to standardize across our fleet how we  
12 approach the Guidance and implement it. And we are  
13 well tied together as a working group with the other  
14 fleets and other BWR owners to try to make sure that  
15 we stay aligned through the process.

16 MR. KRAFT: Yes, and if I could comment.  
17 Just yesterday we had a meeting of our CNOs, the  
18 Fukushima -- what we call Fukushima Response Steering  
19 Committee.

20 And I did discuss with them, particularly  
21 with regard to Phase Two, the need to have an assist  
22 program in the industry. Probably a small group of  
23 people to look at line drawings and things like that  
24 simply because of the point you're making.

25 It's complicated. Plus, we don't want it

1 to become so different at each plant it becomes  
2 difficult for NRC to review and endorse the different  
3 plans. As it is, we have a common template for the  
4 overall integrated plan. That's a good place to  
5 start.

6 And then we'd want to look a little more  
7 -- a little deeper than that. Randy?

8 MR. BUNT: Randy Bunt. We also have our  
9 -- with the BWR Owners Group, we're having periodic  
10 phone calls approximately every four weeks to cover  
11 this particular topic on Phase One implementation, to  
12 get all the owners involved with that.

13 And then we have a meeting roughly every  
14 half a year where we go in detail and talk about --  
15 have talked about that. So we are staying aligned  
16 with that.

17 MEMBER SKILLMAN: Okay, Randy and Steve  
18 and Phil, thank you.

19 MR. AMWAY: Okay, so just to recap, it is  
20 a phased implementation of the Order. Phase One being  
21 the vent capability from the wetwell that is severe  
22 accident capable.

23 And Phase Two being either the vent  
24 capability from the drywell. Or the alternate venting  
25 strategy that we have since referred to as the

1 SAWA/SAWM approach.

2 High level water functional requirements.  
3 The objective is to limit the containment pressure  
4 within the primary containment pressure limit or the  
5 containment design pressure, whichever is lower.

6 The objective there is to make sure that  
7 we maintain the containment capability. To control  
8 the use of common systems within and between units.

9 And that's primarily there to address the  
10 concern with hydrogen migration to other systems and  
11 other units. And also to make sure that we address  
12 the vent usage during ELAP conditions and under -- so  
13 include severe accident conditions.

14 Some Phase One topics, just to touch on at  
15 the ACRS meeting. We read that letter coming out of  
16 Phase One and the recommendations that were in there.  
17 And the concern about combustible gas control.

18 We have since addressed that with endorsed  
19 industry White Paper, HCVS White Paper 03. And we  
20 have also had considerable information that's very  
21 closely aligned with the White Paper actually.

22 It's a -- there's a lot of close  
23 similarities between the two documents, to address the  
24 methods to control hydrogen. Or to prevent detonation  
25 -- detonable mixtures from occurring within the HCVS

1 piping.

2 Those ML numbers that you see referenced  
3 here is the first one is the actual industry White  
4 Paper that was submitted for endorsement. The second  
5 ADAMS ascension number is the NRC endorsement letter.  
6 Appendix H being in 13-02.

7 To go along with that it's, you know,  
8 we've done analysis for the referenced plan of concern  
9 that we used to develop the Guidance. And that  
10 analysis shows that the combustible gasses are largely  
11 vented as part of the SAWM strategy within the first  
12 24 hours, such that the concentrations remaining in  
13 the containment are very low.

14 Additionally, we addressed accessibility  
15 due to radiation. We developed and issued an industry  
16 White Paper, HCVS 02. That again, was review by the  
17 staff and endorsed.

18 It does provide a methodology for  
19 calculating integrated dose to HCVS equipment  
20 qualification that would include instrumentation. It  
21 also provides methods for determinating dose rates  
22 from the HCVS piping so that we can assess operator  
23 actions and accessibility for HCVS controls.

24 That as also extended, would include the  
25 SAWA components that need to be manipulated.



1                   MEMBER CORRADINI:     Can I ask you a  
2                   question? I wasn't at the meeting on Friday when you  
3                   guys did this.

4                   For the vacuum breaker performance, what's  
5                   assumed in the analysis for the range of performance  
6                   for the vacuum breakers for leakage from drywell to  
7                   wetwell? Because the leakage rate would affect this  
8                   if I understand the system correctly.

9                   MR. AMWAY:     In terms of, you're talking  
10                  about potential impacts to HCVS White Paper 02?

11                  MEMBER CORRADINI:   Oh, yes.

12                  MR. AMWAY:     Predom --

13                  MEMBER CORRADINI:   Because historically,  
14                  again, I'm not very familiar. But historically this  
15                  has always been a continuing issue. And that means --  
16                  so you have to assume sort of leakage during these  
17                  sorts of accidents.

18                  And I'm curious how if the accident  
19                  proceeds into a severe accident, how the degreda -- if  
20                  there's an effect on the leakage rate of the vacuum  
21                  breakers?

22                  MR. AMWAY:     And just to be clear, we're  
23                  talking about the vacuum breakers that go from the  
24                  wetwell back to the drywell?

25                  MEMBER CORRADINI:   Right.

1 MR. AMWAY: Okay. Jeff, you might be able  
2 to help me. But I'll give a crack here. That under  
3 the initial sequence of the accidents, once you start  
4 core damage, you'll get a substantial gap release.

5 Most of that gap release should end up in  
6 the wetwell through the SRVs. When you implement the  
7 SAWA, you're putting water in the drywell.

8 The heat generation, steam production in  
9 the drywell should put positive pressure seating force  
10 on the check valves down through the suppression  
11 function of the containment. So that for most of the  
12 accident the pressure should be higher in the drywell  
13 side then it is in the wetwell side because you're  
14 going to vent from the wetwell.

15 Which should minimize --

16 MEMBER CORRADINI: Well that was my guess,  
17 but --

18 MR. AMWAY: Should minimize the leaking.

19 MEMBER CORRADINI: Again, I haven't seen  
20 the evolution of the accident. I would expect  
21 somewhere in there you're going to have a burping of  
22 the vacuum breakers. And I'm worried about resealing  
23 and leakage rates that are assumed in the analysis.

24 MR. AMWAY: Do you have --

25 MR. GABOR: Yes, I -- this is Jeff Gabor.

1 I guess we haven't specifically looked at what  
2 influence that leakage would have.

3 I know -- I can't say in the Mark -- in  
4 the radiation calculation because the -- from a  
5 radionuclide perspective and what the vent pipe, what  
6 kind of radiation levels the vent pipe itself are  
7 exposed to, that was considered.

8 We actually assumed a well mixed drywell/  
9 wetwell compartment so that if there were for venting  
10 through the wetwell, and there was a large fraction of  
11 radionuclides in the drywell, the vent pipe doesn't  
12 necessarily see those. And if it does, it's after  
13 scrub.

14 So I know in the radiation analysis, I  
15 think that the topic that you're discussing was  
16 addressed. In our calculations on hydrogen  
17 distribution, that amount of leakage wasn't factored  
18 in.

19 And for the qualitative reasons that he  
20 gave.

21 MEMBER CORRADINI: But if you can point me  
22 to where it is, after the fact I'll read it. I just  
23 -- since I wasn't there, I didn't know if this was  
24 asked.

25 And to me, vacuum breaker performance

1 always tends to be a knotty issue with and when you're  
2 going into a severe accident regime chunk cares about  
3 sealing as I get to higher temperatures, et cetera, et  
4 cetera, et cetera.

5 MR. GABOR: Yes. And don't forget in our  
6 analysis, the scenarios we've adopted the water  
7 addition strategy. And in those scenarios, as you  
8 see, and in the NRC presentation, the temperatures are  
9 relatively mild in those cases, so.

10 MEMBER SKILLMAN: But we didn't discuss  
11 this in detail in the Subcommittee either.

12 MR. AMWAY: But the last Phase One, and  
13 it's really also a Phase Two topic, is the drywell  
14 vent design temperature 545. If you recall, that was  
15 originally proposed back when we developed the Phase  
16 One Guidance.

17 It was an open issue because it really  
18 impacted Phase Two. We have since confirmed through  
19 analysis that the water addition that we're proposing  
20 through the SAWA strategy provides us with the  
21 assurance that we should be able to maintain the  
22 containment temperature below -- at or below 545  
23 degrees Fahrenheit.

24 The figures shown here, that was also  
25 included under the Phase One Guidance. But it's

1 still, you know, applicable under Phase Two.

2 And just what I'd like to point here is  
3 that under point two, if you look at that dotted line,  
4 that envelopes the expected operating regime of the  
5 containment. With the implementation of the hard  
6 containment vent system and SAWA.

7 Yes, go ahead?

8 MR. GABOR: Yes, I'll -- this is Jeff  
9 Gabor again. I had a couple of comments.

10 This -- if you look at this curve, this is  
11 supposed to repre -- looks to represent the ultimate  
12 capacity of the containment. The red bar was actually  
13 taken from the original Chicago Bridge and Iron Work  
14 on the Mark I containment where they evaluated both  
15 pressure and temperature capability of the  
16 containment.

17 And as you can roughly see, that beyond a  
18 temperature of around 700 Fahrenheit, the pressure  
19 capability degrades to the point where it has  
20 essentially no capability beyond 900. And that's a  
21 typical representation that a plant, IPE or PRA would  
22 factor in.

23 The other areas, the darker blue in the  
24 center upper comes from the SOARCA analysis  
25 representing again, an upper bound. The green area on

1 the right is a compilation of a lot of the Sandia and  
2 various penetration experiments that were done to look  
3 at, at what point would a penetration begin to degrade  
4 and potentially leak.

5 So we -- obviously we didn't want to pick  
6 a design temperature where the -- in this case, this  
7 is specific to the development or the design of the  
8 drywell vent. We didn't want to pick something where  
9 that valve would be the last thing standing and come  
10 up with a reasonable expectation for the design.

11 So that's what led to the -- it justifies  
12 a 545 limit.

13 MEMBER REMPE: During -- excuse me, the  
14 Subcommittee meeting at the end, I believe our  
15 consultant Bill Shack mentioned that he had read some  
16 of the background information on that temperature.  
17 And he said that there were some questions about it.

18 And I apologize, but I was busy with other  
19 things and I didn't follow up on his concern. Has  
20 anybody looked at what he said?

21 MEMBER BALLINGER: It had to do with the  
22 seal material. Whether it was silicone based or  
23 another material base. And there was a paper which he  
24 sent us related to the capability of that material --  
25 those materials with respect to the 545.

1 MR. AMWAY: Yes. His concerns if I recall  
2 is in the report. It talks about silicone rubber and  
3 EPDM.

4 MEMBER BALLINGER: Yes.

5 MR. AMWAY: And at one point in that  
6 paper, that those materials were reversed in the  
7 report.

8 MEMBER BALLINGER: And that there was an  
9 error in it.

10 MR. AMWAY: So to be careful when we use  
11 that paper.

12 MEMBER BALLINGER: Yes. But I guess the  
13 concern is, have you checked that out?

14 MR. GABOR: Well, I know that if you go  
15 back, the green band on this chart addresses both  
16 types of penetrations. So there's experimental  
17 results for both silicone and EPDM.

18 MEMBER BALLINGER: Okay. Because I think  
19 there was some talk around the table of not knowing  
20 what seal material was used with what plant.

21 MR. GABOR: The next chart that we  
22 included as we did in the Subcommittee presentation,  
23 is just showing that if you recall the work that the  
24 industry is doing on the rulemaking, on the filter  
25 rulemaking, the CPRR.

1           We developed much like the NRC, a PRA  
2       framework to look at the ways in which we can get to  
3       a core damage event. And then we analyzed using an  
4       accident progression tree or a containment event tree,  
5       how that accident might progress to a potential  
6       containment breach or release of radionuclides.

7           And there was some 500 end states that are  
8       analyzed. All we've done here is to look at a  
9       compilation of those end states and their associated  
10      temperatures in the drywell that are assessed.

11          And we've looked at that on the left  
12      curve, we've looked at a probability that the maximum  
13      drywell gas temperature stays below whatever that  
14      limit is. And if you look at the blue line, those are  
15      just scenarios where we were successful in getting  
16      water into the containment post-core damage, post-  
17      vessel breach.

18          And you can see in those scenarios again,  
19      probabilistically weighted, probability weighted,  
20      we're able to demonstrate through a large number of  
21      calculations and uncertainties that the temperatures  
22      remained below the 545 type limit pretty consistently.

23          The red line in that first curve are the  
24      other scenarios where we assumed for different reasons  
25      that the water injection source did not function. So



1 this is the kind of typical, kind of a SOARCA type  
2 analysis, where there wasn't severe accident water  
3 addition.

4 The core comes out. It's dry on the floor  
5 and the containment heats up. You can see those  
6 temperatures are well above 1,000 Fahrenheit.

7 MEMBER CORRADINI: So just to, again, just  
8 to clarify. It doesn't matter when the water comes  
9 in. It's essentially covered with water to some  
10 extent. And what was the extent? I forgot.

11 MR. GABOR: Yes. The calculations we did,  
12 we did cal -- we did -- obviously these are  
13 simulations. Best estimate simulations.

14 So prior to the debris entering the  
15 containment, obviously there is potential for  
16 condensation on the walls and some accumulation.  
17 There's also some nominal leakage through the recert  
18 pumps. Pretty standard 36 gpm kind of numbers.

19 All of those things might put water on the  
20 floor prior. But the real key success is to be able  
21 to inject in our simulations and these simulations,  
22 500 gpm at or about the time of vessel breach,  
23 consistent with the NRC calculations as well.

24 So it's 500 -- and 500 gpm will fill the  
25 drywell up to the spillover point where water is now

1 running down into the torus.

2 MEMBER CORRADINI: And then eventually  
3 you're going to get this management of the water. But  
4 that will take you --

5 MR. GABOR: Yes, that's no reflected here.

6 MEMBER CORRADINI: That will take you up  
7 to the spill level?

8 MR. GABOR: Yes. The 500 will give us --

9 MEMBER CORRADINI: But what is that  
10 typically? Because they vary in all these designs?

11 MR. GABOR: It does. I think in our Mark  
12 I surveyed, we surveyed all the plants and we provided  
13 that data to the NRC. We had a range from nine inches  
14 to I think 30 inches.

15 MR. AMWAY: 30 inches, yes.

16 MR. GABOR: Yes.

17 MEMBER CORRADINI: Okay. Thank you.

18 MR. GABOR: And then the right side is  
19 merely, these are both scenarios where we have water  
20 either into the RPV post-vessel breach or into the  
21 containment, into the drywell. And what you can see  
22 from this is a slight preference to RPV injection in  
23 terms of maintaining.

24 And the benefit we see from that is from  
25 putting the water in the RPV after the core is melted

1 and after a large quantity has been discharged into  
2 containment. The RPV can either retain some of that  
3 core debris, can have fission products deposited on  
4 surfaces.

5 The water that goes in is able to have  
6 some benefit in cooling the internal structures of the  
7 RPV, making the radiation into containment slightly  
8 reduced in those scenarios. They both seem to be  
9 giving us successfully temperatures in the 545 or less  
10 range consistently.

11 But we do see by -- just simply by cooling  
12 the -- helping to cool the gas and the structures in  
13 the RPV, it kind of cuts down the thermal radiation  
14 off of that hot vessel long term.

15 MEMBER REMPE: But your model did consider  
16 radiation heat transfer off the outer surface of the  
17 vessel as a heat transfer removal mechanism along with  
18 the 185 control ride drives?

19 MR. GABOR: It did. It did and what --  
20 and to the drywell head reason and to the cylindrical  
21 part, the more tightly compacted area next to the RPV.  
22 And then into the spherical part below.

23 MEMBER SCHULTZ: Jeff, if we could just go  
24 back briefly to the containment capability figure.

25 MR. GABOR: Um-hum.

1                   MEMBER SCHULTZ:   What Bill Shack, our  
2                   consultant, brought up at the meeting, had to do with  
3                   the Paper and other discussions that -- from our  
4                   discussions at the Subcommittee, the industry had  
5                   reviewed or at least was aware of, and the question  
6                   really had to do with the boundary line that is from  
7                   point three down and across the pressure curve.

8                   That that's not a -- that's not a bright  
9                   line.

10                  MR. GABOR:   Right.

11                  MEMBER SCHULTZ:   Rather it's an area --  
12                  there's an area around that sharp line of uncertainty.  
13                  We didn't get into questions related to the point that  
14                  has been chosen for the limit, the 545 degree  
15                  Fahrenheit limit at point two.

16                  Rather the discussion was around how well  
17                  we understood or how well the evidence supported the  
18                  containment integrity along that bright line that's  
19                  between the --

20                  MR. GABOR:   Yes, and I wouldn't disagree  
21                  with that line of thought.   I mean, we're not trying  
22                  to show that as a hard line.

23                  MEMBER SCHULTZ:   I understand.

24                  MR. GABOR:   Right.   And in fact my  
25                  attention is drawn more to the green box because

1 that's where a lot of those uncertainties lie.

2 MEMBER SCHULTZ: Correct.

3 MR. GABOR: And we feel that the 545  
4 number is sufficiently low within that region that it  
5 protects us.

6 MEMBER SCHULTZ: And that reflects what we  
7 discussed at the Subcommittee meeting. Thank you.

8 MR. GABOR: Okay.

9 MR. BUNT: This is Randy Bunt. I think  
10 you're straight on Dr. Schultz. What we're showing  
11 here is the relationship is from point one on that  
12 chart to point three is relatively the gap between  
13 them. And when you design, at the lower gray box,  
14 that you get some failure -- when you get ultimate  
15 failure out at point three.

16 So you expand that design element window  
17 to point two. Then you've got some margin that it  
18 would expect you to be somewhere out where four is.  
19 And four is not a strict distinct point. Four is  
20 somewhere in the red bar.

21 So that's why -- and we realized that the  
22 other colored bars are really shaded bars as they  
23 start having some failure when that color starts. And  
24 the failure will go further.

25 MEMBER SCHULTZ: Thank you.

1 MR. AMWAY: Okay, so moving on with the  
2 Phase Two terminology. The two terms, severe accident  
3 and water addition as a means of providing reliable  
4 water addition to either the reactor vessel or the  
5 drywell post-core damage. With a severe accident  
6 water management managing that same water addition in  
7 a manner which preserves the wetwell vent path.

8 If you look at the order in total, this is  
9 just an outline of all the different order elements.  
10 We are in Phase One right now, which is at the top  
11 green box.

12 Phase Two, drywell vent, a reliable  
13 alternative implementation. That's what's due in the  
14 2017 to 2019 time frame. Our integrated plans are due  
15 at the end of this year.

16 The gray box off to the side is the Bravo  
17 1 drywell vent option that would not include severe  
18 accident water addition. And as Jeff showed on the  
19 charts that would require that design boundary  
20 condition to be far in excess of 545 degrees.

21 And that would require some plant specific  
22 analysis. As we've mentioned, there's different  
23 seals. Some are silicone. Some are EPDM. So, you  
24 would have to look at that in context of what you  
25 defined as a boundary condition.

1                   MEMBER CORRADINI:     Can I ask another  
2 question?

3                   MR. AMWAY:    Yes.

4                   MEMBER CORRADINI:     Since I've been  
5 prompted and I've forgotten. So, we're all talking  
6 Mark I geometries. If I move into the world of Mark  
7 IIs, how many are we talking about? And how diverse  
8 they are geometrically?

9                   MR. AMWAY: In the Mark IIs, there's seven  
10 total. And they are very dif -- well, I'll say --

11                  MEMBER CORRADINI: Seven different designs  
12 is at a minimum.

13                  MR. AMWAY: Because there are essentially  
14 seven different designs in terms of whether they have  
15 a sunken pedestal. Whether they have downcomers  
16 within the sunken pedestal region or not.

17                  You know, there --

18                  MEMBER CORRADINI: So let me push the  
19 point. So, are any of them such that they are such  
20 flushed that if you put water there it goes right down  
21 into the wetwell? Or are you going to build something  
22 up that keeps you nice and cool versus toasty?

23                  MR. GABOR: Again, this is Jeff Gabor. I  
24 think the -- it's not correct to compare the two  
25 relative to the -- what you're referring to the

1 spillover of water myth.

2 MEMBER CORRADINI: Well I was trying to  
3 get back to your curve about temperatures and  
4 pressures and --

5 MR. GABOR: Yes.

6 MEMBER CORRADINI: Okay.

7 MR. GABOR: So, the behavior in the Mark  
8 IIs is they have -- as you know, they have downcomers  
9 that will most likely transport the debris into the  
10 suppression pool. And -- or they have drain lines,  
11 which has been evaluated by Oak Ridge many years ago,  
12 to look at the possibility that the plates that --  
13 under the vessel that hold the drain piping would melt  
14 and fail and also allow debris to be discharged.

15 So there's -- the Mark IIs have various  
16 ways for the debris to find the pool. Where in the  
17 Mark I, that doesn't happen. We have to put the pool  
18 or put the water on the debris.

19 VICE CHAIRMAN BLEY: Well, the trouble is  
20 if the debris finds the pool, it's also probably  
21 creating a wetwell bypass.

22 MR. GABOR: That's a true statement. And  
23 in our Mark II analysis we consider that bypass. But  
24 we don't see that bypass creating any kind of a  
25 variation on the thermal response of the containment.

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1 And we also don't --

2 VICE CHAIRMAN BLEY: You don't have a  
3 containment.

4 MR. GABOR: With the bypass?

5 VICE CHAIRMAN BLEY: Yes. You're  
6 bypassing the wetwell then.

7 MR. GABOR: The wetwell, but the wetwell  
8 is there to -- as vapor suppression. Right? I mean,  
9 that's the point of it.

10 If I put the debris in the wetwell, I'm  
11 getting that vapor suppression.

12 MEMBER CORRADINI: But I thought Dana said  
13 -- oh, okay.

14 MR. GABOR: But my heat balance is the  
15 same. But I do have the bypass. And from a  
16 radionuclide transport, it's something that we did  
17 analyze.

18 VICE CHAIRMAN BLEY: Yes. You're just  
19 venting all your volatiles. Or you're --

20 MR. GABOR: Well, we can vent the  
21 volatiles. But what we see in our analysis and what  
22 we saw in our radiation analysis is that now that I've  
23 moved my pressure source into the wetwell and I'm  
24 venting the wetwell, you can tend to have the drywell  
25 stay at a lower pressure and not as effectively

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1 communicating with the wetwell air space.

2 So my heat source is in the wetwell. My  
3 vent's in the wetwell. I can vent that heat out  
4 without really involving the drywell. And we do see  
5 fairly significant deposition in the drywell long  
6 term, even with that bypass model.

7 MEMBER CORRADINI: I guess I'm really not  
8 as familiar as he is with the geometry. But when you  
9 say bypass, I would -- I interpret that to mean that  
10 you don't get any sort of scrubbing at all.

11 MR. GABOR: For radionuclides leaving a  
12 drywell going out the wetwell vent, you're correct.  
13 You're correct.

14 What you get is the passive deposition  
15 mechanisms in the drywell to function.

16 MEMBER CORRADINI: And that's it?

17 MR. GABOR: And that's it. But again, you  
18 have to analyze it integrally because we find that our  
19 wetwell, because that's where the debris is, that's  
20 where the pressure source is, stays at a slightly  
21 enough higher pressure than the drywell.

22 And we don't see a lot of flow from the  
23 drywell into the wetwell from through that bypass.

24 MEMBER CORRADINI: Okay.

25 MEMBER POWERS: It seems to me that that

1 would be a very strong function of how much of your  
2 core debris actually penetrated down. That if you  
3 have a substantial amount either in the vessel, hung  
4 up on the drives or on the diaphragm floor, that that  
5 could reverse that pressurization.

6 MR. GABOR: And we -- in our radiation  
7 calculation I believe we've -- I'm pretty certain it's  
8 documented in the White Paper 02. There is a  
9 sensitivity to try to address your concern.

10 And we looked at, what if, you know, our  
11 typical simulation would have let's say 90 percent of  
12 the core debris draining into the pool. Maybe 10  
13 percent remaining behind. We varied that.

14 We found ways to increase how much we got  
15 -- we left behind. We didn't see a large variation  
16 because it's such a strong pressure source in the  
17 wetwell.

18 MEMBER POWERS: If I used an alternative  
19 model that didn't bring the core debris down at a very  
20 high temperature onto the diaphragm floor, would I get  
21 the same -- within your range of variability?

22 MEMBER CORRADINI: What he's asking is,  
23 what I assume you know is, instead of it being nice  
24 and liquidy, it's nice and mushy and it just sticks  
25 where you dump it.

1           MR. GABOR: I think that those original  
2 Oak Ridge studies looked at that. Because they were  
3 using the BWSAR melt releases, which were more in  
4 line with the MELCOR or the current day MELCOR  
5 results, where it did come out pretty low temperature  
6 and more solid then liquid.

7           And in some of those scenarios, these  
8 plates, diaphragm plates for the penetrations for the  
9 drain lines did not even melt because of debris. But  
10 what they did see as soon as they had any kind of  
11 oblation of the concrete, the downcomer pipes  
12 themselves did give way and debris was able to flow.

13          MR. POWERS: Yes, I would suspect that.  
14 It doesn't take much of a thermal stress on the  
15 diaphragm concrete to pop it. Because it's only three  
16 feet thick or something like that.

17          MR. GABOR: But our Mark II strategy is  
18 similar to our Mark I strategy in that we are still  
19 relying on the addition of water to the containment  
20 post-vessel breach.

21          MEMBER POWERS: You can't get very much  
22 water in on the diaphragm floor can you?

23          MR. GABOR: Yes, but the downcomers are in  
24 the 18-inch range, if you look at the Mark IIs. One  
25 of the plants is very unique, Nine Mile 2. It has

1 these downcomer pipes directly under the reactor  
2 vessel. So, there's a pretty much straight shot.

3

4 The other ones have a uniform floor and  
5 the downcomers are outside the door, the pedestal  
6 door.

7 VICE CHAIRMAN BLEY: I kind of missed a  
8 piece of your discussion there. When you did the  
9 sensitivity studies and left more behind, what did you  
10 say that did to the results?

11 MR. GABOR: The radiation results, we  
12 still found that there was a large amount of  
13 deposition of radionuclides in the drywell. And we  
14 still were not seeing a huge flow of radionuclides  
15 from the drywell to the wetwell because the majority  
16 of our heat source was still in the wetwell.

17 So wherever the heat source is, obviously  
18 it's going to generate the greatest pressure. And  
19 that's what we saw in those calcs.

20 Now we didn't take them to an extreme of  
21 keeping it all up on the floor.

22 VICE CHAIRMAN BLEY: This seems like a  
23 case where what's conservative from one point of view  
24 might not be from the other. And you don't treat it  
25 probabilistically. But do you think the sensitivity

1 study has showed you enough to be --

2 MR. GABOR: I think it helps. And I never  
3 used the word conservative in level two parameters.

4 VICE CHAIRMAN BLEY: I know you didn't.  
5 But I did to work.

6 MR. GABOR: Because you picked something.  
7 Right. But we specifically for the rad calc, we  
8 wanted to see was there a way that we could increase  
9 the local doses in the wetwell, which would obviously  
10 increase the local doses going out the vent pipe and  
11 the shielding required.

12 And so that was the point of that  
13 calculation.

14 MR. AMWAY: Okay. With that I'll continue  
15 here. Working down this chart here, the gray box,  
16 this is something that, you know, we don't see really  
17 as a viable approach for the industry.

18 We talked about, you know, the need to be  
19 standard in how we're trying to implement Phase Two of  
20 the order. We are certainly not aware of anybody in  
21 the industry that's going to attempt to do that.

22 We will strongly discourage that approach  
23 in the workshops that we do. And in the various  
24 vehicles we have to make sure that we stay aligned  
25 across the fleet for implementation.

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1           Our Guidance really is very restricted in  
2 terms of what we do. In fact, you know, we make the  
3 statement that the Guidance provided in section three  
4 of the Phase Two Guidance 13-02 really isn't right to  
5 address this. And anything that, you know, any plant  
6 that would want to try to do that, they would have to  
7 work that out specifically with the staff to figure  
8 out what they would have to do for that type of  
9 design.

10           So really what I'd like to do is turn my  
11 focus down to the bottom section of this chart, which  
12 is where the Guidance is written for Phase Two. And  
13 this is, if you look in the ISG, this is methods two  
14 and three, which both include reliable water addition,  
15 which is the SAWA.

16           Then down below that, then the options  
17 exist for either a severe accident drywell vent  
18 designed to 545 degrees Fahrenheit. Or the water  
19 management approach that doesn't need a drywell vent.

20           I expect that the box that includes the  
21 water management will be the dominant path that the  
22 industry follows. That's where we are all headed.

23           The only reason that we would have a plant  
24 that would go into the drywell vent option is if for  
25 some reason they can't follow the Guidance to

1 implement a successful SAWM strategy. And then  
2 ultimately chooses to put in the severe accident  
3 capable drywell vent.

4 Now this next slide, I pretty much talked  
5 about on the previous slide. And again section three,  
6 you'll see that's very short in terms of saying, you  
7 know, the Guidance really isn't written for the  
8 drywell vent option that doesn't include water  
9 addition.

10 And that there is other long term impacts  
11 through the rulemaking. Which, you know, one of the  
12 biggest benefits we're seeing is the water addition  
13 with SAWA.

14 That controls the containment temperatures  
15 and preserves the containment function or capability,  
16 which would lead you to not select the option of ISG  
17 method 1. Then going into the ISG methods 2 and 3,  
18 that's where you get the breakdown between the 545  
19 degree drywell vent and the SAWM approach.

20 The next big topic for Phase Two is how  
21 long do we have to preserve the wetwell vent to have  
22 a successful SAWM strategy? And we've broken that  
23 down as three options.

24 The first is if we can show seven days of  
25 sustained operation. That ability to preserve the



1 wetwell vent path that there's no additional actions  
2 required to meet the order.

3 For those plants that can demonstrate  
4 successful SAWM strategies, but maybe not for the full  
5 seven day duration. If they can make it at least 72  
6 hours, between 72 hours and seven days, then they  
7 actually have to provide a functional level  
8 description of the alternate reliable containment heat  
9 removals mechanisms that they can put in place to  
10 remove long term decay heat from the containment.

11 And they would have to describe that in  
12 the Phase Two OIP. The difference between that option  
13 and the third tier is for those plants that can do  
14 SAWM, but for less than 72 hours, they have to go  
15 ratchet up that level of detail.

16 Now they have to have specific Guidance  
17 and procedures to tell you how to do it. And it would  
18 also include plant modifications that are readily  
19 available to be able to implement that alternate  
20 reliable containment heat removal.

21 MEMBER CORRADINI: So again, since I  
22 wasn't around. So is it the FLEX -- is it the FLEX --

23 CHAIRMAN STETKAR: This is by the way, was  
24 largely revamped in the latest revisions. So it  
25 didn't make any difference that you're not around --

1 weren't around.

2 MEMBER CORRADINI: Oh, okay.

3 CHAIRMAN STETKAR: This came in between  
4 then and now.

5 MEMBER CORRADINI: Okay. Fine. So my  
6 question really is about this, is, what is the  
7 equipment that this is the FLEX onsite equipment  
8 that's going to be used for this? That's my -- that  
9 was my starting question.

10 MR. AMWAY: They're equipped for the  
11 alternate decay of heat removal. It could be a  
12 combination of all installed equipment. It could be  
13 a combination of installed and portable equipment

14 It could be all portable. The portable  
15 equipment could be your onsite Phase Two that you're  
16 using to support FLEX. Or it could be offsite  
17 equipment.

18 We're trying to leave that open because of  
19 the timing involved. And the conditions that a plant  
20 might see at that particular point.

21 And that's why we're saying, we want them  
22 to provide two or three different options that would,  
23 you know, consider both, what if I have offsite power  
24 back, can I use the installed equipment to restore  
25 decay heat removal?

1           If they can do that, that would be their  
2 preferred option at that point.

3           If they don't have the offsite power and  
4 they have to rely on portable equipment, well maybe  
5 the equipment at the plant is fine, but they can power  
6 it up with either the FLEX generators they have onsite  
7 or something they bring in for the National Response  
8 Centers to provide, you know, the 4160 capability and  
9 the higher loading capability. And use the installed  
10 plant equipment.

11           And for conditions where they don't have  
12 either of those, they may have to establish an  
13 entirely external loop and means of what that  
14 alternate heat removal is.

15           So we're trying to leave that flexible.  
16 I mean they have to describe it in the OIP what their  
17 approaches are. But leave it flexible enough in  
18 consideration of not every event is going to follow  
19 the same path and you want to keep your options open  
20 in terms of what you're going to use.

21           CHAIRMAN STETKAR: The 72 hour to seven  
22 day time period, a few questions. There is Section C-  
23 72 now and Appendix C, sort of walks people through.

24           Well, you might think about this. You  
25 might think about that. Because in Section -- for

1 that middle option, all you have to do is say, I might  
2 think about this. I might think about that.

3 Some of the things you might think about  
4 are saying, says the Emergency Response Organization  
5 will be at full staff at 24 ours.

6 MR. AMWAY: Um-hum.

7 CHAIRMAN STETKAR: Well, okay. That's  
8 pretty speculative for me in saying that. I can get  
9 stuff from the SAFER Center within 24 hours. It will  
10 start to arrive. Anything I need.

11 That's pretty speculative for me. My  
12 question is, I don't want to get into this discussion  
13 of what people might do. How many of the plants, and  
14 you've looked at them all, fall within that second  
15 bullet?

16 MR. AMWAY: And I'll tell you, I don't --  
17 we don't know yet. Because we haven't done --

18 CHAIRMAN STETKAR: Aw, come on. You've  
19 looked at all of them. How many fall within the  
20 second bullet? There should be very few.

21 MR. AMWAY: I mean, if you look at --

22 CHAIRMAN STETKAR: I hope that there's  
23 very few.

24 MR. AMWAY: And there should be. Because  
25 there's really, I mean, if you look at what the SAWM

1 strategy is, it's just a mass balance. I'm putting  
2 water in. I'm venting steam off.

3 CHAIRMAN STETKAR: If they all fall within  
4 that second bullet, I've got real problems.

5 MR. AMWAY: Right.

6 CHAIRMAN STETKAR: Because you're basing  
7 the entire fleet-wide strategy on speculation. If  
8 only a couple of them are in there, I don't have a  
9 problem.

10 MR. KRAFT: It's not meant to be complete  
11 speculation. It -- and we've had this discussion with  
12 the staff.

13 It -- I don't think it's about at the  
14 time, you'll figure out what to do. You've got to  
15 figure out what your options are in advance.

16 CHAIRMAN STETKAR: But you're only --

17 MR. KRAFT: So you have that understood  
18 and you're not trying to invent it at the time.

19 CHAIRMAN STETKAR: But the require -- the  
20 Guidance just says you have to have a general  
21 functional idea. It doesn't say -- it's not nearly as  
22 specific as that bottom bullet there.

23 The bottom bullet says, you've got to have  
24 some strategies in place. You have to have thought  
25 about this.

1 MR. AMWAY: That's right. And what this  
2 part --

3 CHAIRMAN STETKAR: The middle part just  
4 says, well, I can get some functional restoration of  
5 containment, you know, heat removal of some sort. But  
6 the examples, I mean, you -- there's a long example  
7 set.

8 There are things like, well you might  
9 account for the fact that the Emergency Response  
10 Organization will be there according to NEI 12-01 HCVS  
11 frequently asked question 06. That's why I can assume  
12 that everybody's going to be there.

13 Those kinds of things bother me if indeed  
14 the majority of the plants are going to fall into that  
15 bin. Because that says that all you're doing to tick  
16 off a box is saying, yes, oh, we've kind of thought  
17 about it. And well, everything will be okay because  
18 everything will be okay.

19 MR. AMWAY: And we certainly don't expect  
20 many plants, if any --

21 CHAIRMAN STETKAR: I hope not.

22 MR. AMWAY: To fall in there.

23 CHAIRMAN STETKAR: Okay. So that was my  
24 question.

25 MEMBER CORRADINI: Since he knows more

1       then I, why not?

2                   MR. AMWAY:   Why not?

3                   MEMBER CORRADINI:   Why not?

4                   MR. AMWAY:   Because you know, with the --  
5       the Guidance that we have in place, there is enough  
6       time for the operators to take suf -- even if they  
7       were slow in cutting back the SAWA flow, there's  
8       enough wetwell volume in there that, you know, there's  
9       some flexibility there at the times that you actually  
10      cut back that SAWA flow and establish your long term  
11      flow rate that's preserved in that wetwell vent pad.

12                  CHAIRMAN STETKAR:   Your expecting the  
13      majority of plants to fall within the first --

14                  MR. AMWAY:   The first seven days.

15                  CHAIRMAN STETKAR:   The first seven days.

16                  MR. AMWAY:   They should be able --

17                  CHAIRMAN STETKAR:   That's good.   That  
18      helps me a lot.

19                  MR. AMWAY:   Okay.   Randy did you want --

20                  MR. BUNT:   Randy Bunt.   Another thing is  
21      I think what we may have a little bit of  
22      misunderstanding.

23                  We said that the ERO staff would be  
24      staffed within 24 hours.   But again, we're saying this  
25      is at three days, not at that 24 hour period.   And

1 it's the whole window between three and seven.

2 So there is some speculation here. But  
3 there's also some margin to that time.

4 CHAIRMAN STETKAR: You know, why? I  
5 didn't -- Randy, I didn't get that impression reading  
6 through here. It's the entire just -- these are  
7 examples of the justification that people might use.

8 It doesn't say within 24 hours, after 72  
9 hours. It just says they'll be there within 24 hours.

10 MR. BUNT: Right. That's our assumption  
11 based on other guidance. But again, that's why we --

12 CHAIRMAN STETKAR: I understand.

13 MR. BUNT: That's why we chose 72 hours  
14 instead of saying that middle block should be 24 to  
15 seven days.

16 CHAIRMAN STETKAR: I know.

17 MR. BUNT: So we gave some margin to some  
18 of those time lines in there. So, we said ERO staff  
19 would be avail -- would be fully staffed by 24 hours.

20 But we're not going to credit -- that's  
21 why we didn't want to say that middle box was 24 hours  
22 to seven days. We wanted to say it was 72 hours to  
23 seven days.

24 So that's some of that margin to help you  
25 with some of that speculation. And also, it was



1 intended to be a fuller thought out strategy where the  
2 bottom one was modifications and plant changes that  
3 would be in the bottom one.

4 In the middle one, you would still know  
5 how you would do that. And it would be pre-thought  
6 out before you got there.

7 MEMBER CORRADINI: Can you help me Randy,  
8 about the last one then? What sort of modifications  
9 are you thinking of, might be necessary if they fell  
10 within the less then three days?

11 MR. BUNT: An example of what we see at --  
12 talking about the second bullet and the third bullet,  
13 is in the third bullet you might go and use your  
14 suction or your test return line to your CST as your  
15 suction point back out for your heat exchanger.

16 You'd go ahead and make a modification to  
17 that line and put a T in and a valve and a flange so  
18 that you could go ahead and hook that up in a quicker  
19 time line. Because you wouldn't want to be so much  
20 speculative on getting extra staff in to be able to  
21 cut that line and put a clamp on it or something else.

22 In the middle version, you would go ahead  
23 and identify and say, I'm going to use that suction  
24 line out of the CST for the return line as my suction  
25 point. And I would have tooling to be able to cut it

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1 off and to be able to put a slip on clamp or something  
2 on.

3 And the reason you're out to three days or  
4 longer is you're going to have more resources  
5 available by the time you get there. In the bottom  
6 one you don't have those resources as guaranteed, as  
7 Mr. Stetkar mentioned as.

8 You are speculative on how many you will  
9 have. So you want to go ahead and have that pre-  
10 modified so you can go do a hook up with limited  
11 personnel and limited planning.

12 And that's the distinction between those  
13 two bottom ones. Does that help?

14 MEMBER CORRADINI: It does. I'm -- well,  
15 I guess it kind of does.

16 MR. BUNT: And again, we don't see anybody  
17 that's really -- we don't believe that anybody that's  
18 run their analysis so far is going to be in that  
19 second box.

20 CHAIRMAN STETKAR: That's the thing that  
21 helps me.

22 MR. BUNT: Yes.

23 CHAIRMAN STETKAR: No, I mean, really. It  
24 does.

25 MR. BUNT: And anybody that we've even

1 speculated, we expect that they won't be in that  
2 second box until day five or six at the earliest.  
3 Even if they were there. They wouldn't be in the 72  
4 hour period.

5 MEMBER CORRADINI: But then -- let me ask  
6 the question that's going through my mind. Which is,  
7 why even have the second opportunity?

8 Why not just simply say, you're either  
9 going to have to do some sort of sustained operation  
10 in seven days or, if it's less than seven days, you're  
11 going to have to make some sort of up front fix to  
12 make sure you can get into the seven day.

13 Do you see what I'm asking?

14 MR. BUNT: Yes. And because -- the reason  
15 we choose the three tiered approach was because of the  
16 variability of the progression of the event. And  
17 making those predetermined cases, while they look good  
18 today based on the stylized scenario that we're  
19 building into it, that we want to be more symptom  
20 based as we go forward.

21 And so that middle block allows you that  
22 when you've got more time and you've got more  
23 resources. But if you're in the really short window  
24 that shouldn't be applicable.

25 You should go ahead and have something

1 totally predefined.

2 MEMBER CORRADINI: It's also -- may I  
3 fight back a little bit?

4 MR. BUNT: Sure.

5 MEMBER CORRADINI: So, that sounds good  
6 when everything is nice and rational and calm. But,  
7 I don't know how calm people will be in some sort of  
8 event that leads me to this sort of environment.

9 So it seems to me that if I could -- if  
10 your analysis is suggesting that you can do something  
11 to take you into seven days, you would do it if it's  
12 as you were giving the example of, what you said,  
13 adding a T so you could draw suction from the CST.  
14 Something that would be, at least in my simple mind,  
15 a nominal fix.

16 Do you know what I'm asking?

17 MR. BUNT: Right. It really would come  
18 down to evaluation of that when it's submitted in as  
19 to what the information would be. And how close you  
20 are to the 72 hour or the seven days I think.

21 MEMBER CORRADINI: Okay. Okay. Thank  
22 you.

23 MR. AMWAY: Okay now, if we can move on,  
24 I'm going to turn this over to Jeff Gabor to walk us  
25 through some of these plots.

1 MR. GABOR: Yes, so there's three plots.  
2 Three? Yes. Three plots here. The point of them is  
3 to just demonstrate that we can successfully get into  
4 that third block area where we can get out beyond the  
5 seven days.

6 And the scenario that we looked at was  
7 relatively simple where 500 gpm was initially injected  
8 into the containment. And that was done until, you  
9 can see from the chart here, it was done for something  
10 like eight hours.

11 The decision was made to cut that flow  
12 down to 100 gpm at that point. And for the remaining  
13 seven day period, we just kept it there.

14 The goal for the strategy is to maintain  
15 a slight upward trend in the torus level or in the  
16 wetwell level. If we're maintaining a slightly upward  
17 trend, it means we're putting more water on the debris  
18 then we likely need.

19 And there is water spilling over into the  
20 torus. So having that very slow upward trend, in the  
21 case of our reference plant, which was the most  
22 restrictive of all the plants, the operators would  
23 have to isolate that wetwell vent at 21 feet in the  
24 pool.

25 And you can see if we go well beyond seven

1 days, we could get there, even at 100 gpm. But these  
2 are relatively modest. As Phil said, there's a lot of  
3 time.

4 You're talking about a huge mass of water,  
5 volume of water in the torus. So it's, you know, by  
6 simply monitoring the wetwell or torus water level on  
7 the Mark I, you can, we believe you can achieve the  
8 seven days.

9 And the --

10 MEMBER CORRADINI: So I have a couple of  
11 questions about this one just to help me. So, let's  
12 talk about instrumentation first.

13 So the instrumentation you would use to  
14 make sure that things are going the way you think  
15 they're going would be instrumentation of level  
16 indication out in the wetwell?

17 MR. GABOR: Correct. Right.

18 MEMBER CORRADINI: And it's not going to  
19 have any sort of challenges relative to its  
20 environment that would be outside of its current EQ  
21 range?

22 MR. AMWAY: That's one of the things we  
23 would check. Right, over the seven day period, we  
24 would have to look at that integrated radiation dose  
25 and make sure it falls within that instrument's

1 equipment qualifications.

2 MEMBER CORRADINI: Okay. So, -- all  
3 right. So, the next question is, now I get the seven  
4 days and I hit 21 feet. Then what?

5 MR. GABOR: In the case of this plant,  
6 they would be told to isolate the wetwell vent. In  
7 this case, obviously another adjustment to the  
8 injection rate could be made anywhere from 24 hours to  
9 seven days to try to bring that trend back down to an  
10 almost stable point or a slight increase and buy even  
11 more than seven days.

12 And I was able to get seven days with  
13 these simple actions. You know, additional reduction,  
14 slight reduction in flow could maintain the torus  
15 level essentially forever below the 21 foot.

16 MEMBER CORRADINI: Okay. Just -- I don't  
17 want to take up too much time, but a whole bunch of  
18 questions popped in my head. So, you always want to  
19 maintain a positive slope so that you can get some  
20 sort of instrumentation, a reliable information  
21 response so that you know things are going where  
22 they're going? All right, I'll stop now.

23 MR. AMWAY: And we have also improved the  
24 Guidance between the Subcommittee and now for things  
25 that we want to do to make sure that the SAWA

1 injection flow path is in tact. And you're not in  
2 fact diverting some of the flow from your pump to  
3 places that you don't want it to go.

4 You know, looking at logic. Making sure  
5 that valves are in the right position. Make sure  
6 there's no other diversionary paths that are going to  
7 defer that SAWA flow to someplace that you don't, you  
8 know, need it to go.

9 MR. GABOR: Done.

10 MR. AMWAY: Done?

11 MR. GABOR: Unless there's questions. It  
12 just shows that we're maintaining pressure and  
13 temperature acceptable in a containment.

14 MR. AMWAY: Okay. So moving on. SAWA  
15 equipment. We have to be able to demonstrate that we  
16 can actually connect it and maintain it for the  
17 sustained operational period.

18 That includes the mode of force that may  
19 be needed to power the instrumentation any valves in  
20 the SAWA flow path. And to make sure that were can do  
21 that in a time line that's needed to support the SAWM  
22 strategies or the 545 degree drywell vent.

23 To approve the assurance and reliability  
24 of those actions, for any actions that we need to do  
25 in less then 24 hours, we will be doing a validation



1 of those actions similarly to what was done under NEI  
2 12-06 for FLEX. To make sure that we do have those  
3 actions clear and well defined and implementable.

4 MEMBER SKILLMAN: Phil, how will the  
5 radiation levels be considered in that validation  
6 point?

7 MR. AMWAY: They'll be considered up  
8 front. We will, you know, before we even get to the  
9 validation point, we will have done the radiological  
10 analysis to make sure that we understand what we  
11 expect those dose rates to be, where they are taking  
12 those actions.

13 MEMBER SCHULTZ: And that's done on a  
14 design specific basis?

15 MR. AMWAY: Yes.

16 MEMBER SCHULTZ: I know there was a --

17 MR. AMWAY: It's a design specific basis.  
18 It's going to be a function of wherever those SAWA  
19 components have to be, you know, actually gotten to  
20 when, you know, whether it's connecting, monitoring,  
21 refueling, repowering, pneumatic supplies, anything  
22 that needs to be done within the radiological area.

23 MR. GABOR: The White Paper 02 provides  
24 the basis for that.

25 MR. AMWAY: Right.

1 MR. GABOR: That then it's scalable from  
2 that basis.

3 MEMBER SKILLMAN: Will that include  
4 preemptive placement of shielding?

5 MR. AMWAY: I would like to stay away from  
6 that. I mean, I think it's best if we can locate the  
7 controls and monitoring locations for either HCVS or  
8 SAWA, without predeploying any type of portable  
9 instrumentation.

10 Whether that's on the front ends that we  
11 put it in, you know, as part of the design effort,  
12 before we declare victory on implementation. Or the  
13 location is just far enough away that we would be able  
14 to get to it.

15 We don't want to have to have those  
16 actions done at the time of the event.

17 MR. KRAFT: There may be situations, I can  
18 imagine in the old boilers where you make the personal  
19 entry right where the CDRM hydraulics are. You look  
20 down the hallway, there's a door that used to just  
21 open up basically for guards which now secure the  
22 door. Right?

23 And the way FLEX is going to work, some  
24 plants will have -- would have an ability to overcome  
25 the security requirements, open that door, run a hose

1 into a quick connect, to a standpipe that's right in  
2 that corner for the feed water system.

3 So I've seen that in a number of plants.  
4 You can't stand there during a serious accident  
5 because you're 20 feet from the core. Even though  
6 it's on other side of the, you know, the light bulb.

7 So some plants may decide, okay, I'll hard  
8 pipe that but not penetrate that outer wall. So I  
9 open that door up and maybe I'll erect a new shield  
10 wall that will be permanent, to have the new  
11 connection behind that shield wall.

12 MEMBER SKILLMAN: That was the question.

13 MR. KRAFT: One of the things -- I mean,  
14 so you're ask -- you asked about temporary. I was --  
15 and that's what Phil was talking about.

16 MEMBER SKILLMAN: No, I said preemptive.

17 MR. KRAFT: Yes.

18 MEMBER SKILLMAN: What I'm saying is  
19 you've done your analysis.

20 MR. KRAFT: Right.

21 MEMBER SKILLMAN: Erin said hey, we  
22 believe it's going to be 5,000 RPR and shield it.

23 MR. KRAFT: Right.

24 MEMBER SKILLMAN: You say fine. Since I'm  
25 going to have to access that point, we will build the

1 shield today.

2 MR. KRAFT: If it's necessary, yes.

3 MEMBER SKILLMAN: So that when we can get  
4 to that when we need to.

5 MR. KRAFT: If necessary, yes. There's a  
6 diagram in the Guidance that's really from Phil's  
7 plant that NRC has in their presentation we noticed,  
8 that shows that the FLEX connection as he currently  
9 has it, is a hose that snakes its way in from the  
10 truck bay into a location near the wall.

11 If that becomes a SAWA injection point,  
12 that will hard piped up further. So you're taking  
13 advantage of distance there and of some other shield  
14 walls that are there.

15 So yes, those considerations will be made.  
16 It's one of the reasons that we've been talking about  
17 this assist program. Because we want to make sure  
18 people are A, accomplishing what they need to  
19 accomplish.

20 We want to make sure we're taking  
21 advantage of knowing what the different geometries are  
22 in the Mark IIs. Make sure the water can get to where  
23 it has to go.

24 And also, those questions too. I can  
25 imagine, you know, some industry group looking at some

1 design source, say wait a minute. You know, what  
2 about those levels at that point?

3 It's not a common thing to do in the  
4 industry. But we think this is important enough that  
5 we do it that way.

6 MEMBER SKILLMAN: Well, it seems to me  
7 that unless that evaluation and consideration has been  
8 incorporated, you've only achieved a portion of your  
9 objective.

10 MR. KRAFT: Um-hum.

11 MEMBER SKILLMAN: Because if we really  
12 are, we hope this will never happen. As you said in  
13 the last meeting, it's very rare.

14 MR. KRAFT: Right.

15 MEMBER SKILLMAN: But by golly, if it  
16 happens, we need to be able to fulfil what we say  
17 we're going to fulfil.

18 MR. KRAFT: Absolutely.

19 MEMBER SKILLMAN: And you can't be  
20 irradiating, heroically, your workers.

21 MR. KRAFT: Absolutely. But you and I  
22 were talking before the meeting about experiences at  
23 TMI. While you were with that crew pumping that water  
24 out of the aux building, I was receiving into the  
25 tanks that we had set up in the -- remember the old,

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1 we called it the cap gun system and then we had the  
2 Epicor system. What do we do with the water?

3 I was on that side of the problem. So,  
4 yes. We understand completely the need to avoid those  
5 heroic actions. And Fukushima was a great teaching  
6 event in that regard in terms of what heroic actions  
7 you need to avoid.

8 You know, as heroic as they were, we don't  
9 want to put people in those positions.

10 MEMBER SKILLMAN: Again. Yes.

11 MR. KRAFT: Again, yes.

12 MEMBER SKILLMAN: Thank you.

13 CHAIRMAN STETKAR: Phil, go back to your  
14 last slide. Every time I read these updates when they  
15 come in two or three days before a meeting, I learn  
16 things.

17 This innocuous looking little first sub-  
18 bullet there that says motive force for SAWA may  
19 include power and pneumatics for valves in the SAWA  
20 flow path and instrumentation.

21 And I read the Guidance. And the Guidance  
22 says, yes. We might have to get power to open valves  
23 in that flow path. But we'd run analysis in the  
24 minimum time that's available. And our analysis is  
25 eight hours.

1           And we can take credit for offsite help  
2           within six hours. So, we'll have everything we need  
3           to get that power.

4           I have a different question. So this  
5           pump, and I'm not going to call it -- it's a pump.  
6           It's a 500 gpm low pressure pump.

7           And it -- however we connect it up with a  
8           hose to wherever that connection is located, can pump  
9           water into the reactor vessel. To me that sounds like  
10          a good idea.

11          And let's say it's hooked up through two  
12          normally closed A/C motor operated valves that you say  
13          we don't need power for those valves in eight hours.  
14          And I say I'm in an event where RCIC fails at time t-  
15          zero.

16          And I'm an operator. Does the Guidance  
17          now tell me that I sit on my hands until the core  
18          melts and I just save the public?

19          MR. AMWAY: Absolutely not.

20          CHAIRMAN STETKAR: Because -- okay, how do  
21          I get power to those valves at t-zero?

22          MR. AMWAY: You're going to -- if you get  
23          in a situation where RCIC fails at t-zero, you start  
24          then deploying generators, pumps, whatever you need.

25          CHAIRMAN STETKAR: No, no. I'm sorry.

1 Your Guidance says I don't need to think about that  
2 for eight hours. So my generator that I'm going to  
3 take credit for is 250 miles away because I've done an  
4 analysis that says I can get it there in eight hours.

5 I'm saying, how does your Guidance help me  
6 to get low pressure injection into that reactor vessel  
7 at t-zero? Because your Guidance says, I don't have  
8 to think about that for eight hours.

9 MR. AMWAY: Well, if our Guidance says sit  
10 on -- sit and wait for eight hours, you don't have to  
11 worry about it, that's wrong. I mean the --

12 CHAIRMAN STETKAR: The Guidance tells me  
13 that. Because see FLEX, now I'll give things names.  
14 FLEX assumes RCIC works forever.

15 MR. AMWAY: Yes. I'm told that, right.

16 CHAIRMAN STETKAR: So that's FLEX. This  
17 assumes RCIC fails at t-zero. If I'm an operator, I'd  
18 be darn liking to get low pressure injection into that  
19 reactor vessel at zero.

20 And I'd not like to have A/C closed motor  
21 operated valves that I can't open. Because I can't  
22 get to them and I can't -- I don't -- and the Guidance  
23 says that I don't need power for them.

24 MEMBER SCHULTZ: You've indicated Phil,  
25 that the gap is going to be filled. That is the



1 operator will have equipment to anticipate.

2 CHAIRMAN STETKAR: No, the FLEX Guidance  
3 doesn't require it.

4 MEMBER SCHULTZ: We're not seeing the  
5 requirement for it.

6 CHAIRMAN STETKAR: What I'm talking about  
7 is integration here. We're now -- this is another  
8 example of subdividing and parsing the problem so  
9 small that you guys are only worried on severe  
10 accident water addition for boiling water reactors  
11 with Mark I and Mark II containments for the venting  
12 requirement.

13 I'm worried about giving the operators  
14 guidance for not melting the fricking core of the  
15 plant. And I don't see that integration.

16 MR. BUNT: Okay, if I could help with this  
17 one. What we've done is we've done the analysis. And  
18 again, it's a stylized, particular analysis that says,  
19 if you get to eight hours, you won't challenge  
20 containment as much if you put the water in.

21 CHAIRMAN STETKAR: Yes.

22 MR. BUNT: We also say that if our  
23 analysis says that you can wait until this long  
24 because your batteries and your other functions will  
25 support you. But that's -- no where in there does it

1 say, wait this long before you do it.

2 What we're doing is saying that if that  
3 happened to be the longest that you go, here is still  
4 a success path. And what we want to do is we're not  
5 writing our Guidance or anything else to say wait to  
6 hear.

7 I totally agree that what I would expect  
8 is if I don't have RCIC flow at time equals zero, I'm  
9 going to utilize almost everyone on my site to go get  
10 pumps and power hooked up. Not just the people that  
11 are in this one little Guidance that we stylized in  
12 our scenario.

13 CHAIRMAN STETKAR: FLEX Guidance doesn't  
14 say that.

15 MR. BUNT: That's correct.

16 CHAIRMAN STETKAR: If the FLEX Guidance is  
17 supposed to keep you out of this, the FLEX Guidance  
18 doesn't say that because the FLEX Guidance assumes  
19 that RCIC is working. And you have all of that time  
20 for RCIC to be working.

21 MR. BUNT: That's correct.

22 CHAIRMAN STETKAR: Okay.

23 MR. BUNT: What you would get into is  
24 you'd get into your severe action Guidance, which  
25 tells you that you have no flow injections. You would

1 then go to your other Guidance documents, into your  
2 SFGs and your other documents which then have you go  
3 immediately, start doing that, because you have no  
4 injection.

5 And your operators would prioritize that  
6 based on their ability to not have flow.

7 CHAIRMAN STETKAR: I can make that all  
8 sound so good.

9 MR. AMWAY: Why don't we just take those  
10 facts. We'll look at it because it's certainly not  
11 the intent of our Guidance that they would wait.

12 CHAIRMAN STETKAR: Right. I sure hope --  
13 the reason is that these words have implications on  
14 real designs. Because if the most expedient way for  
15 the guys to hook up the connection is to tie into  
16 let's say the RH/ROI, if those have the two closed  
17 valves, because it's the easiest to get the hose  
18 connections in there.

19 And they're saying that's the way I'm  
20 going to make my modification for this particular  
21 function because, you know, because according to this  
22 Guidance, I'm allowed that time window to get power  
23 back to those valves.

24 I don't need to worry about where they're  
25 powered from or, you know, in the short term. And I

1 can have enough power and cables and all that stuff,  
2 to get those valves open.

3 That can have an implication on people  
4 making design decisions today. That's the real point  
5 of the rant here.

6 And a different design decision might be  
7 made if they wanted to pick a different water  
8 injection point. Or they might have a different  
9 integrated strategy for FLEX out into the SAMGs --  
10 FSGs to SAMGs for different contingencies.

11 MR. AMWAY: The shorter we can get -- the  
12 shorter time we can get water flow, the better we're  
13 doing.

14 CHAIRMAN STETKAR: Sure.

15 VICE CHAIRMAN BLEY: I think, you know,  
16 one of the things we're saying is, we understand where  
17 you started from and why you started that way. And  
18 all the interim places you had to get by certain  
19 times.

20 We're at a point now, pulling it all  
21 together is the right thing.

22 MEMBER SCHULTZ: Right. And pull it all  
23 -- don't -- look at all the stove pipes that have been  
24 created and integrate those to ensure that both the  
25 equipment and the procedures and the overall Guidance

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1 does in fact pull it all together so the right  
2 decisions are made.

3 MR. GABOR: And I think the SAMGs do that.  
4 Because they are symptom based. They don't know that  
5 it took you one hour or 16 hours to get to the core  
6 uncovering.

7 But once you do get there, they're pretty  
8 clear on go find a pump. Hook it up and put water in  
9 the core. And they don't care what the time line is.

10 CHAIRMAN STETKAR: That's right. But  
11 again, all of this stuff would be under the SAMGs.

12 MR. GABOR: This stuff would get triggered  
13 by the SAMG. Yes.

14 CHAIRMAN STETKAR: Yes. Well, but I mean,  
15 yes. We're saying the same thing there.

16 MR. GABOR: Yes.

17 CHAIRMAN STETKAR: I'm talking about that  
18 interim period while things are not good, but you  
19 still have a chance of saving it before you need to  
20 invoke the SAMGs.

21 There are design decisions being made and  
22 people are developing strategies, you know, based on  
23 assumptions over in that part, assumptions over in  
24 this part. And it's not clear that they're well  
25 integrated yet.

1                   MEMBER CORRADINI: I mean, my way of --  
2 John's question or my interpretation of John's  
3 question is that at least in my mind, since I'm not an  
4 operator, and I'm never going to get close.

5                   Is, I don't understand how one leaves the  
6 EOPs and what you enter next. And how all of these  
7 things are hooked together in a logical fashion so the  
8 operator doesn't go into a complete melt down. Him,  
9 in not knowing that to avail himself with.

10                  MR. AMWAY: Um-hum. And I -- I mean,  
11 because I was an operator as late as 2012, anyway.  
12 But, the EOP Guidance is very clear on that transition  
13 point between the EOPs and the SAMGs.

14                  And once they get out of those EOPs and  
15 I'm in the SAMGs, I won't go back to EOPs again.  
16 These other procedures that we have in place, whether  
17 they be EDMGs or FSGs, they are support procedures to  
18 the SAMGs.

19                  So, I'm still on this -- it's not like I  
20 ever leave the SAMGs and go off to EDMGs or FSGs.  
21 They are support procedures that help me implement the  
22 Guidance that's provided in my SAMGs.

23                  They're the -- this is how you connect  
24 this pump. This is how you tie in this electrical  
25 generator. My SAMGs tell me, get power from point A

1 to point B. The FSGs tells me how to do it. So I'm  
2 still in those SAMGs.

3 MR. BUNT: And one thing that we -- I  
4 think we want to leave the thought here, is that while  
5 we've analyzed to be able to cope at this particular  
6 times, there's nothing in our Guidance or anything  
7 else that says wait until you get there to do these  
8 actions.

9 And that you are going to start in your  
10 EOPs. And you're going to quickly transition to your  
11 SAMGs because of your loss of injection flow.

12 And you're going to still have people  
13 trying to get that injection flow back. You're going  
14 to have people getting everything else back.

15 VICE CHAIRMAN BLEY: We understand it  
16 doesn't say wait. But, you guys have been sitting  
17 around thinking about how all this is going to work.  
18 And you've been giving it an awful lot of thought.

19 And you know what you'd do if you were  
20 there. But there's a lot of guys out there who aren't  
21 doing that. They're operators and they're going to  
22 walk into some of these and at least it's going to  
23 cause them pause.

24 Oh, I don't go to this until the core  
25 melts. You know, I -- whatever.

1 MR. AMWAY: And I got -- I got that  
2 feedback.

3 CHAIRMAN STETKAR: Or my plant is built on  
4 a flood plain that's, you know, two and a half inches  
5 above the river level. And to protect my portable  
6 equipment, I'm going to store it in a shed, you know,  
7 back up in the hills, which might be ten miles away.

8 But I can do that because I know for this  
9 purpose, I don't need it for eight hours. So I can do  
10 all kinds of analysis. Even if the water washes  
11 through. But I can get it in eight hours.

12 And that might be a strategy that I think  
13 about because, you know, if I don't think about that  
14 I might need it earlier, I don't think about that.

15 MEMBER SCHULTZ: But it's scenario based.

16 CHAIRMAN STETKAR: It could be scenario  
17 based. But it's also just function based. It's --

18 MR. AMWAY: Okay. This slide deals with  
19 instrumentation. It is a limited set that we're have  
20 in our Guidance as needed.

21 Obviously you need to know how much flow  
22 is coming from your pump to make sure you have the  
23 SAWA flow rate you need. The containment water level,  
24 which would be in the wetwell and containment pressure  
25 so you know when to vent.



1           The instruments that we are selecting are  
2 existing design basis instruments with the exception  
3 of the SAWA pump flow. But I'm talking about  
4 containment pressure, wetwell level here that are in  
5 our tech specs or TRM as post-accident  
6 instrumentation.

7           That instrumentation is for most plants,  
8 qualified to Reg Guide 1.97. For those plants that  
9 are pre-Reg Guide 1.97, they have similar post-  
10 accident qualifications.

11           To demonstrate that those instruments will  
12 function during severe accident conditions for use in  
13 the SAWA/SAWM strategies, we will do an evaluation of  
14 the radiological dose rates and the impact. Both the  
15 radiological and thermal impacts on those instruments  
16 to make sure that they would function through the  
17 seven day sustained operational period.

18           To make sure that we can provide them with  
19 the power that they need through the seven day period.  
20 And make sure that we have a success strategy to make  
21 sure that we can use our FLEX equipment to power up  
22 those instruments before their normal power source is  
23 depleted.

24           The closing comment on there is that, you  
25 know, particularly for wetwell level, we really don't

1 need to have that powered up until it would be the  
2 time and the sequence where we actually need to cut  
3 that back to the 100 gallon per minute range. And to  
4 be able to do that wetwell monitoring as part of the  
5 severe accident water management strategy.

6 CHAIRMAN STETKAR: Phil, and I'm going to  
7 be short here because of the time constraints.

8 MR. AMWAY: Yes.

9 CHAIRMAN STETKAR: A comment. And write  
10 down the section number. It's 4.2.2.4.1.1. And let  
11 me just reads a quote. It says, verification of a  
12 functioning SAWA flow path can be obtained from  
13 indication of pump flow and changing containment  
14 pressure and/or suppression pool level find.

15 As an acceptable alternative approach, is  
16 local or remote valve position indications in the main  
17 control room, remote operating station or some other  
18 severe accident evaluated location for remote operated  
19 valves, can be used for validation of an open SAWA  
20 flow vent.

21 We have had events where the valve  
22 internals have separated from the operating mechanism.  
23 And therefore remote operation -- remote position  
24 indication or even locally looking at the stem does  
25 not give you positive indication that that flow path

1 is open.

2 So, you may want to rethink that  
3 alternative and put higher priority on actual pump  
4 flow and level changes.

5 MR. AMWAY: I understand. Thank you.

6 CHAIRMAN STETKAR: That again, that's  
7 something that popped up in this version of the thing  
8 for some reason.

9 MR. AMWAY: Right. This one, and I don't  
10 want to go through this entire table. What I wanted  
11 to focus on was what's in the green sheeted text.

12 You know, we discussed in the  
13 Subcommittee, you know, why aren't we cycling HCVS  
14 check valves. We certainly agree. So we have added  
15 a requirement to the table to do that on a once every  
16 other operating cycle.

17 We do have some notes down here at the  
18 bottom which discuss that, you know, particularly for  
19 SAWA. I expect that SAWA backflow prevention will be  
20 provided by an existing installed valve.

21 Generally, we would be injecting through  
22 a flow path that already has containment IVs that are  
23 check valves that get leak rate tested per Appendix J.  
24 And that leak rate testing would suffice without doing  
25 additional testing for SAWA.

1 CHAIRMAN STETKAR: Phil, help on this real  
2 quick. Because I had a comment on this. Did the  
3 green thing change between the version of 0F4 that we  
4 have and this slide?

5 MR. AMWAY: Yes. We've been working with  
6 the staff on that to --

7 CHAIRMAN STETKAR: Okay. Okay, fine.  
8 Because this says what I wanted it to say. But the  
9 version of the report that I have is basically just  
10 checking reverse flow.

11 MR. AMWAY: Right. Right. Yes, we --

12 CHAIRMAN STETKAR: This has -- okay,  
13 thanks. That's all --

14 MR. AMWAY: This is all that Guidance will  
15 say.

16 MR. KRAFT: Which shows Dr. Stetkar, we  
17 listen to what you have to say.

18 (Laughter)

19 CHAIRMAN STETKAR: At least one person.

20 MR. KRAFT: At least once. At least I do  
21 and at least one.

22 CHAIRMAN STETKAR: No, thanks. I mean the  
23 group -- no.

24 MR. AMWAY: The other item deals with the  
25 out of service time compensatory action. The concern

1 being there was no defined total out, out of service  
2 time. The concern being was it could go years and  
3 years without being corrected.

4 We have added it to the Guidance that that  
5 out of service time shouldn't exceed one full  
6 operating cycle. The reason why that's in there is  
7 just to make sure that, you know, you do timely  
8 repair. But acknowledge the fact it may take an  
9 outage to fix.

10 RPV depressurization. The concerns with  
11 that, you know, just to acknowledge that our procedure  
12 Guidance and that the procedure Guidance be in the  
13 EOPs, requires RPV depressurization anytime you exit  
14 the EOPs and before entry into the SAMGs.

15 And that we described the likelihood of  
16 success of those actions in India 1.3 of the Guidance.  
17 And that we do not credit failures such as SRV seizure  
18 or main steam line creep rupture to get those actions  
19 done.

20 Remaining steps, we are on a path to issue  
21 13-02 Rev 1 and the final ISG by the end of this  
22 month. Our next steps after that will be to develop  
23 the industry template for Phase Two OIP, conduct the  
24 Phase Two workshop and to make the OIP submittals by  
25 the end of this year.

1           On conclusion, you know, we have achieved  
2           a successful SAWA strategy for meeting Phase Two of  
3           the Order. That's defined as ISG methods two and  
4           three using either the SAWM approach or the 545 design  
5           boundary condition for the drywell vent.

6           And the draft 02 of the ISG, there is a  
7           second draft of that ISG out. And there is, you know,  
8           very good alignment between that draft 02 of the ISG  
9           and NEI 13-02, which will become Rev 1.

10           MEMBER SCHULTZ: Any other questions from  
11           the Committee?

12           MEMBER CORRADINI: So, I have one that I'm  
13           sure you thought of, and you'll tell me that I've got  
14           my engineering wrong.

15           But, if I come into something which is  
16           potentially a loss of offsite power, that's it's  
17           extended. And I'm concerned that I can't risk  
18           covering in time, you have anticipatory venting  
19           allowed?

20           MR. AMWAY: Yes.

21           MEMBER CORRADINI: Has the set point for  
22           that been determined? Or is that still being  
23           evaluated relative to certain plants? Or at least  
24           sample pilot plants?

25           MR. AMWAY: You could -- the EOPs say that

1 you can start the anticipatory venting as early as two  
2 psig, which is above the rps SCRAM set point.

3 The time in which a plant will actually do  
4 that, you know, most of the majority of the plants, at  
5 least the ones that I'm aware of throughout the Exelon  
6 fleet, have done analysis to show that at the time  
7 they plan to open that vent, it's successful in  
8 preserving the RCIC system for the time they need to  
9 be able to transition to the portable pump.

10 So it's somewhat of a function of what  
11 their vent size is and what their venting capability  
12 is, in being able to hold the suppression pool water  
13 temperature below 250 degrees.

14 MEMBER CORRADINI: So let me -- okay, so  
15 I'm sure this sounds wrong, so you tell me where it's  
16 wrong.

17 So, have any thoughts of an accident  
18 scenario where I start down that path, I open the  
19 vent. I now successfully get back power, but I start  
20 leaking and I transition from an ELAP to a loss of  
21 cooling accident, such that I need low pressure  
22 injection.

23 And now, I'm at a CAP plant and I don't  
24 get it any more because I required the operation at  
25 essentially a saturated pool to have a positive

1 pressure and a wetwell.

2 MR. AMWAY: Well once you get to a state  
3 where you have the power back and you have alternate  
4 means of core cooling, you no longer have the  
5 provision to have that vent open.

6 MEMBER CORRADINI: Close it?

7 MR. AMWAY: So it would have to be closed  
8 at that point.

9 VICE CHAIRMAN BLEY: And could damage the  
10 pumps before that, I guess would be --

11 MEMBER CORRADINI: Well, I'm not sure, but  
12 I'll stop for the moment. I'll -- let me think a  
13 little more. But thank you for that.

14 MR. AMWAY: You're welcome.

15 MEMBER SCHULTZ: Other questions? All  
16 right, I'd like to move now to the staff presentation.

17 Jack, I'll turn it to you for  
18 introductions and any other comments you'd like to  
19 make after the industry presentation here.

20 MR. McHALE: Thank you, Dr. Schultz. And  
21 I'll just to get moving with the presentation, I'll  
22 introduce the staff that will be making the  
23 presentation over on the table.

24 First, you have Bill Reckley, who is a  
25 Special Advisor of the Japan Lessons Learned Division.



1 You have Rao Karipineni, a Senior Reactor Systems  
2 Engineer in the Containment and Ventilation Branch in  
3 NRR.

4 And joining them will also be Raj Auluck,  
5 who is also with the Japan Lessons Learned Division as  
6 a Senior Project Manager. And in the room we also  
7 have staff members from NRR and the Office of Research  
8 to assist.

9 So the next thing is to turn it over to  
10 Raj when he gets here for the --

11 CHAIRMAN STETKAR: While we're waiting for  
12 Raj, let me just, you know, we're obviously going to  
13 run over long. We are not strongly constrained on the  
14 amount of time to run over.

15 We have another activity scheduled through  
16 our lunch hour. But I'm informed that that doesn't  
17 have a particular back end constraint on it.

18 So, I'm not saying just, you know, talk at  
19 leisure. But don't rush through the presentation or  
20 Members, don't feel to constrained about asking  
21 questions of the staff, because we do have some time  
22 flexibility.

23 MR. AULUCK: Good afternoon. I'm Raj  
24 Auluck. I'm a Senior Project Manager in the Japan  
25 Lessons Learned Division within the Office of Nuclear

1 Regulation.

2 In addition to at the table, I have Mr.  
3 Nageswara Karipineni and Bill Reckley. There are  
4 other staff members in the audience from the Office of  
5 NRR and Research who participated in developing this  
6 Interim Staff Guidance or the ISG. And they are  
7 prepared to answer your questions.

8 Before we begin our presentation on the  
9 proposed ISG for Phase Two of the Order, I'll briefly  
10 go over the level background.

11 The accident at the Fukushima Daiichi  
12 Nuclear Plant reinforced the importance of reliable  
13 operation of containment events for BWR plants with  
14 Mark I and Mark II containments.

15 As part of its response to and lessons  
16 learned from the accident, the NRC issued Order EA-12-  
17 050 in March 2012, requiring licensees to upgrade or  
18 install a reliable hardened containment venting system  
19 for Mark I and Mark II BWR containments.

20 While directing the requirements of Order  
21 12-050, the NRC staff acknowledged that questions  
22 remained about maintaining containment integrity if  
23 licensees used the venting system during severe  
24 accident conditions.

25 In November 2012, the staff presented

1 options to address these issues for Commission  
2 consideration in SECY 12-0157. It incorporated  
3 comments from the nuclear industry, the stakeholders  
4 and the ACRS.

5 In the supplement SECY issued in March  
6 2013, the Commission directed the staff to take  
7 certain actions, including requiring the licensees to  
8 upgrade or replace the reliable hardened vent required  
9 under EA-12-050 with containment venting system  
10 designed and installed to remain functional in severe  
11 accident conditions.

12 And also, they will have technical basis  
13 and rulemaking for filtering strategies, drywell  
14 filtration and severe accident management of  
15 containments.

16 The NRC subsequently issued Order EA-13-  
17 109 in June 2013, which supersedes the requirements  
18 imposed under EA-12-050 and replaces them with new  
19 requirements. And also allows implementation in two  
20 phases.

21 Under Phase One, upgrade the venting  
22 capabilities from the containment model to provide  
23 operation under severe accident conditions. And 2 --  
24 under Phase Two, install a reliable severe accident  
25 action capable drywell vent system or develop a

1 reliable containment venting strategy that makes it  
2 unlikely that the licensee would need to vent from the  
3 containment drywell before alternate reliable heat  
4 removal and pressure control is reestablished.

5 Implementation for Phase One is no later  
6 then the start of from the refueling outage that  
7 begins after June 30, 2014 or June 30, 2018, whichever  
8 comes first. And for Phase Two, no later then start  
9 up from first refueling outage after June 30, 2017 or  
10 June 30, 2019, whichever comes first.

11 For Phase One, all operating integrated  
12 plans will be submitted by June 30, 2014. And I  
13 believe the staff has issued all interim staff  
14 evaluations ahead of schedule, which was the date of  
15 June 30 of this year.

16 Next slide, please. This slide shows the  
17 schedules for issuing the ISG for Phase Two of the  
18 Order. As directed in the staff comments memorandum,  
19 the staff engaged external stakeholders throughout the  
20 development process.

21 There were 12 public meetings held since  
22 issuance of the Guidance for Phase One. Six of these  
23 have been since August 2014, related to Guidance  
24 development specifically for Phase Two.

25 The staff briefed the Subcommittee last

1 month on March 20. The staff's presentation will  
2 include responses to the questions raised at the  
3 Subcommittee meeting.

4 Once we receive the Committee's letter of  
5 endorsement, we will revise the ISG to include the  
6 Committee's recommendation and any other public  
7 comments. As you can see, the public comment period  
8 ended yesterday.

9 We plan to issue the Phase Two ISG by  
10 April 30, 2015, which will endorse the latest version  
11 of the Guidance document with exceptions and  
12 clarifications as needed. This will provide the  
13 needed time for licensees to prepare and submit their  
14 Phase Two overall integrated plans by December 31,  
15 2015, as required by the Order.

16 And now with that, I will ask Rao  
17 Karipineni to begin the staff presentation on the ISG  
18 -- proposed ISG.

19 MR. KARIPINENI: Thanks Raj.

20 MR. KARIPINENI: Thanks, Raj.

21 Basically, you already know that we are  
22 talking about three matters of compliance, one of  
23 which is very questionable. Hopefully, nobody will go  
24 that path, which is the capable severe accident  
25 drywell vent with no provisions for water addition.

1           The second one is severe accident capable  
2       drywell event with water addition, SAWA, called Severe  
3       Accident Water Addition, at a high flow rate, the idea  
4       being if you are putting it at a high flow rate, at  
5       some point you will get the wetwell vent submerged and  
6       you will need a drywell vent. Therefore, there is a  
7       drywell vent available for that.

8           The third part is preserving the wetwell  
9       vent, and it is achieved by the management of the  
10      severe accident water addition. At somewhat of a  
11      later point, reduce the flow from 500 gallons to  
12      approximately, say, 100 gallons, and may reduce even  
13      further as time goes further. That is the idea here.

14           Next slide.

15           There is work done on the Guidance since  
16      most of the members have seen the Phase 1 items.  
17      There was somewhat required by comments that industry  
18      folks during the implementation made and asked for  
19      clarifications. Therefore, the NEI and the industry  
20      have decided to add some differently-asked questions  
21      than what the staff has told them about answers to  
22      those questions.

23           There are also some White Papers  
24      developed. The doses and source terms is White Paper  
25      No. 2, and the flammable gases was White Paper No. 3.

1 The appendices referred to in the slide were already  
2 there in the Phase 1 Guidance.

3 Glossary of Terms, Appendix A, has been  
4 revised extensively to suit the Phase 2 application.  
5 Also, some changes were made regarding instrumentation  
6 capabilities.

7 The major focus of the Phase 2, which is  
8 the SAWA and SAWM are covered in Appendix I for SAWA  
9 and Appendix C for SAWM.

10 Combustible Gas Control. We had some  
11 identification of issues in Phase 1 that ACRS has made  
12 in a letter to the EDO. I just want to explain  
13 quickly about what we had done, what we had thought we  
14 had done by then and, also, what else we have done  
15 since then.

16 There are two issues with combustible gas  
17 control. One is the possibility of any detonations  
18 within the pipe itself, or the pipe, is it properly  
19 designed for this? Second, is leakages into the  
20 reactor building, et cetera, gas migration and  
21 ingress, et cetera.

22 The first issue was covered by, the pipe  
23 itself is covered by WP-03, White Paper No. 3, to a  
24 large extent. They gave several options for the  
25 individual licensees to take. They include both

1 passive and active approaches.

2 The active approaches are, you know, they  
3 would enter the pipe. They would then install a check  
4 pipe and a check valve at the end of the vent lane to  
5 prevent any ingress back into the system. They would  
6 provide a control valve beyond the two containment  
7 isolation valves, somewhat close to the exit point,  
8 and the control valve would close. It would prevent  
9 any of it to come back into the pipe. And the  
10 sections beyond the control valve, they would either  
11 design for detonations or make any other provisions,  
12 design provisions, that they feel are needed to  
13 prevent any detonations there. Those are the active  
14 issues.

15 The second issue, the passive issues that  
16 were mentioned are they would design these systems to  
17 take deflagration and a detonation or they would  
18 consider some operational experience, et cetera, to  
19 help them reduce the possibility or eliminate the  
20 possibility as much as they can with the design.

21 So, what an individual licensee would  
22 actually do is something we really don't know at this  
23 point until all of them come in and clearly tell them  
24 what they are doing. I think in some cases we have  
25 that information. And I talked to some of the folks



1 that are working on these issues. They said quite a  
2 few of them are coming up with the check valve  
3 approach at the end of the pipe.

4 The other issue about the possibility to  
5 have leakage into the reactor building, et cetera,  
6 those were handled by two approaches. One is design  
7 the entire pipe to be leak-tight. There is testing  
8 included, leakage testing, et cetera, from the pipes.  
9 Design the interfaces into the other system to close  
10 at the initiation of the HCVS. And the closure  
11 mechanisms, whether they are valves or dampers, would  
12 also be tested for leak tightness, both initially  
13 before we place the system into operation and, also,  
14 periodically afterwards, as you saw in the testing and  
15 testing table.

16 MEMBER CORRADINI: So, can I ask --

17 MR. KARIPINENI: Go ahead.

18 MEMBER CORRADINI: So, do you know which  
19 of these two possibilities most plants are going to  
20 choose or is it still up to them in terms of --

21 MR. KARIPINENI: It is still up to them.

22 MEMBER CORRADINI: Because the question I  
23 guess -- I think you are eventually going to show a  
24 calculation -- the question I guess I am curious about  
25 is, if they chose the path, the top one -- or, I'm

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1       sorry, the bottom one, for -- well, I guess whichever  
2       one it is, that I am not going to have to worry about  
3       hydrogen combustion within the path because I fell  
4       well below the detonation limit. How would they know  
5       that going into this? It is purely based on bounding  
6       calculation to the design, and that is the end?

7               MR. KARIPINENI: You are talking about the  
8       top one, which I said there were some active  
9       approaches? You are talking about the active  
10      approaches?

11             MEMBER CORRADINI: The active approaches.

12             MR. KARIPINENI: When you are venting, you  
13      have another control valve, let's say, past the  
14      containment isolation valves. That valve also needs  
15      to be open. When you initially open, you've got steam  
16      and inertia basically --

17             MEMBER CORRADINI: So, it is just the  
18      inerting of it that essentially eliminates any  
19      concern?

20             MR. KARIPINENI: Right. Initially, it is  
21      the inerting, the nitrogen steam inerting. Some  
22      people may come back and say at the time that nitrogen  
23      is pretty much gone from there, if they feel there is  
24      a need, they may actually inert the pipe before they  
25      open the back-end flow valve.

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1 MEMBER CORRADINI: Okay.

2 MR. KARIPINENI: That is what we are told  
3 in the White Paper.

4 MEMBER SCHULTZ: So, the staff has  
5 endorsed the White Paper. And as we have just  
6 discussed, that includes a number of different options  
7 and approaches and design and operation, and so forth.

8 MR. KARIPINENI: Right.

9 MEMBER SCHULTZ: And now, you are saying,  
10 well, we'll see what the licensees come back with in  
11 terms of the design.

12 MR. KARIPINENI: That is correct.

13 MEMBER SCHULTZ: What is planned for that  
14 review of those designs?

15 MR. KARIPINENI: The staff reviewing those  
16 plants that come in, they would write an Interim Staff  
17 Evaluation about how they concluded that it is an  
18 acceptable approach for that plant. That is how it is  
19 done.

20 MEMBER SCHULTZ: Okay.

21 MR. KARIPINENI: They will review those.

22 MEMBER SCHULTZ: And when does that  
23 happen? That comes after the --

24 MR. RECKLEY: Well, actually, keep in mind  
25 that the hydrogen part is applicable to Phase 1 as

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1 well.

2 MEMBER SCHULTZ: Yes.

3 MR. RECKLEY: And so, when licensees have  
4 submitted the Phase 1, they have left this open as an  
5 open item, as to which of the options in the White  
6 Paper they are going to pursue. Again, as was  
7 mentioned, we think many of them will take the check  
8 valve at the end of the pipe approach.

9 But, as they pick it and update to the  
10 integrated plan, which they are required to do every  
11 six months, one of these will capture which approach  
12 the licensee plans to take. At that point, we would  
13 review the plant-specific aspects.

14 Now the general idea that a check valve at  
15 the end of the pipe is good enough we have accepted  
16 through the White Paper. The plant-specific how they  
17 do that, we would do as part of that review of the  
18 integrated plant.

19 MEMBER SCHULTZ: Good. That is what I was  
20 looking for. Thank you.

21 MR. RECKLEY: Yes.

22 MR. KARIPINENI: As far as leaking into  
23 the reactor building, I already talked about what we  
24 are doing on the vent pipe itself. Any interfaces  
25 from the vent pipe to ducts or other piping into the

1 rest of the reactor building, they will be isolated  
2 immediately.

3 The possibility of leakages directly from  
4 the containment into the reactor building, there are  
5 two aspects. One, is the water addition is reducing  
6 the temperatures, encasing the potential sections of  
7 the drywell head seals and, then, other penetrations.  
8 Also reducing the pressure from always staying at  
9 PCPL; rather, you maintain the pressure somewhere  
10 around, as you saw some of the curves that the  
11 industry has put up, somewhere around 20 psi. That is  
12 well below the containment design pressure.

13 So, these factors would also help reduce  
14 the leakage into the reactor building. So, as far as  
15 the vent is concerned and how the vent is operated,  
16 these factors that are there that address the hydrogen  
17 part to the extent they can, and the way the staff is  
18 approaching it is further evaluations will be done  
19 under Tier 3, under Recommendation 6, in consideration  
20 of what has been already done up to now and, then,  
21 what else may need to be done or may not need to be  
22 done for Mark Is and Mark IIs.

23 This graph was put up there. We did just  
24 the left side of the graph before in the Subcommittee  
25 meeting. We added a couple of other graphs here to

1 show what the concentration levels of hydrogen would  
2 be in the containment for the cases that were  
3 analyzed.

4 That shows both the drywell and wetwell.  
5 You can see the average in the summary, around 5  
6 percent in those levels, pretty much after 14 hours or  
7 so except for the small spike in between. So, the  
8 idea being here that most of the hydrogen is actually  
9 getting vented out. A very small amount is remaining  
10 in the containment.

11 Method 1, you already heard from the  
12 industry. Basically, we don't see it as a workable  
13 method at all, and we have added some language into  
14 the Guidance about how it would conflict with  
15 potential requirements in the CPRR rulemaking. Also,  
16 you know, it raises possible concerns with increased  
17 release of hydrogen into the reactor building.

18 And just like the industry is planning to  
19 reinforce those points in these workshops, if staff  
20 gets invited, we will mention them also in those  
21 meetings. They have invited staff during Phase 1  
22 meetings, Phase 1 workshops. We kind of think they  
23 would do that again. We can certainly reinforce those  
24 points again at that time.

25 The graph is, again, the temperatures that

1 you have seen from the analysis the industry has done.  
2 These are the MELCOR results. You can see the  
3 temperatures are pretty high in the pedestal region.  
4 That would be almost up to 2500 degrees Celsius, going  
5 down to the low regions of the drywell, and you are  
6 still up somewhere around 1800 and 1500 most of the  
7 time during the 72 hours.

8 Another tool, actually, provides a severe  
9 accident drywell vent that complies with all the  
10 Guidance requirements as they are being written for  
11 Phase 1. It also has a water addition component to  
12 it. The industry felt it is a strategy. We thought  
13 it was a hybrid approach. It is all just a matter of  
14 words, I guess, you know. It basically does what we  
15 want. The fact you have water addition plus a severe  
16 accident drywell vent is the best thing that you can  
17 do.

18 If you go slide on 13, the temperature --

19 MEMBER CORRADINI: Can I ask a question?

20 MR. KARIPINENI: Sure. So, I think I have  
21 got the right report. What Mark II was used for the  
22 analysis of temperatures and water addition? Was it  
23 LaSalle for the staff's calculation?

24 MR. KARIPINENI: Yes.

25 MEMBER CORRADINI: So, is this a -- I

1 don't know if the right word is "limiting" -- but is  
2 this the least peculiar, most peculiar, or they are  
3 all peculiar in terms of their behavior?

4 (Laughter.)

5 MR. RECKLEY: They're different enough  
6 that I think you would use your last term; they're all  
7 peculiar.

8 (Laughter.)

9 There is a small number and they are all  
10 somewhat unique.

11 MEMBER CORRADINI: But the reason I am  
12 asking is that, going back to what Dr. Powers was  
13 asking about, the range of things that he was asking  
14 the industry, has staff thought about these sorts of  
15 things and have checked it out, such that the analysis  
16 here is -- and again, I will use bounds, limits --  
17 what you expect of the behavior in terms of that it  
18 satisfies your needs?

19 MR. ESMAILI: This is Hossein Esmaili.

20 MEMBER CORRADINI: Hello, Hossein.

21 MR. ESMAILI: Yes. So, yes, for the base-  
22 case calculation, we assume the dry cavity, the dry  
23 lower, you know, that it is a concrete plant, but we  
24 did sensitivity by just removing that one and filling  
25 up with water, so what happens, you know, and then,



1 looking into the timing when a drain clog or a  
2 downcomer would fail and the debris would clog.

3 Based on some of the analysis that was  
4 done previously, they estimated, for example, 20  
5 minutes. You know, when the debris comes into the  
6 lower part, it takes 20 minutes for it to fail the  
7 drain clog and the debris gets moved to the lower  
8 cavity.

9 We played sensitivity. We assumed, you  
10 know, it just like takes maybe one hour or we assume  
11 that it just stays there long enough for the concrete,  
12 separating the lower and upper cavity, to complete  
13 ablate and go there.

14 So, we look at a whole bunch of -- we  
15 started with a base model that had a dry lower cavity,  
16 but we did a whole bunch of sensitivity calculations  
17 based on that base model.

18 MEMBER CORRADINI: Okay. Okay.

19 MEMBER REMPE: Hossein, while you are up  
20 there, could I ask a question? I looked through the  
21 MELCOR report. What was your assumption for heat  
22 transfer off the lower head and the control rod  
23 drives? Did you consider radiation and convection for  
24 heat transfer from the vessel?

25 MR. ESMAILI: You mean as an integral part

1 of the vessel? Because it is --

2 MEMBER REMPE: The lower head and the  
3 control rod drives. I am looking at timing of vessel  
4 failure and what the assumption was for heat loss from  
5 the vessel and how that affected your results.

6 MR. ESMAILI: From the upper head or the  
7 lower head?

8 MEMBER REMPE: The lower head.

9 MR. ESMAILI: Well, the lower head, it  
10 gets really, really hot once the debris gets in there.

11 MEMBER REMPE: Right. And what was your  
12 assumption for heat loss off the vessel? Did you  
13 consider radiation in the calculation?

14 MR. ESMAILI: No, we just assumed a very  
15 low convective heat transfer. And that is why the  
16 temperatures that you are seeing, once the debris gets  
17 in there, you have temperatures of the order of a  
18 couple of thousand Fahrenheit. But that is in the  
19 pedestal.

20 MEMBER REMPE: Uh-hum.

21 MR. ESMAILI: The other part of the driver  
22 stays cooler.

23 MEMBER REMPE: Okay.

24 MR. ESMAILI: But when you add water -- I  
25 mean, this is the case that you add water -- you do

1 get a temperature, even in the pedestal, reaching  
2 about 500, but that one, you know, that is the maximum  
3 temperature that you are going to get because you keep  
4 adding water and you are going to cool the atmosphere,  
5 the lower pedestal, and the entire driver. Okay?

6 And one thing I didn't mention is that all  
7 of these cases assume there is a preexisting --  
8 because I think it was explained during the industry  
9 that there is some leakage. So, you would have some  
10 preexisting water level at this time of the lower head  
11 failure.

12 MEMBER REMPE: Thank you.

13 MR. KARIPINENI: Those temperatures, as  
14 you can see, for the past 24 hours or so, somewhere  
15 around there, the maximum is about 400 degrees. And  
16 it gives you some idea how important the water  
17 addition is.

18 In fact, I may as well add that this is  
19 not a revelation, you know. This is something people  
20 knew from the very beginning, since the GL 89-16 event  
21 times, that the feed-and-bleed system is the way to go  
22 in severe accidents, and this is all really confirming  
23 what has been already there a pretty long time.

24 Go to slide 12. Yes.

25 The severe accident water addition, this

1 is the slide I think Steve Kraft and they were  
2 mentioning, the industry. We have that slide here.

3 This is where the deflection of the  
4 connection point is done, you know, what was very  
5 close to the line. It would be what was a flexible  
6 pipe originally under the FLEX system, FLEX  
7 strategies. It will be made a hard pipe, and it will  
8 be moved to a location where they may already have  
9 some shielding or where they may add some shielding,  
10 which is where the operators will have to go in and  
11 make the connection for a severe accident.

12 CHAIRMAN STETKAR: Let me ask, you don't  
13 have the slide out. So, I will take the opportunity.  
14 Bring the bottom back up again.

15 One of the changes to the Guidance,  
16 indeed, does include this issue of providing motive  
17 power to the valves that aren't shown as operated  
18 valves, but between the drywell wall and the reactor  
19 vessel there, whatever we are showing on the righthand  
20 side, the vertical gray thing there.

21 And the staff endorses this notion that we  
22 don't need to have power for at least eight hours to  
23 be able to make sure that we can maintain containment  
24 function. Did you think at all about this notion of  
25 the inability to get power to it until eight hours and

1       how that might implicate the integrated response to  
2       these events?     Or did you just look at this  
3       containment issue?

4               MR. RECKLEY:  No, I think --

5               CHAIRMAN STETKAR:  Because the staff  
6       reproduces it.  This is one of the areas where it just  
7       doesn't say we endorse NEI 13-02.  It explicitly  
8       reproduces all of that verbiage.

9               MR. RECKLEY:  I think the way we look at  
10      it is back the way Randy was describing it, a slightly  
11      different characterization.  The supporting work shows  
12      you have up to eight hours in order to accomplish some  
13      of these tasks.  We never assumed that that was being  
14      taken as a permission to take up to eight hours, but  
15      if licensees were going to do an analysis, a time-  
16      sensitive analysis, to show how much time they had in  
17      order to accomplish all the tasks that they would have  
18      underway, some of these could take as long as eight  
19      hours, and you could still meet the success that was  
20      laid out for this.

21              But, again, it is a slightly different  
22      twist in that we would assume they are trying to do it  
23      as quickly as they can possibly do it.  But, in  
24      prioritizing what they need to do in response, if that  
25      valve was up to eight hours, the conditions being such

1 that they could still do the manipulation because of  
2 the environment, and so forth, that would be an  
3 acceptable approach as they laid out the timeline.

4 But, again, depending on how you want to  
5 go. We didn't look at it as a case where we were  
6 giving them permission to just wait around for eight  
7 hours. It was they had up to eight hours and they  
8 could still successfully meet the success criteria  
9 that was being laid out for the venting and SAWA  
10 operations.

11 CHAIRMAN STETKAR: Right. But not for  
12 saving the core?

13 MR. RECKLEY: No.

14 MR. KARIPINENI: The order was issued; you  
15 know, it was only for the vent. The water addition  
16 was not anywhere there in the order.

17 CHAIRMAN STETKAR: I understand that,  
18 but --

19 MR. RECKLEY: The SAMGs and other things  
20 would be pushing them to try to get that water in as  
21 quickly as they could possibly get it in. So, we are  
22 not with --

23 CHAIRMAN STETKAR: SAMGs are impending  
24 core damage; FLEX is to prevent core damage. FLEX  
25 doesn't get you into this situation.

1 I have already made the point.

2 MR. RECKLEY: Yes.

3 CHAIRMAN STETKAR: I just want to poll the  
4 staff whether you had thought in that kind of  
5 integrated manner or were you just simply thinking  
6 about your particular little part.

7 MR. RECKLEY: Well, the thought in this  
8 particular case -- and we thought this all along, even  
9 in the initial discussions -- that severe accident  
10 water addition would most likely build off of the  
11 FLEX. It did bind these things together. And again,  
12 we weren't surprised by that.

13 From the very beginning of the  
14 discussions, when we started to talk about severe  
15 accident water addition, the most logical way to do  
16 that was to build off of FLEX.

17 CHAIRMAN STETKAR: But, see, FLEX doesn't  
18 need to get the power back, either, because by  
19 definition for FLEX, my FSGs, that turbine-driven pump  
20 is running. Do you see my point?

21 MR. RECKLEY: A way to look at this, the  
22 way I look at this is that, when you are looking at  
23 Fukushima, you can say, but for the availability of a  
24 few extra tools, a few extra gallons of water, however  
25 you want to put it, that licensee stood a chance of

1 saving those units.

2 And so, FLEX and this order as well is  
3 basically saying the NRC sees fit that licensees  
4 should give those operators a couple of extra tools to  
5 try to do those functions. And that is why FLEX is  
6 written the way it is, I mean the mitigating strategy  
7 order is written the way it is. That is why this  
8 order is written the way it is. It is driven towards  
9 give licensees a few extra tools to try to address  
10 failures that weren't originally foreseen or accounted  
11 for in setting up the design basis events.

12 And so, in both cases the expectation is  
13 that, as systems fail or are unavailable to them,  
14 licensees are going to go to this extra tool and try  
15 to use it in order to save the day.

16 If you are going to say how successful  
17 this capability is, you have to get into the analysis  
18 of the assumptions of how quickly they can set it up  
19 and what additional things might fail or what the  
20 human performance is going to be. And all of that is  
21 useful to say how much we are getting out of this  
22 extra capability. But, in the end, the requirements  
23 are for the capabilities to be added, and the  
24 assumption is it gives, again, the operators just  
25 another tool to try to use to save the day, either to

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1 save the containment in this case for the Mark Is or  
2 IIs or to save the core and the containment and the  
3 spent fuel pool in the case of the mitigating  
4 strategies order.

5 MEMBER CORRADINI: So, Bill, taking that  
6 discussion, then we would have to go look at the  
7 integration of this with SAMGs because, as industry  
8 suggested, once I leave the EOPs, if somehow we are  
9 having a bad day and I don't have AC power, and I  
10 don't have diesels that are starting, and I am on the  
11 road to damage, I would leave the EOPs and I would go  
12 into SAMGs.

13 MEMBER SCHULTZ: No, you go to FSGs.

14 CHAIRMAN STETKAR: No, that's not what  
15 they said.

16 MEMBER SCHULTZ: That's not what they  
17 said?

18 MR. AMWAY: No. When you leave the EOPs,  
19 you enter the SAMGs. The SAMGs may --

20 CHAIRMAN STETKAR: That is contrary to  
21 NEI's guidance that shows entry conditions to FSGs and  
22 triggers for EOPs.

23 MEMBER CORRADINI: So, I am asking the  
24 question for this clarification, because you said it  
25 one way, and I want to make sure I am not

1 misinterpreting. So, what I heard you say, in another  
2 meeting you had pretty, little color charts this way.  
3 It is that EOPs send me to SAMGs, and then, all these  
4 things spiral off of that. Is that correct or  
5 incorrect?

6 MR. AMWAY: That's correct. There are  
7 supporting procedures for either the EOPs, if they are  
8 still in the EOPs, but once you leave the EOPs, enter  
9 the SAMGs, those same support procedures still exist.

10 MEMBER CORRADINI: Okay. So, my question  
11 goes like this: with your explanation/logic, one  
12 would expect the staff to say -- well, now I am  
13 putting words in your mouth, but that is what I am  
14 trying to get. I am trying to sneak it in, but let's  
15 just say it.

16 It would seem to me that you would look at  
17 the SAMGs to make sure that, if I had a very bad day,  
18 and if Plan A didn't work and we went to John's  
19 characterization of Plan B, there is a way to attack  
20 it, so that I would not lead myself into core damage.  
21 I would actually lead myself into mitigation strategy,  
22 that I have a Plan B, not just a Plan A.

23 MR. AMWAY: Yes, and if I could clarify  
24 that, in your SAMGs, across the top, you are  
25 constantly evaluating your actual conditions, such

1 that, as you recover things, like in the example you  
2 get AC power back, and now I have my RHR systems  
3 available to me, you can go back and forth with those  
4 various SAMGs legs as conditions improve and back  
5 yourself up to conditions where you are in a better  
6 overall state for either the RPV or the containment.

7 VICE CHAIRMAN BLEY: That is something  
8 new, right?

9 MR. AMWAY: That's not new. That has  
10 always been in the SAMGs. When you get in the SAMGs  
11 and you look across the top of the SAMGs, the first  
12 question you come in, you know, are you above top of  
13 active fuel? You know, do I have enough to keep above  
14 top of active fuel? If the answer to that is yes, it  
15 gives you a defined set of actions. If the answer is  
16 no, can I stay above bottom of active fuel? Then, a  
17 yes or no, and there's a series of sequences.

18 You evaluate those conditions continually  
19 while you are in the SAMGs. Even though I may be in  
20 these FSGs for hooking up FLEX pumps, I still am  
21 required to constantly evaluate my current plant state  
22 and containment state and what's available, and I can  
23 change paths depending on what comes back to me.

24 MEMBER CORRADINI: Okay.

25 MR. BUNT: Additionally, for the FLEX

1 scenario, you still stay in your EOPs as your  
2 governance document and the FSGs are where you go get  
3 the tools to accomplish the EOP task. So, the EOP is  
4 still your governing document or the severe accident  
5 guidance are your governing documents, depending on  
6 where you are in the accident scenario. The others  
7 are just support procedures that give you the tools to  
8 cope with the symptoms that you are seeing in those  
9 two governing procedures.

10 MEMBER CORRADINI: So, you would make the  
11 claim that everything is integrated already? We just  
12 probably didn't catch it?

13 MR. BUNT: That is our intent, is to have  
14 everything all integrated when we are done with all  
15 these. And we are adding, as Bill mentioned, we are  
16 adding additional tools and capabilities to the  
17 operators to be able to cope with the various  
18 conditions that may apply.

19 And we have designed those tools using a  
20 certain set of assumptions to set up the design  
21 parameters to design them to. So, there is no intent  
22 to go use it at that particular application, depending  
23 on however the scenario applies. The symptoms of the  
24 plant will tell you when to apply that tool at the  
25 appropriate time. We are just ensuring that, if you

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1 followed the scenario that our analysis shows, that  
2 you would still be successful.

3 MEMBER CORRADINI: Okay. Thank you.

4 MR. KARIPINENI: Yes, I also want to add  
5 that the eight hours, I believe, actually, what they  
6 all looked at came from some of the SOARCA work that  
7 was done for us. I believe the RCIC was assumed to  
8 fail maybe within two hours or so in that particular  
9 case. And the remaining water in the vessel at that  
10 time will take you to eight hours, approximately, when  
11 the actual vessel melts, the core melt happens, and  
12 you are exiting the vessel. I think that is where it  
13 came from.

14 MEMBER CORRADINI: Okay.

15 MR. KARIPINENI: So, it was never meant to  
16 say that you have eight hours to provide water. It  
17 was only a scenario that they looked at. If RCIC did  
18 conk out in two hours, when does the core actually  
19 exit the vessel, and I think that is the time that  
20 actually came from.

21 You can correct me, if I am wrong in that.  
22 Correct me? It must be right.

23 MR. RECKLEY: Okay, that's fine.

24 MR. KARIPINENI: Okay, it's okay. It's  
25 okay.

1 I just wanted to say that because I was  
2 told when we looked at that, this is how the eight  
3 hours was looked at, but not necessarily, it doesn't  
4 mean that we are accepting that you can start working  
5 at eight hours or somewhere before eight hours. We  
6 always thought that the 049 strategies would take you  
7 to quickly get there to make some connections work.

8 MR. AMWAY: If I could just -- this is  
9 Phil Amway -- just to make a clarification. For that  
10 eight-hour sequence of events, RCIC never operates.

11 MR. KARIPINENI: RCIC never operates?  
12 Okay.

13 CHAIRMAN STETKAR: That's my whole point,  
14 that if RCIC fails -- and I know how you got to the  
15 eight hours -- if RCIC fails at T-zero, you say, I've  
16 got up to eight hours to save the containment. I'm an  
17 operator. RCIC fails at T-zero. I would really like  
18 to try to save the core. I would like to get pressure  
19 down and I would like to get water in there. If I  
20 have got a couple of series of AC motor-operated  
21 valves that are closed, I would really like to get  
22 those suckers open sometime between T-zero and less  
23 than eight hours.

24 MR. RECKLEY: We don't really see the gap  
25 because we think that SAMGs are going to be telling

1 the operators to do exactly that.

2 MEMBER SCHULTZ: But what is being  
3 discussed here is the potential of different types of  
4 design changes and additional equipment that can be  
5 provided, hard-piped in, that will protect the core,  
6 if the core melts. And I have got eight hours to  
7 provide that capability. Is there a slight change  
8 that one could make to that design change in equipment  
9 to --

10 CHAIRMAN STETKAR: Poor storage --

11 MEMBER SCHULTZ: -- get the water in  
12 earlier and save the core?

13 CHAIRMAN STETKAR: I will take you back to  
14 my flood plain that is 2 feet above the river, and  
15 your FLEX equipment location strategy is to put the  
16 shed up in the hills. You have got the portable  
17 generators with the plug-in things that you can get  
18 power to open my two little valves with. But it is up  
19 in the hills because that was the most expedient place  
20 and I don't need it for hours. And I don't need it  
21 for eight hours because the only reason I need power  
22 to those valves is for this particular function. That  
23 is the kind of thing I am worried about.

24 MR. BUNT: This is Randy Bunt again.

25 I think we have heard you here. We have

1 got some information. If we put something in the  
2 Guidance, in our programmatic element or back in the  
3 general one, that basically says: ensure procedures  
4 and designs consider early deployment of equipment to  
5 facilitate expedited water addition and repowering,  
6 such that no unnecessary delays are done, so that you  
7 can address the accident response, that is what I am  
8 hearing you saying.

9 So, we want to make sure that people are  
10 thinking about not putting delays in and not putting  
11 things in that, even though I am allowed eight hours,  
12 that I am not going to utilize that eight hours if I  
13 don't have to.

14 CHAIRMAN STETKAR: How you do it is -- the  
15 point I am trying to make is that we are not getting  
16 too pigeonholed --

17 MR. BUNT: Right.

18 CHAIRMAN STETKAR: -- into each one of  
19 these functions --

20 MR. BUNT: Right.

21 CHAIRMAN STETKAR: -- and losing the big  
22 picture.

23 MR. BUNT: Right.

24 CHAIRMAN STETKAR: Because we do have  
25 people making decisions about how were we going to

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1 protect that equipment --

2 MR. BUNT: Right.

3 CHAIRMAN STETKAR: -- what equipment do we  
4 need, how are we going to protect it if we have got  
5 equipment, for the entire variety of challenges,  
6 hazards, floods, seismic events, and things like that.

7 MR. BUNT: Right.

8 CHAIRMAN STETKAR: And all of those  
9 decisions are actually integrated in my little example  
10 about where do you put the shed --

11 MR. BUNT: Right.

12 CHAIRMAN STETKAR: -- as some criteria.

13 MR. BUNT: So, we could add some guidance  
14 that gives some enhancements to make sure people  
15 consider that they don't create anything that creates  
16 an unnecessary burden when they are doing that.

17 CHAIRMAN STETKAR: And I am just trying to  
18 challenge the little bits, you know, the various  
19 players here to say how much has the industry been  
20 talking when you developed the various guidance  
21 documents and how much has the staff been thinking as  
22 they develop the different -- whether it is a Draft  
23 Guidance for the beyond-design-basis rulemaking or  
24 whether it is this particular Interim Staff Guidance  
25 for venting requirements for these levels.

1 MR. RECKLEY: And that is a good point.  
2 I think we have talked and we have interfaces between  
3 all of this.

4 But I also don't want to leave the  
5 impression too much that we don't -- because of the  
6 way these regulations and orders and specific  
7 regulatory actions are set up, that there is not some  
8 lines that we're not likely to cross because we can.

9 And I will give you the example that in  
10 this particular case, severe accident water addition  
11 is being set up as a containment function, right? We  
12 are saying there is a preference for it to go into the  
13 reactor vessel and you get this preference, but it is  
14 a preference, because the requirement we are under is  
15 that it is a containment function. And therefore, if  
16 a licensee were to choose to put it to the drywell,  
17 that is okay with this action.

18 CHAIRMAN STETKAR: Right.

19 MR. RECKLEY: So, just what we are trying  
20 to do, but there are constraints based on what order  
21 and what the order was intended to do.

22 CHAIRMAN STETKAR: Yes, I got it.

23 MR. RECKLEY: Okay?

24 CHAIRMAN STETKAR: Thanks.

25 MR. KARIPINENI: Slide 14.

1           Method 2 is where you have a drywell vent,  
2           like I said before, and, of course, this severe  
3           accident water addition. What you have seen in the  
4           Guidance the last time we had the meeting, that is  
5           when the discussions were going on, what functional  
6           requirements apply to the severe accident water  
7           addition.

8           Initially, there were some differences.  
9           Some of it is just a pure strategy that doesn't  
10          require any NRC review. Or does it require some NRC  
11          review? And we are finally all agreed that there are  
12          some functional requirements for a SAWA that need to  
13          be addressed under this order and guidance. And the  
14          sections were properly revised to include what those  
15          functional requirements are for a SAWA. At this  
16          point, we don't have any more questions or  
17          disagreements between the Guidance and what NRC thinks  
18          it should be.

19          Water management. We will preserve the  
20          wetwell vent. Basically, if it preserves the wetwell  
21          vent for the entire seven-day sustained period of  
22          operation, it is like you do have a vent; you have a  
23          vent. So, you can almost say it meets the basic  
24          Guidance because you do have a severe accident wetwell  
25          vent for the entire seven days in a sense. So, that

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1 is the greatest option.

2 The second option would be preservation  
3 about three days and below seven days, in that period  
4 of time. You heard about the discussion with the  
5 industry, and we also thought a little bit about that  
6 part. Is it reasonable to allow them not to make any  
7 modifications? But the intent there is, if a licensee  
8 could preserve it for more than seven days, is it a  
9 reasonable amount of time for him to do whatever is  
10 necessary to put the alternate heat removal system in  
11 place?

12 And they would provide some functional  
13 requirements, descriptions, and what the system is.  
14 That is when the staff would determine, yes, it looks  
15 reasonable; they can do this. It is not like a real  
16 design that you have to look in how each hour is going  
17 there. It is like a very broad sense review that you  
18 would do.

19 When it comes to below three days  
20 operation is when they elevated that a little bit and  
21 said we will actually have some connections made to  
22 reduce the work that will be needed to put the heat  
23 removal system in place, and we are comfortable with  
24 that, too. And that is where we are. At this point,  
25 we don't have any further issues left to be resolved.

1           MEMBER REMPE: I have a question about  
2           some of the information added to Appendix C. I know  
3           earlier industry mentioned that they were looking at  
4           the instrumentation, and the water level in the  
5           wetwell is clearly important, and they are looking at  
6           it for dose. They said it is going to be bounded by  
7           design basis accident conditions, which is what Reg  
8           Guide 1.97 requires.

9           What about the initiating events? What if  
10          it is a beyond-design-basis earthquake, for example,  
11          or something? Is that not going to affect the  
12          validity of that water level to function?

13          MR. KARIPINENI: These are the instruments  
14          that are, basically, already safe. They have looked  
15          at for their seismic --

16          MEMBER REMPE: But if it is a beyond-  
17          design-basis accident?

18          MR. KARIPINENI: Well, when you say if it  
19          is a beyond-design-basis seismic part of it, that is  
20          being handled separately within this seismic, et  
21          cetera. The plants have been looking at, they have to  
22          look at the higher capability than what they have.  
23          And that is going on concurrently. If there is a need  
24          for that to be done for a particular plant, licensees  
25          will do that. It is how we resolve it in Phase 1.

**NEAL R. GROSS**

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1 MEMBER REMPE: Okay. So, even though this  
2 is a beyond-design-basis accident situation, you are  
3 going to just go with what is in the design basis for  
4 the qualification of the equipment?

5 MEMBER BROWN: At this point.

6 MR. KARIPINENI: At this point. At this  
7 point, yes.

8 MEMBER BROWN: But a separate seismic  
9 evaluation is going to be done to determine --

10 MR. KARIPINENI: Yes, they will be doing  
11 it.

12 MEMBER BROWN: -- if anything additional  
13 needs to be done. Is that --

14 MR. KARIPINENI: That's correct.

15 MEMBER RICCARDELLA: But that is kind of  
16 an overall plant PRA type of seismic evaluation. It  
17 is not clear that it is going to cover qualification  
18 of this --

19 MR. RECKLEY: But they will look at the  
20 fragility of individual components and instruments.

21 MEMBER REMPE: But the result will be  
22 something that is within the design basis? You would  
23 qualify the design basis or you are going to go to  
24 beyond-design basis --

25 MR. KARIPINENI: The newly-defined

1 hazards, I think.

2 MR. RECKLEY: But they will look at the  
3 new spectrum, the high-frequency changes. That is one  
4 of the areas that changes the most. And so, it will  
5 be looked at in that context.

6 MR. KARIPINENI: But it is not looked at  
7 right now for this Guidance is what we are saying.

8 CHAIRMAN STETKAR: We are still working  
9 out what is robust with respect to what the evaluated  
10 seismic hazard means quantitatively.

11 MEMBER REMPE: But I guess right now we  
12 don't require people to go beyond design basis. So,  
13 even if you put it in the design basis, if this is a  
14 beyond-design-basis --

15 CHAIRMAN STETKAR: People are still  
16 working out what "robust" with respect to the  
17 reevaluated seismic hazard means.

18 MEMBER SCHULTZ: For this order.

19 MR. KARIPINENI: We have, from the last  
20 meeting, we followed up. That Technical Analysis was  
21 provided to the ACRS.

22 We have already discussed the programmatic  
23 controls and the corrective actions and the  
24 surveillance frequencies from the industry.

25 The revised Guidance for that part of it

1 only came in like the day before yesterday. We have  
2 one small, minor issue that we think we can easily  
3 resolve with them, and I don't see the need to bring  
4 it up here, unless you all want to.

5 Remaining exceptions and qualifications in  
6 the document are pretty consistent with what we did in  
7 Phase 1, but we are not specifically endorsing  
8 EOPs/SAMGs of this Guidance.

9 The reference to the EPRI Technical Report  
10 that the Subcommittee has asked for, you know, the  
11 Summary Report will not be ready until the end of  
12 April. I believe the Final Report would not be  
13 available until October or so, is what we were told.  
14 And if you want to see it, it can be made available to  
15 you. Most possibly, it may be put in ADAMS also; we  
16 don't know.

17 Appendix A, Glossary of Terms, we have an  
18 exception there, basically, talking about how certain  
19 terms used in the Guidance are not consistent in the  
20 regulatory part of the NRC work. And we just wanted  
21 to make sure that people understand that. And  
22 therefore, there was an exception there regarding  
23 that.

24 MEMBER SCHULTZ: It looked like there were  
25 changes made to try to correct that. It didn't go far



1       enough? The changes did not go far enough?

2                   MR. KARIPINENI: Well, I think they look  
3       okay right now. There may be one more little tidbit  
4       we wanted to see. But, yes, as far as it seems like  
5       the depressurization of the vessel, et cetera, that  
6       were discussed, it is a good thing, you know, to make  
7       this --

8                   MEMBER SCHULTZ: It seems it would be good  
9       to make sure that, in fact --

10                  MR. KARIPINENI: Yes, we will make sure of  
11       that.

12                  MEMBER SCHULTZ: -- we do get to the point  
13       where it is clear.

14                  MR. KARIPINENI: Right.

15                  MR. RECKLEY: But this is an exception we  
16       even had in Phase 1. The distinction is, just  
17       whenever you have a glossary for one report, the  
18       staff, unless we are going to spend a lot of time to  
19       make sure there's consistency across every regulatory  
20       arena, we just put in the exception to say the  
21       definitions are good for this report, but we don't  
22       want it to be taken outside of the context of this  
23       report.

24                  MEMBER SCHULTZ: I understand, yes.

25                  MR. KARIPINENI: That's the end of my

1 presentation. Any questions?

2 MEMBER SCHULTZ: Are there questions from  
3 the staff? John? Oh, I see where you are pointing.

4 (Laughter.)

5 At this time, I would like to ask for  
6 public comments. We will open the phone line. But  
7 are there any members of the public who would like to  
8 make a comment to the Committee at this point.

9 (No response.)

10 We hear none from the room.

11 I think the phone line is open, but we  
12 find out whether anyone is listening-in by asking  
13 someone to say "hello". Is anyone there? I hear  
14 someone speaking.

15 Is there any member of the public who  
16 would like to make a comment for the benefit of the  
17 Committee? If so, please state your name and make the  
18 comment.

19 (No response.)

20 Hearing none, I will close the public  
21 comment session.

22 I want to thank the staff and the industry  
23 for the presentations this morning, and then, turn it  
24 back over to you, John.

25 CHAIRMAN STETKAR: Thanks, Steven.

1           Again, I would also like to thank the  
2           industry and the staff. This is obviously part of a  
3           really complex topic, and it is finally coming  
4           together, which is why I think you hear a lot more of  
5           focused questions from us. We appreciate all of the  
6           effort that everyone has put in there.

7           With that, we are, in fact, adjourned.

8           (Whereupon, at 12:51 p.m., the meeting was  
9           adjourned.)

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# Advisory Committee on Reactor Safeguards

Mark I and Mark II BWRs  
Containment Venting Systems Guidance  
for Phase 2 of Order EA-13-109  
and ISG JLD-ISG-2015-01 (Revised NEI-13-02)  
April 10, 2015



# Order EA-13-109

## Background

- EA-12-050
  - Issued March 12, 2012 requiring reliable hardened containment vents for boiling water reactors (BWRs) with Mark I and II containments
- SECY-12-0157
  - Response to Commission direction to provide analyses to inform a decision on whether filtered vents should be required
  - SRM directed modification of EA-12-050 to require venting system remain functional under severe accident conditions and consider additional requirements using rulemaking process
- Order EA-13-109
  - Issued June 6, 2013
- Containment Protection and Release Reduction Rulemaking



# Order EA-13-109

## Background

- Phased approach to minimize delays in implementing the requirements originally imposed by EA-12-050.

### Phase 1

Upgrade venting capabilities from the containment wetwell to provide reliable, severe accident capable hardened vents to assist in preventing core damage and, if necessary, to provide venting capability during severe accident conditions (JLD-ISG-2013-02).

### Phase 2

Additional protections for severe accident conditions through installation of a reliable, severe accident capable drywell vent system or the development of a reliable containment venting strategy that makes it unlikely that a licensee would need to vent from the containment drywell during severe accident conditions



# Order EA-13-109

## Phase 2 ISG Schedule

- Public and industry interactions – August 2014 to March 2015
  - 6 public meetings/webinars
- Draft ISG issued for public comment – March 10, 2015
- ACRS subcommittee meeting – March 20, 2015
- Public comment period ended – April 9, 2015
- ACRS full committee meeting – April 10, 2015
- Phase 2 ISG issued – April 30, 2015
- Phase 2 Overall Integrated Plan Submittals – Dec 31, 2015



# Order EA-13-109

## Phase 2

- Revisions to Industry Guidance Document
  - NEI-13-02, Rev. 0F4
- Draft Interim Staff Guidance JLD-ISG-2015-01
  - Three Methods of Compliance Identified
    - 1) Severe accident capable drywell vent with no provision for water addition
    - 2) Severe accident capable drywell vent with severe accident water addition (SAWA)
    - 3) SAWA with severe accident water management (SAWM) to prevent loss of wetwell vent obviating need for severe accident capable drywell vent





# Order EA-13-109

## Revisions to NEI-13-02

- Updates
  - Flammable Gases (App H & HCVS-WP-03)
  - Evaluation of Doses and Source Terms (APP F & G, HCVS-WP-02)
  - Appendix A (Glossary of Terms)
  - Instrumentation Capabilities
- Phase 2 Focus
  - Severe accident water addition (SAWA)
    - Appendix I
  - Severe accident water management (SAWM)
    - Appendix C

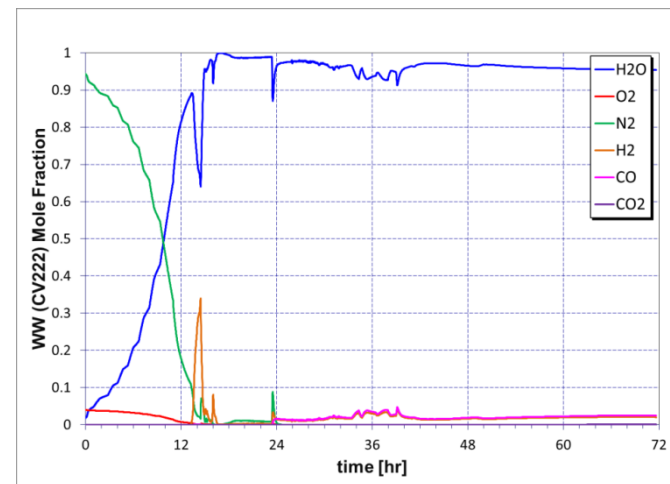
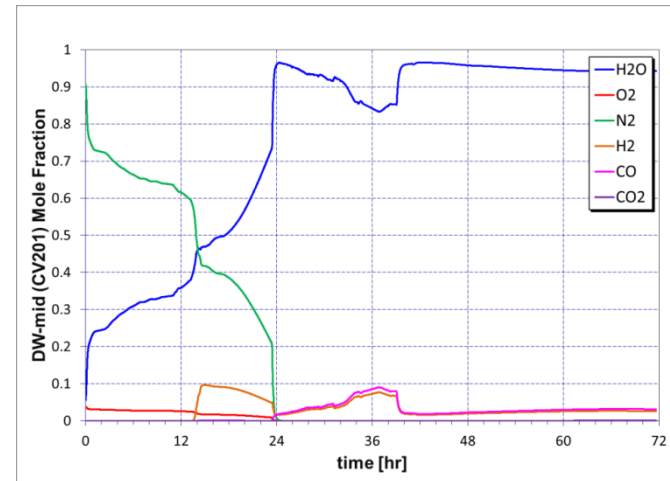
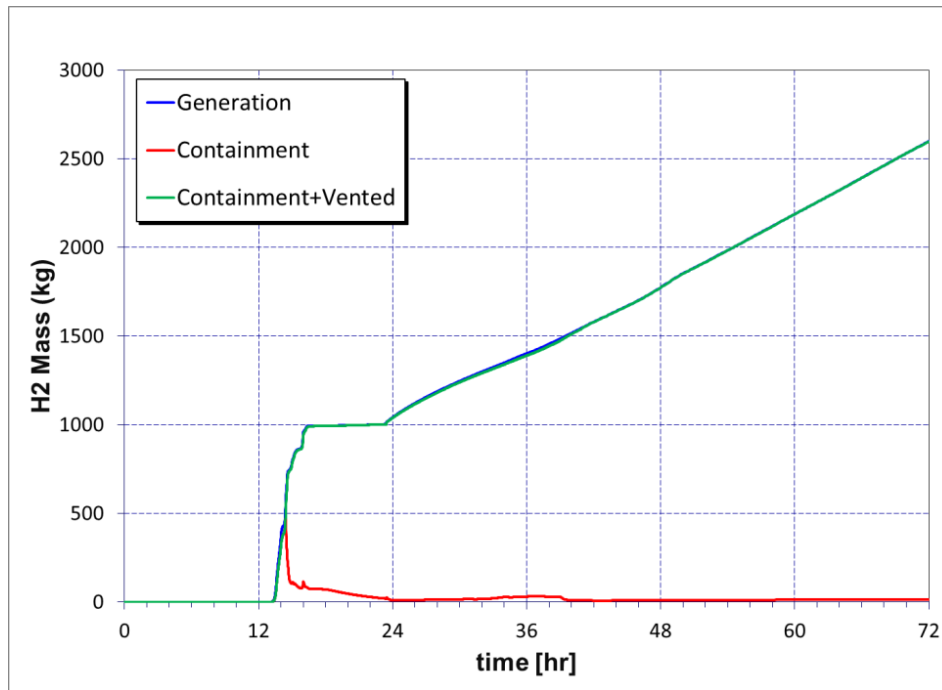


# Combustible Gas Control

- Order EA-13-109
  - The HCVS shall be designed and operated to ensure the flammability limits of gases passing through the system are not reached; otherwise, the system shall be designed to withstand dynamic loading resulting from hydrogen deflagration and detonation.
  - The HCVS shall be designed to minimize the potential for hydrogen gas migration and ingress into the reactor building or other buildings.
- Related guidance is provided in Appendix H to NEI 13-02 and White Paper HCVS-WP-03, “Hydrogen/Carbon Monoxide Control Measures”
- Further evaluation of possible measures to address hydrogen control and mitigation inside containments or other buildings to be addressed under separate Tier 3 item (Recommendation 6)



# Hydrogen Generation and Transport



Mark I Hydrogen Generation and Transport for SAWA



# INTERIM STAFF GUIDANCE

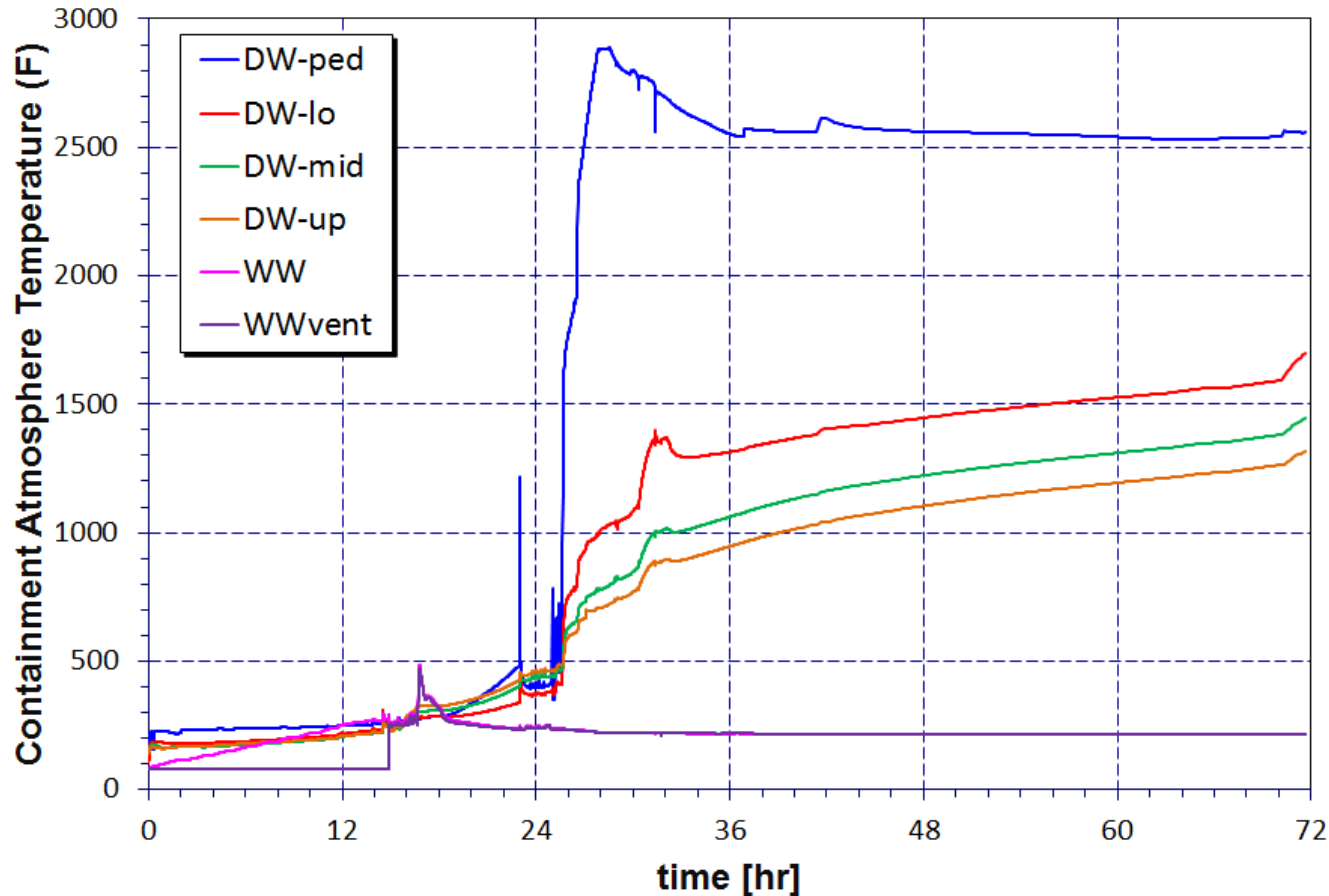
## JLD-ISG-2015-01

### **Method 1**

- Severe accident drywell vent (SADV) with no provisions for water addition
  - drywell temperatures could exceed 1000°F
- No guidance provided in NEI 13-02, Rev. 0F4. Plant specific analysis by individual licensees is required
- JLD-ISG-2015-01 cautions that approach could conflict with potential requirements in CPRR rulemaking; also raises possible concerns with increased release of hydrogen into reactor building
- Plan to reinforce challenges posed by this method during workshops and other interactions



# Evaluation of Drywell Temperatures



Mark I Containment Gas Temperature with no water addition



# INTERIM STAFF GUIDANCE

## JLD-ISG-2015-01

### Method 2

- Severe accident drywell vent (SADV)
- Additional provisions for severe accident water addition (SAWA)
  - Limits drywell temperatures to justify 545°F design specification
- Hybrid approach to implementing Order involving a strategy for SAWA but includes SADV (545°F design specification) for pressure control following loss of the wetwell vent
- Guidance provided in Appendix I to NEI-13-02 (Draft 0F4)



# Severe Accident Water Addition

## Example Plant - SAWA

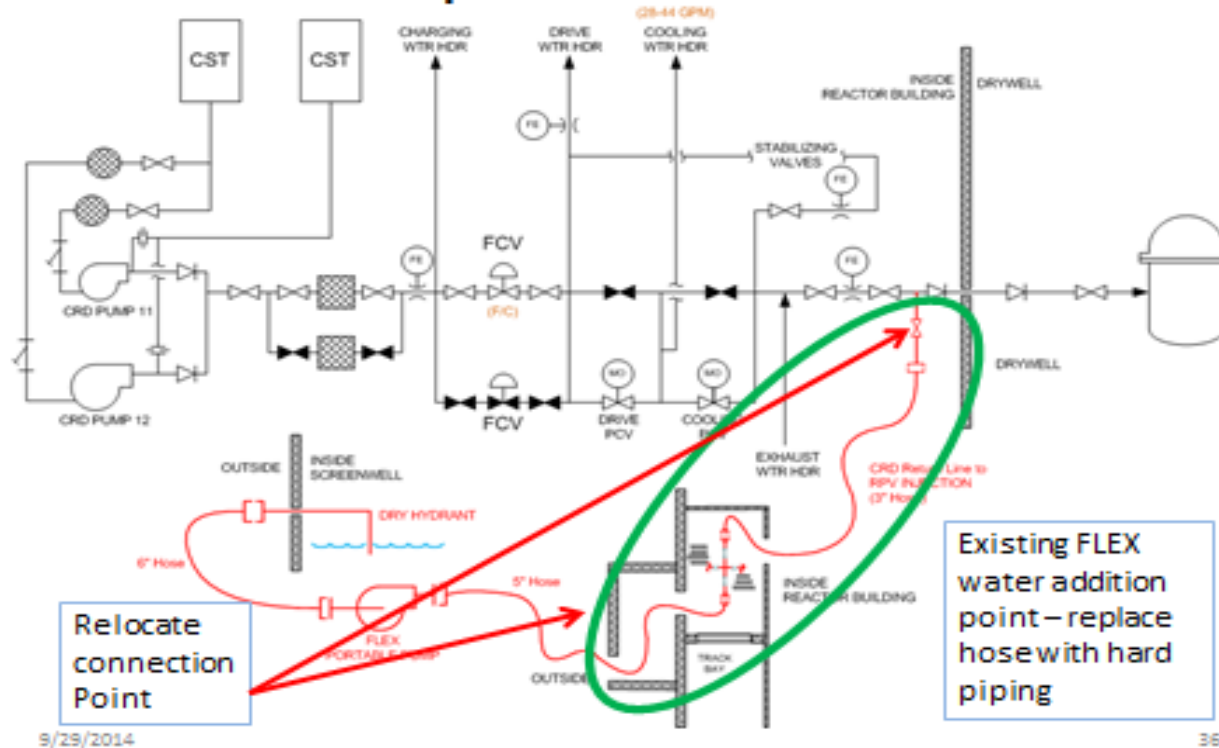
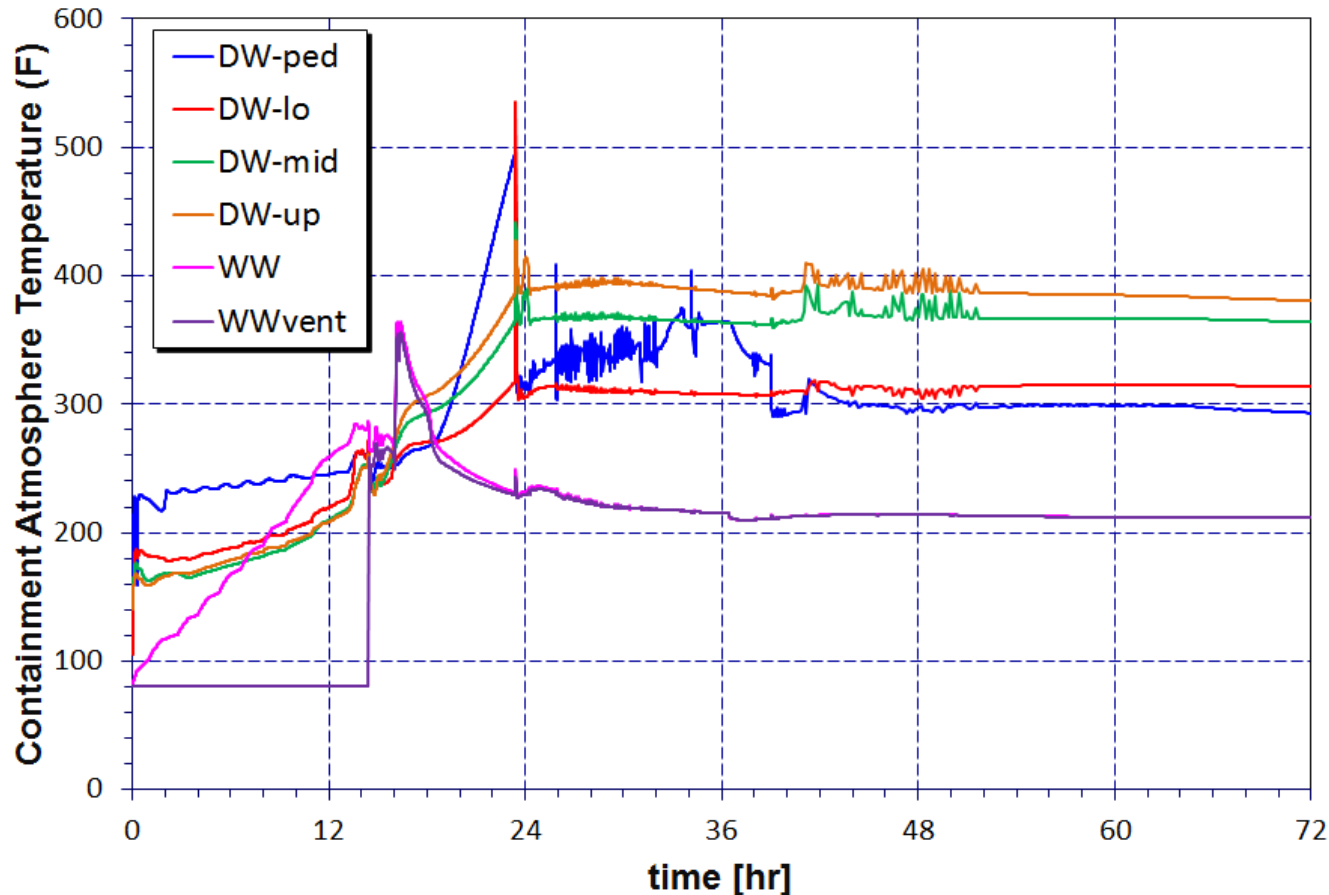


Figure from NEI 13-02 (Draft 0F4)



# Evaluation of Drywell Temperatures



Mark I Containment Gas Temperature with water addition  
 (SAWA/SAWM - SAWA only shows similar behavior/temperatures)





# INTERIM STAFF GUIDANCE

## JLD-ISG-2015-01

### Resolution of Issues in Draft ISG – Method 2

- Issues in Draft ISG
  - Clarify functional requirements for SAWA provisions
- Resolution: Industry added discussion to NEI 13-02, Rev. 0F4 regarding functional requirements for SAWA to address time sensitive actions and equipment capabilities
  - Section 4, “Design Considerations”
  - Section 5, “Programmatic Controls”
  - Section 6, “Operational Considerations”
  - Appendix I, “Severe Accident Water Addition (SAWA)”
- Issues in final ISG
  - None



# INTERIM STAFF GUIDANCE

## JLD-ISG-2015-01

### Method 3

- Additional provisions for severe accident water management (SAWM)
  - Sustained operations using severe accident wetwell vent and/or alternate reliable heat removal capabilities
- Guidance provided in Appendix C to NEI-13-02, Rev. 0F4



# INTERIM STAFF GUIDANCE

## JLD-ISG-2015-01

### Resolution of Issues in Draft ISG – Method 3

- Issues in Draft ISG
  - Clarify functional requirements for various SAWM approaches and coping times
- Resolution: Industry added discussion to NEI 13-02 regarding functional requirements for SAWM to address:
  - Sustained Operations (> 7 days) With Wetwell Vent
  - Sustained Operations (> 7 days) With Wetwell Vent for > 3 days with functional level description of alternate heat removal capabilities
  - Sustained Operations (> 7 days) With Wetwell Vent for < 3 days with detailed description of alternate heat removal capabilities
- Issues in final ISG
  - None



# INTERIM STAFF GUIDANCE

## JLD-ISG-2015-01

### Subcommittee Meeting Issues/Follow-up

- Supporting analyses (MELCOR, EPRI)
  - Draft Technical Analysis Provided
- Programmatic Controls (Corrective Actions)
  - Revised NEI 13-02 to clarify programmatic controls
- Surveillance Frequencies
  - Revised surveillance table to resolve staff questions



# INTERIM STAFF GUIDANCE

## JLD-ISG-2015-01

### Remaining Exceptions and Clarifications

- Did Not Review/Approve :
  - EOPs/SAMGs
  - References in NEI 13-02, Rev. 0F4
    - Including Reference 27 (EPRI Technical Report)
  - Appendix A – Glossary of Terms



# Questions & Discussion

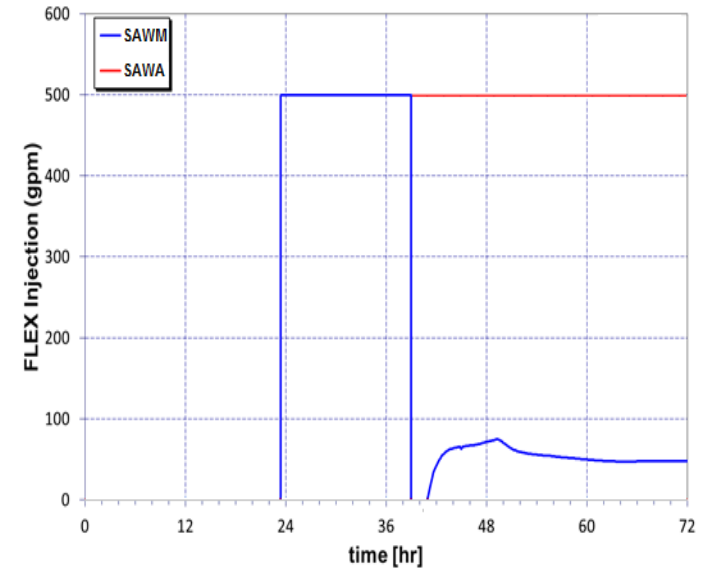


# BACKUPS

# MELCOR Results for Mark I

(Timing of key events for selected scenarios)

Event Timing (hr)	Case 1 (no water)	Case 9 (SAWM)	Case 10 (SAWA)
Start of ELAP	0.0	0.0	0.0
Operators first open SRV to control pressure	0.17	0.17	0.17
Low-level 2 and RCIC actuation signal	0.18	0.18	0.18
Operators open SRV to control pressure (200-400 psig)	1.0	1.0	1.0
RCIC flow terminates	9.6	9.6	9.6
SRV sticks open or operators open SRV after RCIC fails	16.0	9.6	16.0
Water level reaches TAF	12.4	11.9	11.9
First hydrogen production	13.7	13.2	13.7
First fuel cladding gap release	13.7	13.2	13.7
Start of containment venting at 60 psig	14.9	14.4	16.3
Relocation of core debris to lower plenum	15.6	15.5	15.5
RPV lower head dries out	18.1	18.2	18.9
RPV lower head fails	23.0	23.4	23.1
Drywell head flange leakage	27.1	-	-
Hydrogen burn in reactor building refueling bay	28.8	-	-
Drywell liner melt-through	31.4	-	-
Calculation terminated	72	72	72
<b>Selected MELCOR Results</b>	<b>Case 1</b>	<b>Case 9</b>	<b>Case 10</b>
Debris mass ejected (kg)	292,000	280,000	287,000
In-vessel hydrogen generated (kg)	1,195	1,032	1,232
Iodine release fraction at 72 hr	2.28E-01	7.86E-02	8.10E-02
Cesium release fraction at 72 hr	1.94E-02	6.12E-03	7.26E-03



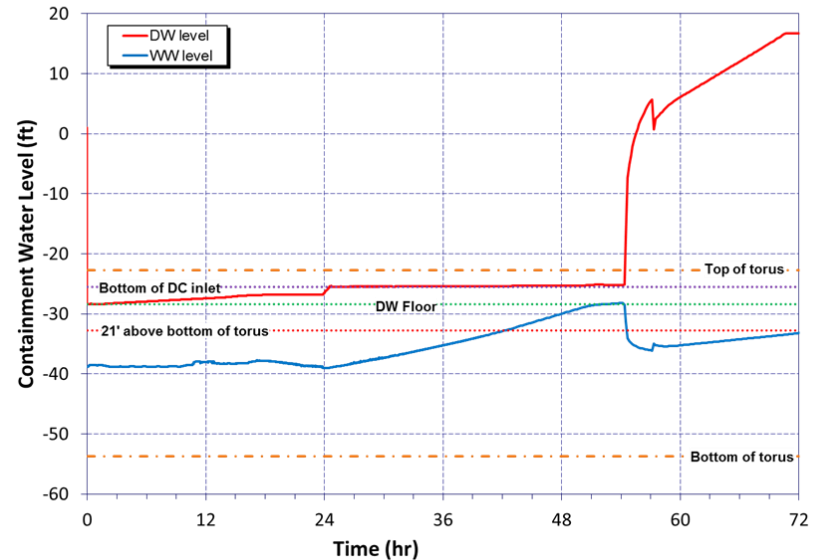
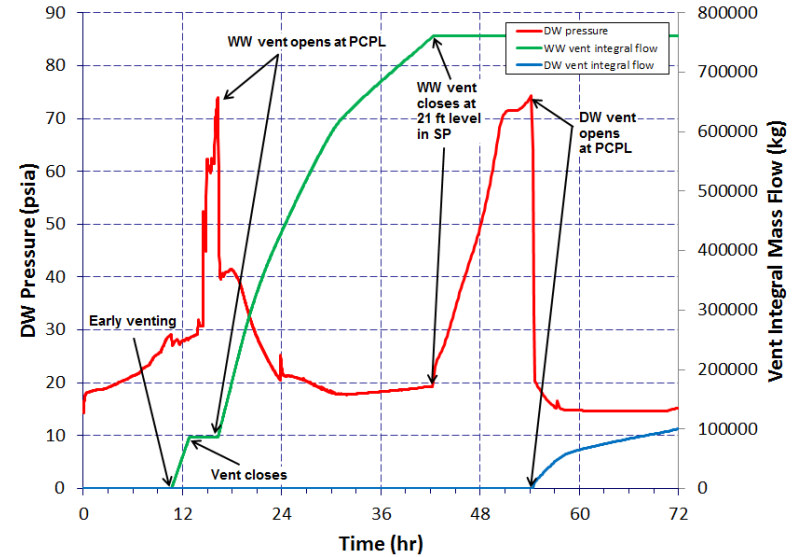
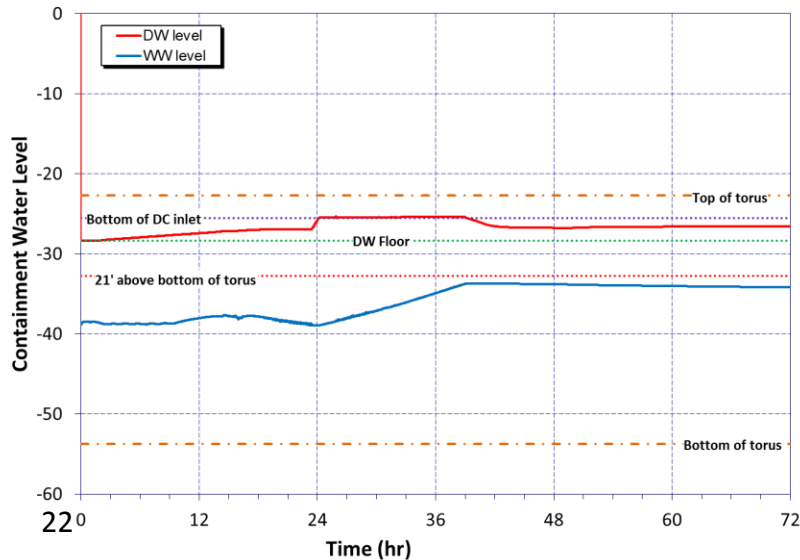
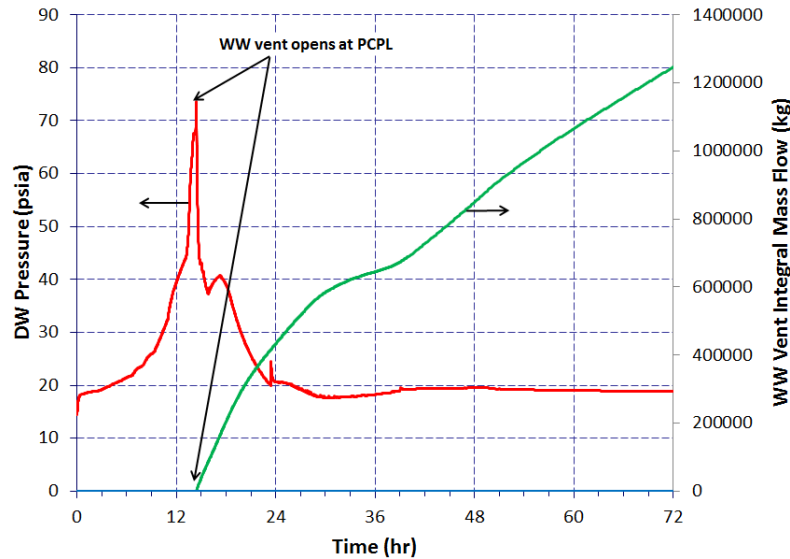


## Case 9: SAWM

# MELCOR Results for Mark I

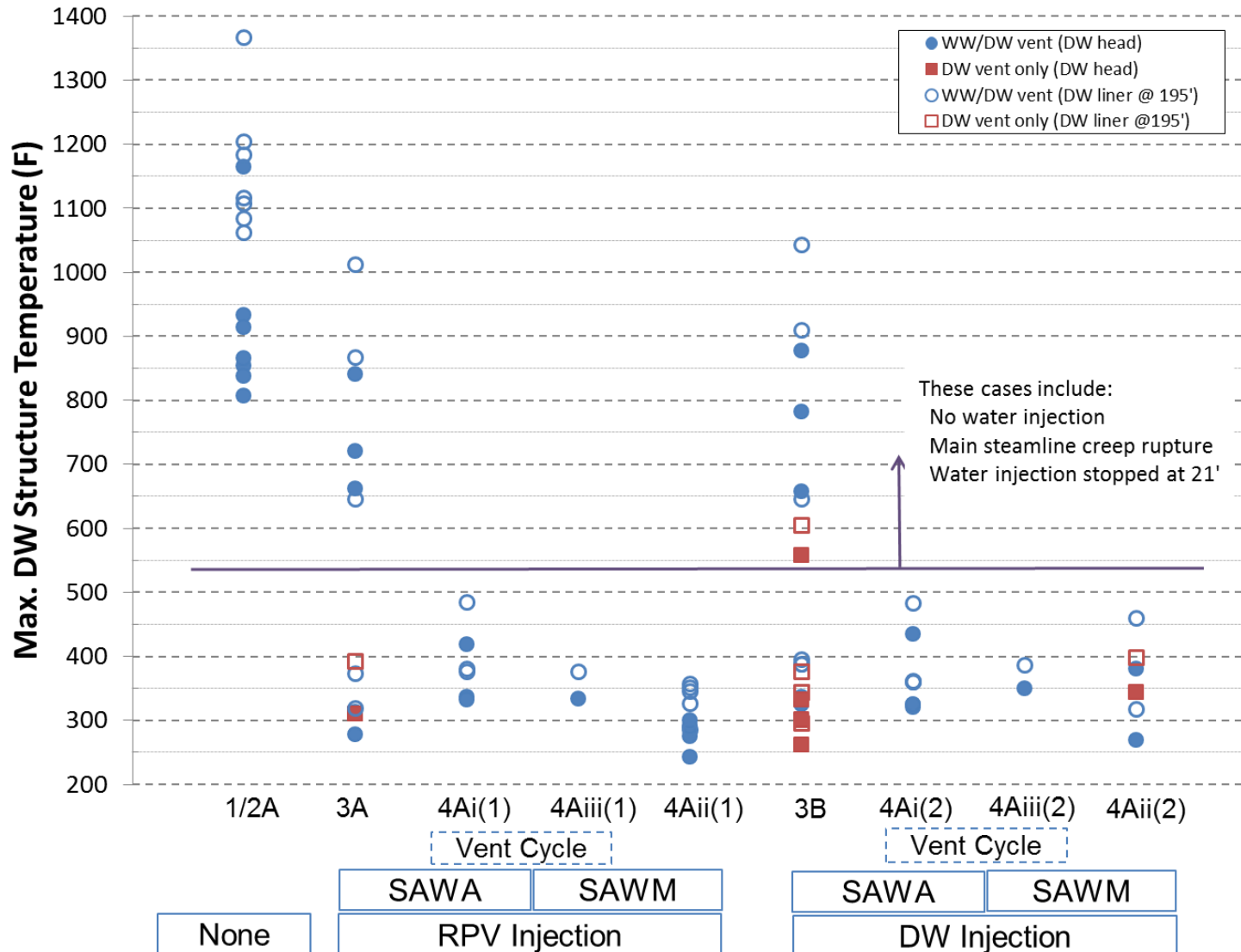
(containment pressure & water level)

## Case 10: SAWA



# MELCOR Results for Mark I

(containment structure temperature)



## NRC Staff Comments on Draft 0F4 – Change Matrix

### Testing and Inspection Requirements

Description	Frequency
Cycle the HCVS and installed SAWA valves <sup>1</sup> and the interfacing system boundary valves not used to maintain containment integrity during <b>Mode 1, 2 and 3 unit operations</b> . For HCVS valves, this test may be performed concurrently with the control logic test described below.	Once per every <sup>2</sup> operating cycle
<b>Cycle the HCVS and installed SAWA check valves not used to maintain containment integrity during unit operations<sup>3</sup></b>	<b>Once per every other<sup>4</sup> operating cycle</b>
Perform visual inspections and a walkdown of HCVS and installed SAWA components.	Once per operating cycle
Functionally test the HCVS radiation monitors.	Once per operating cycle
Leak test the HCVS.	(1) Prior to first declaring the system functional; (2) Once every three operating cycles thereafter; and, (3) After restoration of any breach of system boundary within buildings.
Validate the HCVS operating procedures by conducting an open/close test of the HCVS control <b>function logic</b> from its control <b>location panel</b> and ensuring that all HCVS vent path <b>and interfacing system boundary valves<sup>5</sup></b> move to their proper (intended) positions.	Once per every other operating cycle

\* ~~Not required for HCVS and SAWA check valves if integrity of check function is demonstrated every 4 cycles~~

<sup>1</sup> Not required for HCVS and SAWA check valves.

<sup>2</sup> After two consecutive successful performances, the frequency may be increased to a maximum of once per every other operating cycle.

<sup>3</sup> Not required if integrity of check function (open and closed) is demonstrated by other plant testing requirements.

<sup>4</sup> After two consecutive successful performances, the frequency may be increased by one operating cycle to a maximum of once per every fourth operating cycle.

<sup>5</sup> Interfacing system boundary valves that are normally closed and fail closed under ELAP conditions (loss of power and/or air) do not require control function testing under this section. Performing existing plant design basis function testing or system operation that reposition the valve(s) to the HCVS required position will meet this requirement without the need for additional testing.

# **NEI 13-02 Rev 1**

## **Industry Guidance to Implement EA-13-109**

Advisory Committee on Reactor Safeguards  
Full Committee Meeting  
April 10, 2015



# General Characterization

- Revised NEI 13-02 to include Phase 2 guidance
  - Industry is working toward common design elements for implementation of the order
  - Final version will be informed by ACRS insights
  - Expect limited exceptions and clarifications in final ISG
- Phased implementation
  - Phase 1 - Vent capability from wetwell
  - Phase 2 - Vent capability from drywell or alternate venting strategy

# Order Functional Requirements

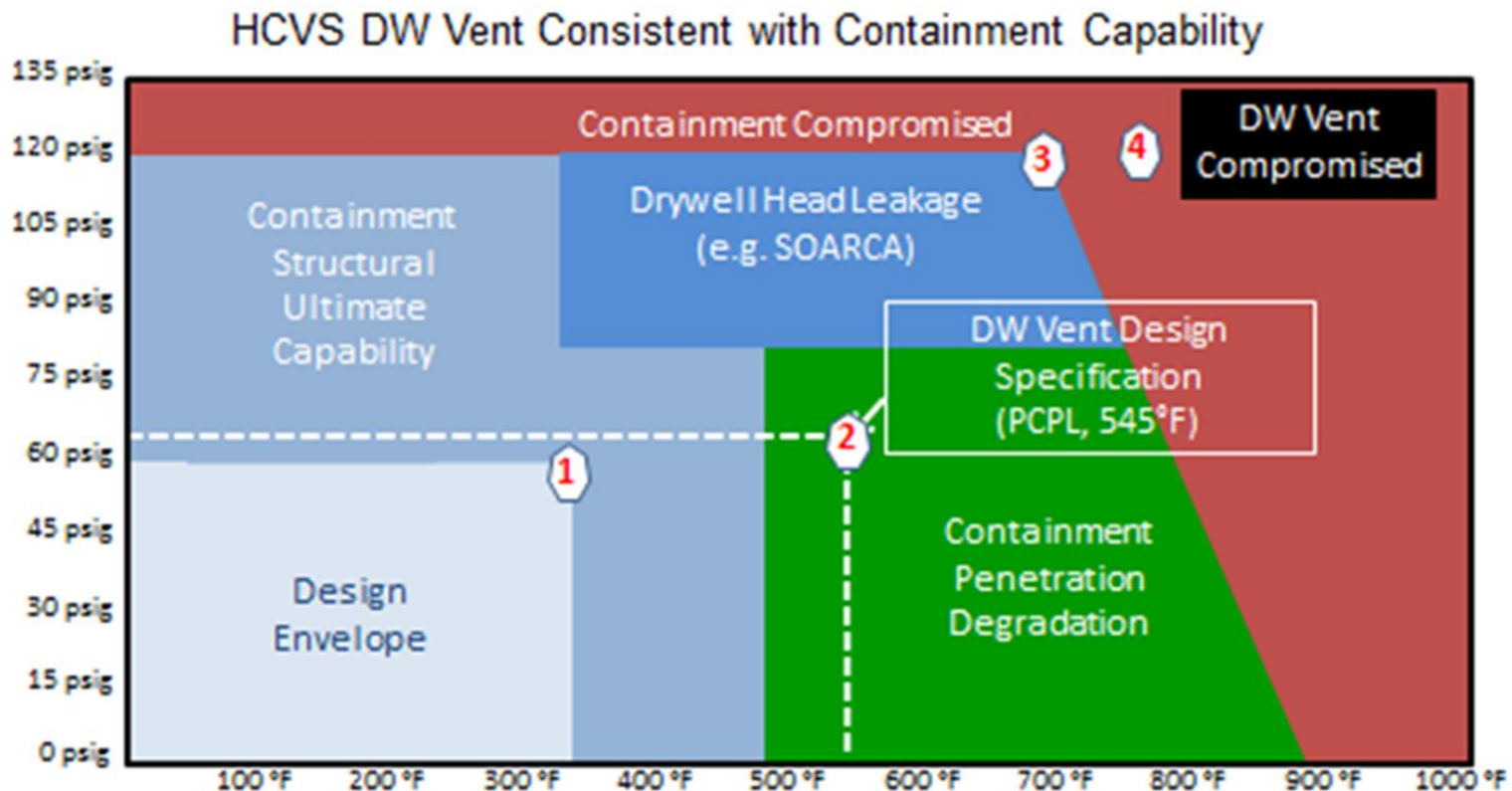
- Limit containment pressure
- Control the use of common systems within and between units
- Vent usage with ELAP and severe accident conditions

# Phase 1 Topics

- Combustible gas control addressed by HCVS-WP-03 and NEI 13-02 Appendix H (ML14302A066/ML15040A038)
  - Analysis shows combustible gases are vented as part of the SAWM strategy within 24 hours
- Accessibility due to radiation – resolved by endorsed HCVS-WP-02 (ML14358A038/ML14358A040)
  - Method for calculating integrated dose for HCVS equipment qualification
  - Method for determining dose rates from HCVS piping during venting for assessment of operator action feasibility

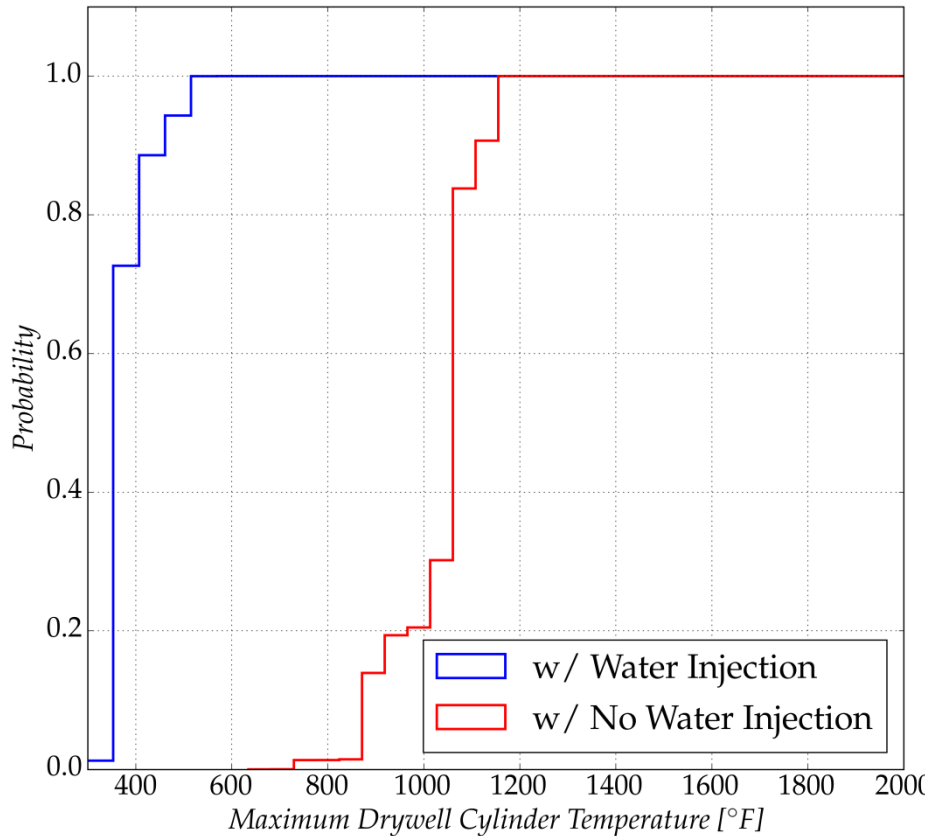
# Phase 1 and 2 Topic

- Drywell vent design temperature of 545°F is confirmed by analysis if water addition is included

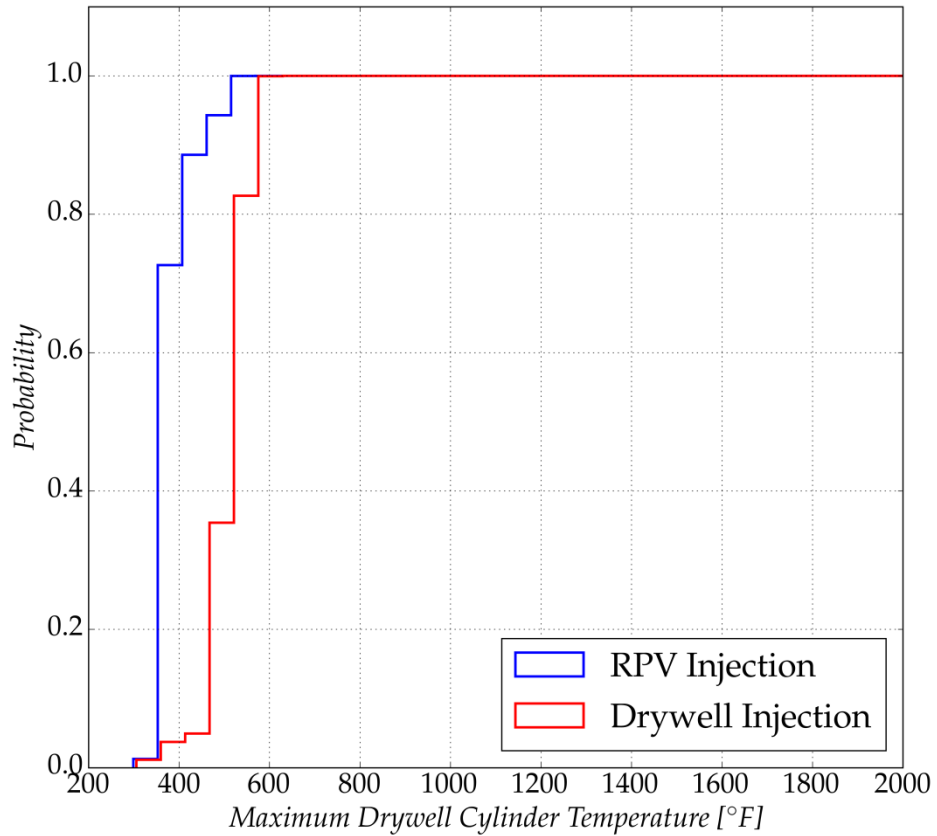




# Phase 1 and 2 Topic



Probability that the Maximum Drywell Gas Temperature is below the indicated value under Various Severe Accident Sequences, Water Addition vs. No Water Addition



Probability that the Maximum Drywell Gas Temperature is below the indicated value under Various Severe Accident Sequences, water addition to RPV vs. water addition to Drywell

# Phase 2 Terminology

- Severe Accident Water Addition (SAWA)
  - Providing water to reactor vessel or drywell post-core damage.
- Severe Accident Water Management (SAWM)
  - Preserve wetwell vent path.

# Phase 2 Guidance

## BWR Vent Order Phase 2 Options

Phase 1 – Severe Accident Wetwell Vent; Plans submitted June 30, 2014

Phase 2 – Drywell Vent or Reliable Alternative  
Implementation Due: 2017-19 (Plans Due: Dec 2015)

Order Att. 2 §B.1 DW Vent  
SADV (>1000F)  
Plant specific analysis required

Order Att. 2 §B.2 Reliable Alternative  
Severe Accident Water Addition (SAWA)  
[Containment Protection per EPRI Evaluation and BWROG Pilot Table Top]

Severe Accident Drywell Vent (SADV)  
(545F)

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Severe Accident Water Management (SAWM)  
[SADV NOT REQUIRED]

Phase 2 guidance applies to bottom three boxes

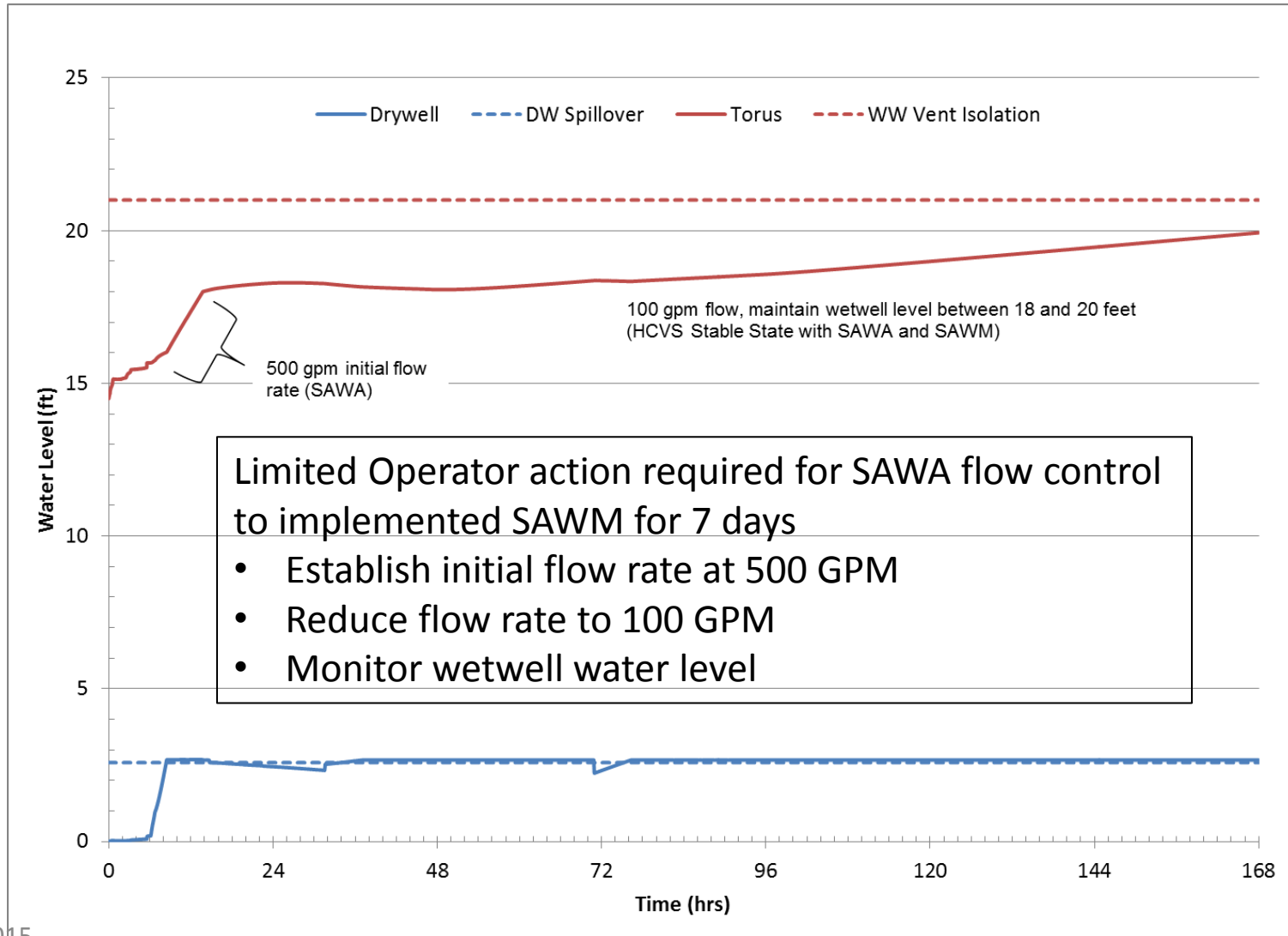
# Phase 2 Guidance

- Section 3 (ISG Method 1):
  - Provide no specific guidance for the high temperature drywell vent option
  - State there are potential longer-term issues related to the CPRR rulemaking should a licensee decide to pursue this option
- NEI 13-02 guidance is written to require SAWA for B.2 options for either:
  - 545°F SADV option with functional requirements from Order Section A (ISG Method 2), or
  - SAWM approach for Phase 2 alternate venting strategy (ISG Method 3)

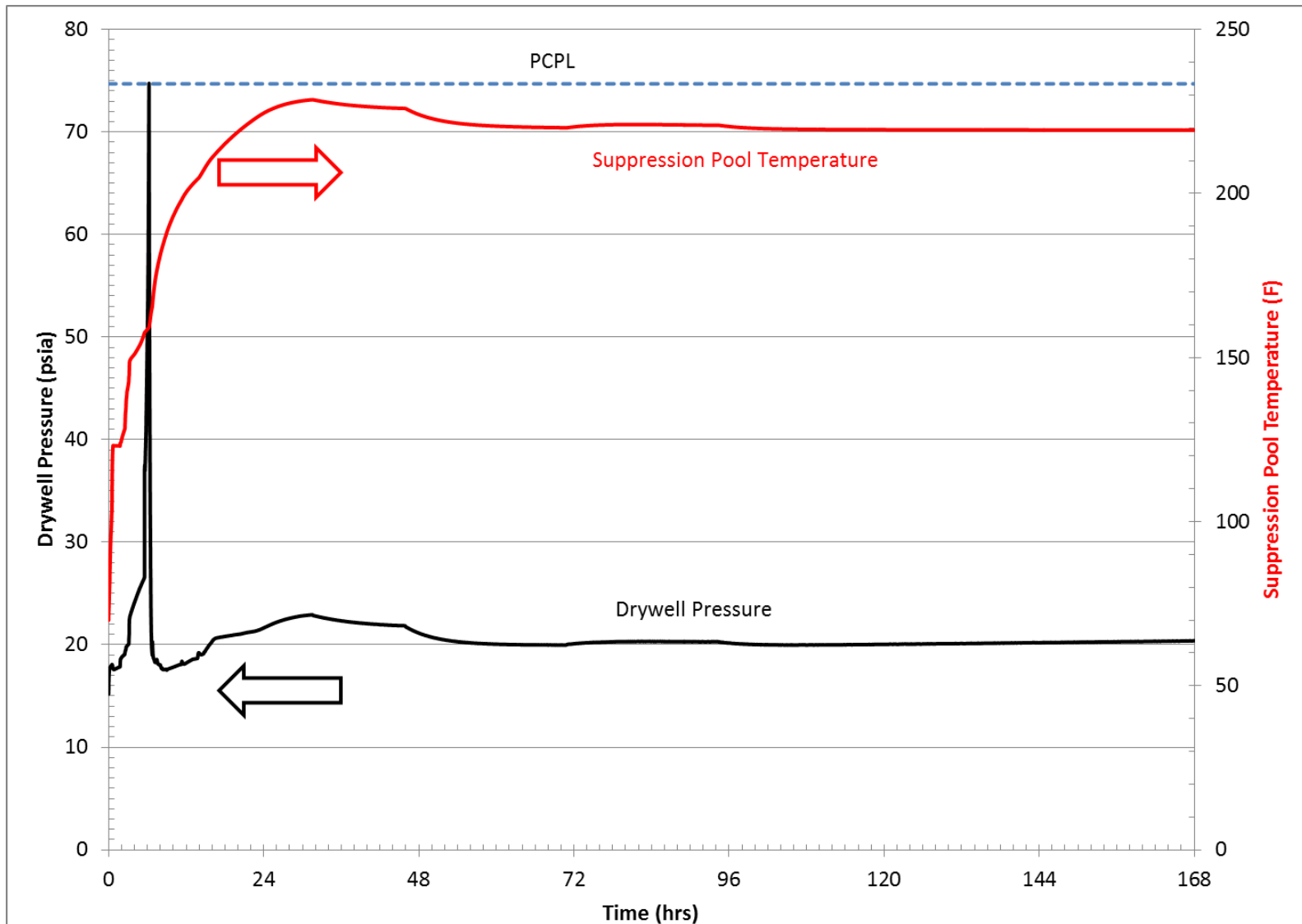
# Wetwell Vent Preservation Time

- Three tier approach for SAWM:
  - 7 days of Sustained Operation – no additional actions are required to meet Order EA-13-109
  - 72 hours to 7 days of Sustained Operation – a functional description of alternate reliable containment heat removal will be included in Phase 2 OIP (similar to S/D Refueling Modes guidance under Order EA-12-049)
  - <72 hours of Sustained Operation – an evaluation of alternate reliable containment removal that includes equipment to be used including plant modifications will be described in the Phase 2 OIP (Similar to Phase 2 action under Order EA-12-049)

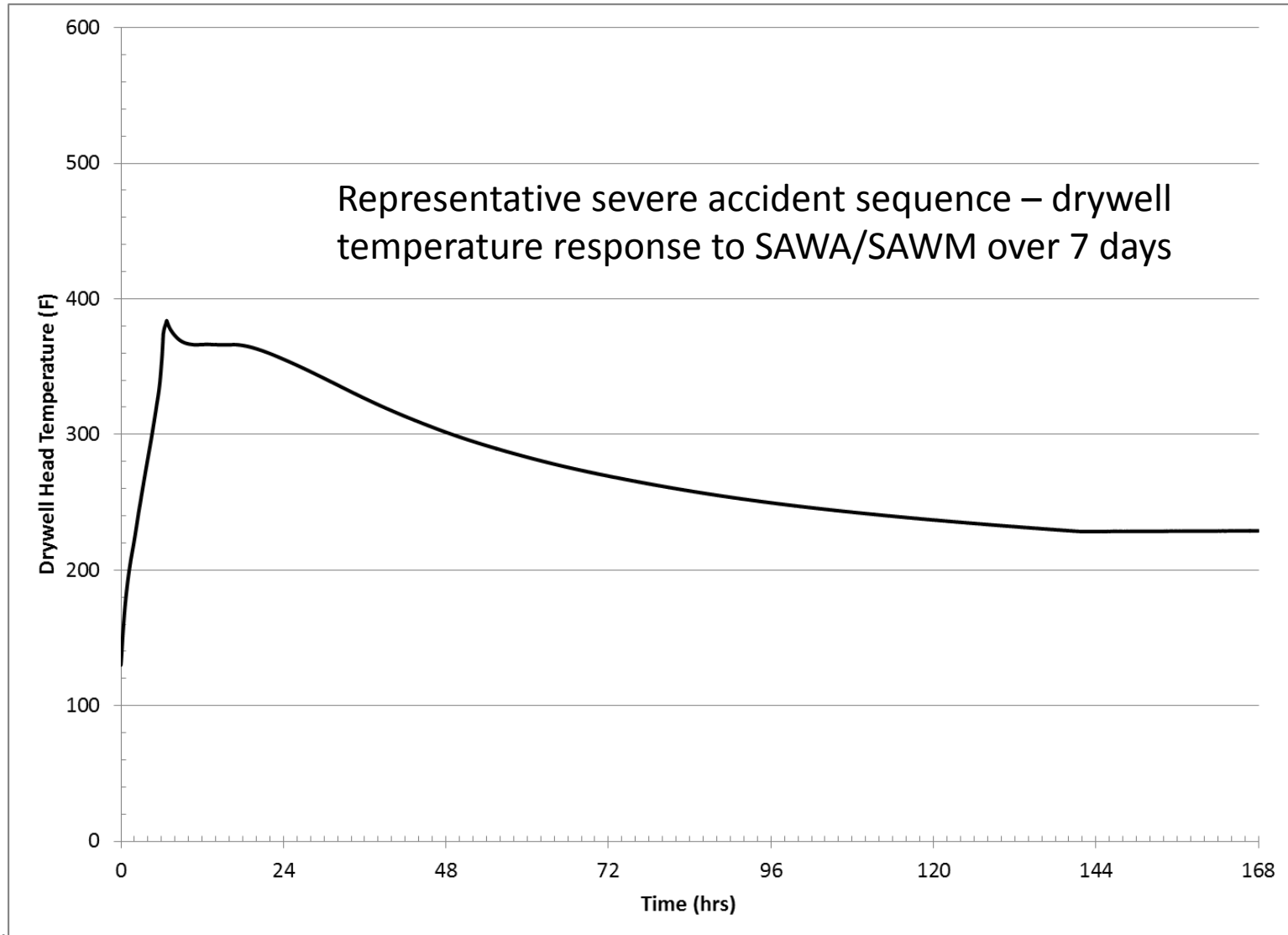
# MAAP 5.02 SAWM Simulation



# MAAP 5.02 SAWM Simulation



# MAAP 5.02 SAWM Simulation





# SAWA Equipment

- NEI 13 – 02 contains guidance for Phase 2 OIPs to describe how SAWA components will be powered including a timeline that shows that components are available to support SAWA in support of 545°F SADV or SAWM
  - Motive force for SAWA may include power or pneumatics for valves in the SAWA flow path and instrumentation
  - For actions less than 24 hours, NEI 12-06 Level “A” validation under severe accident conditions will be used to demonstrate acceptability (treated similar to a “Time Sensitive Action” (TSA))

# SAWM Installed Instruments

- Installed SAWM instruments are the same as those discussed in the Phase 1 guidance
  - Design basis instruments with Technical Specification post accident functions
  - Designed to meet Regulatory Guide (RG) 1.97 requirements or similar qualification for pre-RG 1.97 plants
  - Evaluations performed per HCVS-WP-02 will demonstrate HCVS integrated dose will be bounded by design basis accident integrated dose
  - Post ELAP initial power provided by plant DC or AC through inverters
  - Powered by FLEX equipment before battery power is depleted as part of FLEX mitigation strategy (already evaluated)
  - Not necessary until SAWA flow needs to be controlled to implement the SAWM strategy

# Maintenance and Testing – Check Valves

Description	Frequency
Cycle the HCVS and installed SAWA valves <sup>1</sup> and the interfacing system boundary valves not used to maintain containment integrity during Mode 1, 2 and 3. For HCVS valves, this test may be performed concurrently with the control logic test described below.	Once per every <sup>2</sup> operating cycle
Cycle the HCVS and installed SAWA check valves not used to maintain containment integrity during unit operations <sup>3</sup>	Once per every other <sup>4</sup> operating cycle
Perform visual inspections and a walkdown of HCVS and installed SAWA components.	Once per operating cycle
Functionally test the HCVS radiation monitors.	Once per operating cycle
Leak test the HCVS.	(1) Prior to first declaring the system functional; (2) Once every three operating cycles thereafter; and, (3) After restoration of any breach of system boundary within buildings.
Validate the HCVS operating procedures by conducting an open/close test of the HCVS control function from its control location and ensuring that all HCVS vent path and interfacing system boundary valves <sup>5</sup> move to their proper (intended) positions.	Once per every other operating cycle

[1] Not required for HCVS and SAWA check valves.

[2] After two consecutive successful performances, the frequency may be increased to a maximum of once per every other operating cycle.

[3] Not required if integrity of check function (open and closed) is demonstrated by other plant testing requirements.

[4] After two consecutive successful performances, the frequency may be increased by one operating cycle to a maximum of once per every fourth operating cycle.

[5] Interfacing system boundary valves that are normally closed and fail closed under ELAP conditions (loss of power and/or air) do not require control function testing under this section. Performing existing plant design basis function testing or system operation that reposition the valve(s) to the HCVS required position will meet this requirement without the need for additional testing.

# Out of Service Time – Compensatory Actions

- Revised NEI 13-02 Section 6.3.1.3.3
  - Limits out of service time to a reasonable period of time, not to exceed one full operating cycle
    - Allows for outage related repairs without forcing a plant outage
    - System functionality basis is for coping with beyond design basis events and therefore plant shutdown to address non-functional conditions is not warranted (no change from NEI 13-02 Rev 0 guidance)

# SAWA Flow – RPV Depressurization

- Procedure guidance requires RPV depressurization prior to entry into SAGs
  - RPV depressurization likelihood of success is discussed in I.1.3
  - Failures not assumed to obtain depressurization (e.g., SRV seizure, MSL creep rupture)

# Remaining Steps

- NEI 13-02 Rev 1 (Phase 2)
- JLD-ISG-2015-01 (Phase 2)
- Phase 2 OIP template
- Phase 2 workshop
- Phase 2 OIP submittal

# Conclusion

- SAWA is a viable strategy for meeting Phase 2 of EA-13-109 (ISG Methods 2 and 3)
  - SAWM is a viable strategy for preserving the wetwell vent
  - 545°F design boundary condition for SADV confirmed acceptable with SAWA
- Draft 2 ISG indicates resolution of issues during April public meetings resulting in expected good alignment between final ISG and NEI 13-02 Rev 1