FENOC
First Energy Nuclear Operating Company

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Samuel L. Belcher
President and Chief Nuclear Officer

February 26, 2016
L-16-004

10 CFR 2.202

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-001

SUBJECT:
Beaver Valley Power Station, Unit No. 1
Docket No. 50-334, License No. DPR-66
Davis-Besse Nuclear Power Station
Docket No. 50-346, License No. NPF-3
FirstEnergy Nuclear Operating Company's (FENOC's) Sixth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049) (CAC Nos. MF0841 and MF0961)

On March 12, 2012, the Nuclear Regulatory Commission (NRC or Commission) issued an order (Reference 1) to FENOC. Reference 1 was immediately effective and directs FENOC to develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities in the event of a beyond-design-basis external event. Specific requirements are outlined in Attachment 2 of Reference 1.

Reference 1 required submission of an initial status report 60 days following issuance of the final interim staff guidance (Reference 2) and an overall integrated plan pursuant to Section IV, Condition C. Reference 2 endorses industry guidance document Nuclear Energy Institute (NEI) 12-06, Revision 0 (Reference 3) with clarifications and exceptions identified in Reference 2. Reference 4 provided the FENOC initial status report regarding mitigation strategies. Reference 5 provided the FENOC overall integrated plan for Beaver Valley Power Station (BVPS), Unit Nos. 1 and 2, Davis-Besse Nuclear Power Station (DBNPS), and Perry Nuclear Power Plant (PNPP).

Reference 1 requires submission of a status report at six-month intervals following submittal of the overall integrated plan. Reference 3 provides direction regarding the content of the status reports. The purpose of this letter is to provide the sixth six-month status report pursuant to Section IV, Condition C.2, of Reference 1, that delineates progress made in implementing the requirements of Reference 1. The attached reports for BVPS and DBNPS (Attachments 1 and 2, respectively) provide an update of milestone accomplishments since the last status report, including any changes to the compliance method, schedule, or need for relief/relaxation and the basis, if any.

This letter contains no new regulatory commitments. If you have any questions regarding this report, please contact Mr. Thomas A. Lentz, Manager – Fleet Licensing, at 330-315-6810.

I declare under penalty of perjury that the foregoing is true and correct. Executed on February 26, 2016.

Respectfully,

Samuel L. Belcher

Attachments:
1. Beaver Valley Power Station Sixth Six-Month Status Report for the Implementation of Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events
2. Davis-Besse Nuclear Power Station Sixth Six-Month Status Report for the Implementation of Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events

References:
1. NRC Order Number EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, dated March 12, 2012.
2. NRC Interim Staff Guidance JLD-ISG-2012-01, Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, Revision 0, dated August 29, 2012.
3. NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 0, dated August 2012.
4. FirstEnergy Nuclear Operating Company's (FENOC's) Initial Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated October 26, 2012.
5. FirstEnergy Nuclear Operating Company's (FENOC's) Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 27, 2013.

cc: Director, Office of Nuclear Reactor Regulation (NRR)
NRC Region I Administrator
NRC Region III Administrator
NRC Resident Inspector (BVPS)
NRC Resident Inspector (DBNPS)
NRC Project Manager (BVPS)
NRC Project Manager (DBNPS)
Director BRP/DEP (without Attachments)
Site BRP/DEP Representative (without Attachments)
Utility Radiological Safety Board (without Attachments)

1 Introduction

FirstEnergy Nuclear Operating Company (FENOC) developed an Overall Integrated Plan (OIP) for Beaver Valley Power Station, Unit Nos. 1 and 2 (Reference 1 in Section 8), documenting the diverse and flexible strategies (FLEX), in response to Reference 2. This attachment provides an update of milestone accomplishments since the last status report, including any changes to the compliance method, schedule, or need for relief/relaxation and the basis, if any. The information reported pertains to Unit No. 1 only. (Unit No. 2 compliance with Reference 2 was achieved and reported by letter dated December 21, 2015.)

2 Milestone Accomplishments

The following milestone(s) have been completed since July 31, 2015 and are current as of February 12, 2016.

- Update 5 was submitted
- Complete Construction (FLEX storage)
- Complete Near Site Staging Location (as needed)
- Issue Maintenance procedures

3 Milestone Schedule Status

The following provides an update to Attachment 2 of the OIP. It provides the activity status of each item and whether the expected completion date has changed. The dates are planning dates subject to change as design and implementation details are developed.

The milestones related to BVPS Unit No. 2 were removed from the schedule because compliance with Reference 2 was achieved.

There are no revised milestone target completion dates.

Milestone	Target Completion Date	Activity Status (as of 2/12/16)	Revised Target Completion Date
Submit FLEX Integrated Implementation Plan	02/28/13	Complete	
6 Month NRC Status Updates	08/28/16	Started	
Update 1	08/28/13	Complete	
Update 2	02/28/14	Complete	
Update 3	08/28/14	Complete	
Update 4	02/27/15	Complete	
Update 5	08/28/15	Complete	
*Update 6**	02/28/16	Started	
*Update 7**	08/28/16	Not Started	
Complete FLEX Strategy Review	March-2013	Complete	
Validation	September-2016	Started	
*Walk-throughs or Demonstrations-Unit 1**	September-2016	Started	
Complete Staffing Analysis	November-2014	Complete	
Submit NEI 12-01 Phase 1 Staffing Study	April-2013	Complete	
Submit NEI 12-01 Phase 2 Staffing Study	November-2014	Complete	
Complete Plant Modifications	November-2016	Started	
Target plant modifications	April-2013	Complete	
Unit 1 Modifications complete	November-2016	Started	
Complete 1R22 outage modifications	November-2013	Complete	
Complete on-line modifications	September-2016	Started	
Complete 1R23 outage modifications	May-2015	Complete	
*Complete 1R24 outage modifications**	November-2016	Started	
FLEX Storage Complete	October-2015	Complete	
Complete Building Design	March-2015	Complete	
Commence Construction	March-2015	Complete	
Complete Construction	October-2015	Complete	
River (UHS) Access Complete	October-2014	Complete	
Fence & Gate Modification Design	February-2014	Complete	
New Fence & Gate Construction	August-2014	Complete	
Security Barrier Pipe Penetrations Design	March-2014	Complete	
Security Barrier Pipe Penetration Construction	October-2014	Complete	
On-site FLEX Equipment	September-2016	Started	
Confirm FLEX Equipment Requirements	November-2013	Complete	
FLEX Equipment Ordered	April-2015	Complete	
*FLEX Equipment Delivered-Unit 1**	September-2016	Started	
Off-site FLEX Equipment	October-2015	Complete	
*Develop Strategies with RRC****	June-2015	Complete	
Phase 3 Site Access Strategies in Place	June-2015	Complete	
Complete Near Site Staging Location (as needed)	October-2015	Complete	
Procedures Complete	October-2016	Started	
PWROG issues NSSS-specific guidelines	June-2013	Complete	
*Issue Beaver Valley Unit 1 FSG**	October-2016	Started	
Issue Maintenance Procedures	October-2015	Complete	

Milestone	Target Completion Date	Activity Status (as of 2/12/16)	Revised Target Completion Date
Training Complete	September-2016	Started	
Develop Training Plan	December-2014	Complete	
*Implement Unit 1 Training**	September-2016	Started	
Submit Completion Report	January-2017**	Not Started	

* Milestones added as a result of relief/relaxation for Unit 1 (Reference 4)
** Submittal of completion report occurs after end of refueling outage.
*** Regional Response Center (RRC) is now called National SAFER Response Center (NSRC)

4 Changes to Compliance Method

There are no further changes to the compliance method as documented in the OIP (Reference 1) and previous updates.

5 Need for Relief/Relaxation and Basis for the Relief/Relaxation

Relief/relaxation of the Reference 2 requirement for completion of full implementation for Beaver Valley Power Station Unit No. 1 (BVPS-1) until the completion of the fall of 2016 refueling outage for reactor coolant pump shutdown (RCP) seal installation was granted on May 20, 2014 (Reference 4).

6 Open Items from Overall Integrated Plan and Interim Staff Evaluation

The following tables provide a summary of the open items documented in the OIP or the Interim Staff Evaluation (ISE) (Reference 3) and the status of each item.

Overall Integrated Plan Open Item	Status
OI 1. Finalize the location of the FLEX storage building. The deployment routes, distances, and times provided in this report are bounded for the currently proposed locations but will be updated as necessary.	Complete. (Described in February-2014 status report and updated in the February-2015 status report.)
OI 2. Perform containment evaluation based on the boundary conditions described in Section 2 of NEI [Nuclear Energy Institute] 12-06. Based on the results of this evaluation, required actions to ensure maintenance of containment integrity and required instrument function will be developed.	Complete. (Described in February-2015 status report.)
OI 3. Modify the RWST [refueling water storage tank] at each unit to protect it from tornado missiles or identify a borated source that is protected from tornados and can be utilized to provide core cooling when steam generators are not available.	Complete. (Described in February-2014 status report.)

Interim Staff Evaluation Open Item	Status
3.2.1.6.A Verify that the TDAFW [turbine driven auxiliary feedwater] pump exhaust stacks are adequately protected from tornado missile hazards.	Started.
3.2.1.8.A Verify resolution of the generic concern associated with the modeling of the timing and uniformity of the mixing of a liquid boric acid solution injected into the RCS [reactor coolant system] under natural circulation conditions potentially involving two-phase flow.	Complete. (Described in February-2014 status report.)

ISE Confirmatory Item	Status
3.1.1.4.A Confirm that primary and secondary staging areas for the RRC [regional response center] equipment have been selected and will meet the requirements of the applicable site response plan.	Complete. (Described in August-2015 status report.)
3.1.2.4.A Confirm that the primary and secondary staging areas have been identified and that the plan for the use of offsite resources will comply with NEI 12-06, Section 6.2.3.4 regarding the need to evaluate for flooding hazard. This confirmation should include a description of the methods to be used to deliver the equipment to the site.	Complete. (Described in August-2015 status report.)
3.1.3.1.A Confirm that the location of the storage and protection building for FLEX equipment has been identified. Confirm that the FLEX storage building is designed to withstand tornado missiles at a level equal to, or greater than, the plant's tornado missile design basis.	Complete. (Described in August-2015 status report.)
3.1.3.4.A Confirm that the licensee's plan for the use of offsite resources would provide reasonable assurance that the plan will comply with NEI 12-06, Section 7.3.4 regarding high wind hazards.	Complete. (Described in August-2015 status report.)
3.1.4.4.A Confirm that the licensee's plan for the use of offsite resources would provide reasonable assurance that the plan will comply with NEI 12-06 Section 8.3.4 regarding snow, ice and extreme cold hazards.	Complete. (Described in August-2015 status report.)
3.2.1.1.A Confirm that the licensee has verified that reliance on the NOTRUMP code for the ELAP [extended loss of AC power] analysis of Westinghouse plants is limited to the flow conditions prior to reflux condensation initiation. This includes specifying an acceptable definition for reflux condensation cooling.	Complete. (Described in August-2015 status report.)

ISE Confirmatory Item	Status
3.2.1.1.B Confirm that the application of the WCAP-17601 analysis simulating the ELAP transient is properly established.	Complete. (Described in August-2015 status report.)
3.2.1.2.A Confirm that, if the licensee continues to credit SHIELD shutdown seals, as planned, (e.g., 1 gallon per minute leakage/seal) in the ELAP analyses for the RCS response, then the impacts of the Westinghouse 10 CFR Part 21 report, "Notification of the Potential Existence of Defects Pursuant to 10 CFR Part 21," dated July 26, 2013 (ADAMS Accession No. ML13211A168) on the use of the low seal leakage rate in the ELAP analysis are addressed.	Complete. (Described in August-2015 status report.)
3.2.1.2.B Confirm that if the seals are changed, the acceptability of the seals used is addressed, and the RCP seal leakage rates for use in the ELAP analysis are justified.	Complete. (Described in August-2015 status report.)
3.2.2.A Since the RWSTs are not currently fully protected against tornado missiles, confirm that the licensee has completed their review to determine whether or not the RWST will need to be further protected against missile hazards.	Complete. (Described in February-2014 status report.)
3.2.2.B Confirm that opening doors provides adequate ventilation for SFP [spent fuel pool] area.	Complete. (Described in August-2015 status report.)
3.2.3.A Confirm that containment evaluations for all phases are performed based on the boundary conditions described in Section 2 of NEI 12-06. Based on the results of this evaluation, confirm that required actions to ensure maintenance of containment integrity and required instrument function have been developed.	Complete. (Described in February-2015 status report.)
3.2.4.2.A Confirm that the licensee has clarified why the Integrated Plan stated the maximum temperature of the Unit 1/Unit 2 AFW [auxiliary feedwater] pump rooms would reach 115.9/112.3 degrees Fahrenheit (°F), respectively, while Calculation 8700-DMC-2312, described during the audit process, indicated that the maximum temperature would reach 142.9°F.	Complete. (Described in August-2015 status report.)
3.2.4.2.B Confirm that the licensee has provided an analysis or calculation to demonstrate that the dissipation of heat generated by the batteries via natural circulation will be adequate to maintain the temperatures in the battery rooms within acceptable levels.	Complete. (Described in August-2015 status report.)

ISE Confirmatory Item	Status
3.2.4.2.C Confirm that the licensee has addressed how hydrogen concentration in the battery rooms will be limited to acceptable levels.	Complete. (Described in August-2015 status report.)
3.2.4.6.A Confirm that the licensee has completed a review of Unit 1 AFW room and developed any plans required to maintain a suitable environment.	Complete. (Described in August-2015 status report.)
3.4.A Confirm that the licensee has fully addressed considerations (2) through (10) of NEI 12-06, Section 12.2, Minimum Capability of Off-Site Resources, which requires each site to establish a means to ensure the necessary resources will be available from off-site.	Complete. (Described in August-2015 status report.)

7 Potential Interim Staff Evaluation Impacts

There are no potential impacts to the ISE identified at this time.

8 References

The following references support the updates to the OIP described in this attachment.

1. FirstEnergy Nuclear Operating Company's (FENOC's) Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 27, 2013.
2. NRC Order Number EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, dated March 12, 2012.
3. Beaver Valley Power Station, Units 1 and 2 – Interim Staff Evaluation Related To Overall Integrated Plan In Response To Order EA-12-049 (Mitigation Strategies), dated January 29, 2014.
4. NRC Letter, Beaver Valley Power Station, Unit 1 – Relaxation of the Schedule Requirements for Order EA-12-049 "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design Basis External Events" (TAC No. MF0841), dated May 20, 2014.

1 Introduction

FirstEnergy Nuclear Operating Company (FENOC) developed an Overall Integrated Plan (OIP) for Davis-Besse Nuclear Power Station (Reference 1 in Section 8), documenting the diverse and flexible strategies (FLEX), in response to Reference 2. This attachment provides an update of milestone accomplishments since the last status report, including any changes to the compliance method, schedule, or need for relief/relaxation and the basis, if any.

2 Milestone Accomplishments

The following milestone(s) have been completed since July 31, 2015 and are current as of February 12, 2016.

- Update 5 was submitted
- Submitted Nuclear Energy Institute (NEI) 12-01 Phase 2 Staffing Study
- Complete Building Design-EFWF [Emergency Feedwater Facility]
- Developed strategies with RRC [Regional Response Center (RRC) is now called National SAFER Response Center (NSRC)]
- Phase 3 Site Access Strategies in Place
- Complete Near Site Staging Location (as needed)
- Develop Training Plan

3 Milestone Schedule Status

The following provides an update to Attachment 2 of the OIP. It provides the activity status of each item and whether the expected completion date has changed. The dates are planning dates subject to change as design and implementation details are developed.

The following milestones replaced the previous milestones of *FLEX Storage Complete*:

- FLEX Storage Complete – Emergency Feedwater Facility (EFWF)
- Complete Building Design-EFWF
- Commence Construction-EFWF
- Complete Construction-EFWF

The revised milestone target completion dates do not impact the order implementation date.

Milestone	Target Completion Date	Activity Status (as of 2/12/16)	Revised Target Completion Date
Submit FLEX Integrated Implementation Plan	02/28/13	Complete	
6 Month NRC Status Updates	02/28/16	Started	
Update 1	08/28/13	Complete	
Update 2	02/28/14	Complete	
Update 3	08/28/14	Complete	
Update 4	02/27/15	Complete	
Update 5	08/28/15	Complete	
Update 6	02/28/16	Started	
Validation	May-2016	Started	
Walk-throughs or Demonstrations	May-2016	Started	
Complete Staffing Analysis	October-2015	Complete	
Submit NEI 12-01 Phase 2 Staffing Study	October-2015	Complete	
Complete Plant Modifications	May-2016	Started	
Target plant modifications	May-2013	Complete	
Modifications complete	May-2016	Started	
Complete 1R18 outage modifications	June-2014	Complete*	
Complete on-line modifications	January-2016	Started	March-2016
Complete 1R19 outage modifications	May-2016	Started	
Complete Communications Modifications	May-2016	Started	
Complete SFP Level Indication Modifications	April-2016	Started	
FLEX Storage Complete – Emergency Feedwater Facility (EFWF)	May-2016	Started	
Complete Building Design-EFWF	September-2015	Complete	
Commence Construction-EFWF	June-2015	Complete	
Complete Construction-EFWF	May-2016	Started	
On-site FLEX Equipment	February-2016	Started	April-2016
Confirm FLEX Equipment Requirements	October-2014	Complete	
FLEX Equipment Ordered	February-2016	Started	
FLEX Equipment Delivered	March-2016	Started	April-2016
Off-site FLEX Equipment	February-2016	Complete	
*Develop Strategies with RRC****	October-2015	Complete	
Phase 3 Site Access Strategies in Place	October-2015	Complete	
Complete Near Site Staging Location (as needed)	February-2016	Complete	
Procedures Complete	May-2016	Started	
PWROG issues NSSS-specific guidelines	August-2013	Complete	
Issue Davis-Besse FLEX Strategy Guidelines	May-2016	Started	
Issue Maintenance Procedures	May-2016	Started	
Training Complete	May-2016	Started	
Develop Training Plan	September-2015	Complete	
Implement Training	May-2016	Started	
Submit Completion Report	July-2016**	Not Started	

* Modifications are targeted for 1R19 and on-line; none targeted for 1R18.
** Submittal of completion report occurs after end of refueling outage.
*** Regional Response Center (RRC) is now called National SAFER Response Center (NSRC)

4 Changes to Compliance Method

The following changes to the compliance method as documented in the OIP (Reference 1) are being made. The changes do not impact compliance with Nuclear Energy Institute (NEI) 12-06.

The following discussion details changes to the coping strategies planned for the Davis-Besse Nuclear Power Station (DBNPS) OIP:

- OIP Open Item (OI 1) - Finalize locations for FLEX storage buildings. Deployment routes, distances, and times contained in the submittal are bounded for the currently proposed locations but will be updated as necessary: As previously reported, a separate FLEX storage building has been eliminated from the FLEX mitigation strategies. Construction of a new Emergency Feedwater Facility (EFWF) is in progress. This newly constructed building will be used for FLEX storage, and the milestones in Section 3 have been adjusted to reflect that the construction pertains to the EFWF. This change considered how the diverse locations for the storage buildings are adequately protected. In particular, it addressed whether the chosen locations are either adjacent to existing robust structures or are in lower sections of buildings that minimize the probability that missiles will damage all mitigation equipment and if stored equipment would be tied down. Rather than utilizing a separate, newly constructed FLEX storage building (used solely for FLEX storage), the following primary (N) FLEX equipment with the associated cables, hoses, connections and fittings will be stored in other robust structures (auxiliary building or newly constructed EFWF) constructed to withstand design basis high wind, missile (airborne object), seismic, flooding, and ambient temperature/snow/ice events or stored in diverse locations consistent with the requirements of NEI 12-06. The FLEX N and the N+1 FLEX reactor coolant system (RCS) charging pumps will be stored in the auxiliary building. The Phase 2 FLEX N 480 volt (V) Turbine Marine generator, N alternate low pressure feedwater (Alt LP EFW) pump, N spent fuel pool (SFP) makeup/spray pump, and the N emergency feedwater tank (EFWT) replenishment pump will be stored in the EFWF. The FLEX N debris removal equipment will be stored in a diverse location within the protected area approximately 1,500 feet (ft) from the commercial building (SB-7) that will store the FLEX N+1 debris removal equipment, with the containment and auxiliary buildings located between the two locations acting as a barrier against missiles for at least one of the debris removal trucks. The EFWF and auxiliary building storage locations will have a restraint system to prevent FLEX equipment interactions with installed plant or FLEX components during a safe shutdown earthquake (SSE). No components will be stacked or stored at a raised elevation that could cause interference with the deployment of any FLEX equipment. While deployment time to locations inside the protected area are decreased by a few minutes, deployment times to the areas outside the protected area are increased by a few minutes. Actual deployment times will be confirmed during strategy validation in accordance with industry guidance.

- OIP Open Item (OI 2) - Finalize the strategy for providing a protected source of borated water to support FLEX strategies: FENOC identified two sources of borated water in response to OIP OI 2, the borated water storage tank (BWST) and the clean waste receiver tank (CWRT). At the time, FENOC identified that the BWST inventory could not be credited for mitigation following a high wind or tornado event and the CWRT, the credited borated water source following a high wind event, could not be credited for mitigation following a seismic event.

  FENOC determined through preliminary evaluation that the CWRT in Room 124 provides a protected source of borated water for all external events. The DBNPS FLEX charging strategy will utilize a fully robust tank for the N capability (CWRT), with a fully robust CWRT FLEX booster pump/charging pump combination.

  The charging strategy also employs N+1 capability by utilizing the BWST with a fully robust BWST FLEX booster pump/charging pump combination. The charging strategy includes diversity of suction connections and discharge connections for each charging pump.

  Both the BWST and CWRT can establish suction from either the BWST (via valve DH210 in Room 100) or the CWRT (via valve WC808 in Room 124). The suction hose is 3-inch hose equipped with camlock connectors for ease of installation.

  Both the BWST and CWRT can establish discharge to either high pressure injection (HPI) Train 1 (via valve HP212 in Room 105) or HPI Train 2 (via valve HP214 in Room 115). The discharge hose is 1.5-inch high pressure hose equipped with 1.5-inch hammer union fittings to accommodate the high pressure.

- Interim Staff Evaluation (ISE) Confirmatory Item 3.1.3.1.A – Confirm that the chosen storage locations are sufficiently separated in distance and axially from the typical tornado path as compared to the local tornado data for tornado width: The change discussed in OI 1 above, considered the predominant path of tornados in the geographical location. NEI 12-06 Section 7.3.1 specifies that FLEX equipment may be stored in diverse locations considering high wind hazards to provide reasonable assurance that N sets of FLEX equipment will remain deployable. Based on tornado widths from the National Oceanic and Atmospheric Administration Storm Prediction Center for 1950-2011, 1,200 ft should be considered as the minimum separation distance for which further analysis is not required because DBNPS is located within Region 1 of NEI 12-06 Figure 7-2. The diverse location should also consider the "typical" tornado path for the site. As stated above, the FLEX debris removal equipment will be stored in diverse locations, SB-7 and outside. These locations are approximately 1,500 ft apart, with the containment and auxiliary buildings located between the two locations acting as a barrier against missiles in a north-south arrangement. With the "typical" tornado path being from the west-southwesterly direction for DBNPS, these locations will provide for protection of at least one of the debris removal trucks. Based on NEI 12-06, Revision 0, this is an alternate approach because the N FLEX equipment consists of a combination of both debris removal vehicles in order to be protected from all hazards. Consistent with the alternate approach, the allowed outage time for the equipment will be 45 days, which is consistent with the revision to NEI 12-06 (Revision 2).

- FLEX Equipment Storage - EFWF Functional Description: As described in OI 1 above, construction of a new EFWF is in progress. Engineering Change Package (ECP) 13-0195 installs the new EFWF, which supports the DBNPS FLEX mitigation strategy. The building structure is designed to provide protection from seismic events, flooding, storms with high winds, snow, ice, extreme cold and extreme heat. A missile (airborne object) barrier door protects the 10-ft deployment opening.

  The EFWF includes a 290,000 gallon dedicated water source, a 6,000 gallon diesel fuel oil tank (DFOT), connection points and storage for some N FLEX equipment. A sound powered phone is being included in the facility for operator communications with the control room. Two satellite phone antennas and cable are to be maintained in a storage locker within the EFWF for deployment and connection in the EFWF to support satellite communications from the control room.

  The N Alt LP EFW pump and N 480V Turbine Marine generator are to be staged in the EFWF in their deployment locations. Primary connection points for these components will be within the EFWF. The DFOT will provide fuel to the N 480V Turbine Marine generator and refueling capability to the N Alt LP EFW pump.

  The N EFWT replenishment pump, N SFP makeup/spray pump, and suction/discharge hoses are to be stored in the EFWF for deployment. The earliest deployment is at 16 hours into the event to replenish the 290,000 gallon EFWT. The replenishment connection point is to be located within the EFWF. The SFP makeup/spray pump will be deployed as required.

- Maintain SFP Cooling Phase 2 Strategy - Use and Description of Emergency Feedwater (EFW) System: The OIP described using the BWST, if available, or the intake canal, if the BWST is not available, as a suction source for makeup to the SFP during Phase 2. The EFWT, which is part of the EFW system, will also be used to support this strategy.

  ECP 13-0196 installs the new EFW system and supports the DBNPS FLEX Phase 1 mitigation strategy. The EFW system provides an emergency source of water to the steam generators (SGs) in the event of a loss of normal and auxiliary feedwater flow to provide core cooling for all external hazards.

  The EFW system includes a 290,000 gallon dedicated water source (EFWT), a 6,000 gallon DFOT, and a high-head diesel-driven pump to provide inventory to

SG1 and, with operator action, the ability to cross connect and supply inventory to SG2 for all events.

EFW system piping ties into the existing auxiliary feedwater (AFW) system in the auxiliary building. The system piping includes:

- Primary suction and discharge connection points for the FLEX Alt LP EFW pump inside the EFWF.
- Alternate discharge connection point for the FLEX Alt LP EFW pump inside the auxiliary building.
- A connection point inside the auxiliary building for SFP makeup.
- A connection point inside the auxiliary building for RCS makeup from EFWT in Modes 5 and 6 with SG heat transfer not available.

- Alternate to NEI 12-06 Section 11.2, Equipment Design: RCS charging pumps and booster pumps will be seismically mounted in their deployment location inside the auxiliary building (robust structure). Each pump can draw suction from either the BWST or the CWRT and discharge to HPI Train 1 or HPI Train 2. The CWRT is robust (as described in OI 2 above), and the BWST is protected against all hazards except high wind events. Based on NEI 12-06, Revision 0, this is an alternate approach because the FLEX equipment is not portable; however, it is pre-staged and deployable from that location.

- Alternate to NEI 12-06 Section 11.3, Equipment Storage: The debris removal trucks will be located in diverse locations, but neither is protected from all hazards. In the aggregate, a debris removal truck is available following any one external event. Based on NEI 12-06, Revision 0, this is an alternate approach because the N FLEX equipment in this case consists of a combination of both trucks in order to be protected from all hazards.

- Alternate to NEI 12-06 Section 11.5, Maintenance and Testing: The N+1 Alt LP EFW pump, N+1 EFWT replenishment pump, SFP makeup/spray, and debris removal equipment are not protected against all hazards; therefore, maintenance on N equipment will be completed in 45 days or N+1 equipment will be moved to robust storage. Based on NEI 12-06, Revision 0, this is an alternate approach because the N FLEX equipment is protected from all hazards while the N+1 FLEX equipment is not. Consistent with the alternate approach, the allowed outage time for the equipment will be 45 days, which is consistent with the revision to NEI 12-06 (Revision 2).

- Alternate to NEI 12-06 Section 11.2, Equipment Design: By letter dated May 18, 2015 (ADAMS Accession No. ML15125A442), the Nuclear Regulatory Commission (NRC) endorsed the NEI proposed alternate approach that provides an acceptable alternative for demonstrating compliance with the intent of the N+1 provisions of Section 3 of NEI 12-06, Revision 0, with respect to hoses and cables. NEI 12-06, Revision 0, requires a full extra set. FENOC intends to follow the alternate described in Method 1: Provide additional hose or cable equivalent to 10 percent of the total length of each type/size of hose or cable necessary for the N capability. For each type/size of hose or cable needed for the N capability, at least one spare of the longest single section/length must be provided.

- FLEX Portable Lighting Strategy: The portable lighting requirements for manual valve operation, deployment and connection of FLEX support equipment that must be accessed during ELAP conditions have been reviewed, and a portable lighting strategy has been developed. The strategy for deployment is part of FLEX Support Guideline (FSG) DB-OP-02705, *Initial Assessment and FLEX Equipment Staging*. Attachments 12 and 13 have been created to provide the instructions for portable lighting options and storage locations to be implemented as required based on the initial assessments. Attachment 12 is specific to non-radiologically controlled areas, and Attachment 13 is specific to radiologically controlled areas. Appendix R battery lights are located throughout the plant and have an expected minimum life of 8 hours. Personal lighting, portable battery flood lighting, and generator-powered flood lighting is staged in the auxiliary building and EFWF (both robust structures). The variety of lighting options allows for a graded approach to minimize impacts on the FLEX response timeline initially and to improve on lighting conditions as more resources become available as mitigation of the event continues. The table below illustrates the number, types, and storage locations for the lighting that supports the lighting strategy. The lighting inventory and locations have been reviewed to determine adequacy for manual valve operation, deployment, and connection of FLEX support equipment.

Equipment	Room 100 (BWST Tunnel)	Room 124 (CWRT 1)	Room 303 (Mechanical Penetration Room 3)	Room 512 (Control Room Storage)	Fan Alley	Room 428 (Low Voltage Switchgear Room 2)	EFWF	Room 320
Miners Lights				8				
Miners Lights Batteries				16				
Miners Lights Battery Charger				4				
Portable 6 hour Battery Flood Light	1	1	1	1	1		1	1
Small Flood Lights	1	1	1	1		1		1
Large Flood Lights	1	1	1					1
Flood Light Tripods	2	2	2	1		1		2
Extension Cord – 100 ft	4	4	4	4		4	4	4
Portable Generator			1		1		1	1

5 Need for Relief/Relaxation and Basis for the Relief/Relaxation

As indicated by the revised project milestones, the project has experienced delays with the implementation of on-line modifications and FLEX equipment delivery. Project actions are focused on the completion of the remaining implementation activities to support the order compliance date. However, based on current project status, a request for schedule relief/relaxation is planned.

6 Open Items from Overall Integrated Plan and Interim Staff Evaluation

The following tables provide a summary of the open items documented in the OIP or the Interim Staff Evaluation (ISE) and the status of each item.

Overall Integrated Plan Open Item	Status
OI 1. Finalize locations for FLEX storage buildings. Deployment routes, distances and times contained in the submittal are bounded for the currently proposed locations but will be updated as necessary.	Complete. Described in Section 4 above.
OI 2. Finalize the strategy for providing a protected source of borated water to support FLEX strategies.	Complete. (Described in August-2014 status report and updated in February-2015 status report.) Update: Described in Section 4 above.
OI 3. Determine if a mobile boration unit and/or water purification unit is required to support the FLEX strategies.	Complete. (Described in August-2014 status report.)

Interim Staff Evaluation Open Item	Status
3.2.1.2.A Verify the following with respect to reactor coolant pump (RCP) seals: (1) the DBNPS [Davis-Besse Nuclear Power Station] plant condition during an ELAP [extended loss of all alternating current power] is bounded by the seal leakage test conditions with respect to relevant parameters. (2) the pop-open failure mechanism resulting from hydraulic instability that is discussed in WCAP-16175-P and WCAP-17601-P would not occur or would be bounded by the assumed leakage rate. (3) a basis for the assumed leakage rate of 2 gpm [gallons per minute] is justified in light of	Complete. Described in Section 6a below.

Interim Staff Evaluation Open Item	Status
recommendations for a larger value of leakage for similarly designed RCPs and seals discussed in WCAP-16175-P and WCAP-17601-P. (4) the modeling of the pressure-dependence of the seal leakage rate is justified. (5) the seal design performance under stresses induced by the cooldown of the RCS [reactor coolant system] is justified.	
3.2.1.4.A Verify that any industry-identified gaps and recommendations applicable to the generically developed mitigating strategies proposed for DBNPS are addressed (e.g., those documented in WCAP-17792-P (transmittal letter located at ADAMS Accession No. ML14037A237) and the appropriate revision of the PWROG's [Pressurized Water Reactors Owners Group] Core Cooling Management Interim Position Paper).	Complete. Described in Section 6a below.
3.2.1.6.B Verify that a revised sequence of events that is consistent with the final ELAP analyses is developed.	Complete. Described in Section 6a below.
3.2.1.8.A Verify resolution of the generic concern associated with the modeling of the timing and uniformity of the mixing of a liquid boric acid solution injected into the RCS under natural circulation conditions potentially involving two-phase flow.	Complete. Described in Section 6a below.

ISE Confirmatory Item	Status
3.1.1.1.A Confirm that the diesel-driven service water pumps have deployment and storage plans developed in accordance with the provisions of NEI [Nuclear Energy Institute] 12-06.	Complete. Described in Section 6a below.
3.1.1.2.A Confirm that the routes that plant operators will have to access to deploy and control the strategy will only require access through seismically robust structures.	Complete. Described in Section 6a below.
3.1.1.2.B Confirm that, if power is required to operate the storage building doors, either power supplies will be available to operate the doors or the doors will be equipped with manual overrides to permit manual door opening.	Complete. Described in Section 6a below.
3.1.1.3.A Confirm that guidance is provided for critical actions to perform until alternate indications can be connected and on how to control critical	Complete. Described in Section 6a below.

ISE Confirmatory Item	Status
equipment without associated control power.	
3.1.1.4.A Confirm the RRC [regional response center*] local staging area, evaluation of access routes, and method of transportation to the site.	Complete. Described in Section 6a below.
3.1.2.A Confirm that the licensee has identified the warning time and persistence of the external flooding hazard.	Complete. Described in Section 6a below.
3.1.2.2.A Confirm that the licensee plans to conform to deployment consideration 1 and 2 of NEI 12-06, Section 6.2.3.2.	Complete. Described in Section 6a below.
3.1.3.1.A Confirm that the chosen storage locations are sufficiently separated in distance and axially from the typical tornado path as compared to the local tornado data for tornado width.	Complete. (Described in August-2014 status report.) Update: Described in Section 4 above.
3.2.1.1.A Confirm that reliance on the RELAP5/MOD2-B&W code in the ELAP analysis for Babcock and Wilcox [B&W] plants is limited to the flow conditions prior to boiler-condenser cooling initiation.	Complete. Described in Section 6a below.
3.2.1.1.B Confirm that the licensee has: (1) Identified the specific analysis case(s) from WCAP-17792-P that are being referenced as the basis for demonstrating the acceptability of the mitigating strategies for DBNPS, and (2) Provided justification that the analyses from WCAP-17792-P that are being credited for DBNPS are adequately representative of the actual plant design, FLEX equipment, and planned mitigating strategies.	Complete. Described in Section 6a below.
3.2.1.1.C Confirm the continuity of natural circulation by demonstrating the adequacy of the modeling of operator actions associated with primary-to-secondary heat transfer.	Complete. Described in Section 6a below.
3.2.1.2.B Confirm that either: (1) closure of valve MU38 will not be credited in the ELAP analysis for DBNPS, or (2) procedures to close valve MU38 prior will be implemented to provide assurance that its closure can be credited in the ELAP analysis.	Complete. (Described in August-2015 status report.)
3.2.1.3.A Confirm the basis for the decay heat modeling assumptions present in the analysis credited for DBNPS in WCAP-17792-P, which was not available to the staff during the audit.	Complete. Described in Section 6a below.
3.2.1.3.B Confirm that the cooldown directed by the DBNPS mitigating strategy is consistent with the	Complete. Described in Section 6a below.

ISE Confirmatory Item	Status
capability of the atmospheric vent valves.	
3.2.1.6.A Confirm licensee's hydraulic analysis supports that injecting borated water into the RCS within 6 hours after the event is initiated will maintain subcriticality.	Complete. Described in Section 6a below.
3.2.1.8.B Confirm adequate shutdown margin for ELAP scenarios: (1) with the highest applicable reactor coolant system leakage, and (2) with no reactor coolant system leakage. In addition, confirm that core reload calculation procedures would ensure that these shutdown margin calculations remain bounding for future fuel cycles.	Complete. Described in Section 6a below.
3.2.1.8.C Confirm that adequate RCS venting capability exists to support the ELAP mitigating strategy for DBNPS.	Complete. Described in Section 6a below.
3.2.3.A Confirm that the containment pressure and temperature after an event initiated in Modes 1 through 4 will stay at acceptable levels during Phases 1, 2, and 3 and that no additional installed equipment or operator actions are required to maintain containment integrity.	Complete. Described in Section 6a below.
3.2.4.4.A Confirm that upgrades to the site's communications systems have been completed.	Complete. Described in Section 6a below.
3.2.4.8.A Clarify the discrepancy between the Integrated Plan stated size of the Phase 2 FLEX 480v [volt] portable DGs [diesel generators] (500kW [kilowatt]) and the stated size of the Phase 2 FLEX 480v portable DGs in response to the sizing audit question (600kW).	Started.
3.4.A Confirm that the licensee has fully addressed considerations (2) through (10) of NEI 12-06, Section 12.2, Minimum Capability of Off-Site Resources, which requires each site to establish a means to ensure the necessary resources will be available from off-site.	Complete. Described in Section 6a below.

* Regional Response Center (RRC) is now called National SAFER Response Center (NSRC)

6a Responses

ISE OI 3.2.1.2.A

1. DBNPS has Flowserve N-9000 three-stage RCP mechanical seals. Following an ELAP, the RCPs will lose seal injection and component cooling flow. Since the

RCP seals limit the leakage of reactor coolant along the pump shaft, RCS at cold leg temperature will begin to enter the seals. Seal failures can occur as a result of the overheating of the seals elastomer components and a high rate of two-phase flow across the seal faces.

Station blackout testing was performed by Flowserve. The seal leakage for DBNPS is assumed to be 2 gpm and is bounded by Flowserve testing results.

The following is the expected timeline and cold leg temperatures for both SG loops:

Loop 1: Feedwater will be provided to SG1 within 10 minutes. Analysis shows that this will result in Loop 1 T_{cold} reaching 570°F at approximately 500 seconds after the event begins, and it will increase to a maximum of 580°F at approximately 620 seconds. T_{cold} will decrease when feed begins and will drop below 570°F at approximately 660 seconds. It will continue to decrease and will stabilize at <560°F by approximately 870 seconds. Based on this, Loop 1 T_{cold} will exceed 570°F for approximately 160 seconds and will decrease from 570°F to 560°F in approximately 210 seconds.

Loop 2: For seal performance evaluation, it will be assumed that feedwater will be restored to SG2 at 90 minutes after the event begins. Analysis shows that Loop 2 T_{cold} will increase and reach 570°F at approximately 500 seconds after the event begins. T_{cold} will continue to increase and will stabilize at approximately 600°F at approximately 1,000 seconds. Assuming feedwater is supplied to SG2 in 90 minutes, T_{cold} will immediately begin to decrease and will fall below 570°F within a few minutes after feedwater begins. Loop 2 T_{cold} will stabilize at <560°F approximately 10 minutes after feedwater is restored. Based on this, Loop 2 T_{cold} will exceed 570°F for approximately 1 hour. The cooldown rate from 600°F to 560°F will be rapid; at approximately 4°F per minute.

Based on analysis performed by Flowserve, assuming controlled bleed off is isolated within 10 minutes and feedwater flow is supplied to SG2 within 90 minutes after the ELAP, DBNPS is bounded by Flowserve's seal leakage conditions. (Refer to the DBNPS FLEX timeline provided at the end of this report.)

2. "Popping-open" of seals can be caused by unstable phase changes and increased axial seal friction during shaft movement when seal injection and component cooling water flow are lost. Station blackout testing performed by Flowserve shows the leakage rate to be bounded by the DBNPS assumed leakage rate of 2 gpm.

3. The assumed leakage rate of 2 gpm is justified based on testing and analysis performed by Flowserve, assuming controlled bleed off is isolated within 10 minutes and feedwater flow is supplied to SG2 within 90 minutes after the ELAP.

4. Since the test pressure was maintained in excess of 2,400 psi during Flowserve's testing, the pressure is indicative of plant conditions; therefore, the seal leakage rate is justified.

5. Flowserve has done testing on the N-9000 seals at cooldown rates up to 130°F/hr with no signs of distress or increased leakage from the seals.

   Flowserve completed a review of the DBNPS ELAP scenario and concluded that the DBNPS strategy is bounded by the Flowserve testing. The review results were made available to the NRC for review.

<u>ISE OI 3.2.1.4.A</u>

The analyses presented in WCAP-17792, *Emergency Procedure Development Strategies for the Extended Loss of AC Power Event for All Domestic Pressurized Water Reactor Designs*, for the B&W-designed plants focused on evaluation of the plant response in an ELAP event if no reactor coolant system (RCS) makeup is available. Based on the results of those analyses, a strategy (that is, asymmetric cooldown) was developed to extend the time available until loss of single-phase natural circulation occurs. That strategy is intended to delay the onset of the boiler-condenser cooling (BCC) mode for as long as possible, until a makeup source becomes available.

The recommendations that are presented in WCAP-17792 for the B&W plants are associated with the need to restore an RCS makeup capability and the performance of an asymmetric cooldown to extend the time available to do so. The DBNPS ELAP mitigation strategies are based on recovering an RCS makeup capability as early as possible after initiation of an ELAP event. The timelines for operator actions show that recovering makeup can be accomplished before it becomes necessary to initiate an asymmetric cooldown. However, as a contingency, FENOC plans to implement a new Emergency Operating Procedure (EOP) DB-OP-02700, *Station Blackout*, which provides guidance for performing an asymmetric cooldown, if necessary, based on the results and timing presented in WCAP-17792. The WCAP-17792 recommendations associated with recovering makeup and performance of an asymmetric cooldown are to be implemented.

The PWROG Core Cooling Position Paper, Revision 0, provided as Appendix D of WCAP-17792, identifies several gaps and recommendations. They are presented in bold font below, with the DBNPS response to each.

Section IV, Secondary Cooling, Part A, Initial SG Feed Capability, Page 13, Gaps for all plants:

- **If a utility intends to credit use of the Alternate Low Pressure Feedwater [or Alt LP EFW] pump to maintain SG inventory without crediting the steam (diesel) driven AFW/EFW pump running at the start of the event...the utility must demonstrate capability to establish flow from the Alternate Low**

Pressure Feedwater [or Alt LP EFW] pump prior to the plant specific time to SG dryout.

- **If a portion of the installed AFW/EFW system cannot be credited at the beginning of the event...the utility must demonstrate capability to restore AFW/EFW flow prior to the plant specific time to SG dryout.**

DBNPS credits the diesel-driven EFW pump at the start of the event, and there is no portion of the EFW system that cannot be credited at the beginning of the event. Neither of these gaps apply to DBNPS.

Section IV, Secondary Cooling, Part B, Alternate Low Pressure Feedwater [or Alt LP EFW] Pump Requirements, Page 14, PWROG Recommendations:

- **The Alternate Low Pressure Feedwater [or Alt LP EFW] pump meets or exceeds the following:**
  - **Flow – matches decay heat 1 hour after a reactor trip, and <u>most limiting of the following</u>, [Note: 1 hour is a conservative <u>sizing</u> requirement, not an action-time requirement]**
  - **Pressure – sufficient to restore normal SG level at an elevated RCS temperature required to maintain the reactor subcritical prior to RCS boration or significant xenon build-in assuming RCS cooldown is initiated 1 hour after the reactor trip (using assumptions from Section V.B of this document), [Note: the reference to "assumptions in Section V.B" is misleading. There are no "assumptions" stated in that section. It presents a discussion related to boration requirements, including the allowance to credit xenon in order to support an earlier initiation of RCS cooldown than might be allowed if no credit for xenon were taken.]**
  - **Pressure – sufficient to restore normal SG level at the target SG pressure to prevent CLA/SIT/CFT [Cold Leg Accumulator/Safety Injection Tank/Core Flood Tank] nitrogen injection into the RCS.**

DBNPS calculation C-ME-050.05-001, *Emergency Feedwater Storage Tank Capacity for Decay Heat and Sensible Heat Removal*, shows that approximately 280 gpm of EFW flow is required to remove decay heat at 1 hour after a reactor trip. Preliminary analysis of the DBNPS Alt LP EFW pump performance indicates that it can provide this flow to the SGs with the SGs at a pressure of approximately 250 pounds per square inch gauge (psig), which corresponds to a SG saturation temperature of approximately 400°F. This is the target SG pressure/temperature for use of the Alt LP EFW pump. This SG temperature would correspond to an RCS temperature, under natural circulation conditions, of approximately 400-420°F. Calculation C-NF-062.02-048, *Davis-Besse Cycle 20 ELAP Shutdown Margin Analysis*, shows that the combination of 100 percent full power boron (that is, the existing boron concentration at the time of the trip), and conservative credit for 200 parts per million boron (ppmB) equivalent xenon worth, (that is, a conservative value for the xenon that would exist at all times up to 25 hours after the trip, without crediting any "build-in" of xenon), will ensure the reactor remains subcritical down to an RCS temperature below 400°F. This demonstrates that the Alt LP EFW pump will be able to provide sufficient flow to the SGs to remove the decay heat load that will exist at 1 hour after the reactor trip, and at an RCS temperature that will maintain the reactor subcritical for at least 25 hours after the reactor trip without boration. As noted above, this is not a commitment to be able to cool the RCS and establish feed using the Alt LP EFW pump within 1 hour after the reactor trip. In addition, for prudent reactivity control, the plant will not be cooled down to allow feeding with the Alt LP EFW pump until makeup has been restored and a more conservative boron concentration has been established. The conditions discussed above are simply the bases for establishing the capability of the Alt LP EFW pump. The actual performance of the Alt LP EFW pump has been confirmed using Protoflow modeling of the pump and the flow path to the SGs.

To address the third bullet related to the SG pressure required to prevent CFT nitrogen injection, the guidance in WCAP-17792, Appendix D, was used to determine the RCS pressure that would allow nitrogen injection. That guidance uses the ideal gas law to determine the CFT nitrogen pressure when all of the liquid inventory has been injected. Using that approach, the RCS pressure would have to be reduced below 200 psig to allow CFT nitrogen to inject into the RCS. To cool the RCS low enough to allow its pressure to be reduced to less than 200 psig (that is, an RCS temperature of approximately 380°F), the SG pressure would have to be reduced to below 200 psig. This pressure is lower than the target SG pressure discussed above (approximately 250 psig). Therefore, the criterion identified in the third bullet above is not limiting in establishing the Alt LP EFW pump's capability.

Section IV, Secondary Cooling, Part C, Determine Target Steam Generator Pressure for Plant Cool Down, 1) Nitrogen Injection from the CLAs/SITs/CFTs, Page 15, Gap for CE and B&W NSSS [nuclear steam supply system] design plants:

- **CE and B&W plants should determine the target SG pressure setpoint to prevent [nitrogen] injection from SITs/CFTs. . . . For the B&W plants, a target SG pressure was set that implicitly precludes nitrogen intrusion, but this value could further be optimized to maximize CFT inventory use.**

As presented above, the target SG pressure to prevent CFT nitrogen injection would be approximately 200 psig. This would maximize the CFT inventory injected into the RCS. However, subsequent to the preparation of this Position Paper in November of 2012, the PWROG developed document WCAP-17792. WCAP-17792, Appendix C, Design Specific Analyses for B&W Design Plants, presents the results of various analyses that were prepared to address issues such as this gap. Specifically, Section C.2, Low Pressure ELAP Boration/Depressurization Strategies for B&W Design Plants, evaluated RCS venting strategies to determine how to maximize CFT inventory use. Those analyses showed that the available vent paths are inadequate to reduce RCS pressure low enough to achieve a meaningful injection from the CFTs. Specifically, the analyses showed that the maximum CFT injection was achieved by using the power-operated relief valve (PORV) to vent the RCS. However the total primary inventory discharged through the PORV exceeded the inventory subsequently injected by the CFTs. This represents a net loss of RCS inventory, further challenging the ability to maintain adequate core cooling. The conclusion of these analyses is that CFTs cannot provide effective RCS inventory makeup or boration in B&W-designed plants. Since achieving a meaningful CFT injection is not feasible, the use of its inventory cannot be maximized. Therefore, CFT injection is not part of the DBNPS FLEX strategy, and there is no value in having determined the optimized target SG pressure value to maximize the CFT inventory use.

Section IV, Secondary Cooling, Part C, Determine Target Steam Generator Pressure for Plant Cool Down, 2) Steam Generator PORV (ADV) Size, Page 16, Gaps for all plants:

- **Plants must verify the ability to perform their proposed ELAP core cooling strategy to include review of adequate steam relief capability at all phases of the approach, and adequate control of plant parameters during all phases of the approach which will be labor and communication intensive if utilizing local control for multiple SGs. The multiple SG approach may require additional FLEX equipment and/or plant modifications to assist with plant control (such as portable or installed air supplies for steam release capability). If local control of SG feed and/or steam relief is required, this approach should demonstrate adequate manpower and communications. Otherwise, capability to maintain control of SG feed and steam relief from the control room will be required.**

Steam relief capability: Updated Final Safety Analysis Report (UFSAR) Section 10.4.4, Turbine Bypass System, documents that each SG atmospheric vent valve (AVV) has a capacity of 5 percent of total steam flow at rated NSSS output. This translates to:

0.05 X 2772 MWt = 138.6 MWt X 3,412,141 Btu/Hr / MWt = 4.73E8 Btu/Hr at approximately 980 psig
(MWt = megawatt thermal; Btu/Hr = British thermal unit per hour)

DBNPS calculation C-ME-050.05-001 shows that the decay heat generation rate at 1.7 minutes after the reactor trip is approximately 4.14E8 Btu/Hr. This means that within 1.7 minutes after the reactor trips, one AVV has an energy removal capacity in excess of the decay heat load that will exist. Additionally, calculation C-NSA-083.01-006, *Atmospheric Vent Valve Steam Flow Capacity*, calculated the energy removal rate of one AVV at reduced steam pressures. That calculation determined that one AVV will pass enough steam to remove 1.1E8 Btu/Hr at 200 psig SG pressure. That energy removal rate corresponds to the decay heat generation rate at approximately 2.8 hours after a reactor trip (as shown in calculation C-ME-050.05-001). The plant cooldown will not even have begun by 2.8 hours, and the RCS temperature corresponding to a 200 psig SG pressure (that is, approximately 380°F) could not be achieved earlier than approximately 10 hours after the reactor trip, by which time the decay heat generation rate will be less than 8.0E7 (that is, the decay heat generation rate will decrease more rapidly than the SG pressure can be reduced by plant cooldown). This decay heat generation rate is less than the energy removal capacity of one AVV. This supports the conclusion that even at reduced SG pressures, one AVV can pass more steam flow than required to remove the decay heat load that will exist. In addition, DBNPS FLEX strategies use both SGs and both AVVs for plant cooldown, which provides an energy removal capability of more than twice the decay heat generation rate.

The DBNPS FLEX strategy is to use both SGs and both AVVs to cool down. The AVVs are in close proximity in the same plant area. Because of the easy access to both AVVs, and because of the relatively slow cooldown rate that will be used, one operator will be capable of controlling both AVVs locally. Manning and communications, including the use of sound-powered phones at the AVV location, are adequate to support this strategy.

- **To support use of the Alternate Low Pressure Feedwater [or Alt LP EFW] strategy, plants must determine if the steam release capability for one SG via PORV(s)/ADV(s) is adequate to release the flow to match decay heat one hour after reactor trip, at the target SG pressure. If flow is not adequate, the plant will need to raise the SG target pressure or ensure the strategy and plant configuration allow feeding and steaming additional SGs. If local control is required to implement the strategy, it may be desired to utilize one SG as the secondary heat sink to simplify operator actions and communications.**

The target SG pressure for use of the Alt LP EFW pump will be approximately 250 psig. Calculation C-ME-050.05-001 shows that the decay heat generation rate at one hour after reactor trip will be approximately 1.47E8 Btu/Hr. As stated above, both SGs and both AVVs will be used for plant cooldown. The combined energy removal capability of both AVVs, at 200 psig SG pressure, is >2E8 Btu/Hr, which significantly exceeds the decay heat generation rate at one hour after the reactor trip.

Local control will be used to implement the strategy. However, due to DBNPS plant configuration, this does not unduly challenge operator actions or communications. The suggestion to use one SG to simplify operator actions and communications would not be an enhancement to plant control. Analyses performed after this recommendation was made, and documented in WCAP-17792, show that the use of one SG for cooldown is not desirable. The use of one SG would result in an asymmetric plant cooldown, which has the potential to cause voiding in the idle loop hot leg, high temperatures at the RCP seals in the idle loop, lower RCS cooldown rates, or some combination of these conditions. Any of these conditions individually, and to a greater extent if combined, will complicate and potentially delay the plant cooldown and depressurization, and will not "simplify operator actions and communications," as was intended by this recommendation.

Section V, Subcriticality and Primary System Inventory, Part H, Further Considerations, Page 23, Gaps for all plants:

- **RCS vent capability is required unless either of the following is conducted:**
    - **A plant specific analysis demonstrates the Alternate Primary Makeup/Boration Source boron concentration is sufficiently high such that the required RCS boration volume can be injected into the**

RCS available volume without crediting an RCS vent path (e.g., high or low pressure pump with a very high boron concentration source).
- **A thermal-hydraulic code/model analysis demonstrates the required amount of CLAs/SITs/CFTs borated water volume will be injected to maintain the reactor subcritical without crediting an RCS vent path.**

... Even if a high pressure pump boration strategy is selected that may not need venting, the capability to vent provides a backup boration strategy with low pressure options.

FENOC performed a plant specific analysis, documented in calculation C-NF-062.02-048, that shows the RCS cooldown contraction volume alone, with no credit for venting or RCS leakage, provides the volume necessary to borate the RCS to maintain a 1 percent shutdown value with the boron concentration of the available water sources. The DBNPS strategy includes the use of positive-displacement FLEX charging pumps that can discharge into the RCS at pressures that will exist in an ELAP event. This information shows that DBNPS does not need to vent in order to ensure that the required RCS boron concentration can be maintained during plant cooldown. As suggested by the last bullet, although not required for any FLEX strategy, DBNPS will have some limited ability to vent the RCS. However, the statement that this may provide "a backup boration strategy with low pressure options" is not valid for DBNPS. No low pressure pumped boration options exist, and, as discussed previously, analyses have shown that the CFTs do not provide such an option.

- **More analysis work is needed to prove the Reactor Vessel Head vent path is effective. ...It is anticipated that the analysis results will in most, if not all cases, show that the CLAs/SITs/CFTs volume is sufficient when an RCS vent is available and further cooldown is performed to inject the remaining borated water volume. It may be simpler to credit the high pressure pump for boration requirements to avoid the uncertainties in using the lower pressure options.**

FENOC does not intend to credit the head vent path. The design of the DBNPS head-to-hot leg vent line differs from others in the industry, and it does not provide the direct vent path to containment that the head vent path provides in other plants. Additionally, the statements related to the anticipated analysis results for injection of the CFT volume were shown to be incorrect for B&W-designed plants. Subsequent analyses, documented in WCAP-17792, show that the amount of venting that would be required in order to cause a significant CFT injection would result in excessive and undesirable RCS inventory loss. As a result, the use of venting and CFT injection was eliminated as a viable strategy for B&W plants. As suggested above, it is simpler for the DBNPS strategy to credit a high pressure pump for boration requirements to avoid the uncertainties in using the lower pressure options.

- **Vent mass and energy release impacts on containment response will need to be considered on a plant specific basis. Preliminary analysis indicates the significance is low.**

FENOC does not plan to vent containment to enhance boration in a Mode 1 ELAP event. Due to the large volume of the DBNPS containment, even moderate levels of venting through the available vent paths would not result in containment pressures that could challenge containment integrity.

ISE OI 3.2.1.6.B

A sequence of events has been prepared and may need to be revised based on the results of the outstanding calculations, verification and validation processes and any changes that may be required for the existing ECPs to accommodate installation. A copy of the current DBNPS FLEX timeline is provided at the end of this report.

ISE OI 3.2.1.8.A

Based on AREVA ANP-3288, *Response to Boron Mixing Issues for B&W-Designed Plants*, at no time during the transient analyzed did the loop flow rate decrease below the single phase natural circulation flow rate. Based on the results of the analysis, it was concluded that the B&W-plant responses meet the boron mixing requirements to delay credit for increases in boron concentration by one hour.

ISE CI 3.1.1.1.A

This confirmatory item was based on original strategy that portable service water pumps would be used in Phase 2. This has changed, and portable service water pumps will be part of Phase 3 and will be provided by NSRC.

ISE CI 3.1.1.2.A

The EFWF is being constructed to be seismically robust and is designed with storage for the Phase 2 N 480V Turbine Marine generator, the N Alt LP EFW pump, the N SFP makeup/spray pump, and the N EFWT replenishment pump. RCS charging pumps are staged in the existing auxiliary building (seismically robust). Connections to systems are in close proximity to staged locations and inside seismically robust structures. Portable FLEX equipment in these structures will be appropriately tied down. Routes that plant operators will have to access to deploy and control the strategy will include going outside to access the EFWF. The EFWF is located in close proximity to the auxiliary building and will have a protected access door on the north end of the building and the south end of the building. Additionally, a missile (airborne object) barrier door will be located on the north end of the building.

ISE CI 3.1.1.2.B

It has been confirmed that no power will be required to operate doors in the storage buildings.

ISE CI 3.1.1.3.A

FENOC has identified the list of required instruments. Based on this list, the location and terminal points needed for the local instrument readings have been identified and documented.

Operations has been provided with the instructions for acquiring local instrument readings as well as identifying and documenting equipment necessary for providing power and acquiring measurements from these instruments. It also provides guidance for converting local readings to process parameters (for example, conversion from milliamp output to system pressure).

Draft FSG DB-OP-02704, *Extended Loss of AC Power DC Load Management*, provides the direction that if at any time all DC power is lost (electrical distribution panels D1P, D1N, D2P and D2N), then initiate DB-OP-02707, *Loss of DC Power*. FSG DB-OP-02707 will then provide guidance via individual attachments for the local instrument readings by parameter. DB-OP-02707 is still being drafted, and the attachments will be developed based on the instructions mentioned above.

ISE CI 3.1.1.4.A

Per Revision 1 of the SAFER Response Plan for DBNPS, Appendix 5E, DBNPS Staging Area (SA) Information, SA C (Fremont Airport) and SA D (Wood County Regional Airport) have been identified along with primary and alternate travel routes. In addition, the SAFER Response Plan includes provisions for using helicopters for delivering equipment/material. Steps are in the SAFER procedure to ensure that the helicopter landing zone is set up, lighted and a debris walk down has been performed prior to putting aircraft in the area.

ISE CI 3.1.2.A

Procedure RA-EP-02870, *Station Isolation*, provides the measures to be taken if the DBNPS is likely to, or has, become isolated, typically caused by adverse weather conditions such as snow storms, ice storms and flooding.

Additionally, the external flooding hazard evaluation is supported by the following calculations, which have been made available for NRC review. FLEX N equipment will be staged in locations protected from design basis flood levels.

- C-CSS-020.13-009, *All-Season Probable Maximum Precipitation Analysis for Davis-Besse Nuclear Power Station*
- C-CSS-020.13-010, *Cool-Season Precipitation and Snowmelt Analysis for Davis-Besse Nuclear Power Station*
- C-CSS-020.13-011, *Probable Maximum Flood Analysis for Davis-Besse Nuclear Power Station*

- C-CSS-020.13-012, *Dam Assessment, Ice Jam, and Channel Migration for Davis-Besse Nuclear Power Station*
- C-CSS-020.13-013, *Local Intense Probable Maximum Precipitation Analysis for Davis-Besse Nuclear Power Station*
- C-CSS-020.13-014, *Effects of Local Intense Probable Maximum Precipitation Analysis for Davis-Besse Nuclear Power Station*
- C-CSS-020.13-015, *Site-specific Wind and Pressure Field Analysis for Davis-Besse Nuclear Power Station*
- C-CSS-020.13-016, *Surge and Seiche Screening for Davis-Besse Nuclear Power Station*
- C-CSS-020.13-017, *Surge and Seiche Analysis for Davis-Besse Nuclear Power Station*
- C-CSS-020.13-018, *Tsunami Screening/Analysis for Davis-Besse Nuclear Power Station*
- C-CSS-020.13-019, *Probable Maximum Floor GIS Analysis for Davis-Besse Nuclear Power Station*
- C-CSS-020.13-020, *Local Intense Precipitation GIS Analysis for Davis-Besse Nuclear Power Station*
- C-CSS-020.13-021, *Surge and Seiche Calibration for Davis-Besse Nuclear Power Station*
- C-CSS-020.13-022, *Combined Events Including Wind Wave Analysis for Davis-Besse Nuclear Power Station*
- C-CSS-020.13-023, *Surge and Seiche GIS Analysis for Davis-Besse Nuclear Power Station*

<u>ISE CI 3.1.2.2.A</u>

By letter dated February 25, 2015, FENOC submitted to the NRC a revision to the *DBNPS Flood Hazard Reevaluation Report* (ADAMS Accession No. ML15057A023). The flood hazard reevaluation report evaluated applicable flooding hazards for DBNPS. Two of the postulated reevaluated flood hazard events, the probable maximum storm surge (PMSS) and the local intense precipitation (LIP) events, resulted in maximum flood water elevations higher than the previously calculated for DBNPS. These postulated flooding events are considered beyond-design-basis events. The reevaluated flood levels are small increases with short durations. These low probability events would likely be identified in advance by meteorological forecasting. Current plant procedures addressing flooding at the site provide actions to be taken in the event flooding is imminent or has occurred at or near the DBNPS site.

The procedures define lake water levels for procedure entry. The on-call duty team and Emergency Response Organization (ERO) are mobilized, and the shift manager ensures flood barriers are in place. Procedure RA-EP-02880, *Internal Flooding*, addresses flooding to the service water pump room, component cooling water pump room and emergency core cooling system rooms (safe shutdown equipment).

Review of the applicable flooding procedures determined that there is procedural guidance that can be implemented in advance of a flood emergency; station personnel and ERO are properly notified and mobilized by appropriate flooding trigger points; and that plant shutdown is included in procedurally specified decisions.

The travel routes for getting equipment from the NSRC were walked down by personnel from the NSRC. The staging areas have been identified for delivery of equipment, and the location for deployment of the portable equipment has been determined.

ISE CI 3.2.1.1.A

Initially, there were plans to analyze the BCC mode of operation for potential credit in FLEX core cooling strategies. However, the direction changed, as reflected in the following statement made in WCAP-17792, Appendix C, Section C.4.2.1: "Later, as agreed upon by the PWROG, the direction for addressing this [issue] was altered to more directly avoid entering BCC."

As a result of this decision, analyses documented in WCAP-17792 focused on determining when BCC would begin and identifying the actions necessary to prevent it. That work led to DBNPS strategies and supporting technical analyses that do not involve the use of any code to analyze performance in the BCC mode of operation. DBNPS strategies do not rely upon operation in, or recovery from, the BCC mode.

ISE CI 3.2.1.1.B

1. WCAP-17792, Appendix C, Design Specific Analyses for B&W Design Plants, presents the analyses that were performed to develop a basis for some of the ELAP mitigation strategies for B&W plants.

   The DBNPS FLEX strategy will restore an RCS makeup capability, using a FLEX charging pump with a capacity of approximately 60 gpm, within 2.5 hours after event initiation. WCAP-17792, Appendix C, Section C.6, Alternate Make-up Restoration, determined that, for DBNPS [that is, "Raised Loop" (RL) plant], assuming 9 gpm of total leakage from the RCS, restoration of makeup at a rate of 50 gpm, by 6 hours after event initiation, was sufficient to keep the RCS loops filled with water and to maintain natural circulation for the duration of the event. In addition, Section C.5, Calculation for Time to Loss of Heat Transfer, produced a set of curves showing "Time to Loss of Heat Transfer" versus "Pressurizer Level Rate of Change." These curves adjust the time available for restoration of makeup to account for both higher and lower RCS leak rates. Information from these curves is also incorporated into the DBNPS strategy to trigger the initiation of an asymmetric cooldown to prolong natural circulation in one RCS loop if the alternate makeup capability is delayed or insufficient.

   The results from Section C.4, Development of Operator Guidance Regarding Preventing or Recovering From RCS Reflux Cooling Behavior for B&W Design Plants, are used as the basis for directing an asymmetric cooldown. Performing an asymmetric cooldown is not the DBNPS strategy for this event, but it can be used as a contingency, for added flexibility, if the planned mitigation strategy (that is, restoration of RCS makeup) cannot be performed.

2. The analyses discussed above, which are the bases for some of the DBNPS FLEX strategies, have been reviewed to verify that they are adequately representative of DBNPS and its FLEX equipment and strategies. The information presented in Part 1, above, shows that the actual strategy timelines and equipment capabilities provide margin relative to the values used in or produced by the analyses. In addition to the conservatisms clearly shown in the response to Part 1, the set of "Time to Loss of Heat Transfer" curves that are provided in WCAP-17792, Section C.5, were developed using a very conservative assumption that the pressurizer is empty when level indication goes off-scale low. In fact, the lower level-sensing tap is more than 46 inches above the bottom of the pressurizer. That additional volume provides significant conservatism in the times derived from the curves. The review of the credited analyses concluded that the inputs and assumptions used in those analyses are either representative, conservative, or had no impact on results and conclusions.

<u>ISE CI 3.2.1.1.C</u>

Natural circulation is an empirically proven capability of B&W-designed plants. UFSAR Section 15.2.8.2.3 presents the evaluation of a main feedwater line break, which includes: a loss of all main feedwater, plant trip, loss of off-site AC power, and initiation of AFW flow to the SGs. In that scenario, the RCS cooldown to the point of placing the decay heat removal system into operation is accomplished by manually operating the AVVs and with feedwater being supplied by the AFW system at the capacity of a single AFW pump. With no off-site AC power available, the RCPs cannot be operated, and the cooldown would use natural circulation in the RCS. This is essentially the same scenario as an ELAP event. The EFW pump has essentially the same capacity as an AFW pump, and the preliminary results of analyses (that are still in progress) show that the EFW pump has higher capacity than required to establish and maintain a SG level for decay heat removal. A FLEX RCS makeup capability will be established prior to the development of voiding or two-phase conditions in the RCS, which could impact natural circulation. Based on this information, the existing UFSAR analysis demonstrates the ability to maintain natural circulation in the RCS, and primary-to-secondary heat transfer, under conditions essentially the same as will exist for an ELAP event.

In addition, UFSAR Section 15.2.5 presents the results of a loss of all four RCPs at power. That section evaluated the natural circulation capability of the RCS, and it concluded that the natural circulation capability exceeds the flowrate required for decay heat removal. Furthermore, a test was run in 1978 (that is, TP800.04, *Natural Circulation Test*) as part of original plant start-up testing to determine the natural circulation capability of the plant. That test showed that, with SG levels lower than will be used in an ELAP event, a natural flowrate of greater than 4.5 percent of full flow could be achieved. This flow is adequate to remove significantly more decay heat than will exist in an ELAP event.

Based on the above information, with the availability of FLEX RCS makeup, EFW and the AVVs, operator actions to control primary-to-secondary heat transfer and maintain natural circulation have been demonstrated within existing analyses and plant test results. As a result, no new analyses or modeling of operator actions were needed to validate the adequacy of planned operator actions for maintaining natural circulation and primary-to-secondary heat transfer in an ELAP event.

ISE CI 3.2.1.3.A

A review of WCAP-17792 determined that it does not contain any specific discussion or statements related to the decay heat modeling assumptions that were used. In some cases, it states that the analyses presented are extensions of, or used the same assumptions as, the analyses presented in WCAP-17601, *Reactor Coolant System Response to the Extended Loss of AC Power Event for Westinghouse, Combustion Engineering and Babcock & Wilcox NSSS Designs*. For these cases, the decay heat modeling assumptions are the same as stated in WCAP-17601, which are considered to be applicable and conservative for DBNPS. However, as discussed below, decay heat modeling assumptions did not play a role in the WCAP-17792 analyses.

The analyses presented in WCAP-17792 evaluated the effectiveness of potential mitigating actions that are not directly associated with decay heat removal. The analyses assumed that the plant has been stabilized following the initiation of an ELAP event, with decay heat already being removed via primary-to-secondary heat transfer. The actions that were evaluated would affect other aspects of the event, not decay heat removal.

For the B&W plant design, post-trip stabilization and successful mitigation of an ELAP event require an EFW system and a steam release path that are capable of removing decay heat, via primary-to-secondary heat transfer, following the reactor trip. Analyses are being performed to demonstrate that the DBNPS EFW system and AVVs provide this capability. The preliminary results of analyses show that the decay heat removal capacity of the EFW system and the AVVs exceeds a conservative decay heat generation rate within a few minutes after the reactor trips.

As long as decay heat is being removed via the SGs, the effectiveness of the actions evaluated in WCAP-17792 is independent of the decay heat rate. With the continued decrease in the decay heat generation rate over time, by the time the actions evaluated in WCAP-17792 could be performed, the decay heat removal capability of the DBNPS EFW system will significantly exceed the decay heat generation rate. Because of this, the results would not be affected by the relatively small changes that might result from variations in decay heat modeling assumptions. Based on the above, decay heat modeling assumptions did not play a role in the analyses presented in WCAP-17792, which is consistent with the fact that they are not discussed in that document.

ISE CI 3.2.1.3.B

UFSAR Section 10.4.4, Turbine Bypass System, documents that each SG AVV has a capacity of 5 percent of total steam flow at rated NSSS output. This translates to:

> 0.05 X 2772 MWt = 138.6 MWt X 3,412,141 Btu/Hr / MWt = 4.73E8 Btu/Hr at approximately 980 psig

DBNPS calculation C-ME-050.05-001 shows that the decay heat generation rate at 1.7 minutes after the reactor trip is approximately 4.14E8 Btu/Hr. This means that within 1.7 minutes after the reactor trips, one AVV has an energy removal capacity in excess of the decay heat generation rate. In addition, calculation C-NSA-083.01-006 calculated the energy removal rate of one AVV at reduced steam pressures. That calculation determined that one AVV will pass enough steam to remove 1.1E8 Btu/Hr at 200 psig SG pressure, which is approximately the target SG pressure for termination of the RCS cooldown. An energy removal rate of 1.1E8 Btu/Hr corresponds to the decay heat generation rate at approximately 2.8 hours after a reactor trip (as shown in calculation C-ME-050.05-001). The plant cooldown will not have begun by 2.8 hours, and the RCS temperature corresponding to a 200 psig SG pressure (that is, approximately 380°F) could not be achieved earlier than approximately 10 hours after the reactor trip, by which time the decay heat generation rate will be less than 8.0E7 (that is, less than the energy removal capacity of one AVV).

Calculation C-ME-050.05-001 also shows that the decay heat generation rate at 1 hour after reactor trip will be approximately 1.47E8 Btu/Hr. Using the same technique that was applied in calculation C-NSA-083.01-006, it is determined that the energy removal rate of one AVV, at a reduced SG pressure of 400 psig, is more than 2.0E8 Btu/Hr, which exceeds the decay heat generation rate at 1 hour after reactor trip. The RCS cooldown will not have begun at one hour after the trip. By the time the RCS can be cooled low enough to produce a SG pressure of 400 psig (that is, approximately 470°F), the decay heat generation rate will be less than 1.47E8 Btu/Hr, and one AVV's capacity of 2.0E8 Btu/Hr will provide even more margin for decay heat removal.

This information supports the conclusion that one AVV can pass more steam flow than required to remove the decay heat load that will exist at any time during the initial post trip plant stabilization and subsequent RCS cooldown. In addition, the DBNPS FLEX strategy uses both SGs and both AVVs for plant cooldown, which provides an energy removal capability of more than twice the decay heat generation rate.

ISE CI 3.2.1.6.A

Hydraulic analysis was not required to support that injecting borated water into the RCS within 6 hours after the event is initiated will maintain subcriticality. Calculation C-NF-062.02-048, *Davis-Besse Cycle 20 ELAP Shutdown Margin Analysis*, illustrates that boration is not required until a cooldown is commenced. The RCS is maintained at the post-trip stabilization temperature of approximately 560°F. At this temperature, subcriticality will be maintained, without credit for boration. The DBNPS FLEX strategy does not commence an RCS cooldown until boration through RCS charging pumps is established. The strategy timeline shows RCS charging capability 2.5 hours following declaration of an ELAP. The strategy timeline shows the initiation of RCS cooldown at 4.5 hours. (Refer to the DBNPS timeline provided at the end of this report.)

<u>ISE CI 3.2.1.8.B</u>

Calculation C-NF-062.02-048 addresses this issue. This calculation is based on using the FLEX makeup pump and a water source with a concentration of at least 2,600 ppmB. That concentration will be available from either the BWST, which has a Technical Specification minimum concentration requirement of 2,600 ppmB, or the CWRT, which will be required by FLEX procedures to contain an adequate inventory of water at a minimum concentration of 2,600 ppmB. This calculation shows that the RCS cooldown contraction volume (that is, the amount of RCS volumetric contraction during cooldown) will allow adequate boron injection to maintain a 1 percent shutdown value (SDV) at all times during the cooldown, at all times in core life, with no credit for xenon reactivity. For conservatism, this calculation assumes no RCS leakage and no RCS venting. Any RCS leakage or venting will increase the makeup volume required, which will further increase the boron concentration and resulting SDV. Therefore, this calculation will bound all ELAP RCS leakage scenarios.

FENOC intends to institutionalize the performance of this cycle-specific calculation by requiring inclusion of a cycle-specific verification of adequate ELAP boration capability/SDV in core reload calculation procedure NOBP-NF-1103, *Fuel Cycle Process – Reports, Verifications, and Evaluations*.

<u>ISC CI 3.2.1.8.C</u>

Calculation C-NF-062.02-048 is based on using the FLEX makeup pump and a water source with a concentration of at least 2,600 ppmB. That concentration is available from either the BWST, which has a Technical Specification minimum concentration requirement of 2,600 ppmB, or the CWRT, which will be required by FLEX procedures to contain an adequate inventory of water at a minimum concentration of 2,600 ppmB. This calculation shows that the RCS cooldown contraction volume (that is, the amount of RCS volumetric contraction during cooldown) will allow adequate boron injection to maintain a 1 percent SDV at all times during the cooldown, at all times in core life, with no credit for xenon reactivity. For conservatism, this calculation assumes no RCS leakage and no RCS venting to provide additional boration volume. Calculation C-NF-062.02-048 provides the basis for concluding that DBNPS does not need to perform RCS venting to ensure adequate shutdown margin during an ELAP event and the associated plant cooldown.

<u>ISE CI 3.2.3.A</u>

Calculation C-NSA-060.05-018, *FLEX Mode 1 Containment Response Analysis Due to 10 gpm RCS Leak*, evaluated the response of containment pressure and temperature in an ELAP event, initiated from Modes 1 – 4, with 10 gpm RCS leakage. That calculation determined that the resulting containment conditions, 100 hours after event initiation, would be 8.4 psig and 179°F. The 10 gpm assumed leakage rate bounds the 9 gpm total RCS leakage (that is, 2 gpm per RCP seal, plus 1 gpm pre-existing RCS leakage) that was used in other ELAP-related analyses, including those presented for B&W plant designs in WCAP-17792. The calculation also included heat input to containment from the RCS. The values of pressure and temperature identified in this calculation do not require any additional installed equipment or operator actions. The duration analyzed provides margin beyond the time when NSRC equipment will become available. That equipment will allow restoration of functions such as containment air cooling. Calculation C-NSA-060.05-018 was made available for NRC review.

ISE CI 3.2.4.4.A

An overview of the ECPs is provided below.

ECP 14-0645 FLEX Communications – Satellite Phone Installation: This modification will install two satellite phones in the control room. One is for NRC interfaces and the other is for state, local, and other emergency interfaces. The power is from 120V alternating current (AC) Inverter Distribution Panel Y5005B to the antenna plug enclosure in the EFWF. The input power for the inverter following a BDBEE is 125V Battery D5005D. The battery is to be sized to power the full load of the inverter and additional direct current (DC) loads for up to eight hours. Within eight hours, AC power is restored following deployment of the FLEX 480V generator. The installation of the battery, battery charger, DC switchboard, inverter and inverter distribution panel is based on ECP 13-0195-008. This is a stand-alone satellite telephone system that does not impact the existing station communication system. Deployment of the system is addressed in ECP 14-0738, Implement FLEX at Davis-Besse.

ECP 14-0646 Sound Powered Modifications to Support FLEX: This modification installs additional sound powered phone jack boxes in the auxiliary building Rooms 100 and 124 near the RCS pumps that are being installed by ECP 13-0463. A sound powered phone and a control room sound powered phone disconnect will be located in the EFWF. Closing this disconnect will allow sound powered phone use in the control room. A storage box will also be installed in the control room near the EFW system Panel C5732. The additional phone jacks do not impact the operation of the existing sound powered phone jacks used for safe shutdown.

ISE CI 3.4.A

NEI letter dated September 11, 2014, regarding NSRC operational status, provided the programmatic aspects and implementation plans for the SAFER program to be in conformance with the applicable portions of NEI 12-06, *Diverse and Flexible Coping Strategies (FLEX) Implementation Guide*, Revision 0, dated August 2012. The NSRCs will also maintain on file an operational checklist annotating the specific criteria that will be validated for each individual licensee to support an operational status. The *DBNPS SAFER Response Plan* was made available for NRC review.

7 Potential Interim Staff Evaluation Impacts

FENOC is making changes to the compliance method as documented in the OIP (Reference 1). Some alternate approaches are being taken, and there is a potential impact on the ISE.

8 References

The following references support the updates to the OIP described in this attachment.

1. FirstEnergy Nuclear Operating Company's (FENOC's) Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 27, 2013.
2. NRC Order Number EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, dated March 12, 2012.

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Davis-Besse

Phase 1 – 3 FLEX Baseline Strategy: Mode 1 – 4 ELAP
(Guidance NEI 12-06)

Goals

Employ a 3 Phase approach to maintain: 1) Core Cooling 2) Containment Integrity, and 3) Spent Fuel Pool Cooling during an Extended Loss of AC Power (ELAP) with Loss of access to the Ultimate Heat Sink (LUHS).

- The goal of Phase 1 is to cope with installed plant equipment with on-site personnel.
- The goal of Phase 2 is to augment with on-site FLEX equipment and off-site personnel as necessary.
- The goal of Phase 3 is the additional capability and redundancy utilizing equipment provided by the NSRC.

Strategy

Achieve the goals of maintaining adequate core cooling and containment parameter control using the following strategies:

- Protect assets.
- Minimize complexity of operator actions.
- Use plug and play mechanical / electrical connections.
- Minimize hose runs (pre-deployment).
- Minimize time to repower battery chargers.
- Maximize Control Room indication and control.
- Minimize operator actions in environmentally challenging areas.

External Hazard Considerations

Beyond Design Basis External Events (BDBEE) hazard considerations include:

- Seismic (GMRS)
- Flooding (PMF, PMSS & PMWS)
- High Winds / Tornado – Missile
- Extreme Heat
- Extreme Cold, Snow & Ice

T=0 hrs | T + 2.5 hrs | T + 6.0 hrs | T + 24 hrs | T + 72 hrs

00:00 – 02:30

Installed equipment and initial FLEX response with on-site personnel only.

02:30 – 24:00

FLEX and installed equipment. At T+6 hrs, additional personnel arrive at the site to assist in event mitigation.

24:00 – >72:00

FLEX and installed equipment. Full ERO staffing and National SAFER Response Center Support.

Human Factors Considerations

Installed runs of pipe and cable that aid in strategy implementation. Clear demarcation through use of color coding or labeling of:

- Hoses.
- Cable and cable ends.
- Connection points.
- Staging areas for FLEX equipment.

Deployment Considerations

- Pre-defined pathways for hoses & cables.
- Pre-defined staging areas.
- Pre-defined equipment and trucks.
- Equipment maintenance and testing.
- Personnel qualified FLEX.
- Procedures (FSGs) and Hard Cards.
- Lighting, generators, fuel caddies, hand pumps, extension cords, keys, pipe wrenches, valve wrenches, hammer union wrenches, box fans, vent ducting.

Davis-Besse

Phase1 FLEX Strategy: Mode 1 – 4 ELAP

Goals

Achieve stable plant conditions, attempt to start SBODG, and recognize ELAP conditions. Complete Battery load shed, connect and power RCS Inventory source(s). Begin efforts to restore power to Pressurizer Heaters and Battery Chargers from portable FLEX 480v Generator in EFWF.

Phase 1 Equipment

- EFW Pump (Diesel Driven) and EFW Storage Tank (Seismic and Tornado).
- Station Batteries – Train 2 only in service following initial load shed – approximately 19 hours available from battery 2P.
- Steam Generator Heat Transfer via MSSVs then Atmospheric Vent Valves (AVV's) – local-manual operation.
- RCS Inventory via FLEX Charging Pump from BWST (seismic) or from CWRT (tornado) prepared for service.
- Vital Instrumentation – one train provides all required instrumentation. Alternate: use portable generator or local readings.

Phase 1 Sensitive Actions

- Cross-tie of EFW to SG 2 for RCP seal concerns (90 minutes)
- Severe Load Shedding. (15 min start, complete w/in 1 hour).
- Isolated RCS Letdown and RCP Seal Return (10 minutes) – Isolation valves are operated from the Control Room.
- RCS inventory addition established prior to depletion of PZR inventory (2.5 hours charging is in service; 6 hours is max time otherwise asymmetric cooldown will be required).

Timeline Actions

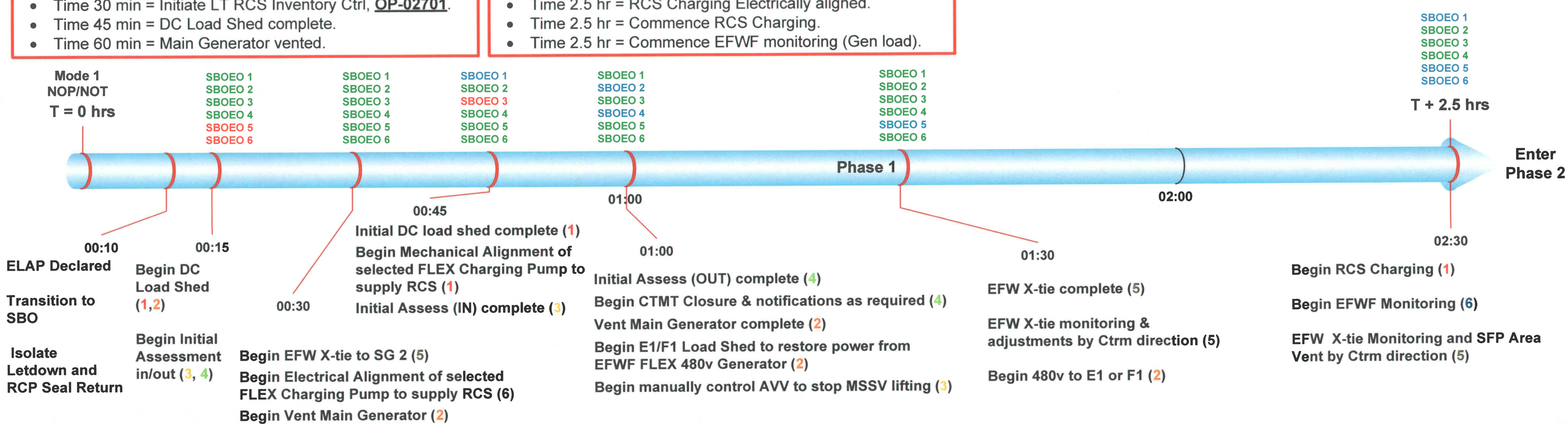
- Time 0 = Enter **OP-02000**.
- Time 10 min = ELAP Declared, enter **OP-02700**.
- Time 10 min = Minimize inventory losses.
- Time 10 min = EFW Auto/Manual initiation complete.
- Time 15 min = Initiate DC Load Mgmt, **OP-02704**.
- Time 15 min = Classify (SS1 or SG1).
- Time 15 min = Initiate Low DH AFW if needed, **OP-02709**.
- Time 15 min = Initiate Initial Assessment and FLEX Staging, **OP-02705**. Initiate Alt LPFW if needed, **OP-02703**.
- Time 30 min = Initiate X-tie of EFW to SG 2
- Time 30 min = Initiate LT RCS Inventory Ctrl, **OP-02701**.
- Time 45 min = DC Load Shed complete.
- Time 60 min = Main Generator vented.

Timeline Actions

- Time 60 min = Initiate Loss of DC if needed, **OP-02707**.
- Time 60 min = Control AVVs manually.
- Time 60 min = Initial Assessment complete; still removing debris and staging (N+1 items) if contingency needed.
- Time 60 min = Initiate Ctmt Closure, **OP-02715** if needed.
- Time 60 min = Initiate Habitability Actions, **OP-02725**.
- Time 60 min = Initiate E1/F1 Shed & Restore, **OP-02721**.
- Time 90 min = Complete EFW X-tie.
- Time 90 min = Commence EFW X-tie Monitoring.
- Time 2.5 hr = RCS Charging Mechanically aligned.
- Time 2.5 hr = RCS Charging Electrically aligned.
- Time 2.5 hr = Commence RCS Charging.
- Time 2.5 hr = Commence EFWF monitoring (Gen load).

Operational Evolutions

- Manually control SG 1 level using EFW (from Control Room).
- Cross connect EFW to SG 2, and manually control level (field & CTRM).
- Complete Battery Load Shed within one hour.
- Establish local-manual control of AVVs (1 hour) to stop MSSVs from lifting.
- Deployment and staging of selected FLEX Charging Pump, EFWF MCC & FLEX 480v Gen cabling to restore RCS Inventory control in Phase 2.
- Deployment and staging of FLEX 480v Gen to supply E1/F1 for Battery Charges and PZR Htrs in Phase 2.



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Davis-Besse

Phase 2 FLEX Strategy: Mode 1 – 4 ELAP

Goals

Maintain stable plant conditions, connect and power FLEX Charging Pump(s). Restore power to Pressurizer Heaters and Battery Chargers from FLEX 480v Generator (EFWF or N+1). Begin RCS Cooldown.
Note: Additional Off-site personnel are not credited until T=6hrs.

Phase 1 Equipment

- EFW Pump (Diesel Driven) and EFW Storage Tank (Seismic and Tornado).
- Station Batteries – Train 2 following initial load shed.
- Steam Generator Heat Transfer via Atmospheric Vent Valves (AVV's) – local-manual operation.
- Vital Instrumentation – one train provides all required instrumentation.

Augment with Phase 2 Equipment

- RCS Inventory via FLEX Charging Pump from BWST (seismic) or from CWRT (tornado).
- Restore Power to Battery Chargers and Pressurizer Heaters (E1/F1 Buses) from FLEX 480v Generator.
- Supply inventory to the Spent Fuel Pool as needed (based on level) from FLEX makeup hoses/pipe header.
- Ctmt minimal pressurization allows delay of SW Restoration to Phase 3 since Ctmt cooling not a concern.

Phase 2 Sensitive Actions

- PZR heaters restored (4 hours).
- Commenced cooldown (4.5 hours).
- Battery Chargers restored (6 hours).
- EFW Storage Tank makeup (16 hours).
- SFP makeup before 10 feet (varies).

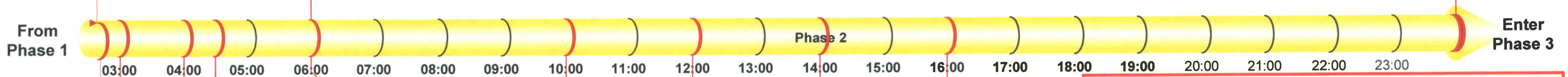
Operational Evolutions

- Restore Power to Battery Chargers and Pressurizer Heaters (E1/F1 Buses)
- Begin Natural Circulation RCS Cooldown.
- Provide EFW Makeup Source – will be required before Phase 3.
- Habitability Actions (Ventilation & Portable Generators refilled).
- SFP venting and makeup as required.
- CFT isolation or venting.
- Habitability actions (HVAC, lighting, dewatering).

T + 2:30 Begin Phase 2

T + 6 hrs– additional off-site personnel available

T + 24 hrs



02:30
Begin RCS Inventory Addition from FLEX Charging Pumps

CTMT Isolation Verification in Progress (4)

03:00
FLEX 480v Generator(s) connected to E1 and F1 complete (2)

Begin PZR Htr restore (2)

04:30
Begin Symmetric RCS Cooldown

04:00
PZR Heaters restore complete (2)
Begin Charger restoration (2)

06:00
Charger restoration complete (2)
Begin restoration of DC loads (2, ERO)

10:00
Continue fuel oil consumption Monitoring and begin replenishment Actions. (ERO)

12:00
Determine specific support required from NSRC (ERO)

14:00
SFP Makeup from EFW Available (ERO)

16:00
EFW ST Makeup may be required (ERO)

SBOEO 1
SBOEO 2
SBOEO 3
SBOEO 4
SBOEO 5
SBOEO 6

SBOEO 1
SBOEO 2
SBOEO 3
SBOEO 4
SBOEO 5
SBOEO 6

SBOEO 1
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SBOEO 1
SBOEO 2
SBOEO 3
SBOEO 4
SBOEO 5
SBOEO 6

ERO
SBOEO 1
SBOEO 2
SBOEO 3
SBOEO 4
SBOEO 5
SBOEO 6

ERO

ERO

ERO

ERO

Timeline Actions

- Time 2.5 hr = RCS Charging Mechanically aligned.
- Time 2.5 hr = RCS Charging Electrically aligned.
- Time 2.5 hr = Commence RCS Charging, **OP-02701**.
- Time 2.5 hr = Commence EFWF monitoring.
- Time 3.0 hr = Initiate PZR Heaters restore, **OP-02724**.
- Time 3.0 hr = FLEX 480v Generator connected to E1 or F1 bus IAW **OP-02721**.
- Time 3.5 hr = Monitor FLEX 480v Generator.
- Time 4.0 hr = PZR Heaters restored IAW, **OP-02724**.
- Time 4.5 hr = Commence Symmetric Cooldown.
- Time 4.5 hr = Initiate Alt Boration C/D tracking, **OP-02708**.
- Time 6.0 hr = Battery Chargers restored.
- ~Time 6.0 hr = Initiate CFT iso, if needed, **OP-02710**.
- Time 6.0 hr = Commence DC Shed Loads restoration.
- Time 10.0 hr = Replenishment preps (ERO).
- Time 14.0 hr = Initiate SFP Makeup, **OP-02711**.
- Time 16.0 hr = Initiate EFWST Makeup, **OP-02706**.

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Phase 3 FLEX Strategy: Mode 1 – 4 ELAP

Goals

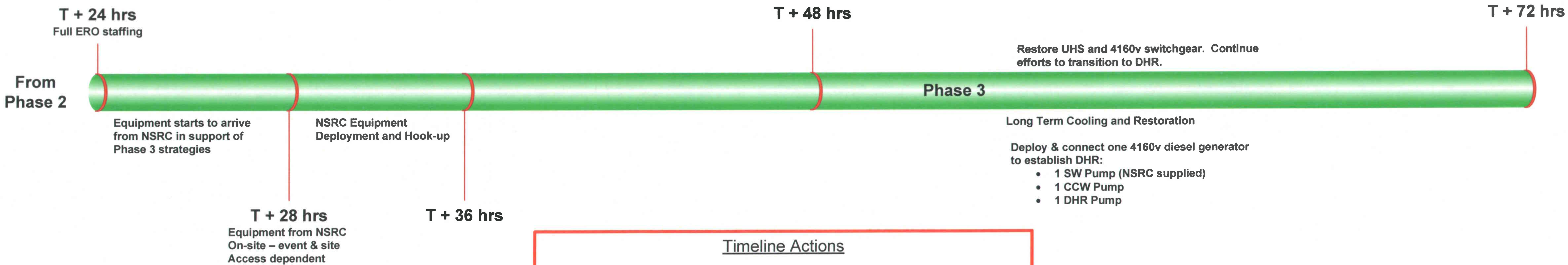
Evaluate recovery of essential installed equipment to maintain critical functions of Core Cooling, Containment Integrity and Spent Fuel Pool Cooling, augmented by NSRC equipment and additional resources.

Phase 3 Equipment

- Recover the Ultimate Heat Sink (NSRC SW pump).
- Re-energize 4160v bus(es) (NSRC generator).
- Transition from EFW to DHR (ERO).
- Restore SFP Cooling, Containment Air Coolers, and Control Room cooling as applicable (ERO).
- Continue monitoring FLEX equipment – fuel supplies, equipment operation & monitoring site conditions.

Operational Evolutions

- Align SW and restore CCW for Long term cooling of RCS via DHR.
- Establish local control of DHR (unless air available).
- Providing fuel and other consumables for portable equipment and EFWF.
- Operation/Control of equipment from NSRC (SW pumps and 4160v generators).



Timeline Actions

- Time 24.0 hr = NSRC equipment starts arriving.
- Time 24.0 hr = Begin Recovery Plan development (ERO).
- Time 72.0 hr = all NSRC equipment on-site and in service.
- Time 72.0 hr = Initiate 4160v Restore, **OP-02723**.
- Time 72.0 hr = Initiate SW Restore, **OP-02722**.
- Time 72.0 hr = Initiate Alt Ctmt Cooling if needed, **OP-02712**.
- Time 72.0 hr = Initiate Transition from FLEX, **OP-02713**.
- Time 72.0 hr = initiate **Recovery Plan**.

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FLEX Strategy for Spent Fuel Pool – All Modes (Guidance NEI 12-06)

Goals

Employ a 3 Phase Strategy to maintain Spent Fuel Pool level above the top of fuel assemblies seated in the fuel racks during an Extended Loss of AC Power (ELAP) and Loss of the access to the Ultimate Heat Sink (LUHS)

Equipment

- The goal of Phase 1 is to cope with installed plant equipment. No SFP actions required.
- The goal of Phase 2 is to transition to on-site FLEX equipment – EFW Storage Tank or any other source.
- The goal of Phase 3 is FLEX equipment and additional capability by utilizing NSRC equipment

Strategy

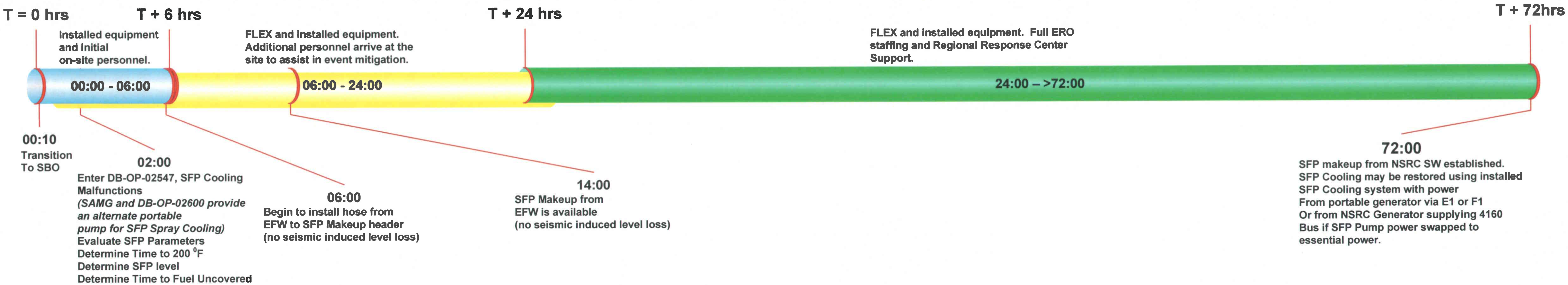
Maintain Spent Fuel Pool level above the top of fuel assemblies seated in the fuel racks using the following:

- Protecting personnel.
- Minimize complexity of operator actions.
- Minimize hose runs.
- Minimize time to restore battery charger for SFPLI (72 hr battery).
- Use new SFPLI (Primary & Backup) to monitor SFP during ELAP.
- Minimize operator actions in environmentally challenging areas.
- Limit use of EFW Storage Tank to preserve inventory for SGs and RCS.

External Hazard Considerations

Beyond Design Basis External Events (BDBEE) hazard considerations include:

- Seismic (GMRS)
- Flooding (PMF, PMSS & PMWS)
- High Winds / Tornado – Missile
- Extreme Heat
- Extreme Cold, Snow & Ice



Operational Evolutions

- SFP area venting (Door 300) and portable generators with fans as available.
- SFP Makeup – install hoses to connections for M/U capability (EFW and NSRC SW)
- SFP Spray via FLEX pump if makeup inadequate.
- Restore power to BDBEE SFP instrumentation.

Spent Fuel Pool Action Times

- With initial Spent Fuel Pool level at 23 feet above spent fuel and full core offload decay heat load, the worst-case time to reach the SFP level for biological shielding of 9.5 feet is approximately 25 hours (no seismic).
- Only monitoring of Spent Fuel Pool level is needed until this level is reached. Prior to reaching the biological shielding minimum level, actions are initiated to add makeup water to the Spent Fuel Pool.
- SFP Makeup from EFW ST is estimated to be available at 14 hours, which is well before the 23 hours to 9.5 feet.
- EFW ST makeup will be required to be initiated to ensure EFW ST for SGs and SFP.

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Phase 1 – 3 FLEX Baseline Strategy: Mode 5 & 6 ELAP

Plant Conditions

In Mode 5 and 6, the plant conditions that exist at the time of the event dictate the response actions. The PWROG identified these 5 plant conditions:

Condition — Cooling Mechanism

- **RCS Full with SGs available** – single phase Natural Circulation.
- **RCS Not Full, RV Head ON, without adequate vent path** – Refill and go on Natural Circulation.
- **RCS Not Full, RV Head ON, and vented** – Core boiling with steam release to Ctmt.
- **RCS Drained below RV Flange level** – Core boiling with steam release to Ctmt.
- **Refueling Canal Full with RV Head OFF** – RFC provides large volume of water for pool boiling.

SFP Sensitive Actions

- SFP Cooling:
  - SFP Cooling Power Source (Non-essential) – TMOD to align to Essential MCC to allow restoration from NSRC 4160 generator could be pursued. Worst case off load time to boil is 3.78 hours, with another 25 hours to reach 10 feet shielding level (no seismic induced level loss). Boil off from SFP is approximately 70 gpm. (Seismic event may compound worse offload)
  - Covering Aux Building Train Bay Floor Drains – will go to ECCS 1 sump which has no power.
- Core Cooling – BWST Available:
  - use BWST to gravity drain to RCS until Charging established. OP-02527 Att 10.
- Core Cooling – BWST not available:
  - Use SFP to supply initial 32,000 gallons to Core. Adequate for 6 hours. Core concentration will be ~ 10k ppmb after 6 hours.
  - CWRT 1 will supply the next 60,000 gallons (lineup established in prior 6 hours) at 60 gpm.
  - EFW can augment CWRT 1 with unborated water in order to match boil-off rate if needed.
  - At 19 hour point, borated sources are exhausted. 19 hours of 2600 ppmb will result in concentration in Core of ~20k ppmb.
  - Will then use EFW alone (unborated). 1% SDM at BOL Cold conditions is 1700 ppmb.
  - Unborated water will aid in preventing precipitation concerns. At 54 hours, would be at 50k ppmb if kept borating RCS with 2600 ppmb makeup and action would be required to prevent boron precipitation from blocking flow channels. Would need ~6% increase in makeup flow > boil off rate to offset precipitation, which would spill to Ctmt floor (~10gpm spillage) and use inventory faster.
  - Using unborated water requires maintaining RV level constant if makeup can be spilled out of core, otherwise would dilute core.
  - Using DH Drop line is preferred over injecting to Cold Legs where no boron mixing occurs.

Plant Conditions and Strategy Actions

Condition — Cooling Mechanism

- **RCS Full with SGs available** – single phase Natural Circulation. All Mode 1-4 FLEX actions are applicable to this condition. Will reheat back up to Mode 4 and Natural Circ will be established using AVVs in manual. EFW will supply SGs. Ctmt Cooling is not required due to low leakage RCP seals having minimal impact on Ctmt pressure. Additionally, RCS inventory losses are low at low RCS pressures.
- **RCS Not Full, RV Head ON, without adequate vent path** – Refill and go on Natural Circulation. All Mode 1-4 FLEX actions are applicable to this condition. Will reheat back up to Mode 4 and Natural Circ will be established using AVVs in manual. EFW will supply SGs. Ctmt Cooling is not required due to low leakage RCP seals having minimal impact on Ctmt pressure. Additionally, RCS inventory losses are low at low RCS pressures.
- **RCS Not Full, RV Head ON, and vented** – Core boiling with steam release to Ctmt. SGs are not available in this condition. RCS makeup rate must match boil off rate to keep fuel covered. Ctmt Venting will be used to prevent backpressure from stopping RCS makeup. Will use Emergency Hatch as vent path. Alternate Ctmt Cooling can be supplied from NSRC 4160v and NSRC SW Pump supply CACs.
- **RCS Drained below RV Flange level with Head OFF (OR Drained with lower primary manway removed)** – Core boiling with steam release to Ctmt. Very short response time required. SGs are not available in this condition. RCS makeup rate must match boil off rate to keep fuel covered. Ctmt Venting will be used to prevent backpressure from stopping RCS makeup. Will use Emergency Hatch as vent path. Alternate Ctmt Cooling can be supplied from NSRC 4160v and NSRC SW Pump to supply CACs.
- **Refueling Canal Full with RV Head OFF** – RFC provides large volume of water for pool boiling. This allows time to restore Core Cooling using NSRC 4160v and NSRC SW pump to restore DHR function. Ctmt Venting will be used to prevent backpressure from stopping RCS makeup.