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September 23, 2016
L-16-123

10 CFR 2.202

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

SUBJECT:
Davis-Besse Nuclear Power Station
Docket No. 50-346, License No. NPF-3
Completion of Required Action by NRC Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (TAC No. MF0961)

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, to FirstEnergy Nuclear Operating Company (FENOC). This Order was effective immediately and directed 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 for the Davis-Besse Nuclear Power Station (DBNPS) as outlined in Attachment 2 of the Order. This letter, along with its attachments and enclosure, provides the notification required by Section IV.C.3 of the Order that full compliance with the requirements described in Attachment 2 of the Order has been achieved for DBNPS.

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 September 23, 2016.

Respectfully submitted,

Brian D. Boles

Brian D. Boles

Attachments:
1. Compliance with Order EA-12-049
2. NRC Requests for Information

Enclosure:
Final Integrated Plan

cc: Director, Office of Nuclear Reactor Regulation (NRR)
NRC Region III Administrator
NRC Resident Inspector
NRC Project Manager
Ms. Jessica A. Kratchman, NRR/JLD/PMB, NRC
Utility Radiological Safety Board (without Attachments)

INTRODUCTION

FirstEnergy Nuclear Operating Company (FENOC) developed an Overall Integrated Plan (OIP) for Davis-Besse Nuclear Power Station (DBNPS) (Reference 1) documenting the diverse and flexible strategies (FLEX), in response to Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" (Reference 2). The information provided herein documents full compliance for DBNPS with Reference 2.

OPEN ITEM RESOLUTION

FENOC has provided a response for the following items and considers them to be complete for DBNPS. A summary of the response to each of the items is provided in Attachment 2 of this letter.

Interim Staff Evaluation (ISE) Open Items – All DBNPS ISE open items have been closed

ISE Confirmatory Items – Complete pending Nuclear Regulatory Commission (NRC) closure

Licensee Identified Open Items – None

Audit Questions/Audit Report Open Items – Complete pending NRC closure

Safety Evaluation (SE) Review Open Items – Complete pending NRC closure

MILESTONE SCHEDULE – ITEMS COMPLETE

Milestone	Completion Date
Submit FLEX Integrated Implementation Plan	February-2013
6 Month NRC Status Updates	February-2016
Update 1	August-2013
Update 2	February-2014
Update 3	August-2014
Update 4	February-2015
Update 5	August-2015
Update 6	February-2016
Validation	July-2016
Walk-throughs or Demonstrations	July-2016
Complete Staffing Analysis	October-2015
Submit NEI 12-01 Phase 2 Staffing Study	October-2015
Complete Plant Modifications	May-2016
Target plant modifications	May-2013
Modifications complete	May-2016
*Complete 1R18 outage modifications**	June-2014
Complete on-line modifications	March-2016
Complete 1R19 outage modifications	May-2016
Complete Communications Modifications	May-2016
Complete SFP Level Indication Modifications	April-2016
FLEX Storage Complete – Emergency Feedwater Facility (EFWF)	May-2016
Complete Building Design-EFWF	September-2015
Commence Construction-EFWF	June-2015
Complete Construction-EFWF	May-2016
On-site FLEX Equipment	April-2016
Confirm FLEX Equipment Requirements	October-2014
FLEX Equipment Ordered	March-2016
FLEX Equipment Delivered	April-2016
Off-site FLEX Equipment	February-2016
*Develop Strategies with RRC****	October-2015
Phase 3 Site Access Strategies in Place	October-2015
Complete Near Site Staging Location (as needed)	February-2016
Procedures Complete	July-2016
PWROG issues NSSS-specific guidelines	August-2013
Issue Davis-Besse FLEX Strategy Guidelines	July-2016
Issue Maintenance Procedures	April-2016
Training Complete	July-2016
Develop Training Plan	September-2015
Implement Training	July-2016
Submit Completion Report	September-2016**

* Modifications are targeted for 1R19 and on-line; none targeted for 1R18.
** Submittal of completion report adjusted based on schedule relaxation granted
*** Regional Response Center (RRC) is now called National SAFER Response Center (NSRC)

ORDER EA-12-049 COMPLIANCE ELEMENTS SUMMARY

The elements identified below for DBNPS, as well as the OIP (Reference 1), the Initial Status Report (Reference 3), the Six-Month Status Reports (References 4, 5, 6, 7, 8, and 9), and two requests for schedule relaxation (References 10 and 11) that were granted (References 12 and 13, respectively), demonstrate compliance with Order EA-12-049.

STRATEGIES – COMPLETE

DBNPS strategies are in compliance with Order EA-12-049. There are no strategy related Open Items, Confirmatory Items, or Audit Questions/Audit Report Open Items.

MODIFICATIONS – COMPLETE

The modifications required to support the FLEX strategies for DBNPS have been fully implemented in accordance with the station design control process.

EQUIPMENT – PROCURED AND MAINTENANCE AND TESTING – COMPLETE

The equipment required to implement the FLEX strategies for DBNPS has been procured in accordance with Nuclear Energy Institute (NEI) 12-06 (Reference 14), Section 11.1 and 11.2, received at DBNPS, initially tested/performance verified as identified in NEI 12-06, Section 11.5, and is available for use.

Maintenance and testing will be conducted through the use of the DBNPS Preventative Maintenance program such that equipment reliability is achieved.

PROTECTED STORAGE – COMPLETE

The storage facilities required to implement the FLEX strategies for DBNPS have been completed and provide protection from the applicable site hazards. The equipment required to implement the FLEX strategies for DBNPS is stored in its protected configuration.

PROCEDURES – COMPLETE

FLEX Support Guidelines (FSGs) for DBNPS have been developed and integrated with existing procedures. The FSGs and affected existing procedures have been verified and are available for use in accordance with the site procedure control program.

TRAINING – COMPLETE

Training for DBNPS has been completed in accordance with an accepted training process as recommended in NEI 12-06, Section 11.6.

STAFFING – COMPLETE

The staffing study for DBNPS has been completed in response to Recommendation 9.3 of the March 12, 2012 NRC request, "Request for Information Pursuant to Title 10 of the *Code of Federal Regulations* 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," (Reference 15), as documented in letter dated November 7, 2014 (Reference 16).

NATIONAL SAFER RESPONSE CENTERS – COMPLETE

FENOC has established a contract with Pooled Equipment Inventory Company (PEICo) and has joined the Strategic Alliance for FLEX Emergency Response (SAFER) Team Equipment Committee for off-site facility coordination. It has been confirmed that PEICo is ready to support DBNPS with Phase 3 equipment stored in the National SAFER Response Centers in accordance with the site specific SAFER Response Plan.

VALIDATION – COMPLETE

FENOC has completed performance of validation in accordance with industry developed guidance to assure required tasks, manual actions and decisions for FLEX strategies are feasible and may be executed within the constraints identified in the OIP / Final Integrated Plan (FIP) for Order EA-12-049.

FLEX PROGRAM DOCUMENT – ESTABLISHED

The DBNPS FLEX Program Document has been developed in accordance with the requirements of NEI 12-06.

REFERENCES

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. Nuclear Regulatory Commission (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. 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.

4. FirstEnergy Nuclear Operating Company's (FENOC's) First 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-12-051) (TAC Nos. MF0841, MF0842, MF0961, and MF0962), dated August 26, 2013.

5. FirstEnergy Nuclear Operating Company's (FENOC's) Second 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) and Relief/Relaxation Request (TAC Nos. MF0841, MF0842, MF0961, and MF0962), dated February 27, 2014.

6. FirstEnergy Nuclear Operating Company's (FENOC's) Third 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) (TAC Nos. MF0841, MF0842, MF0961, and MF0962), dated August 28, 2014.

7. FirstEnergy Nuclear Operating Company's (FENOC's) Fourth 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) (TAC Nos. MF0841, MF0842, MF0961, and MF0962), dated February 26, 2015.

8. FirstEnergy Nuclear Operating Company's (FENOC's) Fifth 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) (TAC Nos. MF0841, MF0842, and MF0961), dated August 27, 2015.

9. 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) (TAC Nos. MF0841 and MF0961), dated February 26, 2016.

10. Request for Schedule Relief/Relaxation from NRC Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049) (CAC No. MF0961), dated March 11, 2016.

11. Request for Schedule Relief/Relaxation from NRC Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049) (CAC No. MF0961), dated July 11, 2016.

12. NRC letter, Davis-Besse Nuclear Power Station, Unit No. 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" (CAC No. MF0961), dated April 6, 2016.

13. NRC letter, Davis-Besse Nuclear Power Station, Unit 1 – Relaxation of the Schedule Requirements for Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" (CAC No. MF0961), dated July 25, 2016.

14. NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 0, dated August 2012.

15. NRC Letter, Request for Information Pursuant to Title 10 of the *Code of Federal Regulations* 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated March 12, 2012.

16. Response to NRC Letter, Request for Information Pursuant to Title 10 of the *Code of Federal Regulations* 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated October 2, 2015.

INTERIM STAFF EVALUATION (ISE) OPEN ITEMS (OI)

OI 3.2.1.2.A

Verify the following with respect to reactor coolant pump (RCP) seals:

(1) the DBNPS [Davis-Besse Nuclear Power Plant] plant condition during an ELAP [extended loss of ac (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 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.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

OI 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).

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

OI 3.2.1.6.B

Verify that a revised sequence of events that is consistent with the final ELAP analyses is developed.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016. The FLEX timeline provided remains current.

OI 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.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

ISE CONFIRMATORY ITEMS (CI)

CI 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.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

CI 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.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

CI 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.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

CI 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 equipment without associated control power.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

CI 3.1.1.4.A

Confirm the RRC [regional response center, now called National SAFER Response Center (NSRC)] local staging area, evaluation of access routes, and method of transportation to the site.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

CI 3.1.2.A

Confirm that the licensee has identified the warning time and persistence of the external flooding hazard.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

CI 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.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

CI 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.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

CI 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.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

CI 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.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

CI 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.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

CI 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.**

Response:

The response to this item was provided by FENOC letter dated August 27, 2015.

CI 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.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

CI 3.2.1.3.B

Confirm that the cooldown directed by the DBNPS mitigating strategy is consistent with the capability of the atmospheric vent valves.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

CI 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.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

CI 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.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

CI 3.2.1.8.C

Confirm that adequate RCS venting capability exists to support the ELAP mitigating strategy for DBNPS.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

CI 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.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

CI 3.2.4.4.A

Confirm that upgrades to the site's communications systems have been completed.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016. Subsequently, the response has been amended as follows.

An overview of the engineering change packages (ECPs) is provided below.

ECP 14-0645 FLEX Communications – Satellite Phone Installation: This modification installed 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 120 volt (V) alternating current (AC) Inverter Distribution Panel Y5005B to the antenna plug enclosure in the emergency feedwater facility (EFWF). The input power for the inverter following a beyond-design-basis external event (BDBEE) is 125V Battery D5005D. The battery is sized to power the full load of the inverter and additional direct current (DC) loads for up to six hours. Within 2.5 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 installed additional sound powered phone jack boxes in the auxiliary building Rooms 100 and 124 near the clean waste receiver tank (CWRT) and borated water storage tank (BWST) FLEX charging pumps installed by ECP 13-0463. A sound powered phone and a control room sound powered phone disconnect is located in the EFWF. Closing this disconnect allows sound powered phone use in the control room. A storage box is also 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.

CI 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).

Response:

The Phase 2 FLEX generators are 480V AC 850 kW Turbine Marine generators.

CI 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.

Response:

The response to this item was provided by FENOC letter dated February 26, 2016.

<u>AUDIT QUESTIONS (AQ)/AUDIT REPORT OPEN ITEMS</u>

ISE CI 3.2.4.8.A

[Listed as an audit report open item – see response above]

AQ 104

Provide information on the adequacy of the ventilation provided in the battery room to protect the batteries from the effects of extreme high and low temperatures.

Response:

Information on ventilation of the battery rooms is provided in Updated Final Safety Analysis Report Section 9.4.2.1.2.1, Battery Rooms. This section states, in part, that due to the relatively small size of the battery rooms, low normal mode room heat loads, and the comparatively large outside wall area, a continuous supply of ventilation air from the low voltage switchgear rooms (LVSWGRs) may be required to maintain the battery rooms above 60°F during severe winter weather. The heating, ventilating, and air conditioning (HVAC) systems are sized to maintain the battery rooms between 60°F and 104°F year round during all modes of operation. To support the mitigation strategy, FENOC recognizes the need to evaluate the battery room temperature performance for low temperature conditions during the period that ventilation will be secured. The following design basis analyses were provided for NRC review:

- C-ISE-028.01-002, Analysis of the Low Voltage Switchgear Room Ventilation
- C-ME-002.02-001, Impact of Winter on Battery Room 429B Vent Fan Operation
- C-ME-002.02-002, Low Temperature in Station Battery Rooms (428A and 429B) and Room Heater Sizing Calculation

Control room high temperature was addressed by Engineering Evaluation Report (EER) 601008220, Strategy for Loss of Ventilation with an Extended Loss of AC Power (ELAP). The purpose of the EER was to develop a strategy for dealing with a loss of ventilation during an ELAP, specifically to consider habitability and equipment functionality. The areas of concern were: Control Room/Cabinet Area, Fan Alley, Spent Fuel Pool Area, Low Voltage Switchgear Rooms/Electrical Isolation Rooms, and High Voltage Switchgear Rooms/CD Switchgear Room. As a result, calculation C-ME-099.25-001, Auxiliary Building Room Temperatures during an ELAP, was developed. This calculation was made available for NRC review.

The estimated alternative ventilation flow rates based on the worst case postulated temperatures are within the capability of portable electric fans. The maximum hydrogen generation rate for Battery Rooms 428A and 429B is easily controlled by opening of the door to Room 429B and the addition of a small fan to ventilate the upper portion of both rooms. If the battery rooms are ventilated directly into the LVSWGRs, additional ventilation of these rooms may eventually be required to sweep the ceiling area of potential hydrogen.

AQ 121

On page 17 of 130, the OIP indicates the atmospheric vent valves (AVVs) will be manually operated using reach rods from rooms 500 and 501. Please discuss the means and ability to communicate between the control room and local equipment operators and whether environmental factors, such as elevated temperatures or ambient noise of exiting steam have been considered in the evaluation to determine that the necessary coordination is feasible.

Response:

The remote manual operators in Rooms 500 and 501 are not located in the same rooms as the AVVs. The internal communications for this location are hand held radios until they fail and then the sound powered phone system will be used.

Additional information regarding the seismic evaluations associated with the reach rods and handles installed on the AVVs was requested by the NRC staff. The following documents were made available for review:

- Engineering Evaluation Request (EER) 601016597
- Drawing M-453-193-1, AVV Control Linkage Assembly
- Drawing Change Notice 1 (DCN) to Assembly Drawing
- Calculation C-ME-083.01-237, Remote Hand Wheel Torque for ICS11A and ICS11B
- Vendor Manual M-410-00720-03, Remote Manual Valve Extension Rods

This information also addresses AQ 127 below.

AQ 127

Motive Force for steam generator (SG), pressurizer overpressure relief valve (PORV), atmospheric relief valve (ARV) and atmospheric dump valve (ADV) operations:

(a) Specify the size of the SG PORV/ARV/ADV backup nitrogen supply source and the required time for its use as motive force to operate the SG PORV/ARV/ADV for mitigating an ELAP event.

(b) Discuss the analysis determining the size of the subject nitrogen supply to show that the nitrogen sources are available and adequate, lasting for the required time.

(c) Discuss the electrical power supply that is required for operators to throttle steam flow through the SG PORV/ARV/ADVs within the required time and show that the power is available and adequate for the intended use before the operator takes actions to manually operate the SG PORV/ARV/ADVs.

(d) Discuss the operator actions that are required to operate SG PORV/ARV/ADVs manually and show that the required actions can be completed within the required time.

Response:

The AVVs are manually operated in accordance with Attachment 3 of DB-OP-02000, RPS, SFAS, SFRCS Trip, or SG Tube Rupture. No electrical power is required for manual AVV operation. AVV operation is not required until RCS cooldown commences. The procedures were validated that the actions can be completed within the assumed times.

The AVVs do not have a remote nitrogen supply. The procedure delineated in DB-OP-02000 directs isolation of the control air and then manual operation with the reach rod.

Additional information regarding the seismic evaluations associated with the reach rods and handles installed on the AVVs was requested by the NRC staff. This information is identified in the response to AQ 121 above.

SAFETY EVALUATION (SE) REVIEW OPEN ITEMS

SE 7

Review the Emergency Feedwater (EFW) building cooling strategy once it becomes available.

Response:

C-ME-050.05-007, Emergency Feedwater Facility (EFWF) HVAC Cooling, Heating, Airflow and Equipment Sizing Calculation, was made available for NRC review. The results of this calculation were used to determine the cooling and heating loads and airflow for the areas inside the EFWF so the HVAC equipment could be sized. The results show what the capacity of fans and electric unit heaters should be in order to meet the building environmental conditions. All spaces remain within the design conditions.

Enclosure
L-16-123

Final Integrated Plan
(132 Pages Follow)

FINAL INTEGRATED PLAN

DAVIS-BESSE NUCLEAR POWER STATION

September 2016

Table of Contents

1. Background

In 2011, an earthquake-induced tsunami caused Beyond-Design-Basis (BDB) flooding at the Fukushima Dai-ichi Nuclear Power Station in Japan. The flooding caused the emergency power supplies and electrical distribution systems to be inoperable, resulting in an extended loss of alternating current (AC) power (ELAP) in five of the six units on the site. The ELAP led to (1) the loss of core cooling, (2) loss of spent fuel pool cooling capabilities, and (3) a significant challenge to maintaining containment integrity. All direct current (DC) power was lost early in the event on Units 1 & 2 and after some period of time at the other units. Core damage occurred in three of the units along with a loss of containment integrity resulting in a release of radioactive material to the surrounding environment.

The US Nuclear Regulatory Commission (NRC) assembled a Near-Term Task Force (NTTF) to advise the Commission on actions the US nuclear industry should take to preclude core damage and a release of radioactive material after a natural disaster such as that seen at Fukushima. The NTTF report contained many recommendations to fulfill this charter, including assessing extreme external event hazards and strengthening station capabilities for responding to beyond-design-basis external events.

Based on NTTF Recommendation 4.2, the NRC issued Order EA-12-049 (Reference 2) on March 12, 2012 to implement mitigation strategies for Beyond-Design-Basis External Events (BDBEEs). The order provided the following requirements for strategies to mitigate BDBEEs:

1. Licensees shall develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment, and SFP cooling capabilities following a BDBEE.

2. These strategies must be capable of mitigating a simultaneous loss of all AC power and loss of normal access to the ultimate heat sink and have adequate capacity to address challenges to core cooling, containment and SFP cooling capabilities at all units on a site subject to the Order.

3. Licensees must provide reasonable protection for the associated equipment from external events. Such protection must demonstrate that there is adequate capacity to address challenges to core cooling, containment, and SFP cooling capabilities at all units on a site subject to the Order.

4. Licensees must be capable of implementing the strategies in all modes.

5. Full compliance shall include procedures, guidance, training, and acquisition, staging or installing of equipment needed for the strategies.

The order specifies a three-phase approach for strategies to mitigate BDBEEs:

- Phase 1 - Initially cope relying on installed equipment and on-site resources.
- Phase 2 - Transition from installed plant equipment to on-site BDB equipment
- Phase 3 - Obtain additional capability and redundancy from off-site equipment and resources until power, water, and coolant injection systems are restored or commissioned.

NRC Order EA-12-049 (Reference 2) required licensees of operating reactors to submit an overall integrated plan, including a description of how compliance with these requirements would be achieved by February 28, 2013. The Order also required licensees to complete implementation of the requirements no later than two refueling cycles after submittal of the overall integrated plan or December 31, 2016, whichever comes first.

The Nuclear Energy Institute (NEI) developed NEI 12-06 (Reference 3), which provides guidelines for nuclear stations to assess extreme external event hazards and implement the mitigation strategies specified in NRC Order EA-12-049. The NRC issued Interim Staff Guidance JLD-ISG-2012-01 (R01) (Reference 4), dated January 22, 2016, which endorsed NEI 12-06. Davis-Besse Nuclear Power Station (DBNPS) is committed to Revision 02 to NEI 12-06 without exception.

NRC Order EA-12-051 (Reference 5) required licensees to install reliable SFP instrumentation with specific design features for monitoring SFP water level. This order was prompted by NTTF Recommendation 7.1.

NEI 12-02 (Reference 6) provided guidance for compliance with Order EA-12-051. The NRC determined that, with the exceptions and clarifications provided in JLD-ISG-2012-03 (Reference 7), conformance with the guidance in NEI 12-02 is an acceptable method for satisfying the requirements in Order EA-12-051.

2016-06-24 L-16-122, Completion of Required Action by NRC Order EA-12-051 RSFP Instrumentation ML16176A244 was submitted to the NRC on June 24, 2016 documenting DBNPS compliance with NRC Order EA-12-051.

2. NRC Order 12-049 – Mitigation Strategies (FLEX)

2.1 General Elements

2.1.1 Assumptions

The assumptions used for the evaluations of a DBNPS ELAP/LUHS event and the development of FLEX strategies are stated below.

Boundary conditions consistent with NEI 12-06 Section 3.2.1, *General Criteria and Baseline Assumptions* are established to support development of flexible and diverse coping strategies (FLEX), as follows:

- The BDB external event occurs impacting DBNPS, a single unit site.
- The reactor is initially operating at power, unless there are procedural requirements to shut down due to the impending event. The reactor has been operating at 100% power for the past 100 days.
- The reactor is successfully shut down when required (i.e., all rods inserted, no anticipated transient without scram (ATWS)). Steam release to maintain decay heat removal upon shutdown functions normally, and reactor coolant system (RCS) overpressure protection valves respond normally, if required by plant conditions, and reseat.
- On-site staff is at site administrative minimum shift staffing levels.
- No independent, concurrent events, e.g., no active security threat.
- All personnel on-site are available to support site response.
- The reactor and supporting plant equipment are either operating within normal ranges for pressure, temperature and water level, or available to operate, at the time of the event consistent with the design and licensing basis.

The following plant initial conditions and assumptions are established for the purpose of defining FLEX strategies and are consistent with NEI 12-06 Section 3.2.1, *General Criteria and Baseline Assumptions*:

- No specific initiating event is used. The initial condition is assumed to be a loss of off-site power (LOOP) with installed sources of emergency on-site

AC power and station blackout (SBO) alternate AC power sources unavailable with no prospect for recovery.

- Cooling and makeup water inventories contained in systems or structures with designs that are robust with respect to seismic events, floods, and high winds and associated missiles are available. Permanent plant equipment that is contained in structures with designs that are robust with respect to seismic events, floods, and high winds and associated missiles, are available. The portion of the fire protection system that is robust with respect to seismic events, floods, and high winds and associated missiles is available as a water source.

- Normal access to the ultimate heat sink (UHS) is lost, but the water inventory in the UHS remains available and robust piping connecting the UHS to plant systems remains intact. The motive force for UHS flow, i.e., pumps, is assumed to be lost with no prospect for recovery.

- Fuel for BDB equipment stored in structures with designs that are robust with respect to seismic events, floods and high winds and associated missiles, remains available.

- Installed Class 1E electrical distribution systems, including inverters and battery chargers, remain available since they are protected.

- No additional accidents, events, or failures are assumed to occur immediately prior to or during the event, including security events.

- Reactor coolant inventory loss consists of unidentified leakage at the upper limit of Technical Specifications, reactor coolant letdown flow (until isolated), and reactor coolant pump (RCP) seal leak-off at normal maximum rate.

- For the spent fuel pool, the heat load is assumed to be the maximum design basis heat load. In addition, inventory loss from sloshing during a seismic event does not preclude access to the pool area.

Additionally, key assumptions associated with implementation of FLEX Strategies are as follows:

- Exceptions for the site security plan or other (license/site specific) requirements of 10 CFR may be required.

- Deployment resources are assumed to begin arriving at hour 6 and fully staffed by 24 hours.

- This plan defines strategies capable of mitigating a simultaneous loss of all AC power and loss of normal access to the UHS resulting from a BDB event by providing adequate capability to maintain or restore core cooling, containment, and SFP cooling capabilities at all units on a site. Though specific strategies are being developed, due to the inability to anticipate all possible scenarios, the strategies are also diverse and flexible to encompass a wide range of possible conditions. These pre-planned strategies developed to protect the public health and safety have been incorporated into the unit emergency operating procedures in accordance with established emergency operating procedure (EOP) change processes, and their impact to the design basis capabilities of the unit evaluated under 10 CFR 50.59.

  The plant Technical Specifications contain the limiting conditions for normal unit operations to ensure that design safety features are available to respond to a design basis accident and direct the required actions to be taken when the limiting conditions are not met. The result of the BDB event may place the plant in a condition where it cannot comply with certain Technical Specifications and/or with its Security Plan, and, as such, may warrant invocation of 10 CFR 50.54(x) and/or 10 CFR 73.55(p). This position is consistent with the previously documented Task Interface Agreement (TIA) 2004-04, "Acceptability of Proceduralized Departures from Technical Specifications (TSs) Requirements at the Surry Power Station," (TAC Nos. MC4331 and MC4332), dated September 12, 2006 (Accession No. ML060590273).

2.2 Strategies

The objective of the FLEX Strategies is to establish an indefinite coping capability in order to 1) prevent damage to the fuel in the reactors, 2) maintain the Containment function and 3) maintain cooling and prevent damage to fuel in the SFP using installed equipment, on-site portable equipment, and pre-staged off-site resources. This indefinite coping capability will address an extended loss of all AC power (ELAP) – loss of off-site power, emergency diesel generators and any alternate AC source, but not the loss of AC power to buses fed by station batteries through inverters – with a simultaneous loss of access to the ultimate heat sink (LUHS). This condition could arise following external events that are within the existing design basis with additional failures and conditions that could arise from a BDBEE.

The plant indefinite coping capability is attained through the implementation of pre-determined strategies (FLEX strategies) that are focused on maintaining or restoring key plant safety functions. The FLEX strategies are not tied to any specific damage state or mechanistic assessment of external events. Rather, the strategies are developed to maintain the key plant safety functions based on the evaluation of plant response to the coincident ELAP/LUHS event. A safety function-based approach provides consistency with, and allows coordination with, existing plant EOPs. FLEX strategies are implemented in support of Emergency Operating Procedures (EOPs) using FLEX Support Guidelines (FSGs).

The strategies for coping with the plant conditions that result from an ELAP/LUHS event involve a three-phase approach:

- Phase 1 – Initially cope by relying on installed plant equipment and on-site resources.
- Phase 2 – Transition from installed plant equipment to on-site BDB equipment.
- Phase 3 – Obtain additional capability and redundancy from off-site equipment and resources until power, water, and coolant injection systems are restored.

The duration of each phase is specific to the installed and portable equipment utilized for the particular FLEX strategy employed to mitigate the plant condition.

The strategies described below are capable of mitigating an ELAP/LUHS resulting from a BDBEE by providing adequate capability to maintain or restore core cooling, containment, and SFP cooling capabilities at DBNPS. Though specific strategies have been developed, due to the inability to anticipate all possible scenarios, the strategies are also diverse and flexible to encompass a wide range of possible conditions. These pre-planned strategies developed to protect the public health and safety are incorporated into the DBNPS EOPs in accordance with established EOP change processes, and their impact to the design basis capabilities of the unit evaluated under 10 CFR 50.59.

2.3 Reactor Core Cooling and Heat Removal Strategy

Core cooling is maintained through natural circulation heat removal from the RCS via the Steam Generators (SG). Natural circulation is maintained by ensuring adequate RCS inventory to prevent voiding at the top of the RCS hot legs. Inventory is maintained initially in Phase 1 by limiting leakage (isolating Letdown and RCP Seal Return from the Control Room and crediting the actual demonstrated RCP seal performance during testing) to minimize RCS losses. Heat rejection through the SGs is maintained by manually starting (from the Control Room) the diesel driven Emergency Feedwater pump (EFWP) taking a suction on the Emergency Feedwater Storage Tank (EFWST) and providing inventory initially to SG1 and later with operator action to include SG2. The size of the EFWST allows makeup to be delayed until in Phase 2 while still ensuring a continuous suction source.

DC bus load shedding in accordance with DB-OP-02704, Extended Loss of AC Power DC Load Management will ensure 2P battery life is extended to 14.6 hours as described in Calculation C-EE-002.01-016, Station Battery Discharge Analysis for Beyond Design Basis Events. The FLEX 480 volt generator will be used to repower installed station battery chargers prior to battery depletion.

RCS makeup and boron addition from the Borated Water Storage Tank (BWST) or from the Clean Waste Receiver Tank 1 (CWRT) will be initiated within 4.5 hours to ensure natural circulation, reactivity control, and boron mixing is maintained.

2.3.1 Phase 1 Strategy

Following the occurrence of an ELAP/LUHS event, the reactor will trip and the plant will initially stabilize at post trip RCS temperature and pressure conditions, with reactor decay heat removal via steam release to the atmosphere through the Main Steam Safety Valves and later with manual operator action, via the Atmospheric Vent Valves (AVVs) using the installed remote hand wheels. Core cooling is maintained through natural circulation heat removal from the RCS via the SGs. Natural circulation is maintained by ensuring adequate RCS inventory to prevent voiding at the top of the RCS hot legs. Inventory is maintained initially by limiting leakage (isolating Letdown and RCP Seal Return per EOP DB-OP-02700, Station Blackout, and crediting the actual demonstrated RCP seal performance during testing) to minimize RCS inventory losses. Refer to Calculation C-ME-064.02-263, Reactor Coolant System Makeup Requirements for FLEX for additional information. The basis for the seal leakage assumption is supported by the N-9000 seal performance documented in Flowserve Station Blackout Testing N-9000 Seal. The evaluation of plant performance for this seal leakage is documented in Topical Report 17792.

Secondary - Heat rejection through the SGs is maintained by ensuring operation of the diesel driven EFWP, initially to SG1 and later with operator action to include SG2 in accordance with EOP DB-OP-02700, Station Blackout. The size of the EFWST allows makeup to be delayed until in Phase 2 while still ensuring a continuous suction source as documented in C-ME-050.05-001, Emergency Feedwater Storage Tank Capacity for Decay Heat and Sensible Heat Removal. Refer to Figures 3 through 5, Emergency Feedwater Figures for additional information on the EFW System.

It should be noted that the Turbine Driven Auxiliary Feedwater (TDAFW) pumps at DBNPS could be credited for all external hazards discussed in NEI 12-06; however, the Condensate Storage Tanks (CSTs), which provide suction to the TDAFW Pumps, are not seismically qualified or missile protected. If the CSTs are available following the BDBEE, both TDAFW Pumps will start automatically on loss of all AC power, and would be used to provide makeup to the SGs until CST inventory is exhausted, TDAFW Pumps are lost due to a lack of ventilation or other issues, or steam pressure is too low to operate the TDAFW Pumps. When the TDAFW Pumps are lost, the operators will switch to SG makeup via the EFW system in accordance with EOP DB-OP-02700, Station Blackout. If the TDAFWP is in service, its continuous performance may require operator action to establish adequate TDAFW Pump room ventilation as directed by DB-OP-02725, Control Room and Miscellaneous Habitability Actions. Should establishing temporary ventilation not be adequate or timely such that the Auxiliary Feedwater (AFW) system fails, the EFW system would then be used to provide inventory to the SGs. When the EFWP is used, its continuous performance is ensured via the installed Emergency Feedwater Facility (EFWF) Ventilation System, which will maintain the room within the ranges required by the EFWF equipment and documented in C-ME-050.05-007, Emergency Feedwater Facility HVAC, Cooling, Heating, Airflow and Equipment and Sizing Calculation.

Electrical and Instrumentation - The Phase 1 electric coping strategy is to maintain DC power to critical systems and essential instrumentation. This direction was based on Abnormal Operating Procedure (AOP) DB-OP-02521 Loss of AC Bus Power Sources actions which have been moved to a new EOP, DB-OP-02700, Station Blackout, and FSG DB-OP-02704, ELAP DC Load Management.

Selected DC loads are removed from service to extend the availability of Station Battery 2P and associated DC and Instrument AC Buses to provide power. DC Power from Battery 2P will allow powering Instrument AC Bus Y2, which will support required instrumentation loads. Load shed activities start at T+15 minutes following the loss of all AC power and are completed by T+60 minutes. These strategies include venting hydrogen from the Main Generator to reduce the risk of fire when the Seal Oil System is shutdown or lost. These strategies are supported by calculation C-EE-002.01-16, Station Battery Discharge Analysis for Beyond Design Basis Events. DBBP-OPS-1113, Control of Time Sensitive Operator Actions includes two Operator actions for load shedding the DC buses, the first completed within 30 minutes of the start of the ELAP and final actions within 60 minutes. DC bus load shedding will ensure 2P battery life is extended to 14.6 hours as described in Calculation C-EE-002.01-016 R1, Station Battery Discharge Analysis for Beyond Design Basis Events. Although a 480 volt FLEX generator will repower battery chargers prior to battery depletion, direction is provided to transition to Battery 1P if Battery 2P is lost or depleted which will provide required instrument loads for an additional 15.4 hours. In addition, FSG DB-OP-02707, Loss of DC Power, provides direction to use portable meters to obtain key parameter information during a loss of all AC and DC Power.

2.3.2 Phase 2 Strategy

In Phase 2, core cooling is continued to be maintained through natural circulation heat removal from the RCS via the SGs, which receive feedwater from the CST via the TDAFWPs for all events in which the CST is available. Where the CST may not be available (e.g., seismic or high wind events), feedwater is provided from the EFWST via the EFWP. Once an essential 480 switchgear (E1 or F1) has been restored using the FLEX 480 volt generator in the EFWF (as directed by FSG DB-OP-02721, Restore 480 Volt Power to E1 and F1), RCS inventory addition and pressurizer heaters can be restored to allow a subcooled, two loop natural circulation cooldown of the RCS to begin.

To ensure that the core is maintained subcritical, borated water injection into the RCS is provided from the BWST when available or from CWRT 1 which provides the protected borated water source via the RCS FLEX Charging Pumps. RCS Injection will begin within 2.5 hours after the start of the event in accordance with FSG DB-OP-02701, Long Term RCS Inventory Control. The RCS FLEX Charging and associated Booster pumps, pre-staged in the Auxiliary Building, are powered from the 480 V FLEX Generator via cables installed by the operators. The BWST is not protected from high wind missiles. As a result, DBNPS investigated various options for providing a protected source of borated water for all conditions and established Clean Waste Receiver Tank 1 as the protected borated source of inventory. For all events, Clean Waste Receiver Tank 1, borated to 2600 – 2800 ppm boron with a minimum of 80,000 gallons available will provide a protected source. The Borated Water Storage Tank will provide the preferred source of borated water for all events except high winds/tornados. Refer to Calculation C-ME-064.02-263, RCS Makeup Requirements for FLEX for additional information. Selection of the source of borated water is controlled by EOP DB-OP-02700, Station Blackout and implemented by FSG DB-OP-02701, Long Term RCS Inventory Control or FSG DB-OP-02714, Shutdown RCS Makeup if the plant was initially in Mode 5 or 6.

This RCS injection also compensates for continued RCS leakage, enabling refill of the RCS and allowing Pressurizer level to be maintained. Power is restored to a 480 volt Essential Bus E1 or F1 in accordance with FSG DB-OP-02721, Restore Power to E1 and F1. Once power is available, a bank of Essential Pressurizer Heaters are then restored in accordance with FSG DB-OP-02724, Restore Pressurizer Heaters to Service. Establishing an injection source and Pressurizer Heater control will allow the two loop subcooled natural circulation cooldown (preferred) of the RCS to begin. RCS Cooldown will begin within 4.5 hours after the event at 30°F/hr to an RCS temperature of 320-350°F. Starting RCS Cooldown is included as a Time Sensitive Operator Action in DBBP-OPS-1113, Time Sensitive Operator Actions.

In the event that a two loop natural circulation cooldown of the RCS cannot be performed, the RCS Cooldown will begin as an asymmetric single loop RCS Cooldown as directed by EOP DB-OP-02700, Station Blackout. This asymmetric cooldown was developed in WCAP-17792-P, Emergency Procedure Development Strategies for the Extended Loss of AC Power Event for all Domestic Pressurized Water Reactor Designs. An asymmetric, or single-SG Cooldown, will allow coping for up to 48 hours with no RCS makeup. An asymmetric cooldown involves cooling down using SG1 as the only active loop and establishing SG2 as an idle loop (i.e., steam and feedwater isolated). As RCS pressure is reduced, voids will form in the idle loop. Inventory from the idle loop (with inventory from the pressurizer) will accommodate RCS losses from RCP Seals.

During the RCS cooldown, EOP DB-OP-02700, Station Blackout directs that if Core Flood Tank (CFT) injection is likely or in progress, then initiate FSG DB-OP-02710, CFT Isolation – Venting. This FSG prevents undesired injection of CFT inventory into the RCS when RCS inventory is available via the RCS FLEX Charging Pumps. If not isolated or vented, injection would begin when RCS pressure is reduced below Core Flood Tank Pressure which is normally 600 psig. The FSG provides direction to either vent the CFTs to remove the nitrogen overpressure, or to close the CFT Isolation valves. Power to operate the CFT Isolation valves would be available when 480 volt essential buses E1 and F1 are restored as described above prior to RCS Cooldown.

When heat rejection through the SGs is maintained via the TDAFWP, actions must be taken to establish adequate ventilation to maintain the TDAFWP room within the ranges required by the equipment contained therein. Providing ventilation is directed in FSG DB-OP-02725, Control Room and Miscellaneous Habitability Actions. In accordance with NEI 12-06 FLEX pump diversity requirements, connections are available for two Alternate Low Pressure EFW (Alt LP EFW) Pumps (N and N+1) to back-up the installed EFW Pump.

Phase 2 activities will also include action to initiate pumped refill of the EFWST. EFWST refill from various alternate inventory sources is provided to ensure a continued suction source is available to the EFWP or Alt LP EFW pump. Directions to refill the EFWST are provided by FSG DB-OP-02706, EFW Storage Tank Makeup. A minimum of 16 hours is available to initiate refill of the EFWST as determined by Calculation C-ME-050.05-001, EFW Storage Tank Capacity for Decay Heat and Sensible Heat Removal.

Maintaining indications and control requires maintenance of battery power, which is extended by use of the 480V FLEX generator in accordance with FSG DB-OP-02721, Restore 480v Power to E1 and F1. This FSG is used to repower an essential 480v switchgear. Restoration of power will allow charging the station batteries, restoring a bank of essential pressurizer heaters, and supporting the electrical needs of other equipment described above. This generator is also used to establish forced ventilation circulation in the battery rooms required once battery recharge operations are initiated to maintain conditions within the ranges required by the equipment contained therein. Instrument function and control room habitability require further action beyond that taken in Phase 1. FSG DB-OP-02725, Control Room and Miscellaneous Habitability Actions provides direction to establish required ventilation. Refer to Calculation C-ME-099.25-001, Auxiliary Building Room Temperatures during an ELAP, for additional information.

In order to deploy FLEX equipment during Phase 2 for use in Phase 2 or 3, debris removal activities may need to be initiated and partially completed, in order to effectively deploy equipment to the appropriate staging location as directed by FSG DB-OP-02705, Initial Assessment and FLEX Equipment Staging. Portable light stands can be deployed to planned Operations areas and along deployment routes also directed by FSG DB-OP-02705, Initial Assessment and FLEX Equipment Staging.

2.3.3 Phase 3 Strategy

In Phase 3, core cooling is continued to be maintained through natural circulation heat removal from the RCS via the SGs. RCS inventory and sub-criticality are adequately maintained via the Phase 2 strategies. Heat rejection through the SGs is continued to be maintained via the EFW Pump, TDAFW

Pumps, or the Alt LP EFW Pumps. Indefinite coping is successfully established once a transition from SG cooling to Decay Heat Removal (DHR) system cooling is complete. Phase 3 deployments of a large National SAFER Response Center (NSRC) supplied pump capable of providing an alternate motive force to the water located in the Ultimate Heat Sink (UHS) allows restoration of Service Water (SW). This is accomplished in accordance with FSG DB-OP-02722, Restore Service Water during an ELAP. Diversity is provided by the ability to recover either train of Service Water for cooling the Component Cooling Water (CCW) system and subsequently the Decay Heat Removal (DHR) System. Refer to C-NSA-011.01-021, FLEX Service Water Flowrate Analysis, for information on Service Water Flow requirements. Restoration of 4160 Essential Buses C1 or D1 using generators from NSRC in accordance with FSG DB-OP-2723, Restore Power to C1 and D1, will provide the electrical power necessary to operate the Component Cooling Water (CCW) and Decay Heat Removal (DHR) Systems.

2.3.4 Systems, Structures, Components

2.3.4.1 Emergency Feedwater pump

DBNPS has two TDAFWP, each capable of taking steam from and providing feedwater to either SG. The TDAFW pumps at DBNPS could be credited for all external hazards discussed in NEI 12-06; however, the Condensate Storage Tanks (CSTs), which provide suction to the TDAFWPs, are not seismically qualified nor missile protected. SW would normally provide the safety grade source of water for the TDAFWPs, but SW cannot be used to respond to these BDBEEs. The TDAFWPs which start automatically on loss of all AC power, would be used to provide makeup to the SGs if the CST is available until CST inventory is exhausted, the TDAFW Pumps are lost due to a lack of ventilation or other issues, or steam pressure is too low to operate the TDAFWPs in accordance with EOP DB-OP-02700, Station Blackout. At this point, operators will switch to SG makeup via the EFW system.

The TDAFW Pumps are not credited for any FLEX response. For events other than Seismic or High Winds/Tornado, SG inventory may initially be provided by either one or both trains of TDAFWPs; however, for Seismic or High Wind/Tornado events or other events that result in the subsequent loss of the TDAFW Pumps (including insufficient ventilation, etc.), SG inventory will be provided initially to SG1 and later to both SGs following manual operator action by the Diesel Driven EFWP from the EFWST.

DBNPS constructed a new EFWF to support the site's FLEX mitigation strategy. The EFWF is designed to meet applicable beyond design basis external hazards. The new facility is comprised of a dedicated water source (EFWST), a high-head diesel-driven EFWP and associated piping to deliver water to the SGs, an Alt LP EFW Pump including the inside connection points to the EFW system, a diesel oil storage tank to provide fuel oil for diesel driven loads, and a FLEX 480 Volt AC generator.

The diesel driven EFWP can be started from the Control Room during a loss of all AC power. The system includes a flow control valve that can be used from the Control Room to control flow from the EFW Storage Tank to SG1. It is expected that upon a loss of all AC power and the failure of both trains of AFW (loss of CST and no Service Water) the operators will start the EFW Pump to provide inventory to SG1 within 10 minutes as directed by EOP DB-OP-02000, RPS, SFAS, SFRCS Trip or SG Tube Rupture, Specific Rule 4, and by EOP DB-OP-02700, Station Blackout. This action is included as a Time Sensitive Operator Action in DBBP-OPS-1113, Time Sensitive Operator Actions.

The EFW System includes cross tie capability that with manual operator action in the field, inventory can also be provided to SG2 to allow a symmetric RCS Cooldown as directed by EOP DB-OP-02700, Station Blackout. This cross tie capability will be established within 1.5 hours after the start of the event. This action is also included as a Time Sensitive Operator Action in DBBP-OPS-1113, Time Sensitive Operator Actions. Calculation C-NSA-063.01-016, Refill of a Dry SG addresses adding inventory to a dry SG. In addition, the EFW System can be used to provide makeup inventory to the Spent Fuel Pool to accommodate boiling and loss of inventory in the SFP as directed by FSG DB-OP-02711, Alternate SFP Makeup.

The EFW System includes the EFWST to provide a suction source for the EFW Pump and the Alt LP EFW Pumps. The tank, at normal level, has an available volume of 290,500 gallons and at the minimum level required by NORM-LP-7202, Davis Besse Specifications for FLEX Equipment Out of Service, 226,670 gallons are available. This minimum level will allow operation of the EFW Pump at maximum expected use rate without replenishing the tank for a minimum of 16 hours. As determined by Calculation C-ME-050.05-001, EFW Storage Tank Capacity for Decay Heat and Sensible Heat Removal, to meet cooldown and core decay heat removal loads and to provide makeup of SFP boil off, a maximum of 284,500 gallons of EWST inventory would be required for the first 23 hours of the event. That level would be 0.60 ft below the normal EWST level described above. Therefore, for the Mode 1 limiting case, replenishment actions required to sustain EFW operation are not needed until 23 hours after a Beyond Design Basis External Event (BDBEE) with an Extended Loss of AC Power (ELAP).

2.3.4.2 Atmospheric Vent Valves (AVVs)

During an ELAP / LUHS event with the loss of all AC power and instrument air, reactor core cooling and decay heat will be removed from the SGs initially by the lifting of the Main Steam Safety Valves (MSSVs). Each DBNPS Steam Generator has two MSSVs set at 1050 psig and seven additional MSSVs set at 1100 psig. Approximately 45 minutes after the start of the event, an operator will establish manual control of the AVVs with a local manual reach rod in accordance with EOP DB-OP-02700, Station Blackout to maintain SG pressure constant, and below the lowest MSSV lift pressure setpoint (approximately 980 – 1020 psig). Local manual reach rod control does not require electrical power or instrument air to operate the valve. Manual control will provide for an indefinite coping time period by opening/throttling the SG AVVs to remove core decay heat. The Operator at the AVVs will be able to communicate with the Control Room initially using radios and then the Sound Powered Phone System. The SG AVV's are missile protected, seismically qualified valves. The Atmospheric Vent Valves will also be used to cooldown the Reactor Coolant System to establish DHR System operation in Phase 3.

2.3.4.3 Station Batteries

Construction

As noted in SD-007, System Description for 125/250 VDC and 120 V Instrumentation AC System, the safety related batteries and associated DC and Instrument AC distribution systems (including battery charges and inverters) are located within the Auxiliary Building, a safety related structure designed to meet all applicable design basis external hazards. The Station Batteries are assembled using Exide Technologies Industrial Energy GNB Flooded Classic NCN Nuclear Class 1E Battery Cells.

Each of the four station batteries consists of 60 cells connected in series and mounted on a seismically qualified two-step steel rack. The cells are lead-calcium type, with each cell made up of 21 plates (10 positive and 11 negative plates) contained in a styrene-acryl nitric clear plastic jar with a plastic cover. The positive-plate material is retained by fiberglass mats. The assembled cells are rated at approximately 1500 ampere-hour capacity at 8-hour discharge rate to an end voltage of 1.75 V per cell. The electrolyte is a dilute solution of sulfuric acid and water with a nominal specific gravity of 1.215 at 77°F. Each cell has a sediment space of 1-1/16 inches below the bottom of the plates. Each cell is equipped with an electrolyte withdrawal tube. The cell posts have floating Oring and seal nuts to effectively seal against leakage of electrolyte. The intercell connectors are lead-plated copper bars. Each of the two-end cells of each battery is provided with terminal plates and lugs to accept four 500 kcmil cables per pole for external connection to 125/250 V DCMCC.

The battery sizing calculation for the station batteries for design basis use is C-EE-002.01-010. The minimum design temperature (used for sizing the batteries) is 60°F. There is no upper temperature limit for battery sizing or performance. Table 5.5-2 of the calculation does address expected performance of the station battery (Service Test) for a range of temperature from 60F to 100F (note that expected battery terminal voltage increases as temperature increases). Temperature above 77°F causes accelerated aging of the batteries but improves performance (battery voltage at a given load). The absolute upper battery temperature limit would be 120°F where damage to battery plastic could start to occur. FSG DB-OP-02725, Control Room and Miscellaneous Habitability Actions provides actions to establish ventilation to maintain battery temperature as required.

Station Battery Use

Station Batteries will be used to initially power required key instrumentation and applicable DC components. DBBP-OPS-1113, Control of Time Sensitive Operator Actions includes two Operator actions for load shedding the DC buses, the first completed within 30 minutes of the start of the ELAP and final actions within 60 minutes. Load shedding provides an estimated service time of approximately 14.6 hours of operations on Battery 2P (during the 1 hour to complete load shedding and then an additional 13.6 hours). Restoration of Station Battery Chargers will be completed within 4.5 hours after the loss of all AC power. In addition, Battery 1P would be available for 15.4 hours if required as directed by FSG DB-OP-02704, Extended Loss of AC Power DC Load Management if station battery chargers are not returned to service for any reason. Refer to Calculation C-EE-002.01-016, Station Battery Discharge Analysis for Beyond Design Basis Events for additional information. Load shedding is included as a Time Sensitive Operator Action in DBBP-OPS-1113, Time Sensitive Operator Actions.

2.3.4.4 Diesel Driven Fire Pump and Fire Protection Piping

The Diesel Driven Fire Pump is located within a safety related structure, therefore protected against applicable design basis external events; however, it takes a suction on the UHS and portions of the fire protection piping are not seismic category I, nor tornado missile protected and therefore determined to not be robust as defined in NEI 12-06. The Fire Protection system is not credited in the DBNPS FLEX response.

2.3.4.5 Condensate Storage Tanks

The CSTs normally provide an AFW water source at the initial onset of the event, however, the CSTs are not seismic category 1 nor tornado missile protected. As a result, the CSTs are not credited in the DBNPS FLEX response. For FLEX, the EFWST provides the typical CST function.

2.3.4.6 Service Water Reservoir

The UHS for DBNPS is Lake Erie, which is the source of cooling water for the SW system. This single water source is utilized for both normal and emergency shutdown conditions. Lake Erie water is conducted through the intake water system to the intake structure, where the service water pumps are located.

An open forebay area ahead of the intake structure serves as a reservoir for an ensured source of water in case of an extreme lowering of the lake due to meteorological conditions or collapse of the intake canal or submerged pipes.

USAR Section 9.2.5.1 Loss of Intake Canal provides the following for loss of the Intake Canal:

> *"The most severe natural phenomenon, which will cause partial loss of the ultimate heat sink, is a loss of the intake canal due to an earthquake. Since the intake canal is categorized as Seismic Class II beyond approximately 700 feet from the intake structure, it has been postulated that the intake from the lake collapses as well as an incredible collapse of the sides of the Seismic Class II portion of the intake canal. All water flow from the lake to the intake canal was assumed stopped. The seismic class II intake canal collapse was assumed to leave one-third of the water surface area and one-third of the water volume from the seismic class II portion of the intake canal.*
>
> *The water stored in the intake canal forebay below elevation 562 feet will provide sufficient cooling surface to continue cooling the station by evaporation for at least 30 days. However, it is estimated that 14 days should provide sufficient time to reestablish direct water flow communication between the lake and the station intake structure via the intake water system."*

2.3.5 FLEX Equipment and Connections

Detailed FLEX Equipment design information is provided in NORM-LP-07204, Davis Besse FLEX Strategy Design & Equipment Bases Detail.

2.3.5.1 ALT LP EFW Pump (N) and Connections

The EFWP is treated as installed plant equipment for FLEX. As a result, DBNPS provides two Alt LP EFW Pumps (N and N+1) in addition to the installed EFWP.

The ALT LP EFW Pump (N) is a diesel driven pump stored in the EFWF together with the required suction and discharge hoses for connection to provide SG injection from the EFWST as directed by EOP DB-OP-02700, Station Blackout and FSG DB-OP-02703, Alternate Low Pressure Emergency Feedwater. The pump is staged inside the EFWF and takes a suction on the EFWST using a flexible hose via suction valve EF27 located inside the EFWF. The discharge of the ALT LP EFW Pump (N) connects to the EFW System via a flexible hose at discharge valves EF46 also located inside the EFW Facility. The injection of water to the SGs uses the EFW System including EF8, EFW Flow Control Valve. Refer to Figures 3 through 5 Emergency Feedwater Figures, for additional information.

2.3.5.2 ALT LP EFW Pump (N+1) and Connections

In the event that the EFW Pump and the ALT LP EFW Pump (N) or connections are not available, a second ALT LP EFW pump (N+1) and connection points are provided.

The ALT LP EFW Pump (N+1) is a diesel driven pump stored in Service Building 7 (SB7) to provide SG inventory as directed by EOP DB-OP-02700, Station Blackout and FSG DB-OP-02703, Alternate Low Pressure Emergency Feedwater. The pump would be towed and staged outside the EFWF and aligned to take a suction on the EFWST using a flexible hose via suction valve EF29. The discharge of the ALT LP EFW Pump (N+1) is manually aligned to the EFW System via a flexible hose at discharge valves EF47. The injection of water to the SGs uses the EFW System including EF8, EFW Flow Control Valve.

Refer to Figures 3 through 5: Emergency Feedwater Figures for additional information.

2.3.5.3 Alternate Flowpath for ALT LP EFW Pumps

In order to improve diversity, in addition to the N and N+1 flowpaths described above, an additional flowpath is available as directed by FSG DB-OP-02703, Alternate Low Pressure Emergency Feedwater. Located in Mechanical Penetration Room 3, EFW Piping includes existing branch connection for SFP Makeup from EFW. This branch connection is located downstream of the point where EFW piping splits. An isolation valve has been added to this line to create train separation for an alternate SG Injection point at the existing SFP Makeup connection.

If conditions warrant use of this additional injection flowpath, an ALT LP EFW Pump (N or N+1) would be deployed to a blowout panel outside the Auxiliary Building Mechanical Penetration Room 3. Approximately 100 feet of discharge hose would be required to connect the pump to this additional connection point. A replenishment pump would be deployed to a surviving water sources other than EFWST, and the discharge line would be connected to the suction side of the ALT LP EFW Pump. Y-Manifold valves would be utilized to prime the line and control pressure to the Alt EFW Pump. Refer to Figure 5, Diverse Connections for Alt LP EFW Pump for additional information. The remaining replenishment pump would be deployed to supply makeup inventory to the SFP as necessary.

2.3.5.4 Emergency Condensate Storage Tank (ECST) – Not utilized at DBNPS

The DBNPS FLEX response does not include an alternate suction source for the TDAFWPs such as an ECST. The EFW System including the EFWST previously described provides the source of inventory for the SGs and the SFP.

2.3.5.5 RCS FLEX Charging Pumps and Connections

To ensure that the core is maintained subcritical and to provide contraction volume in support of the planned RCS cooldown, borated water injection into the RCS is provided from the BWST, when available, or from CWRT1. CWRT1 provides a protected borated water source for all events via the RCS FLEX Charging and associated Booster Pumps. RCS Injection will begin within 2.5 hours after the start of the event in accordance with FSG DB-OP-02701, Long Term RCS Inventory Control. The CWRT and BWST RCS FLEX Charging and associated Booster pumps are powered from the 480 VAC FLEX Generator via cables installed by the operators in accordance with EOP DB-OP-02700, Station Blackout and FSG DB-OP-02701, Long Term RCS inventory Control. Refer Figure 8, RCS Makeup Connections for system drawing and additional information.

Placing a RCS FLEX Charging Pump into service requires deployment of 480 volt AC power cables to the motor and connection of suction and discharge hoses. Two 60 gpm capacity RCS FLEX Charging Pumps are available. One pump is staged in the Auxiliary Building near the supply line from the BWST and the other is staged near CWRT1. Each of the FLEX RCS Charging pumps can be aligned to take a suction from either the BWST or the CWRT and to discharge to the RCS via either HPI Train 1 or HPI Train 2. Alignment of the electrical power cable and the suction and discharge hoses are included as a

Time Sensitive Operator Action in DBBP-OPS-1113, Time Sensitive Operator Actions.

2.3.5.6 CWRT1 RCS FLEX Charging Pump and Connections

The CWRT RCS FLEX Charging Pump and associated Booster Pump is pre-staged in the Auxiliary Building Room 124, Clean Waste Receiver Tank Room, on the 545' elevation. The pump would normally be aligned to take a suction from Clean Waste Receiver Tank 1 using a flexible suction hose via WC808, FLEX RCS Makeup. The pump would then discharge via a flexible hose to the RCS via the High Pressure Injection System Train 2 using HP 213, HP214, and either HP 2A or 2B as directed by FSG DB-OP-02701, Long Term RCS Inventory Control. To improve diversity, this FLEX Charging Pump can be aligned using flexible hoses to take a suction from the BWST and discharge to the RCS via Train 1 High Pressure Injection. Alignment of the CWRT RCS FLEX Charging Pump is included as a Time Sensitive Operator Action in DBBP-OPS-1113, Time Sensitive Operator Actions.

2.3.5.7 BWST RCS FLEX Charging Pump and Connections

The BWST RCS FLEX Charging Pump and associated Booster Pump is pre-staged in the Auxiliary Building Room 100 on the 545' elevation. The pump would normally be aligned to take a suction from the BWST using a flexible suction hose via DH 210, FLEX RCS Makeup. The pump would then discharge via a flexible hose to the RCS via the High Pressure Injection System Train 1 using HP 211, HP212, and either HP 2C or 2D as directed by FSG DB-OP-02701, Long Term RCS Inventory Control. To improve diversity, this FLEX Charging Pump can be aligned using flexible hoses to take a suction from CWRT1 and discharge to the RCS via High Pressure Injection Train 2. Alignment of the BWST RCS FLEX Charging Pump is included as a Time Sensitive Operator Action in DBBP-OPS-1113, Time Sensitive Operator Actions.

2.3.5.8 BWST and CWRT Suction Connections for RCS Injection

The BWST is located outside Containment and the Auxiliary Building. It contains a minimum of 500,100 gallons at 2600 - 2800 ppm boron in solution as required by Technical Specification 3.5.4 and is used both for emergency core injection and filling the refueling canal during refueling. The BWST is seismic Class 1, but is not protected from tornados or high wind hazards.

CWRT1 is located inside the Auxiliary Building and therefore protected from Tornados/high winds. Calculation C-CSS-T15-1 was initiated to determine if CWRT1 (T15-1) is seismically adequate for all design bases seismic loads. This calculation documented the review of CWRT1 using the Seismic

Qualification Utility Group (SQUG) Generic Implementation Procedure (GIP) for Seismic Verification of Nuclear Plant Equipment. This process determined that following modification of one pipe support and one conduit support per ECP 13-0463, CWRT (T15-1) is seismically adequate for design bases seismic loads. As a result, CWRT1 will be available as a suction source for RCS Makeup. To meet the FLEX RCS inventory requirement, CWRT1 will be maintained at a minimum of 80,000 gallons of inventory borated to 2600 – 2800 ppm boron in Modes 1-4.

A suction for the CWRT and BWST RCS FLEX Charging Pumps is available from the BWST using a pre-staged flexible suction hose via DH 210, FLEX RCS Makeup. A suction for the CWRT and BWST RCS FLEX Charging Pumps is available using pre-stage flexible hose from CWRT1 via WC808, FLEX RCS Makeup. These suction hoses are then run to the desired FLEX RCS Charging Pump. All of this equipment is pre-staged in the Auxiliary Building.

2.3.5.9 <u>"N" Electrical Connection</u>

480 volt AC is used to operate the CWRT and BWST RCS FLEX Charging Pumps and the Essential 480 volt buses E1 and/or F1 to return Station loads such as Essential Pressurizer Heaters, Station Battery Chargers, and ventilation systems to service. Refer to Figure 11, FLEX Electrical Distribution for additional information.

The "N" FLEX 480 volt AC generator is a 850 kW Turbine Marine Generator and is pre-staged inside the EFWF including support systems such as fuel oil, ventilation, power cables, and exhaust. Operator action in accordance with FSG DB-OP-02721, Restore Power to E1 and F1 installs deployable cable from the generator to ZSR5005 (also inside the EFWF), which is then hard wire connected to the MCC BYS07 via breaker BYS0702. BYS0702 is Kirk Key Interlocked with the normal power supply breaker for the EFW Facility BYS0701. MCC BYS07 distributes power from the generator to the EFW Facility and various FLEX loads:

- CWRT RCS FLEX Charging Pump and associated booster pump - MCC breaker BSY0718 is hard wire connected to ZSR1802 traveling underground from the EFWF to the Auxiliary Building Room 100. From ZSR1802, a deployable cable is used to provide power to the CWRT RCS FLEX Charging Pump (P296-2) and associated booster pump motors as directed by FSG DB-OP-02701, Long Term RCS Inventory Control. Electrical alignment of a RCS FLEX Charging Pump within 150 minutes from the ELAP is included as a Time Sensitive Operator Action in DBBP-OPS-1113, Time Sensitive Operator Actions.

- BWST RCS FLEX Charging Pump and associated booster pump - MCC breaker BSY0717 is hard wire connected to ZSR1801 traveling underground from the EFWF to the Auxiliary Building Room 100. From ZSR1801, a deployable cable is used to provide power to the BWST RCS FLEX Charging Pump (P296-1) and associated booster pump motors as directed by FSG DB-OP-02701, Long Term RCS Inventory Control. Electrical alignment of a RCS FLEX Charging Pump within 150 minutes from the ELAP is included as a Time Sensitive Operator Action in DBBP-OPS-1113, Time Sensitive Operator Actions.

- Essential 480 volt MCC E1 – MCC breaker BSY0719 is hard wire connected to ZSR3601 traveling underground from the EFWF to High Voltage Switchgear Room B (HVSG-B). From ZSR3601, a deployable cable routed through a penetration between High Voltage Switchgear Room A (HVSG-A) and HVSG-B is used to provide power to ZSR3602 located in HVSG-A. ZSR3602 is hard connected to 480 volt essential switchgear E1 via breaker BE114 located in the Low Voltage Switchgear Room 429. FSG DB-OP-02721, Restore 480 volt power to E1 and F1 provides direction for restoring power to E1 including load shedding of E1 to prevent potential overload prior to restoring power. Restoring power to a 480 volt AC essential bus within 150 minutes from the ELAP is included as a Time Sensitive Operator Action in DBBP-OPS-1113, Time Sensitive Operator Actions.

- Essential 480 volt MCC F1 – MCC breaker BSY0719 is hard wire connected to ZSR3601 traveling underground from the EFWF to HVSG-B. From ZSR3601, a deployable cable is used to provide power to ZSR3603. ZSR3603 is hard connected to 480 volt essential switchgear F1 via breaker BF106 located in the LVSG Room 428. FSG DB-OP-02721, Restore 480 volt power to E1 and F1 provides direction for restoring power to F1 including load shedding of F1 to prevent potential overload prior to restoring power. Restoring power to a 480 volt AC essential bus within 150 minutes from the ELAP is included as a Time Sensitive Operator Action in DBBP-OPS-1113, Time Sensitive Operator Actions.

2.3.5.10 <u>(“N+1”) Electrical Connections</u>

The “N+1” FLEX 480 Volt Generator is an 850 kW Turbine Marine Generator stored in Service Building 7. Prior to use, the generator is towed to just outside the EFWF (FLEX Staging Area 1) or to just outside the Auxiliary Building HVSG Rooms (FLEX Staging Area 2) depending on desired use, using one of two

Debris Removal and Towing Vehicles as directed by FSG DB-OP-02705, Initial Assessment and FLEX Equipment Staging.

Once positioned outside the EFWF, Operator action in accordance with FSG DB-OP-02721, Restore Power to E1 and F1 installs deployable cable from the "N+1" 480 volt FLEX generator to ZSR5005 (inside the EFWF), which is then hard wire connected to the MCC BYS07 via breaker BYS0702. BYS0702 is Kirk Key Interlocked with the normal power supply breaker for the EFW Facility BYS0701. MCC BYS07 distributes power from the "N+1" 480 volt AC generator to the EFW Facility and the CWRT and BWST RCS FLEX Charging Pumps and Essential 480 volt MCC E1 and F1 as described above.

Once positioned outside the HVSG Rooms, power may be supplied from N+1 480 VAC FLEX generator through deployable cables to ZSR3601 as directed by FSG DB-OP-02721, Restore 480v Power to E1 and F1. Once power is available to ZSR3601, the power may be aligned to the following:

- ZSR3602 as directed by FSG DB-OP-02721, Restore 480v Power to E1 and F1 to provide power to essential 480 volt MCC E1,
- ZSR3603 as directed by FSG DB-OP-02721, Restore 480v Power to E1 and F1 to provide power to essential 480 volt MCC F1.
- MCC BYS07 in the EWF via breaker BSY0719 which is hard wire connected to ZSR3601 traveling underground from the High Voltage Switchgear Room B (HVSG-B) to the EFWF. MCC BYS07 distributes power from generator to the EFW Facility and various FLEX loads including the CWRT and BWST RCS FLEX Charging Pumps as described above.
- In order to improve diversity, an additional electrical flowpath is available to provide 480 volt AC power to the CWRT and BWST RCS FLEX Charging Pumps from the N+1 480 volt generator staged outside the HVSG Rooms. In the event of a failure of MCC BYS07 in the EFWF, as directed by FSG DB-OP-02721, Restore 480v Power to E1 and F1, power can be backfed from ZSR3601 to ZSR3803 jumpering around MCC BYS07 to ZSR3801 (hard wired to ZSR1801) or ZSR3802 (hard wired to ZSR1802). This flowpath provides additional diversity for an MCC failure that would still provide a path to the CWRT and BWST RCS FLEX Charging Pumps.

2.3.6 Key Reactor Parameters

Instrumentation providing the following key parameters is credited for all phases of the reactor core cooling and decay heat removal strategy. The instruments available depend on which Station Battery is in service. FSG DB-OP-02704, Extended Loss of AC Power DC Load Management, provides Attachment 3, Severe Load Shed Monitoring Plant Conditions which lists the instruments that will be available depending on the station battery in service. With Battery 2P in service via DC MCC D2P and Instrument Bus Y2 (expected), the following instruments will be available in the Control Room:

- Safety Features Actuation System (SFAS) Channel 2 provides BWST Level, Containment Pressure and RCS Pressure.
- Reactor Protective System (RPS) Channel 2 provides Source Range Nuclear Instrumentation, RCS Temperatures, and RCS Pressure.
- Steam Feed Rupture Control System (SFRCS) Channel 2 provides SG Level for BOTH Steam Generators.
- Post-Accident Monitoring (PAM) Cabinet Channel 2 provides Containment Pressure, RCS Pressure, Nuclear Instrumentation, RCS Temperatures, Incore Thermocouples, and SG1 Level and AFW 2 Flow.
- RCS Hot Leg Level Monitoring which provides indication of RCS Level when the RCS is not full condition is used to control inventory addition rates as described in FSG DB-OP-02714, Shutdown RCS Makeup. RCS Level is available from the Control Room and from a local cabinet as directed by FSG DB-OP-02707, Loss of DC Power.

The following indications that are not dependent on Station Batteries will also be available:

- SFP Level Primary Indication (LI4801A) and Backup (LI4801B) will be on battery backup (72 hour battery capacity).
- Emergency Feedwater Flow
- Emergency Feedwater Storage Tank Level

All of the above instrumentation is available prior to and after load stripping of the DC and AC buses during Phase 1. Availability during Phases 2 and 3 is dependent on the strategy to re-power the essential 480 VAC buses including the Class 1E battery chargers and associated Instrument AC Buses, however, instrumentation is available depending on which Station Battery (1P, 2P, 1N, and 2N) and associated Instrument AC Bus (Y1, Y2, Y3, and Y4) is in service. FSG DB-OP-02704 provides direction to transition from one battery in service to an alternate battery in the event that restoration of power is delayed.

Portable Beyond Design Basis equipment is supplied with the local instrumentation needed to operate the equipment. The use of these instruments is detailed in the associated FSG or the FLEX Support Operator Aid (FSOA) for use of the equipment. These procedures are based on inputs from the equipment suppliers, operation experience, and expected equipment function in an ELAP.

In the unlikely event that Station DC or 120 volt AC Instrument Bus infrastructure is also damaged, alternate FSG direction for obtaining the critical parameters locally is provided in DB-OP-02707, Loss of DC Power. The procedure provides two strategies for obtaining instrument readings:

- This FSG provides direction to use a portable (120 volt AC) generator to restore power to the Non-Nuclear Instrumentation (NNI) System OR the Reactor Protective System (RPS). The goal is to restore the selected RPS Channel and NNI Channel to service prior to the total loss of DC power (due to an ELAP event), and the inability to supply station battery chargers via a FLEX 480v Generator. Restoring portable power to RPS and NNI will provide the ability to monitor key RCS and SG parameters until a dedicated FLEX source is available.

- This FSG also provides directions for obtaining alternate readings for parameters vital to the FLEX strategy, which may have failed even if robustly constructed. These alternate readings will be obtained at the transmitter or as close as reasonably possible to the transmitter.

2.3.7 Thermal Hydraulic Analyses

2.3.7.1 Secondary Analysis

The EFW System including the EFWST design was finalized in ECP 13-0195 and Calculation C-ME-050.05-001, EFW Storage Tank Capacity for Decay Heat and Sensible Heat Removal. This calculation determined the storage capacity requirement for the EFWST. Calculation C-NSA-050.05-001, Emergency Feedwater System Assessment, provides an assessment of the DBNPS EFW Systems ability to deliver water to SG1 for several different system alignments. This calculation concludes that the EFW System can provide sufficient feedwater flow to exceed the decay heat removal requirements for the highest SG pressures that could exist. C-NSA-000.00-025, Auxiliary Feedwater and Emergency Feedwater System Model, documents the development of the DBNPS EFW

System PROTO-FLO model used to analyze EFW System performance in response to BDBEE including ELAP events.

A BDBEE/ELAP which begins during Mode 1 is the limiting case for EFWST capacity. The mitigation strategy assumes a natural circulation cooldown from the Mode 1 conditions to the Mode 4 entry temperature (T < 280°F) within approx. 17 hours of the event.

In addition to supporting core cooling following a BDBEE/ELAP, the EFWST inventory serves as a makeup water source for Spent Fuel Pool (SFP) boil off. If a seismic event were to fail non-seismic piping in the Fuel Pool Cooling System, a drain down of the SFP to El. 596.56 ft. could result. For this worst-case initial SFP condition for a BDBEE/ELAP, boil off would commence no sooner than 7.9 hours into the event. Without any makeup, for this initial condition, it would take at least 45 hours for the SFP level to boil off to 9.5 ft. above the top of the irradiated fuel.

To meet cooldown and core decay heat removal loads and to provide makeup of SFP boil off, a minimum usable volume of 226,670 gallons is maintained in the EFWST as required by NORM-LP-7202, Davis Besse Specifications for FLEX Equipment Out of Service. This minimum level exceeds the 221,420 gallons required to allow operation of the EFW Pump at maximum expected use rate without replenishing the tank for a minimum of 16 hours as determined by Calculation C-ME-050.05-001, EFW Storage Tank Capacity for Decay Heat and Sensible Heat Removal. Therefore, for the Mode 1 limiting case, replenishment actions required to sustain EFW operation are not needed for at least 16 hours after a BDBEE with an ELAP.

A similar calculation is available for the installed Condensate Storage Tanks which are not credited in the FLEX response. C-NSA-037.01-001 determined inventory requirements for the Condensate Storage Tanks (CST) to maintain the Steam Generators in hot standby with a subsequent cooldown to 280°F following a Loss of Offsite Power Event. Technical Specification 3.7.6 requires a minimum usable volume of 270,300 gallons be maintained in the CST although typically almost twice that volume is available.

2.3.7.2 RCS Analysis

Calculation C-ME-064.02-263, Reactor Coolant System Makeup Requirements for FLEX, was utilized to determine the RCS Makeup requirements for FLEX for the preferred two loop natural circulation cooldown. Selection of the source of borated water is controlled by EOP DB-OP-02700, Station Blackout, and implemented by FSG DB-OP-02701, Long Term RCS Inventory Control. In the event that a two loop natural circulation cooldown of the RCS cannot be performed as directed by EOP DB-OP-02700, Station Blackout, the RCS

Cooldown will begin as an asymmetric single loop RCS Cooldown. This asymmetric cooldown was developed in WCAP-17792-P, Emergency Procedure Development Strategies for the Extended Loss of AC Power Event for all Domestic Pressurized Water Reactor Designs. An asymmetric, or single-SG Cooldown, will allow coping for up to 48 hours with no RCS makeup. An asymmetric cooldown involves cooling down using SG1 as the only ACTIVE loop and establishing SG2 as an IDLE loop (i.e., steam and feedwater isolated). As RCS pressure is reduced, voids will form in the IDLE loop. Inventory from the idle loop together with inventory from the pressurizer will accommodate RCS losses from RCP Seals.

WCAP-17601, section 5.3.3.3 discusses the analysis of an asymmetric cooldown, which is the scenario that would produce the longest time to loss of natural circulation when RCS makeup is not available. The goal of this section was to "prolong natural circulation for as long as possible". The use of the asymmetric cooldown was simulated up to 48 hours for the Raised Loop plant like DBNPS. The analysis determined that the core did not become uncovered during the 48 hours analyzed. The resultant plots show adequate core cooling throughout the 48 hours.

WCAP-17792 evaluated coping strategies without RCS makeup, including the use of an asymmetric cooldown to prolong natural circulation. This conservative analysis determined the time when natural circulation would be lost if an asymmetric cooldown were not initiated. This analysis produced a 6 hour time limit for DBNPS to establish RCS Makeup or initiate an asymmetric circulation cooldown as directed by the Asymmetric Cooldown Criteria provided in DB-OP-02700, Station Blackout. The initiation of the asymmetric cooldown would delay the onset of BCC for a significant timeframe. RCS Cooldown will begin within 4.5 hours of the BDBEE.

For some Mode 5 and 6 scenarios that involve boiling in the core and venting steam to atmosphere (RCS initially not full), long term replenishment will make use of both borated and non-borated inventory sources. Calculation C-ME-064.02-263, Reactor Coolant System Makeup Requirements for FLEX describes the strategy for using borated water to sufficiently borate the core and then using non-borated water to maintain RCS level and prevent boron precipitation from blocking flow channels in the fuel. BWST gravity fill of the RCS effectiveness for greater than 2.5 hours in all plant conditions where Steam Generators are not available was confirmed in Calculation C-NSA-060.05-017, Gothic Mode 5 Analysis during Loss Decay Heat Removal. During Phase 1, borated inventory from the BWST (if available) or the SFP is provided to the core in accordance with FSG DB-OP-02714, Shutdown RCS Makeup. In Phase 2, inventory from CWRT1 and the EFWST will be used. AOP DB-OP-02527, Loss of Decay Heat Removal and DSG DB-OP-02714, Shutdown RCS Makeup provide implementing direction for these strategies. Establishing gravity fill of the RCS from the BWST or the SFP within 20 minutes is included as a Time Sensitive Operator Action in DBBP-OPS-1113, Time Sensitive Operator Actions.

2.3.8 Reactor Coolant Pump Seals

DBNPS is a B&W raised two loop NSSS plant with two RCPs per loop using N-9000 RCP seals. RCP seal leakage is a pressure dependent function that affects RCS Makeup requirements as evaluated by calculation C-ME-064.02-263, Reactor Coolant System Makeup Requirements for FLEX. To preserve RCS inventory, the RCP Seal Return Flowpath is isolated within 10 minutes as directed by EOP DB-OP-02700, Station Blackout. This action is included as a Time Sensitive Operator Action in DBBP-OPS-1113, Time Sensitive Operator Actions. The basis for the seal leakage assumption was validated in Flowserve's letter to FirstEnergy dated December 7, 2015. N-9000 seal performance is documented in Flowserve Station Blackout Testing N-9000 Seal. The impact of the expected RCP Seal Leakage and other leakage into Containment is evaluated in Calculation C-NSA-060.05-018, FLEX Mode 1 Containment Response Analysis with 10 GPM Leak.

The evaluation of plant performance for this seal leakage is documented in Topical Report 17792. The B&W ELAP response was performed using RELAP5/Mod 2-B&W. This computer code is approved for use for LOCA analyses in Topical Report BAW-10192PA Rev. 0. The ELAP transient is essentially a small break Loss of Coolant Accident (SBLOCA) due to the RCP seal leakage. ELAP conditions fall within the approved range of applicability for use of this computer code. RELAP5 has been approved in BAW-10192 for SBLOCA analysis.

2.3.9 Shutdown Margin Analysis

Thermal hydraulic analysis to validate RCS injection from the BWST or from CWRT1 borated to 2600 to 2800 ppm Boron at 6 hours after the ELAP event will adequately maintain subcriticality will be required for each operating cycle based on the planned core for the subsequent operating cycle. For cycle 20, the first operating cycle after FLEX implementation, calculation C-NF-062.02-048, DB Cycle 20 ELAP Shutdown Margin Analysis, documents the completed analysis. This analysis concluded that the cycle 20 core will remain sub-critical with significant shutdown value margin, at any point in the operating cycle, following an ELAP event and a plant cooldown by injecting water with a minimum boron concentration of 2600 ppm boron.

2.3.10 FLEX Pumps and Water Supplies

2.3.10.1 FLEX Alternate Low Pressure EFW Pumps

Consistent with NEI 12-06, Appendix D, SG water injection capability is provided using portable ALT LP EFW Pumps (N and N+1) through primary and alternate connections in the EFW System as directed by FSG DB-OP-02703, Alternate Low Pressure Emergency Feedwater. The Alt LP EFW pumps (N and N+1) are 495 gpm (at 405.7 psid) trailer-mounted, diesel driven, centrifugal pumps. The "N" Alt LP EFW Pump is pre-staged and protected in the EFWF. The "N+1" Alt LP EFP Pump is stored in SB 7 and towed to the staging location outside the EFWF as required. The pumps will be staged per FSG DB-OP-02705, Initial Assessment and FLEX Staging. They will be placed in Service per FSG DB-OP-02703, Alternate LP Emergency Feedwater. The EFW System contains Primary and Alternate connection points to supply EFWST inventory to the ALT LP EFW Pumps and to receive the discharge from the ALT LP EFW pumps. Refer to Figures 3 through 5, Emergency Feedwater Figures, for additional information.

In order to improve diversity, in addition to the Primary and Alternate SG Injection Flow Paths, an additional flowpath is available as directed by FSG DB-OP-02703, Alternate Low Pressure Emergency Feedwater. Located in Mechanical Penetration Room 3, EFW Piping includes existing branch connection for SFP Makeup from EFW. This branch connection is located downstream of the point where EFW piping splits. An isolation valve has been added to this line to create train separation for an alternate SG Injection point at the existing SFP Makeup connection.

If conditions warrant use of this additional injection flowpath, an ALT LP EFW Pump (N or N+1) would be deployed to a blowout panel outside the Auxiliary Building Mechanical Penetration Room 3. Approximately 100 feet of discharge hose would be required to connect the pump to this additional connection point. A replenishment pump would be deployed to a surviving water sources other than EFWST, and the discharge line would be connected to the suction side of the ALT LP EFW Pump. Y-Manifold valves would be utilized to prime the line and control pressure to the Alt EFW Pump. Refer to Figure 5, Diverse Connections for Alt LP EFW Pump for additional information. The remaining replenishment pump would be deployed to supply makeup inventory to the SFP as necessary.

2.3.10.2 FLEX Replenishment and Spray Pumps

Two FLEX Replenishment and Spray Pumps are used to replenish the EFW Storage Tank and to spray the SFP if required. In addition, these pumps may be used to supply the suction of the Alt LP EFW Pumps as described above. These pumps are trailer mounted Godwin HL100M with a John Deere Diesel Driver, 920gpm at 165psi and 5gph fuel consumption, and a 100 gallon tank maintained greater than ½ full when stored. The two pumps and associated hoses and fittings for "N" stored in EFWF, and for "N+1" stored in SB7.

For the worst case, EFWST replenishment would be required 16 hours after the start of the event as determined by Calculation C-ME-050.05-001, EFW Storage Tank Capacity for Decay Heat and Sensible Heat Removal. FSG DB-OP-02706, EFW Storage Tank Makeup, Attachment 1 selects the Replenishment Pump and Attachment 3, EFW Storage Tank Makeup Water Sources includes a list of locations that could be available as potential Makeup Sources. The pumps, hoses, and connections required will depend on source selected and conditions that exist on site.

In addition, these pumps have adequate capacity and can be deployed within the time available to be used as alternate SFP makeup sources directed by FSG DB-OP-02711, Alternate SFP Makeup, Attachment 7, SFP Makeup Water Sources.

2.3.10.3 FLEX RCS Charging Pumps

FLEX RCS Charging Pumps are provided to allow inventory to be added to the RCS following a BDBEE. Two FLEX RCS Charging Pumps and associated Booster Pumps are provided. FLEX RCS Charging Pumps with FLEX RCS Charging Booster Pumps are capable of delivering 60 gpm each at approximately full RCS system pressure. FLEX RCS pump injection rate exceeds the RCS inventory control rate (considering RCS thermal volume changes and RCS discharge pressure). Both the CWRT and BWST FLEX RCS Charging Pump and associated FLEX RCS Booster Pump are integral to skids which also contains a motor and a variable frequency drive (VFD). The CWRT and BWST FLEX RCS Charging pumps are electrically driven with power supplied as previously described in Section 2.3.5.6 and Section 2.3.5.7 of this document.

The CWRT RCS FLEX Charging Pump (P296-2) and FLEX CWRT Booster Pump (P296-2B) is permanently staged in the Auxiliary Building at Elevation 545'- 0" in the CWRT1 Room (Room 124). The FLEX CWRT RCS Charging Pump 2 (P296-2) with FLEX CWRT RCS Booster Pump 2 (P296-2B) will normally provide RCS makeup utilizing CWRT1 (T15-1) also consists of pumps (P296-2 and P296-2B), valves, piping, hose and high pressure connections. The hard piped suction tie-in point is on line 4"-HSC-96, upstream of valve WC145 (Room 125). A penetration containing hard piping has been created between Rooms 124 and 125 to support the FLEX mitigation strategy. Hose will connect the hard piped tie-in to the penetration piping and separately from the penetration piping to the booster pump inlet. The booster pump discharge will connect to the charging pump suction via hose. The charging pump outlet discharges via high pressure hose normally connected to a point on the HPI discharge line, 4"-CCB-2, downstream of valve HP25 (Room 115). A penetration containing hard piping has been created between Rooms 115 and 124. Hoses will be used to connect the charging pump outlet to the penetration piping and separately from the penetration piping to the tie-in point. For testing and recirculation, the charging pump outlet is connected via high pressure hose to piping which ties into existing CWRT return line, 3"-HSC-3, upstream of WC160 (Room 124). The hose connection points are readily accessible after a BDBEE. To improve diversity, the CWRT RCS FLEX Charging Pump can be aligned to take a suction on the BWST and discharge to HPI Train 1.

The BWST RCS FLEX Charging Pump (P296-1) and FLEX BWST Booster Pump (P296-1B) are permanently pre-staged in the Auxiliary Building at Elevation 545'-0" in the Equipment and Pipe Chase (Room 100). A suction line to the booster pump will normally be connected via hose to the existing BWST suction line, 14"-HCB-2, downstream of valve DH210 (Room 100). The discharge of the booster pump will be connected via hose to the suction of the charging pump. The charging pump's discharge will connect via high pressure hose to an existing HPI discharge line, 4"-CCB-2, downstream of valve HP24 (Room 105). For testing and recirculation, the charging pump discharge can be connected via hose to piping which ties into the existing BWST recirculation line, 8"-HCC-37, downstream of valve DH68 (Room 100). The hose connection points are readily accessible after a BDBEE and for maintenance and testing. To improve diversity, the BWST RCS FLEX Charging Pump can be aligned to take a suction on CWRT1 and discharge to HPI Train 2.

2.3.10.4 EFW Water Supplies

Emergency Feedwater Storage Tank (T-89)

The EFWST is the protected water source for FLEX mitigation. The EFWST capacity requirement considers water volume supporting Core Cooling for up to 24 hours of decay heat removal with natural circulation cooldown from Mode 3 at Hot Leg temperature (about 606°F) to Mode 3 at 280°F. At a normal level of 334 inches, the tank contains an available volume of 290,500 gallons as described in Calculation C-ME-050.05-011, Tank Level Curve Calculation - Emergency Feedwater Facility Tanks.

The EFW System including the EFWST design was finalized in ECP 13-0195 and Calculation C-ME-050.05-001, Emergency Feedwater Storage Tank Capacity for Decay Heat and Sensible Heat Removal. This calculation determined the storage capacity requirement for the EFWST. The EFWST is located inside the EFWF. The EFWF is designed to meet applicable beyond design basis external hazards.

Replenishment of the EFWST is directed by FSG DB-OP-02706, EFW Storage Tank Makeup.

Ultimate Heat Sink

The UHS for DBNPS is Lake Erie, which is the source of cooling water for the SW system. This single water source is utilized for both normal and emergency shutdown conditions. Lake Erie water is conducted through the intake water system to the intake structure, where the service water pumps are located. An open forebay area ahead of the intake structure serves as a reservoir for an ensured source of water in case of an extreme lowering of the lake due to meteorological conditions or collapse of the intake canal or submerged pipes. FSG DB-OP-02722, Restore Service Water during an ELAP, provides direction to use equipment provided by the National SAFER (Strategic Alliance for FLEX Emergency Response) Center (NSRC) to restore the SW system allowing use of the inventory in the UHS.

USAR Section 9.2.5.1 Loss of Intake Canal provides the following for loss of the Intake Canal:

> *"The most severe natural phenomenon, which will cause partial loss of the ultimate heat sink, is a loss of the intake canal due to an earthquake. Since the intake canal is categorized as Seismic Class II beyond approximately 700 feet from the intake structure, it has been postulated that the intake from the lake collapses as well as an incredible collapse of the sides of the Seismic Class II portion of the intake canal. All water flow from the lake to the intake canal was assumed stopped. The seismic class II intake canal collapse was assumed to leave one-third of the water surface area and one-third of the water volume from the seismic class II portion of the intake canal.*
>
> *The water stored in the intake canal forebay below elevation 562 feet will provide sufficient cooling surface to continue cooling the station by evaporation for at least 30 days. However, it is estimated that 14 days should provide sufficient time to reestablish direct water flow communication between the lake and the station intake structure via the intake water system."*

Various other Tanks and Water Sources

Based on availability assessments completed as direct by FSG DB-OP-02705, Initial Assessment and Staging of FLEX Equipment, a makeup source for inventory to be supplied to the EFWST makeup sources is selected. FSG DB-OP-02706, EFW Storage Tank Makeup provides an attachment that contains a listing of on-site potential EFWST makeup water sources including open water sources such as the Training Center Pond. Tank capacities are listed, but BDBEE damage to the tanks or tank support equipment may require exploring alternate methods of acquiring the usable volume still contained in the tank (i.e., using tank or system breaches to deploy a submersible pump or suction line). Water sources are listed in preferred order of makeup usage based upon chemistry considerations and accessibility. Potential connection points are also listed to aid Technical Support Center guidance for discussions on usable inventories and retrieval possibilities. Refer to Table 3, Water Sources, for a list of potential water sources.

2.3.10.5 Borated Water Supplies

Two sources of borated water have been evaluated for use during a BDBEE. Each borated water source is discussed below, in order of preference. Each water source can be aligned to provide a suction source to either the CWRT or the BWST RCS FLEX RCS Charging Pumps.

- **Clean Waste Receiver Tank 1**: CWRT1 (T-15-1) is available to provide a suction source for the CWRT RCS FLEX RCS Charging Pumps. CWRT1 is a stainless Steel, tank located inside the Auxiliary Building, Room 124, on the 545' level and therefore protected from High Wind/Tornado generated missiles. The tank was originally constructed to be part of the Clean Liquid Radwaste System to allow processing and reuse of excess RCS inventory. Calculation C-CSS-T15-1 was initiated to determine if CWRT1 is seismically adequate for all design bases seismic loads. This calculation documented the review of CWRT1 using the Seismic Qualification Utility Group (SQUG) Generic Implementation Procedure (GIP) for Seismic Verification of Nuclear Plant Equipment. This process determined that following modification of one pipe support and one conduit support per ECP 13-0463, CWRT (T15-1) is seismically adequate for design bases seismic loads. During "at power" operations the CWRT1 borated volume will be maintained ≥ 80,000 gallons at a boron concentration between 2600 and 2800 ppm Boron. During Mode 5 and 6 operations with the RCS not full, CWRT1 borated volume will be maintained ≥ 62,000 gallons at a boron concentration between 2600 and 2800 ppm Boron.

- **Borated Water Storage Tank (BWST):** DBNPS has one BWST (T-10) located outdoors on the West side of the Auxiliary Building at grade level (585'). The tank is a stainless steel, safety-related, seismically qualified storage tank, but is not protected from High Wind/Tornado generated missiles. During "at power" operations the BWST borated volume is maintained ≥ 500,100 gallons and ≤ 550,000 gallons at a boron concentration between 2600 and 2800 ppm Boron in accordance with Technical Specification 3.5.4.

2.3.11 Electrical Analysis

The Phase 1 electric coping strategy is to maintain DC power to critical systems and essential instrumentation. This direction was based on DB-OP-02521 Loss of AC Bus Power Sources actions which have been moved to a new EOP DB-OP-02700, Station Blackout and FSG DB-OP-02704, ELAP DC Load Management.

Selected DC loads are removed from service to extend the availability of the selected Station Batteries and DC Buses to provide power. DBBP-OPS-1113, Control of Time Sensitive Operator Actions includes two Operator actions for load shedding the DC buses, the first completed within 30 minutes of the start of the ELAP and final actions within 60 minutes. These strategies including venting hydrogen from the Main Generator to reduce the risk of fire when the Seal Oil System is shutdown or lost. These strategies are supported by calculation C-EE-002.01-16, Station Battery Discharge Analysis for Beyond Design Basis Events.

For Phase 2, maintaining indications and control requires maintenance of battery power, which is extended by use of the 480 VAC FLEX generator in accordance with FSG DB-OP-02721, Restore 480v Power to E1 and F1. Refer to Figure 11, FLEX Electrical Distribution, for additional information. Two Turbine Marine Generators (850 kW), 110gph fuel consumption are available to restore 480v AC Power. The “N” 480 VAC FLEX generator is pre-staged in the EFWF and “N+1” 480 VAC FLEX generator is stored in SB7. Strategies for providing fuel oil necessary for diesel operations are described in Section 2.9.5 of this report. DBBP-OPS-1113, Control of Time Sensitive Operator Actions includes the Operator actions for restoring power to E1 or F1.

FSG DB-OP-02721, Restore 480v Power to E1 and F1 is used to repower an essential 480 volt switchgear. These safety related electrical MCC are located inside the LVSG Rooms inside the Auxiliary Building. The procedure directs removal of all loads (Attachments 1 and 2) prior to restoring power to control loading of the generator when power is restored. Color coded cables and connectors are used to assure proper phase rotation when power is restored. This FSG includes specific load information in Attachments 21 and 22 for all E1 and F1 loads that could be applied to the FLEX 480 VAC generator. Refer to Notification 600990890 for 3.2.4.8-A 480V & 4160V load lists/capacity calculations for additional loading information. Restoration of power will allow charging the station batteries, restoring a bank of essential pressurizer heaters, and supporting the electrical needs of other equipment described above. These generators are also used to establish forced ventilation circulation in the battery rooms required once battery recharge operations are initiated to maintain conditions within the ranges required by the equipment contained therein. Instrument function and Control Room habitability require further action beyond that taken in Phase 1. Refer to

Section 2.11 and 2.12 and Calculation C-ME-099.25-001, Auxiliary Building Room Temperatures during an ELAP, for additional information.

In order to deploy FLEX equipment during Phase 2 for use in Phase 2 or 3, debris removal activities may need to be initiated and partially completed, in order to effectively deploy equipment to the appropriate staging location. Portable light stands can be deployed as necessary to planned Operations areas and along deployment routes.

For Phase 3, additional replacement 480 VAC generators and 4kV diesel powered generators are available from the NSRC for the Phase 3 strategy. The specifications and ratings for this equipment are listed in Table 3, PWR Portable Equipment from NSRC. Restoration of essential 4160 volt power is directed by FSG DB-OP-02723, Restore Power to C1 and D1. The NSRC 4kv generator will be staged outside the HVSG room on the North Side of the Auxiliary Building. Color coded cables used to ensure proper phase rotation will be used to connect a generator to a breaker cart (refer to FSOA Support Operator Aid DB-OP-02753, 4160v Breaker Cart) that will be installed in place of the Emergency Diesel Generator Output Breakers (AC101 and AD101). Once the desired bus is powered, FSG DB-OP-02723, Attachment 5 provides the necessary loading information. Refer to Notification 600990890 for 3.2.4.8-A 480V & 4160V load lists/capacity calculations for additional loading information. The 4kv diesel powered generators from the NSRC will be used to provide power to the DHR System and the CCW System to allow establishing long term decay heat removal.

2.4 Spent Fuel Pool Cooling/Inventory

As described in USAR 9.1.2.1, *"The spent fuel pool facility is designed to assure the safe storage of irradiated fuel assemblies under normal and accident conditions. The spent fuel pool structure provides for the containment, confinement, and prevents significant reduction in coolant inventory under normal and accident conditions."* As noted in FSG DB-OP-02711, the DBNPS Spent Fuel Pool contains approximately 300,000 gallons of borated water. The basic FLEX strategy for maintaining SFP cooling is to monitor SFP level and provide makeup water to the SFP sufficient to maintain SFP level until SFP Cooling can be restored using equipment from the NSRC.

As a backup to the SFP cooling strategy described below, there is a capability to provide SFP spray by use of portable (Blitzfire) spray nozzles staged on the SFP deck. This strategy is described in Extensive Damage Mitigation Guideline (EDMG) DB-OP-02600, Operational Contingency Response Action Plan, and in FSG DB-OP-02711, Alternate Spent Fuel Pool Makeup. This is strictly a contingency capability required by NEI 12-06, and it is not an active part of the

FLEX SFP cooling strategy. It is not necessary to add borated water to maintain SFP Level. As provided in USAR Section 9.1.2.1 Spent Fuel Pool, Design Bases, the physical construction of the SFP Racks (Boral plates) will prevent criticality even if non-borated water is used to fill the SFP. Refer to Figure 12, Spent Fuel Pool Elevation Drawing for an elevational view of the Spent Fuel Pool.

2.4.1 Phase 1 Strategy

In all ELAP scenarios, SFP cooling is provided via inventory boil-off and replenishment. When the SFP cooling system function is lost, the SFP will begin to heat up and will eventually begin to boil which will effectively remove decay heat and adequately cool the stored fuel.

In Phase 1, action is taken in accordance with FSG DB-OP-02711, Alternate SFP Makeup to create a vent path to from the SFP area to the environment prior to the inventory in the SFP reaching boiling point. In addition, the hoses to provide SFP Makeup are pre-staged. Taking these actions prior to the SFP reaching the boiling point minimizes the impact of steam formation after SFP boiling begins. Also during Phase 1, makeup to the SFP can be provided via gravity-feed from the BWST as directed by System Operating Procedure DB-OP-06021, SFP Cooling System Operating Procedure, Section 4.12. If the BWST is available, it would be possible to establish SFP makeup, using installed equipment, however, if the BWST is not available, SFP makeup cannot be provided until Phase 2 is entered. This is acceptable because SFP makeup would not be required until significantly after Phase 2 equipment has become available, even for the most limiting case. The initial coping strategy for spent fuel pool cooling is to monitor spent fuel pool level using instrumentation installed as required by NRC Order EA-12-051 and directed by FSG DB-OP-02711, Alternate Spent Fuel Pool Makeup.

2.4.2 Phase 2 Strategy

In Phase 2, the SFP will heat to the boiling point and the level in the pool will begin to reduce. SFP makeup is established such that pool level is maintained above the top of the fuel throughout the event.

If the BWST is not available, SFP makeup can be provided from the EFWST using the EFW pump, through connections, to supply the FLEX SFP makeup header. The use of non-borated water from the EFWST is acceptable because the SFP storage rack design ensures subcriticality even with no boron concentration in the SFP water. The time available before makeup is required significantly exceeds the time it would take to establish makeup through this flowpath. Two diesel-driven FLEX Spray pumps will also be available in on-site storage locations. These pumps have adequate capacity and can be deployed within the time available to be used as alternate SFP makeup sources directed by FSG DB-OP-02711, Alternate SFP Makeup, Attachment 7, SFP Makeup Water Sources. The FLEX SFP makeup header is not completely missile protected due to insufficient robustness of the roll-up door in Room 300. Therefore, an alternate flow path is available which requires routing hoses from the selected makeup source connections directly to the SFP. Refer to Figure 13, Spent Fuel Pool Makeup Hose Routes, for additional information.

As a backup to the SFP cooling strategy described above, there is a capability to provide SFP spray by use of portable (Blitzfire) spray nozzles staged on the SFP deck. This is strictly a contingency capability required by NEI 12-06, and it is not an active part of the FLEX SFP cooling strategy. Direction for use of this strategy is directed by FSG DB-OP-02711, Alternate Spent Fuel Pool Makeup and by EDMG DB-OP-02600, Operational Contingency Response Action Plan.

2.4.3 Phase 3 Strategy

In Phase 3, the SFP is initially cooled via continued boil-off and makeup. Once equipment is received from the NSRC, SFP cooling will continue with the transition of makeup water from the NSRC pump supplying SW as directed by FSG DB-OP-02722, Restore Service Water during an ELAP. Restoration of SW and 4160 volt AC power to supply CCW and the DHR Systems as directed by FSG DB-OP-02723, Restore 4160 volt Power to C1 and D1, would allow use of the DHR System to provide SFP Cooling. When off-site power is restored to the station, the normal SFP Cooling System can be restored to service.

2.4.4 Structures, Systems, and Components

2.4.4.1 Primary Connection

The hose connection for the permanent, seismically designed primary emergency SFP make-up connection is located on an inside wall of the Fuel Handling Area. The FLEX makeup header is not completely missile protected due to insufficient robustness of the roll-up door in Room 300, Spent Fuel Pool Area. The primary emergency SFP make-up connection is sufficiently sized to maintain SFP level long term with the loss of SFP cooling and a maximum makeup rate of 70 gpm for SFP boil off as determined in Calculation C-ME-067.01-002, FLEX Spent Fuel Cooling and Makeup Hydraulics.

This new makeup header for the FLEX SFP Cooling allows for connection of flexible hoses from either makeup source; the EFW System (using the EFW Pump or an Alt LP EFW Pump) or from the FLEX SW Connection to provide a minimum of 70 gpm to the new SFP makeup piping installed in the SFP area and finally to the SFP. This is accomplished by routing hoses from EF48, EFW TO SFP MAKE-UP THROTTLE VALVE (located MPR3), to Primary SFP Makeup Header (SFP

Train Bay SE corner 585' level). Once connected, throttle valve EF48 is opened, as necessary to maintain SFP level and maintain pressure less than 50 psig on PIEF44, EFW TO SFP MAKEUP as directed by FSG DB-OP-02711, Alternate Spent Fuel Pool Makeup. As directed by the procedure, an indicated pressure of 40 psig provides approximately 70 gpm makeup flow to the SFP. Refer to Section 2.3.4 Structures, Systems, and Components for further information on the Emergency Feedwater System.

2.4.4.2 Alternate Connections

Emergency Feedwater

In the event the piping or hose connection for the permanent, seismically designed primary emergency SFP make-up connection located on an inside wall of the Fuel Handling Area is not available, FSG DB-OP-02711, Alternate SFP Makeup, provides direction to connect flexible hoses from either makeup source; the EFW System (using the EFW Pump or an Alt LP EFW Pump) or from the FLEX SW connection to provide a minimum of 70 gpm via fire hoses to the 603 elevation of the SFP Area and direct the flow of water from those hoses into the SFP. This is accomplished by routing hoses from EF48, EFW TO SFP MAKE-UP THROTTLE VALVE (located MPR3), to the top of the SFP on the 603' level. Once connected, valve EF48 is opened, as necessary to maintain SFP level and maintain pressure less than 50 psig on PIEF44, EFW TO SFP MAKEUP as directed by FSG DB-OP-02711, Alternate Spent Fuel Pool Makeup. As directed by the procedure, an indicated pressure of 40 psig provides approximately 70 gpm makeup flow to the SFP.

Service Water

FSG DB-OP-02711, Alternate Spent Fuel Pool Makeup provides a method to use inventory from SW to maintain SFP level. The attachment assumes the NSRC SW Pump is used to provide motive force. This attachment requires SW Loop 1 to be aligned. The FSG aligns SW via hoses from SW291, SERVICE WATER SUPPLY TO CAC 1 CHECK VALVE TEST CONNECTION (located SE Corner of MPR4), to Primary SFP Makeup Header (SFP Train Bay SE corner 585' level). In addition, in the event the piping or hose connection for the permanent, seismically designed primary SFP make-up connection is located on an inside wall of the Fuel Handling Area is not available, FSG DB-OP-02711, Alternate SFP Makeup provides direction to connect flexible hoses to the 603' elevation of the SFP Area and direct the flow of water from those hoses into the SFP.

Other Water Sources

FSG DB-OP-02711, Alternate Spent Fuel Pool Makeup, provides direction to use inventory from any available water source to provide SFP Makeup to maintain SFP Level. This FSG provide a list of water sources in a preferred order. This could include inventory from the Circulating Water Canal, the UHS, the Training Center Pond, or any other water source at Command SRO's direction. The FSG makes no assumptions about the pump being used to deliver the inventory, therefore pump selection must ensure sufficient pump head is available to pump water from the inventory source to the 603' level for delivery into the SFP.

2.4.4.3 Ventilation

Ventilation requirements to prevent excessive steam accumulation in the SFP Area is included in an existing AOP DB-OP-02547, Spent Fuel Pool Cooling Malfunctions, as well as FSG DB-OP-02711, Alternate SFP Makeup. These procedures direct the operators to open rollup Door 300 or Door 301 in the SFP Area to establish a steam release path to the environment. Airflow through these doors provides adequate vent pathways through which the steam generated by SFP boiling can exit the SFP Area of the Auxiliary Building. In addition, floor drains in the SFP Area are covered in Phase 1 to prevent condensing steam or any water leakage from draining into Emergency Core Cooling Room 1 sump as directed by FSG DB-OP-02711, Alternate SFP Makeup.

2.4.5 Key Parameter

The key parameter for the SFP Make-up strategy is the SFP water level. The SFP water level is monitored by the instrumentation that was installed in response to Order EA-12-051, Reliable Spent Fuel Pool level Instrumentation. SFP Level Primary Indication (LI4801A) and Backup (LI4801B) have internal battery backup (72 hour battery capacity). Alternative power will be provided within 72 hours as directed by FSG DB-OP-02705, Initial Assessment and FLEX Equipment Staging. Normal power for the Primary SFPLI (C5787A) is via MCC F11A, and for the Backup SFPLI (C5787B), it is via MCC F5. In addition, portable 120 volt AC generators can be used to provide power to either or both SFP Level indicators as directed by FSG DB-OP-02705, Initial Assessment and FLEX Equipment Staging. Refer to Figure 12, Spent Fuel Pool Elevation Drawing for an elevational view of the SFP.

2.4.6 Thermal-Hydraulic Analyses

Calculation CN-SEE-II-12-41, Determination of the time to Boil in the Davis-Besse Spent Fuel Pool after an Earthquake, evaluated Spent Fuel Pool conditions following a BDBEE included impact of sloshing. Four different scenarios were evaluated:

1) SFP at normal level (601.5'), with a normal heat load (i.e., all locations filled, including a normal refueling discharge batch size),

2) SFP at normal level, with a maximum heat load (i.e., all locations filled, including a full core offload),

3) SFP at a reduced level (596') due to a break of the non-seismic SFP cooling system piping, with a normal heat load, and

4) SFP at the reduced level, with a maximum heat load.

The best-case scenario is the case with a normal SFP level and a normal heat load. That case results in at least 8 hours as the time-to-boil, and an additional 41 hours of boil-off before level drops to 10' above the top of the fuel racks. This allows a total of approximately 49 hours before makeup water must be provided. The limiting, worst-case scenario is the case with a maximum SFP heat load and an initial loss of inventory, due to a non-seismic line break, down to a level of 596'. That case results in approximately 2.7 hours as the time-to-boil, and an additional 10 hours of boil-off before level drops to 10 feet above the top of the fuel racks. This allows a total of approximately 12.7 hours before makeup water must be provided. Under worst case SFP decay heat conditions, 70 gpm must be provided to the SFP to replace inventory lost due to boiling in order to maintain SFL level. Refer to Calculation C-ME-067.01-002, FLEX Spent Fuel Cooling and Makeup Hydraulics, for additional information on SFP Makeup Flow rate requirements.

2.4.7 FLEX Pumps and Water Supplies

FSG DB-OP-02711, Alternate Spent Fuel Pool Makeup, provides direction for utilizing FLEX and non-FLEX equipment to provide inventory to the Spent Fuel Pool following a BDBEE. The following is a description of the methods and sources available to provide SFP Makeup.

2.4.7.1 Emergency Feedwater Pump (Refer to 2.3.10.1)

DBNPS constructed a new EFWF to support the site's FLEX mitigation strategy. The EFWF is designed to meet applicable BDBEE. The new facility includes a dedicated water source (EFWST) and a high-head diesel-driven EFW Pump.

The Diesel Driven EFWP can be used to provide makeup inventory to the SFP, through primary and alternate connections in the EFW System as directed by FSG DB-OP-02711, Alternate Spent Fuel Pool Makeup. The EFW Pump is a diesel driven 11 stage centrifugal pump manufactured by Ruhrpumpen. The diesel driver is an 1800 rpm Caterpillar C27 engine. A gear box is used to match the operating speed of the diesel driver to the operating speed of the pump at 3600 rpm. Required NPSH is provided by the Emergency Feedwater Storage Tank without the need for booster pumps. Detailed FLEX Equipment design information is provide in NORM-LP-7204, Davis-Besse FLEX Strategy Design & Equipment Bases Detail.

2.4.7.2 FLEX Alternate Low Pressure EFW Pumps

FLEX Alternate Low Pressure EFW Pumps can be used to provide makeup inventory to the SFP, through primary and alternate connections in the Emergency Feedwater System as directed by FSG DB-OP-02711, Alternate Spent Fuel Pool Makeup. The ALT LP EFW Pumps (N and N+1) are 495 gpm (at 405.7 psid) trailer-mounted, diesel driven, centrifugal pumps. The “N” Alt LP EFWP is pre-staged and protected in the Emergency Feedwater Facility. The “N+1” Alt LP EFWP is stored in Service Building 7 (SB7) and towed to the staging location outside the EFWF as required. The pumps will be staged per DB-OP-02705, Initial Assessment and FLEX Staging. They will be placed in Service per FSG DB-OP-02703, Alternate LP Emergency Feedwater. Refer to Figures 3 through 5 for additional information.

2.4.7.3 FLEX Replenishment and Spray Pumps (Refer to 2.3.10.2)

FLEX Replenishment and Spray Pumps are used to replenish the EFW Storage Tank and to spray the SFP if required. These pumps are trailer mounted Godwin HL100M with a John Deere Diesel Driver, 920gpm at 165psi and 5 gph fuel consumption, and a 100 gallon tank maintained greater than ½ full when stored. The two pumps and associated hoses and fittings are stored with the “N” pump stored in EFWF, and “N+1” pump stored in SB7.

These pumps have adequate capacity and can be deployed within the time available to be used as alternate SFP makeup sources directed by FSG DB-OP-02711, Alternate SFP Makeup, Attachment 7, SFP Makeup Water Sources.

2.4.7.4 Spent Fuel Pool Water Sources (Refer to 2.15)

FSG DB-OP-02711, Alternate Spent Fuel Pool Makeup provides the direction necessary to select a water source for Makeup to the Spent Fuel Pool following a BDBEE.

Emergency Feedwater Storage Tank (T-89)

The EFWST is the protected water source for FLEX mitigation. The EFWST capacity requirement considers water volume supporting Core Cooling for up to 24 hours of decay heat removal with natural circulation cooldown from Mode 3 at Hot Leg temperature (about 606°F) to Mode 3 at 280°F.

The EFW System including the EFW Storage Tank design was finalized in ECP 13-0195 and Calculation C-ME-050.05-001, EFW Storage Tank Capacity for

Decay Heat and Sensible Heat Removal. This calculation determined the storage capacity requirement for the EFWST. The EFWST is located inside the EFWF. The EFWF is designed to meet applicable beyond design basis external hazards. Replenishment of the EFWST is directed by FSG DB-OP-02706, EFW Storage Tank Makeup.

Ultimate Heat Sink (UHS)

The UHS for DBNPS is Lake Erie, which is the source of cooling water for the service water system. This single water source is utilized for both normal and emergency shutdown conditions. Lake Erie water is conducted through the intake water system to the intake structure, where the SW pumps are located. An open forebay area ahead of the intake structure serves as a reservoir for an ensured source of water in case of an extreme lowering of the lake due to meteorological conditions or collapse of the intake canal or submerged pipes. FSG DB-OP-02722, Restore Service Water during an ELAP, provides direction to use equipment provided by the NSRC to restore the SW system allowing use of the inventory in the ultimate heat sink.

USAR Section 9.2.5.1 Loss of Intake Canal provides the following for loss of the Intake Canal:

"The most severe natural phenomenon, which will cause partial loss of the ultimate heat sink, is a loss of the intake canal due to an earthquake. Since the intake canal is categorized as Seismic Class II beyond approximately 700 feet from the intake structure, it has been postulated that the intake from the lake collapses as well as an incredible collapse of the sides of the Seismic Class II portion of the intake canal. All water flow from the lake to the intake canal was assumed stopped. The seismic class II intake canal collapse was assumed to leave one-third of the water surface area and one-third of the water volume from the seismic class II portion of the intake canal.

The water stored in the intake canal forebay below elevation 562 feet will provide sufficient cooling surface to continue cooling the station by evaporation for at least 30 days. However, it is estimated that 14 days should provide sufficient time to reestablish direct water flow communication between the lake and the station intake structure via the intake water system."

Various other Tanks and Water Sources

Based on availability assessments completed as directed by FSG DB-OP-02705, Initial Assessment and Staging of FLEX Equipment, and direction in FSG DB-OP-02711, Alternate Spent Fuel Pool makeup sources are selected for inventory to be supplied to the SFP and to the EFW Storage Tank. FSG DB-OP-02706, EFW

Storage Tank Makeup, provides an attachment that contains a listing of on-site potential EFWST makeup water sources including open water sources such as the Training Center Pond. Where applicable, tank capacities are listed, but BDBEE damage to the tanks or tank support equipment may require exploring alternate methods of acquiring the usable volume still contained in the tank (i.e., using tank or system breaches to deploy a submersible pump or suction line). Water sources are listed in preferred order of makeup usage based upon chemistry considerations, and accessibility. Potential connection points are also listed to aid Technical Support Center guidance for discussions on usable inventories and retrieval possibilities. Refer to Table 1, Water Sources for a list of potential water sources.

2.4.8 Electrical Analysis

The Spent Fuel Pool will be monitored by instrumentation installed in response to Order EA-12-051. The power for this equipment has backup battery capacity for 72 hours. Alternative power will be provided within 72 hours as directed by FSG DB-OP-02705, Initial Assessment and FLEX Equipment Staging. Normal power for the Primary SFPLI (C5787A) is via MCC F11A and for the Backup SFPLI (C5787B) it is via MCC F5. In addition, portable 120 volt AC generators can be used to provide power to either or both SFP Level indicators as directed by FSG DB-OP-02705, Initial Assessment and FLEX Equipment Staging.

2.5 Containment Integrity

Containment Design and Construction

As provided in USAR 3.8.2, Containment Structures, the containment for DBNPS consists of three basic structures: a steel containment vessel, a reinforced concrete Shield Building, and the internal structures. The Containment Vessel is a cylindrical steel pressure vessel with hemispherical dome and ellipsoidal bottom which houses the reactor vessel, reactor coolant piping, pressurizer, pressurizer quench tank and coolers, reactor coolant pumps, steam generators, core flooding tanks, letdown coolers, and normal ventilating system. It is completely enclosed by a reinforced concrete Shield Building having a cylindrical shape with a shallow dome roof. An annular space is provided between the wall of the Containment Vessel and the Shield Building, and clearance is also provided between the Containment Vessel and the dome of the Shield Building. The Containment Vessel and Shield Building are supported on a concrete foundation founded on a firm rock structure. With the exception of the concrete under the Containment Vessel there are no structural ties between the Containment Vessel and the Shield Building above the foundation slab. Above this there is unlimited freedom of differential movement between the Containment Vessel and the Shield Building. The containment internal structures are constructed of reinforced concrete and structural steel. These structures are isolated from the containment vessel by steel grating panels with sliding supports which allows free differential movement between the internal structures and the vessel. The internal structures are supported by the massive concrete fill within the Containment Vessel bottom head.

As provided in USAR Section 6.2.1.2.1 Design Parameters, the Containment Vessel design internal pressure, temperature, and free volume are:

- 36 psig (design) /40 psig (max)
- 264°F
- 2,834,000 ft3

Containment during an ELAP

With an ELAP initiated while DBNPS is in Modes 1-4, Containment cooling is lost for an extended period of time. Containment temperature and pressure will slowly increase. Structural integrity of Containment due to increasing Containment pressure will not be challenged during the first several weeks of a BDB ELAP event. However, even with no cooling in the containment building, temperatures in the Containment are expected to rise and could reach a point where continued reliable operation of key instrument transmitters might be challenged. Sections 2.5.6, Thermal-Hydraulic Analyses and Section 2.16, Shutdown and Refueling Modes Analysis, describe the impact on Containment for an ELAP initiated in Modes 5 or 6.

Conservative evaluations documented in Calculation C-NSA-060.05-018, FLEX Mode 1 Containment Response Analysis Due to 10 GPM RCS Leak, have concluded that Containment temperature and pressure will remain below Containment design limits and that key parameter instruments subject to the Containment environment will remain functional for a minimum of seven days. Therefore, actions to reduce Containment temperature and pressure and to ensure continued functionality of the key parameters will not be required immediately and will utilize off-site equipment and resources during Phase 3.

2.5.1 Phase 1

Containment function is not challenged early in the event; therefore, no actions are required in Phase 1 in support of containment function.

The Containment strategy depends upon the plant conditions when the ELAP event occurs. If the plant is at power or shutdown, but with SGs available for core cooling, Operators will ensure Containment integrity is established or maintained through closure of Containment isolation valves as directed by FSG DB-OP-02715, Containment Isolation and Closure. Analysis has shown that no actions or systems are needed to ensure continued Containment function for any of these scenarios. Containment pressure and temperature both remain acceptable, at relatively low values, without any active Containment cooling. Refer to Calculation C-NSA-060.05-018, FLEX Mode 1 Containment Response Analysis Due to 10 GPM RCS Leak, for additional information.

2.5.2 Phase 2

Phase 2 will be a continuation of the scenarios discussed for Phase 1. If the SGs are available, no Containment cooling is needed and Containment Isolation is confirmed using DB-OP-02715, Containment Isolation, as resources permit. If the SGs are not available, the RCS is vented to Containment and Containment is vented to the atmosphere through the Emergency Hatch per DB-OP-02712, Alternate Containment Cooling. This will ensure Containment pressure and temperature remain acceptable with no further action.

2.5.3 Phase 3

Containment function is not expected to be challenged even later in the event; however, long term seal leakage into Containment will cause pressure and temperature to rise. Phase 3 deployments of a large pumps from the NSRC capable of providing an alternate motive force to use the inventory in the Ultimate Heat Sink will be connected to the Service Water System as directed by FSG DB-OP-02722, Restore Service Water during an ELAP. In addition, restoration of power to E1 and F1 as directed by FSG DB-OP-02721, Restore Power to E1 and F1, will allow operation of the Containment Air Cooler Fans. Restoration of Service Water flow and electrical power for fan operations will provide heat rejection capability for the Containment Air Cooler to establish Containment cooling as directed by FSG DB-OP-02712, Alternate Containment Cooling.

2.5.4 Structures, Systems, Components

2.5.4.1 Ventilation Strategy

The DBNPS FLEX Strategies do not require the use of Ventilation in Containment. Containment conditions are addressed by restoration of the installed Containment Air Coolers as described above.

2.5.4.2 Spray Strategy

DBNPS does not utilize Containment Spray as an option to provide Containment Cooling during a BDBEE.

2.5.5 Key Containment Parameters

Instrumentation providing the following key parameters is credited for all phases of the Containment Integrity strategy:

- Each of the 4 Safety Features Actuation System (SFAS) Channels provides Containment Pressure. Normally, only SFAS Channel 2 would be in service at the conclusion of DC Load Shed actions previously described.
- Post-Accident Monitoring Cabinet Channel 2 provides Containment Pressure.

The above instrumentation is available prior to and after load shedding of the DC and AC buses during Phase 1. Availability during Phases 2 and 3 is dependent on the strategy to re-power the essential 480 volt AC buses including the Class 1E battery chargers and associated Instrument AC Buses, however, instrumentation is available depending on which Station Battery (1P, 2P, 1N, and 2N) and associated Instrument AC Bus (Y1, Y2, Y3, and Y4) is in service. FSG DB-OP-02704, ELAP DC Load Management provides direction to transition from one battery in service to an alternate battery in the event that restoration of power is delayed.

Portable Beyond Design Basis equipment is supplied with the local instrumentation needed to operate the equipment. The use of these instruments is detailed in the associated FSG or FSOA for use of the equipment. These procedures are based on inputs from the equipment suppliers, operation experience, and expected equipment function in an ELAP.

In the unlikely event that Station DC or 120 Volt AC Instrument Bus infrastructure is also damaged, alternate FSG direction for obtaining the critical parameters locally is provided in FSG DB-OP-02707, Loss of DC Power. The procedure provides two strategies for obtaining instrument readings:

- This guideline provides direction to use a portable generator (120 volt AC) to restore power to the Non-Nuclear Instrumentation (NNI) System OR the Reactor Protective System (RPS). The goal is to restore the selected RPS Channel and NNI Channel to service prior to the total loss of DC power (due to an ELAP event), and the inability to supply station battery chargers via a FLEX 480v Generator. Restoring portable power to RPS and NNI will provide the ability to monitor key Containment, RCS and SG parameters until a dedicated FLEX source is available.
- This guideline also provides directions for obtaining alternate readings for parameters vital to the FLEX strategy, which may have failed even if

robustly constructed. These alternate readings will be obtained at the transmitter OR as close as reasonably possible to the transmitter.

2.5.6 Thermal-Hydraulic Analyses

The impact of the expected RCP Seal Leakage and other leakage into Containment for a DBDEE initiated in Mode 1 is evaluated in Calculation C-NSA-060.05-018, FLEX Mode 1 Containment Response Analysis Due to 10 GPM RCS Leak. The maximum Containment Vessel pressure predicted by the COPATTA code at 100 hours after shutdown due to: (1) a 10 gpm Reactor Coolant System (RCS) leak and, (2) RCS heat loss, is 22.8 psia (or 8.4 psig). The corresponding containment vapor temperature is 179 °F. The pressure remains less than the containment design pressure of 36 psig.

The impact of expected events for a BDBEE initiated with the plant initially in Modes 5 was evaluated in C-NSA-060.05-017, Mode 5 Gothic Analysis for Loss of Decay Heat Removal Events. This calculation models several Mode 5 scenarios during a loss of decay heat removal event with a GOTHIC model that combines the RCS and Containment Vessel (CTMT). The scenarios include starting from different RCS levels and gravity-draining from both the BWST and SFP. The calculation assumes Containment is vented to atmosphere. As a result, Containment does not pressurize. FSG DB-OP-02712, Alternate Containment Cooling provides direction for establishing a CTMT vent path to provide for CTMT pressure control during a Mode 5 OR Mode 6 ELAP event until equipment from the NSRC can be utilized to restore Containment cooling via the Containment Air Coolers.

Calculation C-NSA-011.01-021, FLEX Service Water Flowrate Analysis provides information on Service Water Flow requirements for restoration of Service Water to provide Containment Air Coolers following a BDBEE.

2.5.7 FLEX Pump and Water Supplies

The NSRC will provide a high capacity low pressure pump which will be used to restore the Service Water System as directed by FSG DB-OP-02722, Restore Service Water during an ELAP. Service Water will be restored using inventory in the UHS described in Section 2.3.4.6, Service Water Reservoir. Restoring Service Water and Electrical Power will allow restoration of the normal Containment Air Coolers as directed by FSG DB-OP-02712, Alternate Containment Cooling. Water supplies for restoring SW are as described in Section 2.3.10 (i.e., Lake Erie and the Ultimate Heat Sink). Phase 3 deployments of a large NSRC supplied pump capable of providing an alternate motive force to SW located in the UHS during an ELAP for cooling Containment and other uses. This NSRC pump is a diesel driven, 5000 gpm pump with a discharge pressure of 150 psig. The pump has a floating booster pump to provide adequate NPSH. Refer to C-NSA-011.01-021, FLEX Service Water Flowrate Analysis, for information on SW Flow requirements.

2.5.8 Electrical Analysis

Containment is normally cooled using Containment Air Coolers (CACs) via SW System. The fan portion of the CACs are a 480 volt load normal powered from essential MCC's E1 and/or F1. E1 and F1 are normally powered from their respective essential 4160 buses C1 and D1. The 4KV equipment being supplied from the NSRC will provide adequate power to restore power to C1 and/or D1 Buses and are included in calculations to support the sizing of the 4KV (2MW) power being provided. Restoration of 4160 Essential Buses C1 or D1 using generators from NSRC in accordance with FSG DB-OP-02723, Restore Power to C1 and D1 will provide the electrical power necessary to operate the CACs via E1 and/or F1.

2.6 Characterization of External Hazards

2.6.1 Seismic

The NEI guidance states that all sites address Beyond Design Basis seismic considerations in the implementation of FLEX strategies. The following text from the USAR provides insights on the current licensing bases:

USAR Appendix 2C.3.4 Determination of Design Earthquakes

1. General:

Two design earthquakes are recommended: the Maximum Possible Earthquake and the Maximum Probable Earthquake. The Maximum Possible Earthquake (larger) produces a vibratory ground motion for which structures, systems, and components important to safety are designed to remain functional. The Maximum Possible Earthquake and associated ground motion induces the maximum vibratory ground motions into rock-like material at the site which, under the presently known existing geologic conditions, could conceivably or possibly occur at the site. The Maximum Possible Earthquake is similar to the Safe Shutdown Earthquake terminology presently being used.

The Maximum Probable Earthquake (smaller) produces the vibratory ground motions used in the design of structures and equipment whose failure would not result in the release of significant radioactivity and would not prevent reactor shutdown. The Maximum Probable Earthquake and associated ground motion induces the maximum vibratory ground motions into rock-like material at the site which, under the presently known existing *geologic conditions, might, with small chance, reasonably or probably be expected to occur at the site. The Maximum Probable Earthquake is similar to the Operating Basis Earthquake terminology presently being used. The Maximum Possible Earthquake is selected primarily on the basis of structural geologic features. The Maximum Probable Earthquake is selected primarily on the basis of the historic earthquakes with consideration, at least in a qualitative way, of the probability of occurring.*

USAR 3.8.1.4.3 Earthquake Loads

All Class I structures are designed for a Maximum Probable Earthquake of 0.08g in the horizontal direction and a Maximum Possible Earthquake of 0.15g in the horizontal direction. The vertical ground accelerations are 0.053g for the Maximum Probable Earthquake and 0.10g for the Maximum Possible Earthquake and are considered acting simultaneously with the horizontal acceleration. The method of analysis is outlined in USAR Subsection 3.7.2.1, Method of Analysis.

DBNPS performed the Expedited Seismic Evaluation Process (ESEP) as an interim action in response to the NRC's 50.54(f) letter issued on March 12, 2012. This letter requested information to assure that the Near Term Task Force recommendations for additional seismic review were addressed by all U.S. nuclear power plants. The ESEP demonstrated that DBNPS has additional seismic margin plant equipment that can be relied upon to protect the reactor core following a beyond design basis seismic event. The ESEP was performed using the methodologies in the NRC endorsed guidance in Electric Power Research Institute (EPRI) 3002000704, Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1 – Seismic.

Expedited Seismic Evaluation List (ESEL)

The Expedited Seismic Evaluation List (ESEL) was generated as part of Phase 1 of the ESEP process. Review of the ESEL under the ESEP was completed in Phase 2 (fragility analysis/HCLPF analysis). The ESEL includes components that are required to support the DBNPS FLEX strategy. The results of the High Confidence of Low Probability of Failure Analysis (HCLPF Analysis) were used (along with Seismic Probabilistic Risk Assessment information) to determine if additional plant modifications are required to ensure successful FLEX strategy implementation. No modifications were required as a result of the Expedited Seismic Evaluation Process.

FLEX Implementation following a Seismic Event

For FLEX, the earthquake is assumed to occur without warning and result in damage to non-seismically designed structures and equipment. Non-seismic structures and equipment may fail in a manner that would prevent accomplishment of FLEX-related activities (normal access to plant equipment, functionality of non-seismic plant equipment, deployment of BDB equipment, restoration of normal plant services, etc.). A Mitigation Strategy Assessment is being completed as described in NEI 12-06 Revision 2, Appendix H.

2.6.2 External Flooding

Site Information

DBNPS is located on the shore of Lake Erie in Oak Harbor, Ohio. The major hydrological features of the terrain are the broad expanse of Lake Erie to the north and east, and the Toussaint River, which flows east into the lake along the south side of DBNPS, DBNPS is approximately 3,000 feet (ft) from the Lake Erie shoreline (USAR, Section 1.2.1.1) and approximately 2,000 ft from the Toussaint River. Site areas surrounding the station structures have been built up from 6 to14 feet above the existing grade elevation to an elevation of 584 ft. International Great Lakes Datum of 1955(IGLD55) or 15.4 ft above the Lake Erie Low Water Datum of 568.6 ft-IGLD55.Topography at and around DBNPS is relatively flat, with a mean station elevation of approximately 584 ft-IGLD55. The site safety-related structures are protected against high water levels up to an elevation of 585 ft-IGLD55. A Lake Erie dike, which is located along the shore of Lake Erie, protects the site from lake surges. In addition, a wave protection dike is situated along the northern, eastern, and a small portion of southern sides of DBNPS. The elevation at the top of the wave protection dike is 591 ft-IGLD55.

Current Design Basis

The current design basis is defined in the DBNPS USAR. The following is a list of flood-causing mechanisms and their associated water surface elevations that were considered for the DBNPS current design basis:

Local Intense Precipitation

The USAR indicates that the precipitation value of 26.7 inches over a 6 hour period is utilized for the LIP analysis. As indicated in the USAR, the average invert elevation of manholes and catch basins is 582 ft-IGLD55; with 26.7 inches of estimated accumulation, water could build up to 584.5 ft-IGLD55 (USAR, Section 2.4.2.3).

Flooding in Streams and Rivers

The USAR indicates that a flow rate of 78,500 cubic feet per second (cfs) in the Toussaint River at DBNPS (USAR, Section 2.4.3) would result in a maximum water surface elevation of 579 ft-IGLD55. As indicated in the USAR, the elevation of 579 ft-IGLD55 was derived using the conservative assumption that none of the water is discharged to Lake Erie, assuming that the Probable Maximum Flood (PMF) flow is hypothetically dammed up at that point (USAR, Section 2.4.3.5).

Dam Breaches and Failures

The USAR indicates that there are no dams or other regulating hydraulic structures on the Toussaint River which would affect the flow hydrograph at DBNPS (USAR, Section 2.4.3).

Storm Surge & Seiche

The probable maximum meteorological event in Lake Erie results in a maximum water surface elevation of 583.7 ft. - IGLD55. This meteorological event is caused by a maximum east--northeast wind at any location of 100 miles per hour for a 10-minute duration, and a wind speed of 70 miles per hour during the six-hour period both before and after the maximum wind · speed (USAR, Section· 2.4.5).

Low Water

No water is taken from the Toussaint River for plant cooling water requirements. Therefore, low flows in the Toussaint River will not affect DBNPS operation. The probable maximum meteorological event in Lake Erie results in the probable extreme low water level of 556.8 ft.- IGLD55 (USAR, Section 2.4.11).

Ice-Induced Flooding

Flooding of the safety-related structures and equipment at DBNPS due to ice jams in the Toussaint River is not credible. The USAR indicates that the elevation of the plant structures is above the level of normal lake ice formations. Category 1 wave protection dikes are designed to withstand the impact of ice (USAR, Section 2.4.7).

Channel Migration or Diversion

As indicated in the USAR, the mean lake level is not subject to variations due to diversions or source cutoff (USAR, Section 2A.9).

Combined Effect Flood (including Wind-Generated Waves)
Wind-wave activity, including runup, was evaluated for its effect on the wave protection dikes on the north, east, and south sides of DBNPS. As indicated in the USAR the maximum wave run- up on the dike is 6.6 ft above the probable maximum water surface elevation of 583.7 ft-IGLD55. The resulting maximum wave runup elevation is 590.3 ft-IGLD55, which is below the top of the dike (USAR, Section 2A2.2.1).

Flood-Related Changes to the License Basis
There were no changes to the license basis since the initial license issuance with regard to flooding.

Changes to the Watershed and Local Area since License Issuance
The watershed contributory to the Toussaint River upstream of DBNPS is approximately 139.0 square miles. Based on aerial images of the watershed, the changes to the watershed include commercial development within the watershed area, which is a very small percentage of the overall watershed area. The changes to the local area sub-watershed for DBNPS include buildings, parking lots, and security barrier upgrades that have been added to the site since license issuance.

Current Licensing Basis Flood Protection and Pertinent Flood Mitigation Features
The maximum flood level in the design basis is below the finish floor elevation 585 ft.-IGLD55. Therefore, there were no mitigation actions initiated or taken for flooding at the site.

FLEX Equipment usage in response to Ground Water In-leakage
There are no ground water in-leakage concerns that require the use of FLEX equipment to remove ground water.

NTTF Recommendations Flooding 2.1 and 2.3
In accordance with NTTF Recommendation 2.3 Flooding, DBNPS has completed the 2.3 Flooding walkdowns as defined in Enclosure 4 of the 50.54(f) letter and these have been reviewed and accepted by the NRC (ADAMS Accession No. ML14141A525).

In accordance with NTTF Recommendation 2.1 Flooding DBNPS has completed the immediate 2.1 Flooding actions by completion of the Flood Hazard Reevaluation Report (FHRR), submitted in March 2015, and reviewed and accepted via Interim Staff Assessment (ADAMS Accession No.

ML15239B212). The results of the FHRR, and the Interim Staff Assessment, identified two hazards not bounded by the existing design basis as described in 2.6.2.1. These two hazards Local Intense Precipitation (LIP) and Probable Maximum Storm Surge (PMSS) will be evaluated in the Mitigating Strategy Assessment (MSA) currently in progress. The purpose of the MSA is to determine if the new hazards have any impact on the Final Integrated Plan (FIP). The MSA results will be incorporated into the FIP as required. All of the other flood hazards reviewed as part of the FHRR were bounded by the existing design basis or were determined to not be credible for DBNPS. An additional evaluation, a Focused Evaluation will be completed in the future to determine the impact of these two hazards on the existing design basis but should have no impact on the FIP.

2.6.3 Severe Storms with High Wind

Figures 7-1 and 7-2 from the NEI FLEX Implementation Guide NEI 12-06 were used for this assessment. Figure 7-1 indicates that the high wind speed from a hurricane does not exceed 130 mph; therefore, DBNPS would not be susceptible to hurricanes so the hazard is screened out. Figure 7-2 indicates a maximum wind speed of 200 mph for DBNPS. Therefore, DBNPS has the potential to experience damaging tornado winds so the hazard is screened in.

In summary, (1) based on available local data and Figure 7-1 of NEI 12-06, DBNPS would not be susceptible to hurricanes so the hazard is screened out and (2) based on local data and Figure 7-2 of NEI 12-06, DBNPS has experienced damaging tornado winds so the hazard is screened in.

For considering the applicability of tornados to specific sites, data from the NRC's latest tornado hazard study, NUREG/CR-4461, is used. Tornados with the capacity to do significant damage are generally considered to be those with winds above 130 mph. Figure 7-2 of the NEI guidance document (NEI 12-06) provides a map of the U.S. in 2 degree latitude/longitude blocks that shows the tornado wind speed expected to occur at a rate of 1 in 1 million chance of per year. This clearly bounding assumption allows selection of plants that are identified in blocks with tornado wind speeds greater than 130 mph. DBNPS is located at 41°35'49" North latitude and 83°05'16" West longitude which falls under Region 1 of NEI 12-06 Figure 7-2, therefore, high wind hazards from tornados must be considered.

USAR 2.3.1.2.7 Wind

Extreme mile winds are sustained winds, normalized to 30 feet above ground and include all meteorological phenomena except tornados. Annual fastest mile wind data at Toledo and Cleveland were used to determine predicted extreme wind speeds for the Davis-Besse site for recurrence intervals of 50 and 100 years. For

Davis-Besse, the values for the 50- and 100-year recurrence maximum wind speeds for the Davis-Besse region are 84 mph and 90 mph, respectively.

From the information provided above, it has been determined that the DBNPS site is susceptible to high winds. The wind hazard attributes from the USAR data provided above and the data provided in Figure 3.1-2 were compared to determine the bounding characterization. While Figure 7-2 of NEI 12-06 provides a 200 mph wind hazard (Region 1) for DBNPS, the USAR defines the design basis tornado for DBNPS to be one of 300 mph winds. Therefore, the design basis tornado attributes have been used in analysis for DBNPS's FLEX strategies.

Permanent plant equipment credited in the DBNPS FLEX strategies is contained in Safety Related structures designed to the design basis values outlined above which exceed those of the generic guidance. Additionally much of the portable FLEX equipment is stored in the EFW Facility designed to similar requirements and utilize tornado missile and wind rated barriers to the protect FLEX equipment. The Debris Removal Trucks are stored in diverse locations making it unlikely that all equipment would be lost in the event of a tornado. One Truck is stored inside Service Building 7. The building provides protection against external flooding (Elevation 586'), snow/ice/low temperatures and extreme heat. The second Truck location was selected to provide diverse protection against a tornado or seismic event. The second truck is separated by distance that provides reasonable assurance that both trucks would not be disabled by a tornado. Based on tornado widths from NOAA's Storm Prevention Center for 1950-2011, 1,200 feet should be considered as the minimum separation distance for which further analysis is not required since DBNPS is located within Region 1 based on NEI 12-06 Figure 7-2. The diverse location should also consider the "typical" tornado path for the site. The prevailing tornado path for this area is W to E / SW to NE. The second truck position was selected based on distance from Service Building 7 (~1450ft) in a north / south orientation, and its open space and distance from structures.

2.6.4 Ice, Snow and Extreme Cold

The NEI guidance states that all sites will address the challenges from snow, ice and extreme cold for implementation of FLEX strategies, when applicable. The following is the evaluation for DBNPS:

Per NEI 12-06, all sites should consider the temperature ranges and weather conditions for their site in storing and deploying their FLEX equipment. That is, the equipment procured should be suitable for use in the anticipated range of conditions for the site, consistent with normal design practices.

Current Licensing Basis:

USAR 2.3.1.2.2 Snow

Snowfall is generally moderate (35-40 inches annually), distributed throughout the winter from November through March with frequent thaws. Additional normal and extreme values of snow can be found in USAR subsection 2.3.2.1. The record extremes for Toledo and Cleveland are:

Max. Monthly Snowfall - Max. 24 Hours

Toledo 26.2" (Jan. 1918) - 19.0" (Feb. 1900)

Cleveland 30.5' (Feb. 1908) - 17.4' (Nov. 1913)

Snow load data available from an HHFA study conducted in 1952 show that the maximum snowpack of record to be approximately 50 lbs per square foot, the estimated weight of seasonal snowpack equaled or exceeded one year in ten to be 20 lbs. per square foot, and the weight of estimated maximum accumulation on the ground plus weight of maximum probable snowstorm to be 80 lbs. per square foot.

2.3.1.2.3 Ice Storms

Freezing rain can occur in the late fall, winter, and early spring months. During a ten year study by the National Weather Service, the number of days with freezing rain observed at Cleveland were:

Nov	*Dec*	*Jan*	*Feb*	*Mar*	*Apr*	*Total*
2	*24*	*31*	*34*	*12*	*1*	*104*

Accumulations of ice of 0.25 inch once every year and 0.50 inch once every two years can be expected. The mean duration of glaze ice on utility wires if an ice storm occurs (based on an 8 year study of the Edison Electrical Institute) is 34 hours for the State of Ohio as a whole.

Applicability of snow and extreme cold:

DBNPS is above the 35th parallel (41°35'49") (USAR); therefore, the FLEX strategies must consider the impedances caused by extreme snowfall with snow removal equipment, as well as the challenges that extreme cold temperatures may present. On Figure 8-1 of NEI 12-06, the DBNPS site is located in the area identified as purple and pink, so 3 day snowfalls up to 36 inches should be anticipated. The maximum 24-hour snowfall recorded between 1870 and 1970 was 17.5 inches. The minimum recorded temperature in the area around the DBNPS site between 1870 and 1970 was -20°F.

Applicability of ice storms:

DBNPS is subject to moderate annual snowfall and ice accumulation.

Figure 8-1 of NEI12-06 provides a visual representation of the maximum three day snowfall records across the U.S. This figure shows that DBNPS is susceptible to a large amount of snow that could be a significant problem for deployment of the FLEX equipment.

Applicability of ice storms is based on a database developed by the EPRI for the United States. The database summarized ice storms that occurred in any area of the United States from 1959 to April 1995. Regional ice severity, ice event, and maximum level maps were generated based on the information in the ice storm database. Specifically, one set of maps developed by EPRI characterizes the expected maximum severity of ice storms across the U.S. Figure 8-2 of the NEI guidance document collects the EPRI data. The white and green regions (Levels 1 and 2) identify regions that are not susceptible to severe ice storms that may impact the availability of off-site power. Sites in all other regions (i.e., yellow, purple and red) should consider ice storm impacts on their FLEX strategies.

Based on Figure 8-2 of NEI 12-06, DBNPS is designated as a Level 3, susceptible to "low to medium damage to power lines and/or existence of considerable amount of ice."

In summary, based on the available local data and Figures 8-1 and 8-2 of NEI 12-06, DBNPS experiences significant amounts of snow and is susceptible to low to medium damage to power lines and/or existence of considerable amount of ice, therefore, the hazard is screened in.

2.6.5 High Temperatures

Per NEI 12-06, all sites must address high temperatures. Virtually every state in the lower 48 contiguous United States has experienced temperatures in excess of 110°F. Many states have experienced temperatures in excess of 120°F. Sites that should address high temperatures should consider the impacts of these conditions on the FLEX equipment and its deployment.

Monthly and annual values of daily mean temperature and average and extreme daily maximum and minimum temperatures are provided in the USAR (Reference 18) and are based on data records for Toledo and Cleveland. From this data, the monthly averages indicate that July and August are the hottest months and

January the coldest month. The annual mean temperature in the site area is 50°F and the hottest average daily maximum is 83°F with a record max temperature of 105°F in Toledo in July 1936.

In summary, based on the available local data and industry estimates, DBNPS does not experience extreme high temperatures. However, per NEI 12-06, all sites will address high temperatures. Therefore, for selection of FLEX equipment, FENOC considered the site maximum expected temperatures in their specification, storage, and deployment requirements, including ensuring adequate ventilation or supplementary cooling, as required.

2.7 Planned Protection of FLEX Equipment

The EFWF and SB7 are used for FLEX equipment storage. Other FLEX equipment is located inside the Auxiliary Building generally near locations where the equipment will be used. The EFWF and the Auxiliary Building locations provide protection from all hazards - seismic events, flooding, storms with high winds, snow, ice, and extreme cold, and extreme heat.

Emergency Feedwater Facility

The EFWF is a seismic Class II building, but designed for Seismic Class I loads. Liquefaction of the soil under the EFW Facility was not required to be considered since the basement bears on bedrock and the Emergency Feedwater Storage Tank foundation has piles that bear on bedrock. The building ventilation systems are designed to maintain temperature required to support equipment operation. AC power is not required to open EFWF Doors. In addition to the Phase 1 EFW System, the missile protected building includes the following Phase 2 FLEX equipment stored or staged inside and seismically restrained:

- “N” FLEX 480v Generator (operated from stored location)
- “N” FLEX Alt LP EFWP (operated from stored location)
- “N” FLEX SFP Spray Pump (deployed as contingency to surviving water source)
- “N” FLEX Replenishment Pump (deployed to refill EFWST, 16hrs after event)
- “N” & “N+1” Hoses for FLEX Alt LP EFWP, SFP Spray, Replenishment
- “N” & “N+1” Cables for FLEX 480v Generator

Auxiliary Building

The Auxiliary Building is a seismic class I, temperature controlled (including post event heat up calculations), missile protected, internal flood evaluated building. The Auxiliary Building provides protection against all applicable hazards. The operators have keys to allow opening all required Auxiliary Building Door in the event that AC power is lost. Refer to Section 2.8.2 Accessibility for additional information. The following Phase 2 FLEX equipment is stored or staged inside the Aux Building and seismically restrained:

- "N" FLEX CWRT RCS Charging Pump
- "N+1" FLEX BWST RCS Charging Pump
- "N" & "N+1" Hoses for FLEX Charging Pumps
- "N" & "N+1" Cables for FLEX Charging Pumps

Service Building 7

SB7 is climate controlled and the floor is elevated above maximum evaluated flood level. SB7 is not seismically rated nor capable of withstanding high winds. SB7 is a commercial grade building that was used prior to and during 18RFO to store the new Once-Through Steam Generators (OTSGs). The construction drawings for SB7 are documented in Notification 601021775. These drawings state that structural design of SB7, previously designated as the New Steam Generator Storage Facility (NSGSF), is in accordance with the 2011 Ohio Building Code. Note that the 2011 OBC uses ASCE 7-05 as the basis for design loads. The superstructure is constructed of premanufactured frames with roof and wall purlins to support the metal siding and roofing. The substructure consists of a slab-on-grade, a perimeter grade wall with strip footing extending below the frost line and spread footings at the building frames. The finish floor elevation of SB7 is 584'-7 1/4". The SB7 is separated in distance from the EFW Facility. The following Phase 2 FLEX equipment is stored in SB7:

- "N+1" FLEX SFP/Replenishment Pump
- "N+1" FLEX Alt LP EFWP
- "N+1" FLEX 480v Generator
- "N+1" FLEX Debris Removal Truck

Towing and Debris Removal Trucks

Two towing and debris removal trucks are utilized. One truck is stored in SB7 and the second is parked inside the Protected Area on the north side of the plant where prevailing tornado path and width should not impact both debris removal trucks.

Other Equipment

Refer to Table 2 for a list of storage locations for FLEX related equipment.

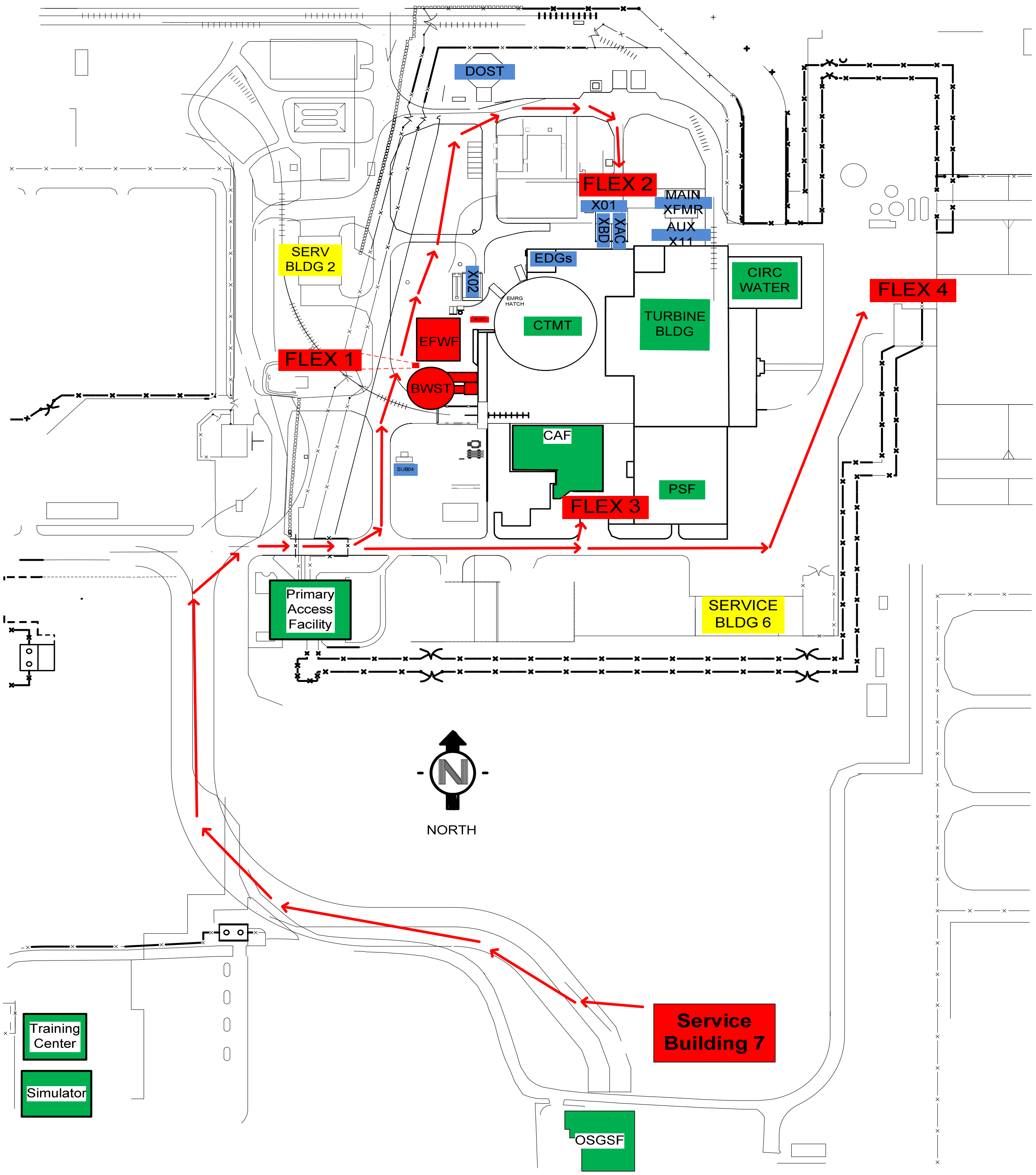


Figure 1: FLEX Storage Locations and Haul Routes

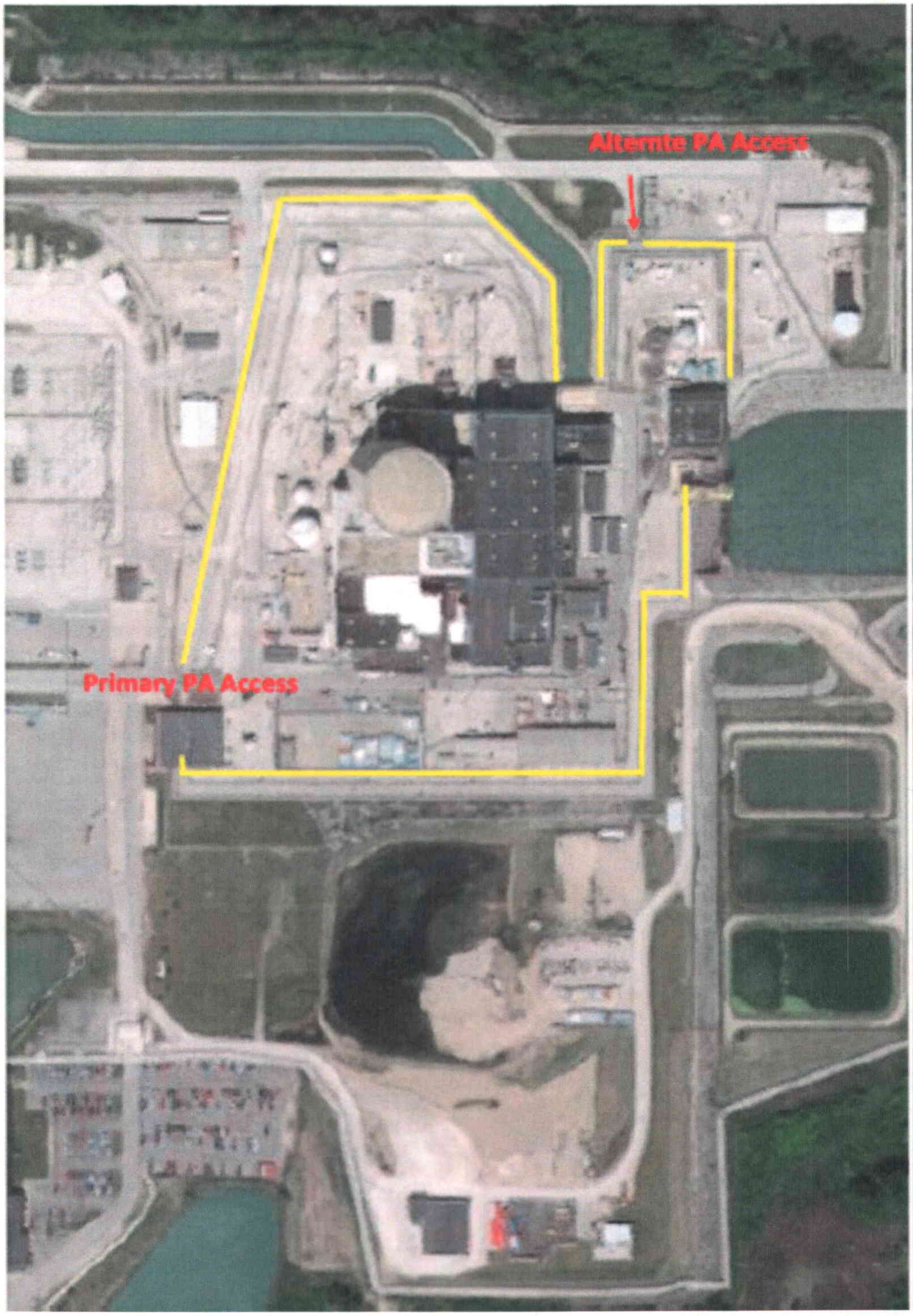


Figure 2: Protected Area Access Points

2.8 Planned Deployment of FLEX Equipment

2.8.1 Haul Paths

Pre-determined, preferred haul paths have been identified and documented in the FSGs DB-OP-02705, Initial Assessment and FLEX Equipment Staging. Figure 1 shows the haul paths from SB7 to the various deployment locations. These haul paths have been reviewed for potential soil liquefaction (see below) and have been determined to be stable following a seismic event. Additionally, the preferred haul paths attempt to avoid areas with trees, power lines, narrow passages, etc. when practical. However, high winds can cause debris from distant sources to interfere with planned haul paths. Two Heavy Duty Pickup Trucks will be used as debris removal vehicles. One truck is stored in Service Building 7 and the second is stored on the north side of the plant inside the Protected Area. The storage locations for the trucks are diverse such that prevailing tornado path and width cannot render both trucks unavailable.

NOP-LP-7200, FLEX Program for Davis-Besse, provides direction to ensure that work and change-related processes include appropriate screening requirements to identify impacts on the FLEX equipment and strategies including haul paths. As described in the procedure, the Site FLEX Program Owner is required to review and provide concurrence for activities that would create a FLEX equipment travel path blockage where the blockage cannot be easily removed within a few minutes by one person.

DBNPS FLEX storage is designed to minimize the deployment routes to the operations areas (designed areas where FLEX equipment is operated). The use of two storage areas (EFWF and SB7) on opposite sides of the plant provides for avoidance of site hazards while allowing deployment during the event. In addition, the DBNPS FLEX strategies are intended to minimize the impact of debris by installing equipment in robust locations such as inside the Auxiliary Building or the EFWF that minimize the number of activities the operators must perform outside.

Two haul paths into the Protected Area have been identified as shown on Figure 2, Protected Area Access Points. The preferred haul path uses the normal vehicle entrance into the protected area located adjacent to the Personnel Access Facility at the southwest corner of the Protected Area. An alternate haul path into the Protected Area uses “Gate 10” which is the former main entry point in the Protected Area located at the North East corner of the Protected Area. The current configuration of Gate 10 includes security features and barriers that can be manually opened. The size of the pathway through each barrier is adequate for the FLEX equipment deployment. Removal of the security features and barrier would be performed with security notification and is within the capability of debris removal equipment.

A site liquefaction evaluation was completed by Bowser Morner. The evaluation is captured in Engineering Evaluation Report 600984768, Report of Geotechnical Engineering Services Liquifaction Vulnerability Study Proposed Site Travel Path for Davis-Besse Nuclear Power Station 5501 North SR2, Oak Harbor, Ottawa CO., Ohio. Bowser Morner concluded that the subsurface soils and man-made fill deposits encountered below the anticipated haul paths are not considered to be susceptible to liquefaction during seismic events.

2.8.2 Accessibility

The potential impairments to required access are: 1) doors and gates, and 2) site debris blocking personnel or equipment access. The coping strategy to maintain site accessibility through doors and gates is applicable to all phases of the FLEX coping strategies, but is immediately required as part of the immediate activities required during Phase 1.

Doors and gates serve a variety of barrier functions on the site. One primary function is security and is discussed below. However, other barrier functions include fire, flood, radiation, pressure boundary, tornado, and HELB. As barriers, these doors and gates are typically administratively controlled to maintain their function as barriers during normal operations. Following a BDBEE and subsequent ELAP event, FLEX coping strategies require the routing of hoses and cables to be run through various barriers in order to connect BDB equipment to station fluid and electric systems. For this reason, certain barriers (gates and doors) will be opened in response to the events and remain open. This violation of normal administrative controls is acknowledged and is acceptable during the implementation of FLEX coping strategies.

The ability to open doors for ingress and egress, ventilation, or temporary cables/hoses routing is necessary to implement the FLEX coping strategies. Operators responsible for implementing FLEX strategies have keys in their possession that provide access to all required areas. Keys will be turned over between individuals as part of the Shift Relief and Turnover Process described in NOP-OP-1002, Conduct of Operations.

Access into the Protected Area of the Plant through the normal entrance (Protected Area sally port) is protected by a security barrier. This barrier can be manually operated during a loss of all AC power. The ability to open the barrier during a loss of AC power event is achieved through Security Shift Supervisor training and the requirement of maintaining a minimum number of individuals qualified as

Security Shift Supervisors. Due to the sensitive nature of this information the details are not included in this document. If additional information is required, contact a DBNPS Security Shift Supervisor.

Two Heavy Duty Pickup Trucks will be used as debris removal and towing vehicles. They are equipped with snow plows to remove snow from travel paths as necessary. Ice augers and chop saws are available in the EFWF to create openings in the ice to access water during cold weather events if necessary.

Phase 3 of the FLEX strategies involves the receipt of equipment from offsite sources including the NSRC and various commodities such as fuel and supplies. Transportation of these deliveries can be through airlift or via ground transportation. Refer to Section 2.10 for additional information on agreements with the Fremont Airport (Staging Area C) and the Wood County Regional Airport (Staging Area D). Debris removal for the pathway between the site and the NSRC receiving location and from the various plant access routes may be required. The same debris removal equipment used for on-site pathways will be used to support debris removal to facilitate road access to the site as required.

2.9 Deployment of strategies

2.9.1 Emergency Feedwater Makeup Strategy

Inventory for use by the EFW System is stored in the EFWST located in the EFWF. For a BDBEE scenario, a minimum of 16 hours will be available to establish a makeup source of inventory to the EFWST as determined by Calculation C-ME-050.05-001, Emergency Feedwater Storage Tank Capacity for Decay Heat and Sensible Heat Removal. FSG DB-OP-02706, EFW Storage Tank Makeup provides direction to add inventory to the EFWST following a BDBEE. This will be a Phase 2 requirement.

To protect the SGs for as long as possible, the highest quality water source available for makeup will be selected prior to lower quality sources. For example, Demineralized water from the Demineralized Water Storage Tank is preferred over water from Lake Erie. Based on assessments directed by FSG DB-OP-02705, Initial Assessment and FLEX Equipment Staging and preferred order of makeup usage based upon chemistry considerations, and accessibility provided in FSG DB-OP-02706, EFW Storage Tank Makeup, the Command SRO will determine which inventory source(s) will be aligned to provide makeup water to the EFW. Refer to Table 1, Water Sources for a list of potential water sources.

Lake Erie via the UHS provides an indefinite supply of water, as a make-up source for the EFWST for supply to the EFW pump, or the Alt LP EFWP. The UHS inventory will remain available for any of the external hazards listed in Section 2.6.

FLEX Replenishment and Spray Pumps are available to be used to replenish the EFWST and to spray the SFP if required. These pumps are Godwin HL100M pumps with a John Deere Diesel Driver, rated at 920gpm at 165psi. The two pumps and associated hoses and fittings are stored, "N" stored in EFWF, and "N+1" stored in SB7. The Replenishment and Spray Pumps would be staged as required with EFWST makeup provided via EF26, EFW Storage Tank Makeup Valve located inside the EFWF on the 585' level. The EFWF is designed to meet applicable BDBEE.

2.9.2 Reactor Coolant System Strategy

To ensure that the core is maintained subcooled and subcritical, borated water injection into the RCS is provided from CWRT1 which provides the preferred protected borated water source via the RCS FLEX Charging Pumps (described in Section 2.3.5.3 – 2.3.5.5). CWRT 1 is protected from all BDBEE. RCS Injection will begin within 2.5 hours after the start of the event in accordance with FSG DB-OP-02701, Long Term RCS Inventory Control. Refer to Figure 8, RCS Makeup Connections for additional information. The FLEX Charging and associated Booster pumps are powered from the 480 V FLEX Generator via cables installed by the operators.

The BWST is not protected from high wind missiles. As a result, DBNPS investigated various options for providing a protected source of borated water and established CWRT1 as the protected borated source of inventory. The BWST will be available as the preferred source of borated water for all events except high winds/tornados. For those events, CWRT1, borated to 2600 – 2800 ppm boron with a minimum of 80,000 gallons available will provide a protected source. Refer to Calculation C-ME-064.02-263, RCS Makeup Requirements for FLEX for additional information. Selection of the source of borated water is controlled by FSG DB-OP-02700, Station Blackout, and implemented by FSG DB-OP-02701, Long Term RCS Inventory Control.

This RCS injection also compensates for continued RCS leakage, enabling refill of the RCS and allowing Pressurizer level to be maintained. Power is restored to a 480 volt Essential Bus E1 or F1 in accordance with FSG DB-OP-02721, Restore Power to E1 and F1. Once power is available, a bank of Essential Pressurizer Heaters are then restored in accordance with FSG DB-OP-02724, Restore Pressurizer Heaters to Service. Establishing an injection source and Pressurizer Heater Control will allow the two loop subcooled natural circulation cooldown (preferred) of the RCS to begin. RCS Cooldown will begin within 4.5 hours after the event at 30°F/hr to an RCS temperature of 320-350°F. This action is included as a Time Sensitive Operator Action in DBBP-OPS-1113, Time Sensitive Operator Actions.

In the event that a two loop natural circulation cooldown of the RCS cannot be performed, the RCS Cooldown will begin as an asymmetric single loop RCS Cooldown as directed by FSG DB-OP-02700, Station Blackout. This asymmetric cooldown was developed in WCAP-17792-P, Emergency Procedure Development Strategies for the Extended Loss of AC Power Event for all Domestic Pressurized Water Reactor Designs. An asymmetric, or single-SG Cooldown, will allow coping for up to 48 hours with no RCS makeup. An asymmetric cooldown involves cooling down using SG1 as the only active loop and establishing SG2 as an idle loop (i.e., steam and feedwater isolated). As RCS pressure is reduced, voids will form in the idle loop. Inventory from the idle loop (with inventory from the pressurizer) will accommodate RCS losses from RCP Seals.

2.9.3 Spent Fuel Pool Makeup Strategy

In Phase 2, the Spent Fuel Pool will heat to the boiling point and the level in the pool will begin to reduce. Action is taken in accordance with FSG DB-OP-02711, Alternate SFP Makeup to create a vent path to from the SFP area to the environment prior to the inventory in the SFP reaching boiling point. SFP makeup is established such that pool level is maintained above the top of the fuel throughout the event.

If the BWST is not available, SFP makeup can be provided from the EFWST using the EFW pump, through temporary connections, to supply a FLEX SFP makeup header. The use of non-borated water from the EFWST is acceptable because the SFP storage rack design ensures subcriticality even with no boron concentration in the SFP water. The time available before makeup is required significantly exceeds the time it would take to establish makeup through this flowpath.

FLEX Replenishment and Spray Pumps are available to be used to replenish the EFWST and to spray the SFP if required. These pumps are Godwin HL100M pumps with a John Deere Diesel Driver, rated at 920gpm at 165psi. The two pumps and associated hoses and fittings are stored, “N” stored in EFWF, and “N+1” stored in SB7. These pumps have adequate capacity and can be deployed within the time available to be used as alternate SFP makeup sources directed by FSG DB-OP-02711, Alternate SFP Makeup, Attachment 7, SFP Makeup Water Sources. The FLEX makeup header is not completely missile protected due to insufficient robustness of the roll-up door 300. Therefore, an alternate flow path is available which requires routing hoses from the selected makeup source connections directly to the SFP. Refer to Figure 13, Spent Fuel Pool Makeup Hose Routes for additional information.

As a backup to the SFP cooling strategy described above, there is a capability to provide SFP spray by use of portable (Blitzfire) spray nozzles staged on the SFP deck. This is strictly a contingency capability required by NEI 12-06, and it is not an active part of the FLEX SFP cooling strategy.

2.9.4 Electrical Strategy

The Phase 1 electric coping strategy is to maintain DC power to critical systems and essential instrumentation. This direction was based on AOP DB-OP-02521 Loss of AC Bus Power Sources actions that have been moved to a new EOP, DB-OP-02700, Station Blackout and FSG DB-OP-02704, ELAP DC Load Management.

Early in Phase 1, selected DC loads are removed from service to extend the availability of the selected Station Batteries and DC Buses to provide power. DBBP-OPS-1113, Control of Time Sensitive Operator Actions includes two Operator actions for load shedding the DC buses, the first completed within 30 minutes of the start of the ELAP and final actions within 60 minutes. These strategies including venting hydrogen from the Main Generator to reduce the risk of fire when the Seal Oil System is shutdown or lost. These strategies are supported by calculation C-EE-002.01-16, Station Battery Discharge Analysis for Beyond Design Basis Events.

Maintaining indications and control requires maintenance of battery power, which is extended by use of the FLEX 480V generator in accordance with FSG DB-OP-02721, Restore 480v Power to E1 and F1. This FSG is used to repower essential 480v switchgear E1 and F1. Two 480 volt diesel generator are available with the “N” generator pre-staged in the EFWF and the “N+1” generator stored in SB7. Restoration of power will allow charging the batteries, restoring a bank of essential pressurizer heaters, and supporting the electrical needs of other equipment. This generator is also used to establish forced ventilation circulation in the battery rooms required once battery recharge operations are initiated to maintain conditions within the ranges required by the equipment contained therein.

Restoration of 4160 Essential Buses C1 or D1 using generators from NSRC in accordance with FSG DB-OP-02723, Restore Power to C1 and D1 will provide the electrical power necessary to operate the CCS and DHR Systems to provide long term core cooling.

2.9.5 Fueling of Equipment

The FLEX strategies for maintenance and/or support of safety functions involve several elements including the supply of fuel to necessary diesel powered generators, pumps, hauling vehicles, compressors, etc. The general coping strategy for supplying fuel oil to diesel driven portable equipment, i.e., pumps and generators, being utilized to cope with an ELAP / LUHS, is to draw fuel oil out of any available existing diesel fuel oil tanks on the DBNPS site.

Diesel fuel will be required to support the FLEX equipment for the FLEX strategies. FLEX equipment that use fuel oil will have an onboard fuel tank (maintained normally greater than 1/2 filled). These onboard fuel tanks will provide the fuel necessary for initial implementation of the strategies. For example, the two Alt LP EFW Pumps have a 250 gallon on board tank. The two FLEX Replenishment and Spray Pumps have a 100 gallon on board tank.

Diesel fuel is provided from a 6000 gallon diesel fuel tank that is located in the EFWF. Engineering Change Package (ECP) 13-0195 and 13-0196 delineates fuel storage requirements for operation of the EFW Pump and the 850 kW FLEX generator. At full load, the EFW Pump Diesel would use 51.3 gallons/hour. The 480 volt 850 kW FLEX Generator would use 110 gallons/hour. As a result, without considering the EFWP day tank and assuming maximum fuel consumption rates, a minimum of 37 hours is available to move fuel to replenish the EFWF Fuel Oil Storage Tank.

As inventory in the diesel fuel tank is depleted, fuel will be transferred from the EDG day tanks located inside the Auxiliary Building to fuel transfer equipment, or directly to equipment using a small electric powered transfer pump. A connection will be made to a drain line located on the supply line to the EDG from the associated EDG day tank. The installed 480V Fuel Transfer Pumps will be repowered by the FLEX 480V Generator when E1 or F1 power is restored in accordance with DB-OP-02721, Restore Power to E1 and F1, and will transfer inventory from the EDG week tanks (located underground, west of the Auxiliary Building) to the EDG day tanks as needed. FSG DB-OP-02705, Initial Assessment and FLEX Staging, provides direction for monitoring usage and transferring Diesel Fuel Oil as necessary. FSOA DB-OP-02759, FLEX Portable Fuel Oil Pumps provides detailed transfer direction.

Fuel oil for portable equipment will also be available from the EDG Fuel Oil Day Tanks (T46-1 and T46-2). These two diesel tanks contain a minimum of 4000 gallons of diesel fuel each as required by Technical Specification Surveillance Requirement 3.8.1.4 (a total of 8000 gallons) and are seismically mounted and housed in the tornado protected EDG rooms. The preferred fueling strategy as directed by FSG DB-OP-02705, Initial Assessment and FLEX Equipment Staging is to cross-tie the EDG Day Tanks, then connect one fuel hose to EDG Day Tank 2 drain with a manual trigger nozzle for filling smaller items such as Portable Generators, and to connect one fuel hose to EDG Day Tank 1 drain to supply a portable ac pump with a manual trigger nozzle for filling larger items such as Fuel Transfer Cubes and the Debris Removal Truck 110 gallon tanks. Fuel can be obtained using the tank drain valve and a flexible hose. Portable Battery-Backed lighting, Portable Generator, Fuel Hoses and triggers are staged at the Room 320 FLEX Storage Box location.

Another source for fuel oil will be the two EDG Week Tanks (T153-1 and T153-2). Each tank has a 40,000 gallon capacity. These tanks are protected from high wind tornado missile by virtue of their underground location and are also protected from seismic and flooding events. Fuel can be obtained using a portable fuel pump to transfer fuel oil to the Portable Fuel Oil Container and FLEX Fuel Caddy as directed by FSG DB-OP-02705, Initial Assessment and FLEX Staging.

Additional On-Site sources of fuel oil as described in FSG DB-OP-02705, Initial Assessment and FLEX Staging, include the following:

Diesel Oil Storage Tank (T45) ~ 100,000 gallons

Diesel Fire Pump Day Tank (T47) ~ 350 gallons

Miscellaneous Diesel Generator Day Tank (T168) ~ 740 gallons

Station Blackout Diesel Generator Day Tank (T210) ~ 2000 gallons

Diesel fuel in the fuel oil storage tanks is routinely sampled and tested to assure fuel oil quality is maintained to ASTM standards. This sampling and testing surveillance program also assures the fuel oil quality is maintained for operation of the station EDGs.

If necessary, DBNPS has a commitment from Great Lakes Petroleum, 4500 Renaissance Parkway, Cleveland, OH 44128 to provide fuel oil to DBNPS. Their Sandusky location is their main vendor. At Sandusky, they have 2 tank wagons one is 4500 and one is 4000 gallons. At their Toledo Ohio location, they have 2 transports, 7500 gallons each. At their Lorain Ohio location, they have 2 tank wagons, one is 4500 gallons, and the second is 4000 gallons. At their Cleveland Ohio location, they have 6 transports and 5 tank wagons rated at 4500, 4500, 4000, 4200, and 2600 gallons. The Great Lakes Petroleum on call dispatch phone line is 216 830 5108, which is staffed 24 hours per day, 7 days per week.

Great Lakes Petroleum maintains 16,000 gallon in stock at any given moment as part of their contract with the Sandusky bulk facility. If for any reason fuel oil is not available at the Sandusky Bulk facility, fuel oil would be available from other sources including:

- Marathon
- PBF
- Sunoco
- Husky
- World
- Citgo
- Center

The diesel fuel consumption information above does not include fuel requirements for the large 4kV generators to be received from the NSRC. More than adequate diesel fuel is available on site for these generators if the above ground 100,000 gallon Diesel Oil Storage Tank is available. If it is not, provisions for receipt of diesel fuel from offsite sources describe above will be necessary to implement the Phase 3 re-powering strategy with the NSRC 4kV diesel generators.

2.10 Offsite Resources

2.10.1 National SAFER Response Center (NSRC)

The industry has established two NSRC to support utilities during BDBEE. Each NSRC holds five (5) sets of equipment, four (4) of which can be fully deployed when requested, the fifth set may have equipment in a maintenance cycle. Equipment is moved from an NSRC to the near site staging area, established by the SAFER team and the utility. Communications are established between the affected nuclear site and the SAFER team and required equipment moved to the site as needed. First arriving equipment, as established during development of the SAFER Response plan, is to be delivered to the site within 24 hours from the initial request.

FENOC has signed a contract with SAFER to meet the requirements of NEI 12-06. The approved SAFER Response Plan is currently located in FileNet under Vendor Manual M-768-00022, SAFER Response Plan for Davis-Besse. The initial contact with the SAFER Response Center is directed by EOP DB-OP-02700, Station Blackout. A Letter of Agreement has been signed with the Fremont Airport for offsite Staging Area C. A Memorandum of Agreement has been signed with Wood County Regional Airport for approval as Staging Area D. From there, equipment can be taken to the DBNPS site and staged by helicopter if ground transportation is unavailable. Communications will be established between the DBNPS plant site and the SAFER team via satellite phones and required equipment moved to the site as needed. First arriving equipment will be delivered to the site within 24 hours from the initial request.

2.10.2 Equipment List – (SAFER Equipment)

The equipment stored and maintained at the NSRC for transportation to the local assembly area to support the response to a BDBEE at DBNPS is listed in Table 3. Table 3 identifies the equipment that is specifically credited in the FLEX strategies for DBNPS but also lists the equipment that will be available for backup/replacement should on-site equipment break down. Since the equipment will be located at the local assembly area, the time needed for the replacement of a failed component will be minimal.

2.11 Equipment Operating Conditions

2.11.1 Ventilation

Following a BDBEE and subsequent ELAP event at DBNPS, ventilation providing cooling to occupied areas and areas containing FLEX strategy equipment will be lost. Per the guidance given in NEI 12-06, FLEX strategies must be capable of execution under the adverse conditions (unavailability of installed plant lighting, ventilation, etc.) expected following a BDBEE resulting in an ELAP/LUHS. The primary concern with regard to ventilation is the heat buildup which occurs with the loss of forced ventilation in areas that continue to have heat loads. A loss of ventilation analyses was performed to quantify the maximum steady state temperatures expected in specific areas related to FLEX implementation to ensure the environmental conditions remain acceptable for personnel habitability and within equipment qualification limits. Refer to Calculation C-ME-099.25-001, Auxiliary Building Room Temperatures during an ELAP, for additional information. Detailed FLEX Equipment design information is provide in NORM-LP-7204, Davis-Besse FLEX Strategy Design & Equipment Bases Detail.

The key areas identified for all phases of execution of the FLEX strategy activities are the Control Room, the EFWF, the HVSG Rooms, the LVSG Rooms (includes station inverters, battery chargers, and battery rooms), Mechanical Penetration Room 3 (MPR3), Fan Alley, and the SFP Area. These areas have been evaluated in Calculation C-ME-099.25-001, Auxiliary Building Room Temperatures during an ELAP to determine the temperature profiles following an ELAP/LUHS event. The calculation concludes that the worst case temperature in each room is low enough to allow Operators to safely complete the mitigation task, or the calculated flow rates for removing the heat load is within portable alternative ventilation capability and implementation of the alternative ventilation is within the allotted time for room entry as defined in the mitigation strategy. FSG DB-OP-02725, Control Room and Miscellaneous Habitability Actions provides direction to establish ventilation as required using portable equipment.

An additional ventilation concern applicable to Phase 2 is the potential buildup of hydrogen in the station battery rooms. Off-gassing of hydrogen from batteries is only a concern when the batteries are charging. Once a 480 volt AC power supply is restored in Phase 2 and the station Class 1E batteries begin re-charging, power is also restored to the battery room ventilation fans to prevent any significant hydrogen accumulation as directed by FSG DB-OP-02721, Restore Power to E1 and F1 and establishing required ventilation as described in FSG DB-OP-02725, Control Room and Miscellaneous Habitability Actions.

2.11.2 Heat Tracing/Protection of Equipment from Cold Weather

For protection of FLEX related equipment from extreme cold weather, the Auxiliary Building, the EFWF and SB7 are used for equipment storage. The equipment located inside the Auxiliary Building is generally pre-staged near locations where the equipment will be used. The EFW Facility and the Auxiliary Building locations provide protection from seismic events, flooding, storms with high winds, snow, ice, and extreme cold, and extreme heat. The Auxiliary Building and the EFW Facility include heating and ventilation systems to maintain building temperatures required to prevent freezing of equipment. SB7 is also heated to provide protection against extreme cold events for equipment stored in the building.

DBNPS uses installed heat trace systems to maintain the concentrated boric acid stored in the Boric Acid Addition System and related lines above the boric acid temperature precipitation point. The Boric Acid Addition System is not credited in the FLEX response to a BDBEE, therefore the installed heat trace systems are not a required element of the FLEX response.

2.12 Habitability

Personnel habitability was evaluated as described in section 2.11.1, Ventilation, above and determined to be acceptable.

2.13 Lighting

In order to validate the adequacy of supplemental lighting and the adequacy and practicality of using portable lighting to perform FLEX strategy actions, an evaluation of the tasks to be performed and the available lighting in the designated task areas was completed as an element of the FSG Procedure validation process described in NORM-LP-7201, Davis Besse FLEX Validation Process Report. Tasks evaluated included traveling to/from the various areas necessary to implement the FLEX strategies, making required mechanical and electrical connections, performing instrumentation monitoring, and component manipulations.

Operators responsible for implementing FLEX related tasks are required to carry flashlights in accordance with the operator tours section of NORM-OP-1002, Conduct of Operations. In addition, Battery Powered (Appendix “R”) emergency lights are available to provide lighting. These emergency lights are designed and periodically tested to ensure the battery pack will provide a minimum of eight (8) hours of lighting with no external AC power sources. Appendix R Battery lights are located throughout the plant.

Personal lighting, portable battery flood lighting and generator powered flood lighting is staged in the Auxiliary Building and EFWF (both robust). The variety of lighting options allows for a graded approach to minimize impacts on the FLEX response timeline initially, and improve on lighting conditions as more resources become available as mitigation of the event continues. The strategy for deployment of this lighting is part of FSG DB-OP-2705 Initial Assessment and FLEX Equipment Staging. Attachment 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.

The table below illustrates the number, types and storage locations for the portable 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.

FLEX Related Portable Lighting Equipment:

Equipment	Room 100 (BWST Tunnel)	Room 124 (CWRT 1)	Room 303 (MPR 3)	Room 512 (Ctrm Storage)	Room 428 (LVSGR F)	EFW F	EDG Corridor Bkr Lab Rm 320
Portable Battery Backed Light	1	1	2	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	8
Miners Lights	-	-	-	8			
Miners Lights Batteries	-	-	-	16			
Miners Lights Battery Charger	-	-	-	4			

2.14 Communications

A standard set of assumptions for the communication requirements during a Beyond Design Basis ELAP event is identified in NEI 12-01, Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities, May 2012.

The DBNPS communications systems and equipment are designed and installed to assure reliability of on-site and off-site communications in the event of a Design Basis Accident scenario. However, in the event of an ELAP, limited communications systems functionality would be available. ECP 14-0645, Control Room Satellite Phone to Support FLEX and ECP 14-0646, Sound Powered Phone to Support FLEX has been implemented to improve communications between the Control Room and operators in the plant (sound powered phones) and between the control room and other facilities (satellite phone).

On site:

The communications strategy involving permanent plant equipment uses radios, sound powered phones, and the station Page/party system (Gaitronics) to communicate between the control room and all remote equipment locations. The page/party system is a multiple-channel system connecting all areas of the plant. The operation of page/party system is dependent on the availability of the electric power system. Electric power will be lost as a result of the ELAP. As a result, internal communications will be completed using radios and the sound powered phone system. ECP 14-0646, Sound Powered Phone to Support FLEX has been implemented to provide a communications method that does not require electrical power. FSG DB-OP-02705, Initial Assessment and FLEX Equipment Staging, Attachment 14, Staging FLEX Communication Equipment directs necessary actions to extend the Sound Powered Phone System into the Control Room and to other key locations to implement FLEX Strategies.

Off-Site:

Satellite phones are the only reasonable means to communicate off- site when the telecommunications infrastructure surrounding the nuclear site is non-functional. They connect with other satellite phones as well as normal communications devices. FSG DB-OP-02705, Initial Assessment and FLEX Equipment Staging, Attachment 14, Staging FLEX Communication Equipment directs necessary actions to deploy both of the Satellite phone external antennas to allow satellite communications from the Control Room.

In addition to the fixed Satellite Phones in the Control Room and Emergency Response Facilities, hand held Satellite phones are available for offsite communications. These phones are distributed between the Control Room and the 6 Blue “Jump Pack Cabinets” with 3 located in the Protected Area and 3 others located in the Owner Controlled Area. Additionally, local Offsite Response Organizations (OROs) have been provided a satellite phone if they are within a 25-mile radius of the DBNPS site.

The CR satellite phones are installed units. The antennae setup is a deployable system with a combination of permanently installed and temporary cabling from the inside “desk sets” to outdoor portable satellite antennae. In addition, a handheld satellite phone is available for initial notifications. The modifications to the plant required to support this strategy were performed under ECP 14-0645, Control Room Satellite Phone Modifications to Support FLEX

Additional Communication Program Features:

Hand-held radios normally used by the operators are available for the implementation of the FLEX strategies. Sufficient batteries and chargers are also available. The antenna and repeater system that normally allows communications in almost all areas of the plant is powered from YAU. Once load shed of DC loads is complete, YAU will be de-energized. This repeater system is also battery backed up by two 12 VDC 100 ampere batteries. The battery supplies enough power for two hours continuous usage of the repeater. Use of the hand-held radios may be somewhat limited on a point-to-point basis once internal batteries in the repeater system are drained. Once power is restored to the essential 480 volt system using FSG DB-OP-02721, Restore Power to E1 and F1, YAU will be returned to service as diesel loading permits.

In addition, key locations where equipment is operated and the Control Room are interconnected using a sound powered telephone system. This system operates without any external or internal power sources and allows the operators to communicate with each other including the Control Room using headphones. The sound powered phone system was initially designed to be used during a Serious Control Room Fire Scenario to allow communications between the Auxiliary Shutdown Panel and various locations in the Plant. In the original design of the Sound Powered Phone system, there was not a sound powered phone jack available in the Control Room because a Control Room Fire could fault the cable creating a short preventing use of the system. During 19 RFO, the system was modified under ECP 14-0646: Sound Powered Modifications to Support FLEX. This modification added additional stations including a jack for the Control Room. To protect the Serious Control Room Fire use of the system, a disconnect for the Control Room sound powered phone jack was installed in the EFWF. Attachment 14 of FSG DB-OP-02705, Initial Assessment and FLEX Equipment Staging directs an available person to close the Control Room Sound Powered Phone disconnect, UTS5732 (located EFWF 586’) to enable the sound powered phone jack in the Control Room.

2.15 Water sources

2.15.1 Secondary Water Sources

Table 1, Water Sources, provides a list of potential water sources that may be used to provide cooling water to the SGs or the SFP, their capacities, and an assessment of availability following the applicable hazards identified in Section 2.6. Descriptions of the preferred water usage sources identified in Table 1, Water Sources are in sequence in which they would be utilized, based on their availability after an ELAP/LUHS event. The deployment of each strategy would be performed prior to depletion of the EFWST.

On-site water sources have a wide range of associated chemical compositions. Therefore, extended periods of operation with the addition of these various on-site water sources to the SGs were evaluated for impact on long term SG performance and SG material (e.g., tube) degradation and potential impact on the heat transfer capabilities of the SGs in Westinghouse Calculation DAR-SEE-II-12-20, Evaluation of Alternate Coolant Sources for Responding to an Extended Loss of All AC Power at the Davis-Besse Nuclear Power Station. This calculation evaluated the impact of potential water sources to be used to provide inventory to the SGs. This study concluded that although the heat transfer surfaces would experience fouling, the SGs would remain available for the expected duration required to establish core cooling during Phase 3 using the DHR System with support equipment from the SAFER Response Center.

Use of Lake Erie water was also evaluated in B&W Canada calculation 205S-A161, DB Unit 1 ROTSG Heat Transfer Evaluation Using Lake Erie Water. This calculation also concluded that SG performance would remain acceptable.

2.15.2 <u>Primary Water Sources</u>

Two sources of borated water have been evaluated for use during a Beyond-Design-Basis event. Each borated water source is discussed below, in order of preference. Each water source can be aligned to provide suction for either the CWRT or the BWST RCS FLEX Charging Pump.

- Clean Waste Receiver Tank 1: Clean Waste Receiver Tank 1 (T-15-1) is the protected source to provide a suction source for the FLEX RCS Charging Pumps. CWRT1 is a stainless steel, tank located inside the Auxiliary Building, Room 124, on the 545' level and therefore protected from High Wind/Tornado generated missiles. Calculation C-CSS-T15-1 was initiated to determine if CWRT1 is seismically adequate for all design bases seismic loads. This calculation documented the review of CWRT1 using the Seismic Qualification Utility Group (SQUG) Generic Implementation Procedure (GIP) for Seismic Verification of Nuclear Plant Equipment. This process determined that following modification of one pipe support and one conduit support per ECP 13-0463, CWRT (T15-1) is seismically adequate for design bases seismic loads. During "at power" operations CWRT1 borated volume is maintained ≥ 80,000 gallons at a boron concentration between 2600 and 2800 ppm Boron. During Modes 5 and 6 when the SGs are not available for decay heat removal, CWRT1 will be maintained ≥ 62,000 gallons at a boron concentration between 2600 and 2800 ppm Boron.

- Borated Water Storage Tank (BWST): DBNPS has one BWST (T-10) located outside on the West side of the Auxiliary Building at grade level (585'). The tank is a stainless steel, safety-related, seismically qualified storage tank, but is not protected from High Wind/Tornado generated missiles. During "at power" operations the BWST borated volume is maintained ≥ 500,100 gallons and ≤ 550,000 gallons at a boron concentration between 2600 and 2800 ppm Boron in accordance with Technical Specification 3.5.4.

2.15.3 Spent Fuel Pool Water Sources

Although the use of a borated source is not required, makeup to the SFP can be provided via gravity-feed from the BWST if available as directed by Operating Procedure DB-OP-06021, SFP Cooling System Operating Procedure, Section 4.12. Details for the BWST are provided above.

Table 1 provides a list of potential water sources that may be used to provide cooling water to the SFP, their capacities, and an assessment of availability following the applicable hazards identified in Section 2.6. The preferred source of SFP Makeup inventory is from the EFWST.

2.16 Shutdown and Refueling Modes Analysis

DBNPS will abide by the NEI position paper entitled "Shutdown/Refueling Modes" addressing mitigating strategies in shutdown and refueling modes. This position paper is dated September 18, 2013 and has been endorsed by the NRC staff in NEI Position Paper: "Shutdown/ Refueling Modes," dated September 18, 2013 (ML1 3273A514) and in Letter to Mr. J.E. Pollock (NEI) from Mr. J. R. Davis (NRC) dated September 30, 2013 endorsing NEI Shutdown/Refueling Modes Position Paper, (ML13267A382). These mitigating strategies are described below. Refer to NORM-LP-7204, Davis-Besse FLEX Strategy Design & Equipment Bases Detail for additional specific information on ELAP events for DBNPS in Modes 5 and 6.

The reactor core cooling and heat removal strategies discussed above (Reactor initially at power) are effective as long as the RCS is intact and the SGs are available for use. The window between elimination of natural circulation availability and when the refueling canal is flooded (approximately 50-100 hours), is considered in the Modes 5 and 6 core cooling strategy development. During this window, the RCS is less than full and the RCS is vented, typically by removing Steam Generator primary side handholes.

In a normal shutdown-cooldown, the DHR System is placed in service in Mode 4 while SG cooling continues in parallel until SG heat removal is no longer effective. At this point, the Main Steam Isolation Valves are closed and the Feedwater Supply to the SGs is isolated. In this condition, the SGs are not immediately available to remove decay heat. However, early in a plant shutdown, if the RCS remains intact and sufficiently filled to establish a flowpath from the reactor to the SGs, and if the SGs remain intact and capable of being supplied with feedwater, decay heat removal via the SGs may be recovered. In this scenario, when the ELAP occurs and the DHR system function is lost, the RCS will heat up and natural circulation will develop in the RCS to transfer decay heat to the SGs. This will result in an RCS heatup and eventual steam formation on the secondary side of the SGs, allowing manual control of steaming through the AVVs for decay heat removal. The EFW system is placed into service to feed the SGs, and the plant is stabilized in the same conditions that would exist at the end of Phase 2 with SGs available, as described in the previous sections. These strategies are directed by Abnormal Operating procedure DB-OP-02527, Loss of Decay Heat Removal. Phase 2 and Phase 3 would be the same in this scenario as described above for the case with SGs available.

If the plant shutdown has progressed to a stage where RCS draining has reduced the primary inventory below that required to establish natural circulation flow to the SGs, then SGs will remain unavailable for decay heat removal. In this scenario, core cooling is established using once-through heat removal from the RCS via coolant boil-off. During a planned outage, once plant conditions for RCS natural circulation are not available (RCS drained to a reduced inventory level and an RCS vent path is created), SGs are not available for removal of decay heat. As a result, when the DHR function is lost due to an ELAP event, the core will heat up and eventually begin to boil. The steam will be released to Containment removing decay heat in the process. That heat will then be released to the environment via the Emergency Hatch vent path in accordance with FSG DB-OP-02712, Alternate Containment Cooling. In Phase 1, inventory is maintained in the reactor vessel by establishing a gravity-feed flowpath from either the BWST or from the SFP, dependent upon which specific BDBEE has occurred as directed by AOP DB-OP-02527, Loss of Decay Heat Removal and FSG DB-OP-02714, Shutdown RCS Makeup. RCS level is monitored using the Hot Leg Level Monitoring system to control the rate of inventory addition to the RCS to maintain a stable level with the core covered. As RCS inventory boils off, removing decay heat to cool the core, the inventory is replenished from the BWST or the SFP as necessary. DBBP-OPS-1113, Control of Time Sensitive Operator Actions includes the Operator actions to add inventory to the Reactor Coolant Systems from the BWST and from the SFP for this plant condition.

Phase 2 will begin when the 480V FLEX generator is put into service to power additional FLEX support equipment in accordance with FSG DB-OP-02721, Restore 480 Volt Power to E1 and F1. If the SFP is being used to provide RCS inventory replenishment, it can only provide this function for approximately 6 to 7 hours as documented in calculation C-NSA-060.05-017, Mode 5 GOTHIC Analysis during Loss of Decay Heat Removal Event. After that time, the SFP level drops too low to provide gravity-driven flow to the reactor vessel, and pumped makeup to the RCS becomes required as directed by FSG DB-OP-02714, Shutdown RCS Makeup. The 480V FLEX generator will be used to power a FLEX RCS Charging Pump to take a suction from CWRT1. If the RCS boil-off rate exceeds the capacity of the FLEX RCS Charging Pump, the EFW pump will be put into service to augment the makeup rate to match the boil-off rate. In this scenario, boil-off of the borated water that is added to the RCS will result in a very high boron concentration in the RCS (i.e., on the order of 20,000 ppm boron). At this concentration, the use of non-borated EFWST water does not cause any dilution concern. In fact, it helps control the boron concentration to prevent potential precipitation in the core region, which could block cooling flow channels.

Phase 3 will begin when additional, offsite equipment begins arriving at the site and is first placed into service. The strategy in Phase 3 will be essentially the same as described above for the scenario with SGs available. The offsite equipment will be used to restore 4160V power and the large pumps will be used to provide SW flow. Once the required support systems have been recovered, the plant will transition to the use of the normal DHR system for core cooling. This condition will be maintained indefinitely, as normal AC power and plant systems are recovered.

With respect to the SFP during a refueling outage, the limiting, worst-case scenario is the case with a maximum SFP heat load (Full Core Off Load) and an initial loss of inventory, due to a non-seismic line break, down to a level of 596'. That case results in approximately 2.7 hours as the time-to-boil, and an additional 10 hours of boil-off before level drops to 10 feet above the top of the fuel racks. This allows a total of approximately 12.7 hours before makeup water must be provided. Under worst case SFP decay heat conditions, 70 gpm must be provided to the SFP to replace inventory lost due to boiling in order to maintain SFP level. Refer to Calculation C-ME-067.01-002, FLEX Spent Fuel Cooling and Makeup Hydraulics for additional information on SFP Makeup Flow rate requirements.

2.17 Sequence of Events

Section 3.1 presents a Sequence of Events (SOE) Timeline for an ELAP/LUHS event at DBNPS. Validation of each of the FLEX time constraint actions has been completed in accordance with the FLEX Validation Process documented in NEI12-

06, Revision 2, Appendix E, Validation Guidance and includes consideration for staffing. In order to minimize the impact of debris removal, a majority of the FLEX equipment is staged in protected environments. The first time sensitive action that may require removal of debris is 16 hours into the event (adding inventory to the EFWST). As a result, responding personnel from the Emergency Response Organization will be available to perform debris removal. This time is considered to be reasonable based on site reviews and the location of the EFWF and SB7. Debris removal equipment is stored at diverse locations to provide protection from the external hazards described in Section 2.6.

2.18 Programmatic Elements

2.18.1 Overall Program Document

NOP-LP-7200, FLEX Program for Davis-Besse is the overall program document for implementing the FLEX program at DBNPS.

NEI 12-06 (Reference 3) includes the following requirements for developing a FLEX Program Document. These requirements are either directly addressed in NOP-LP-7200 or via reference to supporting documentation.

a. The FLEX strategies and basis are maintained in an overall program document.

b. The program document will direct site implementation documents to contain a historical record of previous strategies and the basis for changes.

c. The document will direct site implementation documents to contain the basis for the ongoing maintenance and testing programs chosen for the FLEX equipment.

d. Validation will be included or incorporated by reference in the Program Document.

e. Documentation of the Mitigating Strategies Assessment for New Flood Hazard Information per appendix G.

f. Documentation of the Mitigating Strategies Assessment for New Seismic Hazard Information per appendix H.

The key elements of the program include:

- Maintenance of the FSGs including any impacts on the interfacing procedures (EOPs, AOPs, etc.)

- Maintenance and testing of BDB equipment (i.e., SFP level instrumentation, emergency communications equipment, portable equipment, support equipment, and support vehicles)
- Portable equipment deployment routes, staging areas, and connections to existing mechanical and electrical systems
- Validation of time sensitive operator actions
- The EFWF and the NSRC
- Hazards considerations (Flooding, Seismic, High Winds, etc.)
- Supporting evaluations, calculations and drawings
- Tracking of commitments and equipment unavailability
- Staffing, Training, and Emergency Drills
- Configuration Management
- Program Maintenance

In addition, the program description references (1) a list of the BDB FLEX basis documents that will be kept up to date for facility and procedure changes, (2) a historical record of previous strategies and their bases, and (3) the bases for ongoing maintenance and testing activities for the BDB equipment.

Existing design control procedures have been revised to ensure that changes to the plant design, physical plant layout, roads, buildings, and miscellaneous structures will not adversely impact the approved FLEX strategies.

Future changes to the FLEX strategies may be made without prior NRC approval provided 1) the revised FLEX strategies meet the requirements of NEI 12-06, and 2) an engineering basis is documented that ensures that the change in FLEX strategies continues to ensure the key safety functions (Containment, core and SFP cooling) are met.

Refer to NORM-LP-7204, Davis-Besse FLEX Strategy Design & Equipment Bases Detail, for additional information.

2.18.2 Procedure Guidance

The inability to predict actual plant conditions that require the use of BDB equipment makes it impossible to provide specific procedural guidance. As such, the FSGs provide guidance that can be employed for a variety of conditions. Clear criteria for entry into FSGs ensures that FLEX strategies are used only as directed for BDBEE conditions, and are not used inappropriately in lieu of existing procedures. When BDB equipment is needed to supplement EOPs or AOPs strategies, the EOP or AOP directs the entry into the appropriate FSG procedure. FSGs have been developed in accordance with Pressurized Water Reactor Owner's Group (PWROG) guidelines. The FSGs provide instructions for implementing available, pre-planned FLEX strategies to accomplish specific tasks in the EOPs or AOP's. FSGs are used to supplement (not replace) the existing procedure structure that establishes command and control for the event. Refer to Section 3.2.2, Procedural Guidance for additional information on FSGs and FSOAs developed for use at DBNPS

FSG procedural Interfaces have been incorporated into EOP DB-OP-02700, Station Blackout, to the extent necessary to include appropriate reference to FSGs and provide command and control for the ELAP. In addition, procedural interfaces have been incorporated into the following procedures to include appropriate reference to FSGs:

- EOP DB-OP-02000, RPS, SFAS, SFRCS Trip or SG Tube Rupture
- AOP DB-OP-02527, Loss of Decay Heat Removal
- AOP DB-OP-02547, Spent Fuel Pool Cooling Malfunctions

FSG maintenance is performed as directed by NOP-SS-3001, Procedure Review and Approval. In accordance with site administrative procedures, NEI 96-07, Revision 1 (Reference 21), and NEI 97-04, Revision 1 (Reference 22) are to be used to evaluate changes to current procedures, including the FSGs, to determine the need for prior NRC approval. However, per the guidance and examples provided in NEI 96-07, Revision 1, changes to procedures (EOPs, AOPs, or FSGs) that perform actions in response events that exceed a site's design-basis should screen out. Therefore, procedure steps which recognize the BDB ELAP/LUHS has occurred and which direct FLEX strategy actions to ensure core cooling, containment, or SFP cooling should not require prior NRC approval.

FSGs have been reviewed and validated by the involved groups to the extent necessary to ensure that implementation of the associated FLEX strategy is feasible. Specific FSG validation was accomplished via table top evaluations and walk-throughs of the guidelines when appropriate. FSG Procedure validation is described in NORM-LP-7201, Davis Besse FLEX Validation Process Report.

2.18.3 Staffing

DBNPS completed a staffing study using the methodology of NEI 12-01, Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities. The assumptions for the NEI 12-01 Phase 2 scenario postulate that the BDBEE involves a large-scale external event that results in:

A. An extended loss of AC power (ELAP)

B. An extended loss of ultimate heat sink (UHS)

C. Impact on all units (all units for multi-unit sites are in operation at the time of the event – not applicable to DBNPS)

D. Impeded access to the unit by off-site responders as follows:

- 0 to 6 Hours Post Event – No site access. This duration reflects the time necessary to clear roadway obstructions, use different travel routes, mobilize alternate transportation capabilities (e.g., private resource providers or public sector support), etc.
- to 24 Hours Post Event – Limited site access. Individuals may access the site by walking, personal vehicle or via alternate transportation capabilities (e.g., private resource providers or public sector support).
- 24+ Hours Post Event – Improved site access. Site access is restored to a near-normal status and/or augmented transportation resources are available to deliver equipment, supplies and large numbers of personnel.

A team of subject matter experts from Operations, Radiation Protection, Chemistry, Security, Emergency Preparedness, FLEX project and industry consultants performed a tabletop evaluation in July 2015 for the on-shift portion of the assessment. The participants reviewed the assumptions and existing procedural guidance, including applicable draft EOPs and FSGs for coping with a BDBEE using minimum on-shift staffing. Particular attention was given to the sequence and timing of each procedural step, its duration, and the on-shift individual performing the step to account for both the task and time motion analyses of NEI 10-05, Assessment of On-Shift Emergency Response Organization Staffing and Capabilities.

Analysis result items have been entered into the corrective action program.

1.1 On-shift ERO Analysis

The on-shift ERO analysis concluded that the current DBNPS on-shift staffing present for the "no site access" 6-hour time period is sufficient to perform the EOP, FSG and emergency response tasks. Refer to L-15-288, NEI 12-01 Phase 2 Extended Loss of AC Power (ELAP) ERO Staffing Analysis Report for additional information.

1.2 Expanded ERO Analysis

The expanded ERO analysis concluded that the current DBNPS augmenting ERO is sufficient to fill positions for the expanded ERO functions. Thus, the ERO resources and capabilities necessary to implement Transition Phase coping strategies performed after the end of the "no site access" 6-hour time period exist in the current program.

The staffing assessments noted above were performed in conjunction with the development of procedures and guidelines that address NRC Order EA- 12-049. As part of the FSG development process, a validation assessment of the FSGs was performed using communication equipment determined available post-BDBEE and the staff deemed available per the staffing studies. The validation process was performed based on NEI12-06, Revision 02, Appendix E, Validation Guidance. FSG Procedure validation is described and documented in NORM-LP-7201, Davis Besse FLEX Validation Process Report.

2.18.4 Training

DBNPS's Nuclear Training Program has been revised to assure personnel proficiency in utilizing FSGs and associated BDB equipment for the mitigation of BDBEE is adequate and maintained. These programs and controls were developed and have been implemented in accordance with the Systematic Approach to Training (SAT) Process.

Initial training has been provided and periodic training will be provided to site emergency response leaders on BDB emergency response strategies and implementing guidelines. Personnel assigned to direct the execution of the FLEX mitigation strategies for BDBEE have received the necessary training to ensure familiarity with the associated tasks, considering available job aids, instructions, and mitigation strategy time constraints.

Care has been taken to not give undue weight (in comparison with other training requirements) to Operator training for BDBEE accident mitigation. The testing/evaluation of Operator knowledge and skills in this area has been similarly weighted.

In accordance with Section 11.6 of NEI 12-06, ANSI/ANS 3.5, Nuclear Power Plant Simulators for use in Operator Training (Reference 25), certification of simulator fidelity is considered to be sufficient for the initial stages of the BDBEE scenario until the current capability of the simulator model is exceeded. Full scope simulator models will not be upgraded to accommodate FLEX training or drills. The DBNPS Simulator has been updated to include the EWF System equipment and indications available in the Control Room.

2.18.5 Equipment List

The equipment stored and maintained at DBNPS necessary for the implementation of the FLEX strategies in response to a BDBEE at DBNPS is listed in Table 2. Table 2 identifies the quantity, applicable strategy, and capacity/rating for the major BDB equipment components only, as well as, various clarifying notes. Details regarding fittings, tools, hose lengths, consumable supplies, etc. are not in Table 2, but are detailed in DBBP-OPS-0037, FLEX Equipment Inventory. This Business Practice provides an inventory list by location of FLEX equipment. Confirmation that the required inventory is available is checked by Operations personnel once per quarter. Any missing or damaged equipment requires initiation of a Condition Report and repaired or replaced as necessary to comply with FLEX Program requirements.

2.18.6 N+1 Equipment Requirements

NEI 12-06 invokes an N+1 requirement for the major BDB FLEX equipment that directly performs a FLEX mitigation strategy for core cooling, containment, or SFP cooling in order to assure reliability and availability of the FLEX equipment required to meet the FLEX strategies. Sufficient equipment has been purchased to address all functions at all units on-site, plus one additional spare, i.e., an N+1 capability, where "N" is the number of equipment required by FLEX strategies for all units on-site. Therefore, where a single resource is sized to support the required function of both units, a second resource has been purchased to meet the +1 capability. In addition, where multiple strategies to accomplish a function have been developed, (e.g., two separate means to repower instrumentation), the equipment associated with each strategy does not require N+1 capability.

The N+1 capability applies to the portable FLEX equipment that directly supports maintenance of the key safety functions identified in Table 3-2 of NEI 12-06. Other FLEX support equipment provided for mitigation of BDB external events, but not directly supporting a credited FLEX strategy, is not required to have N+1 capability.

In the case of hoses and cables associated with FLEX equipment required for FLEX strategies, the following method as documented in NEI 12-06 R2 to meet

N+1 capability has been selected. These hoses and cables are passive components being stored in a protected facility (EFWF or Auxiliary Building). It is postulated the most probable cause for degradation/damage of these components would occur during deployment of the equipment. Therefore the N+1 capability is accomplished by having sufficient hoses and cables to satisfy the N capability + 10% spares or at least 1 length of hose and cable. This 10% margin capability ensures that failure of any one of these passive components would not prevent the successful deployment of a FLEX strategy. The N+1 requirement does not apply to the BDB FLEX support equipment, vehicles, and tools. However, these items are covered by a fleet administrative procedure and are subject to inventory checks, requirements, and any maintenance and testing that are needed to ensure they can perform their required functions.

2.18.7 Equipment Maintenance and Testing

Initial Component Level Testing, consisting of Factory Acceptance Testing and Site Acceptance Testing, was conducted to ensure the portable FLEX equipment can perform its required FLEX strategy design functions. Factory Acceptance Testing verified that the portable equipment performance conformed to the manufacturers rating for the equipment as specified in the Purchase Order. Verification of the vendor test documentation was performed as part of the receipt inspection process for each of the affected pieces of equipment and included in the applicable Vendor Technical Manuals. Site Acceptance Testing confirmed Factory Acceptance Testing to ensure portable FLEX equipment delivered to the site performed in accordance with the FLEX strategy functional design requirements.

The portable BDB equipment that directly performs a FLEX mitigation strategy for the core cooling, containment, or SFP cooling is subject to periodic maintenance and testing in accordance with NEI 12-06 Revision 02 and INPO AP 913, Equipment Reliability Process, to verify proper function. Additional FLEX support equipment that requires maintenance and testing will have Preventive Maintenance to ensure it will perform its required functions during a BDB external event.

EPRI has completed and has issued Preventive Maintenance Basis for FLEX Equipment - Project Overview Report. Preventative Maintenance Templates for the major FLEX equipment including the portable diesel pumps and generators have also been issued.

The PM Templates include activities such as:

- Periodic Static Inspections - Monthly walkdown

- Fluid analysis - Annually
- Periodic operational verifications
- Periodic performance tests

Preventive maintenance (PM) procedures and test procedures are based on the templates contained within the EPRI Preventive Maintenance Basis Database, or from manufacturer provided information/recommendations when templates were not available from EPRI. The corresponding maintenance strategies were developed and documented. The performance of the PMs and test procedures are controlled through the site work order process. FLEX support equipment not falling under the scope of INPO AP 913 will be maintained as necessary to ensure continued reliability. Performance verification testing of FLEX equipment is scheduled and performed as part of the DBNPS PM process.

NORM-LP-7202, Davis-Besse Specifications for FLEX Equipment Out of Service was established to ensure the unavailability of equipment and applicable connections that directly perform a FLEX mitigation strategy for core cooling, containment, and SFP cooling will be managed such that risk to mitigation strategy capability is minimized. Maintenance/risk guidance conforms to the guidance of NEI 12-06 as follows:

** Portable FLEX equipment may be unavailable for 90 days provided that the site FLEX capability (N) is available.*

" If portable equipment becomes unavailable such that the site FLEX capability (N) is not maintained, initiate actions within 24 hours to restore the site FLEX capability (N) and implement compensatory measures (e.g., use of alternate suitable equipment or supplemental personnel) within 72 hours.

The definitions, requirements, and directions for control of FLEX Equipment and FLEX facilities are contained in NOP-LP-7200, FLEX Program for Davis-Besse. Timeliness of restoration actions is commensurate with the significance of the degraded FLEX function. Prioritization of corrective actions is described in NOP-WM-1003, Nuclear Maintenance Notification, Initiation, Screening and Minor Deficiency Monitoring Process.

3. References

1. Letter to All Power Reactor Licensees, Request for Information Pursuant to Title of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3,

and 9.3, of the Near Term Task Force Review of Insights from the Fukushima Daiichi Accident, March 12, 2012, U.S. Nuclear Regulatory Commission.

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. NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 2, December 2015.
4. NRC Interim Staff Guidance JLD-ISG-2012-01 (R01), Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, Revision 1, dated January 22, 2016.
5. NRC Order Number EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation, dated March 12, 2012.
6. NEI 12-02, Revision 1, Industry Guidance for Compliance with NRC Order EA-12-051, 'To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation', Nuclear Energy Institute, August 2012.
7. NRC Interim Staff Guidance JLD-ISG-2012-03, Compliance with Order EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation, Revision 0, dated August 29, 2012.
8. NRC (E. Leeds and M. Johnson) Letter to All Power Reactor Licensees et al., “Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3 and 9.3 of the Near-Term Task Force Review of Insights from the Fukushima Dai-Ichi Accident,” March 12, 2012.
9. Davis-Besse Nuclear Power Station Technical Specifications.
10. WCAP-17601, Reactor Coolant System Response to the Extended Loss of AC Power Event for Westinghouse, Combustion Engineering and Babcock & Wilcox NSSS Designs, August 2012, Revision 0.
11. WCAP-17792-P, Emergency Procedure Development Strategies for the Extended Loss of AC Power Event for all Domestic Pressurized Water Reactor Designs, Revision 0,
12. PWROG-1 4064-P, Application of NOTRUMP Code Results for PWRs in Extended Loss of AC Power Circumstances, September 2014, Revision 0.

13. N-9000 seal performance documented in Flowserve Station Blackout Testing N-9000 Seal and validated in Flowserve's letter to FirstEnergy dated December 7, 2015.

14. "Westinghouse Response to NRC Generic Request for Additional Information (RAI) on Boron Mixing in Support of the Pressurized Water Reactor Owners Group (PWROG)," dated August 16, 2013 (ML13235A135).

15. Letter to Mr. J. Stringfellow (Westinghouse) from Mr. J. R. Davis (NRC) dated January 8, 2014 endorsing the Westinghouse Position Paper on Boron Mixing (ML13276A183).

16. Letter to Mr. J. E. Pollock (NEI) from Mr. J. R. Davis (NRC) endorsing NEI White Paper entitled "Battery Life Issue," dated September 16, 2013 (ML1 3241A1 82).

17. Davis-Besse Nuclear Power Station Updated Safety Analysis Report (USAR), Revision 30.

18. AREVA Document Number 51 – 9242059, SAFER response Plan for Davis-Besse Nuclear Power Station, Revision 0.

19. NEI Position Paper: "Shutdown/ Refueling Modes," dated September 18, 2013 (ML1 3273A514).

20. Letter to Mr. J.E. Pollock (NEI) from Mr. J. R. Davis (NRC) dated September 30, 2013 endorsing NEI Shutdown/Refueling Modes Position Paper, (ML13267A382).

21. NEI Guideline 96-07, Guidelines for 10CFR50.59 Implementation, November 2000, Revision 1.

22. NEI Guideline 97-04, Design Basis Program Guidelines, February 2001, Revision 0.

23. NEI 12-01, Guidelines for Assessing Beyond Design Basis Accident Response Staffing and Communications, Revision 0.

24. NEI 10-05, Assessment of On-Shift Emergency Response Organization Staffing and Capabilities, June 2011, Revision 0.

25. ANSI/ANS 3.5-2009, Nuclear Power Plant Simulators for use in Operator Training.

26. INPO AP 913, Equipment Reliability Process Description, Institute of Nuclear Power Operations, March 2011, Revision 3.

27. Preventive Maintenance Basis for FLEX Equipment - Project Overview Report (EPRI Report 3002000623), September 2013.

28. Letter to Mr. J. E. Pollock (NEI), Electric Power Research Institute Final Draft Report, "Seismic Evaluation Guidance: Augmented Approach for the Resolution of Fukushima Near-Term Task Force Recommendation 2. 1: Seismic," As an Acceptable Alternative to the March 12, 2012, Information Request for Seismic Reevaluations, May 7, 2013, U.S. Nuclear Regulatory Commission (ML13114A949).

29. Davis-Besse Nuclear Power Station NEI 12-01 Phase 2 ELAP ERO Staffing Analysis Report, Revision 0.

30. Davis-Besse EOP DB-OP-02000, RPS, SFAS, SFRCS Trip or SG Tube Rupture, Revision 28.

31. NOP-LP-7200, FLEX Program for Davis-Besse.

32. NORM-LP-7202, Davis-Besse Specifications for FLEX Equipment Out of Service.

33. NORM-LP-7204, Davis-Besse FLEX Strategy Design & Equipment Bases Detail.

34. NOP-WM-1003, Nuclear Maintenance Notification, Initiation, Screening and Minor Deficiency Monitoring Process.

35. DBBP-OPS-1113, Control of Time Sensitive Operator Actions.

36. PWROG-15015-P, PWROG SAMG (PA-PSC-0932), PWR Owners Group Severe Accident Management Guidelines Revision 0.

37. Davis-Besse Extensive Damage Mitigation Guideline, DB-OP-02600, Operational Contingency Response Action Plan.

38. Westinghouse Calculation DAR-SEE-II-12-20, Evaluation of Alternate Coolant Sources for Responding to an Extended Loss of All AC Power at the Davis-Besse Nuclear Power Station.

39. B&W Canada calculation 205S-A161, DB Unit 1 ROTSG Heat Transfer Evaluation Using Lake Erie Water, Revision 0.

40. NG-DB-00319, Control of the Emergency Operating Procedure and Technical Basis.

41. C-ME-050.05-011, Tank Level Curve Calculation - Emergency Feedwater Facility Tanks.

42. System Description SD-007 System Description for 125/250 VDC AND 120 V Instrumentation AC System.

43. Notification 600990890 for 3.2.4.8-A 480V & 4160V load lists/capacity calculations.

44. Bowser Morner 173728-0316-5834, Report of Geotechnical Engineering Services Liquifaction Vulnerability Study Proposed Site Travel Path for Davis-Besse Nuclear Power Station 5501 North SR2, Oak Harbor, Ottawa CO., Ohio captured in Notification 600984768.

45. C-NSA-050.05-001, Emergency Feedwater System Assessment.

46. C-NSA-000.00-025, Auxiliary Feedwater and Emergency Feedwater System Model

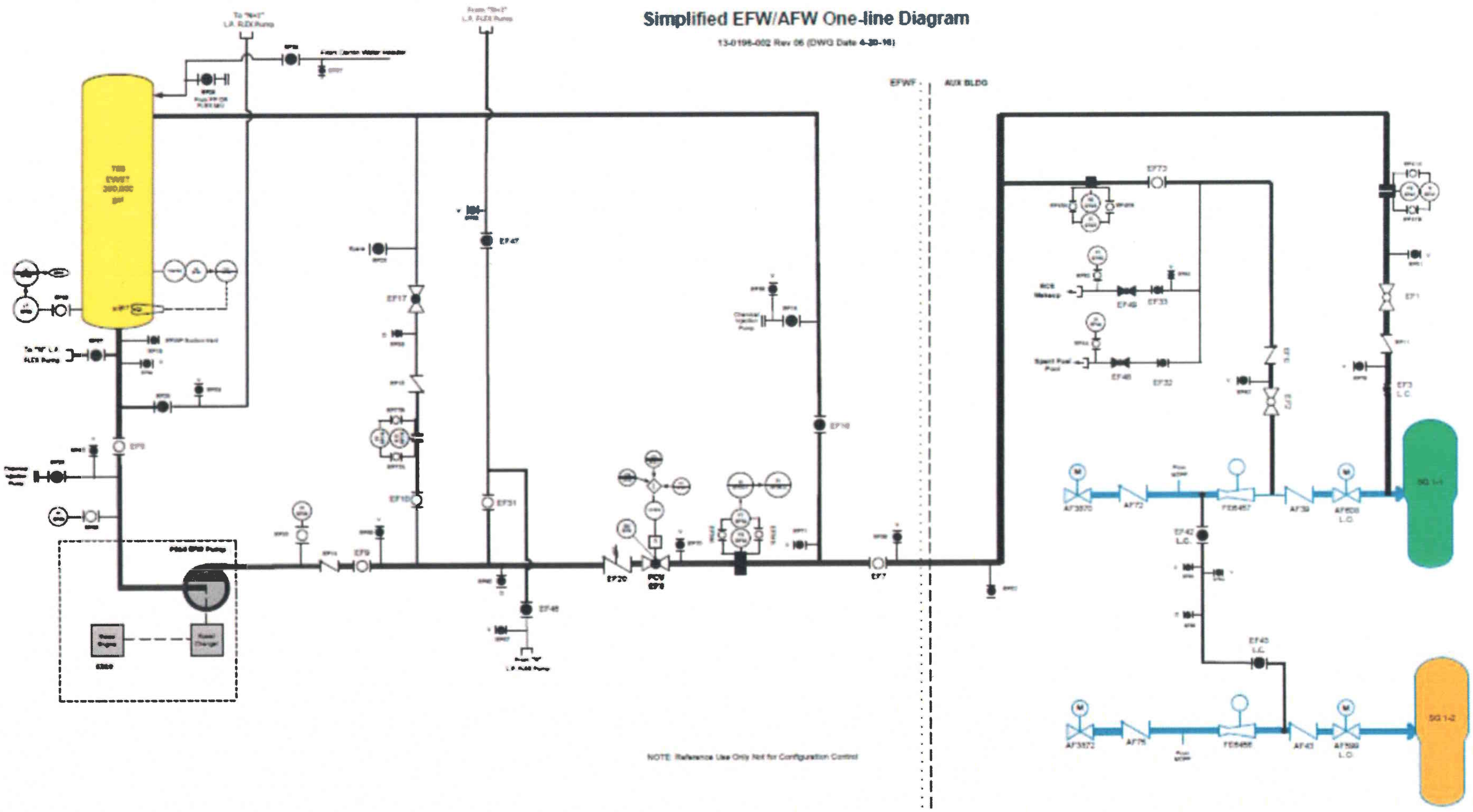


Figure 3: Emergency Feedwater with connections with Auxiliary Feedwater

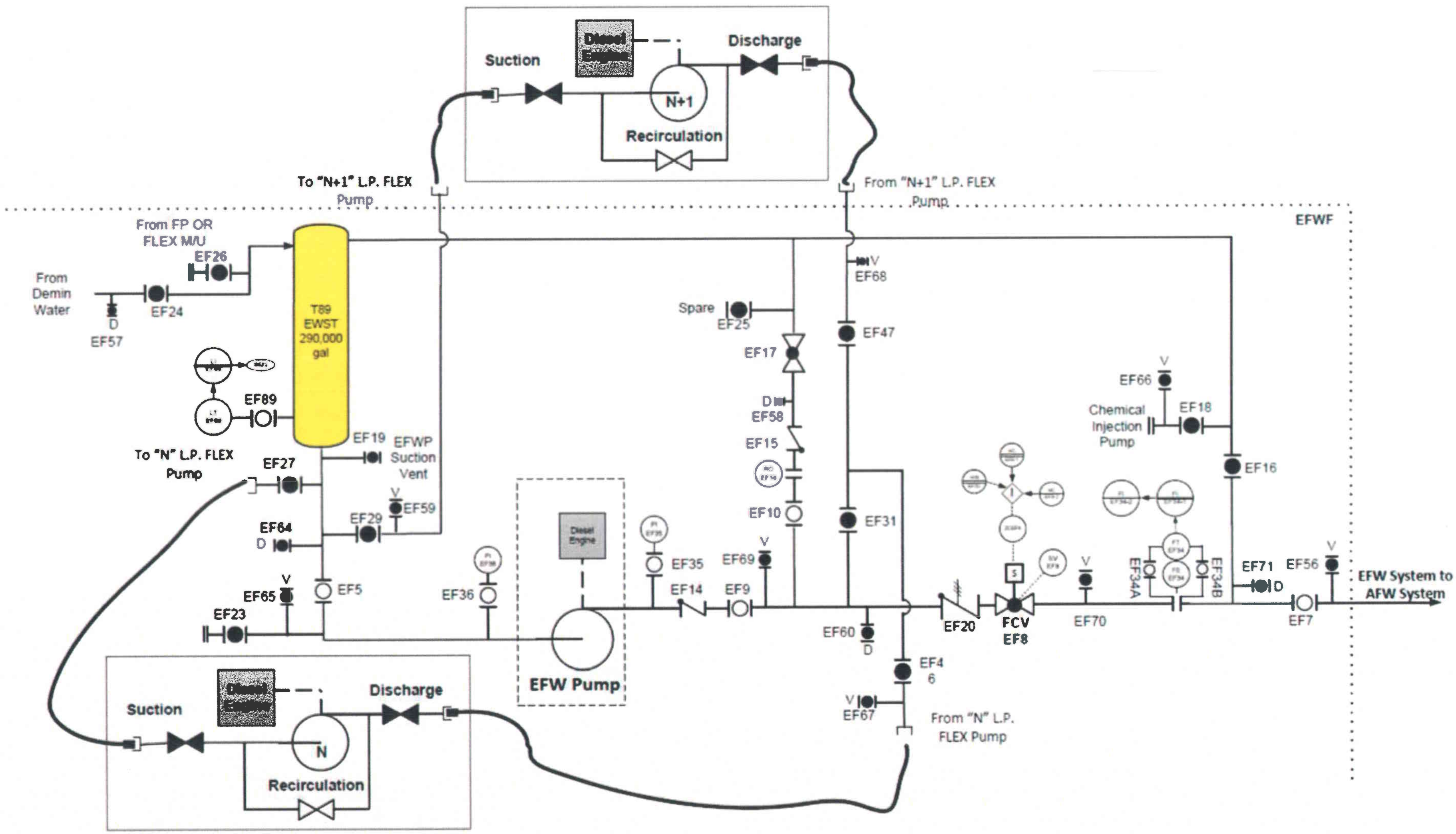


Figure 4: Emergency Feedwater with connections for Alt LP EFW Pumps

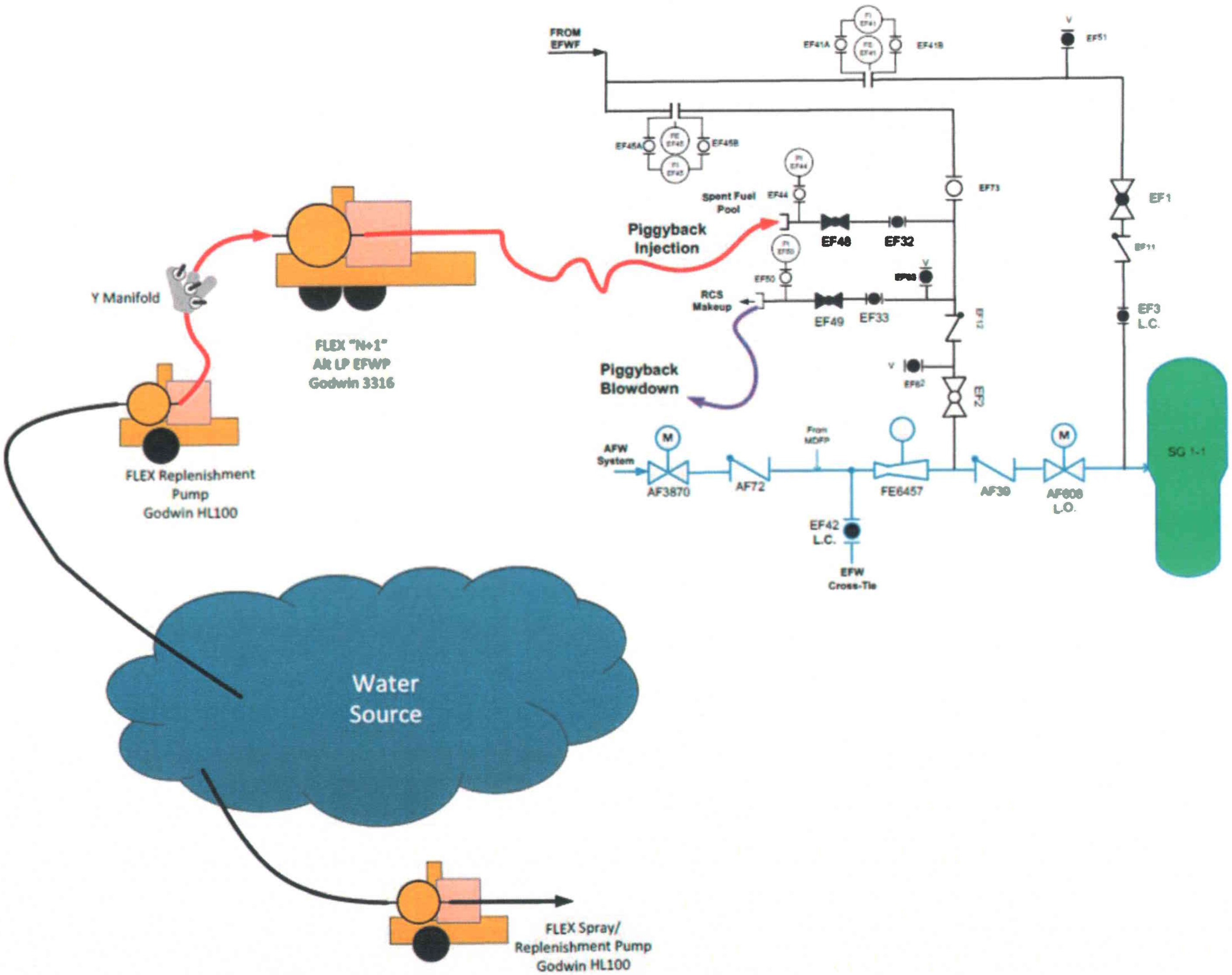
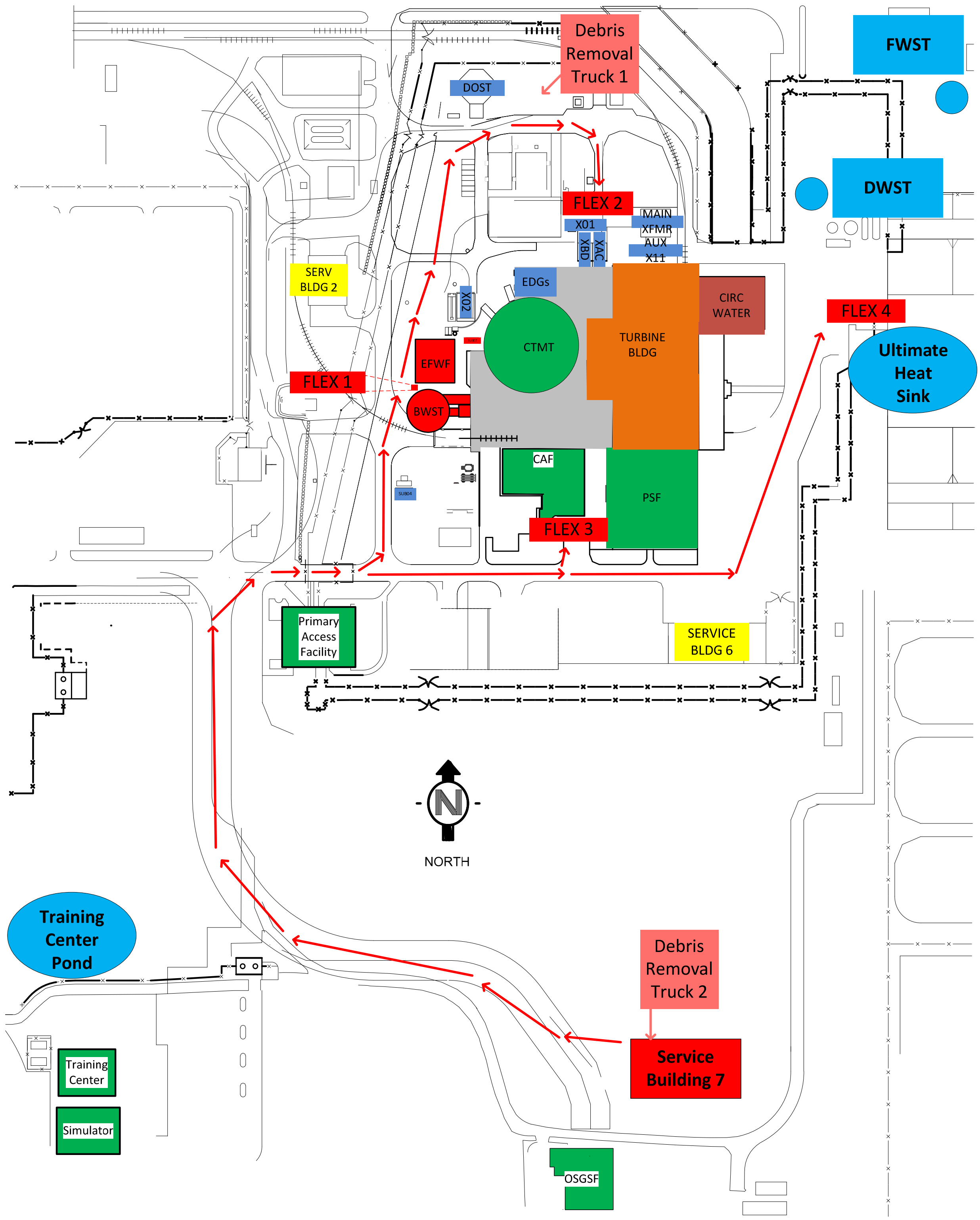
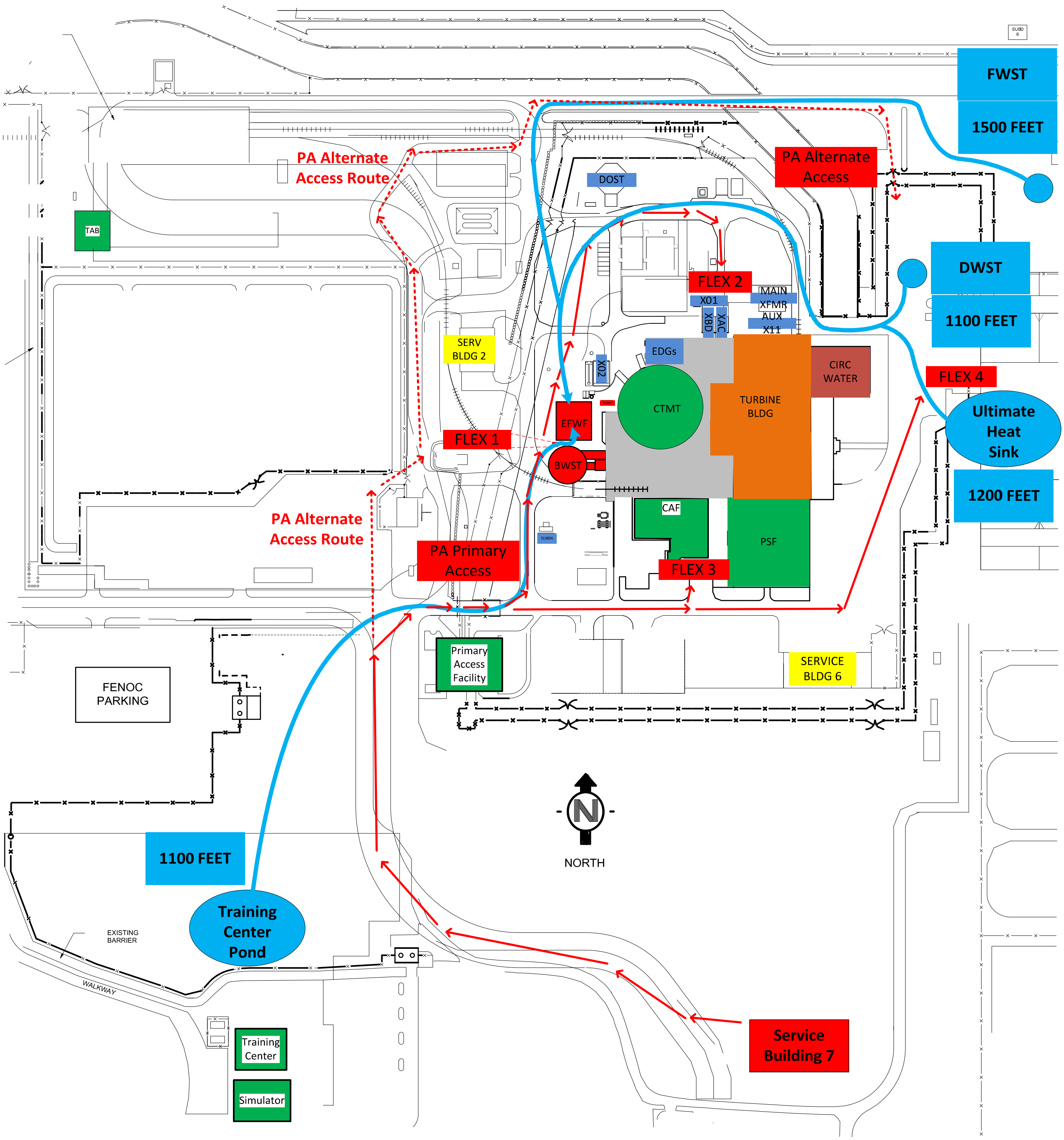


Figure 5: Diverse Alternate Connections for Alt LP EFW Pump



FLEX Staging Areas are depicted as FLEX 1, FLEX 2, FLEX 3 AND FLEX 4.

Figure 6: FLEX Equipment Deployment Locations and Haul Paths



FLEX Protected Area access routes are depicted as Primary (solid red line) and Alternate (hashed red line). Distances are from water source to EFW Facility.

Figure 7: FLEX Equipment Deployment Protected Area Access Point

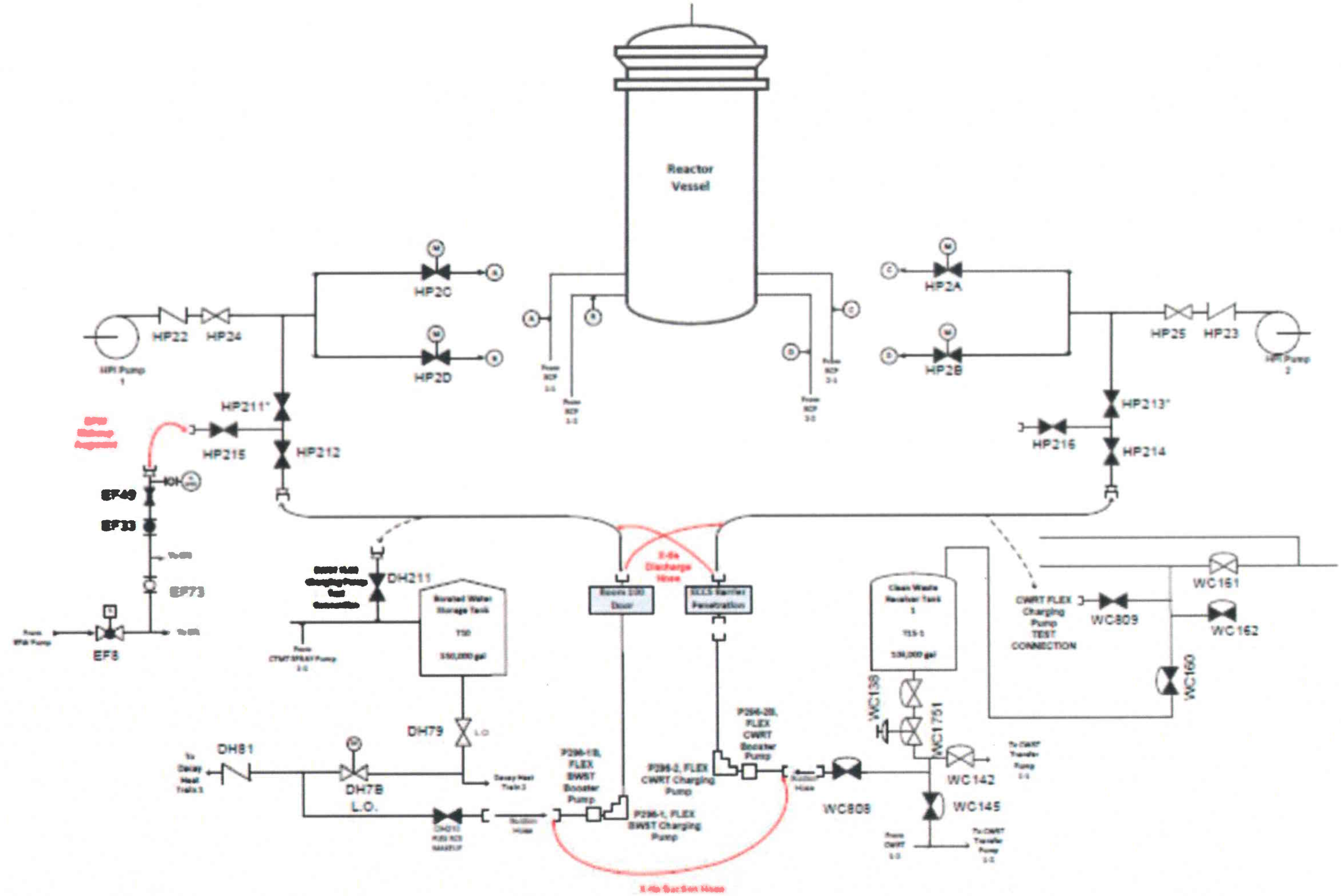
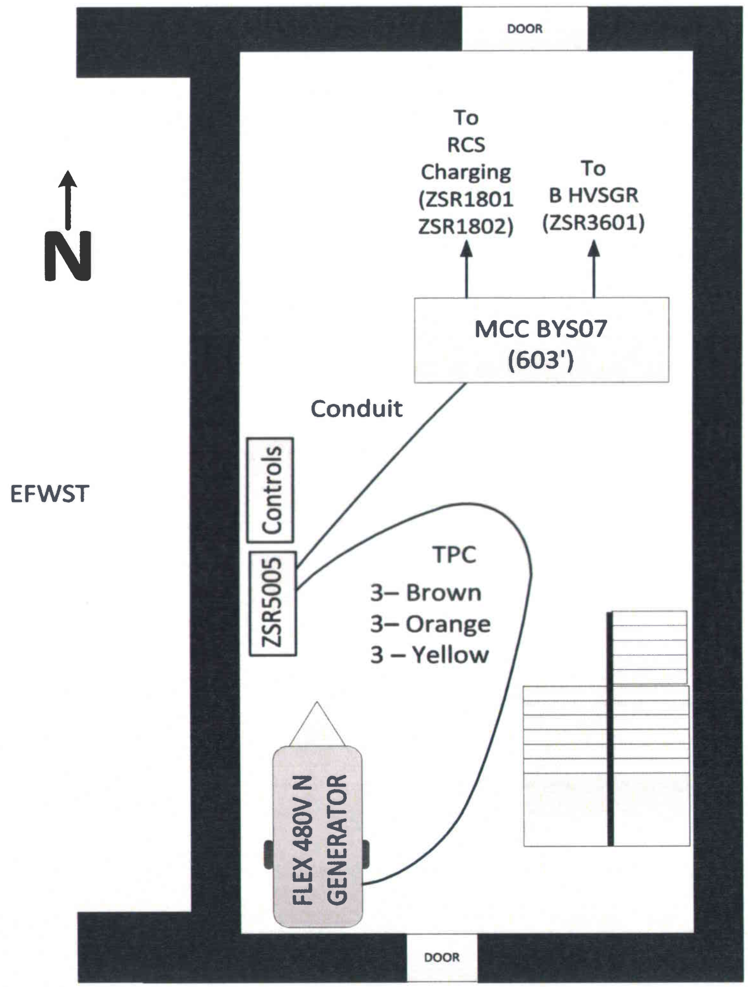


Figure 8: RCS Makeup Connections

N FLEX 480 Volt Diesel Generator



N + 1 FLEX 480 Volt Diesel Generator

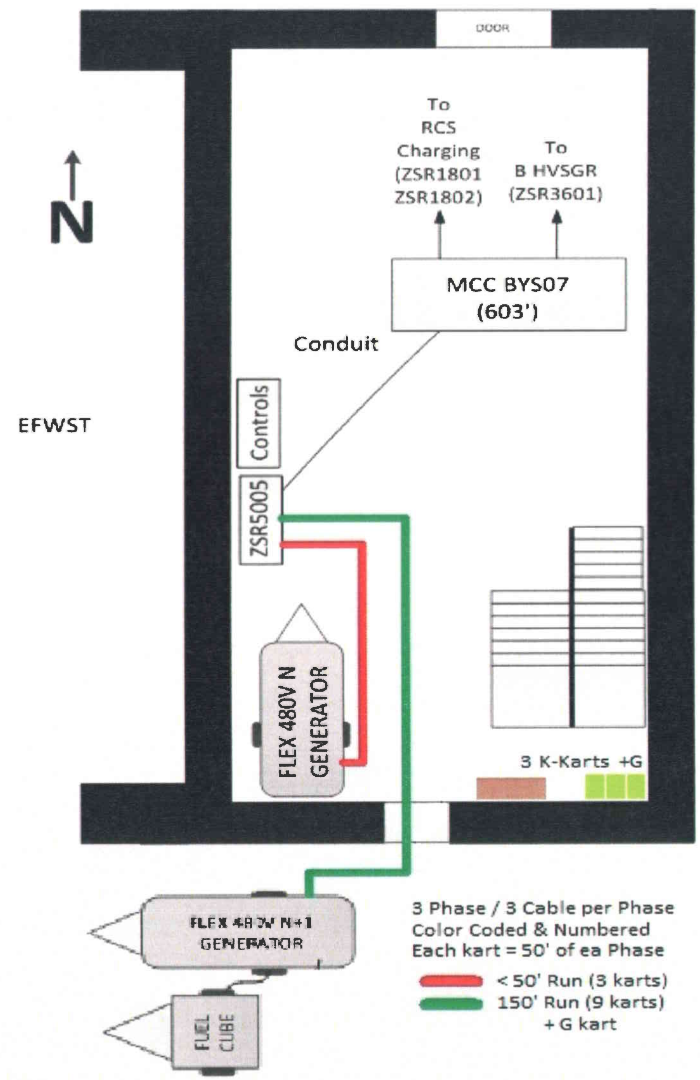


Figure 9: Restore Power to 480 volt E1 and F1 and powering FLEX Charging Pumps from EFW Facility

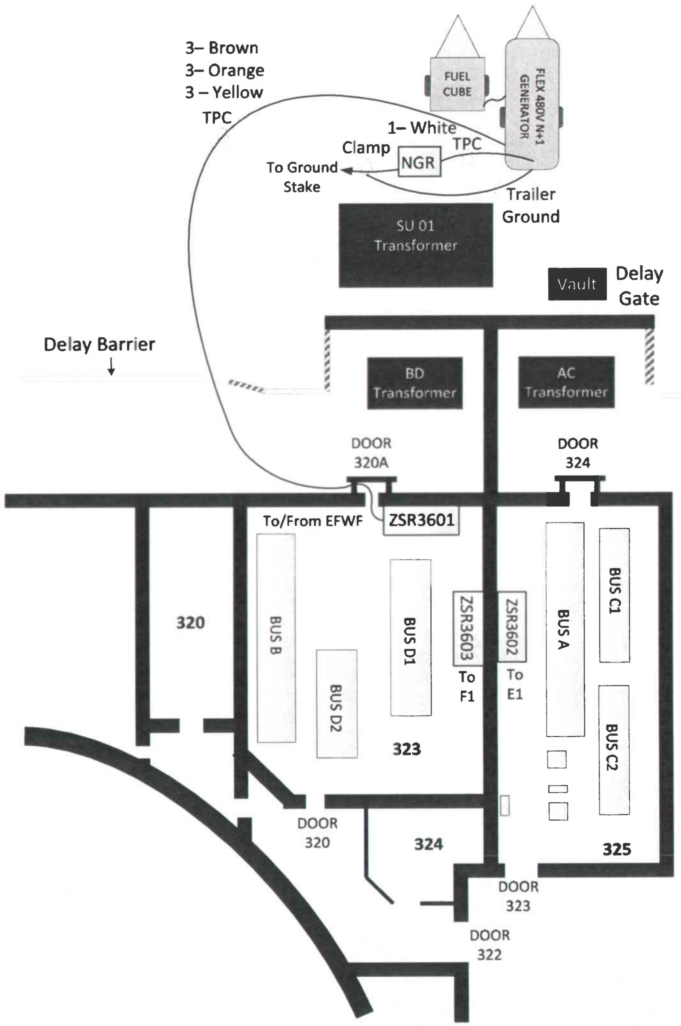


Figure 10: Restore Power to 480 volt E1 and F1 and powering FLEX Charging Pumps from Outside the HVSG Room

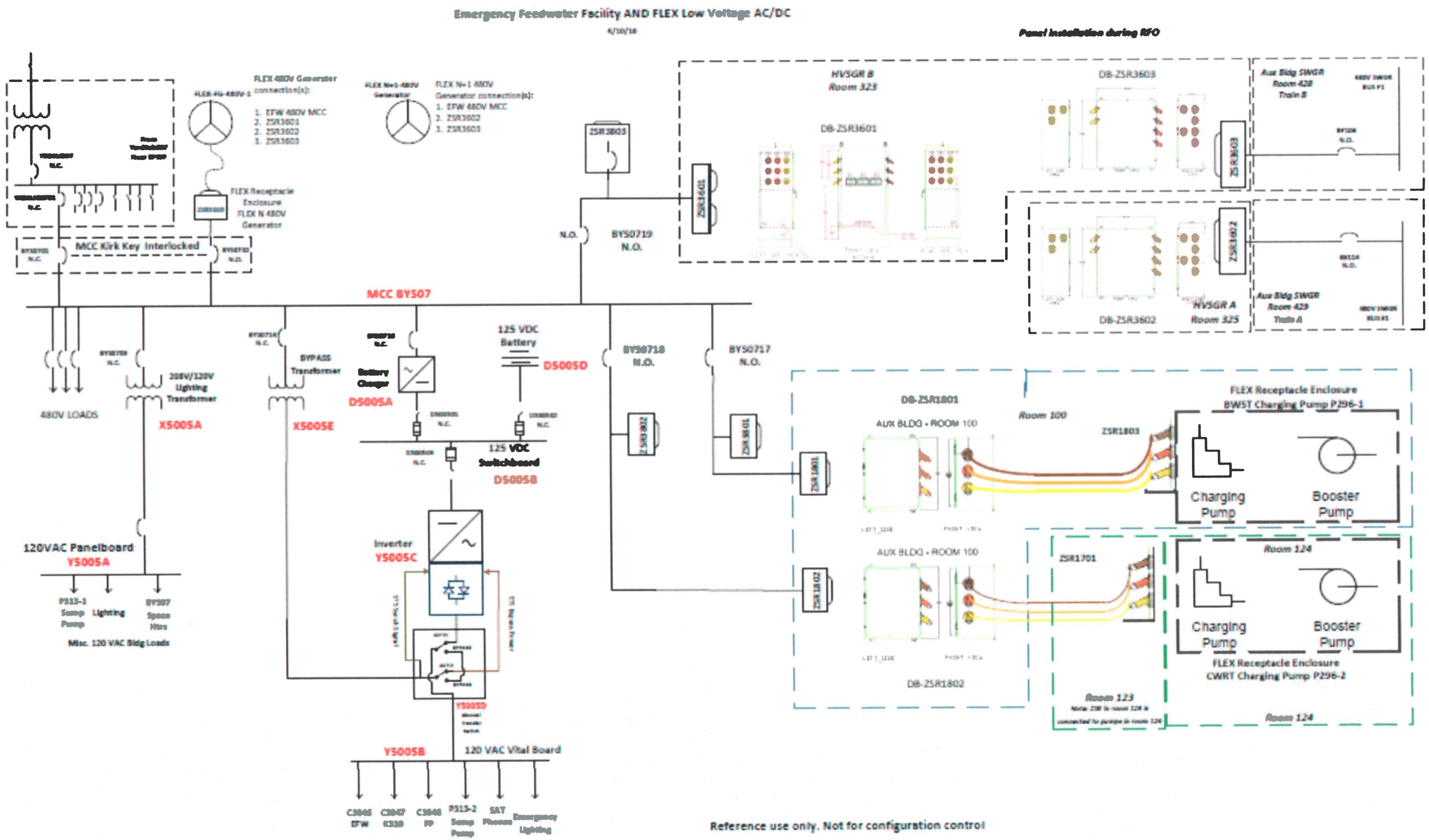


Figure 11: FLEX Electrical Distribution

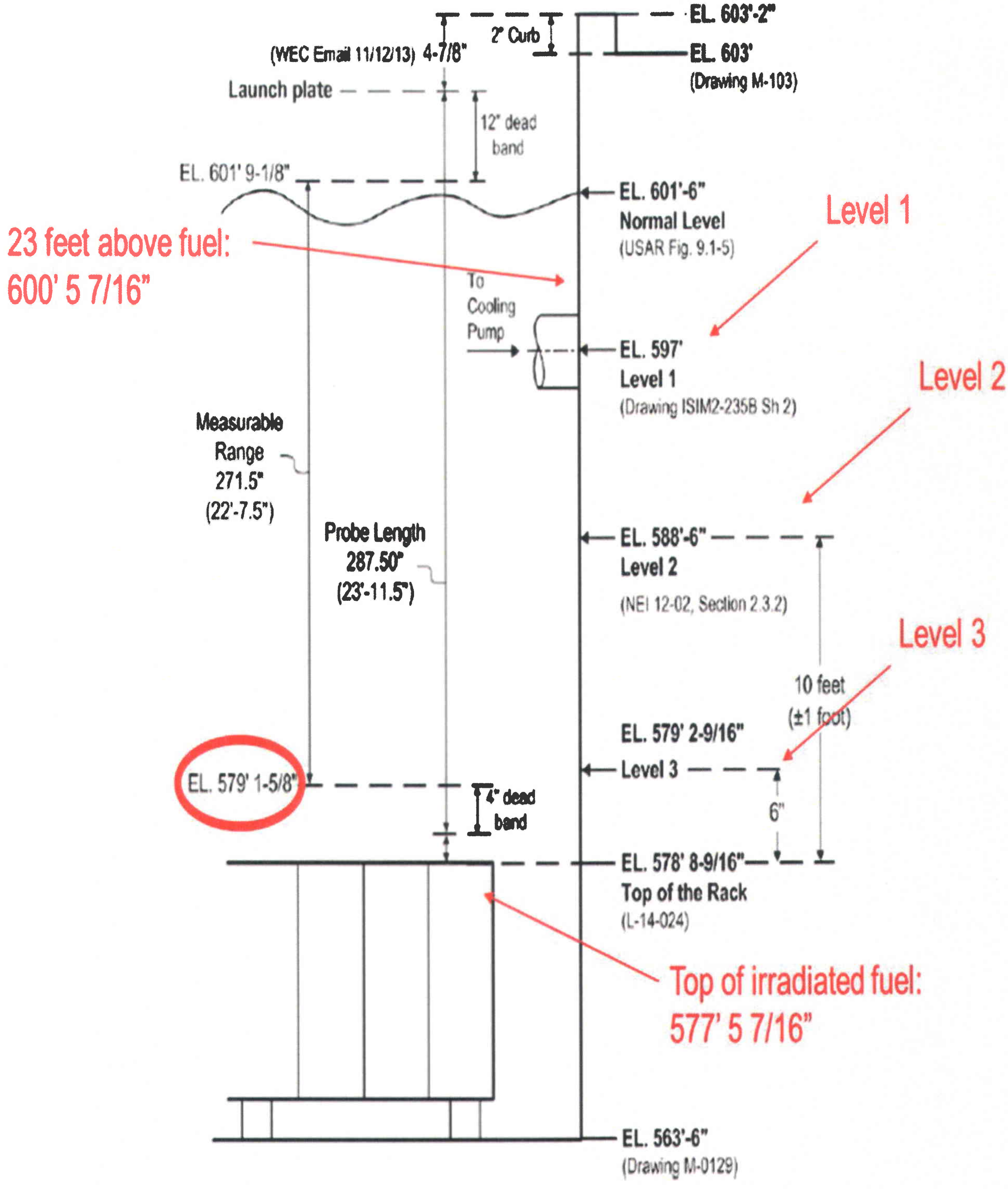


Figure 12: Spent Fuel Pool Elevation Drawing

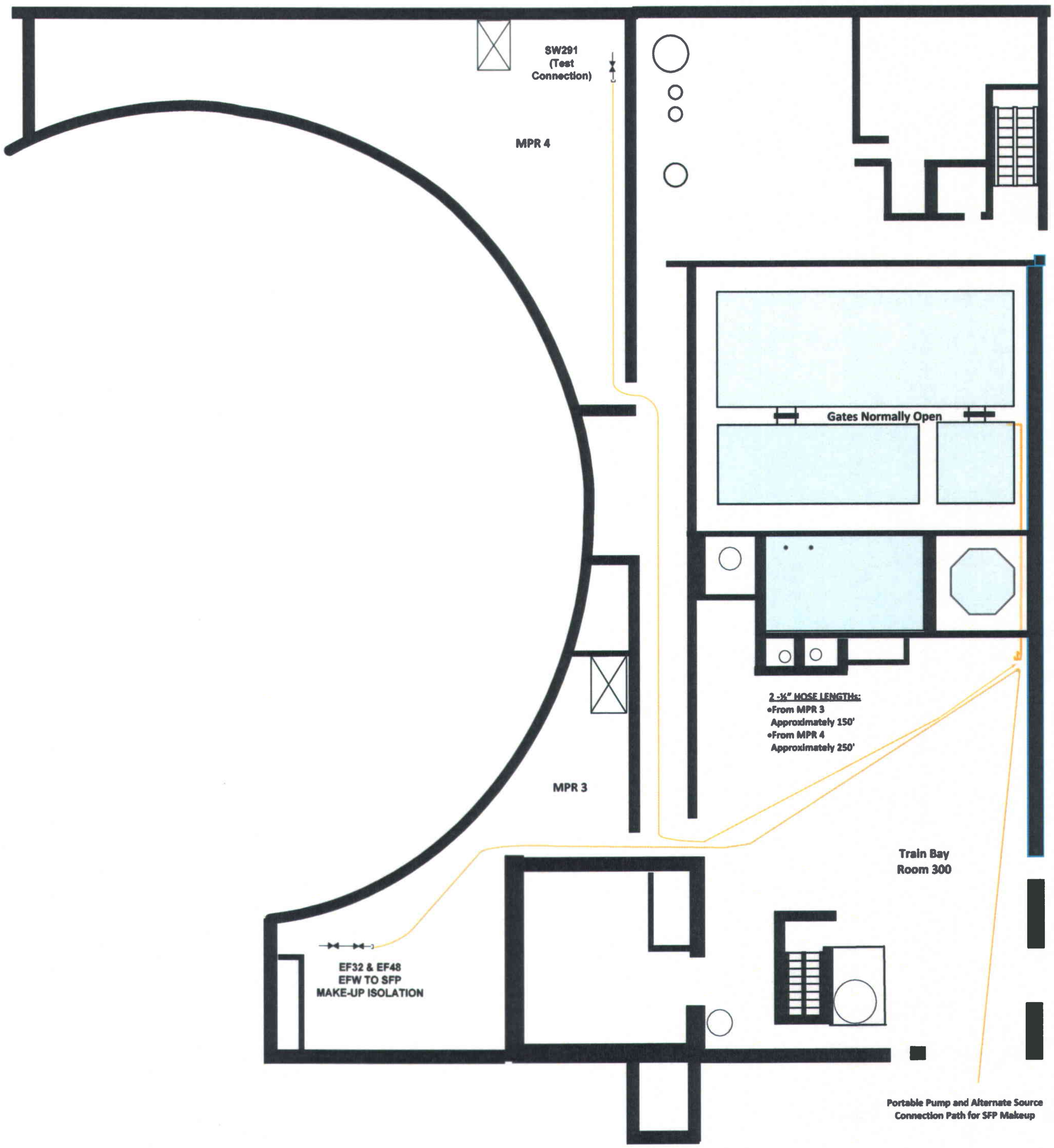


Figure 13: Spent Fuel Pool Makeup Hose Routes

3.1 Sequence of Events

3.1.1 NEI 12-01 Staffing Analysis Report On-Shift Staffing Task Timetable.

Assumptions of ELAP ERO Staffing Assessment

1. The ELAP event occurs during off-normal work hours at a time when augmented ERO responders are not at the site (e.g., during a backshift, weekend or holiday). This analysis uses 6 hours as the time period to conduct the on-shift ERO response actions. See assumption 13.A below.

2. Only personnel required to be on-shift are credited in the staffing analysis. Interim minimum on-shift staffing reductions allowed by Technical Specifications and/or Technical Requirements Manual are not invoked for the study.

   The on-shift personnel complement for this event includes the minimum required number and composition as described in the DBNPS Emergency Plan:

Functional Area	Major Tasks	Emergency Positions	Analysis Shift Staffing
1. Plant Operations and Assessment of Operational Aspects	Control Room Staff	Shift Manager (SRO) Unit Supervisor (SRO) Shift Engineer (STA) Reactor Operator Non-Licensed Operator (EO3)	1 1 1 2 1
2. Emergency Direction and Control	Command and Control	Shift Manager	1[(a)]
3. Notification & Communication	Licensee	CAS Operator	1[(a)]
	Local/ State	NLO or above	1[(a)]
	Federal	NLO or above	1[(a)]
4. Radiological Assessment	Dose Assessment	Shift Engineer (STA)	1[(a)]
	In-plant Surveys	RP Technician	1
	Onsite Surveys	RP Technician	1[(a)]
	Chemistry	Chemistry Technician	1
5. Plant System Engineering, Repair, and Corrective Actions	Technical Support	Shift Engineer (STA)	1[(a)]
	Repair and Corrective Actions	Mechanical Maintenance Electrical Maintenance I&C Maintenance	1[(a)] 1[(a)] 1[(a)]
6. In-Plant PAs	Radiation Protection	RP Technician	2[(a)]
7. Fire Fighting	--	Fire Brigade Captain (RO/EO3) Fire Brigade Member	1 4
8. 1st Aid and Rescue	--	NLO	1[(a)]
9. Site Access Control and Accountability	Security & Accountability	Security Shift Supervisor CAS Operator Security Personnel	1 1 (b)
		TOTAL:	**15**

(a) May be filled by someone filling another position having functional qualifications.
(b) Per DBNPS Physical Security Plan.

Task Time Table

Position Legend
SM=Shift Manager
US=Command SRO in Control Room
STA – Shift Technical Advisor (SRO Licensed position)
ATC=At the Controls Reactor Operator in the Control Room
BOP=Balance of Plant Reactor Operator in the Control Room
SBEO1 through 06= one of the six equipment operators assigned to each shift
CT=Chemistry Technician
RPT=Radiation Protection Technician
SSS=Security Shift Supervisor
CAS=Security Central Alarm Station Operator

Time (T+mins)	Position	Action	Duration (min)
0	**Complete loss of station AC power event occurs**		
0	SM US ATC BOP	Standard Post-trip actions (DB-OP-02000)	4
1	SBEO2	Deploy to EDGs to assess conditions (auto post trip actions)	10
1	SBEO3	Deploy to AFW room to assess conditions (auto post trip actions)	5
1	SBEO4	Deploy to CCW room to assess conditions (auto post trip actions)	3
2	BOP	Attempt to restore vital AC power (DB-OP-02000, Att 28)	1
3	CT	Report to CR	[redacted]
3	SEC1	Deployed to CR to act as comms interface between SM and SSS	[redacted]
3	BOP	Assess plant conditions (SR-4)	1
3	SBEO1	Report to CR	[redacted]
3	SBEO5	Report to CR	[redacted]
3	SBEO6	Report to CR	[redacted]
4	ATC	Attempt to start SBO DG (DB-OP-02000, Att 28)	2
5	SBEO4	Report to CR	[redacted]
6	RPT	Report to CR	[redacted]
6	US	Determine ELAP conditions exist (DB-OP-02000, Att 28, Step 4)	1
6	SBEO3	Report to CR	[redacted]
7	RPT	Survey for failed fuel and SG leakage (DBBP-RP-1004)	2
7	US	Initiate SBO procedure actions (DB-OP-02700)	3
8	US	Direct CT to deploy satellite antennae (DB-OP-02700)	1
8	ATC	Minimize RCS inventory loss (DB-OP-02700, Step 2)	1
8	BOP	Verify secondary system operation (DB-OP-02700, Step 3 & 4)	1
9	BOP	Verify EFW in operation (DB-OP-02700, Step 3.4)	1
9	CT	Deploy satellite antennae (DB-OP-02705, Att 14)	15

Time (T+mins)	Position	Action	Duration (min)
9	ATC	Perform plant operations actions (DB-OP-02700 and US direction)	duration
10	RPT	Perform in-plant dose rate surveys (DBBP-RP-1004)	50
10	US	Initiate ELAP load shed (DB-OP-02704)	1
11	US	Direct STA to monitor ELAP (DB-OP-02704)	1
11	SBEO2	Report to CR	
12	STA	Initiate actions for instrument readings (DB-OP-02704, Att 6)	3
12	US	Direct BOP to implement ELAP load mgmt (DB-OP-02704, Step 3.2)	1
13	BOP	Initiate ELAP load shed (DB-OP-02704, Att 1)	1
13	BOP	Direct SBEO1 perform severe load shed (DB-OP-02704, Att 1, Step 2)	1
13	US	Attempt call to system dispatch (DB-OP-02704, Step 3)	1
14	BOP	Direct SBEO2 to perform H2 purge (DB-OP-02704, Att 1, Step 2)	1
14	SBEO1	Perform severe load shed (DB-OP-02704, Att 2)	30
14	US	Direct SM to evaluate E-Plan, contact NSRC, notify SSS of ELAP (DB-OP-02700, Step 3.6)	1
15	SBEO2	Perform H2 purge / break MC vacuum (DB-OP-02704, Att 1, Step 4)	45
15	SM	Declare the SAE based on EAL SS1 (RA-EP-1800)	1
15	SM	Provide notification and direction to on-shift staff (RA-EP-1500)	duration
15	US	Initiate initial ELAP assessment and FLEX equipment staging (DB-OP-02700, Step 3.8)	1
16	SM	Attempt to sound nuclear emergency siren (RA-EP-1800)	1
16	US	Direct BOP to assess plant conditions (DB-OP-02705, Step 3.1)	1
17	SM	Attempt protected area PA of declaration / entry into E-Plan (RA-EP-1800)	1
17	BOP	Perform initial assessment from CR (DB-OP-02705, Att 1)	5
17	US	Direct SBEO3 to perform in plant assessment (DB-OP-02705, Step 3.2)	1
18	SM	Direct SSS (via SEC1 in CR) to make OCA PA announcement and activate CANS (RA-EP-1800)	1
18	SBEO3	Perform in plant conditions assessment (DB-OP-02705, Att 2)	30
18	US	Direct SBEO4 to perform outside assessment (DB-OP-02705, Step 3.3)	1
19	SSS	Attempt to make OCA PA announcement (RA-EP-1800)	1
19	SM	Complete / approve State/local notification form - initial SAE (RA-EP-2110)	2
19	SBEO4	Perform outside assessment (DB-OP-02705, Att 3)	41
20	CAS	Attempt to activate CANS (RA-EP-1800)	5
20	US	Direct SBEO5 to perform EFW cross-tie (DB-OP-02700, Step 3.9)	1
21	SBEO5	Perform EFW cross-tie (DB-OP-02700, Att 4)	25
23	BOP	Perform plant operations actions (DB-OP-02700 and US direction)	337
24	**Satellite Phone Systems Activated**		
25	CT	Line up sound powered phones to CR (DB-OP-02705, Att 14)	30
25	SM	Direct SBEO6 to perform State/local notifications - initial SAE (RA-EP-1800)	1
26	SBEO6	Perform State/local notifications - initial SAE (RA-EP-1800)	5
27	SM	Initiate PA Evacuation and Accountability (RA-EP-2520)	2
29	SM	Complete NRC event notification form (RA-EP-2110)	5
31	SM	Direct STA to activate CANS (RA-EP-1800)	1

Time (T+mins)	Position	Action	Duration (min)
31	SBEO6	Return to CR	
32	STA	Activate CANS via sat phone (RA-EP-1800)	5
32	US	Direct SBEO6 to line up long-term RCS inventory control electrical equipment (OP-2701, Step 3.3)	1
33	SBEO6	Line up long-term RCS inventory control electrical equipment (OP-2701, Att 4)	120
38	SM	Direct STA to perform NRC ENS notifications (RA-EP-2110)	1
39	STA	Perform NRC notifications (RA-EP-2110)	321
39	SM	Contact NSRC (DB-OP-02700, Step 6)	1
44	SBEO1	Return to CR	
45	US	Initiate long-term RCS inventory control (DB-OP-02700, Step 3.11)	1
46	US	Direct SBEO1 to line up long-term RCS inventory control mechanical equipment (OP-2701, Step 3.2)	1
46	SBEO5	Monitor and throttle EFW flow to SGs (DB-OP-02700, Att 4)	312
47	SBEO1	Line up long-term RCS inventory control mechanical equipment (OP-2701, Att 2)	60
48	SBEO3	Return to CR	
49	US	Direct SBEO3 to take local control of AVV (DB-OP-02700, Step 3.16)	1
50	SBEO3	Take local control of AVVs (DB-OP-02000, Att 3)	310
55	CT	Return to CR	
60	RPT	Return to CR	
60	SBEO4	Return to CR	
60	SBEO2	Return to CR	
61	US	Direct SBEO2 to load shed E1 and F1 (DB-OP-02700, 3.24)	1
62	SBEO2	Perform load shed of E1 and F1 (OP-2721, Att 1)	15
70	SM	Declare the GE based on EAL SG1 (RA-EP-1900)	1
71	SM	Determine / approve offsite PARs (RA-EP-2245)	3
74	SM	Complete / approve State/local notification form - initial GE (RA-EP-2110)	2
76	SM	Direct SBEO4 to perform State/local notifications - initial GE (RA-EP-1900)	1
77	SBEO4	Perform State/local notifications - initial GE (RA-EP-1900)	5
77	SM	Direct STA to perform ERO pager update (RA-EP-1900)	1
77	SBEO2	Return to CR	
78	STA	Perform ERO pager update (RA-EP-1900)	5
107	SBEO1	Return to CR	
134	SM	Complete / approve State/local notification form – follow up GE (RA-EP-2110)	2
136	SM	Direct SBEO4 to perform State/local notifications – follow up GE (RA-EP-1900)	1
137	SBEO4	Perform State/local notifications – follow up GE (RA-EP-1900)	5
153	SBEO6	Perform electrical lineup for EFW FLEX generator (OP-2701, Att 9)	30
182	US	Direct SBEO1 to operate and monitor FLEX charging pump (DB-OP-02700, Step 3.21)	1
183	SBEO1	Operate FLEX charging pump (OP-2701, Step 3.4)	177
183	SBEO6	Monitor EFW FLEX generator (OP-2750)	177
184	US	Direct SBEO2 to restore bus F-1 (DB-OP-02700, Step 3.24)	1
185	SBEO2	Restore power to F-1 (OP-2721, Step 3.5 and Att 7)	30

Time (T+mins)	Position	Action	Duration (min)
194	SM	Complete / approve State/local notification form – follow up GE (RA-EP-2110)	2
196	SM	Direct SBEO4 to perform State/local notifications – follow up GE (RA-EP-1900)	1
197	SBEO4	Perform State/local notifications – follow up GE (RA-EP-1900)	5
215	SBEO2	Return to CR	
215	SBEO2	Return to CR	
216	US	Direct SBEO2 to restore PZR heaters (DB-OP-02700, Step 3.24)	1
216	US	Direct SBEO2 to restore battery charger(s) (OP-2721, Step 3.10)	1
217	SBEO2	Restore power to PZR heaters (OP-2724, Att 2)	15
217	SBEO2	Restore battery chargers (OP-6321)	15
232	SBEO2	Return to CR	
254	SM	Complete / approve State/local notification form - follow up GE (RA-EP-2110)	2
256	SM	Direct SBEO4 to perform State/local notifications - follow up GE (RA-EP-1900)	1
257	SBEO4	Perform State/local notifications - follow up GE (RA-EP-1900)	5
314	SM	Complete / approve State/local notification form - follow up GE (RA-EP-2110)	2
316	SM	Direct SBEO4 to perform State/local notifications - follow up GE (RA-EP-1900)	1
317	SBEO4	Perform State/local notifications - follow up GE (RA-EP-1900)	5
360	**End of Shift Staffing Task Sequence Analysis**		

3.1.2 Time Sensitive Operator Actions

DBBP-OPS-1113 was created to track and control Time Sensitive Operator Actions. This business practice contains a list of DBNPS time sensitive operator actions (TSOA). Time sensitive operator actions are operator actions required to be performed to support assumptions in FLEX, PRA or other similar programs that assume Operator actions are completed within a predetermined time. This business practice also provides specific information about TSOA including documents that require the action to be performed and the procedures that direct the actions. Time Critical Operator Actions described in NOP-OP-1013, Control of Time Critical Operator Actions is a similar document that tracks and controls Operator Actions related to accident analyses assumptions pertaining to fuel/clad temperature and/or dose that could become invalid if not performed within the assumed time.

The following Time Sensitive Operator Actions related to implementation of FLEX related activities have been identified. Refer to DBBP-OPS-1113, Control of Time Sensitive Operator Actions for additional information.

Time Sensitive Operator Action	Task Description	Time required for completion from Loss of all AC power
FLEX Action 1 - Preserve RCS Inventory.	Following a Station Blackout, isolate RCS Letdown and Reactor Coolant Pump Seal Return.	10 minutes
FLEX Action 2 - Declare an ELAP.	Following a Station Blackout, declare an Extended Loss of AC Power.	10 minutes
FLEX Action 3 – DC Bus Load Shed.	Following a Station Blackout, align DC Buses and Loads to extend the life of Station Batteries.	30 minutes for 1st phase and a total of 60 minutes for all actions.
FLEX Action 4 – Manually Start the EFW Pump.	Following a Station Blackout and loss of all AFW, manually start the EFW Pump and supply inventory to SG1.	10 minutes
FLEX Action 5 – Provide inventory to SG2.	Following a Station Blackout and AFW System Failure, manually align Emergency Feedwater to provide inventory to SG2.	90 minutes
FLEX Action 6 – Mechanically align FLEX Charging Pump for RCS inventory.	Following a Station Blackout, mechanically align a FLEX Charging Pump to provide inventory to the Reactor Coolant System.	150 minutes
FLEX Action 7 – Electrically align FLEX Charging Pump for RCS inventory.	Following a Station Blackout, electrically align a FLEX Charging Pump to provide inventory to the Reactor Coolant System.	150 minutes
FLEX Action 8 – Electrically align 480 volt power to EFWF MCC.	Following a Station Blackout, electrically align 480 volt power to the EFW Facility MCC.	150 minutes

Time Sensitive Operator Action	Task Description	Time required for completion from Loss of all AC power
FLEX Action 9 – Initiate RCS Cooldown.	Following a Station Blackout, initiate cooldown of the Reactor Coolant System.	4.5 hours
FLEX Action 10 – Establish the BWST as an RCS makeup source.	Following a Station Blackout in Mode 5 OR 6 with the RCS drained and vented, establish gravity drain from the BWST as a source of RCS makeup.	20 minutes
FLEX Action 11 – Establish the SFP as an RCS makeup source.	Following a Station Blackout in Mode 5 OR 6 with the RCS drained and vented and the BWST not available, establish gravity drain from the SFP as a source of RCS makeup.	10 minutes

3.2 Programmatic Elements

3.2.1 Overall Program Documents

NOP-LP-7000, Diverse and Flexible Coping Strategies, FLEX Program is a FirstEnergy nuclear fleet document that provides a description of the FLEX Program for FENOC Plants. NOP-LP-7200, FLEX Program for Davis-Besse and referenced documents provide specific program information for DBNPS. The key elements of the program include:

- Maintenance of the FSGs including any impacts on the interfacing procedures (EOPs, AOPs, EDMGs, SAMGs, etc.)
- Maintenance and testing of BDB equipment (i.e., SFP level instrumentation, emergency communications equipment, portable BDB equipment, BDB support equipment, and BDB support vehicles)
- Portable equipment deployment routes, staging areas, and connections to existing mechanical and electrical systems
- Validation of time critical operator actions
- The EFWF and the NSRC

- Hazards Considerations (Flooding, seismic, high winds, etc.)
- Supporting evaluations, calculations and BDB series drawings
- Tracking of commitments and equipment unavailability
- Staffing, Training and Emergency Drills
- Configuration Management
- Program Maintenance

In addition, the program descriptions includes (1) a list of the BDB FLEX basis documents that will be kept up to date for facility and procedure changes, (2) a historical record of previous strategies and their bases, and (3) the bases for ongoing maintenance and testing activities for the BDB equipment.

The instructions required to implement the various elements of the FLEX Program and thereby ensure readiness in the event of a BDBEE are contained in a nuclear fleet administrative procedure.

Existing design control procedures have been revised to ensure that changes to the plant design, physical plant layout, roads, buildings, and miscellaneous structures will not adversely impact the approved FLEX strategies. Changes for the FLEX strategies will be reviewed with respect to operations critical documents to ensure no adverse effect.

Future changes to the FLEX strategies may be made without prior NRC approval provided 1) the revised FLEX strategies meet the requirements of NEI 12-06, and 2) an engineering basis is documented that ensures that the change in FLEX strategies continues to ensure the key safety functions (core and SFP cooling, Containment integrity) are met.

3.2.2 Procedural Guidance

FLEX Related Implementing Procedures Overview

- Based on PWR Owners Group generic guidance, a new Emergency Operating Procedure, DB-OP-02700, Station Blackout was developed
- The previous initial response to loss of all AC has been moved out of DB-OP-02521, Loss of AC Bus Power Sources, to new Emergency Operating Procedure, DB-OP-02700, Station Blackout
  - This is a new EOP level procedure to align with industry (in an Emergency Operating Procedure vice an Abnormal Operating Procedure).
  - Declaration of ELAP is included in this procedure.

  - This procedure controls transition or implementation of the FLEX Support Guidelines (FSGs) – DB-OP-02700 series procedures.

- **Abnormal Operating Procedures:**
  - DB-OP-02521, Loss of AC Bus Power Sources still addresses the loss of other AC buses.
  - DB-OP-02527, Loss of Decay Heat Removal provides direction to implement FLEX Strategies for ELAP events that are initiated when core cooling is being provided by the Decay Heat Removal System
  - DBNPS Abnormal Operating Procedures (DB-OP-02500 series) still contain response to specific events

- **FSGs: FLEX Support Guidelines - DB-OP-02700 Series Procedures**
  - Preplanned set of responses.
  - Two column format in Control Room (Attachments or Operator Aids single column).
  - Directs strategy execution.
  - Deployment routes & locations.
  - Contain the connection points, valves, breakers, etc. & manipulations required to place FLEX equipment in service.
  - Directs use of FLEX Support Operator Aids for local operation of equipment
- **FSOA: FLEX Support Operator Aid – Instructions for portable equipment**
  - Portable equipment operation (starting, monitoring, shut down).
  - Provide detailed information including pictures of connections, controls, etc.

DB-OP-02700, Station Blackout, coordinates the overall response including Control Room implementation of FSGs.

Overall goals to implement FLEX Strategies are as follows:

- Establish SG Heat Transfer (Emergency Feedwater (EFW) to SG1).
- Preserve RCS Inventory (minimize inventory loss/protect RCP Seals).
- Restore RCS Inventory Addition using FLEX Charging Pump(s).
- Restore 480V Power to E1/F1 (Battery Chargers and Pressurizer Heaters).
- Restore Pressurizer Heaters to maintain Subcooled Margin.
- Restore Feedwater to SG2 using EFW (Manual Cross-Connect).
- Symmetric cooldown of the RCS via Natural Circulation on AVVs.
- Restore SW for DHR & SFP Cooling.

– Restore Containment Cooling (venting).

– Restore Power to C1/D1 using NSRC Equipment for CCW, DHR and portable SW pump.

– Establish DHR for Core Cooling.

Bases and Deviation Document for DB-OP-02700 and the FLEX Support Guidelines

This document provides the bases for each step in the DBNPS Station Blackout (SBO) procedure, DB-OP-02700. This document provides bases information for each of the FSGs (DB-OP-02700 series procedures). This document also identifies and evaluates significant differences between EOP DB-OP-02700 and the DB-OP-02700 series procedures, and Volume 1 of the Emergency Operating Procedure Technical Bases Document (EOP TBD) including the FSGs which provides the PWR Owners Group generic direction for B&W Plants. Some FSGs are unique to DBNPS based on the FLEX Strategies implemented at DBNPS.

For steps that deviate from the generic PWR Owners Group guidance, additional information about the nature of the deviation and whether the deviation is safety significant is provided.

This document is an element of the EOP program described in NG-DB-00319, Control of the Emergency Operating Procedure and Technical Basis.

Industry FLEX Support Guidelines – Developed by PWR Owner Group

- FSG-1, "Long Term RCS Inventory Control"
- FSG-2, "Alternate EFW Suction Source" – Not required for DB (due to new EFW system)
- FSG-3, "Alternate Low Pressure Emergency Feedwater"
- FSG-4, "Extended Loss of AC Power DC Load Management"
- FSG-5, "Initial Assessment and FLEX Equipment Staging"
- FSG-6, "EFW Storage Tank Makeup"
- FSG-7, "Loss of DC Power"
- FSG-8, "Alternate RCS Boration"
- FSG-9, "Low Decay Heat Temperature Control"
- FSG-10, "CFT Isolation/Venting"
- FSG-11, "Alternate Spent Fuel Pool Makeup"
- FSG-12, "Alternate Containment Cooling"
- FSG-13, "Transition from FLEX Equipment"
- FSG-15 "Containment Isolation and Closure"

DBNPS Specific FLEX Support Guidelines – One for One alignment with PWR Owners Group

- DB-OP-02701, Long Term RCS Inventory Control
- DB-OP-02703, Alternate Low Pressure Emergency Feedwater
- DB-OP-02704, Extended Loss of AC Power DC Load Management
- DB-OP-02705, Initial Assessment and FLEX Equipment Staging
- DB-OP-02706, EFW Storage Tank Makeup
- DB-OP-02707, Loss of DC Power
- DB-OP-02708, Alternate RCS Boration
- DB-OP-02709, Low Decay Heat Temperature Control
- DB-OP-02710, CFT Isolation/Venting
- DB-OP-02711, Alternate Spent Fuel Pool Makeup
- DB-OP-02712, Alternate Containment Cooling
- DB-OP-02713, Transition from FLEX Equipment
- DB-OP-02714, Shutdown RCS Makeup
- DB-OP-02715, Containment Isolation and Closure

DBNPS Specific FLEX Support Guidelines – These FSG's address tasks unique to DBNPS strategies

- DB-OP-02721, Restore 480v Power to E1 and F1
- DB-OP-02722, Restore Service Water During an ELAP
- DB-OP-02723, Restore 4160 volt Power to C and D1
- DB-OP-02724, Restore Pressurizer Heaters to Service
- DB-OP-02725, Control Room and Miscellaneous Habitability Actions

DBNPS Specific FLEX Support Operator Aids – These FSOA's provide operating direction for equipment unique to DBNPS strategies, such as portable generators, 4160 breaker cart, etc.

- DB-OP-02750, FLEX 480V Generator
- DB-OP-02751, FLEX Charging Pump
- DB-OP-02752, FLEX Alternate Low Pressure EFW Pump
- DB-OP-02753, FLEX Replenishment Pump
- DB-OP-02754, FLEX Small Portable Generators
- DB-OP-02755, FLEX Communications
- DB-OP-02756, FLEX 4160V Breaker Cart
- DB-OP-02757, FLEX Debris Removal Truck
- DB-OP-02758, FLEX 7.5KW Generator
- DB-OP-02759, FLEX Portable Fuel Oil Pumps

The FLEX Support Operator Aids provide operating instruction for using FLEX equipment and could be used to respond to beyond design bases event mitigated by the Severe Accident Management Guidelines or the Extensive Damage Mitigation Guidelines.

3.2.3 Staffing

DBNPS completed a staffing study using the methodology of NEI 12-01, Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities. The assumptions for the NEI 12-01 Phase 2 scenario postulate that the BDBEE involves a large-scale external event that results in:

- An extended loss of AC power (ELAP)
- An extended loss of ultimate heat sink (UHS)
- Impact on all units (all units for multi-unit sites are in operation at the time of the event – not applicable to DBNPS)
- Impeded access to the unit by off-site responders as follows:
  - 0 to 6 Hours Post Event – No site access. This duration reflects the time necessary to clear roadway obstructions, use different travel routes, mobilize alternate transportation capabilities (e.g., private resource providers or public sector support), etc.
  - to 24 Hours Post Event – Limited site access. Individuals may access the site by walking, personal vehicle or via alternate transportation capabilities (e.g., private resource providers or public sector support).
  - 24+ Hours Post Event – Improved site access. Site access is restored to a near-normal status and/or augmented transportation resources are available to deliver equipment, supplies and large numbers of personnel.

A team of subject matter experts from Operations, Radiation Protection, Chemistry, Security, Emergency Preparedness, FLEX project and industry consultants performed a tabletop evaluation in July 2015 for the on-shift portion of the assessment. The participants reviewed the assumptions and existing procedural guidance, including applicable draft EOPs and FSGs for coping with a BDBEE using minimum on-shift staffing. Particular attention was given to the sequence and timing of each procedural step, its duration, and the on-shift individual performing the step to account for both the task and time motion analyses of NEI 10-05, Assessment of On-Shift Emergency Response Organization Staffing and Capabilities.

Analysis result items have been entered into the corrective action program.

1.1 On-shift ERO Analysis

The on-shift ERO analysis concluded that the current DBNPS on-shift staffing present for the “no site access” 6-hour time period is sufficient to perform the EOP, FSG and emergency response tasks.

1.2 Expanded ERO Analysis

The expanded ERO analysis concluded that the current DBNPS augmenting ERO is sufficient to fill positions for the expanded ERO functions. Thus, the ERO resources and capabilities necessary to implement Transition Phase coping strategies performed after the end of the “no site access” 6-hour time period exist in the current program.

3.2.4 Training

DBNPS’s Nuclear Training Program has been revised to assure personnel proficiency in the mitigation of BDBEE is adequate and maintained. These programs and controls were developed and have been implemented in accordance with the Systematic Approach to Training (SAT) Process.

Initial training has been provided and periodic training will be provided to site emergency response leaders on BDB emergency response strategies and implementing guidelines. Personnel assigned to direct the execution of mitigation strategies for BDBEE have received the necessary training to ensure familiarity with the associated tasks, considering available job aids, instructions, and mitigating strategy time constraints.

Care has been taken to not give undue weight (in comparison with other training requirements) for Operator training for BDB external event accident mitigation. The testing/evaluation of Operator knowledge and skills in this area has been similarly weighted. Operator training does include use of equipment from the NSRC.

“ANSI/ANS 3.5, Nuclear Power Plant Simulators for use in Operator Training” certification of simulator fidelity is considered to be sufficient for the initial stages of the BDBEE scenario until the current capability of the simulator model is exceeded. Currently, there are no plans to upgrade the full scope simulator model to accommodate FLEX training or drills. The DBNPS Simulator has been updated in include the EFW System equipment located in the Control Room.

Where appropriate, integrated FLEX drills or other validation activities will be organized on a team or crew basis and conducted periodically; with all time-sensitive actions to be evaluated over a period of not more than five years as documented in DBBP-OPS-1113, Time Sensitive Operator Action. It is not required to connect/operate permanently installed equipment during these evaluations.

3.2.5 Equipment List

The equipment stored and maintained at DBNPS necessary for the implementation of the FLEX strategies in response to a BDBEE at DBNPS is listed in Table 2. Table 2 identifies the quantity, applicable strategy, and capacity/rating for the major BDB equipment components only, as well as, various clarifying notes. Details regarding fittings, tools, hose lengths, consumable supplies, etc. are not in Table 2, but are detailed in DBBP-OPS-0037, FLEX Equipment Inventory. This Business Practice provides an inventory list, by location, of FLEX related equipment. Confirmation that the required inventory is available is checked by Operation's personnel. Any missing or damaged equipment requires initiation of a Condition Report and repaired or replaced as necessary to comply with FLEX Program requirements.

3.2.6 Equipment Maintenance and Testing

Initial Testing of FLEX Equipment

Performance testing of the FLEX mitigation equipment was performed at the vendor facilities and performance reports were received from the vendors. The equipment was functionally tested once received at the site to ensure no damage had occurred during shipment. The FLEX RCS Charging and Booster Pumps have been tested through a recirculation test path installed as part of the system design. The testing includes the equipment and the assembled sub-system to meet the planned FLEX performance.

The following is a list of the testing that was performed on the FLEX equipment as a demonstration that flowpaths work, equipment functions as expected, and that the strategies are viable.

Document Number	Document Title
DB-TP-12419	Emergency Feedwater Flow Test for Post Installation Testing For ECP 13-0196
DB-TP-12420	EFW Facility Power Systems Post Installation Electrical Testing
DB-TP-12421	TESTING OF THE FLEX CHARGING PUMPS FOR ECP 13-0463
DB-TP-12422	Emergency Feedwater Storage Tank Post Installation Test
DB-TP-12423	SUPPLYING POWER TO THE FLEX CHARGING PUMPS FOR TESTING DURING R19
DB-TP-12424	Diesel Fuel Oil Storage Tank and Day Tank Pump System
DB-TP-12425	Diesel Driven EFW Pump System Post Installation Test

SAP Order Number	Brief Description
200610315	ECP 13-0196-002 Fwd Flow Test SG1 & SG2 > SG2
200674351	ECP 13-0463-006 Test FLEX Chg Pmp P296-1
200674352	ECP 13-0463-006 Test FLEX Chg Pmp P296-2
200674353	ECP 13-0195-007 Test EFWST T89
200674354	ECP 13-0196-002 Test EFW Diesel Pmp P310
200674355	ECP 13-0196-002 Test AC/DC Electrical
200677109	ECP 13-0196-002 DFO Fill Testing

Periodic Maintenance and Testing

Periodic testing and preventative maintenance of the BDB equipment conforms to the guidance provided in INPO AP-913. DBNPS has implemented the maintenance and testing templates issued by the EPRI. The template has been developed to meet the FLEX guidelines established in NEI 12-06.

EPRI has completed and has issued "Preventive Maintenance Basis for FLEX Equipment – Project Overview Report" (Report 3002000623). Preventative Maintenance Templates for the major FLEX equipment including the portable diesel pumps and generators have also been issued.

The PM Templates include activities such as:

- Periodic Static Inspections – Monthly walkdown
- Fluid analysis (Yearly)
- Periodic operational verifications – Quarterly starts
- Periodic functional verifications with performance tests – Annual 1 hour run with pump flow and head verifications

The EPRI PM Templates for FLEX equipment conform to the guidance of NEI 12-06 providing assurance that stored or pre-staged FLEX equipment are being properly maintained and tested. EPRI Templates are used for most equipment. However, in those cases where EPRI templates were not available, Preventative Maintenance (PM) actions were developed based on manufacturer provided information/ recommendations.

Currently FENOC has developed maintenance and testing templates specifically for FLEX Equipment. Below is a list of current FENOC FLEX Equipment NORMs, see filenet for a current list if required:

- NORM-ER-3730, FLEX EQUIPMENT
- NORM-ER-3731, FLEX GENERATOR - DIESEL ENGINE
- NORM-ER-3732, FLEX GENERATOR - GAS TURBINE

- NORM-ER-3733, FLEX SPENT FUEL POOL LEVEL MONITOR
- NORM-ER-3734, FLEX ELECTRICAL DISTRIBUTION CENTER
- NORM-ER-3741, FLEX PUMPS - VERTICAL
- NORM-ER-3742, FLEX AIR COMPRESSOR
- NORM-ER-3743, FLEX PUMPS – HORIZONTAL
- NORM-ER-3745, FLEX PUMPS - DIAPHRAGM
- NORM-ER-3748, FLEX VEHICLES

The unavailability of equipment and applicable connections that directly perform a FLEX mitigation strategy for core, containment, and SFP will be managed such that risk to mitigating strategy capability is minimized. Refer to NORM-LP-7202, Davis-Besse Specifications for FLEX Equipment Out of Service for information on allowed out of service time for FLEX related equipment. Maintenance/risk guidance conforms to the guidance of NEI 12-06 as follows:

- Portable BDB equipment may be unavailable for 90 days provided that the site FLEX capability (N) is available.

- If portable equipment becomes unavailable such that the site FLEX capability (N) is not maintained, initiate actions within 24 hours to restore the site FLEX capability (N) and implement compensatory measures (e.g., use of alternate suitable equipment or supplemental personnel) within 72 hours.

- The N+1 Alt LP EFWP, N+1 Replenishment/Spray pump & Debris removal 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

4. TABLES

Table 1 –Water Sources – Refer to DB-OP-02706, EFW Storage Tank Makeup for additional information and utilization direction

Water Sources	*Volume (Gallons)*	*Applicable Hazard*				
		Satisfies Seismic	*Satisfies Flooding*	*Satisfies High Winds*	*Satisfies Low Temp*	*Satisfies High Temp*
Water sources and associated piping that fully meet ALL BDB Hazards						
EFW Storage Tank T89 (Phase 1)	*290,000*	*Y*	*Y*	*Y*	*Y*	*Y*
Clean Waste Receiver Tank 1 (T15-1) (Phase 2)	*103,000*	*Y*	*Y*	*Y*	*Y*	*Y*
Lake Erie Water via FLEX Pump (Phase 3)	*Unlimited*	*Y*	*Y*	*Y*	*Y*	*Y*
Potential Water sources that PARTIALLY meet BDB hazards.						
BWST T10 (Phase 1)	*550,000*	*Y*	*Y*	*N*	*Y*	*Y*
Clean Waste Receiver Tank 2 (T15-2)	*103,000*	*N*	*Y*	*Y*	*Y*	*Y*
Demin Water Storage Tank DWST (T188)	*140,000*	*N*	*Y*	*N*	*N*	*Y*
Condensate Storage Tank CST 1 (T31-1)	*250,000*	*N*	*Y*	*N*	*Y*	*Y*
Condensate Storage Tank CST 2 (T31-2)	*250,000*	*N*	*Y*	*N*	*Y*	*Y*
Fire Water Storage Tank FWST (T81)	*300,000*	*N*	*Y*	*N*	*Y*	*Y*
Clean Waste Monitor Tank CWMT 1 (T23-1)	*23,200*	*N*	*Y*	*N*	*Y*	*Y*
Clean Waste Monitor Tank CWMT 2 (T23-2)	*23,200*	*N*	*Y*	*N*	*Y*	*Y*
Turbine Plant Cooling Water LL Tank T39	*57,000*	*N*	*Y*	*N*	*Y*	*Y*
Condensate System including Main Condenser (E7-1 and E7-2) and Deaerator Storage Tanks (T42-1 and T42-2)	*~250,000*	*N*	*Y*	*N*	*Y*	*Y*
Training Center Pond	*N/A*	*Y*	*Y*	*N*	*N*	*Y*
Carroll Township Water Tower	*N/A*	*N*	*Y*	*N*	*N*	*Y*

Table 2 – PWR Portable Equipment Stored On-Site - Refer to NORM-LP-7204, Davis-Besse FLEX Strategy Design & Equipment Bases Detail for additional information						
Use and (Potential / FLEXibility) Diverse Uses						***Performance Criteria***
List Portable Equipment	Core	Containment	SFP	Instrumentation	Accessibility	
FLEX ALT LP EFW Pumps (2) assoc. hoses and fittings – EFWF and SB7	X		X			495 GPM @ 405.7 psi
FLEX Replenishment and Spray Pumps (2) and assoc. hoses and fittings – EFWF and SB7	X		X			920gpm @ 165psi
FLEX RCS Charging Pumps (2) and assoc. Booster Pumps, hoses, and fittings – AB 545’	X					60 gpm @ 2000 psi
FLEX 480 Volt Generators (2) and associated cables, connectors and switchgear – EFWF and SB7	X			X		850 kW @ 480 Volts

Table 2 – PWR Portable Equipment Stored On-Site - Refer to NORM-LP-7204, Davis-Besse FLEX Strategy Design & Equipment Bases Detail for additional information						
Use and (Potential / FLEXibility) Diverse Uses						***Performance Criteria***
List Portable Equipment	Core	Containment	SFP	Instrumentation	Accessibility	
TRANSCUBE Fuel Tank (2) – SB7	X	X	X	X	X	1247 gallon capacity
Debris Removal/Tow vehicles (2)	X	X	X		X	Heavy Duty Diesel Pickup Truck

FLEX Storage Boxes

A number of FLEX Equipment Storage Boxes are located in the plant. These boxes provide minor equipment such as portable lighting, fittings, pipe wrenches, fans, waders, and other items that may be used following a station blackout event. The following is a list of the Storage Box locations and equipment at each location. FSG DB-OP-02705, Initial Assessment and Equipment Staging, Attachment 25, FLEX Staging Equipment provides the most current list of this equipment.

A. Emergency Feedwater Facility – 586' Level

Equipment	**Staging Use**
Sandbags	SAT Antenna Tripods
(4) 100' Extension Cords	Lighting & Ventilation
(1) Battery-backed Light	Lighting

(2) Pipe Wrenches	Hose connections
(2) Valve Wrenches	Valve operations
(1) Box Fan	Ventilation
(1) 25’ Box Fan Ducting	Ventilation
(1) Portable Generator (120 volt AC)	Lighting & Ventilation
(2) Storz “Y” valves	Hose Routing
(2) Storz 4 way splitters	Hose Routing
(2) Chop Saws	Debris Removal
(1) Ice Auger	Debris Removal
(1) 5” Storz to 2½” FH Female	Fire Hose makeup to EF26
(2) 50’ Sound-Powered Cables	Potential Communications
(2) 28 gal Portable Generator Long Term Fuel Caddies	Lighting & Ventilation
(2) 6 gal Portable Generator Initial Fill containers	Lighting & Ventilation
(5) Door Blocks	N/A

B. Control Room 512 (CTRM)

Equipment	**Staging Use**
(4) 100’ Extension Cords	Lighting & Ventilation
(1) Battery-backed Light	Lighting
(1) Small Flood Light & Tripod	Lighting
100 pack Ty-Wraps	Hose & Nozzle restraints
(8) Miner’s Headlamps	Lighting

(16) Miner's Headlamps batteries	Lighting
(4) Miner's Headlamps chargers	Lighting
(1) Box Fan	Ventilation
(1) 25' Box Fan Ducting	Ventilation
(2) 50' Sound-Powered Cables	Potential Communications
(2) Waders, Large	Room 100 Flooding
(2) Waders, XL	Room 100 Flooding
(2) Foul-Weather Gear (L & XL)	N/A
(5) Door Blocks	N/A
(8) Jump Packs (100 pack ty-wraps, 3 door blocks, gloves, cutters, utility knife, 2 adjustable wrench, fuse pullers, 2 pens, 25' rope, 2 spanner wrenches)	N/A

C. Aux Bldg Room 428 (F LVSGR)

Equipment	**Staging Use**
(1) Small Flood Light & Tripod	Lighting
(4) 100' Extension Cords	Lighting & Ventilation
(5) Door Blocks	N/A

D. Aux Bldg Room 100 (BWST Tunnel)

Equipment	**Staging Use**
(4) 100' Extension Cords	Lighting & Ventilation
(1) Battery-backed Light	Lighting

(2) Hammer Union Wrenches	Hose connections
(2) Pipe Wrenches	Hose connections
(2) Valve Wrenches	Valve operations
100 pack Ty-Wraps	Hose & Nozzle restraints
(1) Large Flood Light& Tripod	Lighting
(1) Small Flood Light & Tripod	Lighting
(2) 50' Sound-Powered Cables	Potential Communications
(5) Door Blocks	N/A

E. Aux Bldg Room 124 (CWRT 1)

Equipment	**Staging Use**
(4) 100' Extension Cords	Lighting & Ventilation
(1) Battery-backed Light	Lighting
(2) Hammer Union Wrenches	Hose connections
(2) Pipe Wrenches	Hose connections
(2) Valve Wrenches	Valve operations
(2) Adjustable Wrenches	WC1751 AOV ops
100 pack Ty-Wraps	Hose & Nozzle restraints
(1) Large Flood Light & Tripod	Lighting
(1) Small Flood Light & Tripod	Lighting
(2) 50' Sound-Powered Cables	Potential Communications
(5) Door Blocks	N/A

F. Aux Bldg Room 303 (MPR 3)

Equipment	**Staging Use**
(4) 100’ Extension Cords	Lighting & Ventilation
(1) Large Flood Light & Tripod	Lighting
(1) Small Flood Light & Tripod	Lighting
(2) Battery-backed Lights**	Lighting
(7) 100’ 3” Fire Hose	SFP Makeup/Spray & RCS Makeup
100 pack Ty-Wraps	Hose & Nozzle restraints
(2) Pipe Wrenches	Hose connections
(2) Valve Wrenches	Valve operations
(2) Portable Generators (120 volt AC)	Lighting & Ventilation
(2) Blitzfire Nozzles	SFP Spray
(30) Floor Drain Covers	SFP Train Bay Drains
(6) Electrical Jumpers	CFT isolations & Pzr Htrs
(2) Waders, Large	Room 100 Flooding
(2) Waders, XL	Room 100 Flooding
(2) Screwdrivers	CFT isolations & Pzr Htrs
(2) Stopwatches	CFT isolations
(2) 50’ Sound-Powered Cables	Potential Communications
(5) Door Blocks	N/A

G. Aux Bldg Room 320 (EDG Corridor Breaker Lab)

Equipment	Staging Use
(8) 100' Extension Cords	Lighting & Ventilation
(1) Large Flood Light & Tripod	Lighting
(1) Small Flood Light & Tripod	Lighting
(1) Battery-backed Light	Lighting
100 pack Ty-Wraps	Hose & Nozzle restraints
(2) Pipe Wrenches	Hose connections
(2) Valve Wrenches	Valve operations
(1) Portable Generator (120 volt AC)	Lighting & Ventilation
(2) Box Fans	Ventilation
(2) 25' Box Fan Ducting	Ventilation
(1) 75' Fuel Transfer Hose	Fueling Operations
(1) 100' Fuel Transfer Hose	Fueling Operations
(1) 15' Fuel Nozzle Hose	Fueling Operations
(2) Fuel Trigger Nozzles	Fueling Operations
(1) Portable AC Fuel Pump	Fueling Operations
(2) 28 gal Portable Generator Long Term Fuel Caddies	Lighting & Ventilation
(2) 6 gal Portable Generator Initial Fill containers	Lighting & Ventilation
(5) Door Blocks	N/A

Table 3 – PWR Portable Equipment From NSRC – Refer to Areva 51 - 9242059 - 000, Davis Besse Nuclear Power Station SAFER Response Plan for additional information

Use and (Potential / FLEXibility) Diverse Uses									Performance Criteria		Notes
List Portable Equipment	Quantity Req'd	Quantity Provided	Power	Core Cooling	Cont. Cooling/ Integrity	Access	Instrumentation.	RCS Inventory			
Medium Voltage Generators	1	2	Diesel	X	X		X		4.16 kV	1 MW	(1)
Low Voltage Generators	0	1	Diesel		X		X	X	480 VAC	1000 KW	(2)
High Pressure Injection Pump	0	1	Diesel					X	2000 psi	60 GPM	(2)
S/G RPV Makeup Pump	0	1	Diesel	X				X	500 psi	500 GPM	(2)
Low Pressure / Medium Flow Pump	0	1	Diesel		X	X			300 psi	2500 GPM	(2)
Low Pressure / High Flow Pump	1	1	Diesel	X	X				150 psi	5000 GPM	(3)

Table 3 – PWR Portable Equipment From NSRC – Refer to Areva 51 - 9242059 - 000, Davis Besse Nuclear Power Station SAFER Response Plan for additional information

Use and (Potential / FLEXibility) Diverse Uses									Performance Criteria		Notes
List Portable Equipment	Quantity Req'd	Quantity Provided	Power	Core Cooling	Cont. Cooling/ Integrity	Access	Instrumentation.	RCS Inventory			
Lighting Towers	0	3	Diesel			X				440,000 Lu	(4)
Diesel Fuel Transfer	0	1	N/A	X	X	X	X	X		264 Gal	(2)

Note 1 - NSRC 4kV generator supplied in support of Phase 3 for Core Cooling, Containment Cooling, and Instrumentation FLEX Strategies.
Note 2 - NSRC Generic Equipment – Not required for FLEX Strategy – Provided as Defense-in-Depth.
Note 3 - NSRC Low Pressure / High Flow pump supplied in support of Phase 3 for Core Cooling and Containment Cooling FLEX Strategies.
Note 4 - NSRC components provided for low light scenarios.