FENOC™
FirstEnergy Nuclear Operating Company

Perry Nuclear Power Plant
P.O. Box 97
10 Center Road
Perry, Ohio 44081

Ernest J. Harkness
Vice President

440-280-5382
Fax: 440-280-8029

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L-15-227

10 CFR 2.202

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

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
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. MF0962)

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 Perry Nuclear Power Plant (PNPP) 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 PNPP.

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 August 20, 2015.

Respectfully submitted,

Ernest J. Harkness

NOTE:
This version of the Perry Nuclear Power Plant, Unit 1 Completion of Required Action by NRC Order EA-12-049 is the licensee's version submitted on August 20, 2015, with certain redactions of sensitive information by staff of the U.S. Nuclear Regulatory Commission to allow release to the public.
The redactions are made in accordance with 10 CFR 2.390(d)(1).
The material included within is classified as publicly available information.

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

INTRODUCTION

FirstEnergy Nuclear Operating Company (FENOC) developed an Overall Integrated Plan (OIP) for Perry Nuclear Power Plant (PNPP) (Reference 1) and a revision to the OIP (Reference 2), 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 3). The information provided herein documents full compliance for PNPP with Reference 3.

OPEN ITEM RESOLUTION

FENOC has provided a response for the following items and considers them to be complete for PNPP. 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 PNPP 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 Status Updates	February-2015
Update 1	August-2013
Update 2	February-2014
Update 3	August-2014
Update 4	February-2015
FLEX Strategy Review	May-2013
Validation	July-2015
Walk-throughs or Demonstrations	July-2015
Complete Staffing Analysis	October-2014
Complete Plant Modifications	April-2015
Target plant modifications	May-2013
Complete on-line modifications	March-2015
Complete 1R15 outage modifications	April-2015
FLEX Storage	July-2015
Complete Unit 2 Aux Building for storage and Use	July-2015
Convert Diesel Building for storage and use	June-2015
Convert ESW Pumphouse building Unit 2 areas for storage and use	April-2015
Lake (UHS) Access	April-2015
Install FLEX Lake Water Pumps in the Emergency Service Water Pump House	April-2015
On-site FLEX Equipment	March-2015
Ordered	February-2015
Delivered	March-2015
Off-site FLEX Equipment	March-2015
*Develop Strategies with RRC***	March-2015
Complete Near Site Staging Location (as needed)	March-2015
Phase 3 Site Access Strategies in Place	March-2015
Procedures	July-2015
Implement EPG/SAG Rev 3 Guidance	April-2015
Create Perry FSG	July-2015
Implement Perry FSG	April-2015
Define Maintenance Strategy	April-2015
Training	April-2015
Develop EOP Training Plan	January-2014
Implement EOP Training	April-2015
Develop FLEX Training Plan	August-2014
Implement FLEX Training	March-2015
Submit Completion Report	August-2015*

* 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 PNPP, as well as the OIP (References 1 and 2), the Initial Status Report (Reference 4), the Six-Month Status Reports (References 5, 6, 7, and 8), and a request for schedule relaxation (Reference 9) that was granted (Reference 10), demonstrate compliance with Order EA-12-049.

STRATEGIES – COMPLETE

PNPP 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 PNPP 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 PNPP has been procured in accordance with Nuclear Energy Institute (NEI) 12-06 (Reference 11), Section 11.1 and 11.2, received at PNPP, 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 PNPP Preventative Maintenance program such that equipment reliability is achieved.

PROTECTED STORAGE – COMPLETE

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

PROCEDURES – COMPLETE

FLEX Support Guidelines (FSGs) for PNPP 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 PNPP 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 PNPP 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 12), as documented in letter dated November 7, 2014 (Reference 13) and supplemented in letter dated March 30, 2015 (Reference 14).

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 PNPP 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 PNPP 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. FirstEnergy Nuclear Operating Company's (FENOC's) Revision of Overall Integrated Plan for Perry Nuclear Power Plant 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 No. MF0962), dated September 25, 2014.

3. 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.

4. FirstEnergy Nuclear Operating Company's (FENOC's) Initial Status Report in Response to March 12, 2012, Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated October 26, 2012.

5. FirstEnergy Nuclear Operating Company's (FENOC's) 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.

6. 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.

7. 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.

8. 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.

9. 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) (TAC No. MF0962), dated March 26, 2015.

10. NRC letter, Perry Nuclear Power Plant, 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" (TAC No. MF0962), dated April 15, 2015.

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

12. 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.

13. 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 November 7, 2014.

14. Response to Request for Additional Information Regarding Phase 2 Staffing Assessment Provided Pursuant to Title 10 of the *Code of Federal Regulations* 50.54(f) Request Regarding Near-Term Task Force Recommendation 9.3: Emergency Preparedness (TAC No. MF5314), dated March 30, 2015.

INTERIM STAFF EVALUATION (ISE) OPEN ITEMS (OI)

OI 3.2.1.7.A

FENOC [FirstEnergy Nuclear Operating Company] has not indicated their intent to follow the provisions of the NRC [Nuclear Regulatory Commission]-endorsed NEI [Nuclear Energy Institute] position paper on Shutdown/Refueling Modes that describes how licensees will develop and maintain an appropriate plan for mitigating strategies capability in all plant modes (ADAMS Accession Nos. ML13273A514 and ML13267A382). FENOC should either confirm that PNPP [Perry Nuclear Power Plant] will follow the endorsed guidance, or provide an alternate approach acceptable to the NRC staff.

Response:

The response to this item was provided by FENOC letter dated February 27, 2014.

ISE CONFIRMATORY ITEMS (CI)

CI 3.1.1.3.A

FENOC indicated that the gravity discharge system passively performs the mitigation of groundwater intrusion. It was not clear how the passive portion of this system will maintain groundwater elevation below the 590 foot elevation with no pumping power when the flood level around the plant may be at the 620 foot elevation. The licensee needs justification for groundwater mitigation during flooding conditions.

Response:

The PNPP Updated Safety Analysis Report (USAR), Section 2.4.13.5, Design Basis for Subsurface Hydrostatic Loadings, provides the design basis for the underdrain system. The gravity discharge system is designed to provide a redundant periphery discharge, which incorporates a gravity outfall, having no active components, to handle a 15,000 gallons per minute (gpm) flow entering the underdrain system on either side of the plant.

Alternating current (ac) power to the plant underdrain system is not credited as the system is capable of passively controlling the groundwater level. However, the capability to use ac power may be available. The plant underdrain system contains a diesel-backed underdrain pump. The underdrain pump is a 5 horsepower (hp) pump supplied from 480 volts ac (Vac) distribution panel F1C08 disconnect 12. This pump is load shed as part of energizing of the distribution panel. 480 Vac distribution panel F1C08 will be powered during an extended loss of ac power (ELAP) condition through manual transfer switch 1R25-S0161 (alternate power breaker EF2B09).

Actions required to place the underdrain pump into service are to close the power disconnect on distribution panel F1C08 and operate the pump at the local control panel on the radwaste building (RW) 602' level. Distribution panel F1C08 and the local control panel are located in seismic structures and are robustly protected from all diverse and flexible strategies (FLEX) evaluated hazards. The underdrain pump(s) are not considered robust with respect to the NEI hazards. However, if available they can be used at the operators' discretion. Gravity discharge piping is the credited method for groundwater mitigation.

USAR 2.4.13.5 and NORM-LP-7301, FLEX Electrical Design Report for the Perry Nuclear Power Plant, were made available for NRC review.

CI 3.1.1.4.A

With regard to offsite resources, the licensee will develop a plan that will address the logistics for equipment transportation, area set up, and other needs for ensuring the equipment and commodities to sustain the site's coping strategies.

Response:

The PNPP overall integrated plan (OIP) revision submitted by letter dated September 25, 2014 (ADAMS Accession No. ML14268A214), documented that the industry will establish two National Strategic Alliance for FLEX Emergency Response (SAFER) Response Center (NSRCs) to support utilities during beyond-design-basis events. Each NSRC will hold five sets of equipment, four of which will be able to be fully deployed when requested, the fifth set will have equipment in a maintenance cycle. Equipment will be moved from a NSRC to the near site staging area, established by the SAFER team and the utility. Communications will be 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 nuclear site's playbook, will be delivered to the site within 24 hours from the initial request. On November 11, 2014, NEI issued a National SAFER Response Center Operational Status (ADAMS Accession Nos. ML14259A222 and ML14259A223) confirming the scope of the NSRC. The NSRCs are operated by AREVA and are located in Memphis, Tennessee and Phoenix, Arizona. The local staging area for PNPP is the local airport in Ashtabula, Ohio. A walkdown of the transportation route from the staging area to the site was performed during the week of November 23, 2104, to confirm the logistics. Equipment needed for Phase 3 strategies will be brought in from regional centers. NORM-LP-7303, FLEX Implementation Plan, describes the interface with the NSRC.

Additionally, there is a signed agreement to allow participation in a multi-utility agreement for regional response centers for pooled inventory. The Perry Nuclear Power Plant Response Plan, "Perry SAFER Response Plan 38-9233762-000" has been developed to meet the requirements of NEI 12-06, Section 12, and signed by FENOC.

The PNPP SAFER Response Plan 38-9233762-000 and NORM-LP-7303 were made available for NRC review.

CI 3.1.2.1.A

During the audit, the licensee was requested to provide the elevations of FLEX equipment that will be deployed or staged across the site. In response, the licensee stated that the flooding re-analysis will need to be reviewed to determine the potential impacts. Confirm the location of FLEX equipment that will be deployed or staged is finalized with that consideration.

Response:

The response to this item was provided by FENOC letter dated February 26, 2015.

CI 3.2.1.1.A

Benchmarks must be identified and discussed which demonstrate that Modular Accident Analysis Program (MAAP) is an appropriate code for the simulation of an ELAP event at PNPP, Unit 1, consistent with the NRC endorsement of the industry position paper on MAAP (ADAMS Accession No. ML13275A318).

Response:

Addendum A-01 of calculation X11-001, FLEX Event Coping Strategies and Time Analysis, dated February 9, 2015, was made available for NRC review. This calculation addendum presents the results of containment and vessel response analyses, as determined via use of MAAP, in the standardized industry template.

CI 3.2.1.1.B

Confirm that the collapsed reactor pressure vessel level remains above Top of Active Fuel and the reactor coolant system cool down rate is within technical specifications limits.

Response:

Table C-2 of the PNPP integrated plan (NORM-LP-7303) shows that the operators will commence a cool down of the reactor pressure vessel (RPV) at 1 hour (hr) at a rate not to exceed 100°F/hr, which is within the technical specifications limit (100°F/hr, Technical Specifications Surveillance Requirement SR 3.4.11.1). The plot on page 3 of 10 of LTW-BWR-ENG-14-073, Revision 1 (addendum A-01 of calculation X11-001), of the RPV pressure from the MAAP confirms this cool down rate.

For the representative MAAP run (Case 704 – 1500/1500 gpm Process/Cooling Flow), RPV water level remains well above Top of Active Fuel (TAF) for the duration of the analysis. The plot shows that the lowest RPV level, calculated by MAAP, was approximately -74" below instrument zero. Instrument zero is at +565" above vessel zero, and TAF is located at -202" relative to instrument zero. As shown in the plot, the collapsed RPV water level remains 10.6' above TAF. Calculation X11-001, addendum A-01, was made available for NRC review.

CI 3.2.1.1.C

Confirm that MAAP is used in accordance with Sections 4.1, 4.2, 4.3, 4.4, and 4.5 of the June 2013 position paper.

Response:

From calculation X11-001, addendum A-01, the MAAP performed for PNPP was carried out in accordance with Sections 4.1, 4.2, 4.3, 4.4, and 4.5 of the June 2013 position paper, EPRI Technical Report 3002001785, "Use of Modular Accident Analysis Program (MAAP) in Support of Post-Fukushima Applications." Calculation X11-001, addendum A-01, was made available for NRC review.

CI 3.2.1.1.D

Confirm that, in using MAAP, the licensee identifies and justifies the subset of key modeling parameters cited from Tables 4-1 through 4-6 of the "MAAP Application Guidance, Desktop Reference for Using MAAP Software, Revision 2" (Electric Power Research Institute Report 1020236).

Response:

From calculation X11-001, addendum A-01, the reactor vessel nodalization is fixed by the MAAP code and cannot be altered by the user, with the exception of the detailed core nodalization. The PNPP MAAP 4.0.7 parameter file divides the core region into 5 equal volume radial regions and 33 axial regions. The axial nodalization represents 30 equal-sized fueled nodes, 1 unfueled node at the top, and 2 unfueled nodes at the bottom.

Containment nodalization is defined by the user. The standard nodalization scheme is used in the PNPP MAAP 4.0.7 parameter file and represents the following individual compartments: Reactor Pedestal & Sump, Drywell, Downcomer, Suppression Pool, Middle Wetwell Compartment, Lower Dome Compartment, Upper Dome Compartment, Spent Fuel Refueling Pool, Annular Gap and Environment.

General two-phase flow from the reactor vessel is described in the EPRI BWR Roadmap [EPRI Technical Report 3002001785]. In the case of the scenario outlined in the integrated plan, flow can exit the RPV via the open safety relief valve(s) (SRV) and from the assumed recirculation pump seal leakage. Flow from SRV(s) will be single-phase steam, and flow from the recirculation pump seal will be single-phase liquid due to the location of the break low in the RPV with RPV level continuing to be maintained above TAF. Upon exiting the RPV, the seal leakage will flash a portion of the flow to steam based on saturated conditions in the drywell, creating a steam source and a liquid water source to the drywell. As described in the EPRI BWR Roadmap, there are two parameters that can influence the two-phase level on the RPV. The following table confirms that the parameter values match the recommended values as outlined in the roadmap.

Parameter Name	Value used in PNPP MAAP analysis	EPRI recommended value
FCO	1.5248	1.5248
FCHTUR	1.53	1.53

Modeling of heat transfer and losses from the RPV are described in the EPRI BWR Roadmap. The parameters that control these processes, as defined in the roadmap, are provided in Calculation X11-001, Addendum A-01.

Choked flow from the SRV and the recirculation pump seal leakage is discussed in the EPRI BWR Roadmap. The parameters identified that impact the flow calculation are provided in Calculation X11-001, Addendum A-01.

Vent line pressure loss can be represented in two ways. The actual piping flow area can be input along with a discharge coefficient (FCDJ). An alternative method would be to calculate the effective flow area given the estimated piping losses and input a loss coefficient of 1.0. For the PNPP analysis, the containment vent was not utilized.

Decay heat in MAAP is discussed in the EPRI BWR Roadmap. Input parameters used to compute the decay heat are provided in calculation X11-001, addendum A-01.

Calculation X11-001, addendum A-01, was made available for NRC review.

CI 3.2.1.2.A

Calculations prepared in support of the licensee's Integrated Plan determined the required Phase 1 flow rate needed to stabilize boil-off, using suppression pool water, was well within the RCIC [reactor core isolation cooling] System injection capacity of 700 gallons per minute. The licensee indicated that further information regarding the specific assumptions and calculations for quantification of inventory losses are captured in proprietary analysis used for Integrated Plan preparation. The licensee should demonstrate adequate RCIC capacity.

Response:

Calculations prepared in support of the PNPP submittal determined the required Phase 1 flow rate needed to stabilize boil-off, using suppression pool water, is approximately 300 gallons per minute (gpm). System leakage with the vessel pressurized was estimated to be 66 gpm. This results in a total Phase 1 injection capability of 366 gpm. This value is well within the RCIC system injection capacity of 700 gpm. Further information regarding the specific assumptions and calculations for quantification of inventory losses are provided below.

Modeling of heat transfer and losses from the RPV are described in the EPRI BWR Roadmap. The parameters that control these processes, as defined in the roadmap, are provided in calculation X11-001, addendum A-01, which was made available for NRC review.

The reactor recirculation pumps are vertically mounted, single-stage, two-speed, centrifugal pumps designed to deliver a rated flow of 42,000 gpm at 1800 revolutions per minute (RPM) (fast speed). The reactor recirculation pump seals are replaced in each pump every four years. Before installation, seals are hydro-tested in a test fixture within two weeks of pump installation.

Per the seal vendor manual, design seal controlled bleed off (CBO) of 0.75 gpm is established using a two stage, pressure breakdown assembly (PBA). GMI-164, Section 5.6.2, validates the CBO flow rate prior to pump seal installation. This CBO flow rate, which accounts for approximately 1.5 gpm of the total identified drywell leakage is directed to the drywell equipment drain sump. Identified and unidentified drywell leakages are evaluated per PYBP-SITE-0029, Reactor Coolant System (RCS) Leakage Monitoring, which applies to RCS leakage as defined by Technical Specification 3.4.5, RCS Operational LEAKAGE, and monitored by NRC Performance Indicator Barrier Integrity 2 (NRC PI BI-02) Reactor Coolant System Leakage.

Current identified and unidentified drywell leakages are within the GREEN action levels per PYBP-SITE-0029, Section 4.1.

First indicators of reactor recirculation pump seal failure would be high and/or low first and second stage cavity seal pressures, which are trended daily. Seal degradation would also be reflected by abnormal identified and unidentified drywell leakages, which are also trended daily by Operations on Technical Specification rounds.

Based on this information, there is ample capacity from the RCIC and FLEX Lake Water pumps to maintain or restore reactor vessel level under the expected leakage conditions for the various mitigating accident strategies.

The following supporting documents were made available for NRC review:

- Drawing L111761, Flow Schematic, RR Pump Seal
- 2015 Daily PI Data Cycle 16, Equipment and Floor Drain Sumps
- 2015 Daily PI Data Cycle 15, Equipment and Floor Drain Sumps
- TM-0238, Technical Manual for Reactor Recirculation Pump, Section Seven – Operation
- Calculation X11-004, PNPP FLEX Event Coping Strategies Hydraulic Analysis
- Calculation X11-002, RCIC FLEX Vulnerability Review

CI 3.2.1.3.A

The licensee stated that Boiling Water Reactor Owners Group Emergency Procedure Guideline/Severe Accident Guideline, Revision 3, would allow the temperature limit of the suppression pool to be exceeded. The licensee should demonstrate why exceeding this temperature limit is acceptable for PNPP.

Response:

This evaluation addresses the postulated FLEX strategy-related increase in suppression pool temperature to 230°F (versus containment vessel suppression pool design of 185°F per specification SP-0660, Design and Fabrication of Steel Containment Vessels and Related Items for Reactor Buildings 1 & 2) and containment air temperature of 200°F (versus containment vessel design air temperature of 185°F per SP-0660). These higher temperatures were derived in calculation X11-001, revision 0, and addendum A-01. Review of calculation X11-001 shows, for the FLEX strategies, that the containment design basis pressure of 15 pounds per square inch, gauge (psig) remains bounding. Calculation X11-001 shows that the peak temperatures occur at about 6 hours after event initiation. Per calculation X11-001, the suppression pool design accident temperature (185°F) is reached at about 2.5 to 3 hours after the event initiation. By comparison to the containment vessel design conditions specified in SP-0660, Appendix B, Section 1.0, the FLEX scenario is a more gradual heat up than for the loss-of-coolant-accident (LOCA) design accident condition for suppression pool temperature. Per SP-0660, the 185°F containment design air temperature is based on long term conditions resulting from a large break LOCA.

The postulated loading conditions for the FLEX strategies are dead weight, pressure, and temperature. Initiating event loading conditions are not included as the initiating event is postulated to have already occurred. The FLEX strategies are beyond the design basis and as such, reasonable assurance of functionality is demonstrated. Evaluation to design basis stress limits is not required.

The major components evaluated are the containment vessel, piping systems, containment vessel penetrations, and the drywell wall exposed to 230°F suppression pool temperature and 200°F containment air temperature. Key aspects of the major components were assessed to determine available margin for thermal effects. In general, design codes are predicated on maintaining safety margins against failure. For this beyond-design-basis evaluation, the evaluation demonstrates that the components are able to function (that is, pipe may deform, but would still be intact to transport fluid).

CONTAINMENT VESSEL:

The Individual Plant Examination Containment Capacity Analysis (calculation DI-250) was completed in response to NRC Generic Letter 88-20. The evaluation defined the capacity of the containment structure subjected to pressure resulting from a postulated accident. The probability of failure as a function of containment internal pressure was developed considering the effects of elevated accident temperatures. The containment vessel was shown to have a pressure capacity of greater than 50 pounds per square inch (psi) at a 5 percent probability of failure.

Calculation DI-250 also reviewed the effects of higher temperatures on various materials.

Reinforced concrete: At 400°F, the compressive strength of reinforced concrete is estimated to be 80 percent of the compressive strength at room temperature. However, at 230°F suppression pool temperature, a smaller reduction is expected. In addition, the mean compressive strength of concrete based on break testing is typically higher than the design strength. Gilbert Commonwealth memorandum PY-STR-1851 documents the break tests for 3,000 psi concrete mix designs placed in PNPP structures, including the containment structure. The memorandum documents a minimum strength of 4,500 psi is expected for 3,000 psi concrete. In addition, concrete gains strength with age, and additional margin is expected. Similar logic can be applied to the drywell wall, which has 5,000 psi concrete design strength.

Reinforcement steel: Per calculation DI-250, the yield strength of reinforcement steel at 230°F is expected to be about 90 percent of that at room temperature. The reinforcement steel carries tensile loads (due to tension and bending) of reinforced concrete structures. The reduction in yield strength is judged to be enveloped by the inherit strength margin of the material. In addition, specified material yield strengths are minimum values and actual values are typically higher.

Steel Plate: The containment vessel, containment/drywell hatches, airlocks and drywell head are mainly composed of carbon steel SA516 Grade 70. Calculation DI-250 shows the yield strength of the steel plate at 300°F is expected to be about 97 percent of that at room temperature. It is assumed that the loss of yield strength is comparable to the loss of allowable stress. Overall, this reduction is considered negligible. In addition, specified material yield strengths are minimum values and actual values are typically higher.

Seal Material: Calculation DI-250 concludes good performance below 300°F for seals for the personnel airlocks, equipment hatches, and electrical penetrations.

Containment Vessel Analysis: The containment vessel is carbon steel SA516 Grade 70. The lower portion has stainless steel cladding for corrosion protection. The containment vessel is designed to American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section III subsection NE, "Class MC Components." The specification, SP-0660, shows the load combinations for the design of the containment vessel. Thermal accident load combinations were reviewed to see if the increased thermal condition is bounded by other loads not present for FLEX beyond-design-basis conditions.

The general stresses in the containment vessel shell due to a design basis accident (DBA) thermal transient are summarized in the "General Stresses" report (calculation 1:29.001). These stresses are included in Runs 8 and 9 (Equation 10, which includes operating basis earthquake (OBE)) and Runs 19 and 20 (Equation 12, which includes safe shutdown earthquake (SSE)). At the maximum primary membrane stress intensity location (Run 9 for OBE and Run 20 for SSE), the OBE load combination has an allowable of 1.0Sm. The interaction ratio of this ASME code limit including OBE loads is 0.74. The SSE load combination has an allowable of 1.2Sm. The interaction ratio for this ASME code limit including SSE loads is 0.64. Therefore, there is margin to accommodate the increased primary membrane stresses. Additional margin is available if the stress limit was increased to 1.5Sm, the limit applied for post-accident core recovery load case.

The primary membrane plus primary bending stress intensities are not driven by thermal conditions, and therefore, were not further evaluated. The controlling area is at the containment fix region (lower containment vessel stiffened with concrete in outer lower annulus) with thermal as a high contributor to total stresses. The locations with stress intensities greater than 1.5Sm were evaluated further using more accurate combinations of loads. To assess the effects due to the increased temperature, the Equation 12 evaluations of long term DBA + hydro + SSE at 183°F were reviewed. The SSE contribution was removed, and the thermal load (183/70 case) was adjusted by a factor of (230-70)/(183-70) = 160°F/113°F = 1.416 for the top surface and bottom surface elements. The total stress was recalculated, and the principal stresses and stress intensity determined. The stress intensity was compared to the 1.5Sm limit. The new stress intensity was also compared to the stress intensities used in the stress range check; new totals were determined if the recalculated values were not bounded by the existing evaluation. Although the stress intensities exceed 1.5Sm, all are less than 3Sm using this approach. In addition, the stress ranges are less than 3Sm except for a location near the first stiffener, which has a stress range of about 4 percent over the 3Sm design basis allowable limit and is approximately 86 percent of the specified minimum ultimate strength of the material. By judgment, this is acceptable.

Compressive material was placed along the top of the containment vessel stiffeners and penetrations encapsulated in the concrete annulus fix. Compressive material was also placed between the concrete fix and outer face of the containment vessel above the fourth ring stiffener and below the first ring stiffener. Bond break was applied to the outer face of the containment vessel at the concrete interface. This compressive material was designed to allow for thermal growth. During an accident condition (LOCA) the containment vessel experiences a temperature increase while the containment fix concrete through most of its thickness does not. This discontinuous temperature distribution creates the thermal forces and movements in the vessel and annulus concrete, which depend on the degree of bond at the interface between these structures. The added thermal growth would further compress the material and would tend to increase the bearing pressure at the concrete and steel and introduce additional forces and movements into the structures. Review of calculation 3:56.9 for the compressive material shows the maximum thermal growth at the top stiffener is anticipated to be 0.2" and that the maximum temperature will be less than the accident temperature of 180°F. The increase in bearing pressure is expected to be bounded by the loads and stresses due to SSE. Review of calculation 3:56.2 for the shield building to annulus concrete shows the loads and stresses due to the thermal increase are expected to be bounded by the SSE loads and stresses or hydrodynamic loads. Review of calculation 3:56.2, shows there is margin in the annulus concrete shield building interface stresses (pool swell, seismic) to bound the expected thermal stress increase. The temperature gradient through the annulus concrete tapers off from 185°F at the face to less than 90°F at 1.5' into the annulus fix concrete (calculation 3:56.4). The containment vessel anchorage evaluation (DCC-02 to 1:29.1 revision 3) did not consider the thermal effects to offset (reduce) loads when evaluating the containment vessel. The expected increase in thermal accident loads on the anchorage embed due to 230°F thermal condition are bounded by the SSE inertia loads.

The containment vessel shell above the annulus concrete fix area would be free to expand outward within the confines of the in-plane material capacity. Deflections at containment penetrations would tend to push the components upward and outward from the containment vessel penetration anchors.

Calculation 1:13 lists the deflections for containment temperature of 185°F (delta T of 185°F-70°F = 115°F). For an assumed 200°F temperature, the revised deflections were determined by the ratio of the change in temperature with the new delta T = 200-70 = 130°F and the ratio of new to old delta T = 130/115 = 1.13.

Exiting radial displacement = 0.5225"

New thermal radial displacement = 0.5225" (1.13) = 0.59" or an increase of 0.07"

Exiting vertical displacement = 1.3326"

New thermal vertical displacement = 1.3326" (1.13) = 1.51" or an increase of 0.18"

Calculation 1:09 contains the seismic displacements of structures. The horizontal SSE displacement (east-west and north-south) of the containment vessel at elevation 725' is 0.1418", which bounds the expected 0.07" increased radial displacement for 200°F containment temperature.

The vertical SSE displacement of the containment vessel at elevation 725' is 0.0157", which is less than the predicted vertical thermal deflection increase of 0.18" for 200°F containment temperature. However, components, such as piping interfacing with the containment vessel, have gaps at supports that would relieve the loads through component deformation. There may be local load and stress increases at the penetrations, but the increased displacement and increased loads would be expected to be bounded by the SSE or hydrodynamic accident load effects. In addition, design limits for design basis conditions contain margins against failure, and actual carbon steel material properties tend to be higher than the minimum required.

PIPING SYSTEMS:

Review of the ASME design specifications shows the piping is designed for seismic and thermal anchor displacements (normal and upset thermal conditions). The accident case results in the largest containment expansion. This is not the controlling thermal case since the ASME code does not require it to be evaluated for piping (one cycle of secondary stress will not cause pressure boundary failure).

Piping systems typically have some built in flexibility, which accommodates thermal displacements and growth. Although rigid guide supports are modelled without gaps, there is often a small gap of about 1/16". In addition, brackets for standard strut supports have gaps, which will permit some movement and rotation. Thermal loads are self-relieving since the component will deform as the component heats up and deflects. Loads on pipe supports due to higher thermal loads are expected to continue to be bounded by the SSE or hydrodynamic loads for any thermal loads not relieved by supports gaps.

Calculation X11-004 shows the hydraulic models for the various operating modes for FLEX strategy. These models were used to identify the piping sections used to support FLEX strategies. The piping directly communicating with the suppression pool were reviewed to compare projected thermal loads and stresses to other loads and stresses due to seismic and hydrodynamic loads.

<u>Pipe stress analysis 1E22G001A</u>: From containment (suppression pool, penetration P401) through high pressure core spray (HPCS) valve 1E22F0016 to suppression pool clean up (SPCU) pump 1G42C0001. The thermal accident case was run at 185°F. The postulated temperature increase = (230-185)/(185-70) = 45/115 = 0.39. Review of the thermal accident computer output shows an Equation 10 stress ratio of 0.529. The revised stress ratio = 1.39(0.529) = 0.74, which is less than 1.0 and is acceptable. Review of pipe support loads shows thermal load increases are bounded by SSE inertia loads.

<u>Pipe stress analysis 1G42G001A</u>: From fuel pool cooling and cleanup (FPCC) pump 1G41C001 through SPCU valve 1G42F0583 to anchor. The piping was evaluated for 230°F. No further evaluation required.

<u>Pipe stress analysis 1E21G001A</u>: From containment (suppression pool, penetration P103) through low pressure core spray (LPCS) valve 1E21F0001 to alternate decay heat removal (ADHR) branch. This piping was designed for 185°F and sections with ADHR flow were designed for 200°F. The postulated temperature increase = (230-185)/(185-70) = 45/115 = 0.39. Review of the pipe stress summary shows the controlling load case is normal + secondary with a total load of 28,206 psi. The secondary stress is 26,700 psi, which leaves 28,206-26,700 = 1,506 psi normal stress. Therefore, the revised stress = 1.39(26700) + 1506 = 38,619 psi, which is about 3 percent greater than standard allowable of 37,500 psi. This is acceptable by engineering judgment.

<u>Pipe stress analysis 1E12G012A</u>: Two branches tie in from pipe stress analysis G41G007A near residual heat removal (RHR) valve 1E12F004A at containment penetration P102 and near RHR valve 1E12F004B at containment penetration P402; also branches into pipe stress 1E12G030A, which is anchored at RHR heat exchanger

1E12B0001A and pipe stress 1E12G025A, which is anchored at RHR heat exchanger 1E12B0001B. The review of ASME piping design specification DSP-E12 shows portions of this piping used for FLEX were evaluated for 200°F due to ADHR. The effects of the added 30°F temperature increase is judged to be bounded by SSE loads and stresses.

Pipe stress analysis 1G41G007A: Ties into 1E12G012A. The piping was evaluated for FLEX temperature of 230°F. No further evaluation required.

CONTAINMENT VESSEL PENETRATIONS:

The design specifications for the containment vessel penetrations are P3000 (penetrations with Class 1 piping) and P900 (penetrations with Class 2 piping).

The design loads on the containment vessel penetrations due to piping included the piping maximum normal or upset thermal loads and do not include piping thermal accident loads. This approach is based on the time dependent aspect of the loads associated with a LOCA. The piping thermal accident loads at penetrations are considered to be longer term (occur greater than 1.25 hours after the event start) and therefore, are not coincident with the hydrodynamic loads such as pool swell, chugging, condensation oscillation, and so forth, which occur well within 1.25 hours of event start (hydrodynamic conditions end within minutes of the initiating event). The loads on the penetrations due to piping hydrodynamic conditions bound the thermal accident piping loads.

Loads on the penetrations due to the 230°F suppression pool temperature are expected to continue to be bounded by the hydrodynamic loads. Loads on the penetrations due to the piping were reviewed to confirm the relative magnitude of the thermal loads compared to the hydrodynamic loads as shown in Appendix C to SP-0660. To ease the comparison, the thermal loads for selected penetrations was increased by (230-150)/(150-70) = 80°F/80°F = 1.0 (that is, conservatively the increase in thermal load is equal to the thermal load) unless noted otherwise below. This is considered conservative since the pipe stress analysis may have derived thermal loads based on higher temperatures than 150°F. The reported thermal load is compared to the OBE + SRV loads, or pool swell loads or chugging loads. The thermal loads were bounded by these other loads.

A review of the drawings for the containment vessel and drywell wall penetrations show no penetration seal material is located in the containment vessel or drywell wall.

DRYWELL WALL:

The drywell temperature and pressure are expected to remain within design basis accident limits during FLEX strategy conditions. Per the design input for the drywell structure in File Code 3:20.0, the small break accident (SBA) generates the highest temperature in the drywell and is the enveloping case for the temperature gradient through the drywell wall. With the higher temperature on the outside surface of the drywell wall, the gradient is expected to be less severe. The additional loads and stresses on the drywell structure due to the higher temperature on the outer face of the drywell wall are expected to be bounded by the design basis seismic or hydrodynamic loads and stresses that are not postulated as present during FLEX strategy events. The radial beams of the structural steel platforms attached to the drywell wall have slotted connections on one end; the slotted connections accommodate thermal growth.

CI 3.2.3.A

Confirm that containment response calculation is completed, commensurate with the level of detail contained in GE [General Electric] Hitachi Report NEDC-33771P/NEDO-33771, Revision 1, "GEH Evaluation of FLEX Implementation guidelines," ADAMS Accession No. ML130370742.

Response:

Containment response analysis for PNPP FLEX strategies is presented in calculation X11-001 and includes a level of detail consistent with the referenced GEH documentation. Further information regarding the method of analysis and inputs is provided in addendum A-01 of the calculation, utilizing the approved industry template.

CI 3.2.3.B

The licensee should provide results from the successful completion of the evaluations and possible modifications which demonstrate that the Suppression Pool Cleanup pump and piping are seismically "robust".

Response:

The SPCU pump was found to be acceptable in the PNPP expedited seismic evaluation process (ESEP) report submitted to the NRC by FENOC letter dated December 19, 2014 (ADAMS Accession No. ML14353A060). Also, the SPCU pump passed the ESEP as documented in PNPP Seismic Fragility of ESEP Components Report (600930107). SPCU piping has been qualified outside of the ESEP process under engineering change package (ECP) 13-0519-003. SPCU pipe supports have been modified to address an over-constraint condition for seismic inputs/forces, which is documented in calculation 1G42G001A.

The PNPP Seismic Fragility of ESEP Components Report was made available for NRC review.

CI 3.2.4.2.A

It is not clear that (1) the assumed temperatures of the various critical rooms, e.g., RCIC Room and Control Room, are adequately evaluated for the potentially high temperature that may occur in these areas or that (2) time critical actions are

not required to be taken to maintain equipment functionality or personnel habitability limits. Confirm that these analyses/evaluations are completed.

Response:

Procedure guidance is provided in FLEX support guideline (FSG) 90.3, Alternate Room Ventilation, which will open the RCIC room door and install portable fans to address extended use of RCIC in supplying supplemental ventilation for the RCIC Room. The guidance is provided in ONI-R10-2 Station Blackout (SBO) and in FSG 10.1, RCIC FLEX Operation.

Additional guidance is addressed for the control room ventilation, if needed, as described in FSG 90.3. Ventilation needs with the control room and RCIC room are addressed with the normal SBO procedures as described in section 4.1.1 of NORM-LP-7302, FLEX Mechanical Design Report.

Calculation X11-003, FLEX Transient Thermal Analysis of Auxiliary Building Following an ELAP Scenario, demonstrates that RCIC room temperature is maintained below 150°F for the entirety of Phases 1 and 2 of a postulated FLEX event using the operator actions defined in FSGs. These actions include opening the RCIC pump room door within 1 hour to promote room cooling, and placement of a temporary fan to support continued cooling no later than 4.1 hours following event initiation. Additionally, the RCIC room does not require habitation. Once an alternate water supply is established, personnel entry into the room will be limited.

The results from calculation X11-006 for a maximum heat load in the spent fuel pool (SFP) is a time estimate of over 11 hours to reach boiling. This provides sufficient time to restore power in the mitigating strategy timeline such that a habitability evaluation for the SFP area is not necessary. There is no need for operators to stage hoses or other equipment in the SFP area since the time to boil calculations indicate sufficient time to allow for power to be restored for FLEX cooling of the SFP. Based on current strategies and analysis, there is no need for deployment of personnel into the spent fuel pool area.

Additional analysis has been performed in calculation X11-002, RCIC System FLEX Vulnerability Review, and adjacent room temperatures in calculation X11-003, FLEX Transient Thermal Analysis of Auxiliary Building Following an ELAP Scenario, that demonstrates the capability of the RCIC system to perform for 24 hours following the transient event, including those electronic components required as part of the mitigating strategy responses throughout the auxiliary building.

Calculation X11-010, Transient Thermal Analysis of Control Room following an ELAP Scenario, performs a transient thermal analysis of the control room for an ELAP resulting from a postulated beyond-design-basis external event (BDBEE). In particular, the transient temperature response of the control room is determined so that conclusions can be drawn with respect to personnel habitability, equipment function and acceptability of proceduralized operator actions. In this calculation, control room temperatures reach a maximum of approximately 95°F wet bulb globe temperature

(WBGT) and 103°F dry bulb temperature (DBT) during the warmest part of the day when outside air is provided through the control room ventilation. Activation of portable fans reduces the temperature rise during the initial period of the transient. Later, however, control room ventilation is needed to prevent higher temperatures, as provided in FSGs in Phase 2 and Phase 3. Temperatures are maintained in a habitable range for personnel, and equipment is not expected to be damaged based on the analytically determined temperatures.

The following calculations were made available for NRC review:

- Calculation X11-002, RCIC System FLEX Vulnerability Review
- Calculation X11-003, FLEX Transient Thermal Analysis of Auxiliary Building Following an ELAP Scenario
- Calculation X11-006, FLEX Spent Fuel Pool Boil-Off Analysis
- Calculation X11-010, Transient Thermal Analysis of Control Room following an ELAP Scenario

CI 3.2.4.2.B

The licensee provided insufficient information on monitoring temperatures and hydrogen concentration levels in the battery rooms to ensure temperature and hydrogen concentration level are within acceptable level. Confirm that battery room temperature and hydrogen concentration remain acceptable.

Response:

From calculation R42-001, Hydrogen Battery Production, and addendum A-01, with the addition of a battery cell, the hydrogen gas concentration in Division 1, 2 and 3 battery room (Unit 1 and 2) does not reach 2 percent concentration for 14 days for Division 1 and 2, and 47 days for Division 3. Additionally, during Phase 2, the battery room ventilation is restored prior to restoring the battery chargers.

With respect to monitoring temperature based on monitoring battery electrolyte temperatures as part of battery capacity surveillance testing, the highest temperature recorded was 82°F. Based on the FLEX strategy to shed load during an ELAP, the values measured during the surveillance testing would be bounding.

Drawing 022-0010-00000, Environmental Conditions for Control Building, details the temperature conditions during a loss of heating, ventilating, and air conditioning (HVAC), which was determined to be a maximum of 81°F. During normal operations the temperature can vary from 72°F to 80°F. This is well within the temperature limits of the battery documented in the vendor manual of 25°F to 107°F.

Calculation R42-001, addendum A-01, was made available for NRC review.

CI 3.2.4.4.A

Confirm that the proposed communications upgrades in the licensee's communications assessment are completed as planned.

Response:

PNPP met the communications requirements by implementing two ECPs. ECP 14-0563 provides the station with the capability to communicate both internally and externally through the use of satellite phones. The new satellite phone system equipment is located in Seismic Category 1 buildings. ECP 14-0564 provides the station with a FLEX-dedicated communications power supply (battery back-up) for the page/party (Gai-Tronics) system. Areas accessed during normal plant operations are expected to have audible page/party capabilities following a loss of ac power.

To ensure Gai-Tronics system availability throughout the event, the system has been modified with the addition of a battery backup system that is qualified for a minimum of 6 hours of backup until the normal power supply is restored by the portable 4160 Vac FLEX generators. The battery, charger and inverter for the backup Gai-Tronics power are installed in the intermediate building, which is a Seismic Category 1 building, in the previously unused Unit 2 annulus gas exhaust room at elevation 620' 6" and is protected from hazards in accordance with NEI 12-06.

Satellite telephone communication has been enhanced by the addition of two desk mounted phones in the control room with satellite capabilities. The satellite receiver will not be housed in the Technical Support Center (TSC) as originally planned because the TSC was determined not to be robust. The satellite receiver has been installed in the control complex building, which is robust. The satellite phones have an antenna system that will be deployed after the BDBEE has occurred. In addition to the control room phones, two hand held satellite phones have been purchased, with spare batteries and charging stations. These portable satellite phones are stored in FLEX Debris Removal and Equipment Transport trucks, one in each FLEX equipment bay. Satellite phones purchased for offsite agencies have been provided to the proper authorities. Procedure PYBP-ERS-0003, Emergency Plan Facility/Equipment Inventory Checklists was revised to add the new satellite phones to the quarterly availability/operational check.

CI 3.2.4.7.A

The licensee should confirm that the quality of water injected into the reactor pressure vessel supports and maintains acceptable long term core cooling.

Response:

The response to this item was provided by FENOC letter dated February 26, 2015.

CI 3.2.4.8.A

During the audit process, the licensee indicated that the basis for the minimum bus voltage for Division 1 and Division 2 battery systems is the coil voltage required to operate the 4160 volt ac breakers (diesel generator output breakers) on the divisional busses and operation of Automatic Depressurization System SRV solenoids. Confirm that the battery loading analyses considers the appropriate minimum voltage.

Response:

Calculation PRDC-0012, Station Blackout Design Battery Capacity, Revision 3, determines that battery loading and capacity is sufficient to ensure cross tied batteries mission time as required by NEI 12-06 and site procedures. While these site procedures assume that diesel generators are unavailable for the ELAP, the calculation does not remove field flashing attempts at 60, 120, 180, and 239 minutes after the event that initiates an ELAP. Additionally, since the emergency diesel generators (EDGs) are placed in pull-to-lock during an SBO, field flashing cannot occur, and therefore, provide additional margin for battery capacity. This calculation is bounding and adds conservatism and margin to ensure that even in a worst case scenario that the batteries will meet mission time. A note has been added to the calculation to remove the assumption of field flashing loading to clarify plant conditions during an ELAP.

Loading profiles for an ELAP are summarized in PRDC-0012, Revision 3, Attachment 3. Procedure ONI-R10-2 CHART, Station Blackout (SBO) – CHART, directs a cross tying of Unit 1 and Unit 2 batteries 30 minutes after the start of the event and executed through ONI-SPI D-3, Cross-Tying Unit 1 and 2 Batteries. Loading on Unit 2 Division 1 batteries is minimal and has no significant effect on battery capacity. Using PRDC-0012 load current and load times, the Unit 1 Division 1 battery capacity is 1182 ampere-hours (AH) at the time of cross-tying. Unit 2 Division 1 is assumed to be 1260AH. As the batteries are now in parallel, total capacity of the now combined batteries is 2442AH.

When the cross-tying of batteries occurs, the Unit 1 battery is loaded and operating at a lower voltage than Unit 2 battery. Unit 2 is considered to be at open circuit voltage of 125 Vdc and PRDC-0012 calculates Unit 1 battery at 121.09 Vdc. This potential difference results in arcing in the breaker as it closes. The voltage difference is limited by procedure ONI-SPI D-3, by only allowing cross tying in the first 30 minutes after a total loss of ac power event.

Unit 2 divisional and balance of plant (BOP) batteries are maintained in an operable status to support Unit 1 operation. The Unit 2 batteries are tested and maintained to the same requirements of the Unit 1 batteries. The list below contains the various maintenance tasks, which are procedurally performed for the Unit 2 batteries. These procedures ensure the availability/functionality of the batteries in question. These have been made available for NRC review.

SVI-R42-T5203	UNIT 2 WEEKLY 125V BATTERY VOLTAGE AND CATEGORY A LIMITS CHECK
SVI-R42-T5213	SERVICE TEST OF BATTERY CAPACITY - DIVISION 1 (UNIT 2)
SVI-R42-T5214	SERVICE TEST OF BATTERY CAPACITY - DIVISION 2 (UNIT 2)
SVI-R42-T5217	PERFORMANCE TEST OF BATTERY CAPACITY - DIVISION 1 (UNIT 2)
SVI-R42-T5218	PERFORMANCE TEST OF BATTERY CAPACITY - DIVISION 2 (UNIT 2)
SVI-R42-T5222	UNIT 2, DIVISION 1, 125V BATTERY CATEGORY B LIMITS, TERMINAL CORROSION AND ELECTROLYTE TEMPERATURE CHECK
SVI-R42-T5223	UNIT 2, DIVISION 2, 125V BATTERY CATEGORY B LIMITS, TERMINAL CORROSION AND ELECTROLYTE TEMPERATURE CHECK
SVI-R42-T5234	BATTERY CELLS, CELL PLATES, AND RACK INSPECTION; CONNECTION CHECKS (DIV 1, UNIT 2)
SVI-R42-T5235	BATTERY CELLS, CELL PLATES, AND RACK INSPECTION; CONNECTION CHECKS (DIV 2, UNIT 2)
SVI-R42-T5236	BATTERY CELLS, CELL PLATES, AND RACK INSPECTION; CONNECTION CHECKS (DIV 3, UNIT 2)
SVI-R10-T5228	ON-SITE POWER DISTRIBUTION SYSTEM VERIFICATION
SOI-R42 (DIV 1)	DIV 1 DC DISTRIBUTION, BUSES ED-1-A AND ED-2-A, BATTERIES, CHARGERS, AND SWITCHGEAR
SOI-R42 (DIV 2)	DIV 2 DC DISTRIBUTION, BUSES ED-1-B AND ED-2-B, BATTERIES, CHARGERS, AND SWITCHGEAR
SOI-R42 (DIV 3)	DIV 3 DC DISTRIBUTION, BUS ED-1-C AND ED-2-C: BATTERIES, CHARGERS, AND SWITCHGEAR

While there exists a potential difference across the breaker when cross tying the batteries as shown in PRDC-0012, arcing contacts are installed and designed to quench this arc. No other precautions are required.

The breaker used on the bus to cross-tie the batteries is a K1600 series breaker. This breaker has arcing contacts installed and is designed to quench arcs that result in cross-tying of Unit 1 and Unit 2 batteries.

CI 3.2.4.8.B

The applicable electrical drawing(s) provided during the audit process were not legible. The licensee should provide a legible copy of electrical drawings for NRC staff review.

Response:

Legible copies of electrical drawings were made available for NRC review.

CI 3.2.4.8.C

During the audit, the licensee indicated a total load of 429 kilowatts for the FLEX diesel generator which does not appear to match the total sum of all the loads provided during the audit. The licensee should explain and/or resolve this discrepancy.

Response:

The response to this item was provided by FENOC letter dated February 26, 2015

CI 3.2.4.9.A

With respect to refueling of deployed equipment, PNPP is currently evaluating the feasibility of either procuring a fuel trailer (trailer mounted tank with on-board pump mechanism), or mounting a fuel tank within the bed of a heavy-duty truck, with appropriate pumping mechanisms. The licensee should provide a description of the final plans for refueling once these evaluations are complete.

Response:

The FLEX turbine generators do not have an onboard fuel tank and each generator uses about 110 gallons per hour (gph) of diesel fuel under full load. The turbine generators are equipped with fuel pumps that can be used to take a suction on an external supply. For the N set of diesels that will be used at Operations Area 1 (outside the EDG building), a hose is connected to the day tank drain valve on one of the three day tanks. Any of the day tanks can be used, and selection will be event specific based upon availability. Each day tank has approximately 3 hours worth of fuel supply before the auto transfer of fuel oil from the storage tank to the day tank is disabled due to low tank level. From the time that the FLEX turbine generator is started until the critical 480 Vac divisional busses are energized is less than 1 hour. This is sufficient time to restore power to the associated division critical 480 Vac to allow the fuel oil transfer pumps to be restored to normal operation and automatically supply makeup needs of the day tank. As an alternate, any of the three in-ground fuel oil storage tanks can be used by running a hose to the tanks dewatering or dipstick connections and pumping fuel directly to the generator. Establishing the fuel oil supply is a matter of connecting a hose from the 3/4 inch drain valve (1R45-F507A(B) / IR45-F566) and routing the hose to the FLEX turbine generator and connecting the hose to the fuel oil connection. Staging of the FLEX generator occurs between T+1 and T+5, this is sufficient time (4 hours) to stage the generators outside the FLEX Equipment Bay 1 (EDG building), establish the fuel oil supply and connect the required cabling using two infield personnel.

For the N+1 turbine generator that is used at the emergency service water pump house (ESWPH) if a N turbine generator is unavailable, the N+1 generator is moved from the FLEX Equipment Bay 2 (Unit 2 auxiliary building) and staged at Operations Area 1 (outside the EDG building) to replace the failed N turbine generator. If access to Operations Area 1 (outside the EDG building) is precluded due to debris, the N+1 generator will be moved from FLEX Equipment Bay 2 (Unit 2 auxiliary building) and staged at Operations Area 2 (outside the ESWPH). As part of this deployment, a portable fuel oil tank is staged by the turbine generator to serve as its fuel oil tank. Two large capacity tanks (1,240 gallons each) are stored in FLEX Equipment Bay 2 to allow continuous operation of the N+1 generator at the ESWPH. Tanks can be cycled into or out of service at a rate that supports fuel consumption. These large tanks (in addition to the small capacity fuel caddies) can also be used to refill other deployed equipment as necessary. Three pumps are provided to assist in this transfer of fuel oil: a 110 Vac pump, a 12 Vdc pump, and a hand pump. Portable 110 Vac generators are available to be used to power the 110 Vac pump.

In addition, the normal fuel oil supply vendor has a long term contract and has provided fuel oil reliably for several years. Actions taken by the fuel oil vendor in the past have indicated their understanding and support of maintaining adequate fuel oil supply at the PNPP during emergency conditions. This vendor has access to over two million gallons of diesel fuel oil in the local area as well as an emergency supply of over 250,000 gallons. In addition, oil from refineries in Toledo, Ohio, and Canton, Ohio are also available to the fuel vendor essentially ensuring an indefinite supply. During large scale events that activate the PNPP emergency facilities, state and county support will be provided for ensuring that PNPP has the necessary resources to respond to the event. Letters of Agreement exist between the state, counties and PNPP ensuring support.

CI 3.2.4.10.A

The licensee should provide the battery dc load profile with the required loads for the mitigating strategies to maintain core cooling, containment, and spent fuel pool cooling.

Response:

Load shedding is performed in accordance with procedures ONI-R10, Loss of AC Power, ONI-SPI D-2, Non-Essential DC Loads, and ONI-SPI D-3, Cross-Tying Unit 1 and Unit 2 Batteries. These procedures provide the guidance to Operations personnel for performing the load shedding of batteries and the cross-tying of Unit 1 and Unit 2 station batteries that would extend the capabilities of the batteries to support core cooling, containment integrity and SFP cooling. These procedures were made available for NRC review.

CI 3.2.4.10.B

The licensee should provide the final load shedding procedure for review when it is completed.

Response:

The final approved load shedding procedure ONI-SPI D-2, Non-Essential DC Loads, was made available for NRC review.

CI 3.4.A

The licensee did not address considerations 2 through 10 of NEI 12-06, Section 12.2, regarding offsite resources. This information should be confirmed and documented.

Response:

The PNPP OIP revision submitted by letter dated September 25, 2014 (ADAMS Accession No. ML14268A214), documented that the industry will establish two NSRCs to support utilities during beyond-design-basis events. Each NSRC will hold five sets of equipment, four of which will be able to be fully deployed when requested, the fifth set will have equipment in a maintenance cycle. Equipment will be moved from a NSRC to the near site staging area, established by the SAFER team and the utility. Communications will be 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 nuclear site's playbook, will be delivered to the site within 24 hours from the initial request. On November 11, 2014, NEI issued a National SAFER Response Center Operational Status (ADAMS Accession Nos. ML14259A222 and ML14259A223) confirming the scope of the NSRC. The NSRCs are operated by AREVA and are located in Memphis, Tennessee, and Phoenix, Arizona. The local staging area for PNPP is a regional airport located in Ashtabula, Ohio. A walkdown of the transportation route from the staging area to the site was performed during the week of November 23, 2104, to confirm the logistics. Equipment needed for Phase 3 strategies will be brought in from regional centers. NORM-LP-7303, FLEX Final Integrated Plan, describes the interface with the NSRC.

Additionally, there is a signed agreement to allow participation in a multi-utility agreement for regional response centers for pooled inventory. The Perry Nuclear Power Plant Response Plan, "Perry SAFER Response Plan 38-9233762-000" has been developed to meet the requirements of NEI 12-06, Section 12, and signed by FENOC.

The PNPP SAFER Response Plan 38-9233762-000 and NORM-LP-7303 were made available for NRC review.

AUDIT QUESTIONS (AQ)/AUDIT REPORT OPEN ITEMS

AQ.28

049-RAI-Perry-28 Open Item, 3.1.5.1.A Protection of Equipment – High Temperatures. On pages 20, 31, 39, and 46 of 96, in the section of FENOC's integrated plan regarding the strategies for maintaining core cooling, containment, spent fuel pool cooling, and safety function support, respectively, FENOC stated that protection of associated portable equipment from hazards from high temperatures would be provided as follows: The FLEX storage building will include adequate ventilation to ensure that high temperatures do not affect the functionality of FLEX equipment.

Although FENOC will provide a building with adequate ventilation to ensure that temperatures do not affect functionality of FLEX equipment, no plan was provided to demonstrate how this will be accomplished. Additionally, it is unclear what adequate ventilation means. Provide a plan that will ensure that adequate ventilation that will maintain temperatures so the functionality of FLEX equipment will not be affected. Provide the technical basis of how the adequate ventilation was determined according to NEI 12-06.

Response:

A new FLEX storage building was not built. FLEX equipment is stored in existing safety-related Category 1 buildings. Specifically, FLEX Equipment Bay 1 (common unit EDG building), FLEX Equipment Bay 2 (Unit 2 auxiliary building east elevation 620' 6"), and the ESWPH for the FLEX Lake Water pumps.

Storage locations for FLEX equipment include portable fans that can be powered from the diesel generators to provide adequate ventilation to FLEX equipment in storage or deployed for use. Procedure guidance exists to provide monitoring of storage areas to ensure continued functionality of the FLEX equipment.

Forced ventilation is provided for storage of FLEX equipment in FLEX Equipment Bay 1 as part of the common unit EDG building. There is no adverse environmental consequences expected for the storage of equipment in this area based on weather conditions experienced during the plant life.

Storage of FLEX equipment in FLEX Equipment Bay 2, which has no forced ventilation, does not have any adverse environmental conditions expected based on weather conditions experienced during the plant life in this area. Based on temperatures experienced in this area during the plant life, it has been less than 105°F. FLEX equipment stored in this area has been procured to meet the design and licensing basis high temperature of 105°F. As a result, FLEX equipment stored in this area will not be impacted by adversely high temperature conditions.

For low temperatures, monitoring of the storage area will be performed by Operations as part of their seasonal weather preparations and routine rounds (IOI-15, Seasonal Variations and ONI-R36-2, Extreme Cold Weather) to ensure that temperatures do not get below freezing in the storage area. Calculation X11-007, FLEX Equipment Bay 2 HVAC, has been performed for necessary heat load in FLEX Equipment Bay 2 under design basis low temperature conditions. Temporary heaters can be deployed as necessary to protect FLEX equipment.

Calculation X11-007, FLEX Equipment Bay 2 HVAC was made available for NRC review.

AQ.37

049-RAI-Perry-37 Open Item, 3.2.1.5B SEQUENCE OF EVENTS. On page 8 of 96, in the Provide Sequence of Events section, FENOC stated that: The sequence of events and any associated time constraints are identified for Perry Modes 1 through 4 strategies for FLEX Phase 1 through Phase 3. These actions are bounding when compared to Mode 5 as they require the most personnel, actions, and time constraints. See attached sequence of events timeline (Attachment 1A) for a summary of this information. The times identified to initiate each action in this section and in Attachment 1A are based on resource loading to allow completion of all actions prior to their individual time constraints. The time and resources required to complete these tasks have been developed using plant staff walkthroughs and table top evaluations. The times stated are taken to be the elapsed time after the loss of power due to the external event. Time sensitive completion times are included.

In the above statement, FENOC indicated that the time and resources required to complete these tasks were developed using plant staff walkthroughs and table top evaluations. There is no evidence that plant staff walkthroughs and table top evaluations were documented with an established basis that justifies final numbers and results. Without this information on walkthroughs and table top evaluations, there is insufficient information presented to demonstrate that the time constraints for implementing coping strategies for Core Cooling and Maintaining Containment are satisfied. Therefore, there is insufficient information to conclude that the plans will conform to the guidance of NEI 12-06 with regard to a sequence of events timeline and time constraints. Provide documentation that discusses the MAAP analysis, plant staff walkthroughs and table top evaluations with an establish bases that justifies final numbers and results used in the Perry integrated plan.

Response:

The PNPP OIP revision submitted by letter dated September 25, 2014 (ADAMS Accession No. ML14268A214), provided the sequence of events that formed the strategy basis. The intent of the quoted statement from the PNPP OIP submittal is to state that walkdowns were performed with plant personnel for feasibility of the strategy.

NORM-LP-7305, Perry FLEX Validation Process Report, identifies the process that was used by PNPP to reasonably assure that the 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 PNPP.

The overall verification and validation process includes the requirements of NOP-SS-3001, Procedure Review and Approval, PAP-0550-3, Procedure Validation, and application of the NEI 14-07 FLEX Validation Process for the FSGs.

Time sensitive actions (TSAs) within the first 24 hours are validated using the NEI 14-07 style process (graded approach). This consists of identification of the tasks, manual actions and/or decisions that require validation and in accordance with the guidelines in NEI 14-07 selecting the appropriate graded approach (Level A – TSA must be started within the first 6 hours; Level B – TSA must be started between 6 and 24 hours after the start of the event; or Level C – FSGs, and FSG sections, validated only for PAP-0550.3, Procedure Validation, requirements). The results of the verification and validation process are documented in NORM-LP-7305.

Operations training was completed prior to the implementation date for FLEX. The list of procedures for FLEX is contained in NOP-LP-7300, FLEX Program for PNPP.

NOP-LP-7300 was made available for NRC review. The NEI 12-01 Phase 2 staffing assessment was provided by letter dated November 7, 2014 (ADAMS Accession No. ML14311A979).

AQ.43

049-RAI-Perry-43 Open Item, 3.2.1.8.A Motive Power, Valve Controls and Motive Air System. On page 9 of 96 of the integrated plan in the section on the Discussion of time constraints identified in Attachment 1A table, FENOC stated that:

9. At 16 hours, start and operate diesel powered compressor (Table item 23). Calculations have determined that instrument air receiver tanks can support operation of the SRV valves for up to 24 hours. This calculation is based on design leakage and air use for over 200 actuations. The coping analysis estimates less than 200 actuations in 24 hours.

10. At 24 hours, begin SFP Spray (Table item 26). Calculations of the SFP heat up and boil off assuming inventory loss due to seismic sloshing and maximum heat load determined the time to lower water levels to 10 feet above the fuel is at least 29 hours. The SFP spray system can be initiated remotely from the Fuel Handling

Calculations were referenced for determining the operation of SRVs for up to 24 hours and for SFP heat up and boil off. These calculations did not have a

reference material identified nor were the assumptions and initial conditions for the calculations stated. Provide the calculations on the ePortal that support the above evaluations for determining the operation of SRVs for up to 24 hours and for SFP heat up and boil off.

Response:

The following information was discussed and/or provided to address this question during the December 2014 NRC On-site portion of the Audit:

- Calculation X11-001, FLEX Event Coping Strategies and Time Analysis, provides the specific analysis details to support the Perry coping strategy.
- Westinghouse Calculation Note CN-SEE-II-12-45, Revision 0, Determination of the Time to Boil for the Perry Nuclear Power Plant Unit 1 Spent Fuel Pool after an Earthquake, December 21, 2012.
- X11-006, FLEX Spent Fuel Pool Boil-Off Analysis, provides the result of the revised time to boil calculations using more realistic assumptions relative to the amount of water volume and the decay heat required to be removed. For assumptions that the event occurs 100 days after a refueling outage the time to boil determination is greater than ten hours.
- LTR-AEO-13-0005 Rev. 0, Evaluation of the Safety-Related Compressed Air Consumption at Perry Nuclear Power Plan Unit 1 for an ELAP Condition, January 30, 2013.
- Calculation P57-013 provides documentation on the seven day supply of air from the safety related Instrument Air System for the required operation of SRV actuations (108 actuations for seven days of operation). In addition a portable air compressor is available to maintain sufficient air supply for operation of the SRVs.

AQ.79

Describe how electrical isolation will be maintained such that (a) Class 1E equipment is protected from faults in portable/FLEX equipment and (b) multiple sources do not attempt to power electrical buses.

Response:

FLEX equipment is physically disconnected from plant equipment during periods of normal operation or isolated by open manual breakers. Following the onset of a FLEX event, cables (which are staged locally for the generators) are connected to corresponding power receptacles (docking stations). Prior to energy being able to reach permanently installed plant equipment, several operator actions are required (closing of breakers). No automatic function is provided to start, synchronize or load the Phase 2 generators. Procedural guidance (40 series FSGs) direct the necessary operator actions to connect, start, synchronize and load the Phase 2 generators. The procedurally controlled breaker alignment prohibits plant equipment from being energized by multiple power sources.

With respect to relay protection, depending on the configuration, either the mobile switchgear protective relaying or the portable generator protective relaying integral to those components provide protection to the bus/plant equipment. The settings of the relaying required to protect the plant equipment are controlled administratively by procedure and verified before using the portable generators to energize plant equipment.

Protection for installed equipment is maintained by breakers on the FLEX generator output, load center input / output as well as isolation breakers on Bus EH21 (EH2106 and EH2110). Busses EH11, EH12 and EH21 are rated for 2000 Amp / 350 MVA / 4160 Vac service. Bus EH13 is rated for 1200 Amp / 250 MVA / 4160 Vac service. The FLEX generator output, load center input / output breakers have a rating of 1200 Amp / 4160 Vac; therefore the power that can be supplied to the EH busses is at or below the rating of the EH bus. Breakers EH2106 over current trip setting was adjusted as part of the modification (ECP 13-0521) to prevent over powering of the EH busses from portable generators. During an ELAP event where portable equipment is used, the affected switchgears are procedurally isolated from normal power sources and are not permitted to be used in parallel. Restoration of normal supply circuits (off-site power or EDG) is accomplished by de-energizing the affected bus and repowering it from the normal supply. All permanently installed equipment utilized by FLEX procedures is under design control. Protection and coordination is documented under PRLV-0063, FLEX Breaker Coordination (EFB207, EFB208, EFB209 and EFB215), and PRMV-0067, FLEX Medium Voltage Breaker Coordination (EH2106).

The plant diesel generators output breaker will not inadvertently close during an event due to the following:

- Design feature – To automatically close the diesel output breaker closure circuit looks at bus voltage to ensure there is no power on the bus prior to closure.
- Design feature – To manually close the diesel output breaker the closure circuit looks at the synchronization selector switch to allow closure.
- Operator Action – FSG 40.1 Supplying Alternate Power to Vital Unit 1 Busses, directs the operator to verify the diesel output breaker is out of service by racking the breaker out of service or disabling the breaker by use of the installed mechanical lockout device prior to energizing the EH bus from a portable generator.
- Operator Action – ONI-SPI A-5 (B-5, C-5) Division 1 (2, 3) EDG Restoration is the normal prescribed method to restore a diesel during an event. The EH bus is prepared by performance of ONI-SPI A-1 (B-1, C-1) Bus EH11 (EH12, EH13) Preparation, which includes actions to open all supply breakers to the EH bus to ensure it is de-energized prior to manual restoration of the diesel generator.
- Operator Action – If an EDG had started at the being of the event and not supplied the associated EH Bus, then emergency shutdown of the generator would have been performed, placing the generator in pull-to-lock, preventing

further operation until manual restoration was performed by performance of ONI-SPI A-5 (B-5, C-5) Division 1 (2, 3) EDG Restoration.

- Operator Action – If an emergency bus feeder is being used to supply the bus per FSG 40.4 Emergency Bus Feeder Operation, the diesel output breaker is removed from service to allow installation of the emergency bus feeder. Therefore, the diesel generator output is isolated from the EH bus.

Analysis of electrical fault protection is detailed in calculations PRMV-0067 and PRLV-0063. Portable generation is upstream of all loads. A fault in the generation equipment will cause a trip in the nearest breaker and will not cause damage to any installed or FLEX portable equipment. A fault in portable equipment is protected by the nearest breaker. Coordination is maintained and will limit faults to the equipment itself and prevent propagation to FLEX generation, FLEX portable equipment, and permanently installed plant equipment.

The following calculations were made available for NRC review:

- PRLV-0063, FLEX Breaker Coordination (EFB207, EFB208, EFB209 and EFB215)
- PRMV-0067, FLEX Medium Voltage Breaker Coordination (EH2106).

AQ.83

Provide a summary of the sizing calculation for the FLEX generators to show that they can supply the loads assumed in phases 2 and 3. Provide a copy of FLEX generator manufacturer provided technical details including maximum and minimum operating temperatures.

Response:

Loading requirements for implementation of the mitigating strategies are summarized in NORM-LP-7301, FLEX Electrical Design Report for the Perry Nuclear Power Plant, including the comparison between the needed loads and that supplied from the portable diesel generators. Appendix A of the procedure contains the summary for all assumed loads for the strategies employed. Overall, the requirements total an estimated 1248 kilowatt (kw), which will be supplied by the two N FLEX generators as described below.

The Phase 2 FLEX generators have been procured with capacity in excess of this total loading. The capacity is 1100 kw maximum with 850 kw continuous load. PNPP FLEX modification for plant electrical systems provided updates to the electrical distribution system, which will allow loading of the FLEX generators to ~750 kw (1200 amps at a minimum). This provides for more than sufficient capacity to satisfy minimum required loads. This also allows for potential additional loads to be supplied at the discretion of the control room operators based on guidance contained in FSG procedures.

Procedure FSG 40.5, FLEX Generator Loading and Plant System Operation, provides guidance for loading of the portable FLEX generators depending on required equipment needs to address the implementation strategies.

In addition, FLEX communications via the Gai-tronics, which is battery supplied initially, will be a minor load. This battery load can be bypassed as a result of maintenance switch, if necessary.

FLEX generator load was determined based on the coping strategies. Once the strategies were developed, the equipment required was identified and the specific kilowatt loading was determined as documented in NORM-LP-7301, FLEX Electrical Design Report for the Perry Nuclear Power Plant, Appendix A. Based on the needs to fulfill the coping strategies, the generators were sized. For PNPP, this is two FLEX generators, which can provide the required power for loads during Phase 2 of the FLEX event. As part of the procurement specifications to account for extreme temperatures, the minimum and maximum operating temperatures were also considered. For the 4160 Vac FLEX turbine generators purchased, their operating temperature range is -4°F to 158°F based on the vendor manual.

NORM-LP-7301 was made available for NRC review.

SAFETY EVALUATION (SE) REVIEW OPEN ITEMS

SE.2

a. **Discuss the design of the suction strainers used with FLEX pumps taking suction from raw water sources, including perforation dimension(s) and approximate surface area.**
b. **Provide reasonable assurance that the strainers will not be clogged with debris (accounting for conditions following, flooding, severe storms, earthquakes or other natural hazards), or else that the strainers can be cleaned of debris at a frequency that is sufficient to provide the required flow. In the response, consider the following factors:**
    i. **The timing at which FLEX pumps would take suction on raw water relative to the onset and duration of the natural hazard.**
    ii. **The timing at which FLEX pumps would take suction on raw water relative to the timing at which augmented staffing would be available onsite.**
    iii. **Whether multiple suction hoses exist for each FLEX pump taking suction on raw water, such that flow interruption would not be required to clean suction strainers.**

Response:

FLEX Lake Water pumps are submersible motor-driven pumps, which are deployed during the event. The pumps take suction from Lake Erie on the ESWPH suction forebay and are discharged into the emergency service water (ESW) system between the pump discharge check valve and discharge strainer. Prior to reaching the suction of the FLEX pumps, water is obtained through the normal or alternate intake structures and passes through traveling screens.

Based on the Phase 1 coping strategy, the FLEX Lake Water pumps will start taking a suction after six hours into the event and continue through Phase 3. Operator actions, using minimum site staffing, are performed during Phase 1 to ready the FLEX Lake Water pumps for operation in Phase 2 upon restoration of ac power. Pump operation continues into Phase 3 when augmented resources become available.

The design of the ESW system pump forebay incorporates traveling screens for removing submerged debris that may have entered through the intake structure. The water inlet is located more than one quarter mile offshore and submerged more than 15' below the surface of the lake.

Two traveling screens are provided, each designed to supply two units of operation. Each screen has the capacity to supply water with all ESW pumps and fire protection pumps operating and still maintain a relatively low approach velocity, minimizing debris accumulation and clogging potential. Maximum velocities were calculated assuming low lake level and 20' of active screen height.

In order for debris to enter the ESWPH, the debris would have to be submerged to the elevation of the intake heads, travel approximately 100' vertically downward, travel approximately 3,000' almost horizontally and then rise vertically approximately 100' to the ESWPH. Also, the intake system is designed for an approach velocity of 0.5 feet per second (fps), which diminishes the uptake of debris.

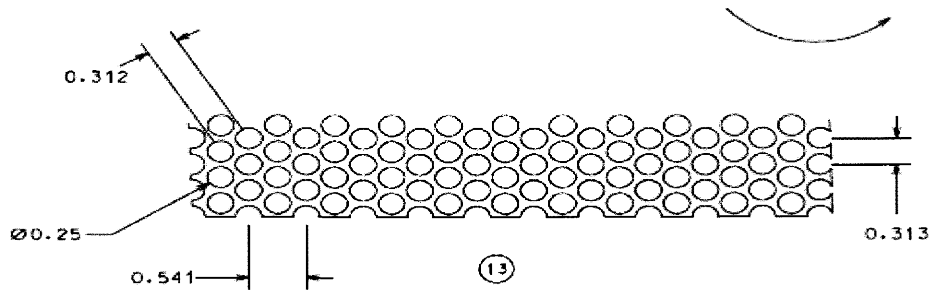
Because of these design features, it is highly unlikely that any significant amount of debris will enter the ESWPH and clog the screens.

NOP-LP-7300, FLEX Program at Perry, and NORM-LP-7302, FLEX Mechanical Design Report, provide additional description of the coping strategies and were made available for NRC review.

The size of the strainers on the suction of the FLEX Lake Water pumps is shown below from the vendor information:

The 14RHMC screen details are as follows:

- Hole diameter: 0.25"
- Center to center on 60° pattern: 0.313"



Based on the above dimensions of the suction strainer and that the flow path for Lake Erie water from the lake to the plant follows that of normal ESW operation, including debris, strainers are not susceptible to excessive clogging. Specifically, these suction strainers are located after the suction screens for all water entering the ESW suction forebay.

SE.5

Provide evaluation of impact of peak high temperature on the performance of the electrical equipment due to loss of ventilation in the RCIC room, battery charger/switchgear rooms during ELAP event.

Response:

Calculation X11-003, FLEX Transient Thermal Analysis of Auxiliary Building Following an ELAP Scenario, demonstrates that RCIC room temperature is maintained below 150°F for the entirety of Phases 1 and 2 of a postulated FLEX event using the operator actions defined in FSGs. These actions include opening the RCIC pump room door within 1 hour to promote room cooling, and placement of a temporary fan to support continued cooling no later than 4.1 hours following event initiation. The impact on the electrical equipment credited for the FLEX strategy under the condition described above is negligible and within acceptable environmental conditions throughout the auxiliary building and within the RCIC pump room. The impact on the battery charger / switchgear rooms during an ELAP is also acceptable based on insignificant changes to the environmental conditions experienced during normal plant operation in the switchgear and battery charger rooms during battery discharge testing.

Calculation X11-002, RCIC System FLEX Vulnerability Review, documents the capability of electronic equipment needed for RCIC operation to continue to function in the post event environment. Section 6.4 of this calculation provides the details of the survivability analysis for the RCIC governor located within the RCIC room and associated RCIC instrumentation located in the hallway outside the RCIC room.

Calculations X11-002 and X11-003 were made available for NRC review.

SE.6

Verify that the licensee's maintenance and testing program for the FLEX equipment include (but not limited to) the acceptance and replacement criteria for electrical equipment (especially for FLEX diesel generators, batteries, cables, etc.). For example, voltage and frequency limits when starting a generator. And also address shelf life of components (like O-rings, seals battery life, etc.). It appears that above items are currently not covered by EPRI Maintenance and Testing Template.

Response:

Details for the preventative maintenance (PM) program to ensure functional FLEX equipment are included in the following reference manuals that were made available for NRC review:

- 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-3748, FLEX Vehicles

FLEX diesel generators have the testing and PM performed in accordance with the specifications in NORM-ER-3731. Electrical cables are tested and maintained in accordance with guidance in NORM-ER-3730 with templates NORM-ER-3730A and B. Electrical batteries are tested and maintained in accordance with NORM-ER-3106.

For the FLEX generators the operation is controlled by FSG 40.4, Emergency Bus Feeder Operation, and FSG 40.5, FLEX Generator Loading, and the hardcard for starting the generator in accordance with OAI-1703, Hardcards, Attachment 26, FLEX Generator Hardcard. Normal operating parameters for the generator are voltage: 3900 to 4400 Vac and frequency: 58 to 62 hertz.

Shelf life considerations for items like O-rings, seals and batteries are taken into account for the individual equipment components and are typically handled as part of PM inspection with replacement based on evidence of wear and tear from use. For example, replace hose based on manufacturer's or industry standard shelf life limits for the applicable environment.

SE.7

Provide an evaluation of the environmental qualification of containment electrical equipment including Safety Relief Valve (SRV) components, showing that the equipment will be functional for the ELAP mission time.

Response:

The FLEX scenario does not involve a line break such as those used for small and large break LOCAs. Additionally, the duration of the higher temperatures during a beyond design basis FLEX scenario is no greater than 24 hours during which the peak temperature does not exceed 230°F.

Based on review of the FLEX scenario (Case 704), which forms the basis of the PNPP FLEX strategy and is part of the licensing basis, the suppression pool and containment do not exceed 230°F. There is no LOCA large or small line break that must be considered for the FLEX scenario. The heat input is from the SRVs discharging into the suppression pool while being used to control reactor pressure and temperature. Therefore, the only heat input into the drywell would be from the shutdown reactor (significantly less than during normal operation) and from the portion of the suppression pool that is inside the weir wall in the drywell, which would also not exceed 230°F. The calculations performed do not determine conditions inside the drywell during the FLEX scenario. However, based on the above, it is reasonable to conclude that the drywell would not exceed 250°F during the first 24 hours during which the peak suppression pool temperatures occur, especially given that the peak temperature of the suppression pool is of a relatively short duration (a few hours) and is reduced by FLEX based actions.

The limiting design basis thermal conditions for the drywell are for a small line break LOCA scenario. In this scenario, the drywell environment is 330°F for the first 3 hours, 310°F for the next 3 hours, and 250°F for next 24 hours (that is, ≥250°F for 30 hours). This envelopes the FLEX scenario conditions. Therefore, it is judged that, for the drywell FLEX BDBEE scenario, the drywell thermal conditions would not exceed the design basis accident conditions for the first 24 hours and environmental qualification (EQ) equipment would not be challenged by the FLEX conditions.

The limiting design basis pressure conditions for the drywell are for a large break LOCA scenario. In the FLEX scenario, there is no line break. Therefore, it is judged that, for the drywell FLEX BDBEE scenario, the drywell pressure conditions would not exceed the design basis accident conditions for the first 24 hours and EQ equipment would not be challenged by the FLEX conditions.

In summary, based on the FLEX conditions in drywell not exceeding the drywell design basis accident scenarios and conditions, there would be no challenge to EQ equipment located in the drywell as a result of the credited FLEX scenario.

Enclosure
L-15-227

Final Integrated Plan
(306 Pages Follow)

Perry Nuclear Power Plant FLEX Final Integrated Plan Report

Effective Date: 08/12/15

APPROVED BY ORIGINAL SIGNED BY MARK BENSI 08/11/15
Perry FLEX Program Manager Date

FirstEnergy

TABLE OF CONTENTS

TABLE OF CONTENTS		ii
1.0	EXECUTIVE SUMMARY	9
1.1	PURPOSE	9
1.2	FLEX STRATEGIES DETERMINATION	10
1.2.1	Establish Baseline Coping Capability	11
1.2.2	Determine Applicable Extreme External Hazards	11
1.2.3	Define Site-Specific FLEX Strategies	11
1.2.4	Programmatic Controls	12
1.2.5	Synchronization with Off-Site Resources	12
1.3	STRUCTURE OF REPORT	13
2.0	INTRODUCTION	16
2.1	BACKGROUND	16
2.2	SCOPE	18
2.3	ASSUMPTIONS	19
2.4	ACTION ITEMS	24
2.5	ACRONYMS	30
3.0	SUMMARY OF EXTREME EXTERNAL HAZARDS	33
3.1	SEISMIC HAZARD ASSESSMENT	33
3.1.1	Expedited Seismic Evaluation List (ESEL)	34
3.2	EXTERNAL FLOOD ASSESSMENT	35
3.3	EXTREME COLD ASSESSMENT	40
3.4	EXTREME HIGH TEMPERATURE ASSESSMENT	41
3.5	HIGH WIND HAZARD ASSESSMENT	42
4.0	GUIDANCE EVALUATION	45
5.0	SEQUENCE OF EVENTS	46
5.1	MODES 1 – 4 WITH RCIC AVAILABLE	46
5.1.1	Phase 1 Actions	46
5.1.2	Phase 2	51
5.1.3	Phase 3 Actions	55
5.1.4	Development of the Safety Function Timeline	56

5.2	MODE 5 / REFUELING	57
5.2.1	Phase 1	57
5.2.2	Phase 2	62
5.2.3	Phase 3	64
5.2.4	Development of the Safety Function Timeline	64
5.3	FULL CORE OFFLOAD	66
6.0	DEPLOYMENT IN ALL MODES	67
7.0	PROGRAMMATIC CONTROLS	68
7.1	EQUIPMENT DESIGN & QUALITY ATTRIBUTES	68
7.2	EQUIPMENT STORAGE	68
7.3	DEPLOYMENT OF FLEX EQUIPMENT	68
7.4	PROCEDURE GUIDANCE	68
7.5	MAINTENANCE AND TESTING	69
7.6	TRAINING PLAN	70
7.7	STAFFING	70
7.8	CONFIGURATION CONTROL	71
7.9	NATIONAL SAFER RESPONSE CENTERS (REGIONAL RESPONSE CENTERS)	71
8.0	FLEX STRATEGIES	72
8.1	REACTOR CORE COOLING (MODES 1-4)	72
8.1.1	Phase 1	72
8.1.2	Phase 2	76
8.1.3	Establishing the FLEX water source	77
8.1.4	Phase 3	111
8.2	REACTOR CORE COOLING (MODE 4 / 5 - REFUELING)	111
8.2.1	Phase 1	111
8.2.2	Phase 2	112
8.2.3	Phase 3	114
8.3	CONTAINMENT FUNCTION	114
8.3.1	Phase 1	114
8.3.2	Phase 2	115
8.3.3	Phase 3	121
8.4	CONTAINMENT INTEGRITY	121
8.4.1	Phase 1	121

8.4.2 Phase 2 122

8.4.3 Phase 3 122

8.5 SPENT FUEL COOLING 122
8.5.1 Phase 1 123

8.5.2 Phase 2 123

8.5.3 Phase 3 125

8.6 SAFETY SUPPORT FUNCTIONS 126
8.6.1 Phase 1 127

8.6.2 Phase 2 128

8.6.3 Phase 3 139

9.0 AREAS FOR STANDARDIZATION 141

10.0 IMPACT OF NTTF TIER 1 ACTIVITIES ON FLEX 143
10.1 PLANS TO UTILIZE SITE INSTALLED EQUIPMENT 144
10.2 POTENTIAL IMPACT OF ONGOING SEISMIC ACTIVITIES 147
10.2.1 Protection 147

10.2.2 Deployment 148

10.2.3 Procedural Interfaces 148

10.3 POTENTIAL IMPACT OF ONGOING EXTERNAL FLOODING ACTIVITIES 149
10.3.1 Protection 151

10.3.2 Deployment 151

10.3.3 Procedural Interfaces 152

10.4 EOP/SAMG ACTIVITIES 153
10.4.1 Procedural Interfaces 153

10.5 EMERGENCY RESPONSE ORGANIZATION 153
10.5.1 Staffing 153

10.5.2 Communications 154

10.6 COMBINED EVENTS 154
10.7 SPENT FUEL POOL INSTRUMENTATION 154
10.8 NTTF SUMMARY 154
11.0 NRC Order EA-12-051 Spent Fuel Pool Level 155
11.1 Background 155
11.2 Compliance 155
11.3 Identification of Levels of Required Monitoring 156
11.4 Instrumentation Design Features 156
11.5 Program Features 159
12.0 NRC Order NEI 12-01 Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities, [Revision 0], May 2012 160
12.1 Background 160
12.2 Compliance 160
12.3 Identification of Communication Improvement Requirements 160
12.4 Communication Improvement Design Features 161
12.5 Additional Communication Program Features 162
13.0 SUMMARY 163
14.0 REFERENCES 164
15.0 SCOPE OF REVISION 169
16.0 APPENDIXES 170
17.0 APPENDIX A SAFETY FUNCTIONS AND WATER SOURCES 173
18.0 APPENDIX: Table A-2 WATER SOURCES 188
19.0 APPENDIX: Table B-1 On-Site Phase 1 Equipment Requirements 189
20.0 APPENDIX: Table B-2 On-Site Phase 2 Equipment Requirements 190
21.0 APPENDIX: Table B-3 Storage Locations Summary 192
22.0 APPENDIX: Table C1-1 Timing and Deployment Timeline for Modes 1-4 193
23.0 APPENDIX: Table C-2: Timing and Deployment Reference Values 196
24.0 APPENDIX: Table C-3: NEI 12-01 Phase 2 Total Loss of AC (TLAC) Power ERO Staffing Analysis Report On-Shift Staffing Task Timetable 197
25.0 APPENDIX: Table D-1: Equipment Design Confirmation Summary Table 200
26.0 APPENDIX: Figure D-1 Power Block Buildings 201
27.0 APPENDIX: Figure D-2 FLEX Equipment Bay 1 Emergency Diesel Generator (EDG) Building 202
28.0 APPENDIX: Figure D-3 FLEX Equipment Bay 2 - Unit 2 Auxiliary Building East Side 203

29.0 APPENDIX: Figure D-4 Equipment Storage/Deployment Locations 204
30.0 APPENDIX: Figure D-5 FLEX Deployment Path 1 205
31.0 APPENDIX: Figure D-6 FLEX Deployment Path 2 206
32.0 APPENDIX: Figure D-7 FLEX Deployment Path 3 207
33.0 APPENDIX: Figure D-8 FLEX Deployment Path 4 208
34.0 APPENDIX: Figure D-9 FLEX Deployment Path 5 209
35.0 APPENDIX: Figure E-1 RCIC Suction Connection Point 210
36.0 APPENDIX: Figure E-1A RCIC Suction Connection Point Expanded 211
37.0 APPENDIX: Figure E-1B RCIC Suction Connection Point 212
38.0 APPENDIX: Figure E-2: Two Bed / Mixed Bed Storz Connector Location 213
39.0 APPENDIX: Figure E-2A: Two Bed / Mixed Bed Storz Connector Physical Location 214
40.0 APPENDIX: Figure E-2C: Two Bed / Mixed Bed Storz Connector Location 215
41.0 APPENDIX: Figure E-2D: Exterior Hose Path from Mixed Bed Tank 216
42.0 APPENDIX: Figure E-3: Interior Hose Path from Mixed Bed to the RCIC Suction Connection 217
43.0 APPENDIX: Figure E-3A: Interior Hose Path from RHR to FPCC Return Header to the RCIC Suction Connection 218
44.0 APPENDIX: Figure E-3B: Interior Hose Path from ESW A to the RCIC Suction Connection 219
45.0 APPENDIX: Figure E-4: Aux Building Dry Standpipes 220
46.0 APPENDIX: Figure E-5 Mechanical FLEX Equipment and Modifications Photos 221
47.0 APPENDIX: Figure E-6: LPCS / HPCS Storz Connection Points 259
48.0 APPENDIX: Figure E-7 Simplified Unit 1 and Unit 2 Divisional AC busses without modifications 260
49.0 APPENDIX: Figure E-8 Simplified Unit 1 Division 1 Electrical 261
50.0 APPENDIX: Figure E-9 Simplified Unit 1 Division 2 Electrical 262
51.0 APPENDIX: Figure E-10 Simplified Unit 1 Division 3 Electrical 263
52.0 APPENDIX: Figure E-11 Simplified Unit 2 Division 1 Electrical 264
53.0 APPENDIX: Figure E-12 Simplified Unit 2 Division 2 Electrical 265
54.0 APPENDIX: Figure E-13 Simplified Unit 2 Division 3 Electrical 266
55.0 APPENDIX: Figure E-14 Simplified Electrical Modifications 267
56.0 APPENDIX: Figure E-15 Termination Enclosure 1X11-S0001 268

57.0 APPENDIX: Figure E-16 Transfer Switch 1R25-S0291 269

58.0 APPENDIX: Figure E-17 Transfer Switch 1R25-S0174 270

59.0 APPENDIX: Figure E-18 Transfer Switch 1R25-S0292 271

60.0 APPENDIX: Figure E-18-A: FLEX Electrical Equipment and Modification Photos: 272

61.0 APPENDIX: Figure E-19 Termination Enclosure 1X11-S0001 to Bus EH21 Feeder 296

62.0 APPENDIX: Figure E-20 Alternate Supply to Bus EH11 297

63.0 APPENDIX: Figure E-22 Alternate Supply to Bus EH12 298

64.0 APPENDIX: Figure E-23 Alternate Supply to Bus EH13 299

65.0 APPENDIX: Figure E-24 Alternate Supply to Bus TH21 300

66.0 APPENDIX: Figure E-25 Alternate Supply to Transformer EHF2A 301

67.0 APPENDIX: Figure E-26 Primary Suppression Pool Closed Loop Cooling Flow Path 302

68.0 APPENDIX: F, FLEX Equipment Task Examples 303

69.0 APPENDIX G Perry Nuclear Power Plant FLEX Overall Integrated Plan, Rev. 4 305

70.0 APPENDIX: H, L-15-128, Completion of Required Action by NRC Order EA-12-051, Reliable Spent Fuel Pool Instrumentation (TAC No. MF0802) 306

NOTE

For optimum viewing, print these appendixes on 8.5 x 14 or 11 x 17 paper.

NOTE

This document contains bookmarked references, if reading an electronic version of this document; place cursor on the word reference, a control/click combination will take you to the reference section and the applicable reference information.

1.0 EXECUTIVE SUMMARY

1.1 PURPOSE

NRC Order EA-12-049 (Reference 01) requires implementation of mitigation strategies for beyond-design-basis external events (BDBEE), based on the industry-proposed Diverse and Flexible Coping Strategies (FLEX) approach to Near-Term Task Force (NTTF) Recommendation 4.2. Implementation was required to be completed by the second refueling outage after the initial submittal (February 28, 2013) of the overall integrated plan, or December 31, 2016, whichever is earlier.

The second Perry refueling outage after the integrated plan submittal was the spring of 2015. Perry Letter L15-097 requested a relaxation of this date for completion of some portions of the FLEX strategy. The NRC approved that request for relaxation to the order for Perry and relaxed the full compliance date until July 31, 2015. This was done to allow Perry sufficient time complete the necessary plant modifications needed to implement the required strategies. This relaxation was documented via letter ADAMS Accession Number: ML 15089A1 82.

NRC interim staff guidance for implementing this order is provided in JLD-ISG-2012-01 (Reference 03). This NRC guidance document endorses, with clarifications, the methodologies described in the industry guidance document, Nuclear Energy Institute (NEI) 12-06 (Reference 02).

The purpose of this NORM is to document the Perry site's event mitigating capabilities which comply with the FLEX requirements as defined by JLD- ISG-2012-01 (Reference 03) and NEI 12-06 (Reference 02) guidance documents.

This report is not considered a design basis document; see applicable Engineering Change Packages for design information. This information is the FLEX Final Integrated Plan (FIP) for the Perry Nuclear Power Plant (PNPP). This report describes the overall coping strategy implemented at PNPP and plant modifications implemented to support this strategy. This report is not intended to direct action, it is intended as reference material only. However, it must be noted that the credited capabilities defined in the NORM are part of the PNPP response to NRC Order EA 12-049 and should be considered part of the PNPP licensing basis.

The information provided in Revision 0 of this document directly supported the February 28, 2013 FLEX Integrated Plan submittal and changes made to the

PNPP FLEX strategies (and associated modifications) since the submittal of Revision 0 to the Nuclear Regulatory Commission. Revision 1 documents the final FLEX implementation at PNPP.

This document has been submitted to the NRC as a description of how the FLEX program was implemented at PNPP. Changes to this document, or the strategies and equipment described herein, may require NRC notification; ensure the Program Manager reviews changes with Regulatory Affairs.

1.2 FLEX STRATEGIES DETERMINATION

The FLEX strategies are focused on maintaining or restoring key plant safety functions under the conditions of extended loss of alternating current (AC) power (ELAP) and loss of normal access to the ultimate heat sink (LUHS) and are not tied to any specific damage state or mechanistic assessment of external events.

Based on NEI 12-06 (Reference 02), the safety functions of core cooling, containment integrity, and Spent Fuel Pool (SPF) cooling need to be maintained indefinitely under these conditions in accordance with an integrated plan. Section 8 of this report outlines these safety functions and provides details related to the methods and strategies employed to maintain those safety functions indefinitely.

Based on NEI-12-06 (Reference 02), the underlying strategies for coping with simultaneous ELAP and LUHS conditions involve a three-phase approach:

Phase 1: Initially cope by relying on installed plant equipment.

Phase 2: Transition from installed plant equipment to the on-site FLEX equipment.

Phase 3: Obtain additional capability and redundancy from off-site equipment until power, water, and coolant injection systems are restored or commissioned.

Section 8 of this report describes each safety function and the three-phase approach to cope with the simultaneous ELAP and LUHS event.

The FLEX approach as defined in NEI 12-06 (Reference 02) consists of five (5) steps:

1. Establish baseline coping capability
2. Determine applicable extreme external hazards
3. Define site-specific FLEX strategies
4. Determine the programmatic controls

5. Establish the synchronization with off-site resources

Steps 1 and 2 have been completed during the Rapid FLEX Gap Assessment in Reference 07. Steps 3 through 5 are outlined in this report.

1.2.1 Establish Baseline Coping Capability

Based on NEI 12-06 (Reference 02), the first step of FLEX capability development is the establishment of the baseline coping capability to address a simultaneous ELAP and LUHS event. NEI 12-06 (Reference 02) has established a set of boundary conditions that were evaluated with respect to the Perry site and the information was used to create the FLEX Integrated Plan herein. See NEI 12-06 (Reference 02) for these conditions and assumptions.

1.2.2 Determine Applicable Extreme External Hazards

The Perry site has been evaluated for external hazards in accordance with NEI 12-06 (Reference 02); the following hazards as applicable to PNPP and require FLEX strategies capable of function following such events:

- Seismic events
- External flooding
- Storms such as high winds, and tornadoes
- Snow and ice storms, and cold
- Extreme heat

The scenarios listed above represent the applicable BDBEE applicable to PNPP. This evaluation is provided in Reference 07 and summarized in Section 3.0, Summary of Extreme External Hazards.

1.2.3 Define Site-Specific FLEX Strategies

FLEX strategies must be developed to mitigate all applicable extreme external hazards applicable to the site. To that end, strategies/modifications have been developed to address the following:

- Protection of FLEX equipment
- Deployment/connection of FLEX equipment
- Provide guidance with procedural interfaces
- Description of utilization of off-site resources

1.2.4 Programmatic Controls

Using the details within this report, the Perry site has developed the following programmatic controls for the implementation of FLEX:

- Quality attributes
- Equipment design
- Equipment storage
- Procedure guidance
- Maintenance and testing
- Training
- Staffing
- Configuration control

1.2.5 Synchronization with Off-Site Resources

Based on NEI 12-06 (Reference 02), the timely provision of effective off-site resources will be coordinated by the site and will depend on the plant-specific analysis and strategies for coping with the effects of the BDBEE. The industry has selected the vendor to run the National Safer Response Centers (NSRC), which will house and maintain various equipment that can be quickly deployed to any nuclear site in the United States to assist in coping with a BDBEE. Perry worked with the vendor of the NSRC to develop a deployment plan specific to Perry. The NSRC deployment plan includes the use of the best means to obtain resources after a BDBEE and considers available staging areas. The full discussion of this item is provided in the Phase 3 sections of this report for each applicable safety function. The SAFER response Plan for Perry Nuclear Power Plant, AREVA Document Number 38-9233762-000 is an attachment to NORM-LP-7307 PNPP SAFER Response Plan Reference Material (Reference 46)

1.3 STRUCTURE OF REPORT

To support the development of Perry-specific FLEX strategies, the following evaluations and reports were generated. Some documents below are considered historical in nature and are not periodically updated. Where referenced, the document was superseded by additional reports/calculations.

- Rapid FLEX Report Reference 07

  Purpose: Evaluate the as-is condition of Perry against the NEI 12-06 (Reference 02) and identify areas where actions are required to meet those requirements.

- Perry Walkdown Report (Reference 19)

  Purpose: Summarize the FLEX walkdown findings and inform the development of FLEX modifications and strategies

- Chemistry Calculation for Alternate Cooling Source Usage during Extended Loss of All A.C. Power at Perry Unit 1 (Reference 21)

  Purpose: Evaluate and prioritize water source usage during BDBEE

- Evaluation of Alternate Coolant Sources for Responding to a Postulated Extended Loss of All AC Power. (Reference 06)

  Purpose: Examination of options to utilize alternate water sources to provide continuous sources of water to maintain key safety functions

- Perry FLEX Conceptual Design AFT Fathom Model (Reference 13)

  Purpose: Conservatively evaluate hydraulic performance of FLEX systems. This evaluation has been superseded with a detailed hydraulic model and is captured in PNPP-Calculation X11-004 FLEX Hydraulic Flow Model (Reference 47)

- FLEX Mechanical Conceptual Design Report for the Perry Nuclear Power Plant

  Purpose: Summarize the mechanical conceptual design of the FLEX strategies and identify any required modifications. This report has been superseded by NORM-LP-7302, FLEX Mechanical Design Report for the Perry Nuclear Power Plant (Reference 09)

- Perry Battery Coping Analysis (Reference 24)

  Purpose: Evaluate the performance capabilities of the DC system during an ELAP event

- FLEX Electrical Design Report for the Perry Nuclear Power Plant

  Purpose: Summarize the electrical conceptual design of the FLEX strategies and identify any required modifications. This report has been superseded by NORM-LP-7301, FLEX Electrical Design Report for the Perry Nuclear Power Plant. (Reference 22)

- Westinghouse Calculation CN-SEE-II-12-45, Revision 0, "Determination of the Time to Boil for the Perry Nuclear Power Plant Unit 1 Spent Fuel Pool after an Earthquake," December 21, 2012. (Reference 12)

  Purpose: Evaluate the impact of sloshing and time-to-boil in the SFP after an earthquake. This evaluation has been superseded by PNPP Calculation X11-006, FLEX Spent Fuel Pool Boil-Off Analysis (Reference 48)

- Evaluation of the Impact of Existing Extreme Hazards Analysis and Planned NTTF Tier 1 Activities on the Conceptual FLEX Design for Perry Nuclear Power Plant (Reference 25)

  Purpose: Summarize on-going industry activities and the potential to influence the developed FLEX strategies

- FLEX Programmatic Controls Report for the Perry Power Station

  Purpose: Summarize the need to implement programmatic control of the FLEX strategies. This report has been superseded by NORM-LP-7304, FLEX Programmatic Controls Report for the Perry Nuclear Power Plant (PNPP) (Reference 08)

- Perry FLEX Timing and Deployment Calculation (Reference 10)

  Purpose: Summarize the FLEX timeline for Perry, identify time constraints and provide a basis for the safety function needs

- Perry FLEX Coping Time Analysis (Reference 14)

  Purpose: Determine Core Cooling and Containment Heat Removal requirements. This calculation has been superseded by PNPP Calculation X11-001, FLEX Event Coping Strategies And Time Analysis (Reference 49)

- Perry Unit 1 Best-Estimate Full Core Decay Heat Curve (Reference 23)

  Purpose: Determine the best-estimate decay heat curve at Perry for use in other FLEX analyses

The purpose of this report is, in part, to summarize these individual evaluations and provide a governing reference document for the Perry FLEX strategy. In addition to summarizing the existing FLEX strategies, the NEI FLEX Integrated Plan response template has been completed. This document will be updated and used to provide documentation to support subsequent status reports.

2.0 INTRODUCTION

2.1 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 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 01) 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:

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

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.

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.

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

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

The accident at Fukushima Daiichi was a BDBEE, which created a condition of an ELAP and led to loss of core cooling, impaired spent fuel cooling, and challenged containment integrity. Current design bases for nuclear plants include bounding analyses with margin for external events at each site. Although highly unlikely, extreme external events beyond those analyzed in design bases can present similar challenges to nuclear sites.

As part of an effort to increase defense-in-depth for BDBEE scenarios, FLEX strategies have been established which address an ELAP and LUHS occurring simultaneously at all units on a site for an indefinite period of time.

The strategies for coping with BDBEE conditions involve a three-phase approach:

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

This document identifies strategies required by the FLEX program in accordance with (Reference 02) and (Reference 03).

Order EA-12-049 (Reference 01) required submission of an overall integrated plan to the NRC for operating plants by February 28, 2013. Additionally, the Order requires submission of an initial status report 60 days following issuance of the Interim Staff Guidance (Reference 03) and at six-month intervals following submittal of an overall integrated plan on February 28, 2013. Finally, the Order requires full implementation of its requirements no later than two refueling cycles after submittal of the overall integrated plan, or December 31, 2016, whichever comes first. Perry Unit 1 had refueling outages scheduled for spring of 2013 and spring of 2015.

The second Perry refueling outage after the integrated plan submittal was the spring of 2015. Perry Letter L15-097 requested a relaxation of this date for completion of some portions of the FLEX strategy. The NRC approved that request for relaxation to the order for Perry and relaxed the full compliance date until July 31, 2015. This was done to allow Perry sufficient time complete the necessary plant modifications needed to implement the required strategies. This relaxation was documented via letter ADAMS Accession Number: ML 15089A1 82.

2.2 SCOPE

The scope of this report includes the following activities:

1. Provide the FLEX Final Integrated Plan for Perry as outlined in the NEI FLEX Implementation Guide (Reference 02).
2. Provide the overall design for the installation of equipment as required to facilitate the implementation of FLEX procedures and the deployment of FLEX equipment.
3. Provide the estimating calculations or reference information for the sizing and other critical aspects of major equipment and materials required to implement the PNPP FLEX strategies/program.
4. Document primary and secondary locations and routings for deploying portable equipment.
5. Document the steps and modifications performed to implement successful FLEX strategies.
6. Provide responses in the FLEX Final Integrated Plan.
7. Provide a basis for conformance with Order EA-12-049 (Reference 01) and serve as the document to be updated to further actions required for conformance with Order EA-12-049.
8. Per Reference 01, any changes to the facility must consider the impact to existing FLEX strategies. This document serves as the governing reference to determine if assumptions have changed, or if strategic aspects have been impacted, and if mitigation is required.

This document is a continuation of the work completed in the Rapid FLEX Assessment in Reference 07 by integrating site walk-downs, engineering analyses, evaluations, and procedure reviews using site-specific requirements.

These activities were used to define functional requirements and designs for the implementation of a FLEX program. This document includes an evaluation of the design to perform the required functions of FLEX and directly supports the development of this document.

Depending on the challenge presented, the approach and FLEX implementation strategies may vary among utilities. Therefore, the NRC staff has requested all operating plant sites to submit their overall integrated plan to meet the requirements of NRC Order EA-12-049 no later than February 28, 2013. This was completed via issuance of Revision 0 of the Overall Integrated Plan, 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. Due to strategy changes and enhancements, Revision 1 of the Overall Integrated Plan was issued September 25, 2014 via letter L-14-285. This NORM has been prepared to document the Final Integrated Plan submittal to the NRC and includes descriptions of the final strategy and changes since issuance of L14-285.

2.3 ASSUMPTIONS

The assumptions listed in this section are referenced throughout the Report. The number format follows an “A1, A2, A3” nomenclature where the number corresponds to the number within this list. This list is direct input to the FLEX Integrated Plan “General Integrated Plan Elements” table. The list provided below is sourced from the industry FLEX Implementation Guide, NEI 12-06, (Reference 02)

NEI 12-06 Assumptions

Initial Plant Conditions

The initial plant conditions are assumed as the following:

A1. Prior to the event the reactor has been operating at 100 percent rated thermal power for at least 100 days or has just been shut down from such a power history as required by plant procedures in advance of the impending event.

A2. At the time of the postulated event, the reactor and supporting systems are within normal operating ranges for pressure, temperature, and water level for the appropriate plant condition. All plant equipment is either normally operating or available from the standby state as described in the plant design and licensing basis.

Initial Event Conditions

The following initial event conditions are to be applied:

A3. No specific initiating event is used. The initial condition is assumed as a loss of offsite power (LOOP) at a plant site resulting from an external event that affects the off-site power system either throughout the grid or at the plant with no prospect for recovery of off-site power for an extended period. The LOOP is assumed to affect all units at a plant site.

A4. All installed sources of emergency on-site AC power and Station Black Out (SBO) Alternate AC power sources are assumed not available and not imminently recoverable.

A5. 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.

A6. Normal access to the 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, are assumed lost with no prospect for recovery.

A7. Fuel for FLEX equipment stored in structures with designs that are robust with respect to seismic events, floods and high winds and associated missiles, remains available.

A8. 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.

A9. Other equipment, such as portable AC power sources, portable back up DC power supplies, spare batteries, and equipment for 50.54(hh)(2), may be used provided it is reasonably protected from the applicable external hazards per Sections 5 through 9 and Section 11.3 of NEI 12-06 (Reference 02) and has predetermined hookup strategies with appropriate procedures/guidance and the equipment is stored in a relative close vicinity of the site.

A10. Installed electrical distribution system, including inverters and battery chargers, remain available provided they are protected consistent with current station design.

A11. No additional events or failures are assumed to occur immediately prior to or during the event, including security events.

A12. Reliance on the fire protection system ring header as a water source is acceptable only if the header meets the criteria to be considered robust with respect to seismic events, floods, and high winds, and associated missiles.

Reactor Transient

The following additional boundary conditions are applied for the reactor transient:

A13. Following the loss of all AC power, the reactor automatically trips and all rods are inserted.

A14. The main steam system valves (such as main steam isolation valves, turbine stops, atmospheric dumps, etc.), necessary to maintain decay heat removal functions operate as designed.

A15. Safety/Relief Valves (S/RVs) initially operate in a normal manner if conditions in the Reactor Pressure Vessel (RPV) so require. Normal valve reseating is also assumed.

A16. No independent failures, other than those causing the ELAP/LUHS event, are assumed to occur in the course of the transient.

Reactor Coolant Inventory Loss

Sources of expected BWR reactor coolant inventory loss include:

A17. Normal system leakage

A18. Losses from letdown unless automatically isolated or until isolation is procedurally directed

A19. Losses due to BWR recirculation pump seal leakage.

A20. BWR inventory loss due to operation of steam-driven systems, Safety Relief Valve (SRV) cycling, and RPV depressurization

SFP Conditions

The initial SFP conditions are:

A21. All boundaries of the SFP are intact, including the liner, gates, transfer canals, etc.

A22. Although sloshing may occur during a seismic event, the initial loss of SFP inventory does not preclude access to the refueling deck around the pool.

A23. SFP cooling system is intact, including attached piping.

A24. SFP heat load assumes the maximum design basis heat load for the site.

Containment Isolation Valves

It is assumed that the containment isolation actions delineated in current station blackout coping capabilities are sufficient.

The following assumptions are specific to the Perry site:

A25. Perry is able to identify an ELAP condition within 1 hour in order to enable actions that place the plant outside of the current design and licensing basis.

A26. Considerations for exceptions to the site security plan or other license/site specific requirements are included in the FLEX support guidelines.

A27. Flood and seismic re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 are not completed and therefore not assumed in this submittal. As the re-evaluations are completed, appropriate issues are entered into the Corrective Action Program and this NORM revised if required.

A28. To support time sensitive FLEX actions, it is assumed adequate staffing levels are available. Required staffing levels have been determined consistent with guidance contained in NEI 12-06 (Reference 02) for each of the site specific FLEX strategies. Assumed available staffing levels have been determined consistent with NEI 12-01, (Reference 36), as described below.

The event impedes site access as follows:

A. Post event time: 6 hours – No site access. This duration reflects the time necessary to clear roadway obstructions, use different deployment routes, mobilize alternate transportation capabilities (e.g., private resource providers or public sector support), etc.

B. Post event time: 6 to 24 hours – 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).

C. Post event time: 24+ hours – 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.

These results have been compared to confirm this assumption, adjustments were not required to plant staffing or FLEX design to meet this requirement.

A29. This plan defines strategies capable of mitigating a simultaneous loss of all alternating current.

A30. The designed hardened connections applicable to FLEX strategies are protected against external events or are established at multiple and diverse locations.

A31. The time to enter Mode 5 after shutdown is at least 60 hours.

A32. This plan defines strategies capable of mitigating a simultaneous loss of all alternating current (ac) power and loss of normal access to the UHS resulting from a beyond-design-basis event by providing adequate capability to maintain or restore core cooling, containment integrity, 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 EOP change processes, and the 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 beyond-design-basis event may place the plant in a condition where it cannot comply with certain Technical Specifications, and, as such, may warrant invocation of 10 CFR 50.54(x) and/or 10 CFR 73.55(p).

A33. Instrumentation of FLEX equipment is used to confirm continual performance.

2.4 ACTION ITEMS

The action items listed in this section are contained throughout the report. The number format follows an “AI-1, AI-2, AI- 3” nomenclature where the number corresponds to the number within this list. These Action Items were identified as requiring future action to support statements made in the initial PNPP OIP submittal in February 2013. Each Actin Item is individually dispositioned demonstrating closure of the Actin Item.

AI-1. Perry to establish admin controls on Reactor Core Isolation Cooling system (RCIC) availability in Mode 4.

PAP-1925 Shutdown Defense in Depth Assessment and Management now contains guidance to maintain a FLEX Credited RPV injection source during Mode 4, 5, or At All Times by one of the following means:

1. The RCIC system will be maintained available for use during mode 4 with the exception that the system can be in secured status and able to be place into standby readiness if needed for RPV injection, or
2. Ensure that an SRV remains available to keep the RPV depressurized and either Suppression Pool Clean Up, SPCU or ADHR pump remains available for low pressure RPV Injection within the current time to boil if RCIC is not available. This item was completed in May 2014 with the issuance of Revision 16 of PAP 1925.

AI-2. Develop FSG to open Fuel Handling Building doors during ELAP.

ONI-SPI D-1, Maintaining System Availability, which provides actions for maintaining identified systems for a TLAC event, has been updated to open a vent path in the FHB. ONI-SPI E-1 Containment And Fuel Handling Building Closure has been modified to allow the FHB man doors to be left open if venting is required in a TLAC event. Per notification 600725398, these actions were completed in Revision 4 and the notification was closed on April 15, 2015.

AI-3. Detailed design phase to evaluate long-term room temperature response.

Procedural guidance for the operation of RCIC during this Phase is FSG 10.1 RCIC FLEX operation. This procedure provides for alignment of RCIC to the Suppression Pool, deployment and operation of a portable fan on the Aux Building 568' 6" elevation and establishing system flow near rated flow. The portable fan on the Aux Building 568' 6" is used to blow cooler air into the RCIC pump room thereby providing air exchange in the RCIC pump room as cooler air is blown in and hotter air exits out the normal ventilation penetration in the roof of the room to the Reactor Water Cleanup (RWCU) pump room area on the Aux Building 599' 6" elevation. This portable fan is powered by a dedicated portable generator that is staged at ground level (620' 6") and extension cords run to the vent fan on the Aux Building 568' 6" elevation. When Electrical power is available, the RCIC room cooler is placed into service to promote airflow within the pump room. This strategy has been evaluated in Calculation X11-003 (Reference 50) and demonstrates acceptability.

Heatup of the HPCS valve room is controlled by use of portable fans. Procedural guidance for this is FSG 90.3 Alternate Room Ventilation. RCIC system operation is the only heat source in the HPCS pump room.

Temperature in the RCIC room, the HPCS pump room, and other vital plant areas have been evaluated in Calculation X11-003 (Reference 50) and demonstrated as acceptable.

Heatup of the Control Room is not expected to challenge the ability to use the Control Room during Phase 1. During Phase 2, either the Control Room Ventilation system is available or portable fans are used to provide cooling to the Control Room. Procedural Guidance for providing ventilation to the Control Room is FSG 90.3, Alternate Room Ventilation. His strategy has been evaluated in Calculation X11-010 (Reference 51) and demonstrated as acceptable.

AI-4. Provide evaluation of containment conditions in Mode 5 ELAP

Normal heat removal from the RPV during this period is provided by the Fuel Pool Cooling and Cleanup (FPCC) system by circulating water from the upper pools through the FPCC HXs to remove the decay heat from the Reactor Core. Additionally water from the SFP is also circulated through the FPCC HXs at the same time to remove heat from the Spent Fuel. If containment integrity were established in Mode 5, guidance of the Emergency Operating Procedures would detail operator actions for maintaining containment pressure below the Primary Containment Pressure Limit (PCL) by venting the containment to the SFP in the Fuel Handling Building. The FHB will be vented per the action to provide a vent path for the SFP. If primary containment integrity cannot be established the openings in primary containment provide a vent path that precludes containment pressurization.

AI-5. The final design will demonstrate the capability to provide sufficient flow to the core to suppress boiling in Mode 5 ELAP.

Establishing FPCC cooling to the upper pools in Mode 5 provide sufficient heat removal to suppress boiling in Mode 5. From the USAR, (Reference 4), on the Design Function of the FPCC system: The maximum abnormal heat load is 46.8 x 106 Btu/hr. This value is the sum of the decay heat from 3,388 bundles discharged over an eight year period, plus a sequential full core off-load which fills the fuel handling pools in the area of the intermediate building (4,020 bundles) and stores 116 bundles in the containment pool <Table 9.1-2>. With both FPCC system pumps and HXs operating, the pool temperature will rise to 154°F. This value is derived from a conservative analysis, which overestimates the heat loading, by approximately 13%. Under realistic conditions, the pool temperature will not exceed 150°F. Additionally Calculation X11-004 (Reference 47) demonstrates adequate capability to provide injection to a pressurized vessel, which bounds the pressure conditions experienced in Mode 5.

AI-6. Perry to develop programmatic controls to maintain storage and deployment paths

The FLEX Program Document, NOP-LP-7300 FLEX Program for the Perry Nuclear Power Plant (PNPP), maintains Storage and Deployment paths.

AI-7. Review and apply BWROG RCIC report and provide evaluation of RCIC pipe to > 140°F

Perry has performed an engineering evaluation, Calculation X11-002 (Reference 52) of the RCIC system to confirm that the RCIC system is ROBUST for all temperatures of the Suppression Pool that are expected during an ELAP or LUHS event. Site Calculation X11-002 (Reference 52) provides analysis of the RCIC system for use during a during a FLEX event.

AI-8. Perry operator guidance may be developed on SRV use during ELAP

This action was to evaluate use of a single SRV to cause localized heating of the Suppression Pool. This action will not be completed and no action is required for this item.

AI-9. Evaluate and provide guidance on control of RCIC alternate water source

This is completed through implementation of FSG 10.3, RCIC Suction Alternate Supply

AI-10. Perry to apply industry evaluation of exceeding containment design temperature limit during an ELAP

The Perry Containment response for ELAP conditions is within the accepted transient response of NEDC-33771P Revision 1 and NEDO-33771 Revision 1, Boiling Water Reactors Owners' Group Technical Report, "GEH Evaluation of the FLEX Implementation Guidelines", January 2013 (Reference 15). Additionally, a site evaluation has been prepared in Calculation X11-011 (Reference 53) to document acceptability of exceeding the Containment design temperature.

AI-11. Detailed design phase will evaluate SPCU to be robust

This activity was completed through three activities. First, the active components (i.e. the SPCU Pump) were evaluated for seismic integrity via the Expedited Seismic Evaluation Process (ESEP, also known as Fragility Analysis). Second, updated pipe stress analysis was performed in Calculation 1G42G001A

(Reference 54) and necessary modifications were made to the SPCU System to ensure the piping is robust. Finally, a new robust power supply has been provided for the SPCU Pump.

AI-12. Detailed design phase will evaluate ADHR to be robust

The ADHR system is designed and installed seismic category 1. Additionally a new robust power supply has been added to the ADHR system.

AI-13. Detailed design calculations will show at least 1100-gpm bleed flow to Unit 2 SP with primary and alternate paths

Feed and Bleed to Unit 2 Suppression Pool is no long part of the PNPP credited strategies.

AI-14. Availability of the SPMU valves in containment will be evaluated for the ELAP conditions.

Peak temperature in containment occurs at T-6 just prior to the initiation of SPMU. Containment Air temperature may be as high as approximately 200° F. The Containment design temperature is 185°F and the SPMU valves are designed to be fully functional up to 185°F. The short period of time and the magnitude that the temperature is exceeded is not expected to affect the valves ability to open when required. Additionally, the SPMU System consists of two redundant trains, only one of which is required to fulfill the FLEX function.

AI-15. Confirm pump curve of procured diesel pumps

This action is not required, as the Fire Trucks have been deleted from the FLEX strategies.

AI-16. Confirm fuel consumption rates of diesel powered equipment and refueling plan

Consumption rates were updated to reflect equipment specifications for FLEX equipment. See Table B-2 On-Site Phase 2 Equipment Requirements for fuel consumption rates.

AI-17. Detailed design to provide analysis to show sub-cooled feed and bleed through SRVs or into upper pool

Mode 5 provides adequate core cooling by injection to keep the core covered and placing FPCC into service to remove heat from the upper pool, boiling of the water is not a concern in mode 5.

AI-18. For NRC Submittal, insert completed cover letter template

No further actions required, completed as requested.

AI-19. Detailed design to determine Suppression Pool Feed and Bleed Flow instrumentation

Feed and Bleed will use the currently installed plant instrumentation. Feed and Bleed is performed using systems within the designed functions and flow paths. Note: This is different from the Unit 1 to Unit 2 Feed and Bleed Strategy of the initial OIP. Feed and Bleed to Unit 2 Suppression Pool is no long part of the PNPP credited strategies.

AI-20. Detailed design to evaluate potential flooding of 574’ Aux Bldg. due to sloshing / liner failure

Based upon the building lay out and the number of variables a quantities analysis was not completed. Compensatory actions for the use of sump pumps to remove water from the Aux Building elevation 568’ (lowest affected plant level) has been provided.

2.5 ACRONYMS

AC	Alternating Current
ADHR	Alternate Decay Heat Removal
ADS	Automatic Depressurization System
ALARA	As Low As Reasonably Achievable
ASCE	American Society Of Civil Engineers
AWG	American Wire Gauge
AWS	Alternate Water Source
AR	As Required
BDB	Beyond Design Basis
BDBEE	Beyond-Design-Basis External Events
BWR	Boiling Water Reactor
BWROG	Boiling Water Reactor Owner's Group
CFM	Cubic Feet per Minute
CFR	Code Of Federal Regulations
CR	Control Room
CST	Condensate Storage Tank
CW	Cooling Water
DBFL	Design Basis Flood Level
DC	Direct Current
DG	Diesel Generator
ECC	Emergency Core Cooling
ECCS	Emergency Core Cooling System
EDG	Emergency Diesel Generator
ELAP	Extended Loss Of All AC Power
EOP	Emergency Operating Procedure
EPG	Emergency Procedure Guide
EPRI	Electric Power Research Institute
ERO	Emergency Response Organization
ESW	Emergency Service Water
ESWPH	Emergency Service Water Pump House
ETAP	Electrical Transient Analysis Program
FENOC	FirstEnergy Nuclear Operating Company
FLEX	Flexible and Diverse Coping Mitigation Strategies
FLEX	Diverse and Flexible Coping Strategies
FSG	FLEX Support Guideline
FHB	Fuel Handling Building
FPCC	Fuel Pool Cooling and Cleanup
GPM	Gallons per Minute
GPH	Gallons per Hour

HPCC	High Pressure Core Cooling
HPCS	High Pressure Coolant System
HVAC	Heating, Ventilation, and Air Conditioning
Hx	Heat Exchanger
IB	Intermediate Building
IER	Industry Event Report
IMS	Installation and Modification Services
INPO	Institute of Nuclear Power Operation
ISG	Interim Staff Guidance
LED	Light Emitting Diode
LOOP	Loss Of Offsite Power
LPCC	Low Pressure Core Cooling
LPCI	Low Pressure Coolant Injection (function of RHR)
LPCS	Low Pressure Core Spray
LUHS	Loss Of Normal Access to The Ultimate Heat Sink
MAAP	Modular Accident Analysis Program
MOVs	Motor Operated Valves
NEI	Nuclear Energy Institute
NLO	Non Licensed Operator
NPSH	Net Positive Suction Head
NRC	Nuclear Regulatory Commission
NSSS	Nuclear Steam Supply System
NSRC	National Safer Response Center
NTTF	Near-Term Task Force
OBE	Operating Basis Earthquake
OD	Outside Diameter
ONI	Off Normal Instructions
OSHA	Occupational Safety and Health Administration
P&ID	Process and Instrumentation Diagram
PMF	Probable Maximum Flood
PMH	Probable Maximum Hurricane
PNPP	Perry Nuclear Power Plant
PSIG	Pounds per square inch, gauge
RCA	Radiologically Controlled Area
RCIC	Reactor Core Isolation Cooling
RCPB	Reactor Coolant Pressure Boundary
RHR	Residual Heat Removal
RO	Reactor Operator
RPV	Reactor Pressure Vessel
RRC	Regional Response Center
SAFER	Strategic Alliance for FLEX Emergency Response
SAMG	Severe Accident Management Guideline
SBO	Station Blackout

SDC	Shutdown Cooling
SFP	Spent Fuel Pool
SP	Suppression Pool
SPC	Suppression Pool Cooling
SPCLC	Suppression Pool Closed Loop Cooling
SPCU	Suppression Pool Clean Up
SPI	Special Plant Instructions
SPMU	Suppression Pool Make Up
SRO	Senior Reactor Operator
SRV	Safety/Relief Valve
SSC	Systems, Structures and Components
SSE	Safe Shutdown Earthquake
TLAC	Total Loss of AC (Industry standard term is SBO)
THHN	Thermoplastic High Heat-resistant Nylon
UHS	Ultimate Heat Sink
USGS	United States Geological Survey
USAR	Updated Safety Analysis Report
Vac	Volts Alternating Current
Vdc	Volts Direct Current

3.0 SUMMARY OF EXTREME EXTERNAL HAZARDS

The Perry site has been evaluated and the following external hazards have been identified (Reference 07):

- Seismic events
- External flooding
- Severe storms with high winds
- Snow and ice storms, and cold
- Extreme heat

PNPP has determined the functional threats from each of these hazards and identified FLEX equipment that may be affected. The FLEX equipment was purchased commercial grade and the storage locations provide the protection required from these hazards.

3.1 SEISMIC HAZARD ASSESSMENT

The NEI guidance states that all sites address BDB seismic considerations in the implementation of FLEX strategies. The following text for the seismic assessment provides insight from several sections of PNPP's USAR: (Reference 4)

USAR Section: 2.5.2.1.2 Spatial Distribution of Seismic Activity

The seismicity data presented in the USAR show two well-defined zones of moderate earthquake activity within the 200-mile radius circle around the site. These zones include some of the largest Modified Mercalli Intensities reported, up to VII and VIII, and the largest magnitudes, ranging from 4.5 to 5.2 mb, observed in the site region

Some seismic activity is apparent within the southwest quadrant of the 50-mile radius circle around the site. Several of these earthquakes have produced felt intensities ranging from II (MM) to V (MM). On January 31, 1986, a moderate earthquake (mb = 5.0) occurred with an epicenter 17 km south of PNPP. This earthquake produced epicentral intensity was VI (MM), as shown on <Figure 2.5-65>, and IV-V (MM) at the plant itself.

USAR Section 2.5.2.4 Maximum Earthquake Potential

The highest seismic intensity observed or estimated for the vicinity of the PNPP site resulting from known earthquake activity is Modified Mercalli (MM) V. This level is believed to have occurred during the largest of the New Madrid earthquakes on February 7, 1812, and during the recent January 31, 1986 earthquake.

USAR Section 2.5.1.1.5.1 Regional Tectonic Elements

Several faults and groups of faults have been defined within the site region: the Chatham Sag faults; the Peck fault and faults associated with the Howell-Northville anticline; the Bowling Green fault; faults near Anna, Ohio; faults along the Cincinnati arch; faults in eastern Ohio; western New York faults; and the Appalachian Plateau and Northern Valley and Ridge faults. Of these faults, the Clarendon-Linden fault system, located in western New York, 165 miles northeast of the Perry site, is currently considered active.

USAR Section 2.5.4.9 Earthquake Design Basis

Seismic Input, the seismic criteria for Perry Nuclear Power Plant (PNPP) includes two design basis earthquake spectra: Operating Basis Earthquake (OBE) and the Safe Shutdown Earthquake (SSE).

The site seismic design response spectra define the vibratory ground motion of the OBE and the SSE. The maximum horizontal acceleration for the SSE is 0.15g. The OBE has a maximum horizontal acceleration of 0.075 g. The maximum vertical response spectra for SSE is 0.15 g and for OBE is 0.075 g.

Per the FLEX guidance, seismic impact must be considered for all nuclear plant sites. The design basis values from the USAR, (Reference 4), were used for Perry's FLEX strategies.

3.1.1 Expedited Seismic Evaluation List (ESEL)

The Expedited Seismic Evaluation List (ESEL) has been generated as part of the Phase 1 analysis in support of the seismic augmented approach. Review under the Expedited Seismic Evaluation Process has been completed via, Phase 2 (fragility analysis/HCLPF analysis). The ESEL includes Unit 1 and Unit 2 components that are required to support the PNPP 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 because of the ESEP.

3.2 EXTERNAL FLOOD ASSESSMENT

Flood susceptibility is identified in several sections of the USAR, (Reference 4), including 2.4.1.1 through 2.4.7.4. Each section of the USAR is identified before each susceptibility description. Flooding was not initially considered a PNPP specific (applicable) hazards as the site was originally considered a dry site. However, during subsequent analysis, remedial actions were determined to be required.

Condition Report 2015-05079 documents the potential for External Flooding during a Probable Maximum Flooding Event (West Side of Plant). The potential exists for water intrusion on the West side of the plant during a probable maximum flooding event due to the site being located non- conservatively approximately 2.5 inches different from external benchmarks. Compensatory measures will be required to eliminate water into door penetrations. See CR 2015-05079 for impacted doors and the description of the compensatory actions.

Modifications to the Major and Minor Streams surrounding the site are in progress. These modifications will address the external flooding hazards for PNPP.

USAR Section 2.4.1 Hydrological Description

USAR Section 2.4.1.1 Site and Facilities

The Perry Nuclear Power Plant is located in Lake County, Ohio, approximately seven miles northeast of Painesville. The southern plant site boundary line is 3,100 feet from the shoreline of Lake Erie on the west side of the site and 8,000 feet on the east side. Grade elevations in the immediate plant area prior to plant construction varied between 620.0 feet and 623.0 feet based upon the USGS datum. The maximum monthly average level of record for Lake Erie is 575.4 feet (USGS) which is in excess of 40 feet below plant grade; therefore, no problems of site flooding exists owing to the nature of the site. The construction of the plant resulted in some minor changes in local drainage patterns, runoff characteristics and in the diversion of one small stream.

Two nameless, parallel streams run close to the plant area. The larger has a drainage basin of 7.16 square miles and runs northwestward within 1,000 feet of the southwest corner of the plant. The smaller stream, which has a drainage area of only 0.76 square mile, borders the plant area to the east and north.

Protection is provided for safety-related structures, exterior systems and access equipment against flooding from Lake Erie, surface runoff and local intense precipitation.

The construction of the plant resulted in some minor changes in local drainage patterns, runoff characteristics and in the diversion of one small stream.

USAR Section 2.4.2.1 Flood History

No records of flooding in the plant area of the site exist, either from the two streams draining the coastal watershed, or from Lake Erie. The terrain is relatively flat and gently sloping toward the lake. The soil is relatively permeable and contains sand layers in the upper reaches of the drainage area. The ground surface in much of the catchment area is forested with a heavy mulch ground cover. Due to the flat terrain, permeable upper soil layers and the small catchment areas, it is unlikely that this location has ever been subjected to flooding or is likely to experience severe flooding from surface runoff in the future.

USAR Section 2.4.2.2 Flood Design Considerations

The probability of any flooding in the area of the site is exceptionally low. The storm drainage system for the plant was designed to prevent flooding during the Probable Maximum Flood (PMF).

Flooding from Lake Erie is extremely improbable. Final grade elevations in the immediate plant area vary from 617 to 620 feet (USGS). This is about 45 feet above the maximum monthly mean lake level of 575.4 feet (USGS). Surge flooding is described in Section 2.4.5. Run-up occurring coincidentally with the probable maximum setup would extend to about Elevation 607.9 feet on the bluff at the lakeshore. This run up would still be about 12 feet below the 620-foot (USGS) plant grade elevation.

USAR Section 2.4.2.3 Effects of Local Intense Precipitation

The Probable Maximum Precipitation (PMP) is the theoretically greatest precipitation over the applicable drainage area that would produce flood flows that have virtually no risk of being exceeded. For the Perry site, the PMP is 26.7 inches in six hours. The maximum hourly rainfall of 13.1 inches per hour will be occurring during the first hour.

The plant site is drained by three separate storm drainage systems, two draining to the west and the third draining to the east. The entire site area is subdivided into discrete subbasins, each having storm water inlets referred to as catch basins. Storm water flows overland for no more than 300 feet before it reaches a catch basin. Additionally, the plant site has been graded so that overland drainage will occur away from the plant site buildings. Assuming the worst case (i.e., complete blockage of the site storm drainage system and using peak discharge from the most intense hour of the PMP), the resulting increase in surface elevation of water would not exceed an elevation of 620'-5". This will have no adverse effect upon safety class equipment because the floors at plant grade are set at Elevation 620'-6".

USAR Section 2.4.3 Probable Maximum Flood (PMF) on Streams and Rivers

The PMF is defined by the US Army Corps of Engineers as the "hypothetical flood characteristics that are considered to be most severe 'reasonable possible' at a particular location, based upon relative comprehensive hydrometeorological analysis of critical runoff producing precipitation and hydrologic factors favoring flood runoff. Procedures and data of the U.S. Army Corps of Engineers and the U.S. Bureau of Reclamation (were used to calculate effective PMFs for the two nameless streams. The calculated PMF for the major stream was found to be 31,250 cfs, and for the minor stream 7,000 cfs, at their outfalls into Lake Erie.

USAR Section 2.4.3.5 Water Level Determinations

The water surface profiles during the PMF were calculated under the assumption that the plant access road and the sediment control dams placed across the streams remained intact during the event. The water surface elevation upstream of the plant access road for the PMF was found to be 624.0 feet until this surface met the normal depth of flow in the existing stream. The existing natural ridge along the right bank of the stream is at a maximum elevation of 630'-0" (approximate). Wind wave activity is of no concern with the flood conditions in these small streams.

USAR Section 2.4.4 Potential Dam Failures, Seismically Induced

There are no impoundments upstream of the plant, and since the drainage basins of the two streams passing through the site are small and the terrain is quite flat, it is unlikely there will be any impoundments in the future. Therefore, dam failure is not included as a design condition.

USAR Section 2.4.5 Probable Maximum Surge (PMS) Flooding

Seiches pose no flood threats because of the size and configuration of the lake and the elevation difference between normal lake level and plant grade. Hurricanes do not cause significant surges but do possess the capability of raising the lake level by the amount of rainfall within the lake drainage basin. The predominant cause of surges at the Perry site is the frontal or cyclonic type wind. The magnitude of the wind induced surges depends primarily on the wind speed, the distance over the water the wind blows (fetch), and the depth of the lake. For the Perry area, winds from the NNW, a minimum velocity equal to or greater than the drag coefficient critical velocity (14 knots), and a duration of at least 10 hours is needed to generate a setup. To determine the maximized setup estimate, alternative orientations of the fetch axis were investigated by varying the direction of the axis slightly from that of the mean wind until a well-defined maximum of 4.30 feet was established.

The wind field used to determine the probable maximum setup was also used to find the concurrent wave action. The average wind speed at the peak of the storm is 80 mph with a duration of 12 hours. Due to the limited depth of the lake across the 50-mile fetch (average depth of 70 feet), the waves generated by the PMS will be limited in height and period by bottom effects. Deep-water waves cannot occur for these high wind speeds. The waves generated by the PMS were determined by the method of forecasting shallow water waves. This gives a significant wave height, Hs (the average height of the highest one third of the waves), of 17 feet with a period of seven seconds, and the “maximum” wave height, Hmax, of 1.77 Hs, (30 feet).

USAR Section 2.4.7.4 Ice Flooding

Ice flooding cannot occur because of the high bluffs between the buildings and the lake. In addition, safety-related onshore buildings are set back from the top of the 45-foot high bluff to preclude ice forces being a problem.

As determined in Reference 4, flooding of PNPP that can affect safety-related equipment and structures is not credible. The site building(s) that house the FLEX equipment are located above the Probable Maximum Flood level. The maximum plant site flood level from any cause is Elevation 620’-5”. The plant site resides at an elevation of 620’-6” (Reference 4, Section 2.4.2.3).

Therefore, flooding is not an external hazard for PNPP.

Condition Report 2015-05079 documents the potential for External Flooding during a Probable Maximum Flooding Event (West Side of Plant). The potential exists for water intrusion on the West side of the plant during a probable maximum flooding event due to the site being located non- conservatively approximately 2.5 inches different from external benchmarks. Compensatory measures will be required to eliminate water into door penetrations. See CR 2015-05079 for impacted doors and the description of the compensatory actions.

The flooding walkdowns of the building housing Structures, Systems, and Components (SSCs) important to safety and decay heat removal have been completed per guidelines of NEI 12-06 as endorsed by NRC and identified deficiencies have been entered in the station Corrective Action Program (CAP). Deficiencies were generally of insignificant nature. The reanalysis of external flooding and associated modification to gain additional margin is in progress. The reanalysis of external flooding is to ensure maximum surface water flooding is sufficiently below the Unit 1 and 2 power block (Control Complex, Diesel Generator, ESWPH, Auxiliary, Intermediate, Radwaste, Turbine, Heater Bay and Off gas,) buildings ground floor elevation (EL. 620’-6”) and will not result in flooding of these buildings.

3.3 EXTREME COLD ASSESSMENT

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 PNPP:

Applicability of snow and extreme cold:

The Perry site is above the 35th parallel; 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 Reference 2, the Perry 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 observed was 26.5 inches, which occurred at Erie in December 1944 (Reference 4, Section 2.3.1.2.5). Therefore, the FLEX strategies must consider the impedances caused by snowstorms.

Monthly and annual values of daily mean temperature and average and extreme daily maximum and minimum temperatures are provided in Section 2.3.2.1.3 of PNPP USAR, (Reference 4), based on data records for Cleveland-Hopkins Airport. From this data, the monthly averages indicate that July and August are the hottest months and February the coldest month. The annual mean temperature in the site area is 76° F and the coldest average daily minimum is 16° F. The minimum-recorded temperature in the area around the Perry site was -20° F (Reference 4, Table 2.3-4).

Therefore, based on the data provided above and the requirements of the FLEX guidelines, extreme low temperature hazards must be considered.

Applicability of ice storms:

Applicability of ice storms is based on a database developed by 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 (Reference 2) 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 Reference 2, PNPP is designated as a Level 3, susceptible to “low to medium damage to power lines and/or existence of considerable amounts of ice.” Therefore, the FLEX strategies must consider the impedances caused by ice storms.

Reference 4 discusses the potential for blockage of the intake structure. In extreme low temperatures, it is possible that the cooling lake will develop frazil ice on its surface; however, the intake structures to the UHS are approximately 2,600 feet offshore and well below the surface of the water. Therefore, the possibility of floating ice sheets being pulled down and blocking the ports is very remote because of the very low intake velocities. The intake structures are protected by reinforced concrete ice protection caissons around them, which will act as a barrier to any floating ice island, which could block the intake ports. For the very unlikely case where complete blockage of the intake structures would occur, water can be drawn from the discharge tunnel. (Reference 4, Section 2.4.7.2) Therefore, flow blockage from ice is not considered a hazard for the Perry site.

In summary, based on the available local data and Figures 8-1 and 8-2 of Reference 2, the PNPP site is susceptible to significant amounts of snow and extreme low temperatures and is screened as being susceptible to low to medium damage to power lines and/or existence of considerable amounts of ice. All FLEX equipment is stored in locations that provide protection from the extreme cold hazards at the site (including ice storms). The storage locations and the close proximity of the storage locations to the operational locations and the use of debris removal ensure that the FLEX equipment is available, deployable, and functional.

3.4 EXTREME HIGH TEMPERATURE ASSESSMENT

Per the NEI FLEX guidance (Reference 2) all sites must address high temperatures.

Normal temperatures representative of the region are taken at Cleveland-Hopkins Airport located in Ohio, approximately 50 miles west of the Perry site. Monthly and annual values of daily mean temperature and average and extreme daily maximum and minimum temperatures are shown in PNPP USAR (Reference 4) Table 2.3-8, based on data records for Erie, Cleveland and PNPP. From this data, the monthly averages indicate that July and August are the hottest months and February the coldest month. The annual average and extreme mean temperatures in the site area is 49° F and 55° F respectively, while the hottest average maximum temperature is 90° F. Additionally, the maximum-recorded temperature in the area around the Perry site between 1942 and 1978 was 103° F (Reference 4, Table 2.3-4)

For FLEX equipment, PNPP has considered the site maximum expected temperatures in the specification, storage, and deployment requirements. The equipment is capable in operating in the expected conditions and storage locations are expected to prevent adverse impact to the equipment due to high ambient temperatures. Additionally, maximum design basis temperatures have been used as input to the environmental conditions analysis performed for PNPP FLEX.

3.5 HIGH WIND HAZARD ASSESSMENT

The NEI FLEX guidance provides methods for identifying sites with the potential to experience severe winds from hurricanes based on winds exceeding 130 mph. The Probable Maximum Hurricane (PMH) is discussed in USAR Sections 2.4.5.1.5 (Reference 4). For the Perry site, the calculated PMH wind speed is 102 mph. This is well below the 130 mph characteristic set forth in the NEI guide and as tropical cyclones including hurricanes lose strength rapidly as they move inland, the greatest concern then becomes the potential damage from flooding due to excessive rainfall. Additionally, during hurricane Agnes in 1972, the maximum hourly wind speeds (15-minute average) recorded at the Perry site were 28.0 mph at 35-foot level and 39.5 mph at the 200-foot level.

Figure 7-1 of Reference 2 provides contours for hurricane wind speeds expected to occur at a rate of 1 in 1 million chances per year. PNPP is located in the (less than) 120 mph contour and does not exceed the 130 mph wind limit. Therefore, there are no threats to PNPP due to high winds from hurricanes and the hazard has been screened out.

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 (Reference 2) 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. PNPP is located at 41.8008° N, 81.1433° W which falls under Region 1 of NEI guide's Figure 7-2 (Reference 2), therefore, high wind hazards from tornados must be considered.

The information provided below from PNPP USAR (Reference 4) Table 2.3-5 characterizes the applicable wind hazard. The design basis tornado parameters used in the design and operation of PNPP are listed below:

Table 3.5-1: Design Basis Tornado for Perry site

Region	1
Maximum Wind Speed	360 mph
Rotational Speed	290 mph
Translational Maximum Speed	70 mph
Translational Minimum Speed	5 mph
Radius of Maximum Rotational Speed	150 ft
Maximum Pressure Drop	3.0 psi
Rate of Pressure Drop	2.0 psi/sec

USAR 2.3.1.2.3 Extreme Winds

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 Cleveland for the 30-year period from 1948 to 1977 (Reference 4) were used to determine predicted extreme wind speeds for the PNPP site for recurrence intervals of 50 and 100 years. For PNPP, the values for the 50- and 100-year recurrence maximum wind speeds for the Perry region are 70 mph and 74 mph, respectively.

From the information provided above, it has been determined that the PNPP site is susceptible to high winds. The wind hazard attributes from the USAR (Reference 4) data provided above and the data provided in Figure 3.1-2 were compared to determine the bounding characterization. While Figure 7-2 of Reference 2 provides a 200 mph wind hazard (Region 1) for Perry, the USAR defines the design basis tornado for Perry to be one of 360 mph winds.

Therefore, the design basis tornado attributes have been used in analysis for PNPP's FLEX strategies.

Permanent plant equipment credited in the PNPP FLEX strategies is contained in Safety Related structures designed to the design basis values outlined above which exceed those of the generic guidance. Additionally portable FLEX equipment is stored in buildings designed to the same requirements and utilize tornado missile and wind rated barriers to the protect FLEX equipment.

4.0 GUIDANCE EVALUATION

PNPP fully complies with the guidance in JLD-ISG-2012-01, (Reference 3) and NEI 12-06 (Reference 2) in implementing FLEX strategies for the site.

The following section summarizes any deviations from the NEI 12-06 (Reference 2) guidance that are to be included in the Integrated Plan submittal.

NEI 12-06 Section	Deviation
N/A	None

5.0 SEQUENCE OF EVENTS

The following section summarizes the strategies that have a time constraint to be successful. All deployment times are given in Reference 10 in the electrical, mechanical, and safety function support strategies, however, only the parameters with time constraints for these strategies are provided in this section. The deployment times developed to date have been validated and provide confidence that the strategies required to be implemented per the plant specific need times identified in this section can be achieved with an adequate degree of margin.

5.1 MODES 1 – 4 WITH RCIC AVAILABLE

Modes 1 through 4 include power operation and hot standby as well as the approach and exit from those conditions with the RPV assembled and the reactor pressure boundary intact. RCIC is available based on the technical specifications for Modes 1-3 with RPV pressure greater than 150 psig. Mode 4 controls are established administratively when time to core uncovery is less than 6 hour. PAP-1925 Shutdown Defense in Depth Assessment and Management will contain guidance to maintain a FLEX Credited RPV injection source during Mode 4 by one of the following means: 1) The RCIC system will be maintained available for use during mode 4 with the exception that the system can be in secured status and able to be place into standby readiness if needed for RPV injection, or 2) ensure that an SRV remains available to keep the RPV depressurized and either SPCU or ADHR pump remains available for low pressure RPV Injection within the current time to boil if RCIC is not available. Notification 600908316 tracked this action to completion. Closure notes are as follows: PAP 1925 was revised to add the action to maintain an SRV available in PAP-1925 Rev. 16 Effective Date 5-23-14, and the notification was closed on November 17, 2014. [**AI-1 Perry to establish admin controls on RCIC availability in Mode 4, AI-1 CLOSED]**

5.1.1 Phase 1 Actions

Phase 1 actions include those that can be performed using installed plant equipment to extend initial coping building on the current SBO response. The key functions to protect are core cooling, containment integrity and SFP cooling. In some cases, actions are required in support of a safety function rather than directly serving a safety function. Appendix: Table A-1 SAFETY FUNCTIONS provides a summary of the actions taken as part of the Station Blackout (and Total Loss of AC -TLAC) response governed by Perry Station procedure ONI-R10-2 (Reference 26).

New guidance reflects the BWROG- Emergency Procedures Committee (EPC) Generic SBO Procedure Template and contain all actions (current ONI-R10 Guidance for TLAC actions was updated to relocate the current guidance as required) required for a TLAC Event for the case where the Coping Period may not be exceeded and the case where the Coping Period may be exceeded. This Owners' Group guidance and the current procedural guidance contain clear transition points. This action was tracked by Notification 600725408, and was completed on 04/15/2015.

Reactor Core Cooling is maintained through injection from the RCIC system to the RPV (taking a suction from the Condensate Storage Tank (CST) if available, or from the Suppression Pool if the CST is not available) and rejection of steam from the RPV to the Suppression Pool by operation of the SRVs. Upon loss of AC power normal injection to the RPV from the feedwater system is lost. Upon decreasing RPV water level, the RCIC pump automatically starts at RPV Low Level 2 restoring injection to the RPV to maintain water level. As RPV pressure increases, steam will vent from the RPV through the SRVs to the Suppression Pool. Per the USAR (Reference 4) assumptions and current Emergency Operating Procedure (EOP) guidance, pressure in the RPV is reduced to approximately 150 to 250 psig by use of the SRVs at a rate not to exceed 100°F per hour. The RPV pressure is maintained within a 150 to 250 psig range to maintain adequate steam pressure for RCIC System operation. All of the energy from the core decay heat and RPV sensible and latent heat from depressurization is deposited in the Suppression Pool. This transfer of heat will result in a temperature increase in the pool.

Elevated Suppression Pool temperatures could challenge the long-term continued operation of the RCIC System. Short-term operation of the RCIC system was evaluated by the BWROG (Reference 11) for the effects on RCIC for short-term operation based upon expected containment conditions during an ELAP. RCIC operations during an ELAP conforms to the bounding assumptions of the BWROG (Reference 11) evaluation. Perry has performed an engineering evaluation of the RCIC system (Calculation X11-002, (Reference 52) to confirm that the RCIC system is ROBUST for all temperatures of the Suppression Pool that are expected during an ELAP or LUHS event. PERRY Unit 1 Supplemental FLEX Coping Time Analysis, LTR-

US-BWR-14-18 (Reference 37) (site Calculation X11-001, (Reference 49)), provides a peek Suppression Pool Temperature of 226°F at hour T+6 just prior to AC power being restored to allow for SPMU to be initiated. To minimize the challenge to the RCIC system in Phase 2, provisions are made to establish an alternative supply of cold water supply (<85°F) to the RCIC pump suction from various sources.

Containment integrity is maintained by keeping containment atmospheric pressure less than the design limit of 15 psig. In Phase 1 three containment penetrations are of concern: Upper Pool drain line, Drywell Backup Purge Line, and the MSIV before seat drain line. The Upper Pool drain line needs to be isolated by manual closure of the 1G41-F0145 (Containment Pools Return Outboard Isolation) valve to eliminate an air vent path from Containment to the Fuel Handling Building. The Drywell Backup Purge Line needs to be isolated by manual closure of the 1M51-F0110 (Drywell Purge Outboard Isolation) valve to eliminate an air vent path from the Drywell to the Intermediate Building. The MSIV before seat drain line needs to be isolated by manual closure of the 1B21-F019 (MSL DRN & MSIV BYP OTBD ISOL VALVE) valve to eliminate a steam vent path from the RPV to the condenser.

SFP cooling is not challenged during Phase 1; however, radiation levels from stored Control Rod Blades in the SFP following seismically induced sloshing may prevent access to the SFP area from the start of the event. Action is required in Phase 1 to establish ventilation in the area of the SFP (such as opening doors). ONI-SPI D-1, Maintaining System Availability, which provides actions for maintaining identified systems for a TLAC event, has been updated to open a vent path in the FHB. ONI-SPI E-1 Containment And Fuel Handling Building Closure has been modified to allow the FHB mandoors to be left open if venting is required in a TLAC event. Notification 600725398 was tracking these actions. Per notification 600725398, these actions were completed in Revision 4 and the notification was closed on April 15, 2015. **[AI-2. Develop FSG to open Fuel Handling Building doors during ELAP, AI-2 CLOSED]**

Calculation X11-006 (Reference 48), provides a calculation of the maximum SFP inventory that can be lost during a seismic event and the time to boil and time to boil down to 10 ft above the fuel racks. The time to boil for the normal pool heat load is approximately 11 hours. The time to boil down to 10 ft above the fuel racks is approximately 121 hours at Normal Decay Heat, and approximately 42 hours at Maximum Offload Decay Heat per Calculation X11-006 (Reference 48).

Safety Function Support

Support to the safety functions is provided by continued observation of conditions by operators using SFP Level instruments (installed per NRC Order EA-12-051) and coordinating activities from the Control Room.

Electrical Coping

An overview of the Phase I electric coping strategy is to maintain DC power to critical systems (such as the RCIC System) and essential instrumentation using the current procedural guidance for a loss of Total Loss of AC power (TLAC, per ONI-R10 Loss of AC Power). These actions are the same as would be performed within the design basis four hour coping period. Note that TLAC actions of ONI-R10 have been moved to a new procedure ONI-R10-2, TLAC and ONI-R10 has been renumbered to ONI-R10-1

The above is done by use of installed on-site equipment (Divisional Batteries and Switchgear). This action requires the cross-tying of Unit 1 and Unit 2 Divisional and BOP batteries by closing the Unit 1 and Unit 2 crosstie breakers per ONI-SPI D-3 and load shedding of non-vital DC loads per ONI-SPI D-2

Note that the DC loads that are removed from service provide power to systems that are non-functional during a TLAC (SBO industry standard). These loads include power to Redundant Reactivity Controls, Station Emergency Diesels, Nuclear Instrument Power inverters, Non-vital alarms, etc. Unit 1 and Unit 2 divisional batteries will be cross-tied prior to T+30 minutes. Limited battery life (24 plus hours) and the need for electrically controlled pumps require a transition to Phase 2, where portable generators will be utilized.

Instrumentation

Instrument function and Control Room habitability are supported by establishing appropriate Control Room ventilation. Control Room emergency lighting is powered by the plant batteries and adequate portable lighting is provided to support activities outside of the Control Room.

As reported in Reference 5 the actions specified in the SBO response will result in extended DC power during Phase 2 and Phase 3.

Procedural guidance for the operation of RCIC during this Phase is FSG 10.1, RCIC FLEX Operation. This procedure provides for the following:

- Alignment of RCIC to the Suppression Pool
- Establishing system flow near rated flow

A portable fan on the Aux Building 568' 6" is deployed by FSG 90.3, Alternate Room Ventilation, and is.used to force ventilation into the RCIC pump room thereby providing cooling function via air exchange. When Electrical power is restored, the RCIC room cooler will be placed into service to promote airflow within the pump room. This portable fan is powered by a dedicated small capacity portable generator that is staged at ground level (620' 6") and extension cords run to the vent fan on the Aux Building 568' 6" elevation.

Heatup of the HPCS valve room is also controlled by use of portable fans during FLEX. Procedural guidance for this action is also governed by FSG 90.3, Alternate Room Ventilation. RCIC system operation is the only heat source in the HPCS pump room during Phase 1.

Temperature in the RCIC room, the HPCS pump room, and other vital plant areas are not expected to challenge system functionality.

Controls for the RCIC system are located in the Control Room. Heatup of the Control Room is not expected to challenge the ability to use the Control Room during phase 1. During Phase 2, either the Control Room Ventilation system is available or portable fans are used to provide cooling to the Control Room. Procedural Guidance for providing ventilation to the Control Room is FSG 90.3, Alternate Room Ventilation. Analysis has been performed in site Calculation X11-010 (Reference 51) and demonstrates acceptability. **[AI-3 Detailed design phase to evaluate long term room temperature response, AI-3 closed.]**

In order to deploy FLEX equipment during Phase 1 for use in Phase 2, 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 to planned Operations areas and along deployment routes.

Technical Bases

An analysis (Calculation LTR-US-BWR-14-18, Rev. 0, Perry Unit 1 Supplemental FLEX Coping Time Analysis, (Reference 37) captured in site calculation X11-001, (Reference 49)) of the core cooling and containment cooling coping strategy has been performed using the MAAP 4.0.7 code. This analysis provides the basis for the core cooling and containment cooling actions and timing (Reference 14). The MAAP analysis shows that the actions in this FLEX strategy result in acceptable performance for the core cooling and containment functions in Phase 1.

Additionally, an analysis of the SFP was performed to determine inventory loss due to seismically induced sloshing and the heat up and boil down of the inventory in the pool. The analysis was performed using the both normal and maximum (Full Core Offload) heat loads in the pool, see Determination of the Time to Boil for the Perry Nuclear Power Plant Unit 1 Spent Fuel Pool after an Earthquake, calculation X11-006 (Reference 48).

5.1.2 Phase 2

Phase 2 actions include those that can be performed using on-site FLEX equipment to further extend coping until external support becomes available. It should be noted that precursor tasks might be required to enable application of required FLEX strategies.

Because the only robust water source installed at Perry is the Suppression Pool, an alternate source of water must be arranged. This source is Lake Erie. One FLEX Lake Water pump will be deployed in the ESWPH taking a suction on the ESWPH Suction Bay via the Unit 2 ESW pump pedestal foundation.

The ESWPH pump suction bay is fed from the either the normal or alternate intake structures via the traveling screens and was originally designed (sized) to provide for the needs of two units. The normal and alternate intake structures, as well as the ESWPH, are seismically qualified are designed to survive all design basis events. Perry will use an electrically driven pump in the ESWPH to draw water from the ESWPH suction bay and discharge that water into an ESW system piping to provide a robust water source to the plant to be used for makeup and cooling needs. The electrically driven pump is designed to provide 2500 to 3000 gpm into the ESW system. 1500 to 2000 gpm will be used to supply the RHR HXs in phase 2 (3000 gpm in Phase 3), approximately 250 gpm will be available to supply SFP makeup requirements, and approximately 250 gpm (average) will be available for use in the RCIC system to provide a robust alternative water source. Note that provisions have been made for other robust and non-robust water sources of higher quality. These sources are described later in this document.

Core Cooling

To ensure that challenges to RCIC operation are addressed adding additional heat capacity (inventory) to the Suppression Pool is directed by the EOPs. Additional coping time until containment heat removal can be established is achieved by dumping the upper pools to the Suppression Pool by opening valves 1G43-F030A(B) and 1G43-F040 A(B) to establish a flow path from the upper pools to the Suppression Pool. 1G43-F030A(B) and 1G43-F040 A(B) are located in containment and are not accessible for local operation in mode 1-4 (due to containment response in these modes) but remain accessible in Mode 5 and “At All Times.” Remote operation of these valves is performed from the Control Room when Either Division 1 480 Vac busses or Division 2 480 Vac busses are re-energized. The method of heat removal from the containment during Phase 2 is to perform SPCLC.

During Phase 2, heated water is pumped from the Suppression Pool to the RHR system back to the Suppression Pool using either the SPCU or ADHR pump. This provides a modified RHR Suppression Pool Cooling (SPC) flow path called SPCLC. In the case that the CST is not available and the Suppression Pool cannot be maintained less than 185°F, a hose connection is provided on the RCIC suction. This allows the RCIC suction to be connected to the new FPCC Return header connection on Aux Building, Elevation 599’ via one of two dry standpipes that run from Aux Building, Elevation 620’ to the Aux Building, Elevation 574’ (568’) with connection points on each floor. Note that the Aux Building, Elevation 574’ and 568’ are functionally one building elevation. Alternate sources of water to the RCIC alternate suction includes the SPCU or ADHR pumps with water through the RHR HXs (described above), or the Mix Bed / Two bed demineralized water tanks. Additionally, ESW A or ESW B can supply RCIC with lake water via the FLEX Lake Water Pumps, and is a robust long-term raw water supply.

Containment Function

The Suppression Pool temperature will increase due to steam discharge from SRVs and RCIC exhaust. This temperature increase will cause the Containment temperature and pressure to increase as well. To avoid the need for containment venting, this heat must be removed and the Suppression Pool water temperature maintained within acceptable limits.

Decay heat is removed from the RPV during an ELAP in Modes 1-4 via steam through one or more SRVs to the Suppression Pool. Additional coping time until containment heat removal can be established is achieved by initiation of the SPMU system as described above. The method of heat removal from the containment during Phase 2 is to perform SPCLC. Cool water from the alternate water sources can also be added to the Suppression Pool to increase inventory and reduce overall bulk temperature. During Phase 2, heated water is pumped from the Suppression Pool to the RHR system back to the Suppression Pool using either the SPCU or ADHR pump. This provides a modified RHR SPC flow path called SPCLC. The difference between the designed RHR SPC and SPCLC is that process water flow is established using either the SPCU or the ADHR pumps at lower flow rates than provided by the RHR pump and the RHR HXs ESW flows are lower than the flow rates provide by the ESW Pump. The method of containment heat removal was evaluated by PERRY Unit 1 Supplemental FLEX Coping Time Analysis, LTR-US-BWR-14-18 (Reference 37).

An Alternative (non-credited) method of Containment Cooling is “Suppression Pool Feed and Bleed”. In this method, cooler water is added to the Suppression Pool (Feed) while hotter water is pumped from the Suppression Pool (Bleed). Feed water is provided by Core Spray (LPCS/HPCS) Lake Water injection into the Suppression Pool and Bleed is provided by pumping from the Suppression Pool water to the Main Condenser using either the SPCU or ADHR pumps via the CST makeup and dump lines to the condenser. This is not a credited strategy as is it requires non-seismic equipment for use as a storage volume, and is only included to provide diversity. Note that other retention volumes may also be used if available during the event.

Spent Fuel Pool

For the normal heat load with maximum water loss from seismic sloshing, the SFP could start to boil at about 11 hours, per calculation X11-006 (Reference 48). To prevent over-pressurizing the fuel handling building (FHB), doors from the FHB to the outside on the East side of the plant will be opened prior to boiling.

NEI 12-06 (Reference 2) requires three methods of filling the SFP: fill from a location external to the pool area, fill using hoses and fill using spray. The fill from the external location and hoses must be capable of making up for losses due to boil off and the spray is required to flow 250 gpm. To meet both requirements, starting in Phase 2, an emergency makeup system (providing lake water from the FLEX pumps via the ESW system) has been be installed.

Order EA 12-051 (Reference 31) has installed upgraded SFP level instruments.

Safety Function Support

The Phase 2 strategies involve starting the 4160 Vac FLEX generator which was connected in Phase 1 (by hour 6) to energize Critical 480 Vac busses fed from Divisional 4160 Vac busses to supply the lighting and instrumentation loads as well as the divisional battery chargers. Once started, the generator supplies power to either the 100 hp SPCU pump (primary) or the 325 hp ADHR pump (secondary). Additional capacity is available for other electrical loads including battery chargers, lighting and Control Complex ventilation fans (Control Room and MCC Switchgear), hydrogen igniters, fuel oil transfer pumps, ESW traveling screens, instrumentation and valve manipulations (Reference 22).

At T+12, a portable FLEX air compressor will be deployed to recharge the Safety Related Instrument Air receiver supplying SRVs to ensure adequate air reserves.

5.1.3 Phase 3 Actions

Phase 3 actions include those that can be performed once off-site FLEX equipment arrives from the NSRC. Phase 3 strategies result in an expected condition of indefinite coping with respect to the required key safety functions. It should be noted that precursor tasks might be required to enable application of required FLEX strategies.

Phase 3 will connect additional NSRC 4160 Vac generators to the Distribution Center located in FLEX Equipment Bay 1 (Diesel Generator Building) to supply additional electrical capacity. This additional capacity will allow the start of an RHR pump for use in SPC or Shutdown Cooling (SDC) modes of operation. The additional electrical capacity also allows for additional flow to the ESW loops to be established by providing power to the N+1 FLEX Lake Water Pump.

Core Cooling

For Phase 3, the intent is to achieve cold shutdown or to stabilize the reactor with a more robust containment heat removal method than the Phase 2 Closed Loop Cooling method.

Per the FLEX Electrical Design Report (Reference 22), the NSRC generators are to arrive on-site by hour 24 and be deployed by hour 26. The primary method of achieving core cooling in a cold stable condition is to use the RHR A system in SDC mode with alternate cooling of the RHR HXs provided by the FLEX Lake Water Pump.

The Distribution Center allows up to four generators to be used to supply Bus EH21. The two Perry N FLEX Generators are supplemented by two NSRC generators. This will provide sufficient electrical capacity (approximately 4 MWe) to allow starting a RHR pump in SDC mode (RHR SDC mode) or in RHR SPC mode with at least 3000 gpm of flow on the process and raw watersides of the RHR HXs. Additional 4160 Vac Generators may be employed with the receipt of the NSRC Distribution Center via a daisy chain configuration as the design of the Distribution Centers and 4160 Vac generators supports synchronized operation of more than 4 generators.

An additional method of Core and Containment cooling in Phase 3 would be to continue to use RCIC to maintain RPV level with RPV pressure around 200 psig but to transition from SPCLC using the SPCU/ADHR pump to RHR in SP Cooling mode.

Containment Function

Containment Function is not expected to be challenged during this phase of the event when RHR is used for SDC. If RHR is used for SPC, containment conditions will be controlled and Suppression Pool temperature will be reduced.

In Phase 3, the SFP is initially cooled via continued boil-off and make-up. The SFP makeup from the ESW system will continue to maintain pool level until the FPCC system is restored and boil off stops.

Support to the safety functions is provided by the NSRC generator energizing 4160 Vac busses to support additional electrical loads. Refueling of the FLEX Generators and other diesel engines will continue throughout the duration of the event.

5.1.4 Development of the Safety Function Timeline

The timing of activities associated with deployment of the FLEX strategy is highly dependent on the particular hazard and scenario conditions. The purpose of developing an indicative time line is to understand when time critical actions are expected to be required based on analysis performed for each safety function and determining that adequate staffing is available to effectively enact the developed FLEX strategies. Due to unknowns about the type of event, some standard action times have been used. One hour has been allotted for plant evaluation and declaration of the event, and 2 hours for debris removal. Should such an event occur, the EOPs and ONI-R10-2, Total Loss of AC Power, will provide a symptom-based approach to addressing plant safety functions, and a detailed damage assessment will be performed to assist in the application of the FLEX strategies. A new set of plant procedures, FLEX Support Guidelines, as described in Reference 2, provide the tactical guidance to restore the identified functions.

The NEI 12-01 Phase 2 Total Loss of AC (TLAC) Power ERO Staffing Analysis Report On-Shift Staffing Task Timetable, Table C-3, time line simply represents one particular, limiting scenario, with respect to those safety functions. In particular, for Perry, the limiting scenario is a seismic event. A seismic event is more limiting with respect to loss of installed plant capability, including water sources, meaning that more time consuming strategies must be employed earlier in the scenario.

5.2 MODE 5 / REFUELING

Mode 5 is entered when the head is detensioned and includes refueling. This condition is bounded by the case of Mode 4 with the RCIC head pipe removed. RCIC will not be available. Mode 5 can be entered as early as 60 hours after shutdown.

The limiting response time for an ELAP occurring in Mode 5 is if the event occurs while the RPV level is at the flange. During most of Mode 5 operation, the head is off and the RPV is flooded up into the upper pool. This additional water inventory, lower decay heat levels, and additional labor available during an outage provides a significant amount of time prior to boiling or uncover of fuel after loss of cooling.

5.2.1 Phase 1

Core Cooling

Reactor Core Cooling – Mode 4-5 Vessel Disassembly

If the postulated FLEX event starts while the plant is in Mode 4 with the RCIC system out of service during RPV disassembly (head spray piping detensioned or removed), RPV level is normally at the RPV flange (to provide shielding to workers). As decay heat removal would be lost, the RPV will slowly heat up and the plant will transition to Mode 3. RPV level during this time is not challenged as the Plant Data Book PDB-A0019, Time-To-Core Uncovery Curves, gives a time to uncover (time to reach TAF) with RPV level initially at the RPV upper flange, 140°F RPV water temperature, and assuming decay heat load at 48 hours post shutdown (60 MBTU/hour) of approximately 10 hours. This is bounding for vessel disassembly as RPV water temperature is maintained below 140°F during these activities.

The time line to restore power to the SPCU pump or the ADHR pump is 6 hours. Once AC power is restored, RPV water level can be maintained by use of injection via ONI-SPI E-4, ADHR Alternate Injection or EOP-SPI 4.3, FPCC Header Alternate Injection using the SPCU pump. Once RPV injection is established, SRVs can be opened to allow water to flow back to the

Suppression Pool. Once water is circulating from the Suppression Pool to the Suppression Pool via the RPV, vessel decay heat is transferred to the Suppression Pool.

Following restoration of RPV level, control of Suppression Pool temperature is the same as in Mode 1-3 with SPCU or ADHR being used in SPCLC; the only difference is the flow path will not return to the Suppression Pool via the RHR TEST VALVE TO SUPR POOL, 1E12-F024A (B) but will inject into the RPV via the LPCI INJECTION VALVE, 1E12-F042A (B).

The disassembled portions of the RPV pose a release path from the RPV to the Containment Building. With a loss of normal decay heat removal, ONI-E12-2, Loss of Decay Heat Removal, is entered and ONI-SPI E-1, Containment/Fuel Handling Building Closure will direct actions to prevent an uncontrolled release external to the closure envelope. Note that this is a small window of vulnerability.

Reactor Core Cooling – Mode 5 Flooded Up / At All Times

In Mode 5, the RPV will be flooded to the vessel flange (minimum water height). If water level in the upper pools is below 22' 9" above the RPV flange (upper pools drained) the ADHR/SPCU pump will be used to maintain RPV level and flood the upper pools using ONI-SPI E-4, ADHR Alternate Injection or EOP-SPI 4.3, FPCC Header Alternate Injection using the SPCU pump. Once the upper pools are flooded to greater than 22' 9" above the RPV flange FPCC can be used as an alternate decay heat removal system. An estimation of time to core uncovery was performed with RCIC unavailable with the vessel flooded to the vessel flange showed that approximately 10 hours was required. This allows adequate time to arrange low-pressure core cooling and other responses as Phase 2 or Phase 3 actions using FLEX equipment. Note that FPCC may not preclude inventory losses due to boiling if the event occurs before decay heat levels are within the FPCC HX capacity, but will limit the inventory losses thus minimizing injection requirements.

Mode 5 may be reached as early as 60 hours after shutdown.

During Phase 1, FLEX equipment will be deployed in preparation of Phase 2 operations.

Containment Function

Upon loss of AC and SDC, ONI-R10-2, Total Loss of AC Power, directs the station personnel to close containment (Reference 26). The loss of core cooling may result in boiling and discharge of steam into the containment.

In Mode 5, the RPV will be flooded to the vessel flange (minimum water height) for a very short period. If water level in the upper pools is below 22' 9" above the RPV flange the ADHR pump will be used to maintain RPV level and flood the upper pools using ONI-SPI E-4, ADHR Alternate Injection or EOP-SPI 4.3, FPCC Header Alternate Injection using the SPCU pump. Once the upper pools are flooded to greater than 22' 9" above the RPV flange FPCC can be used as an alternate decay heat removal system. An estimation of time to core uncovery was performed with RCIC unavailable with the vessel flooded to the vessel flange showed that approximately 10 hours was required. This allows adequate time to arrange low-pressure core cooling and other responses as Phase 2 or Phase 3 actions using FLEX equipment.

Normal heat removal from the RPV during this period is provided by the FPCC system by circulating water from the upper pools through the FPCC HXs to remove the decay heat from the Reactor Core. Additionally water from the SFP is also circulated through the FPCC HXs at the same time to remove decay heat from the Spent Fuel. There may be brief periods during Mode 5 / Refueling when containment integrity might be required, such as during an operation with a potential to drain the reactor vessel. If a BDBEE occurred during these times, the containment function would not be challenged based on containment response analysis performed for Modes 1 through 4, which uses cases bounding for Mode 5 due to the decrease in decay heat rate. If containment integrity were established in Mode 5, guidance of the EOPs would detail operator actions for maintaining containment pressure below the Primary Containment Pressure Limit (PCL) by venting the containment to the SFP in the Fuel Handling Building. The FHB will be vented per the action to provide a vent path for the SFP. If primary containment integrity cannot be established the openings in primary containment provide a vent path that precludes containment pressurization. [**AI-4 Provide evaluation of containment conditions in Mode 5 ELAP, AI-5 Closed]**

Spent Fuel Pool Cooling

For the normal heat load with maximum water loss from seismic sloshing, the SFP could start to boil at about 11 hours, per calculation X11-006 (Reference 48). To prevent over-pressurizing the fuel handling building (FHB), doors from the FHB to the outside on the East side of the plant will be opened per ONI-SPI D-1 prior to boiling.

Makeup to the SFP is calculated to require approximately 33 gpm for the normal heat load case. NEI 12-06 (Reference 2) requires three methods of filling the SFP: Fill from a location external to the pool area, fill using hoses and fill using spray. The fill from the external location and hoses is be capable of making up for losses due to boil off and the spray flow is 250 gpm. To meet both requirements, starting in Phase 2, an emergency makeup system (providing lake water from the FLEX pumps via the ESW system) is installed.

Order EA 12-051 (Reference 31) installed robust SFP level instruments.

As described in Section 8.1 a motor driven FLEX Lake Water Pump is staged in the ESWPH. The FLEX Lake Water Pump is lowered into the suction bay, supplied by the lake via the normal or alternate intake structures and through the ESW traveling screens. Hoses will be connected between the FLEX Lake Water Pump discharge manifold and the installed Storz connectors on the ESW A

Pump or alternately the ESW B Pump discharge pipe to allow ESW System piping to act as the FLEX flowpath to the Auxiliary and Intermediate Buildings.

A 10 inch supply line from ESW A and a 10 inch supply line from ESW B runs through the Intermediate building (IB) at Elevation 599. These lines, which supply cooling water to the FPCC HXs, have been tapped prior to the FPCC HX Supply Valves, with an isolation valve before connecting to a hard piping run to an isolation valve for the fill piping and hose supply connection to provide for the hose and spray requirements.

For scheduling purposes, this evolution is modeled as starting by hour 25, with pre-staging of equipment to occur prior to reaching 200 °F in the SFP, as this is the time filling the SFP cannot be delayed due to reaching level 1 (defined as bottom of transfer gate wall). Note that this action will be completed as work force is available following the start of the FLEX Lake Water Pump at T+6, and is not anticipated to be delayed until hour 25. Filling of the SFP is directed by the EOPs. Three procedures provide guidance on SFP inventory, FSG 50.1, Fuel Pool FILL Using Fire Main or Portable Pump, FSG 50.2, Fuel Pool Spray Using Fire Main or Portable Pump, and FSG 50.3, Fuel Pool Fill Using Emergency Makeup System.

A separate NTTF initiative required upgraded SFP level instruments per EA 12-051 (Reference 31).

Support for Safety Functions

Support for the safety functions during Phase 1 is provided by continued observation of conditions by operators using SFP Level instruments and SFP Temperature indications, and coordinating activities from the Control Room. Maintaining indications and control requires maintenance of battery power, which is extended by cross tying Unit 1 and Unit 2 batteries and performing a load shed. The SFP Level instruments installed per EA 12-051 have a standalone battery capable of 72 hours of operations... Instrument function and Control Room habitability are supported by establishing appropriate Control Room ventilation. Once the FLEX Generators are in service supplying power to Bus EH11 or Bus EH12, Divisional Battery chargers will be powered providing long term DC power and Control Room Ventilation fans will be restored. The FLEX Generators have sufficient capacity to allow one Battery charger in each division to be powered to supply DC power to instruments and allows AC powered Control Room Ventilation fans to be operated in the Normal, Emergency Recirculation Mode, or Smoke Clearing mode.

Backup Control Room lighting is powered by the plant batteries and adequate portable lighting is provided to support activities outside of the Control Room. Once the FLEX Generators are supplying power to Bus EH11 Control Room lighting will be restored by providing 110 Vac power to the Control Room.

FSG 40.5 FLEX Generator Loading and Plant System Operations provides guidance for restoring systems and control of FLEX generator loading.

Essential instrumentation for monitoring core and containment parameters is powered from 125 Vdc busses ED-1-A, ED-1-B and ED-1-C. These busses are provided with individual 125 Vdc batteries. ONI-R10-2 provides guidance to cross tie Unit 1 and Unit 2 batteries in each division within 30 minutes (ONI-SPI D-3). Load shedding (per ONI-SPI D-2) is also performed such that all non-essential circuit breaker loads are opened within three hours of the event. The mission time for the battery bank is extended to greater than 24 hours per station calculations (Reference 24) with the above operator actions. T herefore, the onsite FLEX Generators must be used to supply the battery chargers prior to 24 hours. Vital plant areas (RCIC Pump Room, Control Room and MCC Switchgear areas) are not expected to be above temperature limits defined in USAR (Reference 4) Chapter 3 within the first 6 hours. Concerns for ventilation in these areas will be addressed in Phase 2. FSG 90.3 Alternate Room Ventilation provides guidance for deployment and operation of portable fans in Phase 1 to facilitate RCIC pump room cooling. In Phase 2 Control Room Ventilation Fans and MCC and Misc. Switchgear Area Vent fans will be powered to control temperatures in the Control Complex and to remove hydrogen generated during battery charging. **[AI-3 Detailed design phase to evaluate long term room temperature response, AI-3 Closed]**

5.2.2 Phase 2

In Mode 5, the RPV will be flooded to the vessel flange (minimum water height). If water level in the upper pools is below 22’ 9” above the RPV flange the ADHR pump will be used to maintain RPV level and flood the upper pools using ONI-SPI E-4, ADHR Alternate Injection or EOP-SPI 4.3, FPCC Header Alternate Injection using the SPCU pump. Once the upper pools are flooded to greater than 22’ 9” above the RPV flange FPCC can be used as an alternate decay heat removal system. An estimation of time to core uncovery was performed with RCIC unavailable with the vessel flooded to the vessel flange showed that approximately 10 hours was required. This allows adequate time to arrange low-pressure core cooling and other responses as Phase 2 or Phase 3 actions using FLEX equipment.

Normal heat removal from the RPV during this period is provided by the FPCC system by circulating water from the upper pools through the FPCC HXs to remove the decay heat from the Reactor Core. Additionally water from the SFP is also circulated through the FPCC HXs at the same time to remove heat from the Spent Fuel.

With a loss of normal decay heat removal, ONI-E12-2, Loss of Decay Heat Removal is entered and ONI-SPI E-1, Containment/Fuel Handling Building Closure will be directed to prevent an uncontrolled release external to the closure envelope. **[AI-5. The final design will demonstrate the capability to provide sufficient flow to the core to suppress boiling in Mode 5 ELAP AI 3 Closed.].**

The Phase 2 containment function strategy for Mode 5 events will not require SPC. Removal of excess Suppression Pool water transferred from the RPV can be accomplished using SPCU as described above in Section 5.1.2.

From the USAR (Reference 4) on the Design Function of the FPCC system: The maximum abnormal heat load is 46.8 x 106 Btu/hr. This value is the sum of the decay heat from 3,388 bundles discharged over an eight year period, plus a sequential full core off-load which fills the fuel handling pools in the area of the intermediate building (4,020 bundles) and stores 116 bundles in the containment pool <Table 9.1-2(of the USAR (Reference 4))>. With both FPCC system pumps and HXs operating, the pool temperature will rise to 154°F. This value is derived from a conservative analysis, which overestimates the heat loading, by approximately 13%. Under realistic conditions, the pool temperature will not exceed 150°F. **[AI-5. The final design will demonstrate the capability to provide sufficient flow to the core to suppress boiling in Mode 5 ELAP AI-5 Closed].**

SFP cooling can be ensured by makeup to the pool using the SFP make-up header supplied by the FLEX pumps through ESW.

Support to the safety functions includes using the FLEX generator to energize a 480 Vac vital bus and recharge the batteries, power FLEX Lake Water Pumps, and other loads.

5.2.3 Phase 3

For core cooling, deployment of the 4160 V generators from the NSRC will allow re-establishing SDC with the RHR system. The RHR HXs will be cooled using the FLEX Lake Water Pumps providing water through the ESW system. If the upper containment pool is flooded then ONI-E12-2 Loss of Decay Heat Removal could direct the use of the FPCC system as an alternate to the RHR system. As ESW can be used to cool the FPCC HXs, the FLEX pumps can supply the cooling water to the FPCC System. PAP-1925, Shutdown Defense In Depth Assessment And Management provides additional guidance for availability of decay heat removal systems during shutdown conditions.

With the alignment of SDC or FPCC, the containment function will no longer be challenged.

SFP cooling can be ensured by makeup to the pool using the SFP make-up header as in Phase 2 or by restarting the FPCC System.

Support to the safety functions includes using the NSRC generators to provide additional electric capacity to 4160 Vac vital busses.

5.2.4 Development of the Safety Function Timeline

Table C. 1-1 of Appendix C provides a timeline of actions to be taken in response to this scenario. Most of the Phase 1 actions are common across all modes except RCIC is unavailable in Mode 5. During times where the plant is in Mode 5, Phase 2 actions will use direct water injection via ONI-SPI E-4, ADHR Alternate Injection or EOP-SPI 4.3, FPCC Header Alternate Injection using the SPCU pump. Water will be sourced from the Suppression Pool and injected directly into the Reactor Vessel. Depending on the initial water level in the upper containment pools, the vessel cavity may be flooded up at the discretion of Operations.

The timing of activities associated with deployment of the FLEX strategy is highly dependent on the particular hazard and scenario conditions. The purpose of developing an indicative time line is to understand when time critical actions are expected based on analysis performed for each safety function and determining that adequate staffing is available to effectively implement the developed FLEX strategies. It is noted that should such an event occur, the FLEX support guidelines (Reference 2) provide a symptom based approach to addressing plant safety functions, and a detailed damage assessment is performed to supplement the application of the FLEX strategies. This time line represents one particular, limiting, scenario with respect to those safety functions.

The time line developed in Appendix Table C. 1-1 Timing and Deployment Timeline for Modes 1-4, is based on the operator requirements and deployment timing summarized in Reference 10 and the actions and time constraints are provided in Table C1-1, and Table C-2, see Perry FLEX Integrated Plan, TR-FSE-13-9, (Reference 29) for more details. The time at which each action is initiated (Elapsed Time) was varied until all actions could meet the time constraints with some degree of margin.

5.3 FULL CORE OFFLOAD

If the RPV is defueled ("At All Times"), RPV level is not a concern. Focus is placed on the control of SFP level during the event, as there is a no decay heat in the RPV, the only heat remaining in the RPV is sensible heat. By 6 hours, the alternative core cooling systems are available to makeup to the RPV.

Perry conforms to the provisions of the NRC endorsed NEI position paper on Shutdown/Refueling Modes that describes how licensees will develop and maintain an appropriate plan for mitigating strategies capability in all plant modes (Adams Accession Nos. ML 13272A514 and ML 13267A382).

6.0 DEPLOYMENT IN ALL MODES

Deployment of FLEX equipment is described in Section 8 for each FLEX function and all operating modes. The broad-spectrum deployment strategies are unchanged for the different operating modes. The deployment strategies from the FLEX Equipment Bays to each staging area are identified. Equipment transportation, fuel transportation, debris removal, security barriers, and lighting concerns are discussed as they apply to each FLEX strategy.

The strategies for reactor core cooling described in Section 8.1 are applicable for Modes 1 through 4. The strategies for reactor core cooling described in Section 8.2 are only applicable for Modes 4, 5 / Refueling. The strategies for Containment Function, Containment Integrity, and SFP cooling described in Section 8.3, Section 8.4 and Section 8.5, respectively, are applicable for all strategies.

The Safety Function Support strategies described in Section 8.6 are designed to support all of the various strategies described above, and are applicable for all modes of operation.

Perry will use deployment paths, which refer to the route from a storage location to the staging location for various equipment, and routing paths, which refer to the route from a staging location to the point of connection to existing plant equipment for hoses and cables. Deployment paths and routing paths are shown in Appendix 28 to 32, Figures D-5 to D-9, of this document for all strategies.

To ensure that the strategies can be implemented in all modes, areas adjacent to the equipment storage and staging areas, as well as the deployment and hose routing paths are maintained clear at all times. These requirements are included in an administrative program. See NOP-LP-7300, FLEX Program for the Perry Nuclear Power Plant (PNPP) for details.

Storage and Deployment Paths are maintained clear of obstructions by the FLEX Program Document. **[AI-6 Perry to develop programmatic controls to maintain storage and deployment paths AI -6 Closed]**

7.0 PROGRAMMATIC CONTROLS

The purpose of the programmatic controls is to assure the developed FLEX strategies remain viable and reliable. This section provides a brief description of the controls to establish standards for quality, maintenance, testing of FLEX equipment, configuration management and periodic training of personnel.

Equipment associated with these strategies will be procured as commercial grade equipment with design, storage, maintenance, testing, and configuration control in accordance with NEI 12-06, (Reference 2). Procedures and guidance to support deployment and FLEX strategy implementation including interfaces to the EOP are outlined in this programmatic document. This documentation will be auditable, consistent with generally accepted engineering principles and practices, and controlled within the PNPP electronic document management system. In addition, programs and controls are developed and maintained to assure personnel proficiency in the mitigation of beyond-design-basis events in accordance with NEI 12-06, (Reference 2).

7.1 EQUIPMENT DESIGN & QUALITY ATTRIBUTES

Section 8 of this report details the equipment to be utilized for the PNPP FLEX strategies. The equipment will be sufficiently rugged to function following any of the site-specific beyond-design-basis external events.

7.2 EQUIPMENT STORAGE

This information is detailed in Sections 6 and 8 of this report.

7.3 DEPLOYMENT OF FLEX EQUIPMENT

This information is detailed in Sections 6 and 8 of this report.

7.4 PROCEDURE GUIDANCE

PNPP is a participant in the BWROG-EPC and has implemented EPG/SAG Rev 3 for the EOPs that includes guidance for actions to preserve steam driven injection and protect the function of Primary Containment. EPG/SAG Rev 3 also provides static guidance for implementation of FSGs for restoring functions needed during the event to implement the

EOPs. Additional Generic Off Normal (ONI (AOP)) Guidance has been developed to provide static guidance for restoration of vital electrical power (DC/AC) and management of other functions that are not directly required to restore or maintain a function needed for the EOPs. Perry has revised ONI-R10, Loss Of Off-Site Power, which provided guidance for all events where connection to the Grid is lost to the designated Safety Electrical Busses (EH11 EH12/EH13). ONI-R10 provided guidance for a Total Loss of AC Power (TLAC (SBO Industry Standard)). The TLAC guidance of ONI-R10 was relocated to ONI-R10-2 Total Loss Of AC Power and additional actions for implementation of FSGs (not directed by the EOPs) was provided.

In use, the EOPs and ONI-R10-2 are to be used in parallel to provide the strategic guidance for the event. Individual tactical procedures (FSGs, ONI-SPI, and EOP-SPIs) perform the tactical actions to accomplish the restoration or preservation of the required functions of NEI 12-06 (Reference 2).

The procedural implementation strategy aligns with the procedure hierarchy described in NEI 12-06 (Reference 2) in that actions that maneuver the plant are contained within the typical controlling procedure, and the FSGs are implemented as necessary to maintain the key safety functions of Core Cooling, Spent Fuel Cooling, and Containment Integrity in parallel with the controlling procedure actions. The overall approach is symptom–based, meaning that the controlling procedure actions and FSGs are implemented based upon actual plant conditions.

PNPP incorporated the FSGs into existing plant procedures, via reference, in order to develop the FSG interface.

7.5 MAINTENANCE AND TESTING

The FLEX mitigation equipment has been initially tested (or other reasonable means used) to verify performance conforms to the limiting FLEX requirements. T he testing included the equipment and the assembled sub-system to meet the planned FLEX performance. Additionally, PNPP will implement the maintenance and testing template upon issuance by the Electric Power Research Institute (EPRI). The template will be developed to meet the FLEX guidelines established in NEI 12-06 (Reference 2).

Currently FENOC has developed maintenance and testing templates specifically for the FLEX Equipment. Below is a partial 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-3748 , FLEX VEHICLES

Appendix F lists the current identified tasks planned for the FLEX equipment. The quarterly FLEX 4160 Vac Generator testing sequence has commenced. Appendix F also includes the orders numbers for the June 2015 performance of these tasks. This appendix is not all-inclusive and is not up to date with current order numbers. See SAP for current order numbers and the status of converting the notifications into maintenance plans.

7.6 TRAINING PLAN

Training plans were developed for plant groups such as ERO, Security, Operations, Engineering, Mechanical Maintenance, and Electrical Maintenance. The training plan development was done in accordance with PNPP procedures using the Systematic Approach to Training. The training has been implemented to ensure that the required site staff was trained prior to implementation of FLEX. This training program complied with the requirements outlined in NEI 12-06 (Reference 2).

7.7 STAFFING

The FLEX strategies documented in the event sequence analysis (Reference 10) assume:

- On-site staff are at administrative minimum shift staffing levels,

- No independent, concurrent events, and
- All personnel on-site are available to support site response

PNPP addresses staffing considerations in accordance with NEI 12-06 (Reference 2) to fully implement FLEX at the site. NORM-LP-7306, FLEX Staffing Study Reference Material for the Perry Nuclear Power Plant (PNPP) contains a copy of the Staffing Study (Reference 55).

7.8 CONFIGURATION CONTROL

Per NEI 12-06 (Reference 2) and the Interim Staff Guidance (Reference 03), the FLEX strategies must be maintained to ensure future plant changes do not adversely affect the FLEX strategies. PNPP maintains the FLEX strategies and basis documents in an overall program document and ensures changes to the plant design, physical plant layout, roads, buildings, and miscellaneous structures do not adversely influence the approved FLEX strategies.

7.9 NATIONAL SAFER RESPONSE CENTERS (REGIONAL RESPONSE CENTERS)

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 Strategic Alliance for FLEX Emergency Response (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, (. A copy of the SAFER Response Plan is attached to NORM-LP-7307, FLEX SAFER Response Plan Reference Material for the Perry Nuclear Power Plant (PNPP), (Reference 56)

8.0 FLEX STRATEGIES

Some items within the template are included within each safety function section and can be found in a corresponding appendix. These items are:

- Any physical modifications are identified in APPENDIX: Table A-1 SAFETY FUNCTIONS
- Key parameters of interest are outlined in APPENDIX: Table C-2: Timing and Deployment Reference Values
- Storage / Protection of Equipment is identified in APPENDIX: Table B-2 On-Site Phase 2 Equipment Requirements and APPENDIX: Table B-3 Storage Locations Summary
- Protection of connections input is provided in APPENDIX: Table A-1 SAFETY FUNCTIONS

8.1 REACTOR CORE COOLING (MODES 1-4)

The following Sections outlines the three phases of coping to prevent fuel damage for this safety function during Modes 1-4.

8.1.1 Phase 1

8.1.1.a General Description

Reactor core cooling and heat removal is provided during Phase 1 by using the steam driven RCIC pump in its design basis function to supply water to the RPV. This pump is powered by the steam discharge from the RPV, so the availability of the equipment is unaffected by an ELAP.

The RCIC pump is located on elevation 574’ of the Auxiliary Building. The structure is Seismic Category 1, and protected against seismic events, floods, and high winds. The pump and supporting valves and piping are also seismically qualified. The RCIC pump and associated piping is expected to be available after all hazards addressed by FLEX.

The RCIC system valves and SRVs are required to support this function. The RCIC system valves are powered by 125 Vdc Bus ED1A and are used to balance cooling flow to the RPV with the loss of inventory due to steaming through the SRVs to maintain the water level in the RPV above the Top of Active Fuel. This minimizes cycling of the RCIC system valves to preserve battery capacity until

AC power to the system's chargers is restored. As RPV pressure increases, the spring/pneumatically actuated SRVs are used to maintain RPV pressure by opening the SRVs, releasing steam from the RPV to the Suppression Pool. Operators control the RPV pressure using the ADS SRVs by electric operation of the valves. The ADS SRVs logic power comes from redundant power supplies off 125 Vdc Bus ED1A and 125 Vdc Bus ED1B.

8.1.1.b Description of Procedures / Strategies / Guidelines

8.1.1.b.1 RCIC Pump

The RCIC pump is designed to start automatically in the event of an RPV Low Level 2 (Reference 4, Section 5.4.6) initiation signal. If the automatic start does not occur, the EOPs (ONI-C71-1 Reactor Scram, and ONI-R10-2 Total loss of AC Power), all provide guidance to the operator to Manually Initiate the RCIC system or to take action to locally start the system from the RCIC room. This is an immediate action for the operator upon a low RPV level where no other injection source is available.

If the postulated FLEX event starts while the plant is in Mode 4 with the RCIC system out of service during RPV disassembly (head spray piping detensioned or removed), RPV level is normally at the RPV flange (to provide shielding to workers). As decay heat removal would be lost, the RPV will slowly heat up and the plant will transition to Mode 3. RPV level during this time is not challenged as the Plant Data Book PDB-A0019, Time-To-Core Uncovery Curves, gives a time to uncover (time to reach TAF) with RPV level initially at the RPV upper flange, 140°F RPV water temperature, and assuming decay heat load at 48 hours post shutdown (60 MBTU/hour) of approximately 10 hours. This is bounding for vessel disassembly as RPV water temperature is maintained below 140°F during these activities.

The time line to restore power to the SPCU pump or the ADHR pump is 6 hours. Once AC power is restored, RPV water level can be maintained by use of injection via ONI-SPI E-4, ADHR Alternate Injection or EOP-SPI 4.3, FPCC Header Alternate Injection using the SPCU pump. Once RPV injection is established, the SRVs can be opened to allow water to flow back to the Suppression Pool. Once water is circulating from the Suppression Pool to the Suppression Pool via the RPV, vessel decay heat is transferred to the Suppression Pool.

Control of Suppression Pool temperature is the same as in Mode 1-3 with SPCU or ADHR being used in SPCLC; the only difference is the flow path does not return to the Suppression Pool via the RHR TEST VALVE TO SUPR POOL, 1E12-F024 A (B) but injects into the RPV via the LPCI INJECTION VALVE, 1E12-F042 A (B).

The disassembled portions of the RPV pose a release path from the RPV to the Containment Building. With a loss of normal decay heat removal, ONI-E12-2, Loss of Decay Heat Removal, is entered and ONI-SPI E-1, Containment/Fuel Handling Building Closure directs actions to prevent an uncontrolled release external to the closure envelope.

The normal water source for the RCIC pump is the CST. However, the CST is not considered "robust" as defined in NEI 12-06 (Reference 2) for protection from seismic and tornado events. Therefore, the Suppression Pool is credited as the source for the RCIC pump. The CST is not seismically or missile hazard protected; however the CST is protected by a dike that is seismically and missile hazard qualified. Upon a failure of the CST during an event, the volume of water that was in the CST at the time of failure is contained within the Dike area. For some external events such as Flooding and all but the most catastrophic failures of the CST, the CST is available for a period time to supply the RCIC system. IF the CST is not available for use, the RCIC suction is aligned to the alternate suction from the Suppression Pool per existing operations procedure(s).

RPV makeup is supplied from the Suppression Pool via RCIC injection. The volume of the Suppression Pool is designed to provide for RPV makeup during a loss of AC power event. No makeup water to the Suppression Pool is required during Phase 1 coping.

During Phase 1, all of the energy from the core decay heat and RPV sensible heat would be deposited to the Suppression Pool. This would result in a temperature increase in the pool that could challenge the continued operation of the RCIC System. Continued operation of RCIC with elevated suction water temperature was evaluated by DRF 0000-0155-1541, BWROG RCIC Pump and Turbine Durability Evaluation - Pinch Point Study. (Reference 11). Perry has performed an engineering evaluation calculation X11-002, (Reference 52) of the RCIC system to confirm that the RCIC system in ROBUST for all temperatures of the Suppression Pool that are expected during an ELAP or LUHS event. Site Calc X11-002, (Reference 52)provides analysis of the RCIC system including piping for use during a during a FLEX event. **[AI-7 Review and apply BWROG RCIC report and provide evaluation of RCIC pipe to > 140°F AI-7 Closed]**

To minimize the challenges to continued operation of RCIC to provide core cooling, actions in Phase 2 are provided to provide a cold water supply to the RCIC Pump.

8.1.1.b.2 Ventilation

Procedural guidance for the operation of RCIC during this Phase is contained in FSG 10.1, RCIC FLEX Operation. This procedure provides for alignment of RCIC to the Suppression Pool, deployment and operation of a portable fan on the Aux Building 568' 6" elevation and establishing system flow near rated flow. The portable fan on the Aux Building 568' 6" is used to blow cooler air into the RCIC pump room thereby providing air exchange in the RCIC pump room as cooler air is blown in and hotter air exits out the normal ventilation penetration in the roof of the room to the RWCU pump room area on the Aux Building 599' 6" elevation. This portable fan is powered by a dedicated portable generator that is staged at ground level (620' 6") and extension cords run to the vent fan on the Aux Building 568' 6" elevation. When Electrical power is available, the RCIC room cooler is placed into service to promote airflow within the pump room. This has been evaluated in site calculation X11-003 (Reference 50) for acceptability.

Heatup of the Control Room is not expected to challenge the ability to use the Control Room during phase 1. During Phase 2, either the Control Room Ventilation system is available or portable fans are used to provide cooling to the Control Room. Procedural Guidance for providing ventilation to the Control Room is provided in FSG 90.3, Alternate Room Ventilation. This has been evaluated in site calculation X11-003 (Reference 50) for acceptability. **[AI-3. Detailed design phase to evaluate long term room temperature response AI-3 Closed]**

8.1.1.c Safety Relief Valves

EOPs (Reference 34), provide for the control and reduction of RPV pressure, using (i.e., manually controlled opening and closing) ADS SRVs, at a maximum cool down rate of 100°F per hour. This takes place over the first two to three hours when the operators stabilize reactor pressure at ~200 psig to provide ample steam pressure to the RCIC turbine and to limit heat discharge to the Suppression Pool.

8.1.2 Phase 2

8.1.2.a General Description

Mode 1-3 with RCIC available

During Phase 2, RCIC continues to provide high-pressure core cooling as it had in Phase 1. As the RCIC suction water temperature from the Suppression Pool (the RCIC suction is aligned to the Suppression Pool in Phase 1) is over the waterside piping design temperature of 140°F, switching the suction to cooler water is a priority.

The RCIC pump and turbine have been evaluated by the BWROG (Reference 11) to operate through the expected Suppression Pool Temperatures expected during a FLEX event, without failure of the RCIC pump. FSG 90.3, Alternate Room Ventilation, provides direction to provide portable ventilation to the RCIC pump room to address room heat up. Perry has performed an engineering evaluation calculation, X11-002, (REFERENCE 52) of the RCIC system to confirm that the RCIC system is ROBUST for all temperatures of the Suppression Pool that are expected during an ELAP or LUHS event.

With cooler suction water, RCIC is preferred to continue operation during Phase 2 vice depressurizing the RPV and injecting raw Lake Water to maintain RPV level. A tap is provided from the discharge of the RHR HXs that can be connected to the tap on the RCIC suction line to allow Suppression Pool water that is being cooled by SPCLC to supply the RCIC system. The expected temperature of the RHR HX outlet during SPCLC has been evaluated to be less than 140°F per site calculation X11-001 (Reference 49). An alternate source of water to the RCIC system is provided by a Tap on the ESW system that can be aligned to the RCIC pump suction to allow the FLEX pumps to provide Lake Water to the RCIC system.

With an alternative suction source aligned, RCIC system operation continues until the RPV can go on RHR recirculation in Phase 3.

Should RCIC fail during Phase 2, depressurizing the RPV and using low-pressure injection of Suppression Pool or lake water into the RPV is the secondary method of core cooling.

Mode 4 with RCIC available

If the event starts in Mode 4, the RCIC system is not immediately available due to RPV pressure being too low to support RCIC operation. As decay heat removal would be lost, the RPV will slowly heat up and the plant will transition to

Mode 3 (RPV pressure increases). RPV level during the time RCIC is not in operation is not challenged as there is no loss of inventory during this period as SRVs operation is not required until the RPV pressure nears normal operating pressures. Once RPV pressure rises above the RCIC system isolation pressure of 60 psig, RCIC will be placed into operation (normally around 150 psig). SRV operation is not required to control RPV pressure and recirculation pump seal failure is unlikely during this period as the recirculation loop temperature will be less than 200 degrees at the onset of the event.

8.1.3 Establishing the FLEX water source

Core cooling in a BWR involves keeping the core covered with water. This water boils in a BWR and transfers heat to the containment. Replacement of the boiled-off water initially requires a high-pressure pump to overcome RPV pressure and system losses. Given the scenario of loss of AC power and loss of normal access to the UHS, RCIC will be used to ensure core coverage, when the RPV is pressurized above approximately 60 psig.

RCIC discharges into the RPV head spray. This is permanent installed pipe with flanges to allow RPV head removal during outages. If the Suppression Pool cannot be maintained less than 185°F, a hose connection is provided for on the RCIC suction from an alternate, cooler (suction) water source on Aux Building, Elevation 568'. This allows the RCIC suction to be connected to the new FPCC Return header connection on Aux Building, Elevation 599' via one of two dry standpipes that run from Aux Building, Elevation 620' to the Aux Building, Elevation 574' (568') with connection points on each floor. Note that the Aux Building, Elevation 574' and 568' are functionally one building elevation.

The SPCU or ADHR pumps will supply water through the RHR HXs to a new 5-inch Storz connector. Water from the RHR HX outlet is the primary source as it provides a robust long-term clean water supply. Mix Bed / Two bed tanks can be used to supply RCIC as an alternative that is non-robust. ESW A or ESW B can supply RCIC with lake water and is a robust long-term raw water supply.

High Pressure Core Cooling using RCIC

During Phase 2, RCIC will continue to provide high-pressure core cooling as it had in Phase 1. Continued operation of RCIC with elevated suction water temperature was evaluated by DRF 0000-0155-1541, BWROG RCIC Pump and Turbine Durability Evaluation - Pinch Point Study, (Reference 11). Perry has performed an engineering evaluation calculation X11-002, (REFERENCE 52) of the RCIC system to confirm that the RCIC system in ROBUST for all temperatures of the Suppression Pool that are expected during an ELAP or LUHS event. **[AI-7. Review and apply BWROG RCIC report and provide evaluation of RCIC pipe to > 140°F AI 7 Closed]**.

In Phase 2, core cooling is accomplished by maintaining RPV water level Above the Top of Active Fuel or within the guidance of the EOPs.

If the Suppression Pool cannot be maintained less than 185°F, a hose connection is provided for on the RCIC suction from an alternate, cooler (suction) water source on Aux Building, Elevation 568’. This allows the RCIC suction to be connected to the new FPCC Return header connection on Aux Building, Elevation 599’ via one of two dry standpipes that run from Aux Building, Elevation 620’ to the Aux Building, Elevation 574’ (568’) with connection points on each floor. The RCIC connection is shown in Figure 5.1-1. Note that the Aux Building, Elevation 574’ and 568’ are functionally one building elevation.

The SPCU or ADHR pumps will supply water through the RHR HXs to a new 5-inch Storz connector. Water from the RHR HX outlet is the primary source as it provides a robust long-term clean water supply. Mix Bed / Two bed tanks can be used to supply RCIC as an alternative that is non-robust. ESW A or ESW B can supply RCIC with lake water and is a robust long-term raw water supply.

Low Pressure Core Cooling

If RCIC operation is not available, the EOPs will lower RPV pressure to allow low-pressure injection systems to feed the RPV. The HPCS and LPCS systems contain flush connections that connect into the system between the pump and injection valve. The HPCS system has a previously installed 5-inch Storz connection used for “Fast Firewater” and Alternate Boron Injection. The LPCS has a flush line similar to the HPCS connection, and this line has been modified to accept a standard fire hose for low-pressure vessel injection.

Either of these connection points can be aligned to alternate sources for RPV Injection. ESW A and ESW B systems have a new 5 inch Storz connection on the Aux Building Elevation 599' that are designed to provide approximately 1000 gpm to the HPCS or LPCS systems via the installed Dry Stand Pipes. The Mix Bed / Two Bed tanks have a new 5-inch Storz connection on the Water Treatment Building Elevation 620' that can provide a clean source of water to the HPCS or LPCS systems (via the installed Dry Stand Pipe(s) for LPCS) and provide a source of water for Standby Liquid Control (SLC) pumps (these actions requires a portable pump to be used at the connection point).

Fire Water Hydrants in the Yard area can provide approximately 2000 gpm to the HPCS or LPCS systems in a non-credited capacity.

<u>LPCS</u>

A fire hose from the alternate water source via ESW A (B) could inject directly into the RPV once the manual flush water valve (FLUSH WTR TO LPCS PUMP DISCH LINE, 1E21-F025) is opened and the AC MOV LPCS injection valve (LPCS INJECTION VALVE, 1E21-F005) is opened either electrically from the Control Room or locally. Makeup to the Suppression Pool is also possible via this hose connection.

<u>HPCS</u>

HPCS discharges into the RPV inside the shroud through the HPCS spray ring. If RCIC is or becomes unavailable, a hose connection on the HPCS pump discharge piping allows for the use of an alternate water source on Aux Building, Elevation 620' West Side. This connection allows the HPCS system piping to be connected to the ESW supply piping connection on Aux Building, Elevation 599' via one of two dry standpipes that run from Aux Building, Elevation 620' to the Aux Building, Elevation 574' (568') with connection points on each floor. Note: This connection point is pre-existing (no modifications required) for alternate injection as directed by the EOPs.

Mix Bed / Two bed tanks can be used to supply HPCS as an alternative that is non-robust. ESW A or ESW B can supply HPCS with lake water and is a robust long-term raw water supply.

8.1.3.a Description of Procedures / Strategies / Guidelines

PNPP will continue participation in the BWROG-EPC and will update plant procedures based upon changes to the BWR Generic Guidance. The following

FSGs have been incorporated into the EOPs and ONI-R10-2 Total Loss of AC Power procedures to provide guidance for the FSG interface for Phase 2:

- FSG 10.3 RCIC Suction Alternate Supply
- FSG 10.4 HPCS Alternate Supply
- FSG 10.5 LPCS Alternate Supply
- FSG 60.1 Supply ESW A Header from a FLEX Pump at the ESWPH
- FSG 60.2 Supply ESW B Header from a FLEX Pump at the ESWPH

8.1.3.b Establishing Robust Water Source from Lake Erie to ESWPH

Lake Erie is accessible in the ESWPH by taking a suction on the suction bay. The ESWPH suction bay is supplied from either the Normal Intake or Discharge tunnels. The Normal Intake is a 10-foot diameter concrete tunnel that extends from the Normal Intake Structure and runs under ground in bedrock to the ESWPH forebay. The Normal Intake Structure contains two 100% capacity intakes to preclude blockage and are approximately a quarter mile from the lakeshore. The Discharge Tunnel is a 10-foot diameter concrete tunnel that extends from the discharge nozzle and runs under ground in bedrock to the ESWPH forebay. The discharge nozzle is approximately a quarter mile from the lakeshore and is located near the lake bottom to allow use during loss of lake level events. Both the Normal Intake and Discharge Tunnels are designed to support emergency cooling to both Units 1 and Unit 2 concurrently, are seismically qualified, and are robust for all FLEX events. The Normal Intake and Discharge Tunnels terminate in the forebay with the Discharge Tunnel being separated from the forebay by two 100% capacity sluice gates. The ESWPH forebay is connected to the ESWPH suction bay though two 100%-capacity traveling screens designed to remove debris from the lake water prior to reaching the suction bay. Two 4160 Vac FLEX pumps are stored in the ESWPH near the pedestals for the Unit 2 ESW pumps (Unit 2 ESW pumps were not installed). These pumps are supplied from 4160 Vac Bus EH-21 as the primary source, or supplied by the N+1 generator as an alternate.

Each FLEX Lake Water Pump is able to supply the required flow to either ESW A (B) loop or both can be used if no equipment failures occur. The FLEX pumps are lowered to the suction bay and three discharge hoses connected to the designated ESW loop to supply approximately 3000 gpm. Note the discharge of the FLEX Lake Water Pump can also be used via a hose connection to spray debris off the traveling screens if blockage occurs. The ESW system is designed with a return line from the discharge of ESW A and a return line from the discharge of ESW B to return hot water to the ESW forebay during periods where icing may be experienced. Use of the FLEX pumps to supply the ESW system allows this function of maintaining the forebay deiced to be available during an ELAP. Note: the ESWPH and associated equipment are safety related and are robust for all FLEX events.

8.1.3.b.1 Primary Connection

The ESW A pump discharge piping has been modified by adding three 5" Storz connection points to allow either of the two FLEX Lake Water Pumps to be connected to the ESW A Loop. These connections are located between the ESW A Pump discharge Check Valve and the discharge strainer.

Modifications

- Install pipe connections on ESW A pipe in the ESWPH
  - Install Termination Enclosure 1X11-S002 in the ESWPH

System Alignment

With the declaration of an ELAP at t=1, the FLEX Lake Water Pump can be utilized at its ESWPH Storage location. The motor power cables will be routed to the Termination Enclosure (1X11-S002) in the ESWPH. 1X11-S002 is fed from Bus EH-21 (Breaker EH2106). Once the pump is lowered into the ESW Pumphouse forebay, 10 ft long discharge hoses are connected between the pumps three 5 inch Storz connections on the pump manifold and the ESW A loop's three 5 inch Storz connections, the (two per connection) 6 inch manual isolation valves are then opened (6 total). Once electrical power is available, the ESW A discharge valve P45-F130A is manually opened and the FLEX Lake Water Pump is started.

To ensure that the flow in the ESW system is for FLEX loads the inlet valves to the fuel pool HXs (P42-F260A), ECC HXs (P45-F536A), and the diesel generators (P45-F530A) will be closed. These valves are located in accessible areas in the Intermediate Bldg. Diesel Bldg., and Control Complex. To provide backpressure needed for SFP makeup, the RHR HX ESW outlet valve (P45-F068A) may need to be throttled. Throttling the RHR HX ESW outlet valve ensures that the RHR tubes are exposed to highest ESW Pressure to help preclude air binding of the tubes. The RHR HX ESW outlet valve is in an accessible location in Auxiliary Building 574' elevation.

Routing

Refer to Appendix Figure E series for routing information per the following links:

36.0 APPENDIX: Figure E-1B RCIC Suction Connection Point

37.0 APPENDIX: Figure E-2: Two Bed / Mixed Bed Storz Connector Location

38.0 APPENDIX: Figure E-2A: Two Bed / Mixed Bed Storz Connector Location

39.0 APPENDIX: Figure E-2C: Two Bed / Mixed Bed Storz Connector Location

40.0 APPENDIX: Figure E-2D: Exterior Hose Path from Mixed Bed Tank

41.0 APPENDIX: Figure E-3: Interior Hose Path from Mixed Bed to the RCIC Suction Connection

42.0 APPENDIX: Figure E-3A: Interior Hose Path from RHR to FPCC Return Header to the RCIC Suction Connection

43.0 APPENDIX: Figure E-3B: Interior Hose Path from ESW A to the RCIC Suction Connection

44.0 APPENDIX: Figure E-4: Aux Building Dry Standpipes

45.0 APPENDIX: Figure E-5 Mechanical FLEX Equipment and Modifications Photos

46.0 APPENDIX: Figure E-6: LPCS / HPCS Storz Connection Points

47.0 APPENDIX: Figure E-7 Simplified Unit 1 and Unit 2 Divisional AC busses without modifications

48.0 APPENDIX: Figure E-8 Simplified Unit 1 Division 1 Electrical

49.0 APPENDIX: Figure E-9 Simplified Unit 1 Division 2 Electrical

50.0 APPENDIX: Figure E-10 Simplified Unit 1 Division 3 Electrical

51.0 APPENDIX: Figure E-11 Simplified Unit 2 Division 1 Electrical

52.0 APPENDIX: Figure E-12 Simplified Unit 2 Division 2 Electrical

53.0 APPENDIX: Figure E-13 Simplified Unit 2 Division 3 Electrical

54.0 APPENDIX: Figure E-14 Simplified Electrical Modifications

55.0 APPENDIX: Figure E-15 Termination Enclosure 1X11-S0001

56.0 APPENDIX: Figure E-16 Transfer Switch 1R25-S0291

57.0 APPENDIX: Figure E-17 Transfer Switch 1R25-S0174

58.0 APPENDIX: Figure E-18 Transfer Switch 1R25-S0292

59.0 APPENDIX: Figure E-18-A: FLEX Electrical Equipment and Modification Photos:

60.0 APPENDIX: Figure E-19 Termination Enclosure 1X11-S0001 to Bus EH21 Feeder

61.0 APPENDIX: Figure E-20 Alternate Supply to Bus EH11

62.0 APPENDIX: Figure E-22 Alternate Supply to Bus EH12

63.0 APPENDIX: Figure E-23 Alternate Supply to Bus EH13

64.0 APPENDIX: Figure E-24 Alternate Supply to Bus TH21

65.0 APPENDIX: Figure E-25 Alternate Supply to Transformer EHF2A

66.0 APPENDIX: Figure E-26 Primary Suppression Pool Closed Loop Cooling Flow Path

8.1.3.b.2 Secondary Connections

The ESW B pump discharge piping has been modified by adding three 5” Storz connection points to allow either of the Two FLEX Lake Water Pumps to be connected to the ESW B Loop. These connections are located between the ESW B Pump discharge Check Valve and the discharge strainer.

Modifications

- Install pipe connections on ESW B pipe in the ESWPH
  - Install Termination Enclosure 1X11-S002 in the ESWPH (same as above)

System Alignment

With the declaration of an ELAP at t=1, the N+1 FLEX Lake Water Pump can be utilized at its ESWPH Storage location. The motor power cables will be routed to the Termination Enclosure (1X11-S002) in the ESWPH. 1X11-S002 is fed from Bus EH-21 (Breaker EH2106). Once the pump is lowered into the ESW Pumphouse forebay, 10 ft long discharge hoses are connected between the pumps three 5 inch Storz connections on the pump manifold and the ESW A loop's three 5 inch Storz connections, the (two per connection) 6 inch manual isolation valves are then opened (6 total). Once electrical power is available, the ESW B discharge valve P45-F130B is manually opened and the FLEX Lake Water Pump is started.

To ensure that the flow in the ESW system is for FLEX loads the inlet valves to the fuel pool HXs (P42-F260B), ECC HXs (P45-F536B), and the diesel generators (P45-F530B) will be closed. These valves are located in accessible areas in the Intermediate Bldg. Diesel Bldg., and Control Complex. To provide backpressure needed for SFP makeup, the RHR HX ESW outlet valve (P45-F068B) may need to be throttled. Throttling the RHR HX ESW outlet valve ensures that the RHR tubes are exposed to highest ESW Pressure to help preclude air binding of the tubes. The RHR HX ESW outlet valve is in an accessible location in Auxiliary Building 574' elevation.

Routing

Refer to Appendix Figure E series for routing information per the following links:

36.0 APPENDIX: Figure E-1B RCIC Suction Connection Point

37.0 APPENDIX: Figure E-2: Two Bed / Mixed Bed Storz Connector Location

38.0 APPENDIX: Figure E-2A: Two Bed / Mixed Bed Storz Connector Location

39.0 APPENDIX: Figure E-2C: Two Bed / Mixed Bed Storz Connector Location

40.0 APPENDIX: Figure E-2D: Exterior Hose Path from Mixed Bed Tank

41.0 APPENDIX: Figure E-3: Interior Hose Path from Mixed Bed to the RCIC Suction Connection

42.0 APPENDIX: Figure E-3A: Interior Hose Path from RHR to FPCC Return Header to the RCIC Suction Connection

43.0 APPENDIX: Figure E-3B: Interior Hose Path from ESW A to the RCIC Suction Connection

44.0 APPENDIX: Figure E-4: Aux Building Dry Standpipes

45.0 APPENDIX: Figure E-5 Mechanical FLEX Equipment and Modifications Photos

46.0 APPENDIX: Figure E-6: LPCS / HPCS Storz Connection Points

47.0 APPENDIX: Figure E-7 Simplified Unit 1 and Unit 2 Divisional AC busses without modifications

48.0 APPENDIX: Figure E-8 Simplified Unit 1 Division 1 Electrical

49.0 APPENDIX: Figure E-9 Simplified Unit 1 Division 2 Electrical

50.0 APPENDIX: Figure E-10 Simplified Unit 1 Division 3 Electrical

51.0 APPENDIX: Figure E-11 Simplified Unit 2 Division 1 Electrical

52.0 APPENDIX: Figure E-12 Simplified Unit 2 Division 2 Electrical

53.0 APPENDIX: Figure E-13 Simplified Unit 2 Division 3 Electrical

54.0 APPENDIX: Figure E-14 Simplified Electrical Modifications

55.0 APPENDIX: Figure E-15 Termination Enclosure 1X11-S0001

56.0 APPENDIX: Figure E-16 Transfer Switch 1R25-S0291

57.0 APPENDIX: Figure E-17 Transfer Switch 1R25-S0174

58.0 APPENDIX: Figure E-18 Transfer Switch 1R25-S0292

59.0 APPENDIX: Figure E-18-A: FLEX Electrical Equipment and Modification Photos:

60.0 APPENDIX: Figure E-19 Termination Enclosure 1X11-S0001 to Bus EH21 Feeder

61.0 APPENDIX: Figure E-20 Alternate Supply to Bus EH11

62.0 APPENDIX: Figure E-22 Alternate Supply to Bus EH12

63.0 APPENDIX: Figure E-23 Alternate Supply to Bus EH13

64.0 APPENDIX: Figure E-24 Alternate Supply to Bus TH21

65.0 APPENDIX: Figure E-25 Alternate Supply to Transformer EHF2A

66.0 APPENDIX: Figure E-26 Primary Suppression Pool Closed Loop Cooling Flow Path

Valve manipulations

Number	**Valve**	**Location**
6	6 inch manual isolation valve	ESWPH Elevation 586’
1	1P45-F130A(B)	ESWPH Elevation 586’
1	0P42-F260A(B)	IB Elevation 599’
1	1P45-F068A(B)	Aux Building Elevation 574’
1	1P45-F536A(B)	Control Complex 574’
0	1P45-F530A(B)	D/G Building 620’

Equipment Required

Number	**Equipment**	**Location**
4	Single Phase cables	ESWPH Elevation 586’
3	10’ 5 inch fire hoses (N Loop)	ESWPH Elevation 586’
3	100’ 5 inch fire hoses (N+1 Loop)	ESWPH Elevation 586’

Table 8.1-1: Phase 2 Water Demands

High Pressure Core Cooling				
		RCIC Suction	250 gpm	700 gpm intermittently
Containment Integrity (Suppression Pool Cooling) - 1500 gpm				
One of these two		RHR HX	Mode 1-4	
	Or…	FPCC HX	Mode 5, At All Times***	
Spent Fuel Cooling - 250 gpm				
One of these two		ESW A(B) to SFP	250 gpm Modes 1-4	
	Or…	FPCC HX	2000 gpm Mode 5, At All Times***	
Aggregate Demand - Worst Case (Mode 1-4)				
	250	gpm to Core		
	1500	gpm to RHR HX		
	250	gpm to SFP		
	2500	gpm total		

*** - Flow rates for RPV and SFP are combined into 2000 gpm through FPCC. This does not represent two separate flow rates of 2000 gpm.

Table 8.1-2: Phase 3 Water Demand

High Pressure Core Cooling				
		RCIC Suction	0 gpm	
HX Cooling				
One of these two		RHR HX	3000 gpm Mode 1-4	
	Or…	FPCC HX	2000 gpm Mode 5, At All Times***	
Spent Fuel Cooling - 250 gpm				
One of these two		ESW A(B) to SFP	250 gpm Modes 1-4	
	Or…	FPCC HX	2000 gpm Mode 5, At All Times***	
Aggregate Demand - Worst Case				
	0	gpm to Core		
	3000	gpm to HX		
	250	gpm to SFP		
	2250	gpm total		

*** - Flow rates for RPV and SFP are combined into 2000 gpm through FPCC. This does not represent two separate flow rates of 2000 gpm

Table 8.1-3: ESWPH Hose Lengths

Pipe/Hose	Hose Required	
	Pump Manifold to ESW Pipe (ft)	Hose Size (inches)
Primary Connection Point	10*	5
Alternate Connection Point	100*	5

* The Pump Manifold to ESW Pipe uses three hoses of the length specified.

<u>Storage Requirement</u>

Perry stores the FLEX Lake Water Pumps and hoses in the ESWPH.

<u>Fuel Requirement</u>

FLEX Lake Water pumps are electrically driven and do not require separate fuel oil source for operation. Fuel Oil Consumption is bounded by FLEX generator fuel oil consumption.

8.1.3.c RCIC Suction Source

8.1.3.c.1 Primary Connection RHR A (B) HX outlet via RHR to FPCC Return Header

The principal robust water supply is the Suppression Pool. During Phase 1 and Phase 2, the RCIC system takes a suction on the Suppression Pool to maintain RPV level. During Phase 1 RCIC takes a direct suction on the Suppression Pool and in Phase 2 when SPCLC is established the RCIC suction is shifted to the outlet of the RHR HX to use the Suppression Pool water that is being pumped through the RHR system by the SPCU / ADHR pump (alternate water sources for RCIC are also available). Water at the outlet of the RHR HX has been cooled, which supports RCIC operation within the normal operating parameters.

<u>Modifications</u>

- Install 5" Storz connection on suction line to RCIC Pump in Aux Building Elevation 574'

- Install East and West dry standpipes Aux Building Elevation 568' to Aux Building Elevation 620'
- Install 5" Storz connection on RHR to FPCC Return Header Aux Building Elevation 599'

System Alignment

The preferred robust RCIC alternate water source is the new 5-inch Storz connection off the RHR to FPCC return header. Once SPCLC is in service, the RHR system is connected to the RHR to FPCC Return Header by opening RHR A(B) FPCC Supplement Cooling Discharge Valve, 1E12-F099A(B). This aligns water from the RHR HX outlet to the FPCC Supplement Cooling return header. From the new 5 inch Storz connection a hose is connected to a Dry Stand Pipe 5 inch Storz connection on Aux Building Elevation 599'. A second hose is connected to the Dry Stand Pipe 5 inch Storz connection on Aux Building 568' and routed to the RCIC suction 5 inch Storz connection on Aux Building 574'.

Routing

Refer to Appendix Figure E series for routing information per the following links:

36.0 APPENDIX: Figure E-1B RCIC Suction Connection Point

37.0 APPENDIX: Figure E-2: Two Bed / Mixed Bed Storz Connector Location

38.0 APPENDIX: Figure E-2A: Two Bed / Mixed Bed Storz Connector Location

39.0 APPENDIX: Figure E-2C: Two Bed / Mixed Bed Storz Connector Location

40.0 APPENDIX: Figure E-2D: Exterior Hose Path from Mixed Bed Tank

41.0 APPENDIX: Figure E-3: Interior Hose Path from Mixed Bed to the RCIC Suction Connection

42.0 APPENDIX: Figure E-3A: Interior Hose Path from RHR to FPCC Return Header to the RCIC Suction Connection

43.0 APPENDIX: Figure E-3B: Interior Hose Path from ESW A to the RCIC Suction Connection

44.0 APPENDIX: Figure E-4: Aux Building Dry Standpipes

45.0 APPENDIX: Figure E-5 Mechanical FLEX Equipment and Modifications Photos

46.0 APPENDIX: Figure E-6: LPCS / HPCS Storz Connection Points

47.0 APPENDIX: Figure E-7 Simplified Unit 1 and Unit 2 Divisional AC busses without modifications

48.0 APPENDIX: Figure E-8 Simplified Unit 1 Division 1 Electrical

49.0 APPENDIX: Figure E-9 Simplified Unit 1 Division 2 Electrical

50.0 APPENDIX: Figure E-10 Simplified Unit 1 Division 3 Electrical

51.0 APPENDIX: Figure E-11 Simplified Unit 2 Division 1 Electrical

52.0 APPENDIX: Figure E-12 Simplified Unit 2 Division 2 Electrical

53.0 APPENDIX: Figure E-13 Simplified Unit 2 Division 3 Electrical

54.0 APPENDIX: Figure E-14 Simplified Electrical Modifications

55.0 APPENDIX: Figure E-15 Termination Enclosure 1X11-S0001

56.0 APPENDIX: Figure E-16 Transfer Switch 1R25-S0291

57.0 APPENDIX: Figure E-17 Transfer Switch 1R25-S0174

58.0 APPENDIX: Figure E-18 Transfer Switch 1R25-S0292

59.0 APPENDIX: Figure E-18-A: FLEX Electrical Equipment and Modification Photos:

60.0 APPENDIX: Figure E-19 Termination Enclosure 1X11-S0001 to Bus EH21 Feeder

61.0 APPENDIX: Figure E-20 Alternate Supply to Bus EH11

62.0 APPENDIX: Figure E-22 Alternate Supply to Bus EH12

63.0 APPENDIX: Figure E-23 Alternate Supply to Bus EH13

64.0 APPENDIX: Figure E-24 Alternate Supply to Bus TH21

65.0 APPENDIX: Figure E-25 Alternate Supply to Transformer EHF2A

66.0 APPENDIX: Figure E-26 Primary Suppression Pool Closed Loop Cooling Flow Path

Valve manipulations

With the RCIC pump aligned with suction from the Suppression Pool, the two manual isolation valves at the RHR to FPCC Header hose connection point, East Dry Stand pipe isolation valve, and two manual isolation valves at the RCIC suction hose connection (5 total) are opened, pressurizing the hoses and piping to the RCIC suction valve from the CST. RCIC suction is then shifted from the Suppression Pool to the CST by opening the RCIC suction valve from the CST and closing the RCIC Suppression Pool suction valve per FSG 10.3, RCIC Suction Alternate Supply. The existing in line check valve installed in the 6” CST supply piping prevents flow water from flowing back to the CST. An inline check valve in the RCIC Suppression Pool suction line prevents water flow back into the Suppression Pool during the suction transfer.

Equipment Required

The RCIC design flow rate is 700 gpm. RPV makeup requirements in this scenario would be lower as decay heat decreases with time post-trip. After T-6 hours, a 5 inch fire hose that can provide significantly more than the required flow (approximately 250-gpm) is connected to the RCIC suction line from the CST. At T-6 approximately 250 gpm (average injection rate) is required to maintain RPV level. Results of MAAP and FATHOM calculations have confirmed the 250 gpm (average injection rate).

This suction source is used in when RCIC is in service with low RPV makeup requirements past the T-6 hour point. If the RCIC system is shutdown, the suction will need to be aligned to a robust suction supply during start up unless a portable pump is used to pressurize the hose for the Mix Bed / Two-bed connection point. Manual control of RCIC injection can be implemented from the Control Room, the Remote Shutdown Panel, or locally in the RCIC Pump Room (Aux. Building, 574’ elevation).

RCIC pump room cooling is normally provided by a room cooler using Emergency Closed Cooling (ECC, P42) for cooling water. ECC flow to the room cooler is not available under postulated FLEX conditions. FSG 90.3 Alternate Room Ventilation allows the opening of RCIC room door and providing air flow to the room using a portable fan powered by a small 110 Vac portable generator.

The components and the design parameters of the new connection to the RCIC suction line are provided in Table 8.1-4.

Table 8.1-4: Equipment Requirements for the RCIC Suction Line Connection

Parameter	Component
Storz connector	Standard 5 inch with end cap
100’ Fire Hoses	3-Standard 5” Fire Hose
Isolation/control valve	2- 6 inch, ball valves
3-Power Cords	100’ 110 Vac Extension Cords
110 Vac Power	110 Vac Portable Generator
Ventilation	110 Vac Portable Fan

Storage Requirement

Perry stores the fire hoses, power cords, isolation valves locally in the Auxiliary Building, and the 110 Vac generator and portable fans in FLEX Equipment Bay 1 and/or FLEX Equipment Bay 2.

Deployment

Connecting the alternate water source to the RCIC suction is one of the earliest responses required for Phase 2 and will be performed concurrently with FLEX portable equipment deployment. This action provides an alternative source of water to replace the CST if it has failed to align RCIC operation to the assumptions of the USAR (Reference 4). Establishing SPCLC is discussed separately in Section 8.3. Deployment of fire hoses is a matter of bringing the hose(s) from the FLEX storage facility or its local storage and connecting it.

Fuel Requirement

Phase 1 fuel oil consumption is by the portable generator used to supply the RCIC pump room fan. This generator has an extended run fuel tank that will provide 5 hours of service. Refueling of this generator is not required in Phase 1.

The 1.5 gph diesel fuel oil supply for the small 110 Vac portable generator used to supply the portable fan will be required during Phase 2. Refueling may not be required if the normal room cooler is restored.

8.1.3.c.2 Secondary Connections

If SPCLC cannot be established, heatup of the Suppression Pool challenges RCIC system operation. An alternate robust source of cool water is Lake Erie. Lake Erie is accessible in the ESWPH by taking a suction on the suction bay. The ESWPH suction bay is supplied from either the Normal Intake or Discharge tunnels. The Normal Intake is a 10-foot diameter concrete tunnel that extends from the Normal Intake Structure and runs under ground in bedrock to the ESWPH forebay. The Normal Intake Structure contains two 100% capacity intakes to preclude blockage and are approximately a quarter mile from the lakeshore. The Discharge Tunnel is a 10-foot diameter concrete tunnel that extends from the discharge nozzle and runs under ground in bedrock to the ESWPH forebay. The discharge nozzle is approximately a quarter mile from the lakeshore and is located near the lake bottom to allow use during loss of lake level events. Both the Normal Intake and Discharge Tunnels are design to support emergency cooling to both Units 1 and Unit 2 concurrently and are seismically qualified and are robust for all FLEX events. The Normal Intake and Discharge Tunnels terminate in the forebay with the Discharge Tunnel being separated from the forebay by two 100% capacity sluice gates. The ESWPH forebay is connected to the ESWPH suction bay though two 100%-capacity traveling screens designed to remove debris from the lake water prior to reaching the suction bay. Two 4160 Vac FLEX pumps are stored in the ESWPH near the pedestals for the Unit 2 ESW pumps (Unit 2 ESW pumps were not installed). These pumps are supplied from 4160 Vac Bus EH-21 as the primary source, or supplied by the N+1 generator as an alternate.

Each FLEX Lake Water Pump is able to supply the required flow to either ESW A (B) loop or both can be used if no equipment failures occur. The FLEX pumps are lowered to the suction bay and three discharge hoses connected to the designated ESW loop to supply approximately 3000 gpm. Note the discharge of the FLEX Lake Water Pump can also be used via a hose connection to spray debris off the traveling screens if blockage occurs. The ESW system is designed with a return line from the discharge of ESW A and a return line from the discharge of ESW B to return hot water to the ESW forebay during periods where icing may be experienced. Use of the FLEX pumps to supply the ESW system allows this function of maintaining the forebay deiced to be available during an ELAP. Note: the ESWPH and associated equipment are safety related and are robust for all FLEX events.

<u>Modifications</u>

- Install pipe connections on ESW A and B pipes in Aux Building 599’
- Install 5” Storz connection on suction line to RCIC Pump in Aux Building Elevation 574’
- Install East and West dry standpipes Aux Building Elevation 568’ to Aux Building Elevation 620’

System Alignment

The alternate robust RCIC water source is the new inch 5 inch Storz connection off the ESW supply piping in Aux Building 599’. From the new 5 inch Storz connection on the ESW A (or ESW B) Supply Piping a hose is connected to the East (West) Dry Stand Pipe 5 inch Storz connection on Aux Building 599’. A second hose is connected to the East Dry Stand 5 inch Storz connection on Aux Building 568’ and routed to the RCIC suction 5 inch Storz connection on Aux Building 574’. Once a FLEX Lake Water Pump is in service supplying the ESW A (B) loop, the Isolation Valves are opened to align the ESW loop to the RCIC CST suction line.

Routing

Refer to Appendix Figure E series for routing information per the following links:

36.0 APPENDIX: Figure E-1B RCIC Suction Connection Point

37.0 APPENDIX: Figure E-2: Two Bed / Mixed Bed Storz Connector Location

38.0 APPENDIX: Figure E-2A: Two Bed / Mixed Bed Storz Connector Location

39.0 APPENDIX: Figure E-2C: Two Bed / Mixed Bed Storz Connector Location

40.0 APPENDIX: Figure E-2D: Exterior Hose Path from Mixed Bed Tank

41.0 APPENDIX: Figure E-3: Interior Hose Path from Mixed Bed to the RCIC Suction Connection

42.0 APPENDIX: Figure E-3A: Interior Hose Path from RHR to FPCC Return Header to the RCIC Suction Connection

43.0 APPENDIX: Figure E-3B: Interior Hose Path from ESW A to the RCIC Suction Connection

44.0 APPENDIX: Figure E-4: Aux Building Dry Standpipes

45.0 APPENDIX: Figure E-5 Mechanical FLEX Equipment and Modifications Photos

46.0 APPENDIX: Figure E-6: LPCS / HPCS Storz Connection Points

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48.0 APPENDIX: Figure E-8 Simplified Unit 1 Division 1 Electrical

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51.0 APPENDIX: Figure E-11 Simplified Unit 2 Division 1 Electrical

52.0 APPENDIX: Figure E-12 Simplified Unit 2 Division 2 Electrical

53.0 APPENDIX: Figure E-13 Simplified Unit 2 Division 3 Electrical

54.0 APPENDIX: Figure E-14 Simplified Electrical Modifications

55.0 APPENDIX: Figure E-15 Termination Enclosure 1X11-S0001

56.0 APPENDIX: Figure E-16 Transfer Switch 1R25-S0291

57.0 APPENDIX: Figure E-17 Transfer Switch 1R25-S0174

58.0 APPENDIX: Figure E-18 Transfer Switch 1R25-S0292

59.0 APPENDIX: Figure E-18-A: FLEX Electrical Equipment and Modification Photos:

60.0 APPENDIX: Figure E-19 Termination Enclosure 1X11-S0001 to Bus EH21 Feeder

61.0 APPENDIX: Figure E-20 Alternate Supply to Bus EH11

62.0 APPENDIX: Figure E-22 Alternate Supply to Bus EH12

63.0 APPENDIX: Figure E-23 Alternate Supply to Bus EH13

64.0 APPENDIX: Figure E-24 Alternate Supply to Bus TH21

65.0 APPENDIX: Figure E-25 Alternate Supply to Transformer EHF2A

66.0 APPENDIX: Figure E-26 Primary Suppression Pool Closed Loop Cooling Flow Path

Valve manipulations

With the RCIC pump aligned with suction from the Suppression Pool, the two manual isolation valves at the ESW A(B) supply piping hose connection, East(West) Dry Stand pipe isolation valve, and two manual isolation valves at the RCIC suction hose connection (5 total) are opened, pressurizing the hoses and piping to the RCIC suction valve. An inline check valve installed in the supply piping prevents flow water from flowing back to the CST or Suppression Pool.

Equipment Required

The Equipment requirements are the same as the Primary Connection Point.

Storage Requirement

The Storage requirements are the same as the Primary Connection Point.

Deployment

The Deployment actions are the same as the Primary Connection Point.

Fuel Requirement

The Fuel Requirements are the same as the Primary Connection Point.

8.1.3.c.3 Secondary Non-Robust Connections

Other, non-robust water sources may be available from the mixed bed tank or the two-bed tank after the event. These tanks are located just outside the protected area fence north of the Primary Access Facility on the West side of the plant. These tanks are used via a new hose connection located on transfer pump suction lines from the tanks. Each tank has a transfer pump suction line in the Water Treatment Building. A new 5-inch Storz connection that can be aligned to either or both tank suction lines has been installed. This clean water source can be aligned to the RCIC alternate suction connection via manually deployed fire hose between the Water Treatment Building and Unit 1 Aux. Building.

Use of about 650 feet of hose connected at the drain line off each tank was evaluated and verified by FATHOM calculation, (Reference 13), to flow adequately from the tank to the pump suction with gravity (unboosted) head – no booster pump is required, a diesel driven pump is provided to allow use of Mixed-Bed and Two-Bed water for RPV injection. The use of the connection point in the Water Treatment Building is considered bounding as it replaces a portion of the fire hose with the use of installed piping (reduced frictional losses). It is likewise considered bounding from an operational standpoint because the Water Treatment Building connection requires less manual hose deployment and is more easily accessed than the base of the Mixed-Bed and Two-Bed Demineralized Water tanks.

Modifications

- Install pipe connections Mix Bed Tank transfer pump suction line in Water Treatment Building 620'
- Install pipe connections Two Bed Tank transfer pump suction line in Water Treatment Building 620'

System Alignment

With the RCIC pump aligned with suction from the Suppression Pool, the manual isolation valve at the Mix Bed / Two Bed Tanks supply piping hose connection and two manual isolation valves at the RCIC suction hose connection (3 total) are opened, pressurizing the hoses and piping to the RCIC suction line.

Routing

Refer to Appendix Figure E series for routing information per the following links:

36.0 APPENDIX: Figure E-1B RCIC Suction Connection Point

37.0 APPENDIX: Figure E-2: Two Bed / Mixed Bed Storz Connector Location

38.0 APPENDIX: Figure E-2A: Two Bed / Mixed Bed Storz Connector Location

39.0 APPENDIX: Figure E-2C: Two Bed / Mixed Bed Storz Connector Location

40.0 APPENDIX: Figure E-2D: Exterior Hose Path from Mixed Bed Tank

41.0 APPENDIX: Figure E-3: Interior Hose Path from Mixed Bed to the RCIC Suction Connection

42.0 APPENDIX: Figure E-3A: Interior Hose Path from RHR to FPCC Return Header to the RCIC Suction Connection

43.0 APPENDIX: Figure E-3B: Interior Hose Path from ESW A to the RCIC Suction Connection

44.0 APPENDIX: Figure E-4: Aux Building Dry Standpipes

45.0 APPENDIX: Figure E-5 Mechanical FLEX Equipment and Modifications Photos

46.0 APPENDIX: Figure E-6: LPCS / HPCS Storz Connection Points

47.0 APPENDIX: Figure E-7 Simplified Unit 1 and Unit 2 Divisional AC busses without modifications

48.0 APPENDIX: Figure E-8 Simplified Unit 1 Division 1 Electrical

49.0 APPENDIX: Figure E-9 Simplified Unit 1 Division 2 Electrical

50.0 APPENDIX: Figure E-10 Simplified Unit 1 Division 3 Electrical

51.0 APPENDIX: Figure E-11 Simplified Unit 2 Division 1 Electrical

52.0 APPENDIX: Figure E-12 Simplified Unit 2 Division 2 Electrical

53.0 APPENDIX: Figure E-13 Simplified Unit 2 Division 3 Electrical

54.0 APPENDIX: Figure E-14 Simplified Electrical Modifications

55.0 APPENDIX: Figure E-15 Termination Enclosure 1X11-S0001

56.0 APPENDIX: Figure E-16 Transfer Switch 1R25-S0291

57.0 APPENDIX: Figure E-17 Transfer Switch 1R25-S0174

58.0 APPENDIX: Figure E-18 Transfer Switch 1R25-S0292

59.0 APPENDIX: Figure E-18-A: FLEX Electrical Equipment and Modification Photos:

60.0 APPENDIX: Figure E-19 Termination Enclosure 1X11-S0001 to Bus EH21 Feeder

61.0 APPENDIX: Figure E-20 Alternate Supply to Bus EH11

62.0 APPENDIX: Figure E-22 Alternate Supply to Bus EH12

63.0 APPENDIX: Figure E-23 Alternate Supply to Bus EH13

64.0 APPENDIX: Figure E-24 Alternate Supply to Bus TH21

65.0 APPENDIX: Figure E-25 Alternate Supply to Transformer EHF2A

66.0 APPENDIX: Figure E-26 Primary Suppression Pool Closed Loop Cooling Flow Path

Valve manipulations

With the RCIC pump aligned with suction from the Suppression Pool, the manual isolation valve at the Mix Bed / Two Bed Tanks supply piping hose connection and two manual isolation valves at the RCIC suction hose connection (3 total) are opened, pressurizing the hoses and piping to the RCIC suction valve from the CST. An inline check valve installed in the supply piping prevents flow water from flowing back to the CST or Suppression Pool.

Equipment Required

The Equipment requirements are the same as the Primary Connection Point with the following additional equipment:

- Additional 450' of 5 inch fire hose
- Portable 250 gpm diesel driven pump (optional)

Storage Requirement

The Storage requirements are the same as the Primary Connection Point.

Deployment

The Deployment actions are the same as the Primary Connection Point.

Fuel Requirement

The Fuel Requirements are the same as the Primary Connection Point with the addition of 1.5 gph of fuel oil for the portable pump, if used. No Fuel requirements if using gravity drain.

8.1.3.d Low Pressure Core Cooling

If RCIC operation is not available, the EOPs will lower RPV pressure to allow low-pressure injection systems to feed the RPV. The HPCS and LPCS systems contain flush connections that connect into the system between the pump and injection valve. The HPCS system has a previously installed 5-inch Storz connection used for “Fast Firewater” and Alternate Boron Injection. The LPCS has a flush line similar to the HPCS connection, and this line was modified to accept a standard fire hose for low-pressure vessel injection. Either of these connection points can be aligned to alternate sources for RPV Injection. ESW A and ESW B systems have a new 5 inch Storz connection on the Aux Building Elevation 599' that are designed to provide approximately 1000 gpm to the HPCS or LPCS systems via the installed Dry Stand Pipes. The Mix Bed / Two

Bed tanks have a new 5 inch Storz connection on the Water Treatment Building Elevation 620' that can provide high quality water to the HPCS or LPCS systems (via the installed Dry Stand Pipe(s) for LPCS) and provide a source of water for Standby Liquid Control (SLC) pumps (these actions requires a portable pump to be used at the connection point).

Fire Water Hydrants in the Yard area can provide approximately 2000 gpm to the HPCS or LPCS systems as part of a non-credited strategy.

8.1.3.d.1 Primary Connections

A fire hose from the alternate water source via ESW A (B) could inject directly into the RPV once the manual flush water valve (FLUSH WTR TO LPCS PUMP DISCH LINE) is opened and the AC MOV LPCS injection valve (LPCS INJECTION VALVE) is opened either electrically from the Control Room or locally. Makeup to the Suppression Pool is also possible via this hose connection.

LPCS discharges into the RPV inside the shroud through the LPCS spray ring. If RCIC is or becomes unavailable, a hose connection on the LPCS pump discharge piping is provided for vessel injection to allow for the use of an alternate water source on Aux Building, Elevation 620' East Side. This connection allows the LPCS system piping to be connected to the ESW supply piping connection on Aux Building, Elevation 599' via one of two dry standpipes that run from Aux Building, Elevation 620' to the Aux Building, Elevation 574' (568') with connection points on each floor.

Mix Bed / Two Bed tanks can be used to supply LPCS as an alternative that is non-robust. ESW A or ESW B can supply LPCS with lake water and is a robust long-term raw water supply.

Modifications

The 6 inch LPCS flush line, at Auxiliary Building Elevation 620' has a 6-inch isolation valve to a new 5-inch Storz connection. The connection off the LPCS line has a double isolation valve configuration with the inboard isolation valve serving as the ASME Code and Safety Class break. The outboard isolation valve and Storz connection are seismically designed and installed but are non-safety (non-ASME).

System Alignment

A fire hose from an alternate water source (Mix Bed / Two Bed Tank, ESW A, ESW B) is connected to the 5-inch Storz connection on the LPCS flush line.

Water is then injected directly into the RPV once the new manual isolation valve and the manual flush water valve (1E21-F025) are opened; the LPCS injection valve (1E21-F005) is opened either electrically from the Control Room or locally.

FLEX pumps in the ESWPH supply approximately 2000 gpm of lake water to the ESW system during Phase 2 of the event. A new 5 inch Storz connection on ESW A(B) is then connected to the new LPCS 5 inch Storz connection on Aux Building 620' via the new Dry Stand Pipe installed in the Aux building.

Routing

Refer to Appendix Figure E series for routing information per the following links:

36.0 APPENDIX: Figure E-1B RCIC Suction Connection Point

37.0 APPENDIX: Figure E-2: Two Bed / Mixed Bed Storz Connector Location

38.0 APPENDIX: Figure E-2A: Two Bed / Mixed Bed Storz Connector Location

39.0 APPENDIX: Figure E-2C: Two Bed / Mixed Bed Storz Connector Location

40.0 APPENDIX: Figure E-2D: Exterior Hose Path from Mixed Bed Tank

41.0 APPENDIX: Figure E-3: Interior Hose Path from Mixed Bed to the RCIC Suction Connection

42.0 APPENDIX: Figure E-3A: Interior Hose Path from RHR to FPCC Return Header to the RCIC Suction Connection

43.0 APPENDIX: Figure E-3B: Interior Hose Path from ESW A to the RCIC Suction Connection

44.0 APPENDIX: Figure E-4: Aux Building Dry Standpipes

45.0 APPENDIX: Figure E-5 Mechanical FLEX Equipment and Modifications Photos

46.0 APPENDIX: Figure E-6: LPCS / HPCS Storz Connection Points

47.0 APPENDIX: Figure E-7 Simplified Unit 1 and Unit 2 Divisional AC busses without modifications

48.0 APPENDIX: Figure E-8 Simplified Unit 1 Division 1 Electrical

49.0 APPENDIX: Figure E-9 Simplified Unit 1 Division 2 Electrical

50.0 APPENDIX: Figure E-10 Simplified Unit 1 Division 3 Electrical

51.0 APPENDIX: Figure E-11 Simplified Unit 2 Division 1 Electrical

52.0 APPENDIX: Figure E-12 Simplified Unit 2 Division 2 Electrical

53.0 APPENDIX: Figure E-13 Simplified Unit 2 Division 3 Electrical

54.0 APPENDIX: Figure E-14 Simplified Electrical Modifications

55.0 APPENDIX: Figure E-15 Termination Enclosure 1X11-S0001

56.0 APPENDIX: Figure E-16 Transfer Switch 1R25-S0291

57.0 APPENDIX: Figure E-17 Transfer Switch 1R25-S0174

58.0 APPENDIX: Figure E-18 Transfer Switch 1R25-S0292

59.0 APPENDIX: Figure E-18-A: FLEX Electrical Equipment and Modification Photos:

60.0 APPENDIX: Figure E-19 Termination Enclosure 1X11-S0001 to Bus EH21 Feeder

61.0 APPENDIX: Figure E-20 Alternate Supply to Bus EH11

62.0 APPENDIX: Figure E-22 Alternate Supply to Bus EH12

63.0 APPENDIX: Figure E-23 Alternate Supply to Bus EH13

64.0 APPENDIX: Figure E-24 Alternate Supply to Bus TH21

65.0 APPENDIX: Figure E-25 Alternate Supply to Transformer EHF2A

66.0 APPENDIX: Figure E-26 Primary Suppression Pool Closed Loop Cooling Flow Path

Valve Manipulations

The Dry Stand Pipe to the LPCS hose connection, the two manual isolation valves at the ESW A(B) supply piping hose connection, East Dry Stand pipe isolation valve, and two manual isolation valves (1X11-F018 1E21-F025) at the LPCS hose connection (6 total) are opened, pressurizing the hoses and piping to the LPCS pump discharge piping. The LPCS injection valve (1E21-F005) is opened either electrically from the Control Room or locally to commence injection into the RPV. Note: this lineup can also add water to the Suppression Pool by opening of the LPCS test return valve, 1E21-F012.

Equipment Requirements

Flow rate for this path to the RPV is assumed to be 1000 gpm during Phase 2. The LPCS MOVs are remotely operable if power is available but can be manually cycled if necessary. Table 8.1-6 provides the equipment required.

Table 8.1-6: Primary Equipment Requirements for the LPCS Low Pressure RPV Connection

Storz connector	Standard 5 inch with end cap
Isolation/control valve	Ball Valve, 6 inch
5 inch fire hose (ESW A)	2 -100 foot hoses
5 inch fire hose (ESW B)	3 -100 foot hoses

Storage Requirements

The hoses are stored locally in the Auxiliary Building.

Deployment

This hose for the ESW to LPCS / HPCS connection should be deployed during Phase 1 for prompt Phase 2 use for RPV feed.

Fuel Requirements

The diesel fuel oil supply for Phase 2 is described in Section 8.6.

8.1.3.d.2 Secondary Connection

HPCS discharges into the RPV inside the shroud through the HPCS spray ring. If RCIC is or becomes unavailable, a hose connection on the HPCS pump discharge piping to allow for the use of an alternate water source on Aux Building, Elevation 620’ West Side. This connection allows the HPCS system piping to be connected to the ESW supply piping connection on Aux Building, Elevation 599’ via one of two dry standpipes that run from Aux Building, Elevation 620’ to the Aux Building, Elevation 574’ (568’) with connection points on each floor. Note: This connection point is pre-existing (no modifications required) for alternate injection as directed by the EOPs.

Modifications

The HPCS system requires no modification for FLEX. The existing 5 inch Storz connection is considered robust for all FLEX events.

System Alignment

A fire hose from an alternate water source (Mix Bed / Two Bed Tank, ESW A, ESW B) is connected to the 5-inch Storz connection on the HPCS flush line. Water is then injected directly into the RPV once the manual flush water valve (1E22-F031) is opened; the HPCS injection valve (1E22-F004) is opened either electrically from the Control Room or locally. The duration before this alternate water source is available is at about 6 hours from t=0. Makeup to the Suppression Pool is also possible via this hose connection.

Routing

Refer to Appendix Figure E series for routing information per the following links:

36.0 APPENDIX: Figure E-1B RCIC Suction Connection Point

37.0 APPENDIX: Figure E-2: Two Bed / Mixed Bed Storz Connector Location

38.0 APPENDIX: Figure E-2A: Two Bed / Mixed Bed Storz Connector Location

39.0 APPENDIX: Figure E-2C: Two Bed / Mixed Bed Storz Connector Location

40.0 APPENDIX: Figure E-2D: Exterior Hose Path from Mixed Bed Tank

41.0 APPENDIX: Figure E-3: Interior Hose Path from Mixed Bed to the RCIC Suction Connection

42.0 APPENDIX: Figure E-3A: Interior Hose Path from RHR to FPCC Return Header to the RCIC Suction Connection

43.0 APPENDIX: Figure E-3B: Interior Hose Path from ESW A to the RCIC Suction Connection

44.0 APPENDIX: Figure E-4: Aux Building Dry Standpipes

45.0 APPENDIX: Figure E-5 Mechanical FLEX Equipment and Modifications Photos

46.0 APPENDIX: Figure E-6: LPCS / HPCS Storz Connection Points

47.0 APPENDIX: Figure E-7 Simplified Unit 1 and Unit 2 Divisional AC busses without modifications

48.0 APPENDIX: Figure E-8 Simplified Unit 1 Division 1 Electrical

49.0 APPENDIX: Figure E-9 Simplified Unit 1 Division 2 Electrical

50.0 APPENDIX: Figure E-10 Simplified Unit 1 Division 3 Electrical

51.0 APPENDIX: Figure E-11 Simplified Unit 2 Division 1 Electrical

52.0 APPENDIX: Figure E-12 Simplified Unit 2 Division 2 Electrical

53.0 APPENDIX: Figure E-13 Simplified Unit 2 Division 3 Electrical

54.0 APPENDIX: Figure E-14 Simplified Electrical Modifications

55.0 APPENDIX: Figure E-15 Termination Enclosure 1X11-S0001

56.0 APPENDIX: Figure E-16 Transfer Switch 1R25-S0291

57.0 APPENDIX: Figure E-17 Transfer Switch 1R25-S0174

58.0 APPENDIX: Figure E-18 Transfer Switch 1R25-S0292

59.0 APPENDIX: Figure E-18-A: FLEX Electrical Equipment and Modification Photos:

60.0 APPENDIX: Figure E-19 Termination Enclosure 1X11-S0001 to Bus EH21 Feeder

61.0 APPENDIX: Figure E-20 Alternate Supply to Bus EH11

62.0 APPENDIX: Figure E-22 Alternate Supply to Bus EH12

63.0 APPENDIX: Figure E-23 Alternate Supply to Bus EH13

64.0 APPENDIX: Figure E-24 Alternate Supply to Bus TH21

65.0 APPENDIX: Figure E-25 Alternate Supply to Transformer EHF2A

66.0 APPENDIX: Figure E-26 Primary Suppression Pool Closed Loop Cooling Flow Path

Valve Manipulations

With the hose connections between the ESW A (B) connection to the Dry Stand Pipe, and the Dry Stand Pipe to the HPCS hose connection, the two manual isolation valves at the ESW A (B) supply piping hose connection, West Dry Stand pipe isolation valve, and the manual isolation valve (1E22-F031) at the HPCS hose connection (5 total) are opened, pressurizing the hoses and piping to the HPCS pump discharge piping. The HPCS injection valve (1E22-F004) is opened either electrically from the Control Room or locally to commence injection into the RPV. Note: this lineup can also add water to the Suppression Pool by opening of the HPCS test return valve, 1E22-F023.

Equipment Required

The Equipment requirements are the same as the Primary Connection Point.

Storage Requirement

The Storage requirements are the same as the Primary Connection Point.

Deployment

The Deployment actions are the same as the Primary Connection Point.

Fuel Requirement

The Fuel Requirements are the same as the Primary Connection Point.

8.1.3.d.3 Secondary Non-Robust Connections

Other, non-robust water source to Core Spray systems may be available from the mixed bed tank or the two-bed tank after the event. These tanks are located just outside the protected area fence north of the Primary Access Facility on the West side of the plant. These tanks are used via a new hose connection located on transfer pump suction lines from the tanks. Each tank has a transfer pump suction line in the Water Treatment Building. A new 5-inch Storz connection that can be aligned to either or both tank suction lines has been installed.

LPCS

Approximately 600 foot of fire hose is run from the hose connection in the Water Treatment Building Elev 620’, down the Unit 1 Interbus Alleyway to the Unit 1 Aux Building Elev 599’ using the West Stairwell to the East Dry Stand Pipe connection on Aux Building Elevation 599’. A hose is connected from the East Dry Stand Pipe connection and run to the LPCS hose connection on Aux Building Elevation 620’. An inline portable pump will be required to provide motive flow for RPV Injection but is not required for injection into the Suppression Pool.

HPCS

Approximately 500 foot of fire hose is run from the hose connection in the Water treatment building Elev 620’, down the Unit 1 Interbus Alleyway to the Unit 1 Aux Building to the HPCS hose connection on Aux Building Elevation 620’. An inline portable pump will be required to provide motive flow for RPV Injection but is not required for injection into the Suppression Pool.

The isolation valves and 5-inch Storz connection at Water Treatment Building 620' are installed at an accessible height

Modifications

- Install pipe connections Mix Bed Tank transfer pump suction line in Water Treatment Building 620'
- Install pipe connections Two Bed Tank transfer pump suction line in Water Treatment Building 620'

System Alignment

System alignments are the same as the Primary and Secondary connection points with the exception of hooking the supply hose to the Mix Bed / Two Bed Demin water tank connection in the Water treatment building with the portable 250 gpm pump installed in line.

Routing

Refer to Appendix Figure E series for routing information per the following links:

36.0 APPENDIX: Figure E-1B RCIC Suction Connection Point

37.0 APPENDIX: Figure E-2: Two Bed / Mixed Bed Storz Connector Location

38.0 APPENDIX: Figure E-2A: Two Bed / Mixed Bed Storz Connector Location

39.0 APPENDIX: Figure E-2C: Two Bed / Mixed Bed Storz Connector Location

40.0 APPENDIX: Figure E-2D: Exterior Hose Path from Mixed Bed Tank

41.0 APPENDIX: Figure E-3: Interior Hose Path from Mixed Bed to the RCIC Suction Connection

42.0 APPENDIX: Figure E-3A: Interior Hose Path from RHR to FPCC Return Header to the RCIC Suction Connection

43.0 APPENDIX: Figure E-3B: Interior Hose Path from ESW A to the RCIC Suction Connection

44.0 APPENDIX: Figure E-4: Aux Building Dry Standpipes

45.0 APPENDIX: Figure E-5 Mechanical FLEX Equipment and Modifications Photos

46.0 APPENDIX: Figure E-6: LPCS / HPCS Storz Connection Points

47.0 APPENDIX: Figure E-7 Simplified Unit 1 and Unit 2 Divisional AC busses without modifications

48.0 APPENDIX: Figure E-8 Simplified Unit 1 Division 1 Electrical

49.0 APPENDIX: Figure E-9 Simplified Unit 1 Division 2 Electrical

50.0 APPENDIX: Figure E-10 Simplified Unit 1 Division 3 Electrical

51.0 APPENDIX: Figure E-11 Simplified Unit 2 Division 1 Electrical

52.0 APPENDIX: Figure E-12 Simplified Unit 2 Division 2 Electrical

53.0 APPENDIX: Figure E-13 Simplified Unit 2 Division 3 Electrical

54.0 APPENDIX: Figure E-14 Simplified Electrical Modifications

55.0 APPENDIX: Figure E-15 Termination Enclosure 1X11-S0001

56.0 APPENDIX: Figure E-16 Transfer Switch 1R25-S0291

57.0 APPENDIX: Figure E-17 Transfer Switch 1R25-S0174

58.0 APPENDIX: Figure E-18 Transfer Switch 1R25-S0292

59.0 APPENDIX: Figure E-18-A: FLEX Electrical Equipment and Modification Photos:

60.0 APPENDIX: Figure E-19 Termination Enclosure 1X11-S0001 to Bus EH21 Feeder

61.0 APPENDIX: Figure E-20 Alternate Supply to Bus EH11

62.0 APPENDIX: Figure E-22 Alternate Supply to Bus EH12

63.0 APPENDIX: Figure E-23 Alternate Supply to Bus EH13

64.0 APPENDIX: Figure E-24 Alternate Supply to Bus TH21

65.0 APPENDIX: Figure E-25 Alternate Supply to Transformer EHF2A

66.0 APPENDIX: Figure E-26 Primary Suppression Pool Closed Loop Cooling Flow Path

Valve manipulations

LPCS

With the hose connections between the Mix Bed / Two Bed Tank connection to the West Dry Stand Pipe, a hose ran from the West Dry Stand Piper to the East Dry Standpipe, and the East Dry Stand Pipe to the LPCS hose connection, the manual isolation valve at the Mix Bed / Two Bed connection hose connection, West Dry Stand pipe isolation valves, and two manual isolation valves (1X11-F018, 1E21-F025) at the LPCS hose connection (8 total) are opened, the inline pump is started pressurizing the hoses and piping to the LPCS pump discharge piping. The LPCS injection valve (1E21-F005) is opened either electrically from the Control Room or locally to commence injection into the RPV. Note: this lineup can also add water to the Suppression Pool by opening of the LPCS test return valve (1E21-F012).

HPCS

With the HPCS hose connections between the Mix Bed / Two Bed Tank connection to the HPCS hose connection, the manual isolation valves at the Mixed Bed / Two Bed Tank connection, and the manual isolation valve (1E22-F031) at the HPCS connection (3 total) are opened, the inline pump is started pressurizing the hoses and piping to the HPCS pump discharge piping. The HPCS injection valve (1E22-F004) is opened either electrically from the Control Room or locally to commence injection into the RPV. Note: this lineup can also add water to the Suppression Pool by opening of the HPCS test return valve, (1E22-F023).

Equipment Required

The Equipment requirements are the same as the Primary Connection Point with the following additional equipment:

- Additional 450' of 5 inch fire hose
- Portable 250 gpm diesel driven pump (if required)

Storage Requirement

The Storage requirements are the same as the Primary Connection Point.

Deployment

The Deployment actions are the same as the Primary Connection Point.

Fuel Requirement

The Fuel Requirements are the same as the Primary Connection Point with the addition of 1.5 gph of fuel oil for the portable pump.

8.1.4 Phase 3

By Phase 3, 4160 Vac generators will have arrived from the NSRC. They will be connected to the Distribution Center in parallel with the on-site FLEX generators or directly to the critical bus needing to be energized if the Distribution center is not available. No additional plant modifications are needed for Phase 3 activities.

8.2 REACTOR CORE COOLING (MODE 4 / 5 - REFUELING)

8.2.1 Phase 1

Reactor Core Cooling – Mode 4-5 Vessel Disassembly

If the postulated FLEX event starts while the plant is in Mode 4 with the RCIC system out of service during RPV disassembly (head spray piping detensioned or removed), RPV level is normally at the RPV flange (to provide shielding to workers). As decay heat removal would be lost, the RPV will slowly heat up and the plant will transition to Mode 3. RPV level during this time core uncover is not challenged as the Plant Data Book PDB-A0019, Time-To-Core Uncovery Curves, gives a time to uncover (time to reach TAF) with RPV level initially at the RPV upper flange, 140 degrees RPV water temperature, and assuming decay heat load at 48 hours post shutdown (60 MBTU/hour) of approximately 10 hours. This is bounding for vessel disassembly as RPV water temperature is maintained below 140 degrees during these activities. The time line to restore power to the SPCU pump or the ADHR pump is 6 hours.

With a loss of normal decay heat removal, ONI-E12-2 Loss Of Decay Heat Removal is entered and ONI-SPI E-1, Containment/Fuel Handling Building Closure, will direct actions to prevent an uncontrolled release external to the closure envelope. There may be brief periods during Mode 5 / Refueling when containment integrity might be required, such as during an operation with a potential to drain the reactor vessel. If a BDBEE occurred during these times, the containment function would not be challenged based on containment response analysis performed for Modes 1 through 4, which uses cases bounding for Mode 5 due to the decrease in decay heat rate. If containment integrity were established in Mode 5, guidance of the EOPs would detail operator actions for maintaining containment pressure below the Primary Containment Pressure Limit (PCL) by venting the containment to the SFP in the Fuel Handling Building. The FHB will be vented per the action to provide a vent path for the SFP. If primary containment integrity cannot be established the openings in primary containment provide a vent path that precludes containment pressurization.

8.2.2 Phase 2

Reactor Core Cooling – Mode 4-5 Vessel Disassembly

Once AC power is restored, RPV water level can be maintained by use of injection via ONI-SPI E-4, ADHR Alternate Injection or EOP-SPI 4.3, FPCC Header Alternate Injection using the SPCU pump. Once RPV injection is established, SRVs can be opened to allow water to flow back to the Suppression Pool. Once water is circulating from the Suppression Pool to the Suppression Pool via the RPV, vessel decay heat is transferred to the Suppression Pool. Control of Suppression Pool temperature is the same as in Mode 1-3 with SPCU or ADHR being used in SPCLC; the only difference is the flow path will not return to the Suppression Pool via the RHR TEST VALVE TO SUPR POOL, 1E12-F024, but will inject into the RPV via the LPCI INJECTION VALVE, 1E12-F042. The disassembled portions of the RPV pose a release path from the RPV to the Containment Building. With a loss of normal decay heat removal, ONI-E12-2 Loss Of Decay Heat Removal is entered and ONI-SPI E-1, Containment/Fuel Handling Building Closure will direct actions to prevent an uncontrolled release external to the closure envelope. Note that this is a very small time window of vulnerability. There may be brief periods during Mode 5 / Refueling when containment integrity might be required, such as during an operation with a potential to drain the reactor vessel. If a BDBEE occurred during these times, the containment function would not be challenged based on containment response analysis performed for Modes 1 through 4, which uses cases bounding for Mode 5 due to the decrease in decay heat rate. If containment integrity were established in Mode 5, guidance of the EOPs would detail operator actions for maintaining containment pressure below the Primary Containment Pressure Limit (PCL) by venting the containment to the SFP in the Fuel Handling Building. The FHB will be vented per the action to provide a vent path for the SFP. If primary containment integrity cannot be established the openings in primary containment provide a vent path that precludes containment pressurization.

Reactor Core Cooling – Mode 5 Flooded Up / At All Times

In Mode 5, the RPV will be flooded to the vessel flange (minimum water height). If water level in the upper pools is below 22' 9" above the RPV flange the ADHR pump will be used to maintain RPV level and flood the upper pools using ONI-SPI E-4, ADHR Alternate Injection or EOP-SPI 4.3, FPCC Header Alternate Injection using the SPCU pump. Once the upper pools are flooded to greater than 22' 9" above the RPV flange FPCC can be used as an alternate decay heat removal system. An estimation of time to core uncovery was performed with RCIC unavailable with the vessel flooded to the vessel flange showed that approximately 10 hours was required. This allows adequate time to arrange low-pressure core cooling and other responses as Phase 2 or Phase 3 actions using FLEX equipment.

Normal heat removal from the RPV during this period is provided by the FPCC system by circulating water from the upper pools through the FPCC HXs to remove the decay heat from the Reactor Core. Additionally water from the SFP is also circulated through the FPCC HXs at the same time to remove heat from the Spent Fuel Pool.

With a loss of normal decay heat removal, ONI-E12-2 Loss Of Decay Heat Removal is entered and ONI-SPI E-1, Containment/Fuel Handling Building Closure will direct actions to prevent an uncontrolled release external to the closure envelope.

Establishing FPCC cooling to the upper pools in Mode 5 provide sufficient heat removal to suppress boiling in Mode 5. From the USAR (Reference 4) on the Design Function of the FPCC system: The maximum abnormal heat load is 46.8 x 106 Btu/hr. This value is the sum of the decay heat from 3,388 bundles discharged over an eight year period, plus a sequential full core off-load which fills the fuel handling pools in the area of the intermediate building (4,020 bundles) and stores 116 bundles in the containment pool <Table 9.1-2>. With both FPCC system pumps and HXs operating, the pool temperature will rise to 154°F. This value is derived from a conservative analysis that overestimates the heat loading by approximately 13%. Under realistic conditions, the pool temperature will not exceed 150°F. **[AI-5. The final design will demonstrate the capability to provide sufficient flow to the core to suppress boiling in Mode 5 ELAP. AI-5 Closed]**

8.2.3 Phase 3

By Phase 3, 4160 Vac generators will have arrived from the NSRC. They will be connected to the Distribution Center in parallel with the on-site FLEX generators or directly to the critical bus needing to be energized if the Distribution center is not available. No additional plant modifications are needed for Phase 3 activities. RHR can be placed into service to allow additional heat removal capacity. FSG 30.5, RHR A FLEX Containment Cooling, FSG 30.6, RHR B FLEX Containment Cooling, FSG 30.7, RHR A FLEX RPV Cooling, and FSG 30.8 RHR B FLEX RPV Cooling provide guidance on operation of RHR during a FLEX event.

8.3 CONTAINMENT FUNCTION

8.3.1 Phase 1

During Phase 1, the containment pressure and Suppression Pool temperature would increase to ~12 psig and 225°F, respectively at hour 6 as the Suppression Pool water absorbs the reactor's decay heat and the operators partially depressurize to ~200 psig (Reference 14). This is within the containment design pressure of 15 psig, but exceeds the Suppression Pool temperature limit of 185°F. The containment suppression pool design temperature of 185 deg F for pool will be exceeded before 6 hours regardless of the actions that can be taken in Phase 1. The limit normally comprises part of the consideration in maintaining containment integrity. Evaluation shows that Suppression Pool temperature will exceed the 185 degrees and the RCIC coping study shows that there is no impact to RCIC being able to cope with the event.

The Perry Containment response for ELAP conditions is within the accepted transient response of NEDC-33771P Revision 1 and NEDO-33771 Revision 1, Boiling Water Reactors Owners' Group Technical Report, "GEH Evaluation of the FLEX Implementation Guidelines", January 2013. Additionally, site-specific analysis for the RCIC System and Containment have been performed within Calculation X11-002 (REFERENCE 52) and X11-011 (Reference 53), respectively. **[AI-10. Perry to apply industry evaluation of exceeding containment design temperature limit during an ELAP. AI-10 Closed.]**

Mode 5 / Refueling

There may be brief periods during Mode 5 / Refueling when containment integrity might be required, such as during an operation with a potential to drain the reactor vessel. If a BDBEE occurred during these times, the containment function would not be challenged based on containment response analysis performed for Modes 1 through 4, which uses cases bounding for Mode 5 due to the decrease in decay heat rate. If containment integrity were established in Mode 5, guidance of the EOPs would detail operator actions for maintaining containment pressure below the Primary Containment Pressure Limit (PCL) by venting the containment to the SFP in the Fuel Handling Building. The FHB will be vented per the action to provide a vent path for the SFP. If primary containment integrity cannot be established the openings in primary containment provide a vent path that precludes containment pressurization.

8.3.2 Phase 2

8.3.2.a Primary Connection

General Description

Decay heat is removed from the RPV during an ELAP in Modes 1-4 via steam through one or more SRVs to the Suppression Pool. Additional coping time until containment heat removal can be established is achieved by dumping the upper pools to the Suppression Pool by opening valves 1G43-F030A(B) and 1G43-F040 A(B) to establish a flow path from the upper pools to the Suppression Pool. 1G43-F030A(B) and 1G43-F040 A(B) are located in containment and are not accessible for local operation in mode 1-4 (due to containment response in these modes) but remain accessible in Mode 5 and "At All Times." Remote operation of these valves is performed when Either Division 1 480 Vac busses or Division 2 480 Vac busses are re-energized. The method of heat removal from the containment during Phase 2 is to perform SPCLC. Cool water from the alternate water source and water from the upper containment pool can also be added to the Suppression Pool to increase inventory and reduce overall bulk temperature. During Phase 2, heated water is pumped from the Suppression Pool to the RHR system back to the Suppression Pool using either the SPCU or ADHR pump. This provides a modified RHR SPC flow path called SPCLC. The difference between the designed RHR SPC and SPCLC is that process water flow is established using either the SPCU or the ADHR pumps at lower flow rates than provided by the RHR pump and the RHR HX ESW flows are lower than the flow rates provide by the ESW Pump. The method of containment heat removal as evaluated by PERRY Unit 1 Supplemental FLEX Coping Time Analysis, LTR-US-BWR-14-18 (Reference 37).

An alternative (non-credited) method of Containment Cooling is "Suppression Pool Feed and Bleed". In this method, cooler water is added to the Suppression Pool (Feed) while hotter water is pumped from the Suppression Pool (Bleed) to a retention volume. Feed water is provided by Core Spray (LPCS/HPCS) Lake Water injection into the Suppression Pool and Bleed is provided by pumping from the Suppression Pool water to the condenser using either the SPCU or ADHR pumps via the CST makeup and dump lines to the Main Condenser. This is not a credited strategy as is it requires non-seismic equipment for use as a storage volume and is only included to provide diversity. Note that other retention volumes may also be used if available during the event.

Containment integrity is maintained by keeping containment atmospheric pressure less than the design limit of 15 psig. In Phase 1 and 2, three containment penetrations are of concern: Upper Pool drain line, Drywell Backup Purge Line, and the MSIV before seat drain line. The Upper Pool drain line needs to be isolated by manual closure of the 1G41-F145 (Containment Pools Return Outboard Isolation) valve to eliminate an air vent path from containment to the Fuel Handling Building. The Drywell Backup Purge Line needs to be isolated by manual closure of the 1M51-F110 (D/W PURGE OTBD ISOL VALVE) valve to eliminate an air vent path from the drywell to the Intermediate Building.

The MSIV before seat drain line needs to be isolated by manual closure of the 1B21-F019 (MSL DRN & MSIV BYP OTBD ISOL VALVE) valve to eliminate a steam vent path from the RPV to the condenser.

In a Mode 5 / At All Times Containment heat removal is provided by the strategies of Section 5.4 Reactor Core Cooling Mode 5 / At All Times.

Description of Procedures / Strategies / Guidelines

SPMU

In Phase 2 at about t=6, electrical power is available to vital 480 Vac busses in Division 1 or Division 2. This electrical power will be used to initiate the Suppression Pool Makeup System (SPMU) to transfer approximately 265,000 gallons of water from the upper pools to the Suppression Pool per the design function of the SPMU system. If the SPMU system is not available inventory can be added to the Suppression Pool from the CST via gravity feed (if the CST remains available) or from ESW via the FLEX pumps in the ESWPH. CST gravity drain is accomplished using normal plant piping and is not credited due to the CST not being" robust".

SPCU Suppression Pool Closed Loop Cooling

The SPCLC method of heat removal is established by establishing flow through the RHR system using either the SPCU pump or the ADHR pump to replace the RHR pump. Note: Either loop of RHR can be used for SPCLC.

Mode 5 / Refueling

There may be brief periods during Mode 5 / Refueling when containment integrity might be required, such as during an operation with a potential to drain the reactor vessel. If a BDBEE occurred during these times, the containment function would not be challenged based on containment response analysis performed for Modes 1 through 4, which uses cases bounding for Mode 5 due to the decrease in decay heat rate. If containment integrity were established in Mode 5, guidance of the EOPs would detail operator actions for maintaining containment pressure below the Primary Containment Pressure Limit (PCL) by venting the containment to the SFP in the Fuel Handling Building. The FHB will be vented per the action to provide a vent path for the SFP. If primary containment integrity cannot be established the openings in primary containment provide a vent path that precludes containment pressurization.

Modifications

- Install pipe connections on ESW A and B pipes in the ESWPH
- Install pipe connections on ADHR pump discharge in Aux 574
- Upgrade SPCU to seismically robust for FLEX
- Upgrade ADHR to seismically robust for FLEX
- Install Transfer Switch for SPCU Pump
- Install Alternate supply to the ADHR Transfer switch

System Alignment

The SPCU pump takes a suction on the HPCS suction piping and discharges to the SPCU pump discharge header. The SPCU discharge header is connected to the FPCC to RHR suction header by opening 1G42-F060. The FPCC to RHR suction header is connected to the RHR system at the suction of the RHR Pump by opening 1E12-F066 A (B). To align flow through the RHR system the RHR suction header drain valves (1E12-F071A (B) and the RHR discharge header drain valve, 1E12-F072A (B)) are opened to bypass the RHR pump, the RHR HX inlet and outlet (1E12-F047A (B) and 1E12-F003A (B)) are opened and the Hx bypass (1E12-F048A (B)) is closed. The Test Return to the Suppression Pool (1E12-F024 A (B)) is throttled to control system flow rates.

IF RPV Injection is required in this line up, the RHR RPV Injection valve (1E12F042A(B)) is opened and the Test Return to the Suppression Pool (1E12-F024 A (B)) is throttled to control RPV injection rate to maintain RPV level in the desired band. In this lineup, the outlet of the RHR HX can be aligned to the RCIC CST suction line to provide a robust source of water. When supplying the RCIC system in this line up the isolation valve (1E12-F099 A (B)) to the RHR to FPCC Return Header is opened and the Test Return to the Suppression Pool (1E12-F024 A (B)) is throttled to maintain system flow and provide backpressure to the RCIC turbine supply.

Operation of the FLEX Lake Water pumps is covered in Section 8.1.3

Routing

This lineup uses installed system components.

Equipment Requirements

This strategy uses installed plant equipment no portable equipment is required.

Storage Requirements

This strategy uses installed plant equipment no storage is required.

Deployment

This strategy uses installed plant equipment no deployment is required.

Fuel Requirements

This strategy uses installed plant equipment no fuel oil is required.

8.3.2.b Secondary Connection

A non-robust method of containment heat removal for Modes 1-4 will be to pump in cool lake water (feed) via ESW A (B) into the Unit 1 Suppression using the LPCS Storz connection or HPCS Storz connection, and pump out (bleed) warmer water from the Unit 1 Suppression Pool to the Condenser, CST or other storage tank using the SPCU or ADHR pump. There is approximately 350,000 gallons of storage capacity in the Main Condenser, 450,000 gallons of storage capacity in the CST and 450,000 gallons of storage capacity in the Mix Bed / Two Bed Tanks.

Containment heat removal can be achieved for short periods using this method until SPCLC can be established or in Phase 3, when RPV cooling with RHR in SDC mode is established. To allow the coolest water at the RCIC Suppression Pool suction, injection via the LPCS (HPCS) Storz connection and water removal via the SPCU (ADHR) pump will be used. This alignment of injection to suction gives approximately 100 degrees of separation between the injection point and pump suction point.

“Feed” is established using the same system alignments as Section 5.2, Core Spray (LPCS/HPCS) Lake Water Injection. “Bleed” is established using either the SPCU pump or ADHR pump taking a suction on the Suppression Pool and transferring water via installed system piping and/or hose connections to the designated storage volume(s).

Sources of Coolant

The coolant source is Lake Erie, as described in Section 5.2, Core Spray (LPCS/HPCS) Lake Water Injection.

Piping and/or Hose Routing

The flow path to feed the Suppression Pool begins at the FLEX Lake Water Pump in the ESWPH. Section 8.1., Core Spray (LPCS/HPCS) Lake Water Injection details the method of establishing the feed lineup via the Core Spray Systems.

Either bleed paths are to the CST/Hotwell or to the Mix Bed / Two Bed Tanks; other retention volumes may also be available and employed at the direction/decision of the responding plant personnel. The SPCU Pump will take a suction on the Suppression Pool and send the water to the RHR to FPCC Return Header. The RHR to FPCC Return Header is connected to the Upper Pool Drain Down line by opening 1G42-F506. The Upper Pool Drain Down line goes either to the CST via P11-F508 or to the Condenser via the Condensate Makeup And Dump Valves. This flow path is normally used for maintaining Suppression Pool level. The ADHR Pump will take a suction on the Suppression Pool and send the water to the RHR A system via the LPCS to RHR cross connection. The 1E12-F099A is opened to connect the RHR A system to the RHR to FPCC Return Header.

For use of the Mix Bed / Two Bed Tanks a 5-inch Storz connection on the RHR to FPCC Return Header is used to connect to the Mix Bed / Two Bed tank via the 5-inch Storz connection. Once the isolation valves are opened, water can be transferred to the Mix Bed / Two Bed tanks. These tanks will have been used to provide RPV makeup requirements resulting in the tanks being empty and available for storage.

Note: This option will transfer radioactive water to tanks outside the normal power block structure and should only be used to prevent core damage. Hose temperature ratings need to be a reviewed to preclude hose failures. Finally, the demineralized water tanks can also be manually drained via installed tank drain lines to ready the tanks to receive Suppression Pool discharge.

Power Sources

Electrical Power for the FLEX pumps, Motor operated Valves and 480 Vac pumps (SPCU/ADHR) is described in the Electrical Conceptual Report.

Staging Location of Equipment

Staging of Equipment is detailed in Section 5.1 for the FLEX pumps and Section 5.2, for the Feed of the Suppression Pool.

Ventilation Requirements

If available, room fans (with or without cooling) will be operated to circulate are in the affected pump rooms. Portable Room Fans will be used to direct cooler air into the affected pump rooms to provide heat removal.

8.3.3 Phase 3

By Phase 3, a 4160 Vac generator will have arrived from the NSRC and will be connected to the Distribution Center in parallel with the on-site FLEX generators or directly to the a critical bus needing to be energized if the Distribution center is not available. No additional plant modifications are needed for Phase 3 activities. RHR can be placed into service to allow additional heat removal capacity. FSG 30.5, RHR A FLEX Containment Cooling, FSG 30.6, RHR B FLEX Containment Cooling, FSG 30.7, RHR A FLEX RPV Cooling, and FSG 30.8 RHR B FLEX RPV Cooling provide guidance on operation of RHR during a FLEX event.

8.4 CONTAINMENT INTEGRITY

The Perry Mark III containment atmosphere is not inerted and so contains free oxygen during normal operation. An event that overheats the fuel can generate free hydrogen gas that could cause a violent hydrogen/oxygen reaction when within certain concentration ranges. To preclude damage to equipment inside the containment, hydrogen igniters are energized to stimulate early, non-violent reactions of hydrogen and oxygen at low hydrogen concentrations outside the explosive ranges.

During the postulated FLEX event and response, no fuel damage will occur but NEI 12-06 (Reference 2) requires consideration of hydrogen control during FLEX events.

8.4.1 Phase 1

Containment integrity is maintained by keeping containment atmospheric pressure less than the design limit of 15 psig. Containment integrity, in Modes 1 – 4, will be established under total loss of AC conditions by manually closing three valves. The Upper Pool drain line needs to be isolated by manual closure of the 1G41-F145 (Containment Pools Return Outboard Isolation) valve to eliminate an air vent path from containment to the Fuel Handling Building. The Drywell Backup Purge Line needs to be isolated by manual closure of the 1M51-F110 (D/W PURGE OTBD ISOL VALVE) valve to eliminate an air vent path from the drywell to the Intermediate Building. The MSIV before seat drain line needs to be isolated by manual closure of the 1B21-F019 (MSL DRN & MSIV BYP OTBD ISOL VALVE) valve to eliminate a steam vent path from the RPV to the condenser

No action is required in Phase 1 concerning Hydrogen control. The ELAP is not expected to result in core uncovery or Hydrogen generation beyond normal levels.

8.4.2 Phase 2

8.4.2.a Primary Method

Installed Division 1 hydrogen igniters would be repowered to suppress hydrogen buildup in case of zirconium/water reaction from an overheated core. Normal power sources are from the Div 1 vital 480 Vac bus. Either division is adequate for control of hydrogen. With the portable FLEX 4160 Vac generators connected in Phase 2, the current draw from the igniters is considered in the FLEX generator load assessment (Reference 22). Current plant procedures would be used for initiating hydrogen igniter operation. Portable small generators are also available for local 120 Vac operation of the igniters.

8.4.2.b Secondary Method

Division 2 hydrogen igniters are also adequate for control hydrogen concentrations. Like Division 1, these are powered from the 480 Vac vital bus, but small portable generators are available for backup use.

8.4.3 Phase 3

No additional Hydrogen releases are expected in Phase 3. However, the Hydrogen igniters will be available if chemistry grab samples or station procedures warrant the use.

8.5 <u>SPENT FUEL COOLING</u>

The SFP is subject to water loss from seismic sloshing and from boil-off due to lack of cooling of the spent fuel decay heat. Pool inventory makeup, at a flow rate of about 100 gpm, is estimated to be required at >26 hours with maximum heat load (following a full core off-load) after the event to ensure that the racks remain covered.

NEI 12-06 (Reference 2) requires three methods of filling the SFP: Fill from a location external to the pool area, fill using hoses, and fill using spray. The fill from the external location and hoses must be capable of making up for losses due to boil off. A spray capability of at least 250 gpm is also required. To meet these requirements, starting in Phase 2, an emergency makeup system (providing lake water from the FLEX pumps via the ESW system) will be used.

8.5.1 Phase 1

The SFP Sloshing/Time-to-Boil evaluation determines the time required to boil off SFP inventory to a water level of 10 ft above the fuel racks is approximately 122 hours for the normal decay heat load in the pool and 29 hours for the maximum decay heat load in the pool.

Therefore, no coping strategy is required for Phase 1 for SFP cooling. SFP spray and makeup is discussed later in Phase 2. Note that used control blades stored in the SFP will increase radiation levels in the FHB when exposed by water loss, making the FHB inaccessible besides the high temperatures from boiling.

Based upon the evaluation in Calculation X11-006 (Reference 48), no actions are required for SFP cooling in Phase 1.

Modifications

Per Order EA 12-051 (Reference 31) a SFP level monitoring system is required.

8.5.2 Phase 2

The SFP is subject to water loss from seismic sloshing and from boil-off due to lack of cooling of the spent fuel decay heat (Calculation X11-006 (Reference 48). Makeup is estimated to be required at >26 hours with maximum heat load following a full core off-load after the event to ensure that the racks remain covered at a flow rate of about 100 gpm.

Makeup to the SFP is calculated to require approximately 33 gpm for the normal heat load case. NEI 12-06 (Reference 2) requires three methods of filling the SFP: Fill from a location external to the pool area, fill using hoses and fill using spray. The fill from the external location and hoses must be capable of making up for losses due to boil off and the spray flow is 250 gpm. To meet these requirements, starting in Phase 2, an emergency makeup system (providing lake water from the FLEX pumps via the ESW system) is installed.

In Phase 2, the SFP will heat to the boiling point and the level in the pool will continue to reduce. Action will be taken to align make-up to the pool using lake water supplied through the ESW pipes to a new make-up header along the west end of the SFP. Make-up will be established such that pool level and cooling will be maintained throughout the event.

8.5.2.a Primary Connection Point

As described in Section 8.1 a motor driven FLEX Lake Water Pump is staged in the ESWPH. The FLEX Lake Water Pump will be lowered into the ESWPH suction bay, supplied by the lake via the normal or alternate intake structures and through the ESW traveling screens. Hoses will be connected between the FLEX Lake Water Pump and installed Storz connectors on the ESW A Pump discharge piping (or alternately the ESW B Pump discharge piping) to allow the lake water to flow to the Auxiliary and Intermediate Buildings.

A 10 inch supply line from ESW A runs through the Intermediate Building (IB) at Elevation 599'. This line has been tapped prior to the FPCC HX Supply Valve, with an isolation valve before connecting to a hard piping run to an isolation valve for the fill piping and hose supply connection to provide for the hose and spray requirements. FSG 50.3 Fuel Pool Fill Using Emergency Makeup System provides guidance for filling the SFP from a remote location.

Modifications

The 10 inch ESW A and ESW B lines have been tapped and run to a 4-inch ASME Section 3 Code isolation valve. These two 4 inch valves come together into a common 4-inch line. This 4-inch line runs along the SFP deck, thereby providing remote pool makeup without access to the Fuel Handling Building. Prior to this piping entering the Fuel Handling Building, isolation valves are installed and hose connections are provided so that pool makeup can also be achieved via either manually routed hoses, or via deployment of hose-supplied portable spray nozzles.

System Alignment

The fill header can be aligned once the ESW alignments in section 8 are completed and the ESW piping pressurized with the FLEX pumps. Note that the ESW/ECC System isolation valves are administratively (locked) closed to prevent inadvertent injection of lake water into the SFP.

Valve Manipulations

With ESW A train pressurized by the FLEX Lake Water Pump in the ESWPH (see Section 8), open one trains' isolation valve then open the header shutoff valve (both located on Intermediate Building 599' elevation) to begin makeup to the pools (2 manual valves). The final injection valve is administratively maintained (locked) open and is required to be closed if any type of hose makeup is desired (included pool spray). If hoses are to be used, the hose connection isolation valve (located in the Unit 2 AEGTS fan room) will also need to be opened. This results in a total of four manual valve manipulations for hose applications. Three procedures provide guidance on SFP inventory, FSG 50.1, Fuel Pool Fill Using Fire Main or Portable Pump, FSG 50.2, Fuel Pool Spray Using Fire Main or Portable Pump, and FSG 50.3, Fuel Pool Fill Using Emergency Makeup System.

Routing

This lineup uses installed system components for pool makeup. Hose routing is required if any type of hose makeup is desired (included pool spray). If hoses are to be used, the hose connection isolation valve (located in the Unit 2 AEGTS fan room) will also need to be opened

8.5.2.b Secondary Connection Point

The Secondary Connection Point is the same as the primary connection point with the exception of opening the ESW B Supply isolation valve.

Additionally, the above discussed hose connections which serve to provide connections for manually routed/deployed hoses and spray nozzles can also be used to inject other water sources into the SFP without accessing the Fuel Handling Building. This provision, although not credited, ensures that raw water injection into the SFP can be delayed as long as practical.

8.5.3 Phase 3

Makeup for sloshing and boiloff or for rack spraying is discussed in section 8.5.2 above. Lake water to the SFP Emergency Makeup System concurrent with 2000 gpm to the RHR HX and 250 gpm to the RPV is within the capacity of one of the FLEX pumps (Reference 13).

Calculations (Calculation X11-006 (Reference 48)) have shown that initiating makeup flow to the SFP prior to 29 hours will prevent fuel uncovery assuming maximum heat load. This strategy can be continued until the station chooses to restore FPCC.

8.6 SAFETY SUPPORT FUNCTIONS

An overview of the Phase I electric coping strategy is to maintain DC power to critical systems (such as the RCIC System) and essential instrumentation using the current procedural guidance for a loss of Total Loss of AC power (TLAC, per ONI-R10-2 Total Loss of AC Power). These actions are the same as would be performed within the design basis four hour coping period. Note that TLAC actions of ONI-R10 have been moved to a new procedure ONI-R10-2, TLAC and ONI-R10 have been renumbered to ONI-R10-1

The above is done by use of installed on-site equipment (Divisional Batteries and Switchgear). This action requires the cross-tying of Unit 1 and Unit 2 Divisional and BOP batteries by closing the Unit 1 and Unit 2 crosstie breakers per ONI-SPI D-3 and load shedding of non-vital DC loads per ONI-SPI D-2

Note that the DC loads that are removed from service provide power to systems that are non-functional during a TLAC (SBO industry standard). These loads include power to Redundant Reactivity Controls, Station Emergency Diesels, Nuclear Instrument Power inverters, Non vital alarms, etc. Unit 1 and Unit 2 divisional batteries will be cross tied prior to T+30 minutes. Limited battery life (24 plus hours) and the need for electrically-controlled pumps require a transition to Phase 2, where portable generators will be utilized. Phase 2 strategies use installed and portable on-site equipment that will be deployed to plant deployment locations to provide for continued RPV makeup and SFP cooling, as well as power to the FLEX Pumps and vital 480 Vac buses. Portable FLEX generators will provide power to all necessary loads. The electrical equipment will be relied upon throughout Phase 2 and be supplemented by NSRC equipment in Phase 3. The site FLEX generators and the NSRC generators are identical equipment and the FLEX modifications supports up to four generators being used in parallel without need to de-energize vital loads during connection of additional generators. The FLEX Phase 2 generators will provide Unit 2 Division 1 Bus EH-21 with 2.2 MW / 4160 Vac power. Bus EH-21 will then be used to supply power to the FLEX pump(s) in the ESWPH, Unit 2 Division 1 480 Vac busses EF-2-A , EF-2-B, and Bus TH-21. Bus TH-21 is the alternate source power to Unit 1 Division 1 (Bus EH-11), Division 2 (Bus EH-12), and Division 3 (Bus EH-13). Energizing of these busses supplies electrical power to all required Phase 2 and Phase 3 AC equipment and will ensure that vital instrumentation is maintained to monitor core cooling, SFP inventory, and containment integrity.

Phase 3 coping will be achieved using off-site equipment supplied by the NSRC. The additional power available with four generators (two credited from the NSRC) allows an RHR pump to be started and placed into service while ensuring that vital instrumentation is maintained to monitor core cooling, SFP inventory, and containment integrity.

8.6.1 Phase 1

The required RCIC system components (valves and controls required to maintain RPV injection, and essential instrumentation for plant parameters) are fed from Divisional 125 Vdc busses ED-1-A, ED-1-B, and ED-1-C. Bus ED-1-A provides power to RCIC system valves and controls, SRV solenoid power, Division 1 AC breaker controls, and essential instrumentation. Bus ED-1-B provides SRV solenoid power, Division 2 AC breaker controls, and essential instrumentation. Bus ED-1-C provides Division 3 AC breaker controls, and backup essential instrumentation.

Strategic procedural guidance is provided during Phase 1 by the EOPs and Off Normal Instruction ONI-R10-2, Total Loss Of AC Power. The EOPs provide guidance for the operation of RCIC and other mechanical systems during the event by directing performance of ONI-SPIs and FSGs. ONI-R10-2 provides guidance on restoration of electrical power, managing resources and deployment of equipment by directing performance of ONI-SPIs and FSGs.

<u>RPV Injection</u>

Procedural guidance for the operation of RCIC during this Phase is FSG 10.1 RCIC FLEX Operation. This procedure provides for alignment of RCIC to the Suppression Pool, and establishing system flow near rated flow. FSG 90.3 Alternate Room Ventilation provides direction for deployment and operation of a portable fan on the Aux Building 568’ 6” elevation. The portable fan on the Aux Building 568’ 6” is used to blow cooler air into the RCIC pump room thereby providing air exchange in the RCIC pump room as cooler air is blown in and hotter air exits out the normal ventilation penetration in the roof of the room to the RWCU pump room area on the Aux Building 599’ 6” elevation. This portable fan is powered by a dedicated portable generator that is staged at ground level (620’ 6”) and extension cords run to the vent fan on the Aux Building 568’ 6” elevation. When Electrical power is available, the RCIC room cooler will be placed into service to promote airflow within the pump room.

Heatup of the HPCS valve room is controlled by use of portable fans. Procedural guidance for this is FSG 90.3 Alternate Room Ventilation. RCIC system operation is the only heat source in the HPCS pump room.

Temperature in the RCIC room, the HPCS pump room, and other vital plant areas are not expected to challenge system functionality.

RPV Pressure Control

During the initial transient, upon the closure of the MSIVs due to the loss of AC power, SRVs will cycle open causing Low Low Set to activate. Once RPV pressure lowers below the closure setpoint pressure of the SRVs, all SRVs close and pressure is controlled by cycling of the Low Low Set SRV (B21-F051D) on its lowered pressure set point. SRVs are powered by Bus ED-1-A (for Division 1 Solenoids) and Bus ED-1-B (for Division 2 Solenoids). Use of the SRVs for pressure control is addressed by EOP-01, RPV Control.

Control Room Habitability

Heatup of the Control Room is not expected to challenge the ability to use the Control Room during phase 1. When Electrical power is available, either the Control Room Ventilation system will be available or portable fans will be used to provide cooling to the Control Room. Procedural Guidance for providing ventilation to the Control Room is contained in FSG 90.3, Alternate Room Ventilation.

Battery Life

ONI-SPI D-3, Cross-Tying Unit 1 and 2 Batteries is performed to connect the Unit 1 and Unit 2 batteries into one battery. This action is completed within 30 minutes of the loss of power to the chargers as part of existing Off-Normal Instruction. ONI-SPI D-2, Nonessential DC loads, removes DC loads not needed during the event from the affected busses to extend battery life. This action is completed within 3 hours of the loss of power to the chargers. This gives an effective battery life of greater than 24 hours per calculation PRDC-0012. At the end of the calculated battery life, the battery voltage remains above 90 Vdc and is sufficient to allow for normal operation of RCIC (Div 1 only), SRVs, essential instrumentation, and Switchgear Breakers.

8.6.2 Phase 2

With a loss of All AC power to critical electrical loads from Preferred Sources (Grid / Emergency Diesels), an alternate source of AC power is needed. This alternate source of AC power is provided by the FLEX Generators to provide approximately 2 MWe 4160 Vac power to the Unit 1 and Unit 2 Class 1E switchgear. This power will provide for running a FLEX Pump in the ESWPH, 480 Vac pumps for process flow, charging of station batteries, Control Room and plant essential lighting, essential instruments, installed and portable ventilation, hydrogen Igniter operation, and motor operated valves. The use of two 1 MWe 4160 is based upon running the SPCU, ADHR pump, and FLEX Lake Water Pump simultaneously and provide additional capacity for support equipment.

These minimum required coping loads by themselves will require approximately 1348.5 kW.

Primary Electrical strategy

Turbine Marine 4160 Vac 1.1 MWe generators will be used during Phase 2 and Phase 3. These are the same equipment as the Turbine Marine 4160 Vac 1.1 MWe generators that the NSRC will supply in Phase 3.

The two “N” FLEX generators are stored in one of the Unit 2 portions of the Diesel Generator Building designated as FLEX Equipment Bay 1. Support equipment including a debris removal truck, Distribution Center, cabling, portable fuel pumps and fuel hoses are also stored with the “N” FLEX generators. The “N+1” FLEX generator are stored in the Unit 2 Aux Building East Side designated as FLEX Equipment Bay 2. N+1 Support equipment that includes a debris removal truck, Portable Fuel Tanks, and cabling, is stored with the “N+1” FLEX generator. The Portable fuel Oil pumps stored with the “N” FLEX generator are used for refueling operations for the “N+1” FLEX generator and other remotely deployed diesel machinery.

The N Set (2) of FLEX generators will be connected to a Distribution Center by single phase cables (eight total). The Distribution Center is the same equipment that the NSRC will supply in Phase 3 to support the 4160 Vac Generators. The Distribution Center will be connected to the Termination Enclosure using single-phase cables (17 total). The single-phase cables have friction plug connections that are held in place during use by a mechanical restraint to prevent accidental unplugging of the cable during use, the plug connections also have retention bolts for added protection. The Termination Enclosure is hard wired to the load side of Breaker EH 2101 (6 single conductor 750 mcm cables). This allows the N and N+1 on site equipment to be used as well as providing additional connect points for Phase 3 NSRC generators to be used in parallel to supply required electrical power to support the FLEX strategies.

<u>Primary Connection Operator Actions</u>

During a FLEX event, the N set of generators will be deployed to the area west of the Diesel Generator Building and East of the Underground Fuel oil storage tanks. A set of Single Phase Cables will be run from each Generator to the Distribution Center within FLEX Equipment Bay 1 through either the outside man door or the roll up door. A fuel line will be run from the sample valve on a Day Tank (Division 1, Division 2, or Division 3 can be used) to the first FLEX Generator; a second fuel line will be run from a different Day Tank to the second FLEX Generator. These fuel lines will be run out the outside security man doors (Doors DG-101, DG-102, DG-103) of the respective Diesel Bay. The Day tanks contain at least 3 hours of fuel (100 gph consumption) at the operable low level. Normally the Day Tanks contain approximately 500 gallons allowing 5 hours of operation however, the 316 gallon (Div 1 and 2) or 279 gallon (Div 3) tech spec min values were assumed to provide a bounding case.

As an alternative, fuel oil can be supplied to the FLEX generators directly using portable pumps taking a suction on the in-ground fuel oil storage tanks using a portable pump. Within FLEX Equipment Bay 1, the Distribution Center is then connected to the Termination Enclosure by connection of the dedicated set of single-phase cables (15 cables total). At Control Complex 620’ 6”, Bus EH-21 is prepared to be energized by opening 4160 Vac and 480 Vac load breakers and preventing electric operation as needed. Once Bus EH-21 is prepared the FLEX Generators are started, the generator output breakers are closed, and the supply breakers on the distribution center are closed. Then at Control Complex 620’ 6”, Breaker EH2101 is closed to Energize Bus EH-21.

These actions are addressed in FSG 40.3 Supplying Alternate Power To Vital Unit 2 Busses. Note communication cables are not addressed during this discussion as they are small and do not have a significant impact on manpower and timing.

Once Bus EH-21 is energized two parallel paths for loading of the FLEX generators are taken. One team of personnel will take actions to restore power to 4160 V Busses EH-11, EH-12, and Bus EH-13. The Second Team will take actions to provide power to 480 Vac Bus F1C08 and monitoring of the FLEX generators

<u>Team 1</u>

At Control Complex 620’ 6”, the first team will continue working in actions to restore power to Busses EH11, EH12, and Bus EH13. FSG 40.5, FLEX

Generator Loading and Plant System Operations provides guidance on how to load the FLEX generators. Priority is given for restoration of the Battery Room Exh fan to address concerns with hydrogen build up in the battery rooms during battery charging and for supplying power to the SPMU system to allow dumping of the Upper Pools. At Control Complex 620' 6", Busses EH11, EH12, and EH13 are prepared to be energized by opening 4160 Vac and 480 Vac load breakers and preventing electric operation as needed. Once Bus EH11, EH12, and EH13 are prepared, the Alternate Preferred Source Breaker (EH1115, EH1213, or EH1302) for the bus is closed energizing the respective bus. FSG 40.1 SUPPLYING ALTERNATE POWER TO VITAL UNIT 1 BUSSES directs these actions. Once the respective bus is energized loading of the FLEX generator can be performed per FSG 40.5, FLEX Generator Loading and Plant System Operations). When the FLEX Lake Water Pumps are aligned by the team dedicated to establishing ESW system flow, the ESWPH Termination Enclosure is powered by closure of Breaker EH2106. This will power the ESWPH Termination Enclosure where the N and N+1 FLEX Lake Water Pumps will have been connected to the Termination Enclosure by connection a set of single phase cables (1 Set for each pump). The ESWPH Termination Enclosure supply line was originally intended to supply the 800 Hp Unit 2 Division 1 ESW pump and is large enough to operate both FLEX Lake Water Pumps. The pumps can be individually operated using the pump starters located on the pump skid.

<u>Team 2</u>

The second team performs FSG 40.3, SUPPLYING ALTERNATE POWER TO VITAL UNIT 2 BUSSES, step 12 to energize Unit 2 Vital Loads, step 14 to provide alternate power to Spent Fuel Pool Level Indication and the Communications modification, and monitoring per step 15

When time and resources permit actions are taken to restore Distribution Panel F1C08. This panel provides power to essential lighting transformers and instrumentation that is useful during a FLEX event such as Rad monitors, alternate power to Spent Fuel Pool Level indication, power to the communications modifications, and additional RPV level indication. At Intermediate Building (IB) 620' 6", Load Center F1C08 is prepared; the load center is energized by taking the Manual Bus Transfer Switch 1R25-S0292 to the alternate source at Intermediate Building 620' 6". Actions continue in the Control Complex 638' 6" areas to energize 120 Vac instrumentation Panels to complete the actions to energize Distribution Panel F1C08. FSG 40.5, FLEX Generator Loading and Plant System Operations provides guidance for this action.

Secondary Connection Operator Actions

In the event that a single N FLEX generator fails the N+1 FLEX Generator will be used to replace the failed N FLEX Generator. Two methods to use the N+1 FLEX Generator are provided. If a travel path from FLEX Equipment Bay 2 to FLEX Equipment Bay 1 is or can be established within 2 hours the N+1 Generator is moved to the N FLEX Generator deployment area west of the Diesel Building and East of the In-Ground Fuel Oil Storage Tanks.

If No travel path from FLEX Equipment Bay 2 to FLEX Equipment Bay 1 can be established within 2 hours the N+1 Generator is moved to the Emergency Service Water Pumphouse (ESWPH) where a set of single conductor cables (4 total) is run from the N+1 FLEX Generator to the ESWPH Termination Enclosure to supply the N FLEX Lake Water Pump. If this is the only AC power source Bus EH21 will be back fed from the ESWPH Termination Enclosure through breaker EH 2106 to provided limited electrical power. A Transcube fuel oil tank will be used to supply the N+1 FLEX Generator. This tank is a double walled tank with a capacity of approximately 1200 gallons. This will provide 12 hours of operation before refueling is required with the 4160 Vac generator at full load. Note that the FLEX Pumps use approximately 200 KWe each (0.2 MWe) therefore the N+1 FLEX Generator will be <50% loaded).

These strategies are performed by FSG 40.2 Supplying Alternate Power at ESWPH

In the event N and N+1 FLEX generators are available and can be placed into service providing power to Bus EH21 via the Distribution Center the need for Phase 2 Coping is not needed and Phase 3 coping is entered by using RHR to remove heat from containment in its normal system operation at reduced flow rates vice the Closed Loop Suppression Pool Cooling or Suppression Pool Feed and Bleed Strategies. FSG 40.3 Supplying Alternate Power To Vital Unit 2 Busses provides guidance for Connection of the N, N+1 and NSRC generators to allow generators to be added as they become available.

In the event that Bus EH21 cannot be used due to equipment failure, alternative FLEX Generator Connection strategies allow for powering individual busses straight from a FLEX Generator.

Bus EH11 N+1 Power

To Supply Bus EH11 from the FLEX Generator a set (3 total) of single-phase cables will be run from the FLEX Generator West of the Diesel Generator Building to Breaker Cubical EH 1102. Breaker EH 1102 will be removed and an emergency bus feeder inserted into cubical EH 1102. The single-phase cables will be connected to the feeder and the FLEX Generator. The FLEX generator will then be used to supply Bus EH11 directly. FSG 40.4 Emergency Bus Feeder Operation provides guidance for this action.

Bus EH12 N+1 Power

To Supply Bus EH12 from the FLEX Generator a set (3 total) of single-phase cables will be run from the FLEX Generator West of the Diesel Generator Building to Breaker Cubical EH 1201. Breaker EH 1201 will be removed and an emergency bus feeder inserted into cubical EH 1201. The single-phase cables will be connected to the feeder and the FLEX Generator. The FLEX generator will then be used to supply Bus EH12 directly. FSG 40.4 Emergency Bus Feeder Operation provides guidance for this action.

Bus EH13 N+1 Power

To Supply Bus EH13 from the FLEX Generator a set (3 total) of single-phase cables will be run from the FLEX Generator West of the Diesel Generator Building to Breaker Cubical EH 1301. Breaker EH 1301 will be removed and an emergency bus feeder inserted into cubical EH 1301. The single-phase cables will be connected to the feeder and the FLEX Generator. The FLEX generator will then be used to supply Bus EH13 directly. FSG 40.4 Emergency Bus Feeder Operation provides guidance for this action.

Bus EF-2-B N+1 Power

Bus EF-2-B will receive its N + 1 power from Transformer EHF-2-A directly from the FLEX Generator. A set (3 total) of single-phase cables will be run from the FLEX Generator West of the Diesel Generator Building to Breaker Cubical EH 2104. Breaker EH 2104 will be removed and an emergency bus feeder inserted into cubical EH 2104. The single-phase cables will be connected to the feeder and the FLEX Generator. The FLEX generator will then be used to supply Transformer EHF-2-A directly. FSG 40.4 Emergency Bus Feeder Operation provides guidance for this action.

8.6.2.a Phase 2 Modifications

Bus EH21

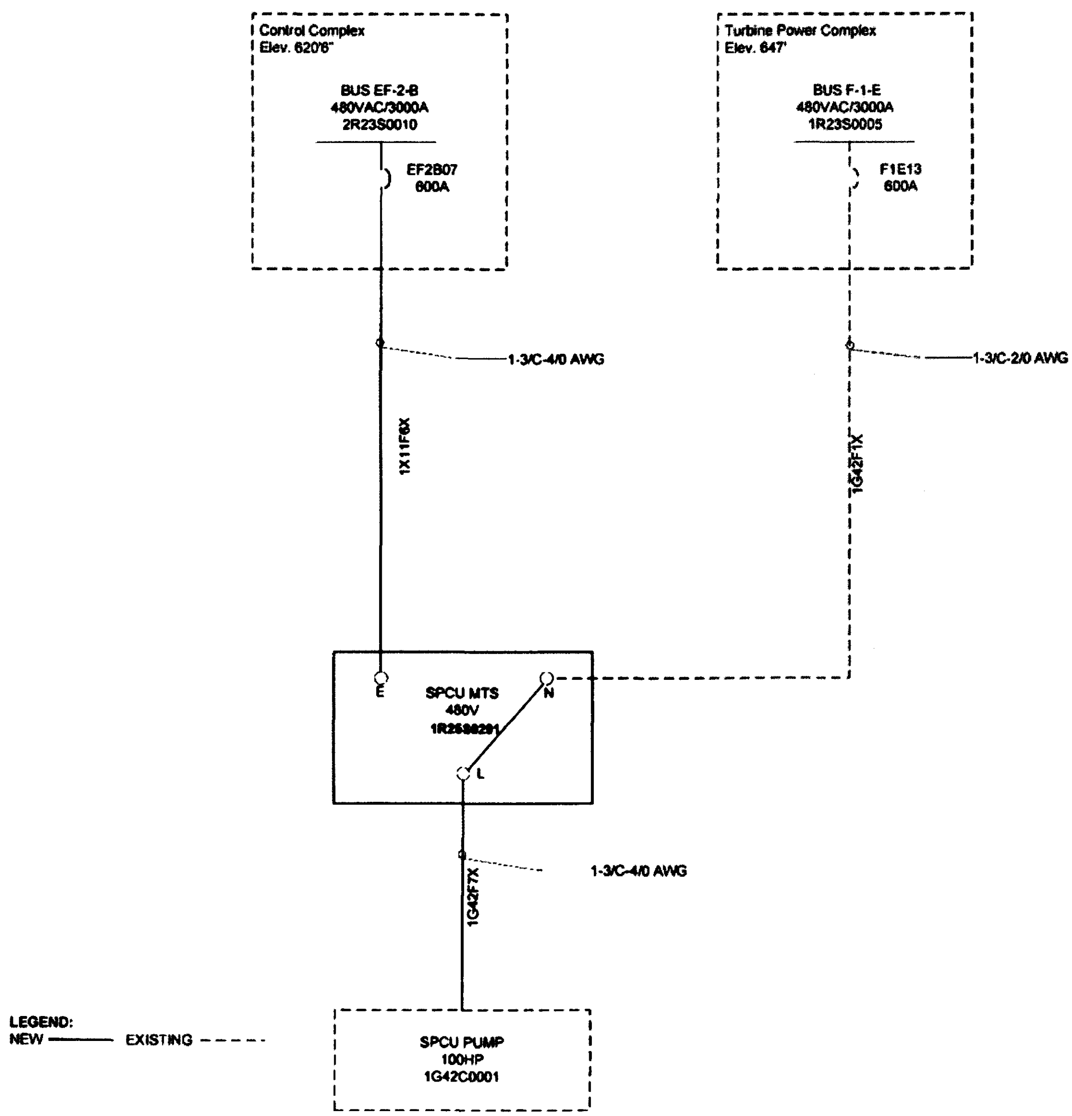
Emergency Bus Feeders are racked into cubicles EH 2101 and EH 2102. Dedicated jumper cables are then connected between EH 2101 and EH 2102, allowing Bus EH21 to supply Bus TH21.

The Load side of Breaker EH2106 is connected to the Termination Enclosure 1X11-S002 in the ESWPH. This cable is designed to support an 800 HP load (Unit 2 ESW A Pump that was not installed) in the ESWPH. This modification terminates the installed cable between Bus EH21 and the Termination Enclosure 1X11-S0002 installed in the ESWPH to support FLEX Lake Water Pump Operation. To complete the modification a Termination Enclosure is installed in the ESWPH, the existing Safety grade cable installed during plant construction between the ESWPH and Bus EH2106 is terminated and a breaker installed in cubical EH2106. Breaker EH2106 will act as the Class 1E break point.

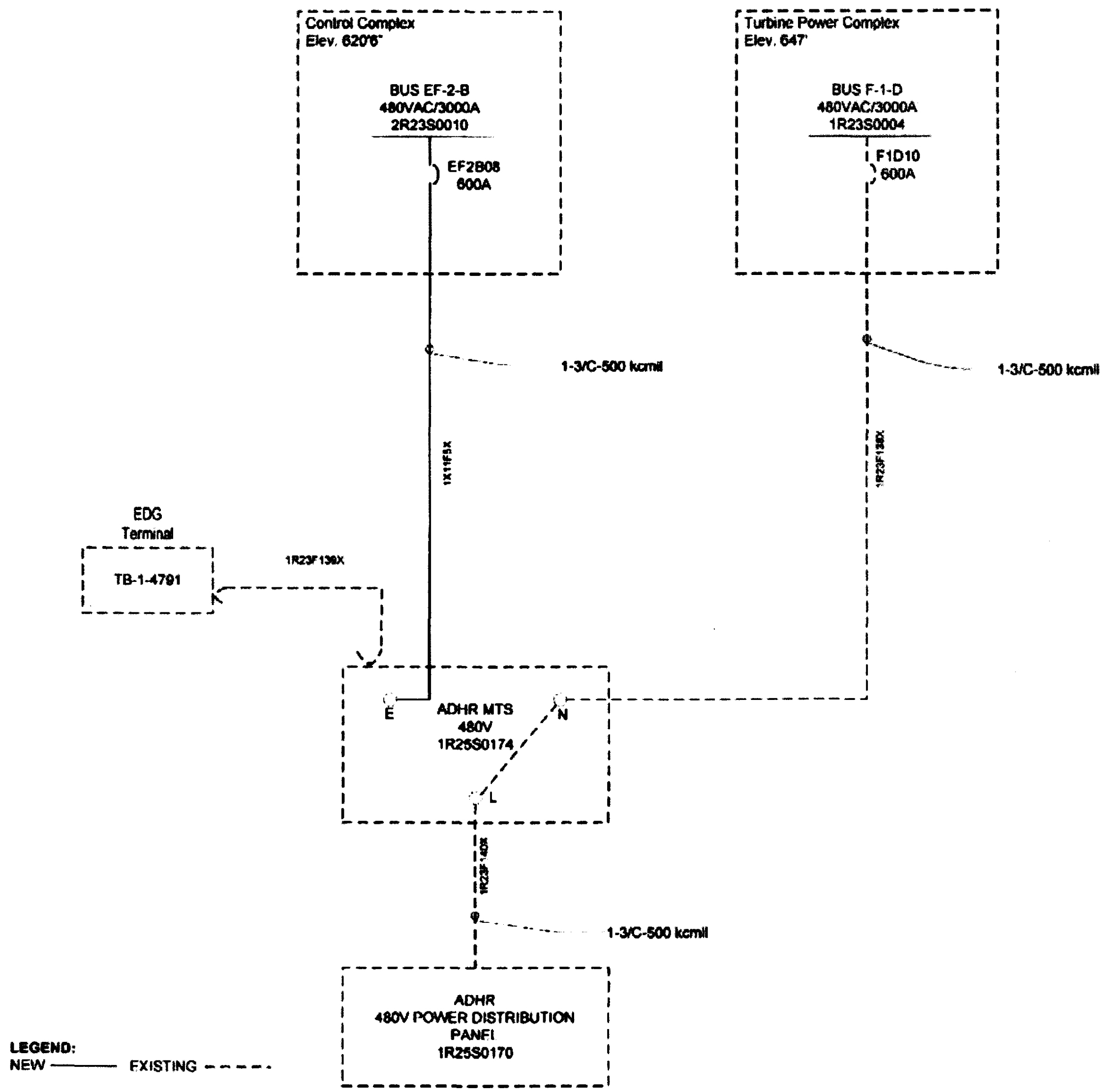
The Load side of Breaker EH2110 is connected to the Termination Enclosure in the Diesel Building. This cable (6 single conductor 750 mcm cables) supports operation of up to five FLEX Generators. This modification connects an installed cable between Bus EH21 and FLEX Equipment Bay 1 Termination Enclosure (1X11-S0001). Termination Enclosure (1X11-S0001) is installed in the FLEX Equipment Bay 1 to support connection of the Distribution Center. Safety grade cabling was installed using new seismically qualified and existing Unit 2 Safety Related conduits and cable trays that were installed during plant construction. During FLEX operations special feeder breakers will be racked into EH 2101 and 2102 and a “soft jumper” will be run between them.

Bus EF-2-B

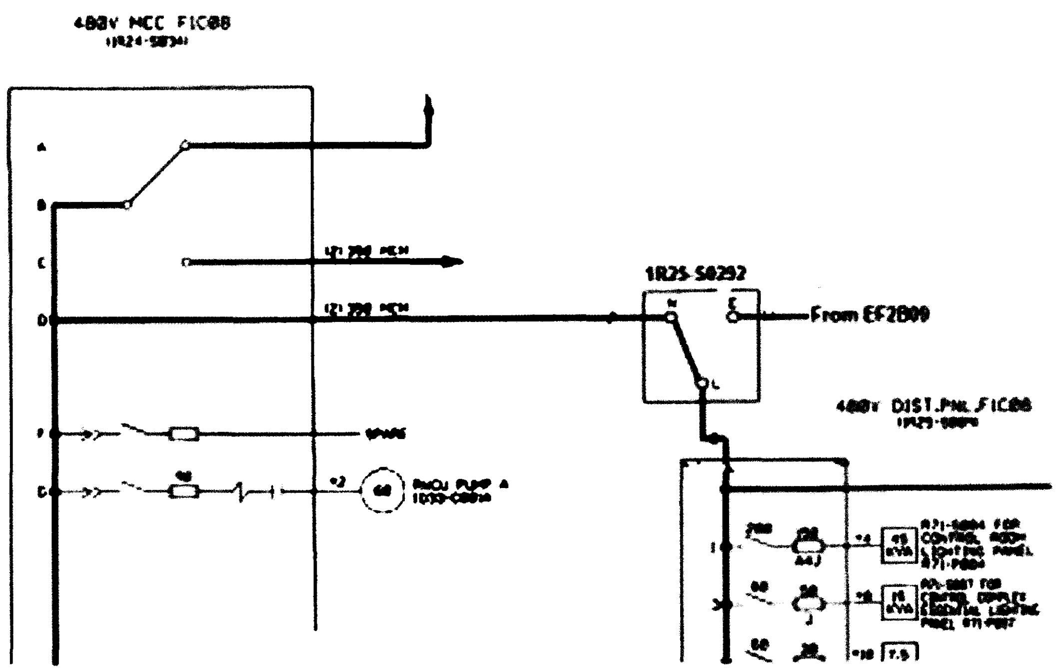
A Safety grade hard wire connection between Breaker cubical EF2B07 load side stabs and new Manual Transfer Switch 1R25-S291 is provided to allow Bus EF-2-B to supply the SPCU pump. This provides a FLEX Generator connection to the SPCU pump to allow its use during a FLEX Event. With the Manual Transfer Switch in alternate source position closure, breaker EF2B07 will supply power directly to the SPCU pump. The SPCU will only trip on a high current condition. New Transfer Switch 1R25-S291 is installed in Aux Building 599' 6". Breaker EF2B07 will act as the Class 1E break point.



A Safety grade hard wire connection between Breaker cubical EF2B08 load side stabs and Manual Transfer Switch 1R25-S174 allows Bus EF-2-B to supply Distribution Panel F1D10 via Manual Transfer switch 1R25-S174. This provides a FLEX Generator connection to the ADHR pump to allow its use during a FLEX Event. The original alternate source connected to the portable diesel connection point is disconnected and abandoned in place. Transfer Switch 1R25-S174 is installed in Aux Building 599' 6". Breaker EF2B08 will act as the Class 1E break point.



A Safety grade hard wire connection between Breaker cubical EF2B09 load side stabs and new Manual Transfer Switch 1R25-S0292 is provided to allow Bus EF-2-B to supply the Distribution Panel F1C08. This provides a FLEX Generator connection to the Essential lighting instrumentation to allow its use during a FLEX Event. A 480 Vac disconnect is provided to allow operation of the ABI Pump C41-C003. This service disconnect can also be used to supply other portable equipment as needed during a FLEX event. New Transfer Switch 1R25-S0292 is installed in Intermediate Building 620' 6". Breaker EF2B09 will act as the Class 1E break point.



8.6.2.b Phase 2 Fuel Oil Supply

The following diesel engines may require diesel fuel during Phase 2 as follows:

- FLEX 4160 Vac generators at the Diesel Generator Building
- FLEX 4160 Vac generators at the ESWPH
- Portable FLEX instrument air compressor for ADS backup
- Portable FLEX Pump for Demin Water to RCIC

The FLEX generators do not have an onboard fuel tank. The generators are equipped with fuel pumps that can be used to take a suction on an external supply.

For the "N" set of Generators that will be used at the Diesel Generator Building, a hose will be connected to the DG FO Transfer Pump Suction Line Drain Valve on one of the three diesel generator day tanks. Any of the day tanks can be used and the selection will be event specific based upon availability. Each day tank has approximately 3 hours' worth of fuel supply before the auto transfer of fuel oil from the storage tank to the day tank is disabled due to low tank level. From the time that the FLEX generator is started until the critical 480 Vac divisional busses are energized is estimated to be less than 1 hour. This is sufficient time to restore power to the associated division critical 480 Vac to allow the fuel oil transfer pumps to be restored to normal operation and automatically supply makeup needs of the day tank. Establishing the fuel oil supply is a matter of connecting a hose from the ¾-inch DG FO pump suction valve (1R45-F587 A (B) / 1R45-F583B) and routing the hose to the FLEX generator and connecting the hose to the generator fuel oil connection. As an alternative, any of the three in-ground fuel oil storage tanks can be used by running a hose to the tanks dewatering or dip stick connections and pumping fuel directly to the generator. Each generator will be connected to a day tank or an alternate path to a fuel oil storage tank. Staging of the FLEX Generator is to occur between T+1 and T+5; this is sufficient time (4 hours) to stage the generators either in place or outside the Diesel Generator Building, establish the fuel oil supply and connect the required cabling using two infield personnel.

For the "N+1" generator that will be used if an "N" generator is unavailable, the "N+1" generator will be moved from the Unit 2 Auxiliary Building and staged outside the Diesel Building to replace the failed N Generator. If access to the Diesel Building is precluded due to debris the "N+1" generator will be moved from the Unit 2 Auxiliary Building and staged outside the ESWPH. As part of this deployment, a

Transcube fuel oil tank will be staged by the generator to serve as the fuel oil tank for the generator. A Transcube fuel oil tank will be used to supply the N+1 FLEX Generator. This tank is a double walled tank with at size of approximately 1200 gallons. This will provide 12 hours of operation before refueling is required (FLEX Pumps use approximately 200 KWe (0.2 MWe) therefore the N+1 FLEX Generator will be <50% loaded). Three pumps are provided to assist in this transfer of Fuel oil, a 110 Vac pump, a 12 Vdc pump and a hand pump. Portable 110 Vac generators are available to be used to power the 110 Vac pump.

The FLEX air compressor (88 scfm capacity) is assumed to be deployed at t=12 and have 5 gallons of fuel on-board and a consumption rate of 1.5 gph. Hence, refueling must occur between T=15 and T=16. This compressor will be refueled using a 28 gallon capacity fuel caddy however, this equipment is not critical and is a back up to the 7-day air supply in the ADS storage tanks.

The demand on installed diesel fuel:

FLEX Generator 1	110 gph X 18 hr. =	1980 gal
FLEX Generator 2	110 gph X 18 hr. =	1980 gal
Portable Air compressor	1.5 gph X 12 hr. =	18 gal
Debris Removal Truck		3 gph
Portable 110 Vac Generator	1.5 gph X 20 hr. =	30 gal
	Total	4011 gal

Total refueling demand from on-site resources is then about 4000 gallons (assuming 18 hours of FLEX generator operation at fuel load). The 184,220 gallons (Tech Spec min values) in the three fuel oil storage tanks could then support well over 24 hours of Phase 2 operations.

8.6.3 Phase 3

By Phase 3, 4160 Vac generators will have arrived from the NSRC and will be connected to the Distribution Center in parallel with the on-site FLEX generators or directly to the a critical bus needing to be energized if the Distribution center is not available. No additional plant modifications are needed for Phase 3 activities. RHR can be placed into service to allow additional heat removal capacity. FSG 30.5, RHR A FLEX Containment Cooling, FSG 30.6, RHR B FLEX Containment Cooling, FSG 30.7, RHR A FLEX RPV Cooling, and FSG 30.8

RHR B FLEX RPV Cooling provide guidance on operation of RHR during a FLEX event.

8.6.3.a Phase 3 Modifications

None

8.6.3.b Phase 3 Fuel Oil Supply

Same as Phase 2

8.6.3.c Phase 3 Instrument Air Supply

The small, portable diesel powered air compressor can be used until the station compressors are restored.

9.0 AREAS FOR STANDARDIZATION

1. The BWROG is working on development of FLEX Support Guidelines; however, the schedule for issuing to the industry has not been set. Perry needs to use this guidance in combination with the actions defined by the FLEX Implementation Plan to address these issues.

2. PNPP worked with the NSRC vendors when considering utilization of off-site resources and deployment strategies.

3. Programmatic Controls: The industry is working towards developing a standard approach to the quality standards of FLEX equipment. This topic was discussed at the NEI Post-Fukushima Conference the first week of September 2012. The information gathered from that meeting, along with information from the vendors selected to operate the NSRC and any direction from the BWROG will be incorporated into the PNPP FLEX strategy as applicable.

4. Maintenance and Testing: The industry is working towards developing a standard approach to the quality standards of FLEX equipment. This topic was discussed at the NEI Post-Fukushima Conference the first week of September 2012. The information gathered from that meeting, along with information from the vendors selected to operate the NSRC and any direction from the BWROG will continue to be incorporated into the PNPP FLEX strategy as applicable. Currently FENOC has developed maintenance and testing templates specifically for the FLEX Equipment. Below is a partial 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-3748 , FLEX VEHICLES

5. Shift Staffing and Training: Definition of minimum staffing levels are defined. FLEX specific training; simulator training, and drill actions and schedules have been determined.

6. Order EA-12-049 (Reference 1) requires maintenance of the guidance and strategies licensees develop. This maintenance is part of the implementation and has the purpose of assuring the continued viability of the strategies feasibility. NEI 12-06 (Reference 2) provides an acceptable method for maintenance of the guidance and strategies.

10.0 IMPACT OF NTTF TIER 1 ACTIVITIES ON FLEX

The following were evaluated for the potential impact of on-going industry efforts evaluating the potential effects of external hazards on the Perry site on the utilization of installed plant equipment in support of FLEX coping strategies. As stated in the NEI Diverse and Flexible Coping Strategies (FLEX) Implementation Guide (Reference 2), effective implementation requires coordination with other on-going NTTF activities, including the following:

- Seismic
- Flooding
- EOP/SAMG
- Emergency Response Organization (ERO)
- SFP level instrumentation

The available guidance for these efforts will be evaluated and assessments will be made regarding how these actions affect the following aspects of FLEX, which based on the NEI guidance, have been revised based on the existing Safe Shutdown Earthquake (SSE) and the external flood strategies currently implemented at the site. Specific areas to be considered in this evaluation are as follows:

- Protection
- Deployment
- Procedural Interfaces
- Plans to Utilize Equipment
- Staffing
- Communications

The purpose of this section is not to address the issues resulting from changes associated with the various activities, but rather to identify issues, risks or open items that should be considered as a part of submission of the FLEX implementation plan.

10.1 PLANS TO UTILIZE SITE INSTALLED EQUIPMENT

Plant equipment planned to be utilized by the Perry FLEX strategy is summarized in Table 10.1-1.

Table 10.1-1: Summary of Key Site Installed Equipment Used for FLEX

Component(s)	Reference	Seismic Qualification
Suppression Pool	9	Seismic Category 1
RCIC System	9	Seismic Category 1
ESW piping (from discharge check valve through discharge weir, both trains)	9	Seismic Category 1
ESWPH including tunnels and the Intake and Discharge structures	9	Seismic Category 1
Alternate Decay Heat Removal Pump (ADHR) and piping	9	Seismic Category 1 **[AI-12]**
RHR HXs (both trains), and a portion of system piping	9	Seismic Category 1
SPCU Pump and associated SPCU and FPCC System Piping	9	non-robust **[AI-11]**
Safety-Related Instrument Air (for SRVs) and a portion of system piping	9	Seismic Category 1
HPCS piping: Suction and Discharge	9	Seismic Category 1
LPCS piping: Suction and Discharge	9	Seismic Category 1
Suppression Pool Make Up (SPMU) Valves and piping	9	Seismic Category 1
Upper Containment Pool Drain Line and a portion of system piping	9	Seismic Category 1
Drywell Backup Purge Outboard Isolation Valve and a portion of system piping	9	Seismic Category 1
Inboard MSIV before seat drain line outboard isolation valve and a portion of system	9	Seismic Category 1
Unit 1 EDG Fuel Oil Day Tanks (3) and sample lines	9	Seismic Category 1
Unit 1 EDG Fuel Oil Transfer Pumps and associated piping	9	Seismic Category 1

Component(s)	Reference	Seismic Qualification
Unit 1 125 Vdc electrical system (batteries, chargers/electrical support (Div 1 &2))	22	Seismic Category 1
Unit 2 125 Vdc electrical system (batteries, and electrical support (Div 1 and 2))	22	Seismic Category 1
Unit 1 480 Vac Vital Switchgear (Div 1 and 2)	22	Seismic Category 1
Unit 2 480 Vac Vital Switchgear (Div 1)	22	Seismic Category 1
Unit 1 4160 Vac Class 1E Electrical System	22	Seismic Category 1
Hydrogen Igniters	22	Seismic Category 1
Battery Room Ventilation Fans (Vital 125 Vdc Batteries)	22	Seismic Category 1
RPV pressure., temperature and level instruments Div 1 or Div 2	22	Seismic Category 1
SP level, & temperature instruments Div 1 or Div 2	22	Seismic Category 1
SFP Temperature instruments	9	Seismic Category 1
Containment Pressure instruments	9	Seismic Category 1
RHR Flow rate instruments	9	Seismic Category 1
ESW Flow to RHR HX instruments	9	Seismic Category 1
Control Room	9	Seismic Category 1
Spent Fuel Pool	9	Seismic Category 1
FPCC Pumps	9	Seismic Category 1

Batteries and battery chargers are also important for coping with the ELAP. Battery power may be used to extend availability of key instruments and extend the availability of core cooling utilizing RCIC. Perry currently has existing plant procedures for cross-tying Unit Division 1 DC bus to Unit 2 batteries and load shedding on the DC bus. No additional changes to the current strategies have been identified. Using current plant procedures, Perry is able to cope with the ELAP for at least 24 hours before generators are required to provide power to the battery chargers (Reference 7).

10.2 POTENTIAL IMPACT OF ONGOING SEISMIC ACTIVITIES

An industry-wide effort to establish revised seismic hazards was started as part of GI-199 and is being subsumed within the post-Fukushima activities. This re-evaluation initiated by recognition that the seismic hazards in the Eastern United States have increased. This increase in seismic hazard may result in design basis seismic hazards increasing above the current levels. Thus, plant equipment used to support FLEX activities that are seismically qualified to the Current Licensing Basis (CLB) may not be guaranteed to survive a future SSE based on the revised seismic hazard. Therefore, due to the challenges associated with meeting the original goals of this activity, a potential shorter term action to ensure a FLEX strategy capable of meeting a higher than current seismic level is being under taken, known as the augmented approach.

Perry has completed assessment of FLEX actions and using the augmented approach validated that the FLEX strategies are in compliance with the augmented approach. Any open items are addressed in the Corrective Action Program.

10.2.1 Protection

FLEX equipment (including site equipment used to support FLEX) is being stored in buildings capable of ensuring that equipment stored within areas will withstand a current SSE. As a result of a re-evaluation of seismic faults in the Eastern US, seismic challenges from the equivalent revised hazard may be greater. An augmented approach review determined that there are no challenges to FLEX equipment stored at PNPP.

10.2.2 Deployment

Deployment of FLEX equipment, including plant equipment used to support the FLEX strategy could be impacted by potential increased seismic hazards. As design basis seismic hazard may increase above current design basis levels, the ability of the equipment to function may be challenged. This is particularly a concern for non-class 1E components.

Additional issues associated with deployment include (1) impact of debris in roadways needed for equipment transport (2) physical damage to roadways, bridges, etc., restricting or preventing transport of equipment along selected routes.

Debris interference can slow down timely deployment as additional time for potential debris removal activities may occur. This is further exacerbated if the activity occurs at night and lighting is required to support the transport. Lighting used for this purpose is expected to be portable and not seismically robust. Perry 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 on opposite sides of the plant provides for avoidance of site hazards while allowing deployment during the event.

Long-term operation of diesel driven equipment could be impeded if the seismic event damages fuel oil storage tanks. This may result in the loss of fuel inventory, potential fire hazards and lower tank capacity (more frequent refill) if the seismic event results in a tank structural failure. Designated Fuel Oil supplies are installed Seismic Category 1 and have been evaluated under the augmented approach.

10.2.3 Procedural Interfaces

As seismic events have no warning, no procedural interface issues for event preparation are anticipated.

In responding to seismic events, mitigation procedures include additional guidance with respect to accessing and moving equipment following seismic events. Such guidance includes alternate routes or strategies to access and remove equipment if debris or structural damage prevents normal access.

10.3 POTENTIAL IMPACT OF ONGOING EXTERNAL FLOODING ACTIVITIES

The flooding evaluations being performed as a part of the NTTF activities have identified that some sites may have a susceptibility to flooding challenges. The source of the flood challenge varies among sites, with some sites having multiple types of external flooding challenges and others being essentially "dry" sites.

The concerns associated with flood hazards include hydrostatic loading on structures, debris transport to areas where the debris may interfere with pump suction, water inundation of equipment areas with subsequent equipment failure and personnel hazards due to potential for electrocution if flooded systems are energized, among others. A general discussion of the impact of external flooding on FLEX implementation issues is provided below.

For Perry: The types of events evaluated to determine the worst potential flood included (1) probable maximum flood (PMF) due to PMP on the total watershed and critical sub-water sheds including seasonal variations and (2) effect of local intense precipitation equal to the PMP at the Perry site.

Per Reference 4, Section 2.4.10, there are four prospective sources of flooding that exist at the Perry site: Lake Erie, intense local precipitation, and flooding by two small, nameless streams that border the site to the east and south. Flooding from Lake Erie is extremely improbable. Final grade elevations in the immediate plant area vary from 617 to 620 feet (USGS). This is about 45 feet above the maximum monthly mean lake level of 575.4 ft. (Reference 4, Section 2.4.2.2). Localized flooding from the streams during a PMF will not affect plant buildings or equipment. Assuming the worst case precipitation scenario (i.e., complete blockage of the site storm drainage system and using peak discharge from the most intense hour of the PMP), the resulting increase in surface elevation of water flowing over the surrounding roads and railroads (acting as weirs) would not exceed one inch. This ponding elevation of 620'-5" will have no adverse effect upon safety class equipment because the floors at plant grade are set at Elevation 620'-6" (Reference 4, Section 2.4.2.3).

Specific analysis of flood levels resulting from ocean front surges and tsunamis is not required because of the inland location of the plant. Flood waves from landslides into upstream reservoirs required no specific analysis due to the lack of topographic and geologic features conducive to landslide formation. Seiche pose no flood threats because of the size and configuration of the lake and the elevation difference between normal lake level and plant grade.

The maximum plant site flood level from any cause is Elevation 620’-5”. The plant site resides at an elevation of 620’-6” (Reference 4, Section 2.4.2.3).

Therefore, for Perry, typical flood hazards are not expected because of precipitation or failure of an on-site water impoundment (Reference 4).

Condition Report 2015-05079 documents the potential for External Flooding during a Probable Maximum Flooding Event (West Side of Plant). The potential exists for water intrusion on the West side of the plant during a probable maximum flooding event due to the site being located non- conservatively approximately 2.5 inches different from external benchmarks. Compensatory measures will be required to eliminate water into door penetrations. See CR 2015-05079 for impacted doors and the description of the compensatory actions.

10.3.1 Protection

Perry Nuclear Power Plant (PNPP) protects FLEX related plant equipment from flooding via locating FLEX equipment in such a manner to protect the equipment from the consequences of precipitation and other external flooding hazards, as necessary. In addition, the plant strategies ensure that the components necessary for flood mitigation are accessible such that FLEX strategies may be implemented. Typically this protection includes ensuring components directly exposed to the flood will not be damaged, supports undermined or re-located by flood waters, maintaining electrical components above anticipated flood levels or in water-proof enclosures.

Flood walkdowns at PNPP indicate that external flood design basis requirements are generally well met. While this effort has been carried out to current design expectations, the results of the flood walkdowns or the results of the flooding re-evaluation may indicate that some aspects of the re-evaluated hazard will not be fully enveloped by the Current Licensing Basis (CLB), leaving the potential for planned protective features to be inadequate.

Specific issues to be reviewed when assessing the applicability of the current protection to the re-evaluated hazard conditions include:

- Reliability/availability of credited equipment below the re-evaluated hazard flood evaluation.
- Penetration seals above current design levels (or those with inadequate current design) will potentially leak into areas where credited equipment is stored/used.
- Doors in previously water free areas may not be water-tight resulting in potential leakage into areas where credited equipment is stored/used

10.3.2 Deployment

Inadequate flood protection for the site can result in difficulty accessing and relocating equipment. It also can complicate repairs.

Most sites will deploy FLEX equipment prior to significant site flooding. If this is not accomplished early, issues regarding site navigation can be complicated and backup strategies for deployment could be considered.

Components that have to be interfaced or mated with plant connections should be carefully evaluated to confirm that the connections points are expected to be above the flood elevation or that the presence of water will not prevent access to the connector. Components to be considered include valve handles, flanges, etc. Motor Control Centers (MCCs), electrical busses and other similar components necessary to provide power to some pumps should be confirmed to not be impacted by floods. If this cannot be assured, alternate strategies for mitigating external floods should be considered.

Long term operational considerations on a flooded site may include concern over integrity of component/piping supports due to water erosion of sub-soil.

The issue of potentially flooded sites poses a unique concern as even if deployment strategies initially consider flood issues site maintenance can alter drainage and expose equipment to flood waters. This effect can be mitigated by control of yard work considered for flooding impacts.

The primary strategy for repowering battery chargers is to be by FLEX generators. It is noted that the connection point outlined in strategies are at or above grade (Elevation 620' 6" per Reference 4) which is above the probable maximum flood (PMF) level of 620' 5" (Reference 4) or within structures designed to preclude water intrusion. Therefore, these strategies will be able to be implemented for this event.

As the PMF hazard is being re-evaluated as part of post-Fukushima Recommendation 2.1, this action and its viability should be re-evaluated.

10.3.3 Procedural Interfaces

External flood mitigation procedures and ELAP response procedures may be included in separate Off Normal Instructions (ONIs). These procedures should be carefully reviewed to ensure that actions are not conflicting. External flood procedures may direct removal of power from selected buses to avoid system shorts and to avoid electrocution hazards.

An additional consideration is ensuring that command and control between the two procedures is clear and adequate staff is available to potentially be in both procedures simultaneously. Procedure should anticipate potential issues with site access for these scenarios and include alternative paths.

10.4 EOP/SAMG ACTIVITIES

10.4.1 Procedural Interfaces

Newly recommended EOP cooldown strategies have been incorporated into the site FLEX strategy. BWROG recommendations are being developed in coordination with the FSGs. EOPs may rely on use of equipment that may be seismically or flood challenged. Under these events, primary strategies may be difficult to implement due to unavailability of equipment that may be lost at higher seismic loadings. Similarly limited access to selected equipment resulting from flooding or seismic events may require actions be taken in alternate sequence or for alternate strategies to be considered. External flooding creates the additional complications of potentially requiring power from buses to avoid shorts or protect staff from electrocution hazards. Furthermore, strategies may have to interface with protective strategies to avoid water damage to equipment.

EOP guidance has been developed for the SFP. FLEX equipment and capabilities are identified as pertinent to the development of and implementation of EOP strategies.

10.5 EMERGENCY RESPONSE ORGANIZATION

10.5.1 Staffing

Staffing requirements for FLEX have been addressed in the overall staffing studies performed. When staff requirements are overlaid with external hazards, one should consider that in the presence of external hazards, human actions can take longer, primary procedural responses may not be available due to access limitations, additional staff may be needed to deal with debris removal, additional actions required to protect rooms containing critical equipment and personnel injuries (e.g., from falling equipment), among other issues. Furthermore, to improve successful implementation, there is an expectation that individuals performing critical tasks will not be time constrained to complete one action prior to receiving another critical action.

10.5.2 Communications

Communication capabilities required by the ERO during ELAP are supplied and powered by the site-specific FLEX strategies. As seismic and flood events can take out cell towers and telephone lines, back-up satellite phones/walkie-talkies have been added to ensure site-wide communication. Provisions for offsite communications (e.g., public, State, Regulator) are also available.

10.6 COMBINED EVENTS

Combined effects are likely at many plants. Structural (tank) failures may be induced by seismic events. Thus, the LOOP may have both physical damage to the plant due to seismic events and the impact of floodwaters on the site. Many weather conditions that induce floods also are associated with high winds that create airborne missile hazards and create hazardous working environment, extending the time need to perform many tasks. While this may be an important issue in the future, it is not developed further in this report.

10.7 SPENT FUEL POOL INSTRUMENTATION

Per Table C-3 of NEI 12-06 (Reference 2), a key FLEX parameter is SFP level. NRC Order EA 12-051 (Reference 31) requires licensees to provide reliable SFP water level instrumentation. The industry has developed a standard approach to respond to this order, as discussed in NEI 12-02 (Reference 32) and endorsed by JLD-ISG-2012-03 (Reference 33).

As a side note, current SAMGs assume SFP instrumentation above the top of the fuel. Should a liner breach occur, SFP level monitoring instrumentation extending into the pool would help both define the location of the breach and the effectiveness of the mitigation strategies should the fuel become uncovered.

10.8 NTTF SUMMARY

NTTF activities are still ongoing. Results of these assessments can impact design and implementation of FLEX strategies. Therefore, as more information emerges, the Perry will continue to review FLEX strategies and associated plant equipment involved with these strategies to ensure that they remain feasible and reliable.

11.0 NRC Order EA-12-051 Spent Fuel Pool Level

11.1 Background

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Order EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Reference 31), to FirstEnergy Nuclear Operating Company (FENOC). This Order was effective immediately and directed FENOC to have a reliable indication of the water level in associated spent fuel storage pools for the Perry Nuclear Power Plant (PNPP) as outlined in Attachment 2 of the Order. The Order required compliance prior to plant startup from the second refueling outage following submittal of the overall integrated plan (OIP), or by December 31, 2016, whichever comes first. The compliance date for PNPP was April 18, 2015. The NRC staff requested that the compliance report be submitted within 60 days of the compliance date. PNPP is in compliance in response to the Order.

11.2 Compliance

FENOC has installed two independent full-scale level monitors on the spent fuel pool (SFP) at PNPP in response to Reference 31. This SFP instrumentation was supplied and qualified by Westinghouse, LLC (Westinghouse). PNPP discharges irradiated fuel to a single spent fuel storage pool. With the exception of limited time periods for maintenance or non-refueling operations, administrative controls maintain gates in the open position between the following pools: fuel storage and preparation pool, fuel transfer pool, spent fuel storage pool, and cask pit. Thus, these pools are normally inter-connected and at the same water level when the water level in the spent fuel pool is greater than 3.5 feet above the top of stored fuel seated in the storage racks. These pools are treated as one SFP with regard to Reference 31.

FENOC submitted the PNPP OIP by letter dated February 27, 2013 (Reference 38). By letter dated December 11, 2013 (Reference 39), the NRC provided its interim staff evaluation and requested additional information necessary for completion of the review. The information requested by the NRC is included in Attachment 2 of Letter L-15-128, Completion of Required Action by NRC Order

EA-12-051, Reliable Spent Fuel Pool Instrumentation (TAC No. MF0802) (Reference 45).

Reference 31 required submission of an initial status report 60 days following issuance of the final interim staff guidance and status reports at six-month intervals following submittal of the OIP. FENOC provided the initial status report for PNPP by letter dated October 26, 2012 (Reference 40). The first, second, third and fourth six-month status reports for PNPP were provided by letters dated August 26, 2013, February 27, 2014, August 28, 2014, and February 26, 2015, respectively (Reference 41, Reference 42, Reference 43, and Reference 44.)

Compliance with Order EA-12-051 was achieved using the guidance in Nuclear Energy Institute (NEI) document NEI 12-02, Revision 1 (Reference 32), which has been endorsed by the NRC (Reference 33) with exceptions and clarifications. A summary of the compliance elements is provided below.

11.3 Identification of Levels of Required Monitoring

FENOC has identified the three required levels for monitoring SFP level in compliance with Reference 31. These levels have been integrated into the site processes for monitoring SFP level during beyond-design-basis external events (BDBEE) and responding to loss of SFP inventory.

The design of the fuel transfer pool and its gates is such that there is an approximate 3.5 foot gap between the top of the fuel racks in the two pools containing spent fuel (the fuel storage and preparation pool and the spent fuel storage pool) and the top of the fuel transfer pool gate seat. As a result, the top of the fuel transfer pool gate seat is used as Level 3. This setting complies with Reference 31; however, it represents a minor deviation to Reference 32. This is a conservative decision and ensures that actions are taken to prevent the spent fuel from being uncovered.

11.4 Instrumentation Design Features

FENOC has installed SFP instrumentation consisting of permanently mounted, fixed primary and backup instrument channels at PNPP. This SFP instrumentation was supplied and qualified by Westinghouse. The design of the SFP instrumentation system installed complies with the requirements specified in

Reference 31 and Reference 32. The SFP instrumentation has been installed in accordance with the site design control process.

The instruments have been arranged to provide reasonable protection against missiles (airborne objects). Each channel consists of a level sensor, an electronics unit, and an indicator. The sensors are mounted at the western end of the SFP (the fuel preparation and storage pool), as close to the adjacent corners as possible to minimize the possibility of a single event or missile damaging both channels. The sensor arrangement also limits interference with existing equipment in or around the SFP. This design complies with Reference 31; however, it does represent a minor deviation from Reference 32. This design also does not pose a potential hazard to personnel working around the pool or on the SFP level instrumentation itself.

See figure 11.4.1 for a sketch of the elevation view of the SFPLI channel.

The instruments have been mounted to retain design configuration during and following the maximum expected ground motion considered in the design of the SFP structure. The instruments will be reliable during expected environmental and radiological conditions when the SFP is at saturation for extended periods. The instruments are independent of each other and have separate and diverse power supplies. The instruments will maintain their designed accuracy following a power interruption and are designed to allow for routine testing and calibration.

The instrument display is readily accessible during postulated BDBEE and allows SFP level information to be promptly available to decision makers.

See Appendix Figure 18-A, FLEX Electrical Equipment and Modification Photos for photos of the Spent Fuel Pool Level panels and control room indications.

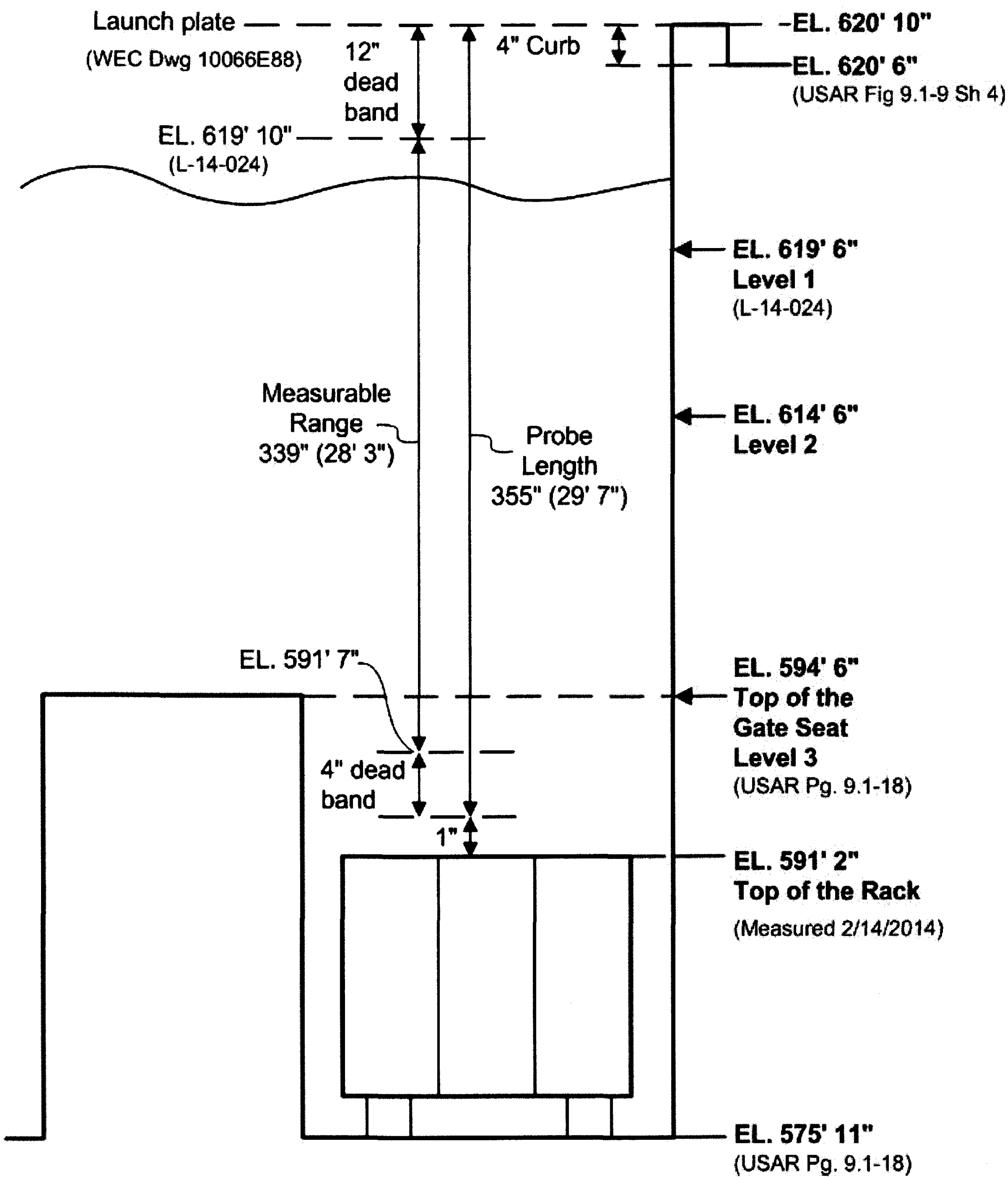


Figure 11.4.1 Elevation view of the SFPLI channel sketch.

11.5 Program Features

The Systematic Approach to Training was utilized to develop and implement training. Training has been provided for applicable personnel in the use of, and provision of alternate power to, primary and backup instrument channels.

Procedures for the testing, calibration, and use of the primary and backup SFP instrument channels have been established and integrated with existing procedures.

Preventive maintenance tasks have also been established and scheduled to ensure the instruments are maintained at their design accuracy.

NEI 12-02 specifies program requirements for Spent Fuel Pool (SFP) Instrumentation that support FLEX strategies. The FLEX program document, NOP-LP-7300, FLEX Program For The Perry Nuclear Power Plant (PNPP), also addresses these requirements. Spent Fuel Pool Level Instrumentation is considered FLEX equipment for the purpose of the NOP and this NORM, and will receive the same considerations as other FLEX equipment such as preventative maintenance task generation and limitations on out of service time.

12.0 NRC Order NEI 12-01 Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities, [Revision 0], May 2012

12.1 Background

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, (Reference 36).

12.2 Compliance

The Perry Units 1 and 2 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 14-0564, supplements 001, 002 and 003, and 14-0563, supplement 001 have been completed to place PNPP in full compliance with the communication requirements of NEI 12-01 (Reference 36).

12.3 Identification of Communication Improvement Requirements

On site

The communications strategy involving permanent plant equipment uses 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 operating unit (Unit 1) as well as areas of the non-operating unit (Unit 2). The operation of page/party system is dependent on the availability of the electric power system.

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. NEI 12-01, Section 4.1 outlines the minimum communication pathways to the federal, state, and local authorities.

12.4 Communication Improvement Design Features

On site:

The operation of page/party system is dependent on the availability of the electric power system. To maintain power to the system during a beyond design basis event modifications have been made to the plant to install a battery back-up system to provide power until the normal power supply can be restored via use of FLEX generators. The modifications were performed under ECP 14-0564, supplements 001, 002 and 003. The page/party system is available in locations where FLEX equipment is stored.

Off site:

19 satellite phones are available for offsite communications. These phones are distributed between the Main Control Room, the FLEX Equipment Storage Bays, Security, and field teams. Additionally, local Offsite Response Organizations (OROs) are being provided a satellite phone if they are within a 25-mile radius of the Perry site.

The MCR 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. A handheld satellite phone will be available for initial notifications. This portion of the communications strategy is intended to suffice for the duration of the event and is powered from the same battery backed source as the page/party system. The modifications to the plant required to support this strategy were performed via ECP 14-0563 supplement 001.

12.5 Additional Communication Program Features

There will be 30 dedicated hand-held radios available for the implementation of the FLEX strategies. Sufficient batteries and chargers are also available. Use of the hand-held radios may be somewhat limited on a point-to-point basis

13.0 SUMMARY

A FLEX assessment has been completed for Perry in response to the requirement to evaluate the coping and mitigation strategies for BDBEE with an assumed simultaneous ELAP and LUHS (Reference 1, Reference 2, and Reference 3). Modifications to the existing structures, systems and components that are necessary to establish an indefinite coping capability to prevent damage to the fuel in the reactor and SFP and to maintain the containment function have been identified and implemented.

Maintaining the plant in a safe condition following a BDBEE will be accomplished by using installed equipment, on-site portable equipment, and pre-staged off-site resources as outlined in this report.

External events that threaten the integrity or deployment of portable emergency equipment were assessed. Strategies for protection of the stored portable emergency equipment and for assuring access for deployment of that equipment for these external events have been implemented. Mechanical and electrical interconnections with existing systems and components that are required for FLEX implementation have been identified and optimal solutions have been implemented. The need for procedures to ensure the protection and facilitate the deployment of FLEX equipment was identified and downstream analyses have been completed to assist the site in the implementation of site-specific procedures. All required FSGs are effective.

Because of this assessment, non-conformances (“gaps”) with the requirements in Order NRC EA-12-049 (Reference 1) were identified in the outstanding areas and actions needed to address these non-conformances are summarized in Section 2.4 and Reference 5. These gaps have subsequently been closed...

Based on the information provided in this report and with the closure of all action items the NRC requirements in Order NRC EA-12-049 (Reference 1) are satisfied.

14.0 REFERENCES

> NOTE
>
> This document contains bookmarked references, if reading an electronic version of this document; place cursor on the word reference, a control/click combination will take you to the reference section and the applicable reference information.

1. NRC EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," March 12, 2012. [ADAMS Accession Number ML12056A045]
2. NEI 12-06, Revision 0, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," August 2012.
3. NRC JLD-ISG-2012-01, Revision 0, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," August 2012.
4. Perry Power Station Unit 1 Updated Safety Analysis Report (USAR)," Revision 18.
5. Letter from Peter P. Sena III (COO - FENOC) to Ms. Kim Maza (VP Analysis - INPO), "Perry Response to INPO IER L1-11-4, Near Term Actions to Address the Effects of an Extended Loss of All AC Power in Response to the Fukushima Daiichi Event", 1/27/12.
6. Westinghouse Report DAR-SEE-II-12-22, Revision 0, "Evaluation of Alternate Coolant Sources for Responding to a Postulated Extended Loss of All AC Power, February 1, 2013.
7. Westinghouse Report TR-FSE-12-9, Revision 0, "Perry Phase 1 Rapid FLEX Evaluation." January 11, 2013.
8. FLEX Programmatic Controls Report for the Perry Nuclear Power Plant (PNPP) NORM-LP-7304, Revision 1
9. FLEX Mechanical Design Report for the Perry Nuclear Power Plant, NORM-LP-7302, Revision 1
10. Westinghouse Report DAR-FSE-13-2, Revision 0, "Perry Nuclear

Power Plant Unit 1 FLEX Timing and Deployment," February 8, 2013.

11. GEH/BWROG, RCIC Pump and Turbine Durability Evaluation – Pinch Point Study, Revision 0

12. Westinghouse Calculation Note, CN-SEE-II-12-45, Revision 0, "Determination of the Time to Boil for the Perry Nuclear Power Plant Unit 1 Spent Fuel Pool after an Earthquake," December 21, 2012. This evaluation has been superseded by PNPP Calculation X11-006, FLEX Spent Fuel Pool Boil-Off Analysis (Reference 48)

13. Westinghouse Calculation Note, CN-FSE-12-12, Revision 0, "Perry FLEX Conceptual Design AFT Fathom Model," January 6, 2013. This evaluation has been superseded by X11-004, FLEX Hydraulic Flow Model, Revision 0. (Reference 47)

14. Westinghouse Calculation Note, CN-AEO-12-0001, Revision 0, "Perry FLEX-Coping Time Analysis," January 31, 2013. This evaluation has been superseded by X11-001, FLEX Event Coping Strategies And Time Analysis, Revision 0, (Reference 49)

15. GE Hitachi Report NED0-33771, Rev 1, "GEH Evaluation of FLEX Implementation Guidelines" January 2013.

16. Not Used

17. EPG Issue Number 1103, 3/1/12

18. EPG Issue Number 1119, 3/1/12

19. Westinghouse Report WR-FSE-12-9, Revision 0, "Perry FLEX Walkdown Report," January 31, 2013.

20. Duplicate to Reference 6, not used

21. Westinghouse Calculation SEW 12-114, Revision 0, "Chemistry and Corrosion Evaluation for Alternative Cooling Source Usage during Extended Loss of All A.C. Power at Perry Nuclear Power Plant Unit 1, Revision. 0"

22. FLEX Electrical Design Report for the Perry Nuclear Power Plant, NORM-LP-7301, Revision 1

23. Westinghouse Calculation, CN-REA-12-71, "Perry Unit 1 Best-Estimate

Decay Heat," 12/14/2012

24. Perry Calculation PDRC-0012 Rev 3 "Evaluation of DC Loads for a 4 Hours Design Basis Station Blackout (SBO) and also for a 24 Hours Beyond Design Basis SBO Events"

25. Westinghouse Report LTR-SEE-II-12-113, Revision 0. "Evaluation of the Impact of Existing Extreme Hazard Analysis and Planned NTTF Activities on the FLEX Design for Perry Nuclear Power Plant Unit 1," February 7, 2013.

26. ONI-R10-2, Total Loss of AC Power

27. Not Used

28. Westinghouse Letter Report LTR-AEO-13-0004, Rev. 0 "Perry Mode 4 and Mode 5 Boil Off Calculations," February 6, 2013

29. Perry FLEX Integrated Plan, TR-FSE-13-9

30. Westinghouse Report LTR-AEO-13-0005, Rev. 0, "Evaluation of the Safety-Related Compressed Air Consumption at Perry Nuclear Power Plant Unit 1 for an ELAP Condition", January 30, 2013

31. NRC Order EA-12-051, "Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," March 12, 2012. [ADAMS Accession No. ML12056A044]

32. 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'," August 24, 2012.

33. NRC JLD-ISG-2012-03, "Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation," August 29, 2012.

34. BWROG Emergency Procedure and Severe Accident Guidelines, Rev 3 (Draft)

35. Perry Station Procedure EOP-01, "RPV Control."

36. NEI 12-01 Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities, [Revision 0], May 2012

37. Westinghouse Calculation LTR-US-BWR-14-18, Rev. 0, PERRY Unit 1

Supplemental FLEX Coping Time Analysis. This evaluation has been superseded by X11-001, FLEX Event Coping Strategies And Time Analysis, Revision 0, (Reference 49)

38. FirstEnergy Nuclear Operating Company's (FENOC's) Overall Integrated Plan in Response to March 12, 2012 Commission Order Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051), dated February 27, 2013.

39. NRC Letter, Perry Nuclear Power Plant, Unit 1, - Interim Staff Evaluation and Request for Additional Information Regarding the Overall Integrated Plan for Implementation of Order EA-12-051, Reliable Spent Fuel Pool Instrumentation, dated December 11, 2013.

40. 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 Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051), dated October 26, 2012.

41. 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 Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051) (TAC Nos. MF0799, MF0800, MF0960, and MF0802), dated August 26, 2013.

42. 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 Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051) (TAC Nos. MF0799, MF0800, MF0960, and MF0802), dated February 27, 2014.

43. 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 Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051) (TAC Nos. MF0799, MF0800, MF0960, and MF0802), dated August 28, 2014.

44. 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 Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051) (TAC Nos. MF0799, MF0800, MF0960, and MF0802), dated February 26, 2015.

45. Letter L-15-128, Completion of Required Action by NRC Order EA-12-051, Reliable Spent Fuel Pool Instrumentation (TAC No. MF0802)

46. NORM-LP-7307 PNPP SAFER Response Plan Reference Material, Revision 0

47. Calculation X11-004 FLEX Hydraulic Flow Model, Revision 0.

48. PNPP Calculation X11-006, FLEX Spent Fuel Pool Boil-Off Analysis, Revision 0

49. Calculation X11-001, FLEX Event Coping Strategies And Time Analysis, Revision 0

50. Calculation X11-003, FLEX Transient Thermal Analysis of Auxiliary Building Following an ELAP Scenario, revision 0.

51. Calculation X11-010, FLEX Control Room Heat-Up Analysis, Revision 0

52. Calculation X11-002, FLEX RCIC Survivability Study, Revision 0.

53. Calculation X11-011, FLEX Containment High Temperature Evaluation, Revision 0

54. Calculation G42G001A, Piping Stress Analysis: Discharge Piping From Pump 1G42C0001 To Subsystem 1G41G007A

55. NORM-LP-7306, FLEX Staffing Study Reference Material for the Perry Nuclear Power Plant (PNPP), Revision 0

56. NORM-LP-7307, FLEX SAFER Response Plan Reference Material for the Perry Nuclear Power Plant (PNPP), Revision 0.

57. Calculation X11-006, FLEX Spent Fuel Pool Boil-Off Analysis, Revision 0.

15.0 SCOPE OF REVISION

1. Replaced the term “Docking Station” to “Termination Enclosure” throughout this NORM.
2. Revised Sections 27.0 and 28.0 (Figures D- and D-3) to more accurately reflect the final FLEX Equipment Bay storage configurations.
3. Updated Section 5.2.1 to state that AI-3 is closed, consistent with the remainder of this NORM.
4. Performed minor reformatting to reduce blank page sections and renumbered page references in the Table of Contents.
5. No revision bars are used due to the administrative nature of the above changes.

16.0 APPENDIXES

NOTE

This document contains bookmarked appendixes, if reading an electronic version of this document; place cursor on the appendix title, a control/click combination will take you to the appendix section and the applicable appendix. For optimum viewing, print these appendixes on 8.5 x 14 or 11 x 17 paper.

17.0 APPENDIX: Table A-1 SAFETY FUNCTIONS

18.0 APPENDIX: Table A-2 WATER SOURCES

19.0 APPENDIX: Table B-1 On-Site Phase 1 Equipment Requirements

20.0 APPENDIX: Table B-2 On-Site Phase 2 Equipment Requirements

21.0 APPENDIX: Table B-3 Storage Locations Summary

22.0 APPENDIX: Table C1-1 Timing and Deployment Timeline for Modes 1-4

23.0 APPENDIX: Table C-2: Timing and Deployment Reference Values

24.0 APPENDIX: Table D-1: Equipment Design Confirmation Summary Table

25.0 APPENDIX: Figure D-1 Power Block Buildings

26.0 APPENDIX: Figure D-2 FLEX Equipment Bay 1 Emergency Diesel Generator (EDG) Building

27.0 APPENDIX: Figure D-3 FLEX Equipment Bay 2 - Unit 2 Auxiliary Building East Side

28.0 APPENDIX: Figure D-4 Equipment Storage/Deployment Locations

29.0 APPENDIX: Figure D-5 FLEX Deployment Path 1

30.0 APPENDIX: Figure D-6 FLEX Deployment Path 2

31.0 APPENDIX: Figure D-7 FLEX Deployment Path 3

32.0 APPENDIX: Figure D-8 FLEX Deployment Path 4

33.0 APPENDIX: Figure D-9 FLEX Deployment Path 5

34.0 APPENDIX: Figure E-1 RCIC Suction Connection Point

35.0 APPENDIX: Figure E-1A RCIC Suction Connection Point

36.0 APPENDIX: Figure E-1B RCIC Suction Connection Point

37.0 APPENDIX: Figure E-2: Two Bed / Mixed Bed Storz Connector Location

38.0 APPENDIX: Figure E-2A: Two Bed / Mixed Bed Storz Connector Location

39.0 APPENDIX: Figure E-2C: Two Bed / Mixed Bed Storz Connector Location

40.0 APPENDIX: Figure E-2D: Exterior Hose Path from Mixed Bed Tank

41.0 APPENDIX: Figure E-3: Interior Hose Path from Mixed Bed to the RCIC Suction Connection

42.0 APPENDIX: Figure E-3A: Interior Hose Path from RHR to FPCC Return Header to the RCIC Suction Connection

43.0 APPENDIX: Figure E-3B: Interior Hose Path from ESW A to the RCIC Suction Connection

44.0 APPENDIX: Figure E-4: Aux Building Dry Standpipes

45.0 APPENDIX: Figure E-5 Mechanical FLEX Equipment and Modifications Photos

46.0 APPENDIX: Figure E-6: LPCS / HPCS Storz Connection Points

47.0 APPENDIX: Figure E-7 Simplified Unit 1 and Unit 2 Divisional AC busses without modifications

48.0 APPENDIX: Figure E-8 Simplified Unit 1 Division 1 Electrical

49.0 APPENDIX: Figure E-9 Simplified Unit 1 Division 2 Electrical

50.0 APPENDIX: Figure E-10 Simplified Unit 1 Division 3 Electrical

51.0 APPENDIX: Figure E-11 Simplified Unit 2 Division 1 Electrical

52.0 APPENDIX: Figure E-12 Simplified Unit 2 Division 2 Electrical

53.0 APPENDIX: Figure E-13 Simplified Unit 2 Division 3 Electrical

54.0 APPENDIX: Figure E-14 Simplified Electrical Modifications

55.0 APPENDIX: Figure E-15 Termination Enclosure 1X11-S0001

56.0 APPENDIX: Figure E-16 Transfer Switch 1R25-S0291

57.0 APPENDIX: Figure E-17 Transfer Switch 1R25-S0174

58.0 APPENDIX: Figure E-18 Transfer Switch 1R25-S0292

59.0 APPENDIX: Figure E-18-A: FLEX Electrical Equipment and Modification Photos:

60.0 APPENDIX: Figure E-19 Termination Enclosure 1X11-S0001 to Bus EH21 Feeder

61.0 APPENDIX: Figure E-20 Alternate Supply to Bus EH11

62.0 APPENDIX: Figure E-22 Alternate Supply to Bus EH12

63.0 APPENDIX: Figure E-23 Alternate Supply to Bus EH13

64.0 APPENDIX: Figure E-24 Alternate Supply to Bus TH21

65.0 APPENDIX: Figure E-25 Alternate Supply to Transformer EHF2A

66.0 APPENDIX: Figure E-26 Primary Suppression Pool Closed Loop Cooling Flow Path

67.0 APPENDIX: F, FLEX Equipment Task Examples

68.0 APPENDIX G Perry Nuclear Power Plant FLEX Overall Integrated Plan, Rev. 4

69.0 APPENDIX G Perry Nuclear Power Plant FLEX Overall Integrated Plan, Rev. 4

70.0 APPENDIX: H, L-15-128, Completion of Required Action by NRC Order EA-12-051, Reliable Spent Fuel Pool Instrumentation (TAC No. MF0802)

17.0 APPENDIX A SAFETY FUNCTIONS AND WATER SOURCES

Safety Function	Strategy	System	Protected Events					Temporary Connection(s)	Water Source(s)	Notes
			Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps			
Reactor Core Cooling (Phase 1)	Primary	RCIC	X	X	X	X	X	NA	Suppression Pool	FSG 10.1
	Secondary	RCIC		X		X	X	NA	CST	FSG 10.1

17.0 APPENDIX A SAFETY FUNCTIONS AND WATER SOURCES

Page 2 of 15

Safety Function	Strategy	System	Protected Events: Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps	Temporary Connection(s)	Water Source(s)	Notes
Reactor Core Cooling High Pressure (Phase 2)	Primary	RCIC	X	X	X	X	X	<u>RPV Makeup</u> Aux 599' FPCC Header 1G41-F201 / 1X11-F014 Aux 599' ESW Loop A(B) 1P45-F757A(B) / 1X11-F005A(B) Aux 599' Dry Pipe East 1X11-F005A Aux 574' Dry Pipe East 1X11-F101A Aux 574' RCIC Room 1E51-F585 / 1X11-F012 <u>RHR Cooling Water</u> ESWPH 568' ESW A(B) Loop 1P45-F754A(B) / 1P45-F755 A(B) 1P45-F756A(B) / 1X11-F001A(B) 1X11-F002A(B) / 1X11-F003A(B) <u>Electrical</u> DG 620, FLEX Equip Bay 1 FLEX Term Panel 1X11-S001 ESWPH 568' FLEX Term Panel 1X11-S002	<u>Preferred source:</u> RCIC Suction Via RHR A(B) HX outlet to RCIC Pump Suction <u>Alternate source:</u> RCIC Suction Via Lake Erie Via ESW A(B) to RCIC Pump Suction	FSG 10.1 Support: • FSG 10.3 providing alternate water source to RCIC Pump Suction • FLEX Generator Supplying Bus EH21, FSG 40.3 • SPCU / ADHR in Suppression Pool Closed Loop Cooling, FSG 30.1, 30.2, 30.3, 30.4 • FLEX Lake Water Pump Supplying ESW Loop Flow FSG 60.1, 60.2 • FSG 90.3 to provide Room Cooling
	Secondary	RCIC	X	X	X	X	X	NA	Suppression Pool	FSG 10.1 Support • FSG 90.3 to provide Room Cooling

17.0 APPENDIX A SAFETY FUNCTIONS AND WATER SOURCES

Safety Function	Strategy	System	Protected Events: Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps	Temporary Connection(s)	Water Source(s)	Notes
Reactor Core Cooling High Pressure (Phase 2	Alternate Source	RCIC		X		X	X	<u>RPV Makeup</u> Water Treatment Building 620' 1X11-F011 / 0P21-F200 / 0P22-F663 Aux 620' Dry Pipe West 1X11-F103B Aux 574' Dry Pipe West 1X11-F101B RCIC Room 1E51-F585 / 1X11-F012	Demin Water (Two / Mix Bed Tanks) to RCIC Pump Suction	FSG 10.1 Support: • FSG 10.3 providing alternate water source to RCIC Pump Suction • FSG 90.3 to provide Room Cooling

Safety Function	Strategy	System	Protected Events: Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps	Temporary Connection(s)	Water Source(s)	Notes
Reactor Core Cooling Low Pressure (Phase 2)	Primary	SPCU in Closed Loop Cooling	X	X	X	X	X	<u>RPV Makeup</u> N/A <u>Electrical</u> DG 620, FLEX Equip Bay 1 FLEX Term Panel 1X11-S001_ ESWPH 568' FLEX Term Panel 1X11-S002 <u>RHR Cooling Water</u> ESWPH 568' ESW A(B) Loop 1P45-F754A(B) / 1P45-F755 A(B) 1P45-F756A(B) / 1X11-F001A(B) 1X11-F002A(B) / 1X11-F003A(B)	Suppression Pool: Via SPCU to RHR A(B) into RPV	SPCU Suppression Pool Closed Loop Cooling, FSG 30.1 / 30.2 Support: • FLEX Generator Supplying Bus EH21 FSG 40.3 • FLEX Lake Water Pump Supplying ESW Loop Flow FSG 60.1, 60.2 The water pumped by the SPCU Pump in Closed Loop Cooling can be return to the Suppression Pool or to the RPV to provide make up requirements

17.0 APPENDIX A SAFETY FUNCTIONS AND WATER SOURCES

Page 4 of 15

Safety Function	Strategy	System	Protected Events: Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps	Temporary Connection(s)	Water Source(s)	Notes
	Secondary	ADHR in Closed Loop Cooling	X	X	X	X	X	<u>RPV Makeup</u> <u>Aux 568' Hallway</u> 1G41-F200 / 1X11-F015 1X11-F016 / 1X11-F017 <u>Aux 574' LPCS Room</u> 1G40-F062 / 1X11-F008 1X11-F009 / 1X11-F010 <u>Electrical</u> DG 620, FLEX Equip Bay 1 FLEX Term Panel 1X11-S001 ESWPH 568' FLEX Term Panel 1X11-S002 <u>RHR Cooling Water</u> ESWPH 568' ESW A(B) Loop 1P45-F754A(B) / 1P45-F755 A(B) 1P45-F756A(B) / 1X11-F001A(B) 1X11-F002A(B) / 1X11-F003A(B)	Suppression Pool: Via ADHR to RHR A(B) into RPV	ADHR Suppression Pool Closed Loop Cooling, FSG 30.3 / 30.4 Support: • FLEX Generator Supplying Bus EH21 FSG 40.3 • FLEX Lake Water Pump Supplying ESW Loop Flow FSG 60.1, 60.2 The water pumped by the ADHR Pump in Closed Loop Cooling can be return to the Suppression Pool or to the RPV to provide make up requirements

17.0 APPENDIX A SAFETY FUNCTIONS AND WATER SOURCES

Page 5 of 15

Safety Function	Strategy	System	Protected Events: Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps	Temporary Connection(s)	Water Source(s)	Notes
Reactor Core Cooling Low Pressure (Phase 2) (cont)	Alternate	LPCS / HPCS	X	X	X	X	X	RPV Makeup Aux 620' 1X11-F018 / 1E22A-F031 Aux 620' Dry Pipe East (West) 1X11-F103A / 1X11-F103B Aux 599' ESW Loop A(B) 1P45-F757A(B) / 1X11-F005A(B) Aux 599' Dry Pipe East (West) 1X11-F005A / 1X11-F005B ESWPH 568' ESW A(B) Loop 1P45-F754A(B) / 1P45-F755 A(B) 1P45-F756A(B) / 1X11-F001A(B) 1X11-F002A(B) / 1X11-F003A(B) Electrical DG 620, FLEX Equip Bay 1 FLEX Term Panel 1X11-S001 ESWPH 568' FLEX Term Panel 1X11-S002	Lake Erie Preferred source: Via ESW A(B) to LPCS into the RPV Alternate source: Via ESW A(B) to HPCS into the RPV	FSG 10.4 / 10.5 Support: • FLEX Generator Supplying Bus EH21 FSG 40.3 • FLEX Lake Water Pump Supplying Associated ESW Loop Flow FSG 60.1, 60.2
Reactor Core Cooling Mode 5 / Refueling (Phase 2)	Primary	FPCC	X	X	X	X	X	RPV Makeup NA FPCC Cooling Water ESWPH 568' ESW A(B) Loop 1P45-F754A(B) / 1P45-F755 A(B) 1P45-F756A(B) / 1X11-F001A(B) 1X11-F002A(B) / 1X11-F003A(B) Electrical DG 620, FLEX Equip Bay 1 FLEX Term Panel 1X11-S001 ESWPH 568' FLEX Term Panel 1X11-S002	Upper Fuel Pool	ONI-E12-2 Loss of Decay Heat Removal Support: • FLEX Generator Supplying Bus EH21 FSG 40.3 • FLEX Lake Water Pump Supplying Associated ESW Loop Flow FSG 60.1, 60.2 FPCC provides a closed loop cooling path when the Reactor Head is removed and the Upper Pool is Filled.

17.0 APPENDIX A SAFETY FUNCTIONS AND WATER SOURCES

Safety Function	Strategy	System	Protected Events					Temporary Connection(s)	Water Source(s)	Notes
			Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps			
Reactor Core Cooling Mode 5 / Refueling (Phase 2)	Secondary	SPCU (RPV Inventory Control)	X	X	X	X	X	RPV Makeup NA Electrical DG 620, FLEX Equip Bay 1 FLEX Term Panel 1X11-S001	Suppression Pool	EOP-SPI 4.3 Support: • FLEX Generator Supplying Bus EH21 FSG 40.3
	Alternate	ADHR (RPV Inventory Control)	X	X	X	X	X	RPV Makeup NA Electrical DG 620, FLEX Equip Bay 1 FLEX Term Panel 1X11-S001	Suppression Pool	ONI-SPI E-4 Support: • FLEX Generator Supplying Bus EH21 FSG 40.3

Safety Function	Strategy	System	Protected Events					Temporary Connection(s)	Water Source(s)	Notes
			Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps			
Reactor Core Cooling (Phase 3)	Primary	RHR A	X	X	X	X	X	RPV Makeup NA RHR A Cooling Water ESWPH 568' ESW A Loop 1P45-F754A / 1P45-F755 A 1P45-F756A / 1X11-F001A 1X11-F002A / 1X11-F003A Electrical DG 620, FLEX Equip Bay 1 FLEX Term Panel 1X11-S001 ESWPH 568' FLEX Term Panel 1X11-S002	RPV	FSG 30.7 Support: • FLEX Generator Supplying Bus EH21 FSG 40.3 • FLEX Lake Water Pump Supplying Associated ESW Loop Flow FSG 60.1, 60.2

17.0 APPENDIX A SAFETY FUNCTIONS AND WATER SOURCES

Safety Function	Strategy	System	Protected Events					Temporary Connection(s)	Water Source(s)	Notes
			Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps			
Reactor Core Cooling (Phase 3)	Secondary	RHR B	X	X	X	X	X	<u>RPV Makeup</u> NA <u>RHR A Cooling Water</u> ESWPH 568' ESW B Loop 1P45-F754B / 1P45-F755 B 1P45-F756B / 1X11-F001B 1X11-F002B / 1X11-F003B <u>Electrical</u> DG 620, FLEX Equip Bay 1 FLEX Term Panel 1X11-S001 ESWPH 568' FLEX Term Panel 1X11-S002	RPV	FSG 30.8 Support: • FLEX Generator Supplying Bus EH21 FSG 40.3 • FLEX Lake Water Pump Supplying Associated ESW Loop Flow FSG 60.1, 60.2
	Alternate	SPCU in Closed Loop Cooling	X	X	X	X	X	<u>RPV Makeup</u> N/A <u>Electrical</u> DG 620, FLEX Equip Bay 1 FLEX Term Panel 1X11-S001_ ESWPH 568' FLEX Term Panel 1X11-S002 <u>RHR Cooling Water</u> ESWPH 568' ESW A(B) Loop 1P45-F754A(B) / 1P45-F755 A(B) 1P45-F756A(B) / 1X11-F001A(B) 1X11-F002A(B) / 1X11-F003A(B)	Suppression Pool: Via SPCU to RHR A(B) into RPV	SPCU Suppression Pool Closed Loop Cooling, FSG 30.1 / 30.2 Support: • FLEX Generator Supplying Bus EH21 FSG 40.3 • FLEX Lake Water Pump Supplying ESW Loop Flow FSG 60.1, 60.2 The water pumped by the SPCU Pump in Closed Loop Cooling can be return to the Suppression Pool or to the RPV to provide make up requirements

17.0 APPENDIX A SAFETY FUNCTIONS AND WATER SOURCES

Safety Function	Strategy	System	Protected Events: Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps	Temporary Connection(s)	Water Source(s)	Notes
Containment Function (Phase2)	Primary	SPCU in Closed Loop Cooling	X	X	X	X	X	<u>RPV Makeup</u> N/A <u>Electrical</u> DG 620, FLEX Equip Bay 1 FLEX Term Panel 1X11-S001_ ESWPH 568' FLEX Term Panel 1X11-S002 <u>RHR Cooling Water</u> ESWPH 568' ESW A(B) Loop 1P45-F754A(B) / 1P45-F755 A(B) 1P45-F756A(B) / 1X11-F001A(B) 1X11-F002A(B) / 1X11-F003A(B)	Suppression Pool: Via SPCU to RHR A(B) into Suppression Pool	SPCU Suppression Pool Closed Loop Cooling, FSG 30.1 / 30.2 Support: • FLEX Generator Supplying Bus EH21 FSG 40.3 • FLEX Lake Water Pump Supplying ESW Loop Flow FSG 60.1, 60.2 The water pumped by the SPCU Pump in Closed Loop Cooling can be return to the Suppression Pool or to the RPV to provide make up requirements
	Secondary	ADHR in Closed Loop Cooling	X	X	X	X	X	<u>RPV Makeup</u> <u>Aux 568' Hallway</u> 1G41-F200 / 1X11-F015 1X11-F016 / 1X11-F017 <u>Aux 574' LPCS Room</u> 1G40-F062 / 1X11-F008 1X11-F009 / 1X11-F010 <u>Electrical</u> DG 620, FLEX Equip Bay 1 FLEX Term Panel 1X11-S001_ ESWPH 568' FLEX Term Panel 1X11-S002 <u>RHR Cooling Water</u> ESWPH 568' ESW A(B) Loop 1P45-F754A(B) / 1P45-F755 A(B) 1P45-F756A(B) / 1X11-F001A(B) 1X11-F002A(B) / 1X11-F003A(B)	Suppression Pool: Via ADHR to RHR A(B) into Suppression Pool	ADHR Suppression Pool Closed Loop Cooling, FSG 30.3 / 30.4 Support: • FLEX Generator Supplying Bus EH21 FSG 40.3 • FLEX Lake Water Pump Supplying ESW Loop Flow FSG 60.1, 60.2 The water pumped by the ADHR Pump in Closed Loop Cooling can be return to the Suppression Pool or to the RPV to provide make up requirements

17.0 APPENDIX A SAFETY FUNCTIONS AND WATER SOURCES

Safety Function	Strategy	System	Protected Events: Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps	Temporary Connection(s)	Water Source(s)	Notes
Containment Function (Phase2) (cont)	Alternate	LPCS / HPCS	X	X	X	X	X	RPV Makeup Aux 620' 1X11-F018 / 1E22A-F031 Aux 620' Dry Pipe East (West) 1X11-F103A / 1X11-F103B Aux 599' ESW Loop A(B) 1P45-F757A(B) / 1X11-F005A(B) Aux 599' Dry Pipe East (West) 1X11-F005A / 1X11-F005B ESWPH 568' ESW A(B) Loop 1P45-F754A(B) / 1P45-F755 A(B) 1P45-F756A(B) / 1X11-F001A(B) 1X11-F002A(B) / 1X11-F003A(B) Electrical DG 620, FLEX Equip Bay 1 FLEX Term Panel 1X11-S001 ESWPH 568' FLEX Term Panel 1X11-S002	Lake Erie Preferred source: Via ESW A(B) to LPCS into the Suppression Pool Alternate source: Via ESW A(B) to HPCS into the Suppression Pool	FSG 10.4 / 10.5 Support: • FLEX Generator Supplying Bus EH21 FSG 40.3 • FLEX Lake Water Pump Supplying Associated ESW Loop Flow FSG 60.1, 60.2
Containment Integrity (BWR Mark 3 Containments Only)	Primary	Division 1 Hydrogen Igniters	X	X	X	X	X	NA	NA	OAI 1703 Hydrogen Igniter Startup Hardcard Support: • FLEX Generator Supplying Bus EH21 FSG 40.3 • FLEX Generator Supplying Bus EH11(12) FSG 40.1
	Secondary	Division 2 Hydrogen Igniters	X	X	X	X	X	NA	NA	Support: • FLEX Generator Supplying Bus EH21 FSG 40.3 • FLEX Generator Supplying Bus EH11(12) FSG 40.1

17.0 APPENDIX A SAFETY FUNCTIONS AND WATER SOURCES

Safety Function	Strategy	System	Protected Events: Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps	Temporary Connection(s)	Water Source(s)	Notes
Containment Integrity (BWR Mark 3 Containments Only)	Alternate	Division 1(2) Hydrogen Igniter on alternate Power	X	X	X	X	X	NA	NA	FSG 30.9 Support: • Three Portable Generators Adds additional available option

Safety Function	Strategy	System	Protected Events: Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps	Temporary Connection(s)	Water Source(s)	Notes
Spent Fuel Cooling (Phase 2 and 3)	Primary	SFP Emergency Make Up System	X	X	X	X	X	ESWPH 568' ESW A Loop 1P45-F754A / 1P45-F755 A 1P45-F756A / 1X11-F001A 1X11-F002A / 1X11-F003A Electrical DG 620, FLEX Equip Bay 1 FLEX Term Panel 1X11-S001 ESWPH 568' FLEX Term Panel 1X11-S002	Lake Erie Via ESW A	FSG 50.3 Support: • FLEX Generator Supplying Bus EH21 FSG 40.3 • FLEX Lake Water Pump Supplying Associated ESW Loop Flow FSG 60.1, 60.2
	Secondary	SFP Emergency Make Up System	X	X	X	X	X	ESWPH 568' ESW A(B) Loop 1P45-F754A(B) / 1P45-F755 A(B) 1P45-F756A(B) / 1X11-F001A(B) 1X11-F002A(B) / 1X11-F003A(B) Electrical DG 620, FLEX Equip Bay 1 FLEX Term Panel 1X11-S001 ESWPH 568' FLEX Term Panel 1X11-S002	Lake Erie Via ESW B	FSG 50.3 Support: • FLEX Generator Supplying Bus EH21 FSG 40.3 • FLEX Lake Water Pump Supplying Associated ESW Loop Flow FSG 60.1, 60.2

17.0 APPENDIX A SAFETY FUNCTIONS AND WATER SOURCES

Safety Function	Strategy	System	Protected Events: Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps	Temporary Connection(s)	Water Source(s)	Notes
Spent Fuel Cooling (Phase 2 and 3)	Alternate	SPCU	X	X	X	X	X	Electrical DG 620, FLEX Equip Bay 1 FLEX Term Panel 1X11-S001	Suppression Pool / CST	ONI-SPI J-4 Support: • FLEX Generator Supplying Bus EH21 FSG 40.3 • FLEX Lake Water Pump Supplying Associated ESW Loop Flow FSG 60.1, 60.2

Safety Function	Strategy	System	Protected Events: Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps	Temporary Connection(s)	Water Source(s)	Notes
Safety Support Function Phase 2 Electrical	Primary	Bus EH21	X	X	X	X	X	Electrical DG 620, FLEX Equip Bay 1 FLEX Term Panel 1X11-S001	NA	FSG 40.3 Support: • FLEX Generator Supplying Bus EF-2-B FSG 40.3 • FLEX Generator Supplying Busses EH11, EH12, EH13 FSG 40.1 • Fuel Oil supply to Generators FSG 70.1 • Deployment of equipment FSG 80.1

17.0 APPENDIX A SAFETY FUNCTIONS AND WATER SOURCES

Page 12 of 15

Safety Function	Strategy	System	Protected Events					Temporary Connection(s)	Water Source(s)	Notes
			Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps			
Safety Support Function Phase 2 Electrical	Secondary	Bus EH11, Bus EH12, Bus EH13, Bus TH21, Transformer EHF-2-A	X	X	X	X	X	Electrical CC 620, FLEX Equip Bay 1 FLEX Term Panel 1X11-S001	NA	FSG 40.4 Support: • FLEX Generator Supplying Bus EF-2-B FSG 40.3 • FLEX Generator Supplying Busses EH11, EH12, EH13 FSG 40.1 • Fuel Oil supply to Generators FSG 70.1 • Deployment of equipment FSG 80.1 Use of Bus Feeders to supply Busses and Loads Directly
	Alternate	Bus EH21	X	X	X	X	X	Electrical ESWPH 568' FLEX Term Panel 1X11-S002	NA	FSG 40.2 Support: • FLEX Generator Supplying Bus EF-2-B FSG 40.3 • FLEX Generator Supplying Busses EH11, EH12, EH13 FSG 40.1 • Fuel Oil supply to Generators FSG 70.2 • Deployment of equipment FSG 80.1 Can supply FLEX Lake Water Pumps directly or Supply FLEX Term Panel 1X11-S002 to supply FLEX Lake Water Pumps and Bus EH21 via Backfeeding

17.0 APPENDIX A SAFETY FUNCTIONS AND WATER SOURCES

Page 13 of 15

Safety Function	Strategy	System	Protected Events: Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps	Temporary Connection(s)	Water Source(s)	Notes
Safety Support Function Phase 2 Instrument Air	Primary	A Train of Safety Related Instrument Air	X	X	X	X	X	NA	NA	7 Day air supply in receiver tanks Support: • FSG 20.2 for compressor to maintain long term air supply or supply header if receivers are lost • FLEX Generator Supplying Busses EH11, EH12, EH13 FSG 40.1 • Fuel Oil supply to Generators FSG 70.3 • Deployment of equipment FSG 80.1
	Secondary	B Train of Safety Related Instrument Air	X	X	X	X	X	NA	NA	7 Day air supply in receiver tanks Support: • FSG 20.2 for compressor to maintain long term air supply or supply header if receivers are lost • FLEX Generator Supplying Busses EH11, EH12, EH13 FSG 40.1 • Fuel Oil supply to Generators FSG 70.3 Deployment of equipment FSG 80.1

17.0 APPENDIX A SAFETY FUNCTIONS AND WATER SOURCES

			Protected Events							
Safety Function	Strategy	System	Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps	Temporary Connection(s)	Water Source(s)	Notes
Safety Support Function Phase 3 Electrical	Primary	Bus EH21	X	X	X	X	X	Electrical DG 620, FLEX Equip Bay 1 FLEX Term Panel 1X11-S001	NA	FSG 40.3 Support: • FLEX Generator Supplying Bus EF-2-B FSG 40.3 • FLEX Generator Supplying Busses EH11, EH12, EH13 FSG 40.1 • Fuel Oil supply to Generators FSG 70.1 • Deployment of equipment FSG 80.2 Connection of RRC Equipment is through the Perry Distribution Center to allow the NSRC Generators to Run in Parallel with the FLEX Generators

17.0 APPENDIX A SAFETY FUNCTIONS AND WATER SOURCES

Safety Function	Strategy	System	Protected Events					Temporary Connection(s)	Water Source(s)	Notes
			Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps			
Safety Support Function Phase 3 Electrical (Cont)	Secondary	Bus EH11 / EH12	X	X	X	X	X	NA	NA	FSG 40.4 Support: • Deployment of equipment FSG 80.2 Use of Bus Feeders to supply Busses and Loads Directly

18.0 APPENDIX: Table A-2 WATER SOURCES

Table A-2: Water Sources

Tank Name	Physical Connection Location	System Connection Point	Required Physical Modifications	Protected Events					Staging Area	Desired Strategy	Volume	Heat Tracing Required	Notes
				Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps					
Suppression Pool	RCIC	RCIC	None	X	X	X	X	X	Permanent Equipment	Core Cooling	1,079,304 gal	No	Includes upper pool (Reference 4 Table 6.2-5)
CST	RCIC	RCIC	None		X		X	X	Permanent Equipment	Core Cooling	150,000 gal	No	Tank Volume is 500,000 gal with 150,000 gal reserved for HPCS, RCIC(Reference 4 Section 9.2.6)
Lake Erie	ESWPH Suction Bay	FLEX Lake Water Pumps, ESW A or ESW B	STORZ hose connectors on ESW A and ESW B pump discharge pipes	X	X	X	X	X	ESWPH	Core Cooling, Containment Cooling, SFP Cooling	Infinite	No	Reference 9
Mixed Bed Tank	Water Treatment Building El. 620' to El. 574' Auxiliary Building	to RCIC suction	5 inch STORZ hose connection at tank transfer pump suction line				X	X	Portable Pump	Core Cooling	360,000 gal	No	Reference 9
Two Bed Tank	Water Treatment Building El. 620' to El. 574' Auxiliary Building	to RCIC suction	5 inch STORZ hose connection at tank transfer pump suction line				X	X	Portable Pump	Core Cooling	50,000 gal	No	Reference 9

19.0 APPENDIX: Table B-1 On-Site Phase 1 Equipment Requirements

Table B-1: On-Site Phase 1 Equipment Requirements

Equipment Description	Functional Location	Protected Events					Supporting Function	Notes
		Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps.		
RCIC Pump	1E51-C001	X	X	X	X	X	Core Cooling	Automatic operation for SBO/ELAP
SRVs	ADS/LLS 1B21F0041A, 1B21F0041B, 1B21F0041E, 1B21F0041F, 1B21F0047D, 1B21F0047H, 1B21F0051C, 1B21F0051D, 1B21F0051G	X	X	X	X	X	Core Cooling	SRV auto actuation, used for depressurization and RPV pressure control
U1 Div 1 Batteries and 125 Vdc Bus	Bus ED1A	X	X	X	X	X	Core Cooling	Required for Instrumentation SRV operation and RCIC operation
U2 Div 1 Batteries and 125 Vdc Bus	Bus ED2A	X	X	X	X	X	Core Cooling	Required for Instrumentation SRV operation and RCIC operation
U1 Div 2 Batteries and 125 Vdc Bus	Bus ED1B	X	X	X	X	X	Core Cooling	Required for instrumentation, SRV Control
U2 Div 2 Batteries and 125 Vdc Bus	Bus ED2B	X	X	X	X	X	Core Cooling	Required for instrumentation, SRV Control
U1 Div 3 Batteries and 125 Vdc Bus	Bus ED1C	X	X	X	X	X	Core Cooling	Required for Instrumentation SRV operation and RCIC operation
U2 Div 3 Batteries and 125 Vdc Bus	Bus ED2C	X	X	X	X	X	Core Cooling	Required for Instrumentation SRV operation and RCIC operation

20.0 APPENDIX: Table B-2 On-Site Phase 2 Equipment Requirements

Table B-2 On-Site Phase 2 Equipment Requirements

	Equipment Description	Storage Location	Protected Events					Design Basis		Fuel Req	Quality Attribute(s)	Supporting Function	Footprint Size (ft²)	Notes
			Seismic	Flooding	High Winds	Ice	High Temps.	Flow / Size	Pressure Rating					
Pumps	FLEX Lake Water Pump (2)	ESWPH	X	X	X	X	X	3000 gpm	125-150 psig		Commercial	RCIC/SP/SFP	4 x 10 (each)	FLEX pumps are skid/trailer mounted
Miscellaneous	Air Compressor (2)	Bay 1 / Bay 2	X	X	X	X	X	2 cfm	200 psig	0.275 gph	Commercial	Recharge SRV accumulators	2 x 6	Air Compressor requirements per B.5.b program
	Portable Pump (2)	Bay 1 / Bay 2	X	X	X	X	X	250 gpm	25 pisg	1 gph	Commercial	RCIC/SP/SFP	2 x 6 each	
	Fire Hose	Bay 1 / Bay 2	X	X	X	X	X	5 in.	200 psig		Commercial	RCIC/SP/SFP	100 total	2000' total length
	FLEX Lake Water Pump Discharge Hose	ESWPH / Bay 2	X	X	X	X	X	5 in.	200 psig		Commercial	RCIC/SP/SFP		4 dedicated hoses
	FLEX Lake Water Pump Suction Hose	ESWPH / Bay 2	X	X	X	X	X	5 in.	-15 psig		Commercial	RCIC/SP/SFP		7-10 ft lengths
	Diesel Fuel Oil Transfer Hose (3)	Bay 1 / Bay 2	X	X	X	X	X	1.5"	-15 psig / 200 psig		Commercial	Day tanks for FLEX Generators		300 ft
	Air Hose	Bay 1 / Bay 2	X	X	X	X	X	3/4 in.	200 psig		Commercial	Recharge SRV accumulators		400 ft
	Portable Light Towers (2)	Bay 1 / Bay 2	X	X	X	X	X			minimal	Commercial	Area Lighting	2 x 3 (each)	Portable lighting as required
Generators								Volts	Watts					
	FLEX Turbine Marine (3)	2 - Bay 1 1 - Bay 2	X	X	X	X	X	4160	1000 kW (stby) 850 kW (prime)	110 gph	Commercial	Backup AC power	128 total	Turbine Marine 1MW 4160 Vac 60 HZ 3 Phase Compact Series Turbine-Powered Generator and cables
	Portable Generators (7)	2 - Bay 1 2 - Bay 2	X	X	X	X	X	120	6000 W	0.275 gph	Commercial	Backup AC power	6	Baldor DG6E 6000 W or equivalent

Table B-2 On-Site Phase 2 Equipment Requirements															
	Equipment Description	Storage Location	Protected Events					Design Basis		Fuel Req	Quality Attribute(s)	Supporting Function	Footprint Size (ft²)	Notes
			Seismic	Flooding	High Winds	Ice	High Temps.	Flow / Size	Pressure Rating					

APPENDIX: Table B-2 On-Site Phase 2 Equipment Requirements

Table B-2 On-Site Phase 2 Equipment Requirements														
	Equipment Description	Storage Location	Protected Events					Design Basis		Fuel Req	Quality Attribute(s)	Supporting Function	Footprint Size (ft²)	Notes
			Seismic	Flooding	High Winds	Ice	High Temps.	Flow / Size	Pressure Rating					
Vehicles	Skid Loader ("Bobcat")	Bay 2	X	X	X	X	X			4 gph	Commercial	Debris Removal	169	
	Pickup Truck (2)	1 - Bay 1 1 - Bay 2	X	X	X	X	X			5 gph	Commercial	Equipment Deployment	2 x 286	Debris removal vehicle
	Transcube Fuel Oil Storage Tanks	Bay 2	X	X	X	X	X				Commercial	FLEX Generators	2 x 120	1,240 gallon capacity

21.0 APPENDIX: Table B-3 Storage Locations Summary

Table B-3 Storage Locations Summary

Storage Location	Dimensions	Stored Equipment	Protected Events					Notes
			Seismic	Flooding	Severe Storms, High Winds	Snow, Ice, Extreme Cold	High Temps	
FLEX Equipment Bay 1	19 X 60 1140 ft^2	2 FLEX Generators 1 Debris removal truck 1 Distribution Center 1 Cable Spool 5" fire hoses Fuel Hoses Fuel pumps 3 portable electric fans 1 portable light unit	X	X	X	X	X	U2 EDG Building
FLEX Equipment Bay 2	12 X 30 + 35 X 40 1760 ft^2	1 FLEX Generator 1 Debris removal truck 1 Cable Spool 1 Bobcat 1 towable diesel powered air compressor 2 portable electric fans 5" fire hoses 1 portable light unit 2 Transcube Fuel Oil tanks	X	X	X	X	X	U2 Auxiliary Building

22.0 APPENDIX: Table C1-1 Timing and Deployment Timeline for Modes 1-4

Page 1 of 3

From TR-FSE-13-9, Rev 1 (Reference 29)

Table C1-1 Timing and Deployment Timeline for Modes 1-4

Phase	Item	Action	SRO	RO	NLO	Elapsed Time (hours)	Duration (hours)	End (hours)	Time Constraint (hours)
Existing SBO Procedures	1	Evacuate Containment	0	1	0	0.05	0.05	0.1	N/A
	2	Confirm all rods in	0	1	0	0	0	0	N/A
	3	Establish Communications	1	0	0	0.25	0.25	0.5	N/A
	4	Confirm RCIC auto-start	0	1	0	0.25	0.25	0.5	N/A
	5	Throttle RCIC flow rate	0	1	0	0.5	1	1.5	N/A
	6	Close Upper Pool Return ISOL Vlv and DW Purge ISOL Vlv locally	0	0	1	0.5	0.5	1	1
	7	Verify closed Main Steam Outboard Drain Valve	0	0	1	1	0.5	1.5	2
	8	Open CR panel doors for cooling	0	0	1	0.25	0.25	0.5	0.5
	9	Crosstie DC buses across units	0	0	1	0.25	0.25	0.5	0.5
	10	Load shed DC busses	0	0	1	0.25	2.75	3	3
	11	Bypass RCIC Leak Detection isolation signal	0	1	0	0	0	0	N/A
	12	Decrease RPV pressure to ~200 psig and maintain	0	1	0	0.5	2.5	3	3
	13	Perform Damage Assessment	0	0	1	0	6	6	6

20.0 APPENDIX: Table C1-1 Timing and Deployment Timeline for Modes 1-4

Page 2 of 3

Table C1-1 Timing and Deployment Timeline for Modes 1-4

Phase	Item	Action	SRO	RO	NLO	Elapsed Time (hours)	Duration (hours)	End (hours)	Time Constraint (hours)
Phase 1	1	Declare ELAP	1	0	0	1	0	1	1
	2	Deploy debris removal equipment	0	0	1	1	2	3	6
	3	Deploy FLEX Lake Water Pump and connect hoses in ESWPH	0	0	2	1	2	3	3
	4	Align ESW trains in ESWPH	0	1	1	1	1	2	6
	5	Deploy and connect hose from Alternate Source to RCIC suction	0	0	2	3	1	4	6
	6	Align ESW in Aux Bldg., Intermediate Bldg., Diesel Bldg. and Control Complex	0	1	1	3	1	4	6
	7	Deploy FLEX Generator	0	0	2	4	2	6	6
	8	Deploy exterior light stands	0	0	1	1	1	2	4
	9	FHB exterior doors propped open	0	0	1	1.5	0.5	2	4

20.0 APPENDIX: Table C1-1 Timing and Deployment Timeline for Modes 1-4

Page 3 of 3

Table C.1-1 Timing and Deployment Timeline for Modes 1-4

Phase	Item	Action	SRO	RO	NLO	Elapsed Time (hours)	Duration (hours)	End (hours)	Time Constraint (hours)
Phase 2	1	Start and Operate FLEX Lake Water Pump in ESWPH	0	0	2	6	0	6	6
	2	Monitor FLEX Lake Water Pump in ESWPH	0	0	1	6	66	72	6
	3	Swap RCIC suction valves and feed RCIC with Alternate Source	0	1	1	6	0.5	6	6
	4	Start FLEX generator to energize vital busses	0	1	2	6	0	6	6
	5	Monitor FLEX generator	0	0	1	6	66	72	6
	6	Initiate SP makeup with SPMU	0	1	0	6	0	6	6
	7	Align SPCLC	0	1	1	6	1	7	7
	8	Start the SPCU/ADHR pump	0	1	1	6.5	0.5	7	7
	9	Establish FLEX Equipment Refueling	0	0	2	12	60	72	12
	10	Deploy and Start diesel-driven air compressor	0	0	2	13	58	72	16
Phase 3	1	Deploy 4160 Vac NSRC Generator	1	1	1	24	2	26	24
	2	Start and operate 4160 Vac NSRC generator	0	0	1	26	46	72	26
	3	Align RHR A to SDC Mode and ESW A to RHR A HX	1	1	1	24	2	26	26
	4	Secure SPCLC	0	1	1	28	0	28	26
	5	Start RPV cool-down	0	1	1	28	44	72	30
	6	Begin SFP makeup from ESW	0	1	1	24	48	72	26

23.0 APPENDIX: Table C-2: Timing and Deployment Reference Values

Table C-2: Timing and Deployment Reference Values				
No.	Parameter of interest	Document Reference	Plant Specific Applied Value	Discussion
1	Decay heat model	X11-001, REV 0	ANS 5.1 1979, no uncertainties	
2	Applicable computer code for NSSS analysis	X11-001, REV 0	MAAP 4.0.7	
3	RPV leakage	X11-001, REV 0	66 gpm	
5	Total RCIC flow	X11-001, REV 0	700 gpm	
8	Time initiating cool down	X11-001, REV 0	1 hour	
9	Rate of RPV cool down	X11-001, REV 0	100°F/hr.	
10	Time target RPV pressure and temperature is achieved for long-term	X11-001, REV 0	3 hours	
11	Target pressure and temperature (stabilized RPV for long-term)	X11-001, REV 0	200 psia	

24.0 APPENDIX: Table C-3: NEI 12-01 Phase 2 Total Loss of AC (TLAC) Power ERO Staffing Analysis Report On-Shift Staffing Task Timetable

Page 1 of 3

Time (T+mins)	Position(s)	Action	Duration (min)
0	**Complete loss of station AC power event occurs**		
0	SM US RO1 RO2	Post-SCRAM CR actions (ONI-C71-1)	2
1	SM	Evaluate E-Plan entry criteria (EPI-A1)	1
2	SM	Determine and declare SAE Classification (EPI-A1)	10
3	US	Direct entry into RPV Control and Loss of AC (EOP-01/ONI-R10-2)	1
3	STA	Perform STA functions	Duration
4	RO1 RO2	Perform CR actions (EOP-01)	1
4	RO1 RO2	Perform CR actions (ONI-R10-2)	Duration
4	US	Direct RO3 to perform EOP system preservation (ONI-SPI D-7)	1
4	RO2	Direct PO2 to investigate EDGs as directed (NOP-OP-1002)	1
5	RO1 RO2	Perform CR actions (EOP-01A)	Duration
5	RO3	Implement EOP system preservation (ONI-SPI D-7)	1
5	PO2	Investigate status of EDGs as directed (NOP-OP-1002)	30
6	US	Direct RO2 to perform ONI-SPI H-1 (ONI-SPI H-1)	6
6	RO1	Review list of CR instrumentation available (ONI-SPI H-3)	2
6	RO3	Direct PO1 to cross-tie fire main to ESW (ONI-SPI D-7)	1
7	PO1	Cross-tie fire main to ESW (ONI-SPI D-7)	5
7	RO2	Direct Security to relocate personnel (ONI-SPI H-1)	1
7	US	Enter Loss of Spent Fuel Pool Cooling procedure (ONI-E12-2)	Duration
8	SAS	Perform announcements for personnel relocation (ONI-SPI H-1)	2
8	RO2	Attempt to establish comms with power dispatch (ONI-SPI H-2)	1
9	RO2	Perform CR actions for ATWS (EOP-SPI 2.3)	5
9	RO1	CR actions - RPV level via RCIC (EOP-SPI 6.6)	Periodic
9	RO3	CR actions - RPV level via RCIC (EOP-SPI 6.6)	Periodic
12	PO1	Return to CR	
13	SM	Notification and direction to on-shift staff	duration
14	SM	Perform announcement for E-Plan entry (I&C report to CR)	1
15	SM	Complete initial SAE notification form (EPI-B1)	5
15	SAS	ERO Notification (SPI-0032)	2
16	I&C	Arrive to CR	
17	FB3	Deploy SAT phone antenna (ONI-R10-2)	15
17	RO3	Direct PO1 to cross-tie batteries (ONI-SPI D-3)	1
18	PO1	Cross-tie batteries (ONI-SPI D-3)	20
18	RO3	Direct FB1 to perform ONI-SPI D1 (ONI-SPI D-1)	1
19	FB1	Open door to Switchgear EH13 room (ONI-SPI D-1)	5

24 APPENDIX: Table C-3: NEI 12-01 Phase 2 Total Loss of AC (TLAC) Power ERO Staffing Analysis Report On-Shift Staffing Task Timetable

Page 2 of 3

Time (T+mins)	Position(s)	Action	Duration (min)
20	SM	Approve content of initial SAE notification form (EPI-B1)	1
21	I&C	Perform SAE initial notification (EPI-B1)	20
30	SM	Complete ENS Notification Form (NOP-OP-1015)	5
32	FB3	Return to CR	
35	PO2	Return to CR	
38	PO1	Return to CR	
39	PO1 FB2 RPT1	Isolate existing containment/steam vent paths (ONI-R10-2)	60
40	RO3	Direct PO2 to perform DC load shed (ONI-SPI D-2)	1
41	PO2	Perform DC load shed (ONI-SPI D-2)	20
41	I&C	Return to CR	
42	I&C	Perform ENS Notification (EPI-B1)	duration
60	US	Implement FLEX Travel Paths (FSG-80.1)	duration
60	SM	Determine and declare GE Classification (EPI-A1)	4
61	PO2	Return to CR	
65	SM	Complete initial GE notification form (EPI-B1)	5
65	FB3 FAT1	Perform site assessment using debris removal vehicle (FSG-80.1)	30
65	US	Direct performance of FLEX power to EH21 (FSG-40.3) and the performance of FLEX power to EH11 /12 /13 or XF1A using TH21 tie-line (FSG-40.1)	5
70	RO3 PO2 FB1 FB4 FAT2	Perform in-plant actions for FLEX diesel generator preparations (FSG-40.3)	230
70	SM	Complete and approve PAR (EPI-B8)	2
72	SM	Approve content of initial GE notification form (EPI-B1)	1
73	SM	Perform initial GE notification (EPI-B1)	12
85	SM	Initiate Accountability (EPI-B5)	1
86	RO2	Perform Accountability for ops staff (EPI-B5)	10
86	SAS	Complete Accountability (EPI-B5)	30
90	SM	Complete NRC notification form for GE (NOP-OP-1015)	10
95	FB3 FAT1	Return to CR	
95	FB3 FAT1	Debris removal for identified FSG strategy(s) (FSG-80.1)	90
99	PO1 FB2 RPT1	Return to CR	

24 APPENDIX: Table C-3: NEI 12-01 Phase 2 Total Loss of AC (TLAC) Power ERO Staffing Analysis Report On-Shift Staffing Task Timetable

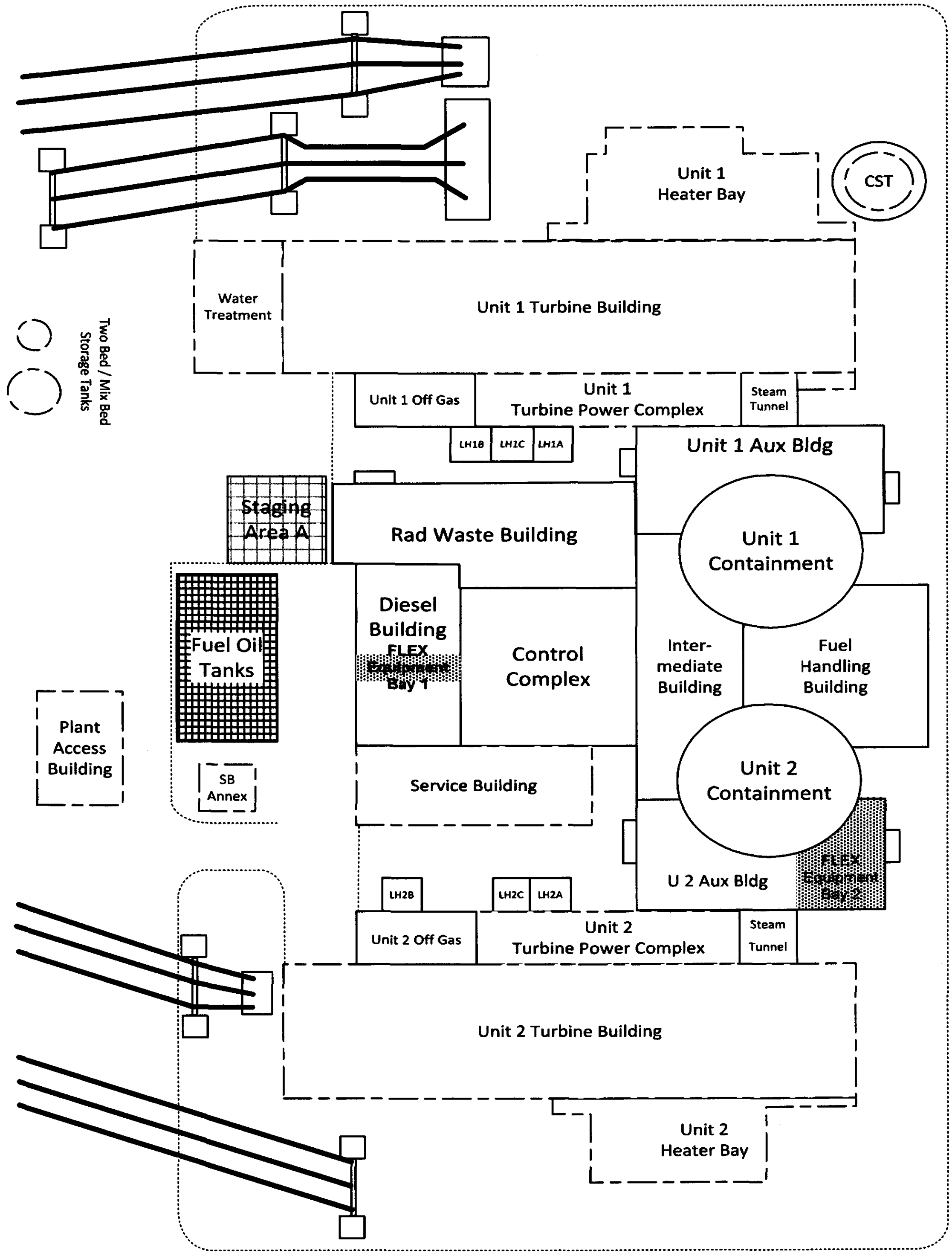
Page 3 of 3

Time (T+mins)	Position(s)	Action	Duration (min)
100	RO1	CR actions / direct in-plant actions of FLEX heat removal strategy (FSG-10.1)	60
100	PO1 RPT2	In-plant valve operations (FSG-10.1)	60
100	CT	Set up room cooling (FSG-10.1)	60
105	RPT1	Perform downwind site boundary surveys (NOP-LP-5015)	60
125	SM	Complete follow-up notification form (EPI-B1)	10
135	SM	Approve content of follow-up notification form (EPI-B1)	1
136	SM	Perform follow-up notification (EPI-B1)	12
160	PO1 RPT2 CT	Return to CR	
160	US	Direct alignment of heat removal via A ESW (FSG-60.1)	5
165	PO1 RPT2 CT	Perform alignment of heat removal via A ESW (FSG-60.1)	120
165	RPT1	Return to CR	
185	FB3 FAT1	Return to CR	
185	SM	Complete follow-up notification form (EPI-B1)	10
195	SM	Approve content of follow-up notification form (EPI-B1)	1
196	SM	Perform follow-up notification (EPI-B1)	12
245	SM	Complete follow-up notification form (EPI-B1)	10
255	SM	Approve content of follow-up notification form (EPI-B1)	1
256	SM	Perform follow-up notification (EPI-B1)	12
285	PO1 RPT2 CT	Return to CR	
290	CT	Perform dose assessment (NOP-LP-5007)	duration
300	RO3 PO2 FB1 FB4 FAT2	Perform FLEX power to EH11 /12 /13 or XF1A using TH21 tie-line (FSG-40.1)	60
305	SM	Complete follow-up notification form (EPI-B1)	10
315	SM	Approve content of follow-up notification form (EPI-B1)	1
316	SM	Perform follow-up notification (EPI-B1)	12
360	**End of Shift Staffing Task Sequence Analysis**		

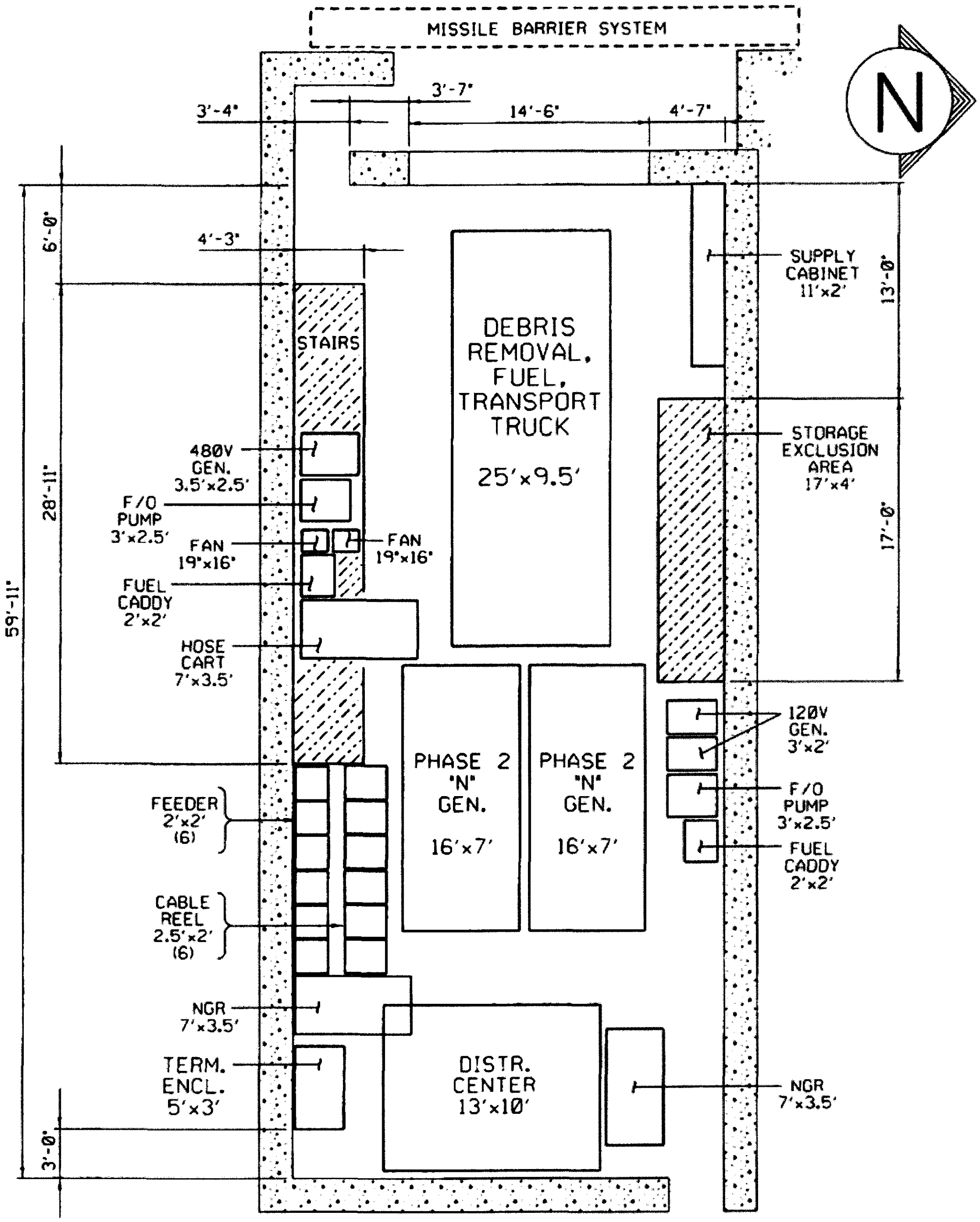
25.0 APPENDIX: Table D-1: Equipment Design Confirmation Summary Table

Table D-1 Deleted, intentionally blank to maintain numbering.

26.0 APPENDIX: Figure D-1 Power Block Buildings



27.0 APPENDIX: Figure D-2 FLEX Equipment Bay 1 Emergency Diesel Generator (EDG) Building

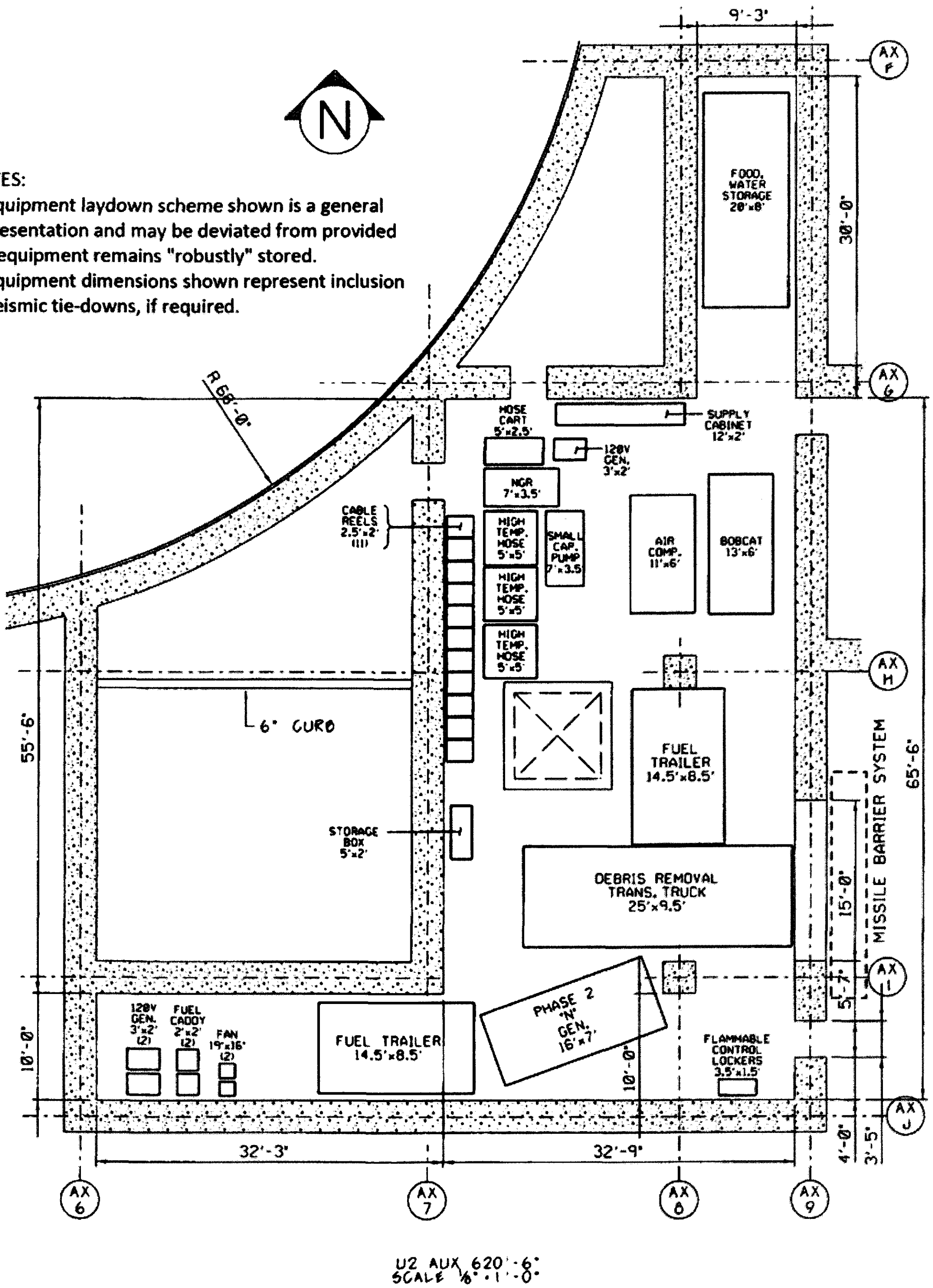


NOTES:

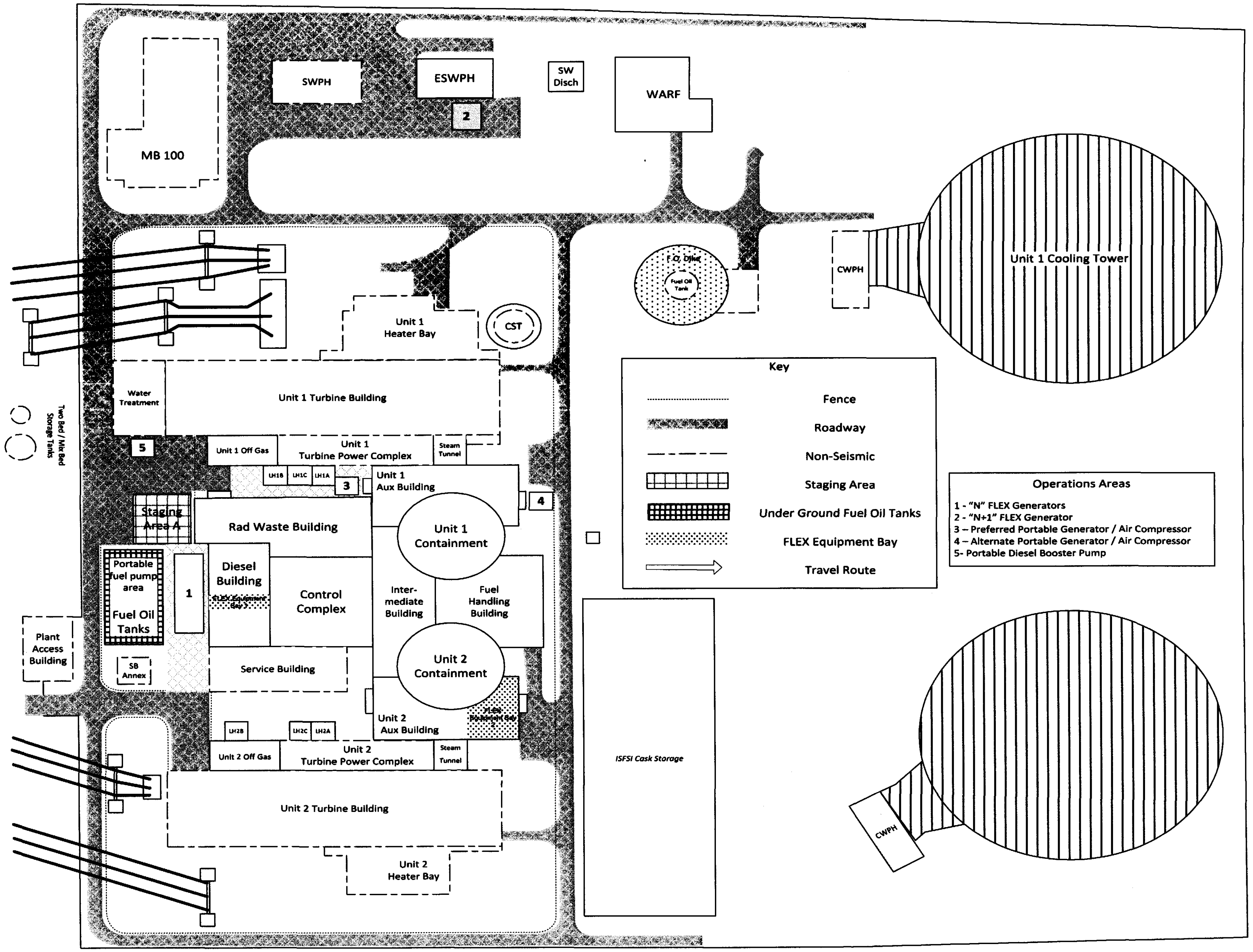
1. Equipment laydown scheme shown is a general representation and may be deviated from provided the equipment remains "robustly" stored.
2. Equipment dimensions shown represent inclusion of seismic tie-downs, if required.

28.0 APPENDIX: Figure D-3 FLEX Equipment Bay 2 - Unit 2 Auxiliary Building East Side

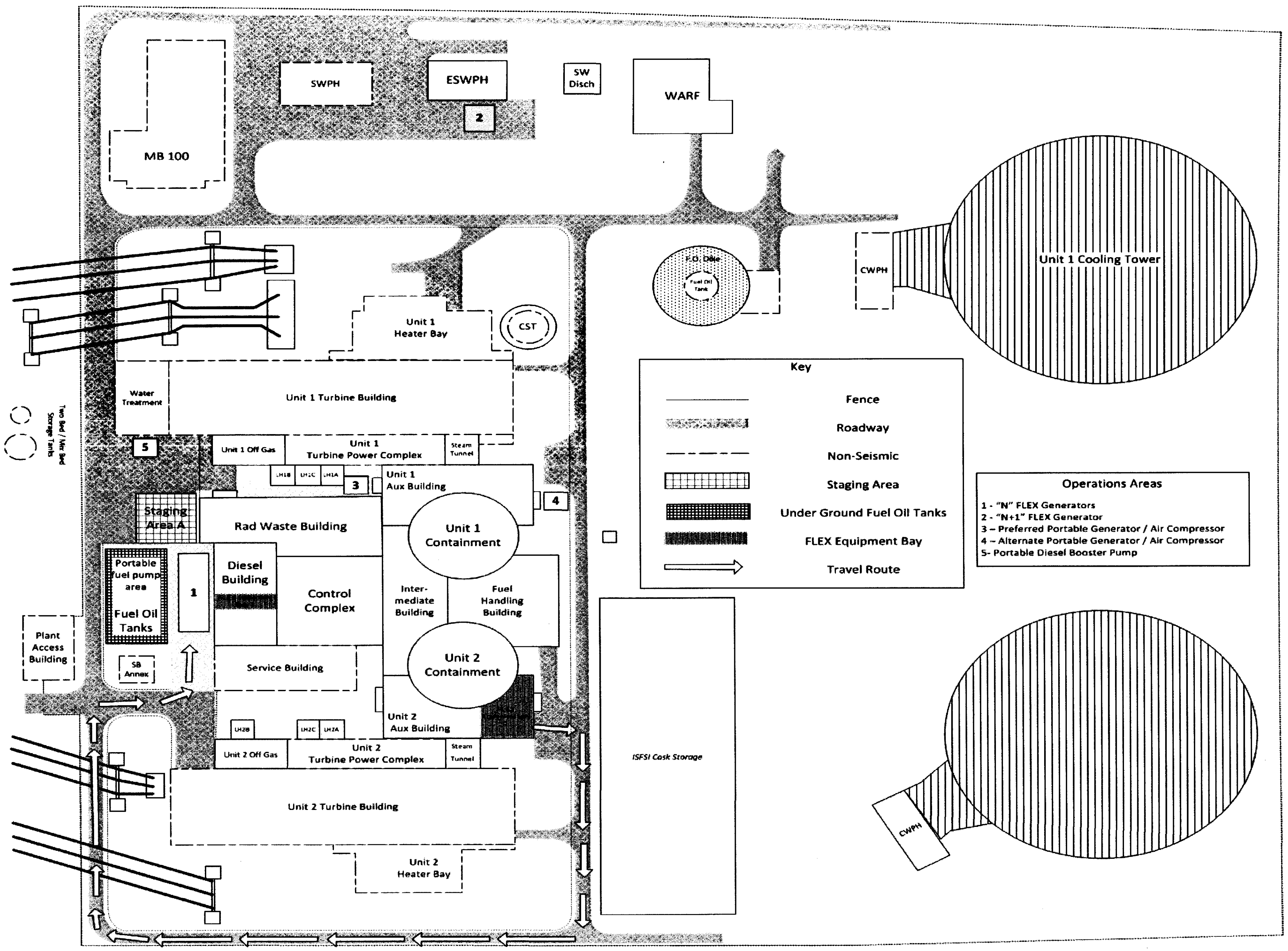
NOTES:
1. Equipment laydown scheme shown is a general representation and may be deviated from provided the equipment remains "robustly" stored.
2. Equipment dimensions shown represent inclusion of seismic tie-downs, if required.



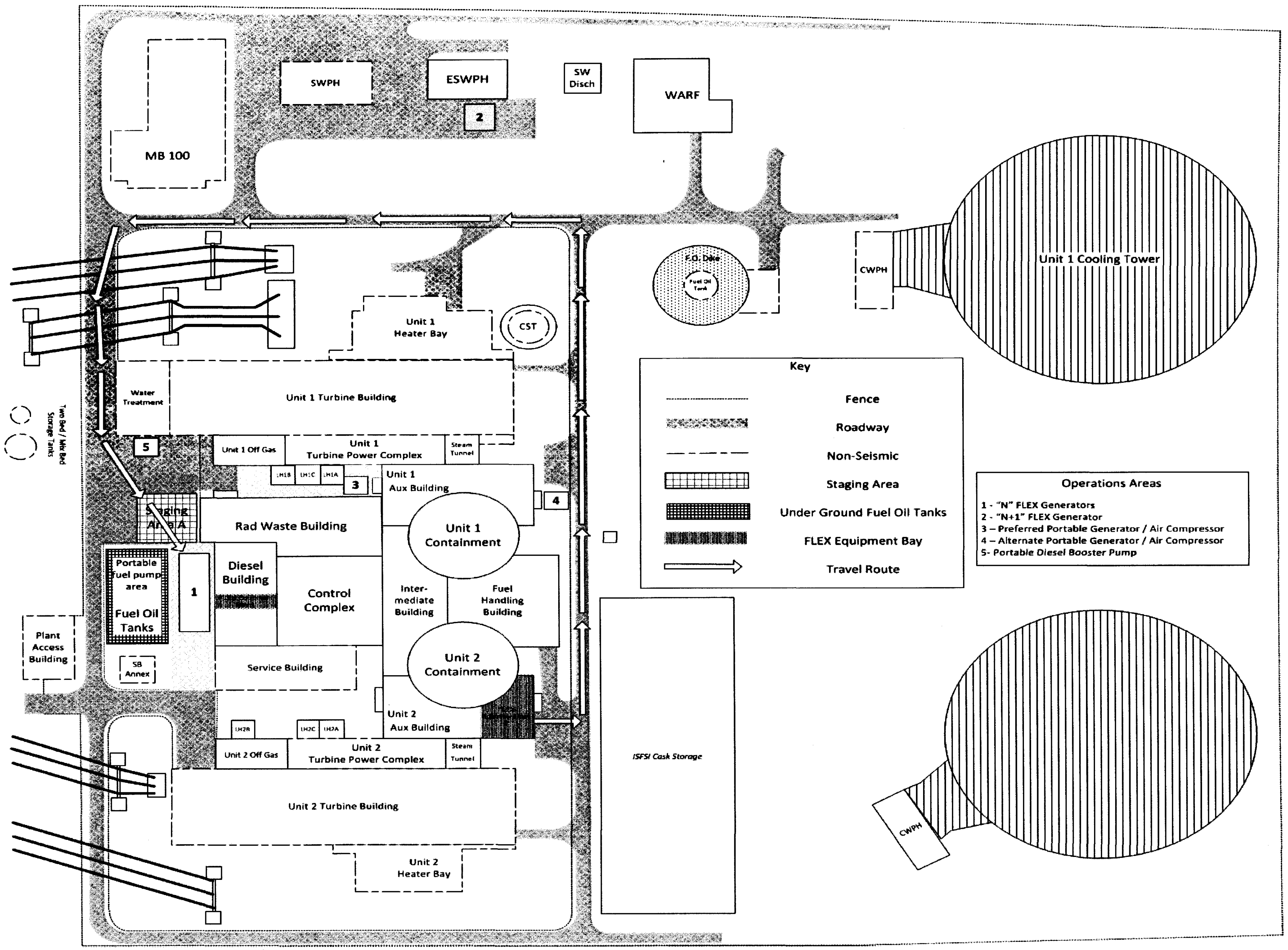
29.0 APPENDIX: Figure D-4 Equipment Storage/Deployment Locations



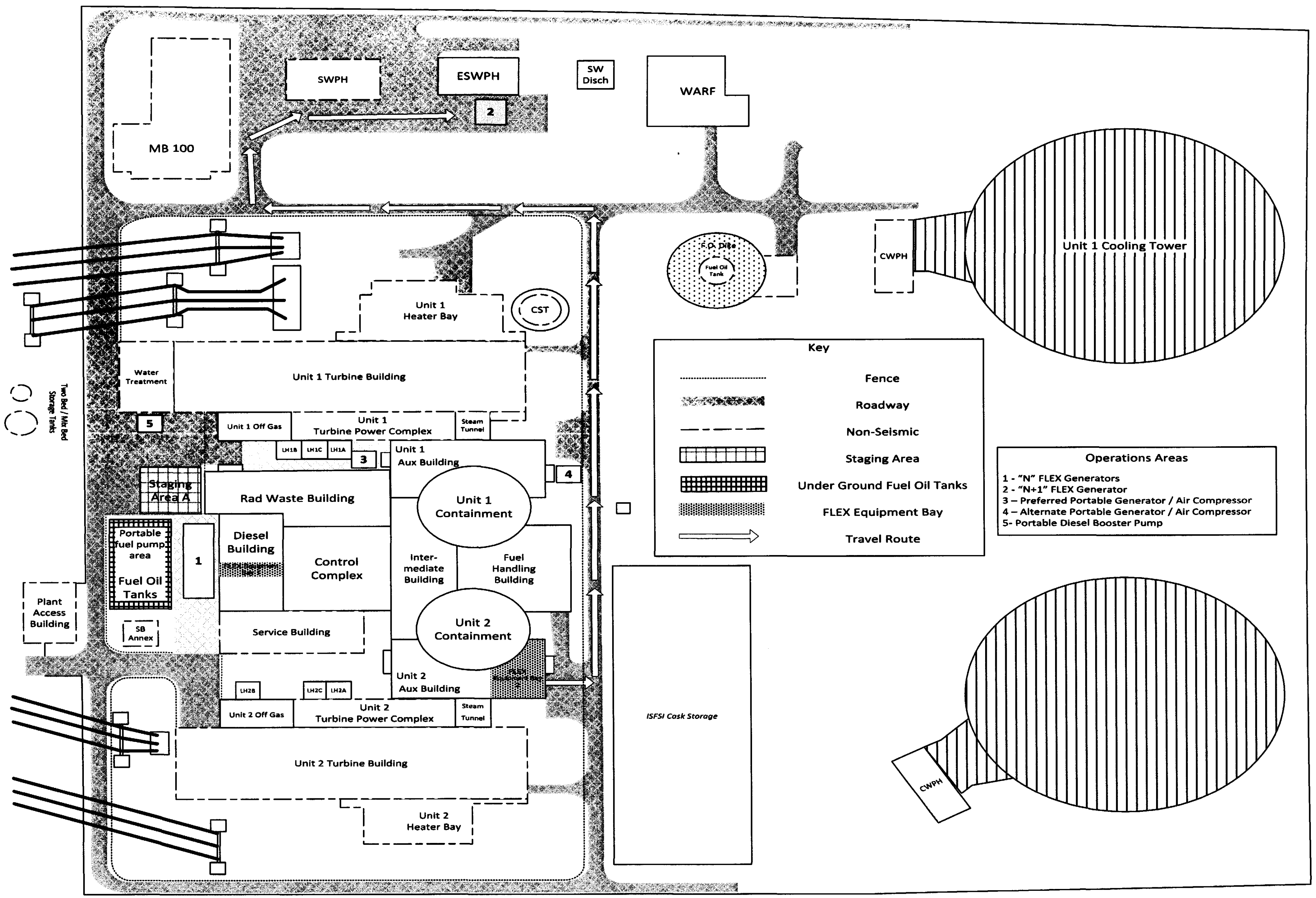
30.0 APPENDIX: Figure D-5 FLEX Deployment Path 1



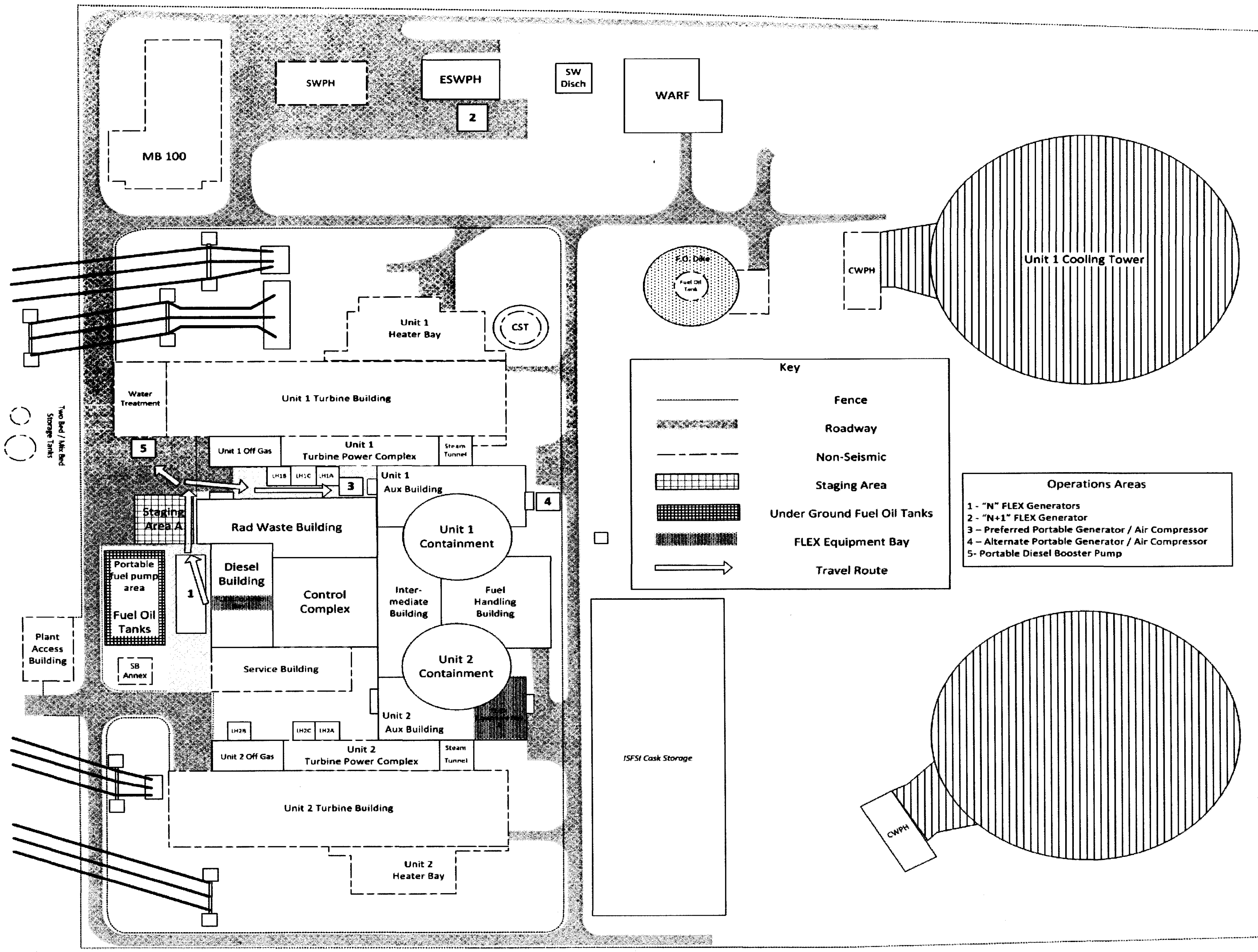
31.0 APPENDIX: Figure D-6 FLEX Deployment Path 2



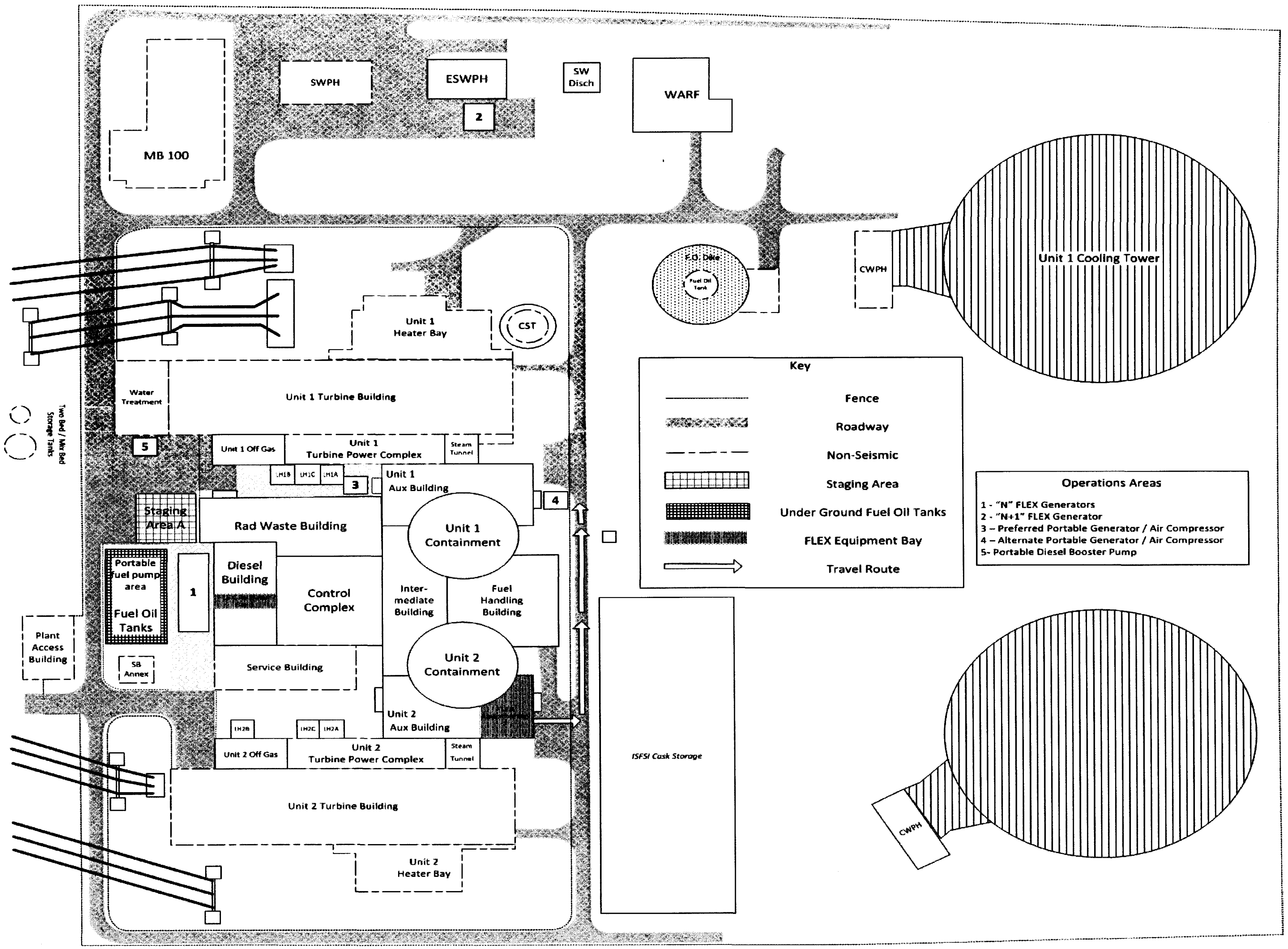
32.0 APPENDIX: Figure D-7 FLEX Deployment Path 3



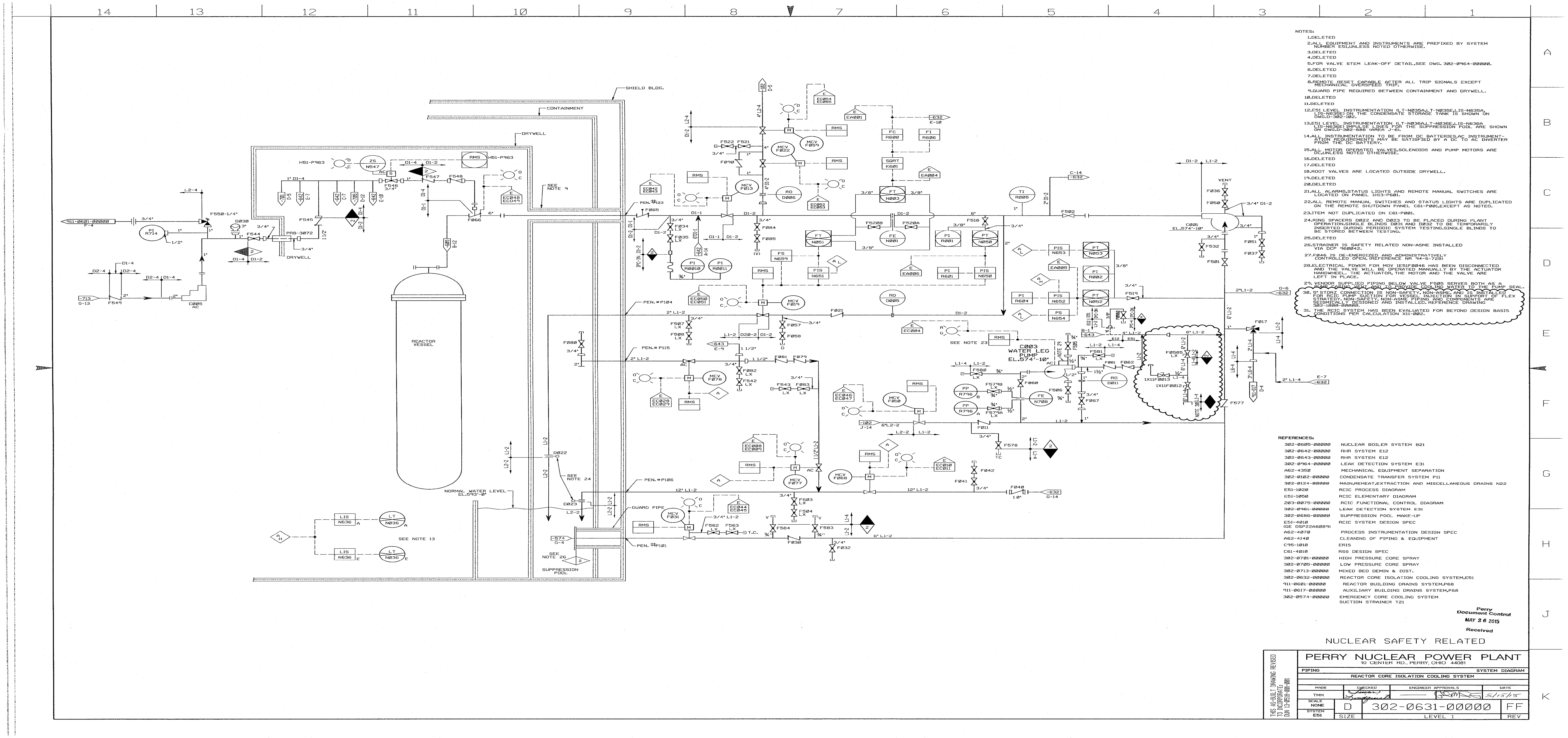
33.0 APPENDIX: Figure D-8 FLEX Deployment Path 4



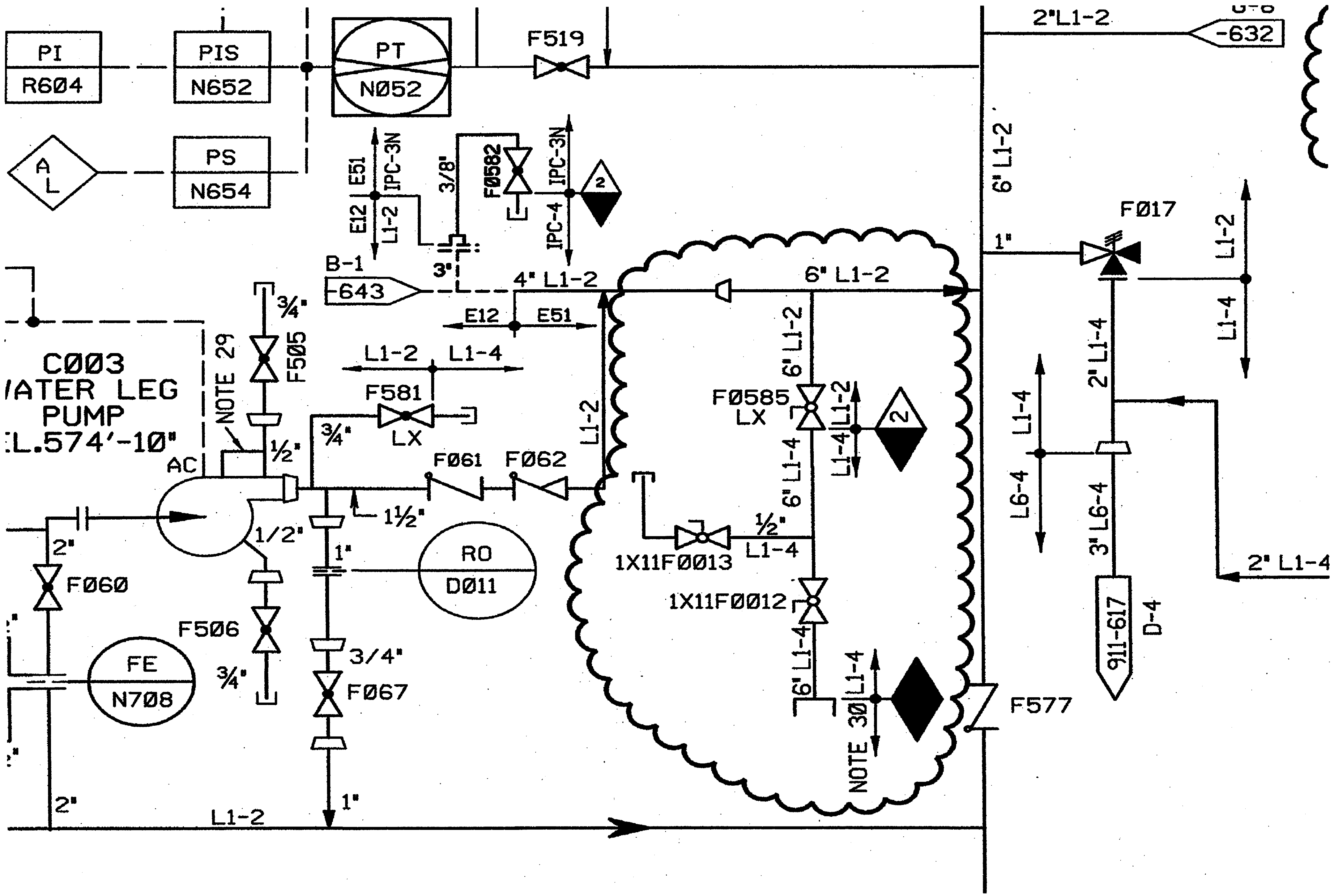
34.0 APPENDIX: Figure D-9 FLEX Deployment Path 5



35.0 APPENDIX: Figure E-1 RCIC Suction Connection Point

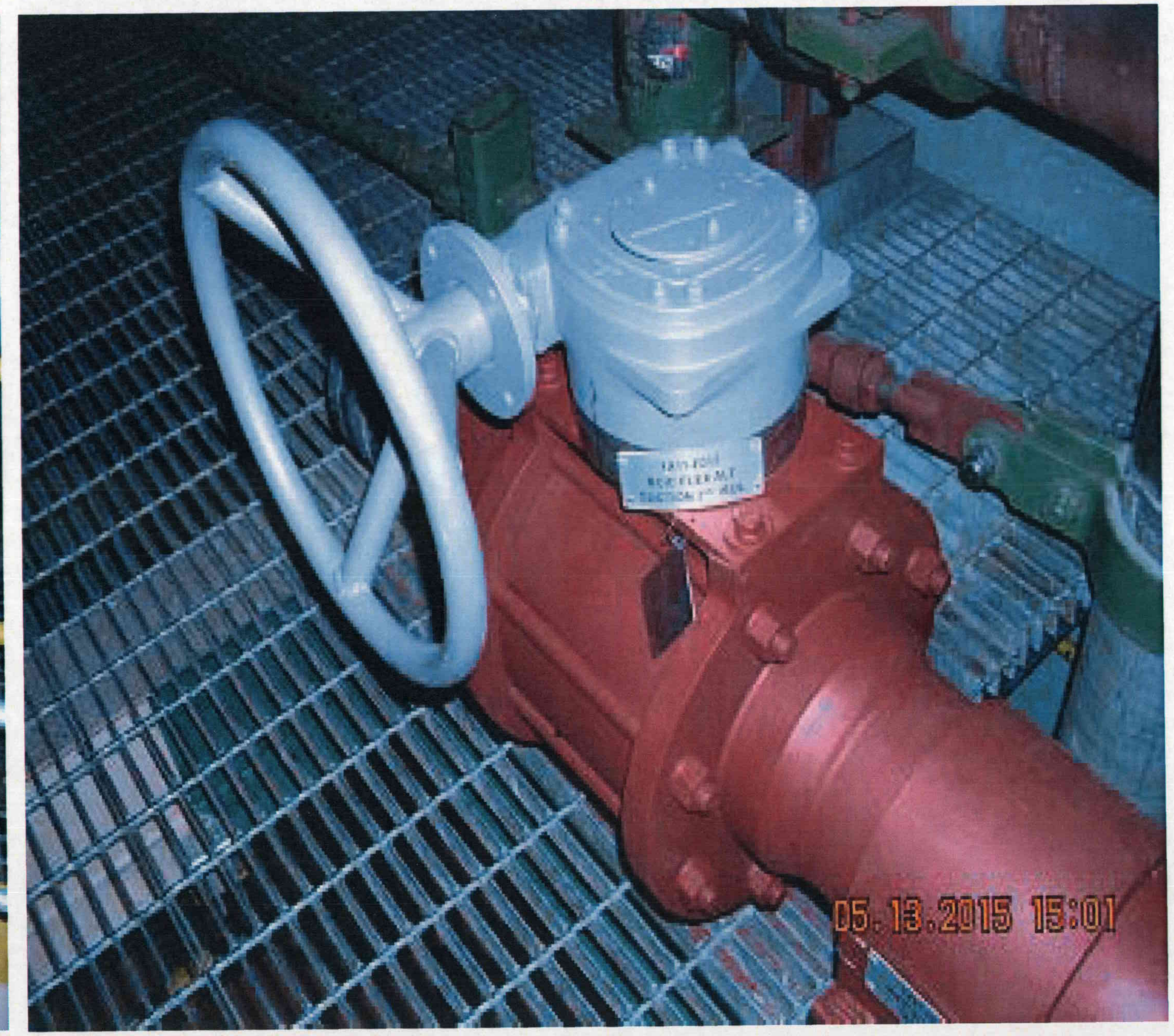


36.0 APPENDIX: Figure E-1A RCIC Suction Connection Point Expanded



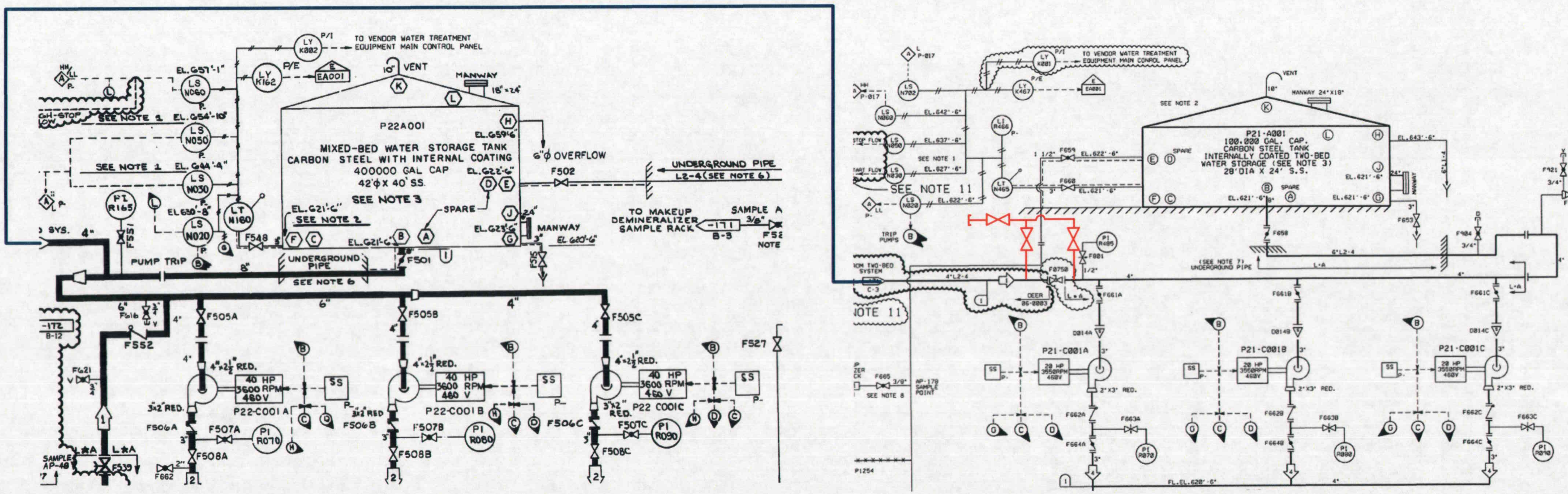
37.0 APPENDIX: Figure E-1B RCIC Suction Connection Point

RCIC Tie In



RCIC X11-F012

38.0 APPENDIX: Figure E-2: Two Bed / Mixed Bed Storz Connector Location



39.0 APPENDIX: Figure E-2A: Two Bed / Mixed Bed Storz Connector Physical Location

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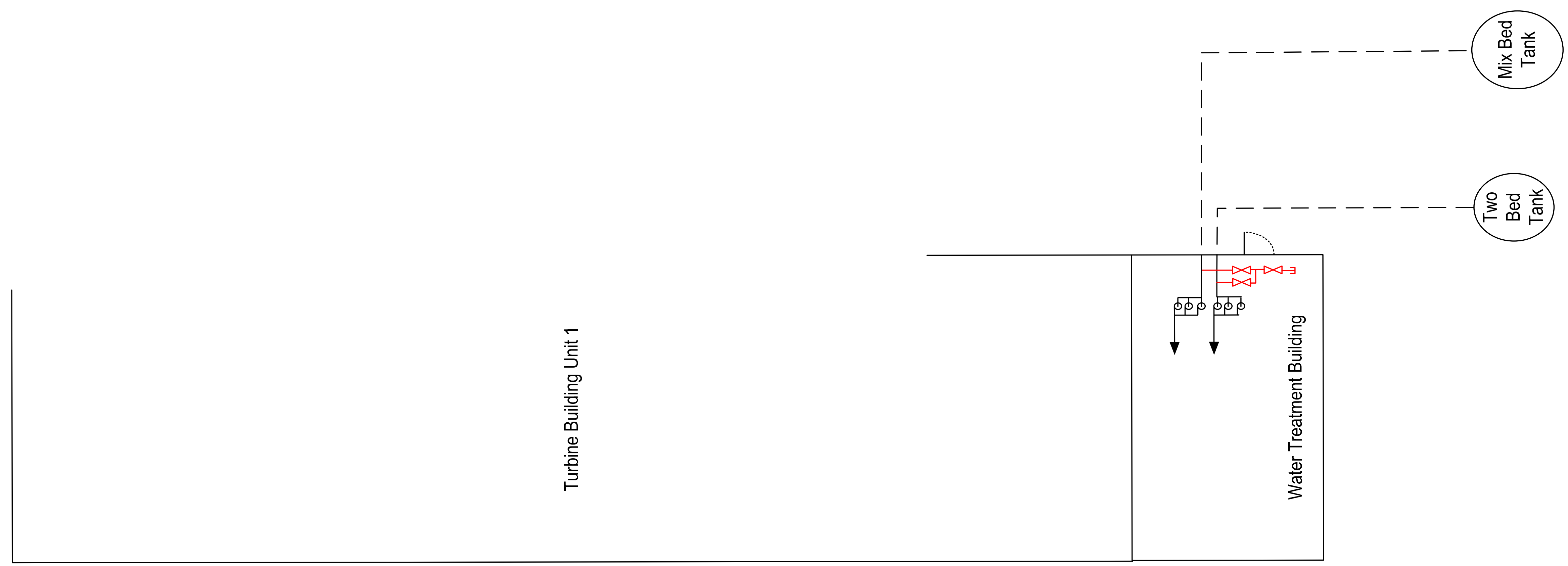

40.0 APPENDIX: Figure E-2C: Two Bed / Mixed Bed Storz Connector Location

View between mixed bed and two bed pumps, looking east

View from Storz connector looking north

41.0 APPENDIX: Figure E-2D: Exterior Hose Path from Mixed Bed Tank

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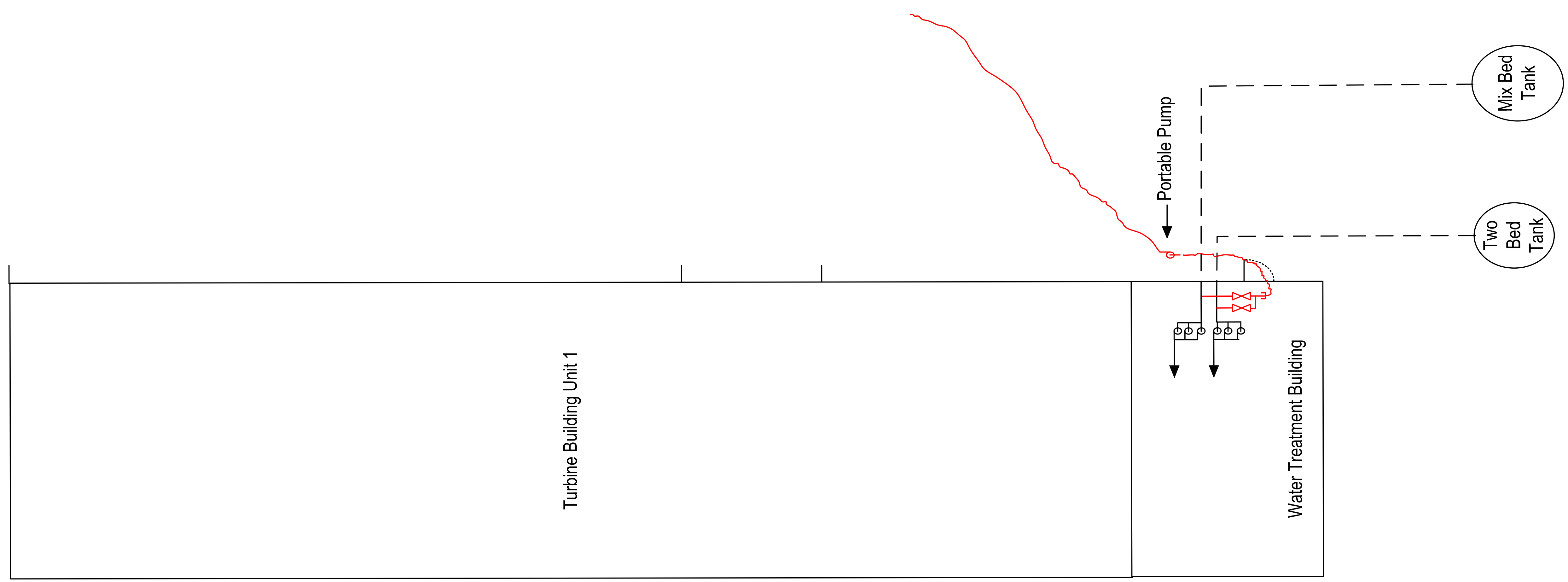

42.0 APPENDIX: Figure E-3: Interior Hose Path from Mixed Bed to the RCIC Suction Connection

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redacted per 10 CFR 2.390(d)(1).

43.0 APPENDIX: Figure E-3A: Interior Hose Path from RHR to FPCC Return Header to the RCIC Suction Connection

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redacted per 10 CFR 2.390(d)(1).

44.0 APPENDIX: Figure E-3B: Interior Hose Path from ESW A to the RCIC Suction Connection

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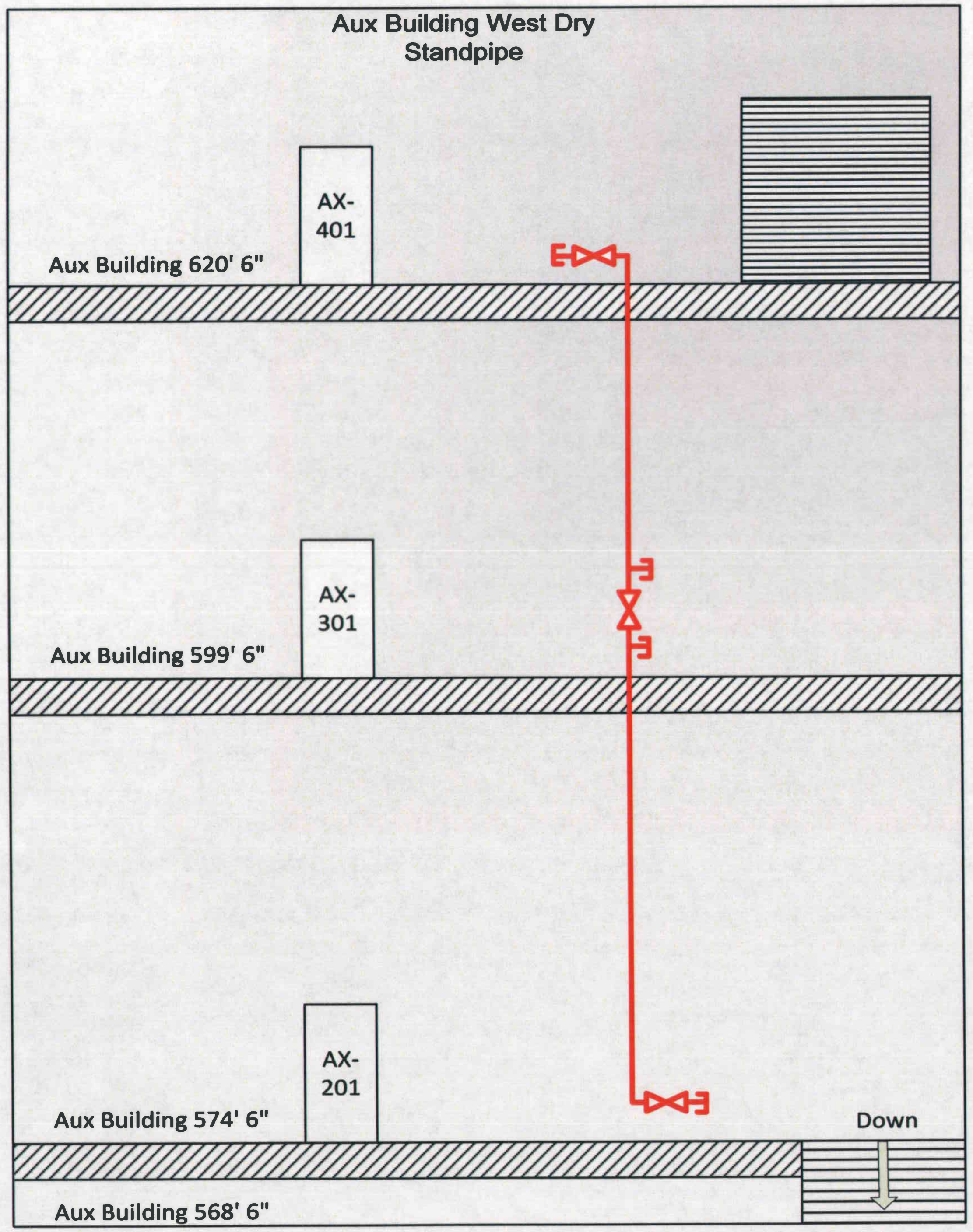
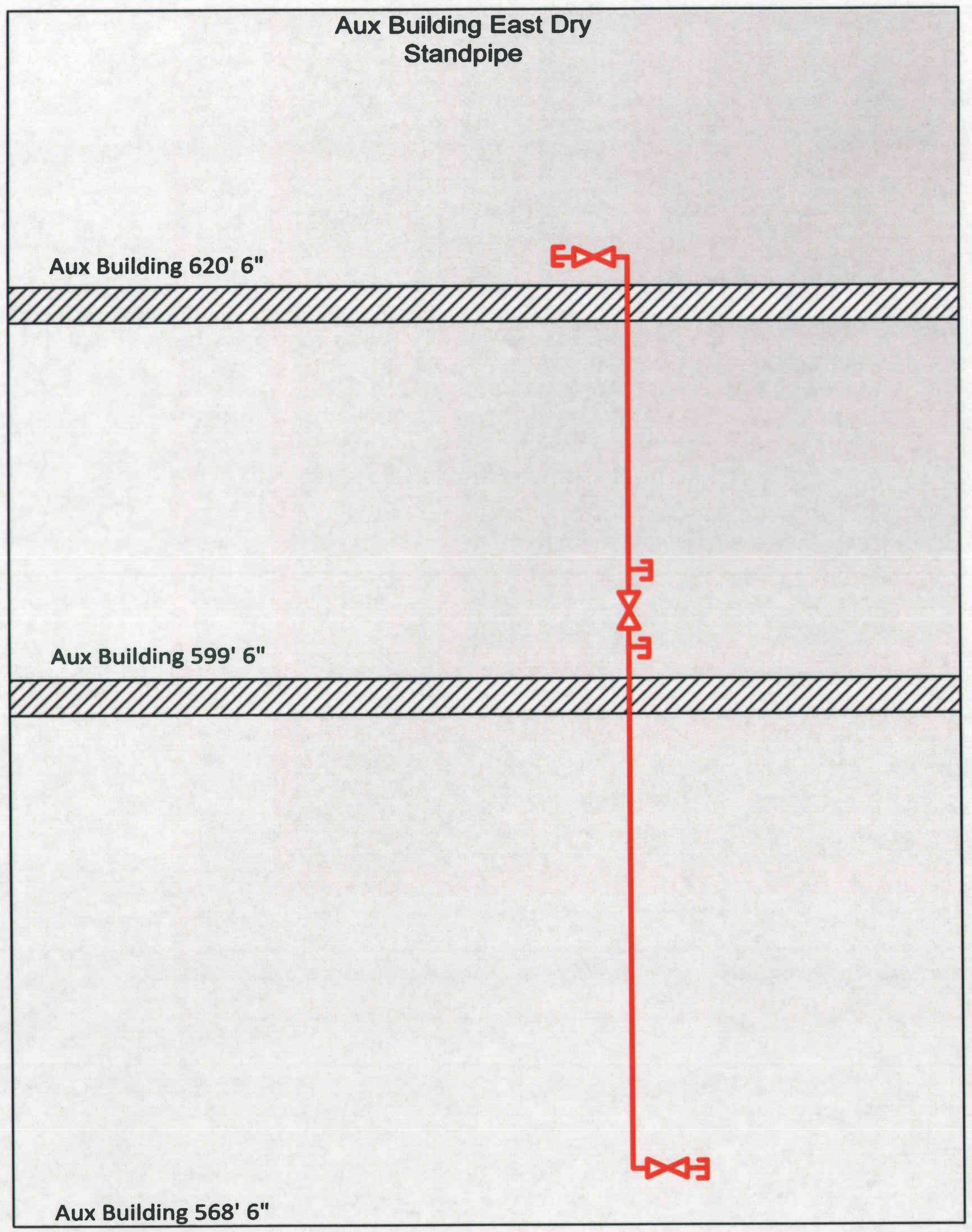
redacted per 10 CFR 2.390(d)(1).

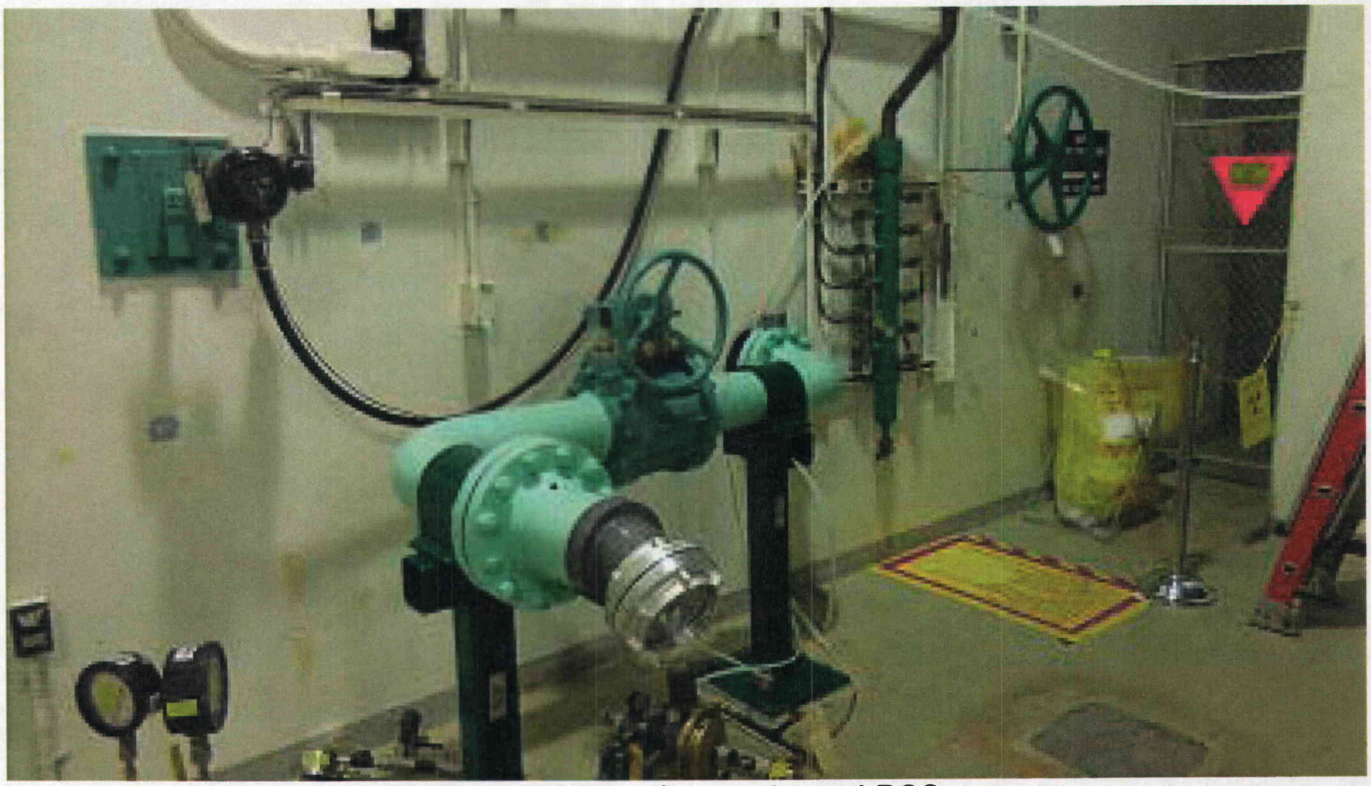
45.0 APPENDIX: Figure E-4: Aux Building Dry Standpipes





46.0 APPENDIX: Figure E-5 Mechanical FLEX Equipment and Modifications Photos

Page 1 of 38

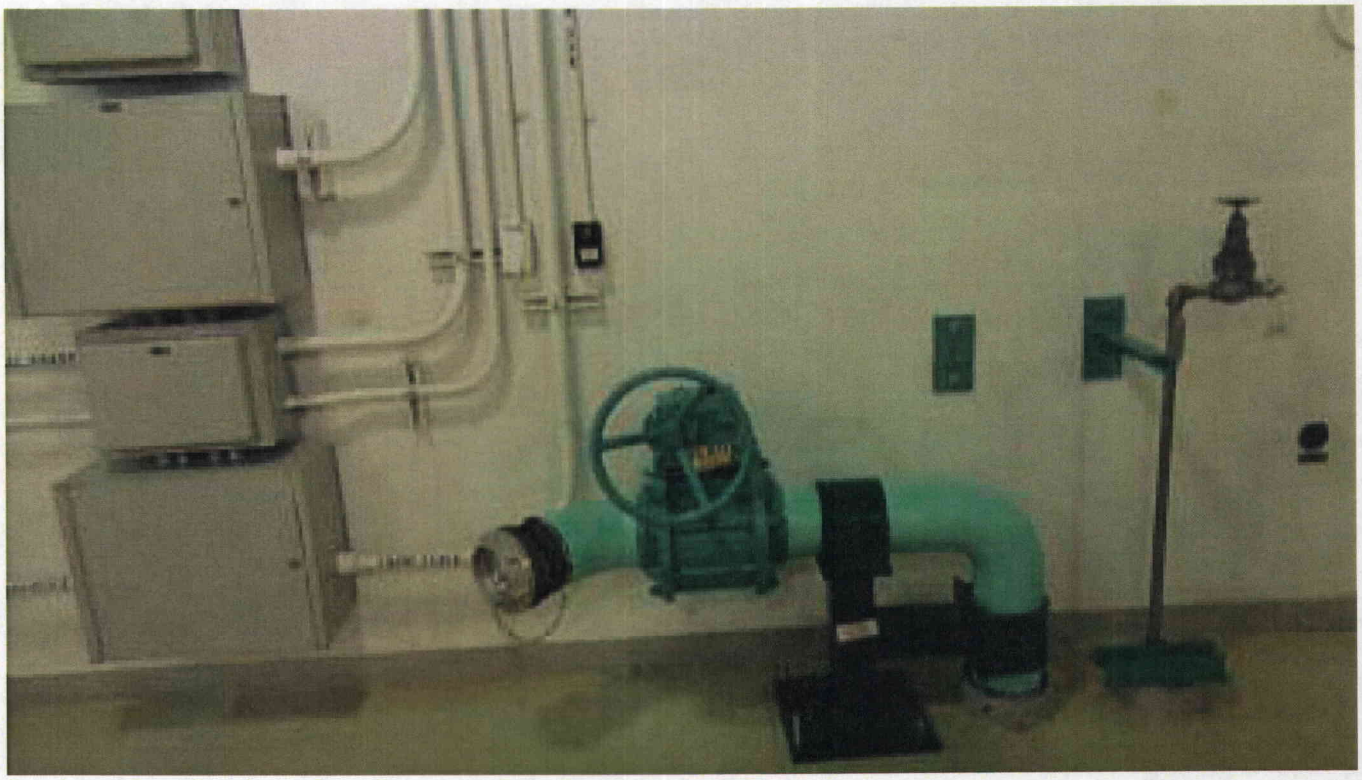


X11-F018 AX 620 East Connection to LPCS

Figure E-5 Continued: Auxiliary Building 620-foot elevation FLEX Photos:
Page 2 of 38

X11-F103A East Riser

Figure E-5 Continued: Auxiliary Building 620-foot elevation FLEX Photos:
Page 3 of 38



X11-F103B West Riser

Figure E-5 Continued: Auxiliary Building 599-foot elevation FLEX Photos:
Page 4 of 38

ESW A (foreground) and FPCC (rear) Tie Ins

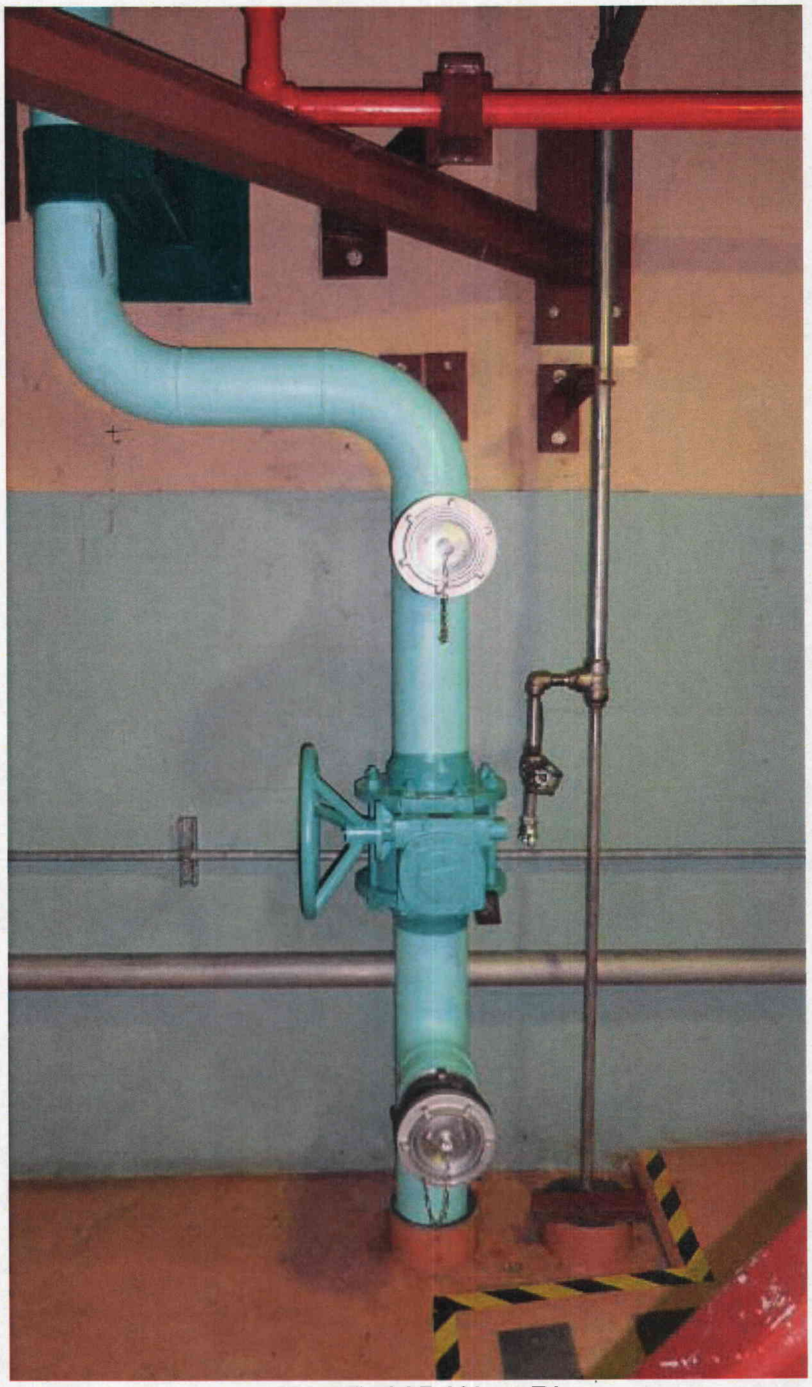
Figure E-5 Continued: Auxiliary Building 599-foot elevation FLEX Photos: Page 5 of 38

ESW A Tie In

Figure E-5 Continued: Auxiliary Building 599-foot elevation FLEX Photos:
Page 6 of 38

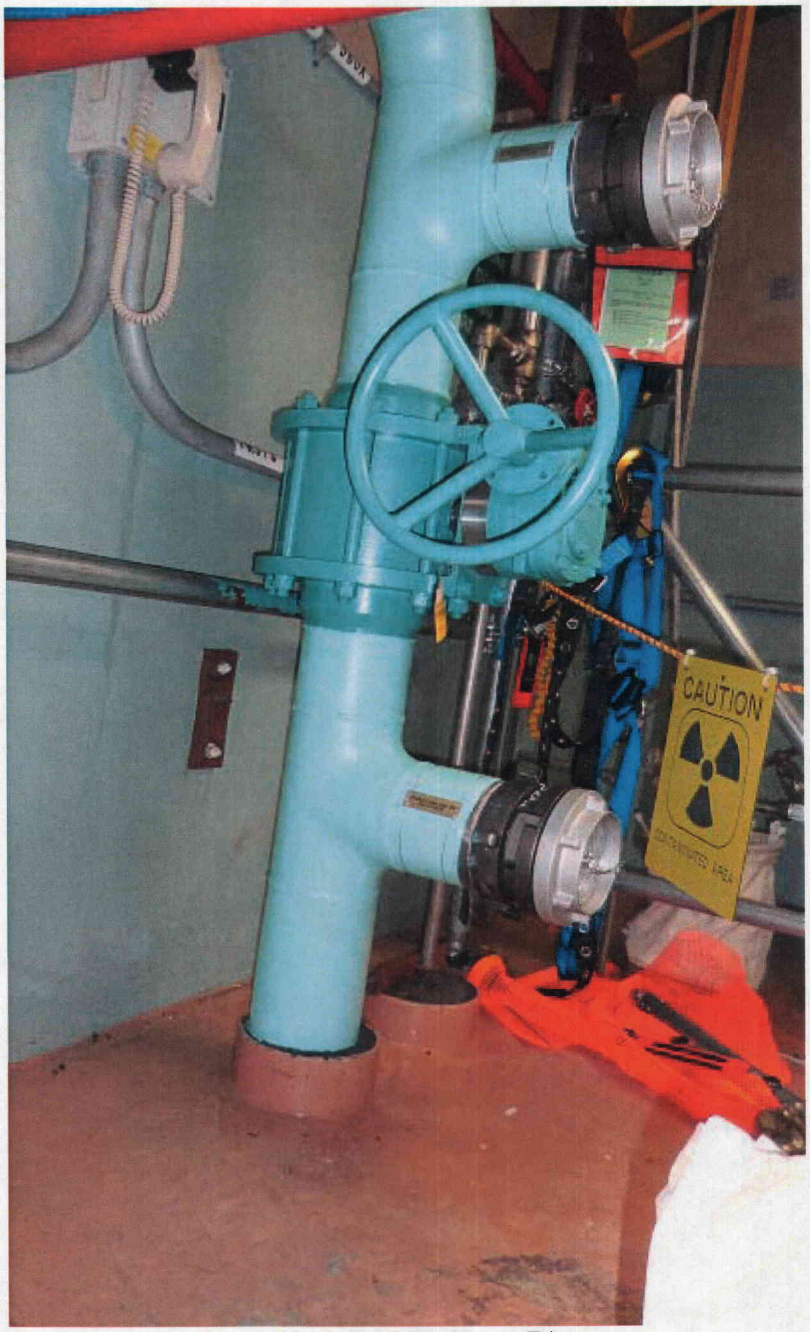
ESW B Tie In

Figure E-5 Continued: Auxiliary Building 599-foot elevation FLEX Photos:
Page 7 of 38



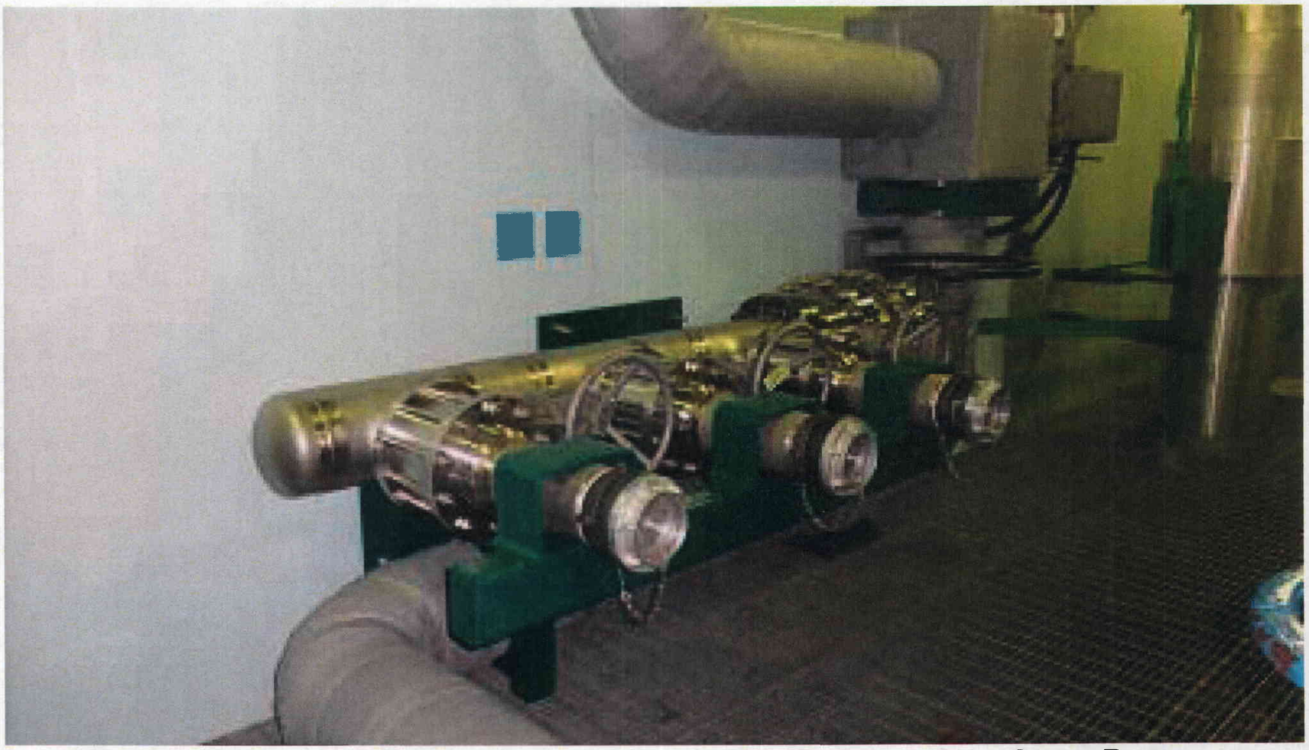
X11-F102B West Riser

Figure E-5 Continued: Auxiliary Building 599-foot elevation FLEX Photos:
Page 8 of 38



X11-F102A East Riser

Figure E-5 Continued: Auxiliary Building 568/574-foot elevation FLEX Photos:
Page 9 of 38



Alternate Decay Heat Removal connections in Low Pressure Core Spray Room

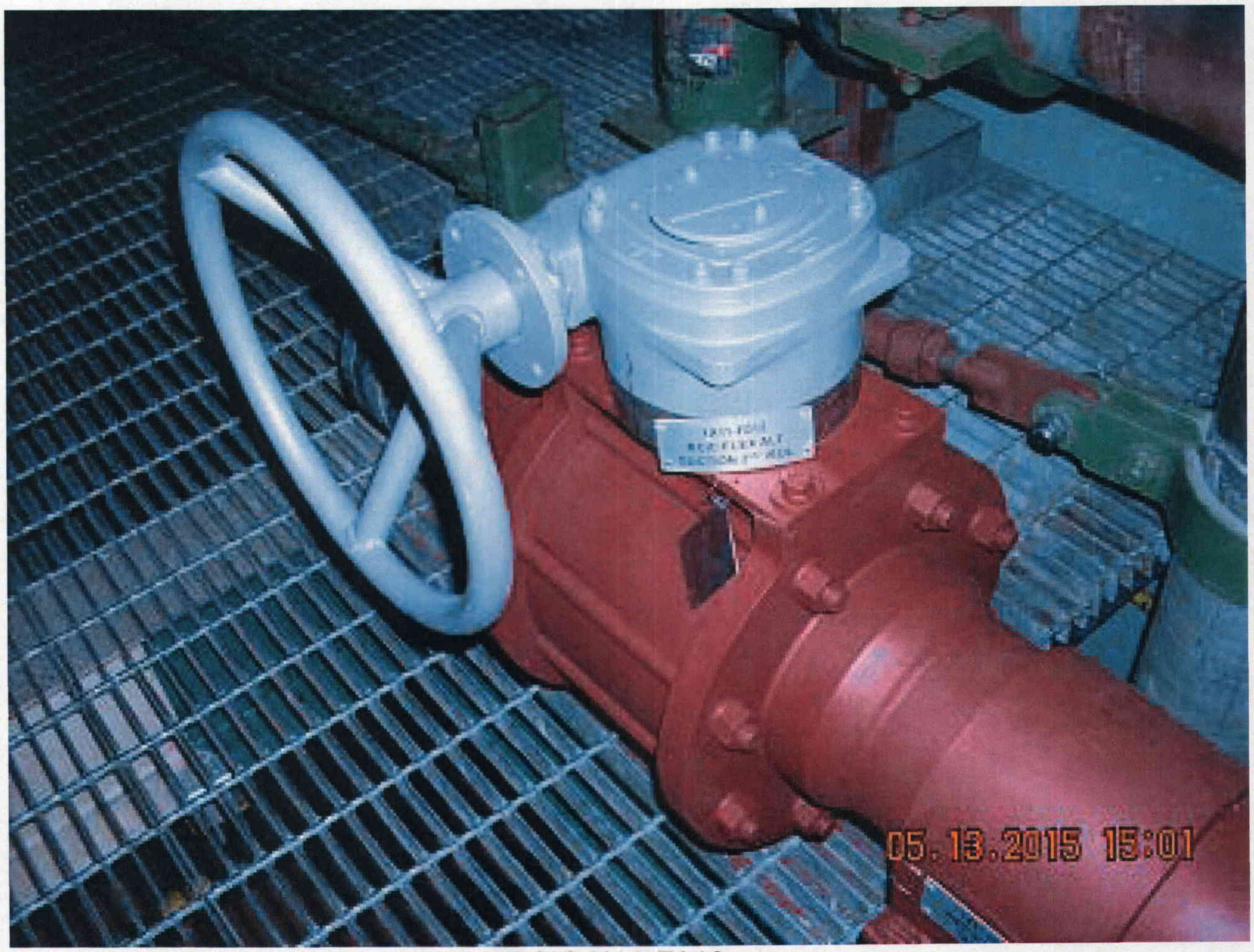
Figure E-5 Continued: Auxiliary Building 568/574-foot elevation FLEX Photos: Page 10 of 38

FPCC Tie In

Figure E-5 Continued: Auxiliary Building 568/574-foot elevation FLEX Photos:
Page 11 of 38

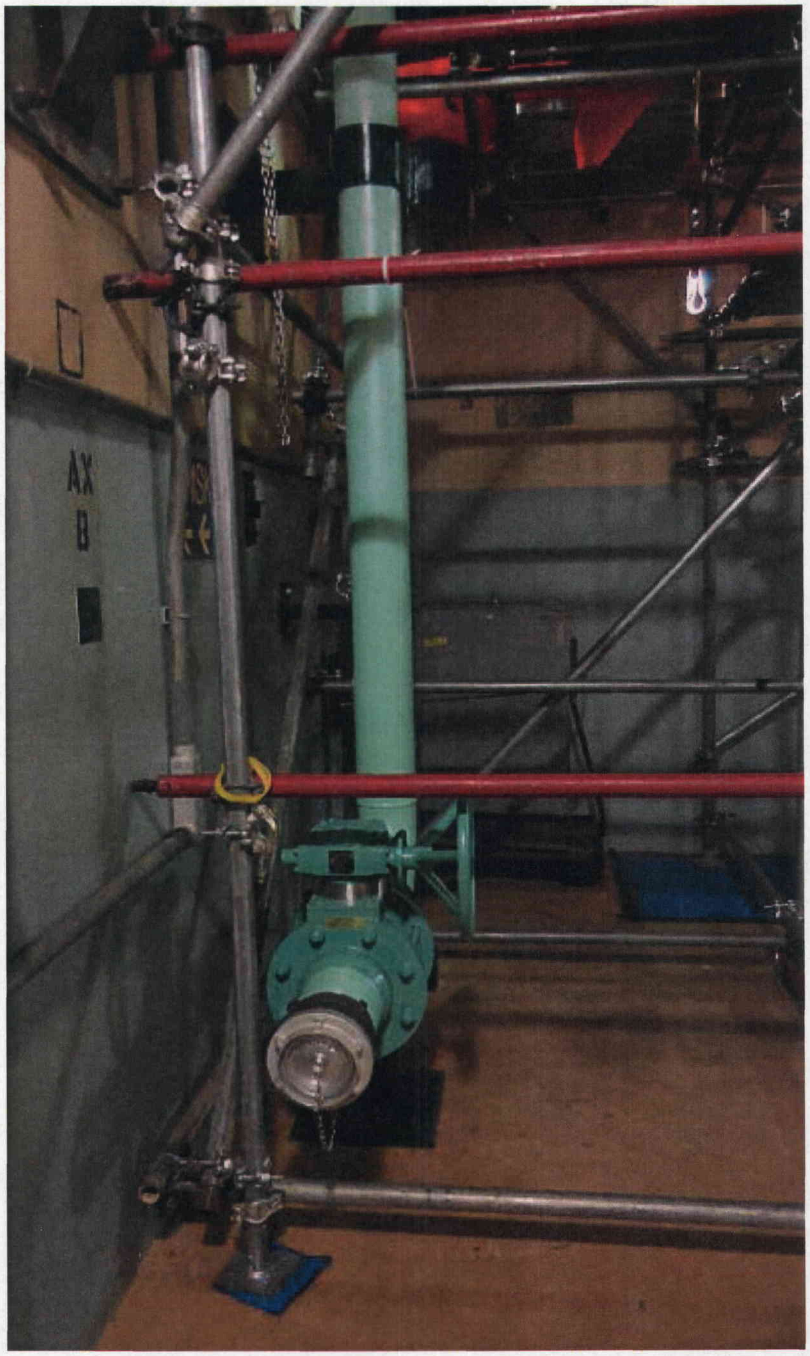
RCIC Tie In

Figure E-5 Continued: Auxiliary Building 568/574-foot elevation FLEX Photos: Page 12 of 38



RCIC X11-F012

Figure E-5 Continued: Auxiliary Building 568/574-foot elevation FLEX Photos:
Page 13 of 38



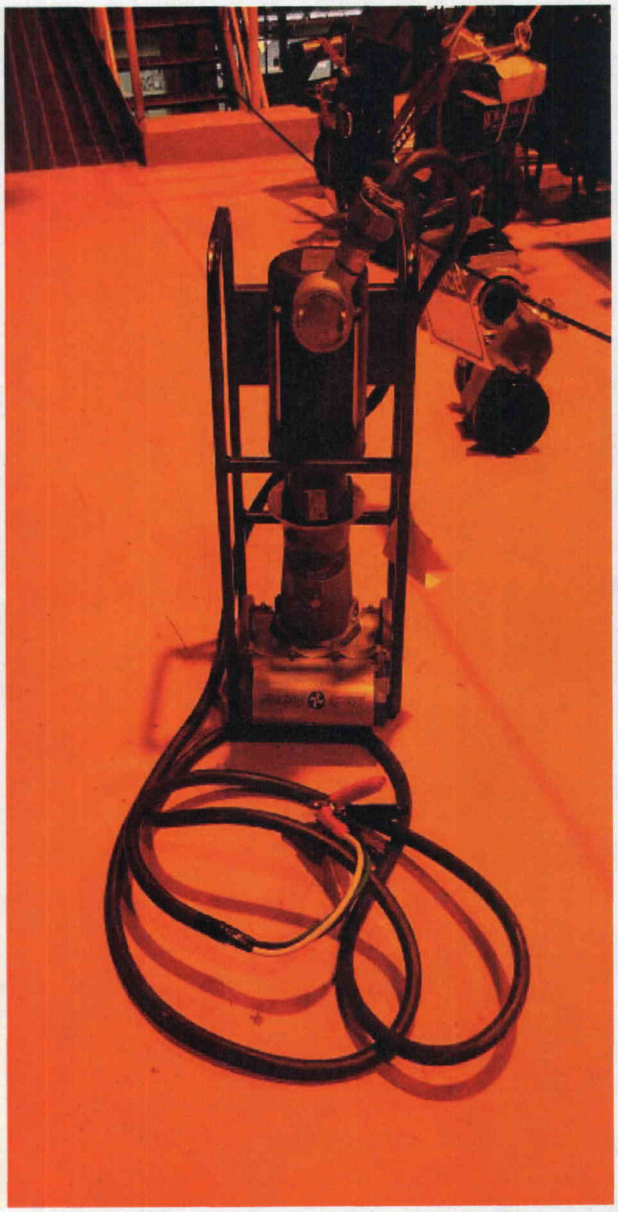
X11-F101A East Riser

Figure E-5 Continued: Auxiliary Building 568/574-foot elevation FLEX Photos:
Page 14 of 38

X11-F101B West Riser

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 15 of 38

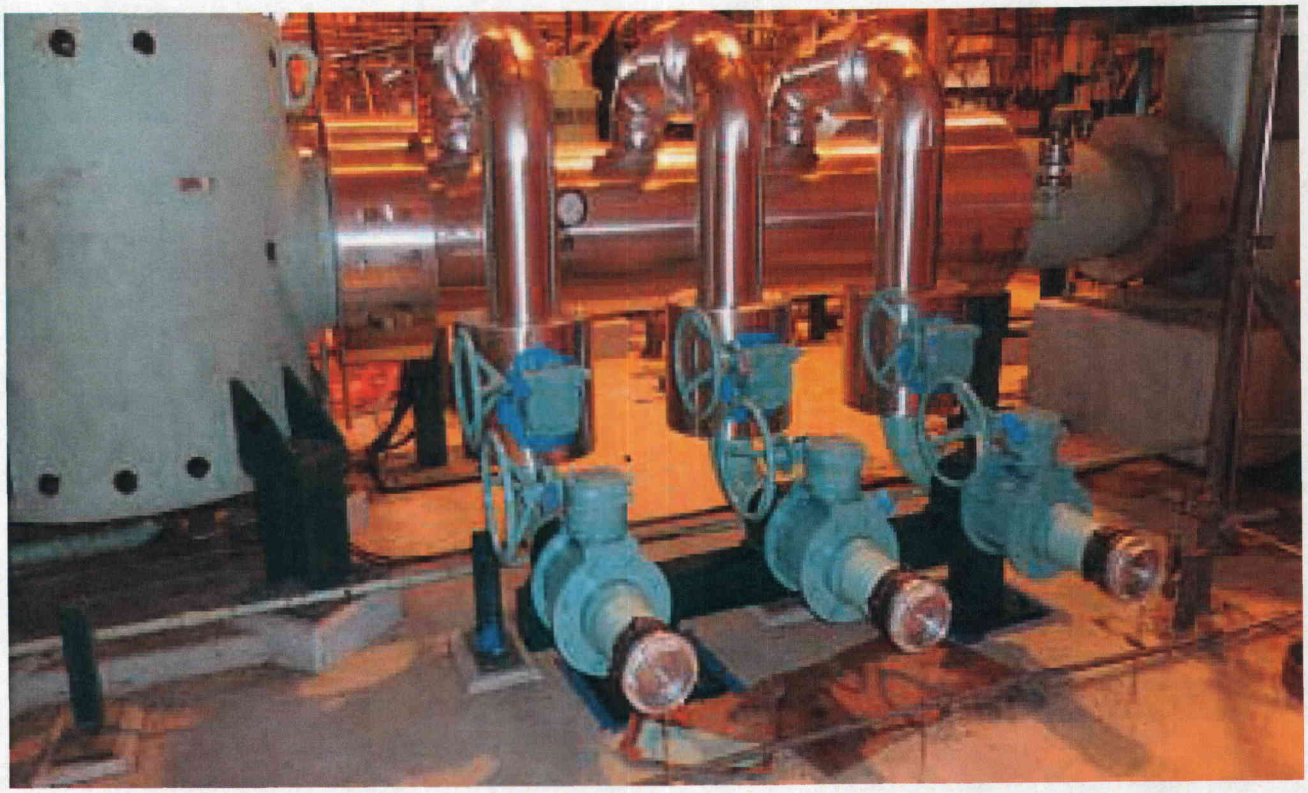
AC



DC

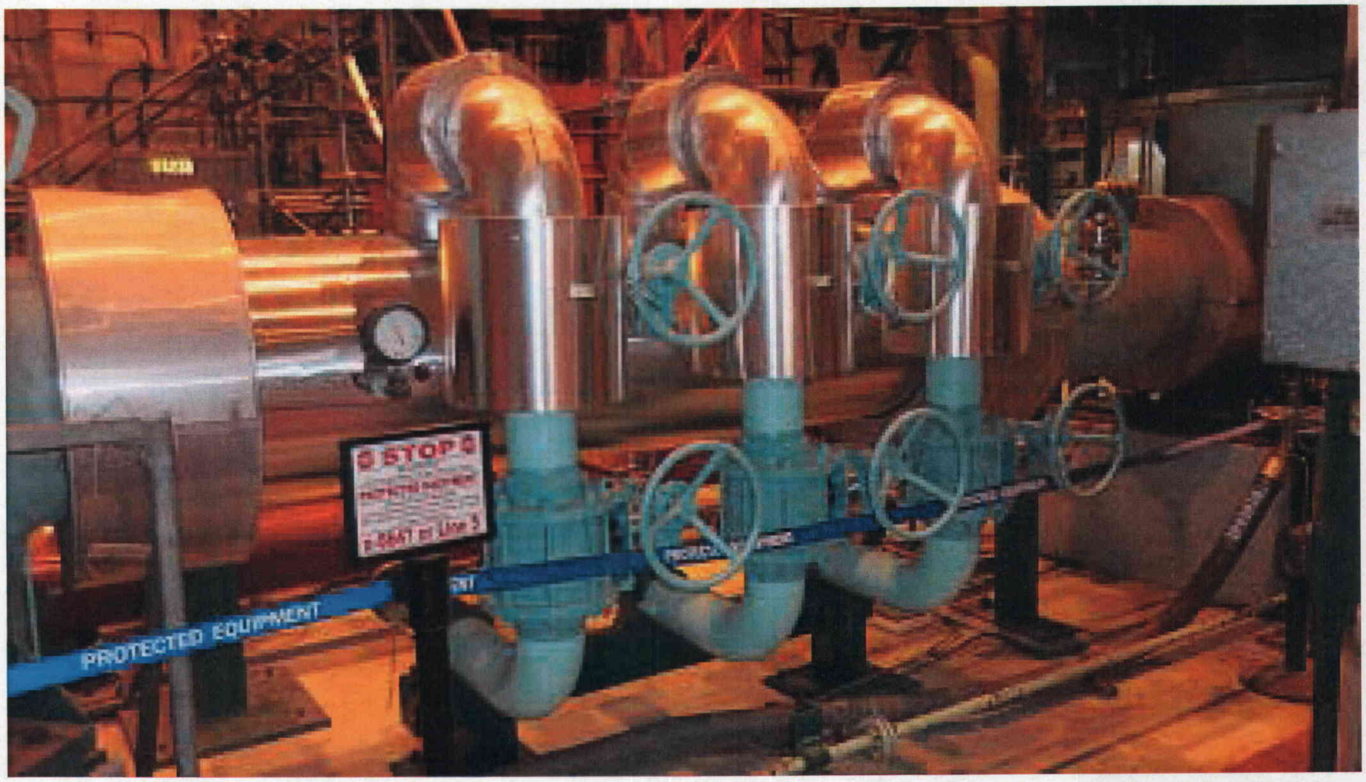
Fuel Oil Pumps for Filling Transcube Fuel Oil Tanks from the Diesel Generator Fuel Oil Storage Tanks

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 16 of 38



ESW Pump house ESW A Tie in

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 17 of 38

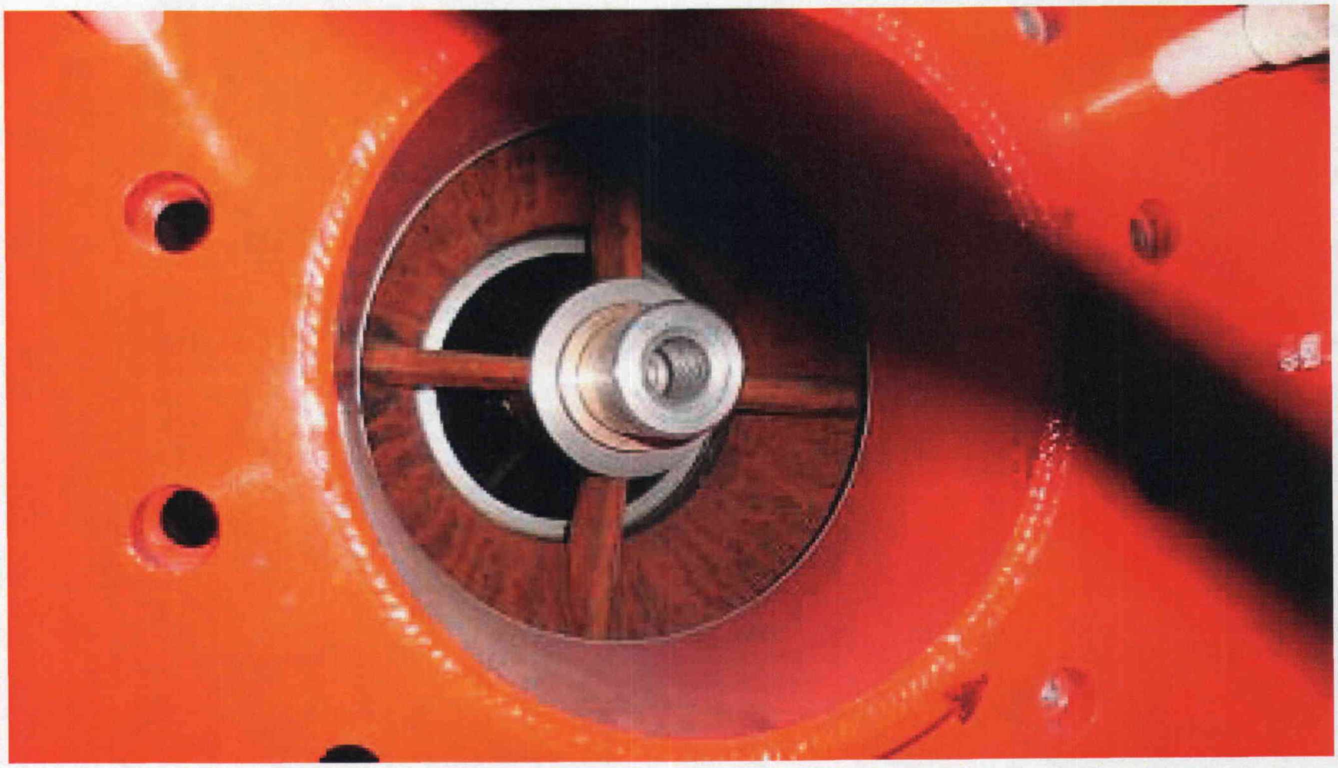


ESW Pump house ESW B Tie in

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 18 of 38

FLEX Lake Water Pumps in warehouse, view is from top of pump

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos: Page 19 of 38

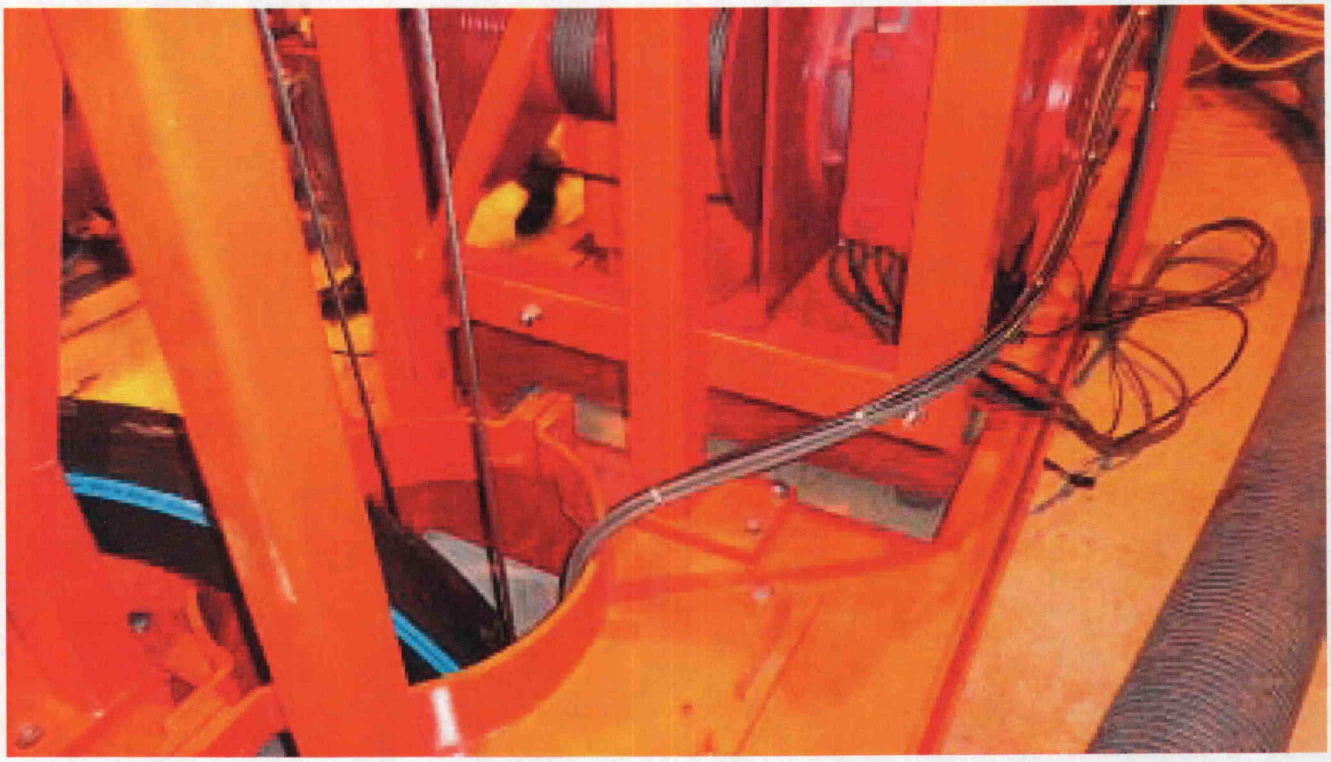


FLEX Lake Water Pumps in warehouse, view is from bottom of pump

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 20 of 38

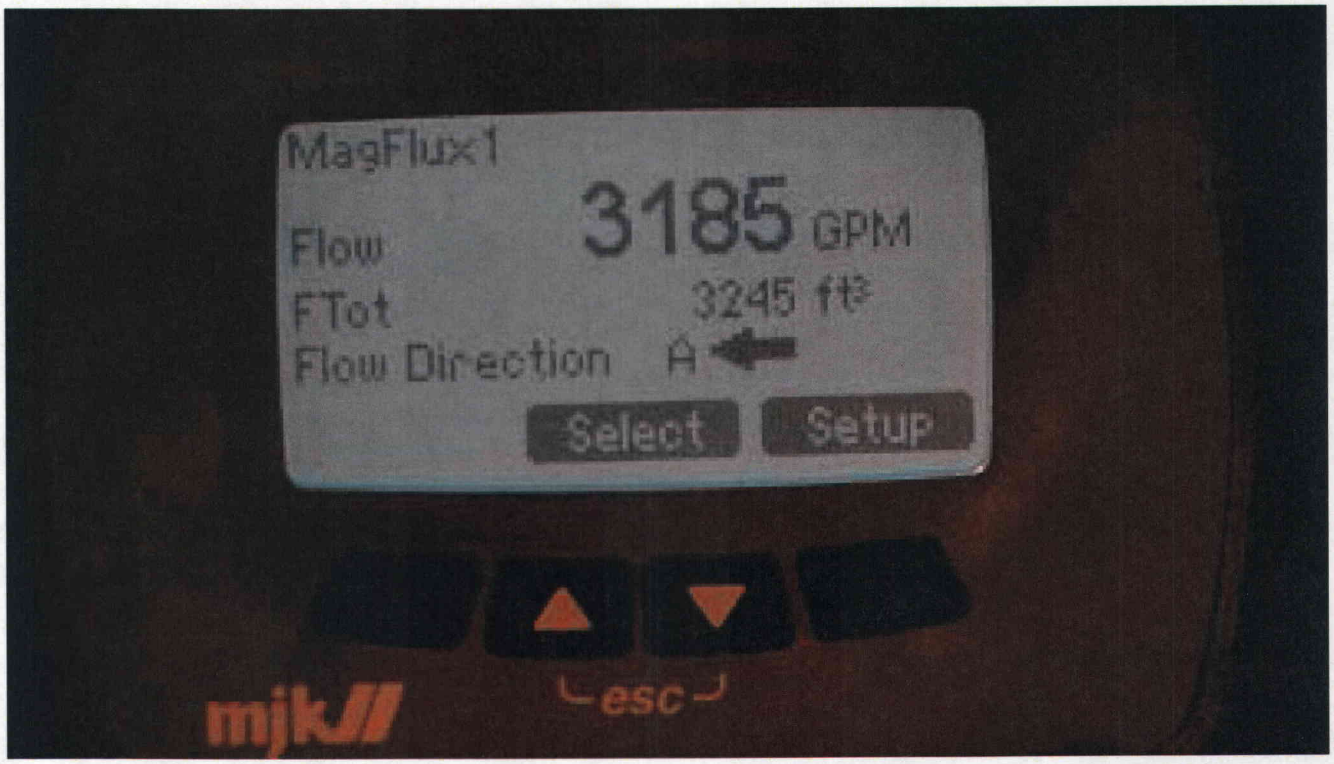
FLEX Lake Water Pump in stand, flow test meter installed at right of photo

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 21 of 38



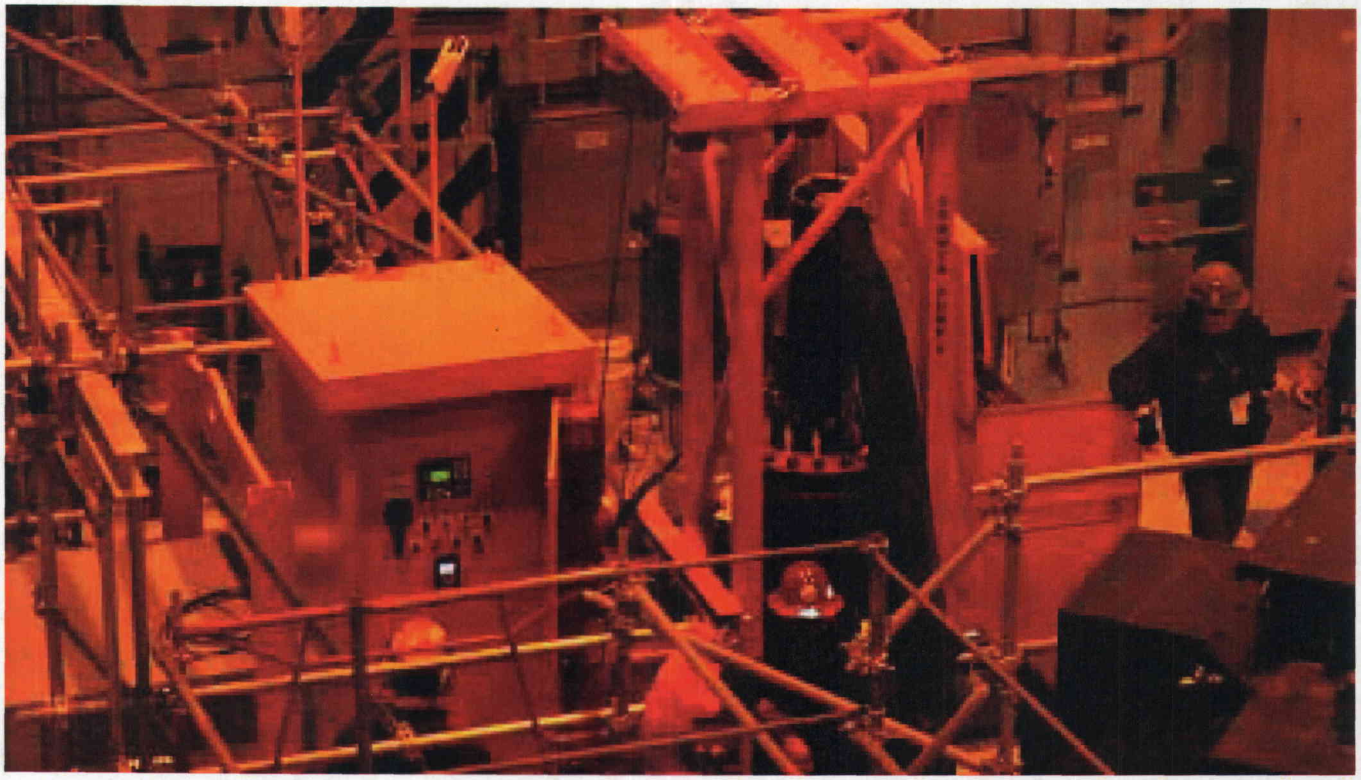
FLEX Lake Water Pump lowered into the ESW Pumphouse bay during pump testing

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 22 of 38



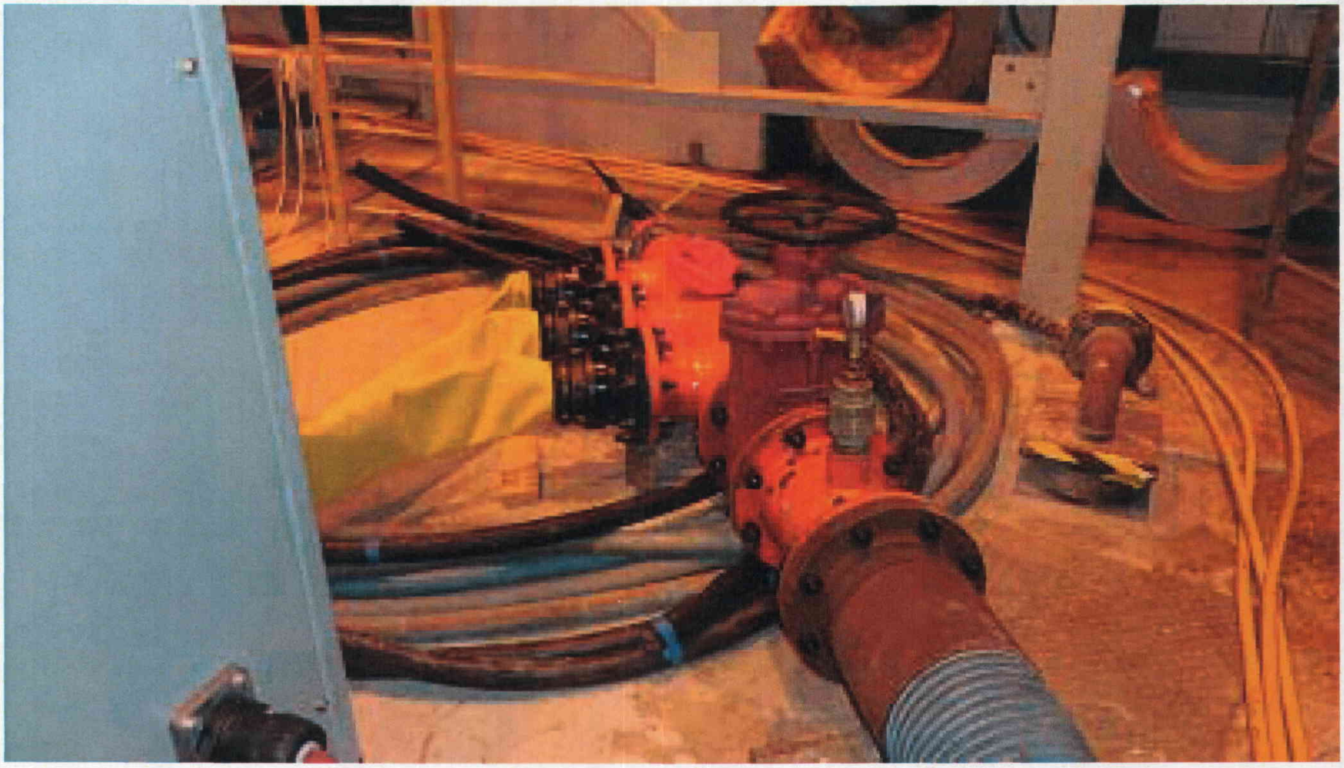
FLEX Lake Water Pump control panel during testing

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 23 of 38



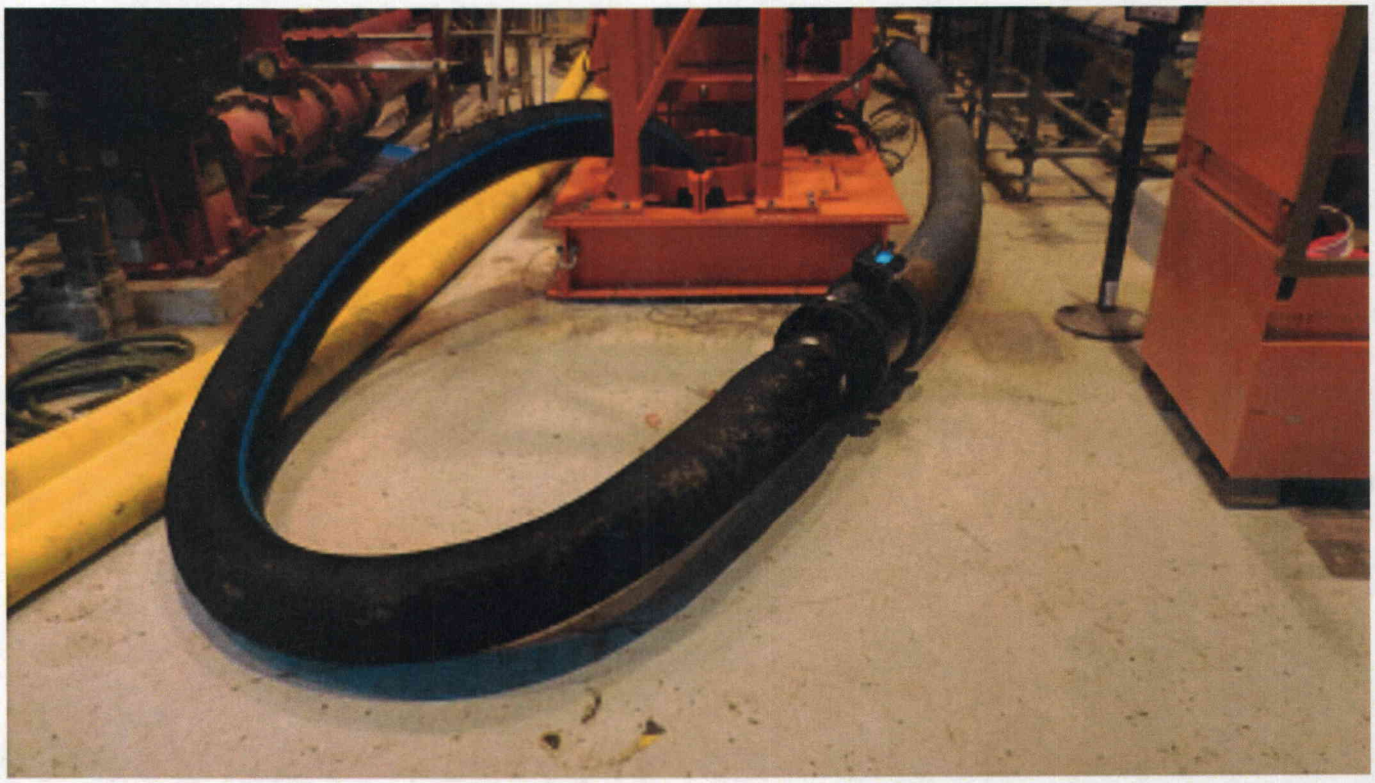
FLEX Lake Water Pump energized for testing

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 24 of 38



FLEX Lake Water Pump flow test setup

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 25 of 38



Flowing water during FLEX Lake Water Pump Testing

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 26 of 38

FLEX Lake Water Pump with distribution header attached, A side

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 27 of 38

Transcube Fuel Oil Storage Tank

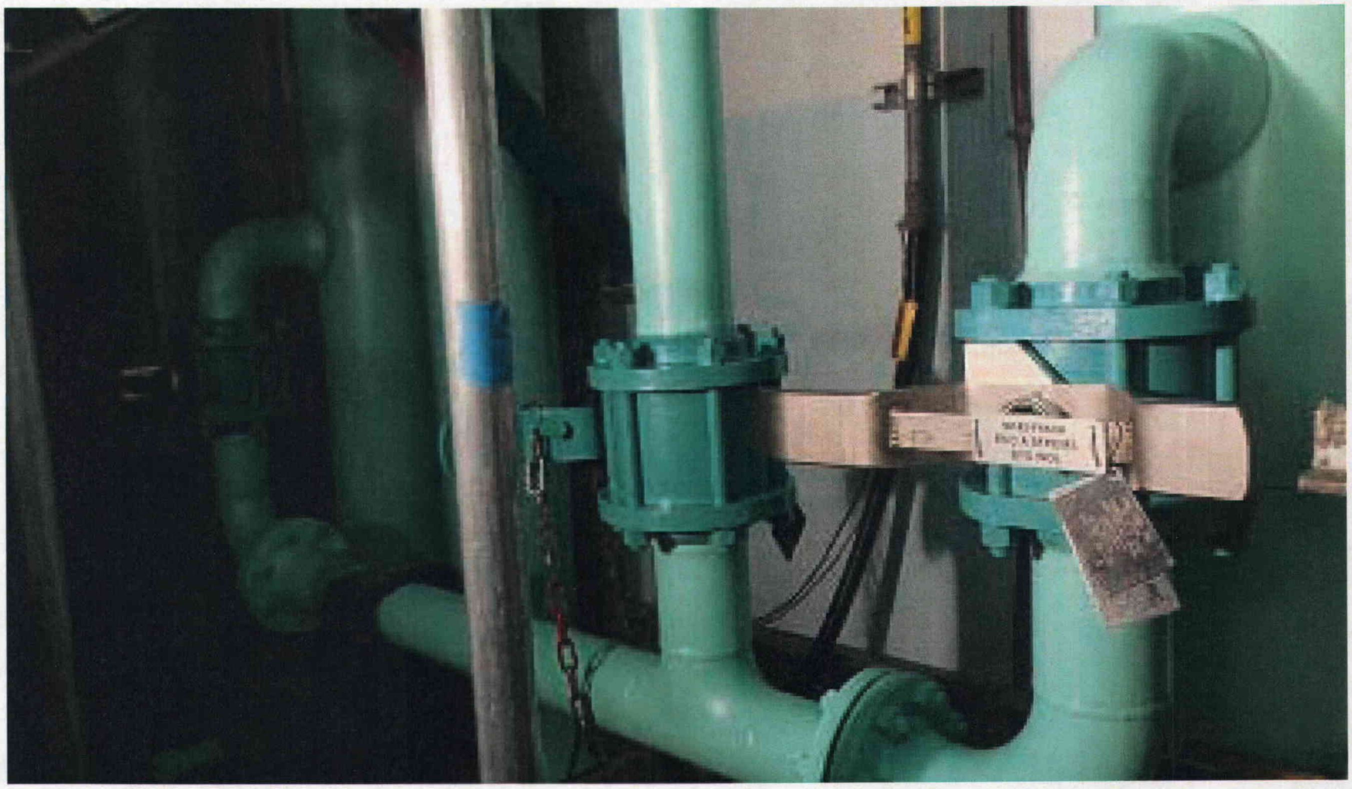
Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 28 of 38

Debris Removal Truck, Transcube and FLEX 4160 Vac generator at ESW Pumphouse for FLEX Lake Water Pump Testing

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 29 of 38

Spent Fuel Pool Fill Connection Intermediate Building 620 foot elevation

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 30 of 38



ESW Loops A (right) and B (left) connection to Spent Fuel Pool fill line (center)

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 31 of 38

Additional view of ESW to SFP Fill Line

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 32 of 38

Air compressor for use in FSG 20.2 MAINTAINING ADS AIR SUPPLY

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 33 of 38

Connection for Fuel Oil to run FLEX 4160 Vac Generator

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 34 of 38

Diesel Fuel Oil Storage Tank Cover, location of fuel oil for use in FSG 70.2, SUPPLYING FUEL OIL TO ESWPH FLEX GENERATOR

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 35 of 38

Fuel caddy for use in FSG 70.3, SUPPLYING FUEL OIL TO MISC FLEX PORTABLE EQUIPMENT

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos: Page 36 of 38

Bobcat for debris removal

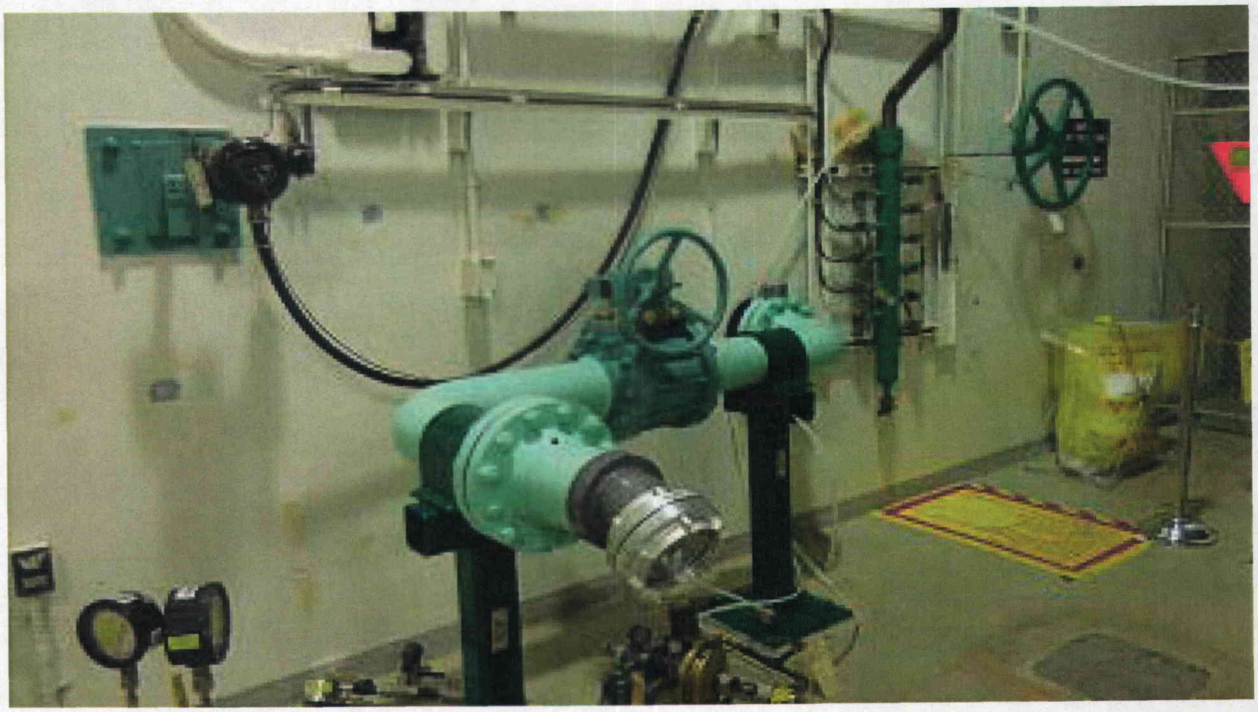
Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos:
Page 37 of 38

Debris removal truck, Transcube and Flex generator staged south of ESW Pumphouse between pump tests

Figure E-5 Continued, Mechanical FLEX Equipment and Modification Photos: Page 38 of 38

FLEX Door blocking device in use holding open door to ESW Pumphouse for 4160 Vac cables during FLEX Lake Water Pump testing

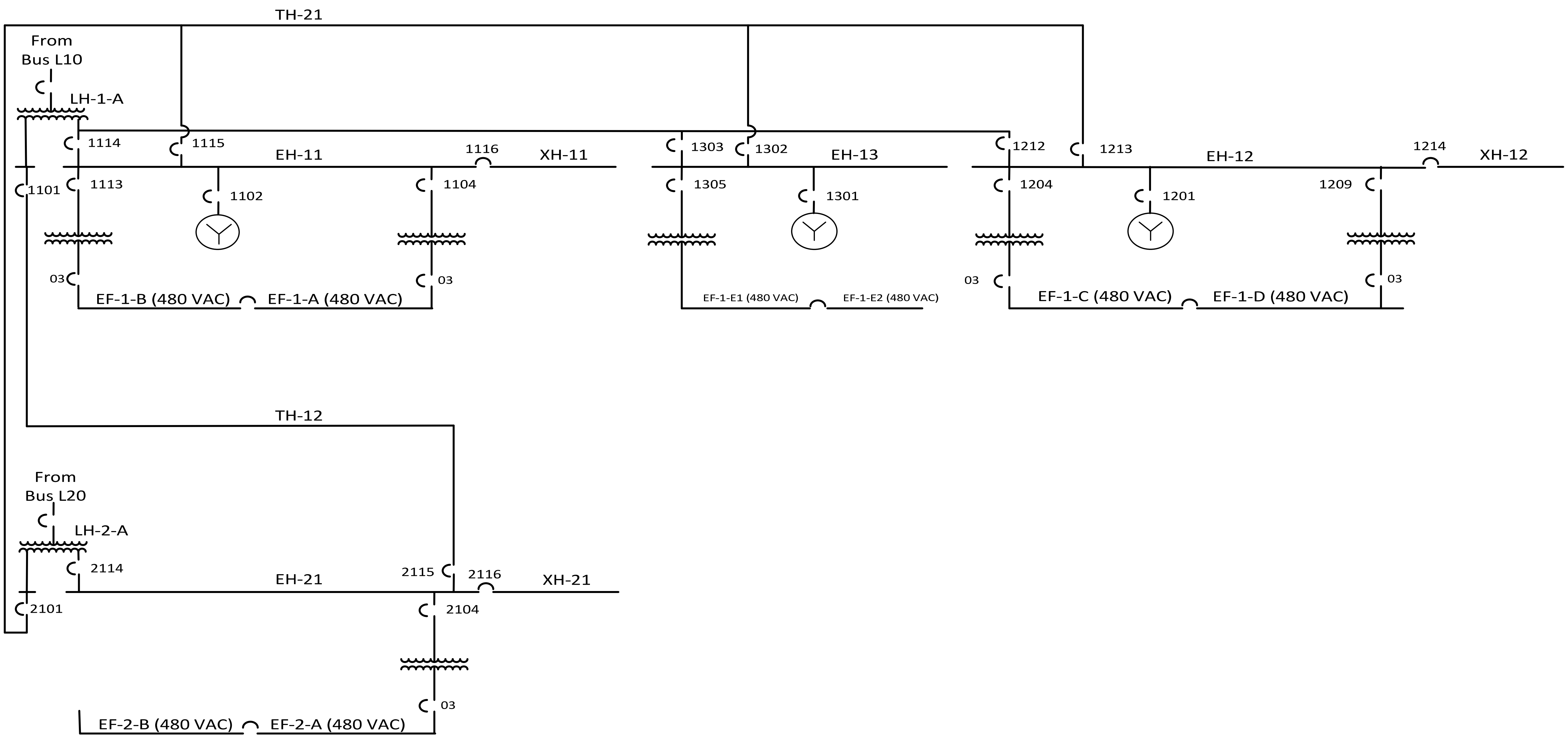
47.0 APPENDIX: Figure E-6: LPCS / HPCS Storz Connection Points



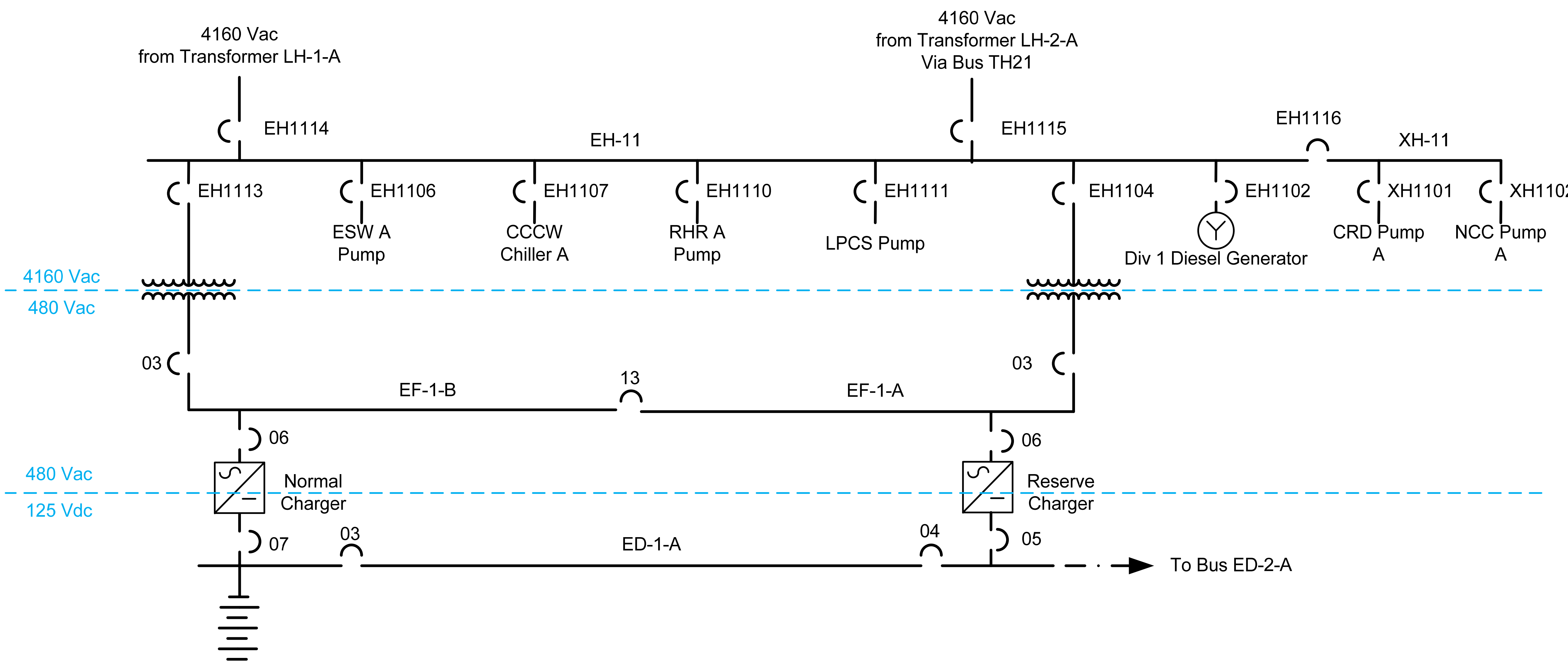
LPCS Connection Auxiliary Building 620 foot elevation east side

HPCS Connection Auxiliary Building 620 foot elevation west side

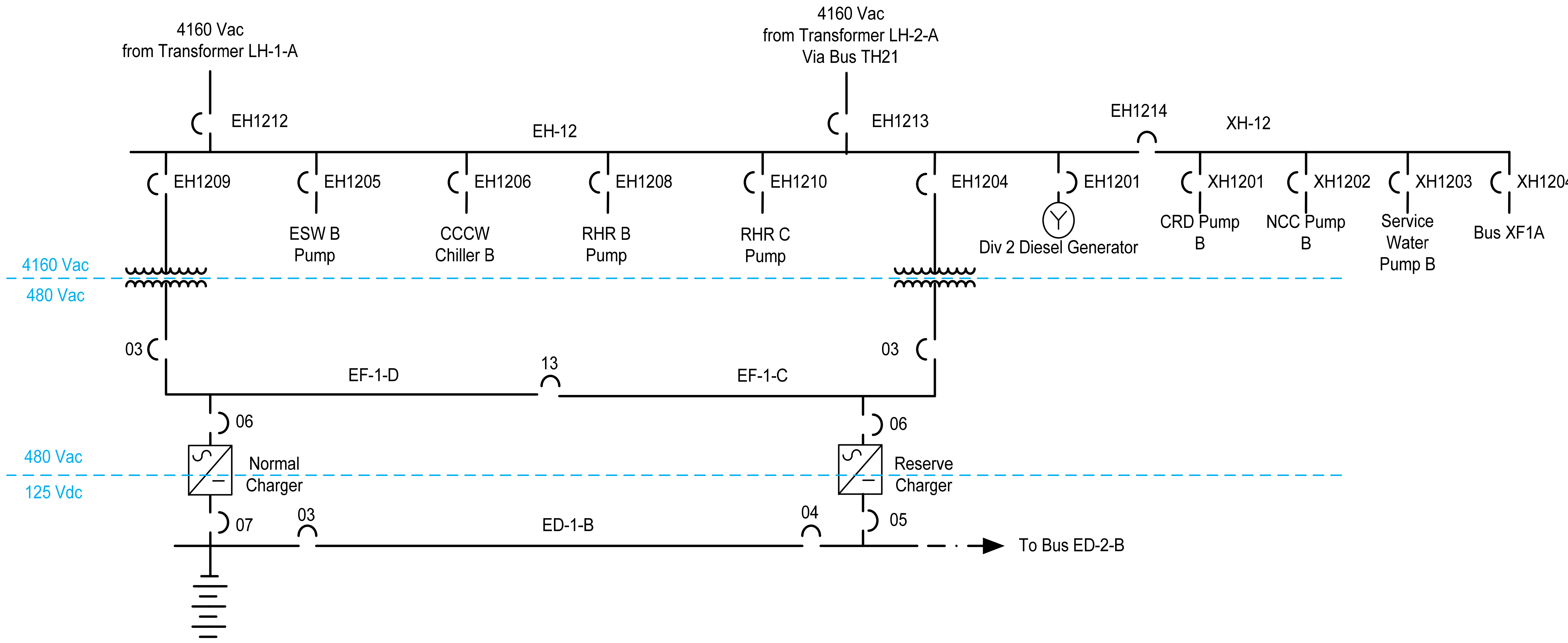
48.0 APPENDIX: Figure E-7 Simplified Unit 1 and Unit 2 Divisional AC busses without modifications



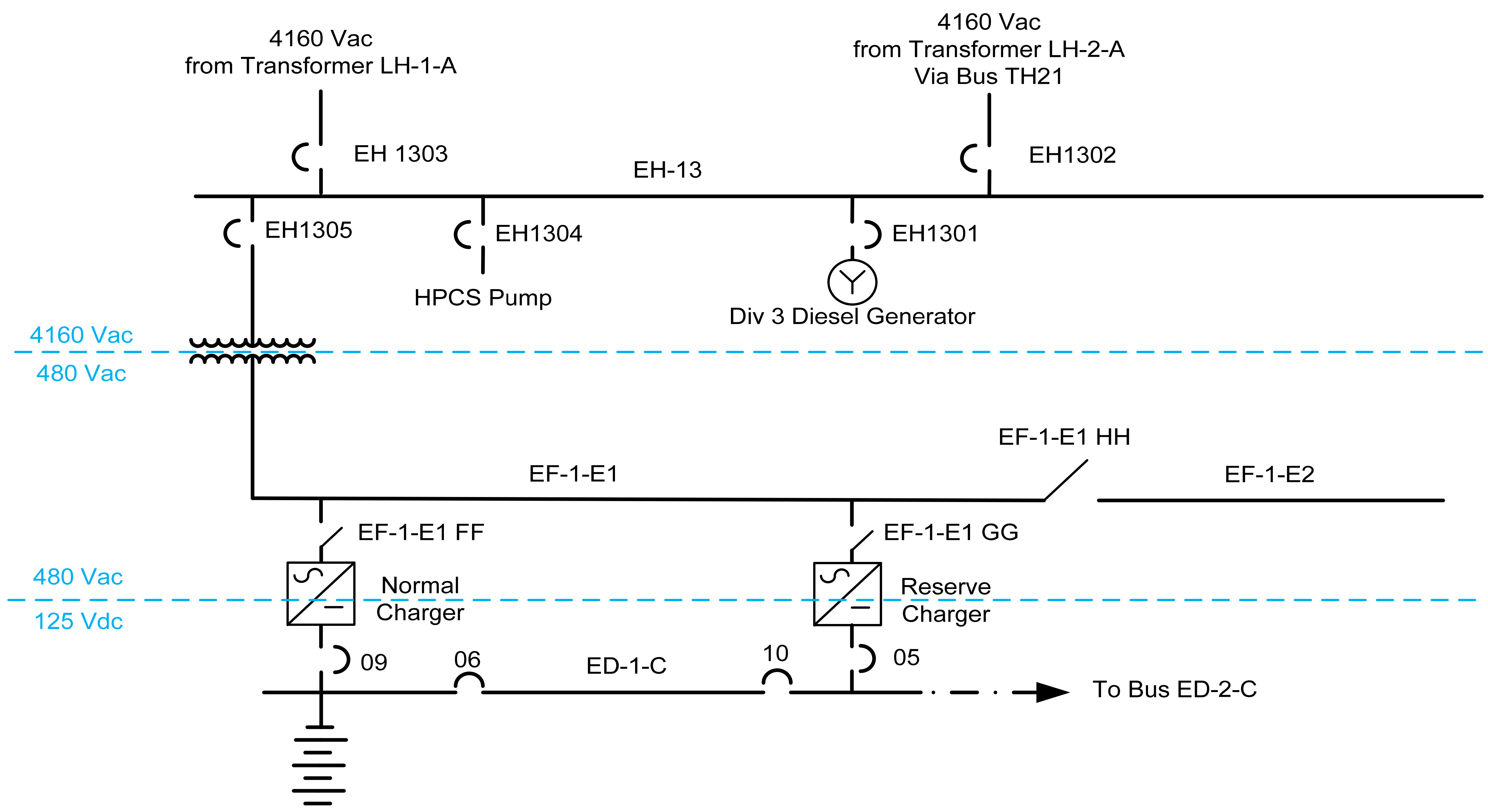
49.0 APPENDIX: Figure E-8 Simplified Unit 1 Division 1 Electrical



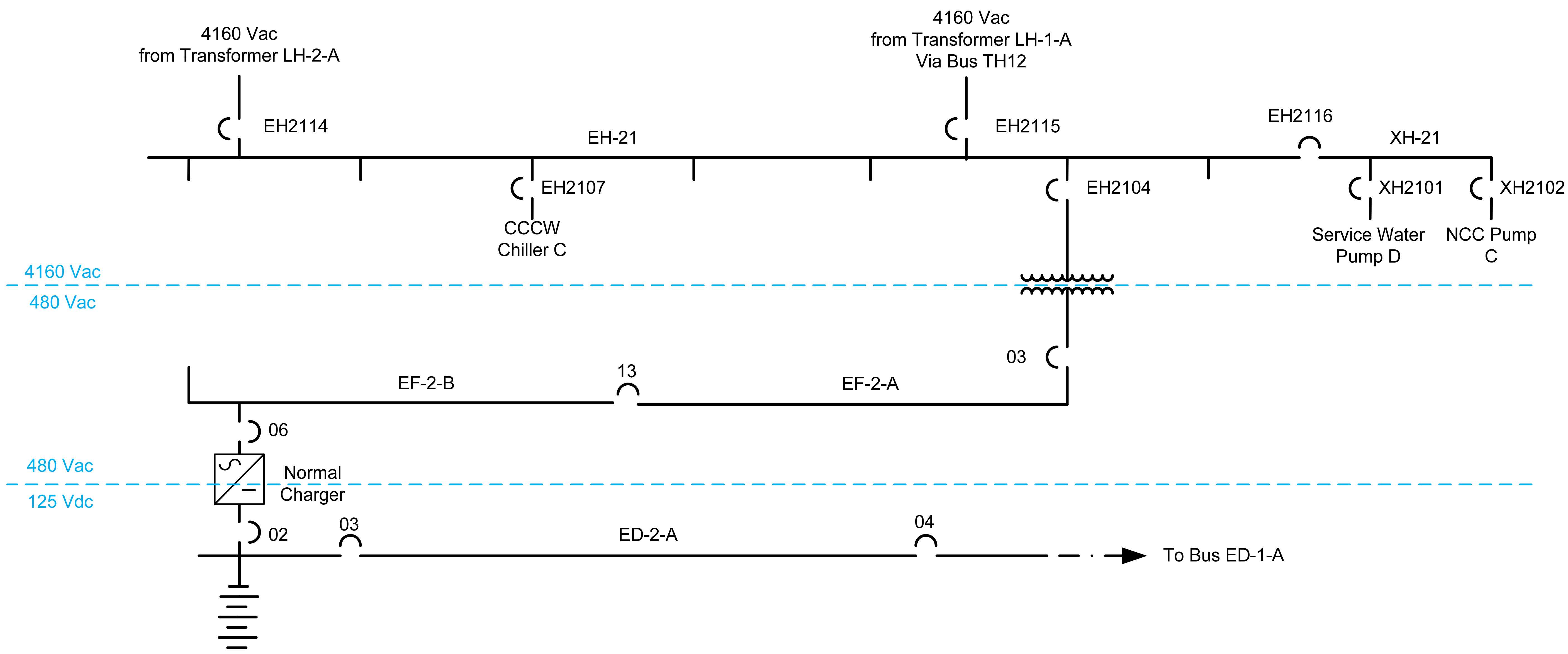
50.0 APPENDIX: Figure E-9 Simplified Unit 1 Division 2 Electrical



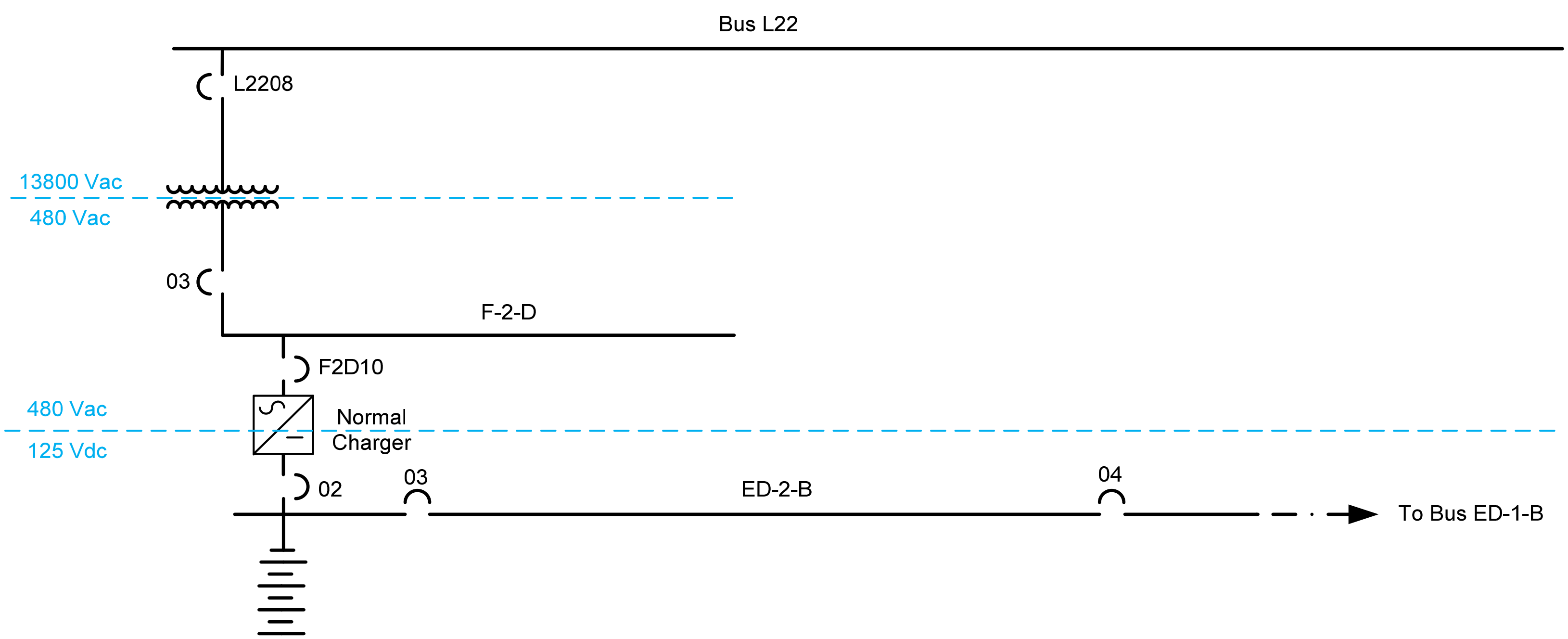
51.0 APPENDIX: Figure E-10 Simplified Unit 1 Division 3 Electrical



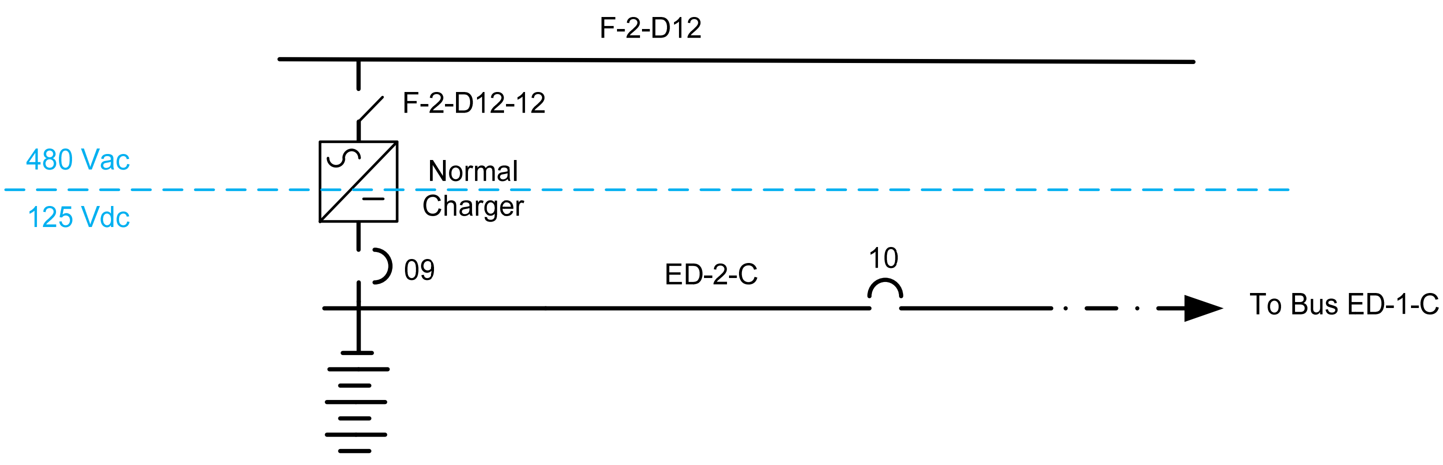
52.0 APPENDIX: Figure E-11 Simplified Unit 2 Division 1 Electrical



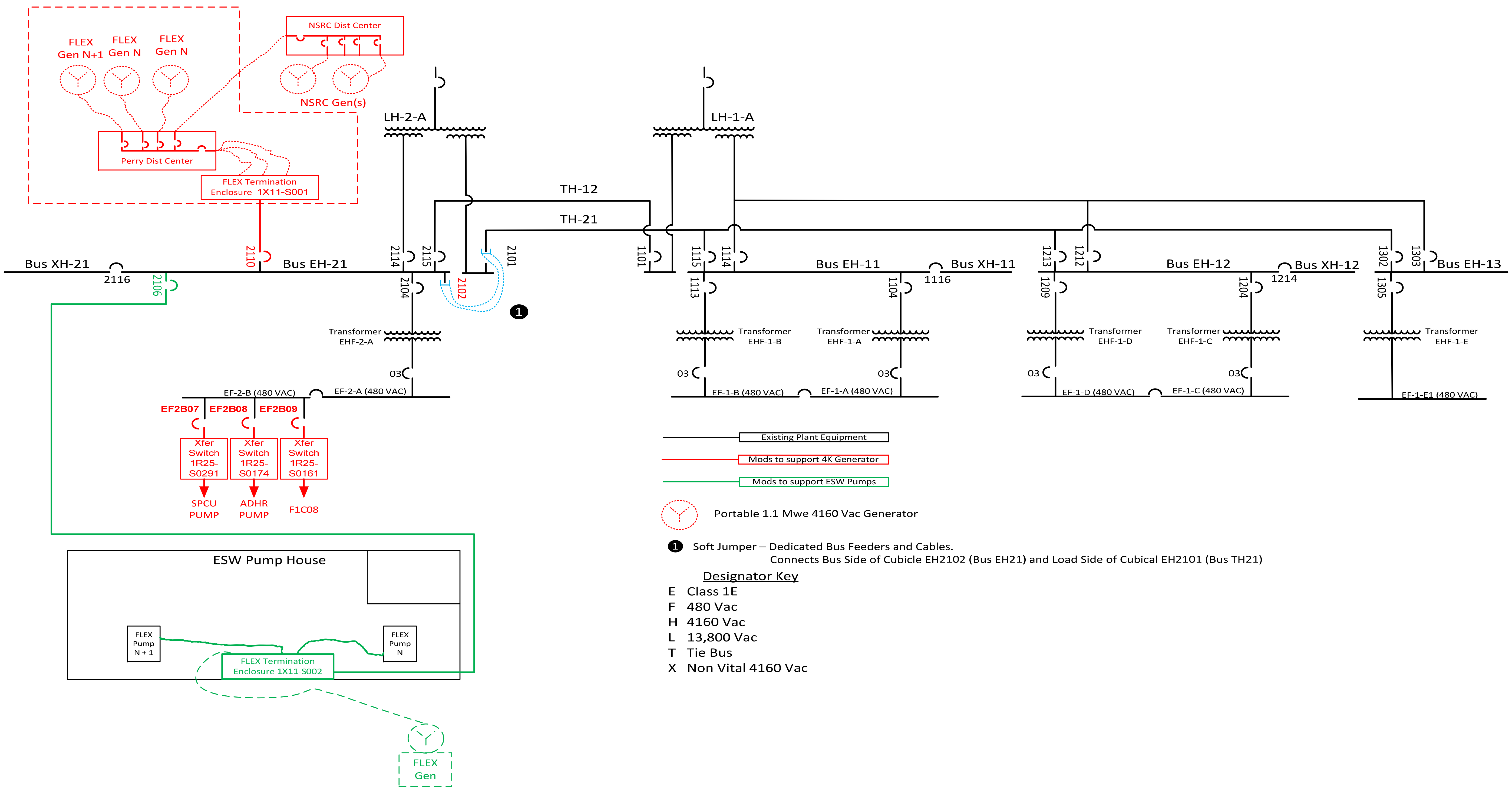
53.0 APPENDIX: Figure E-12 Simplified Unit 2 Division 2 Electrical



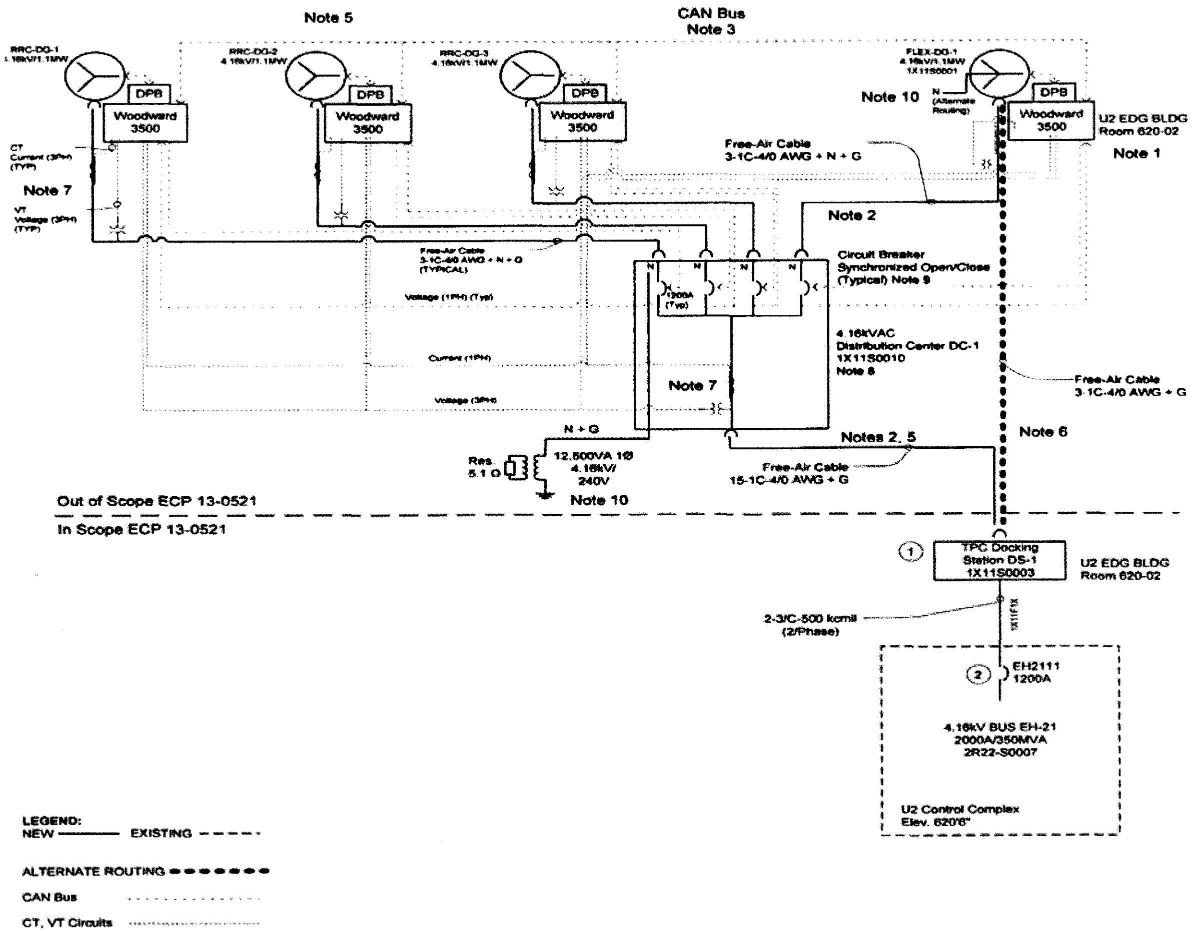
54.0 APPENDIX: Figure E-13 Simplified Unit 2 Division 3 Electrical



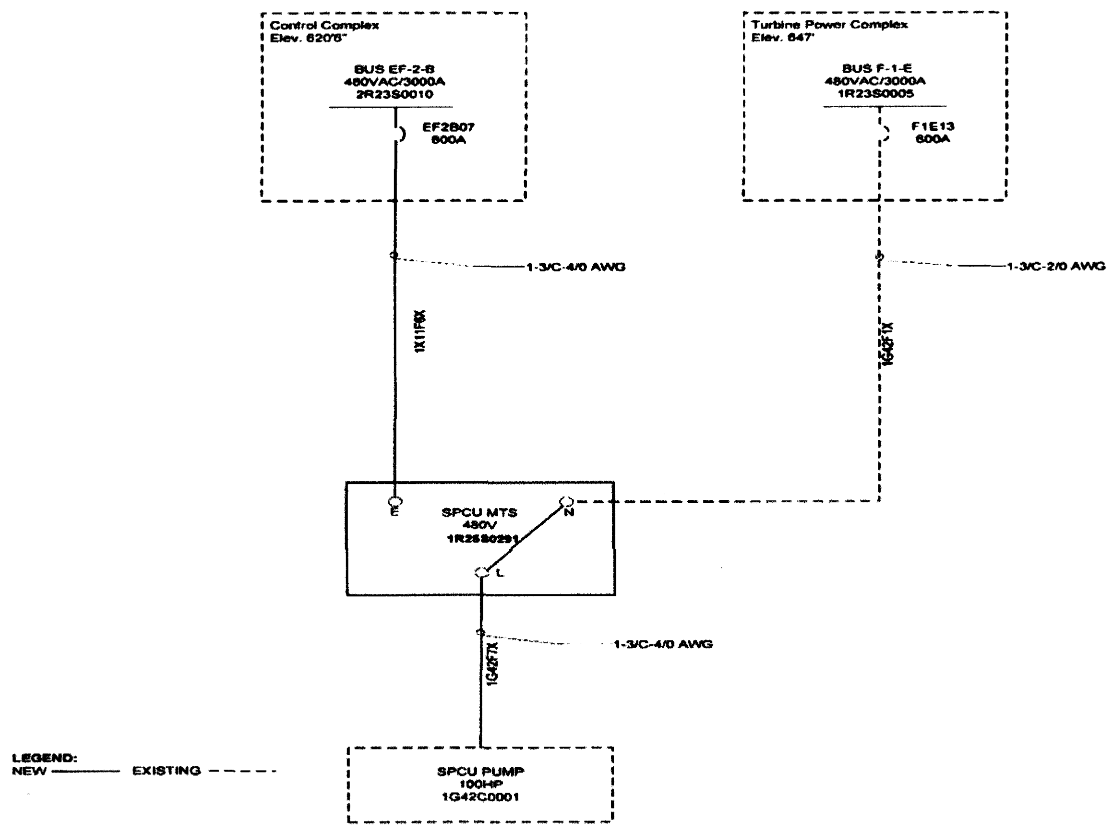
55.0 APPENDIX: Figure E-14 Simplified Electrical Modifications



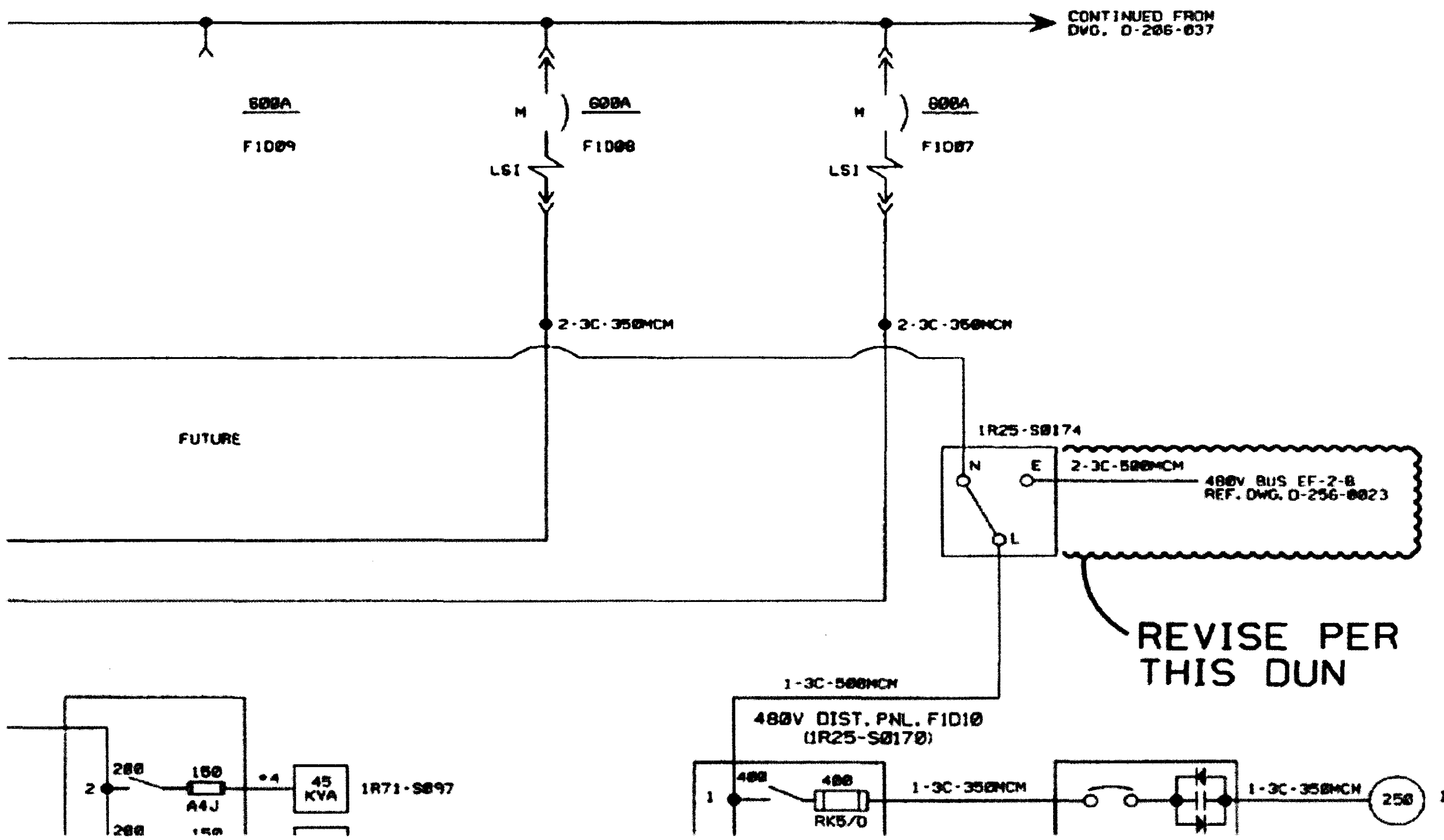
56.0 APPENDIX: Figure E-15 Termination Enclosure 1X11-S0001



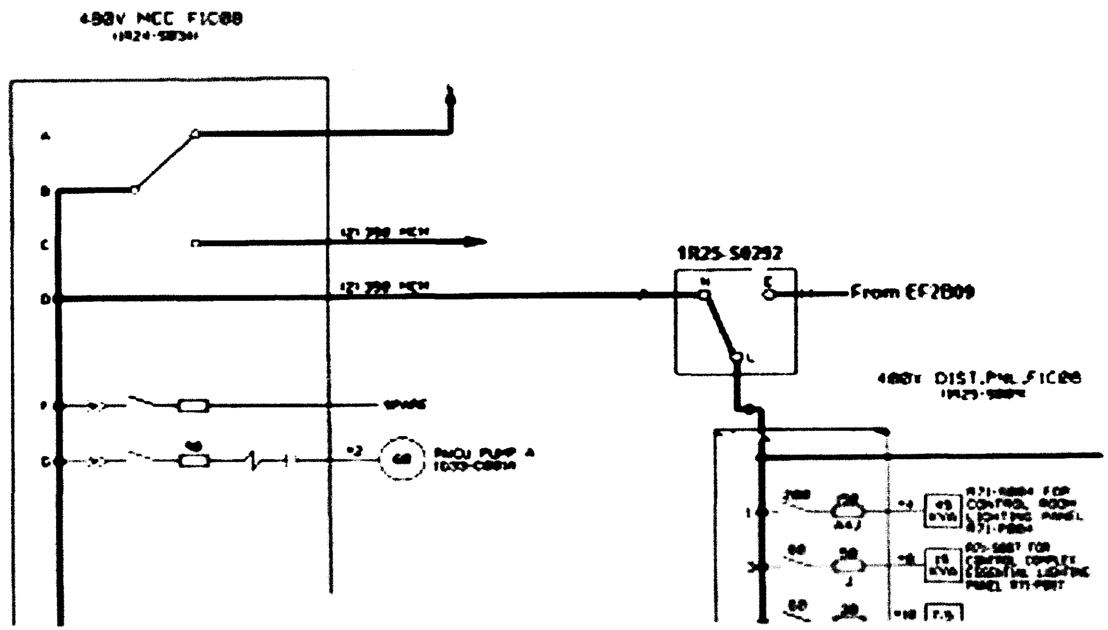
57.0 APPENDIX: Figure E-16 Transfer Switch 1R25-S0291



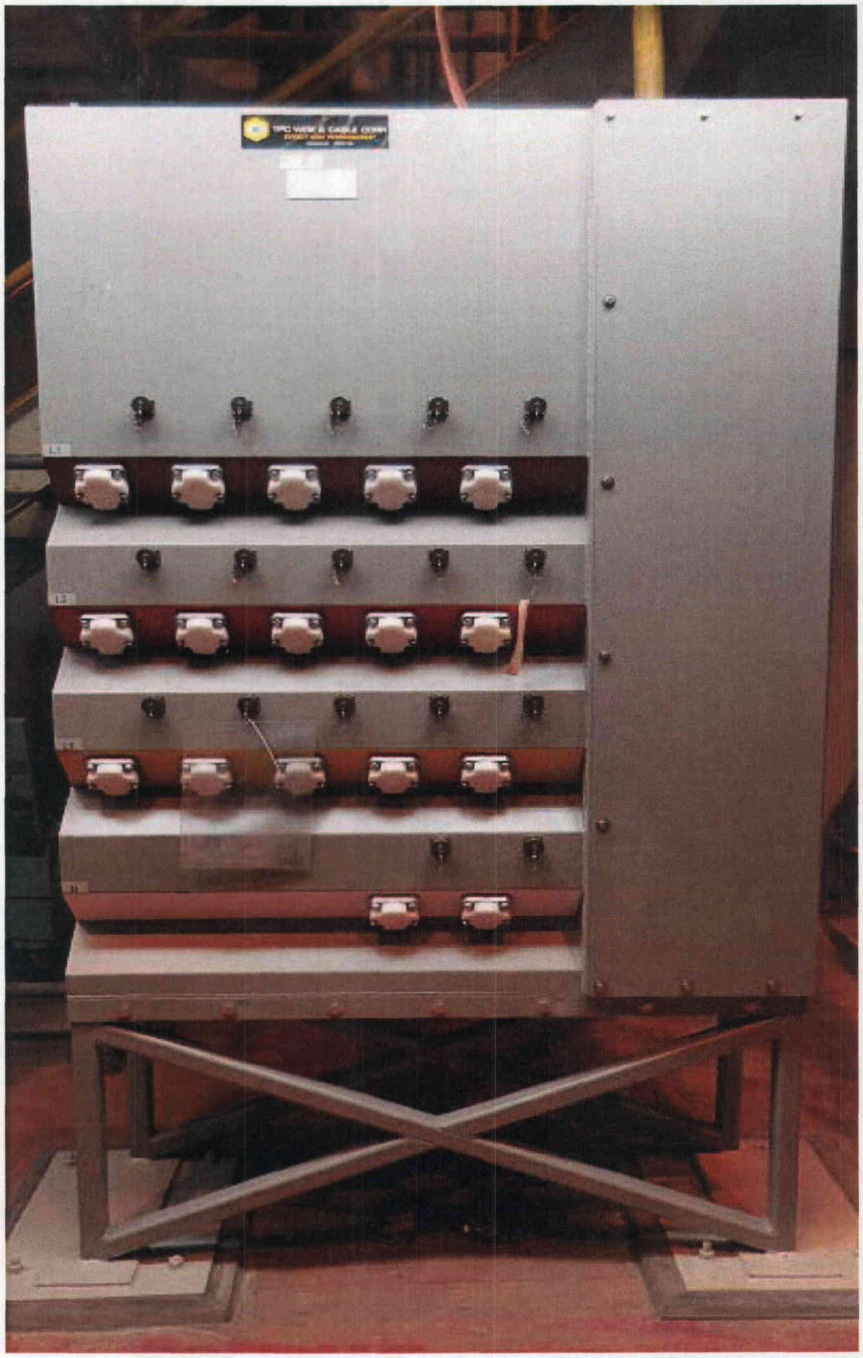
58.0 APPENDIX: Figure E-17 Transfer Switch 1R25-S0174



59.0 APPENDIX: Figure E-18 Transfer Switch 1R25-S0292

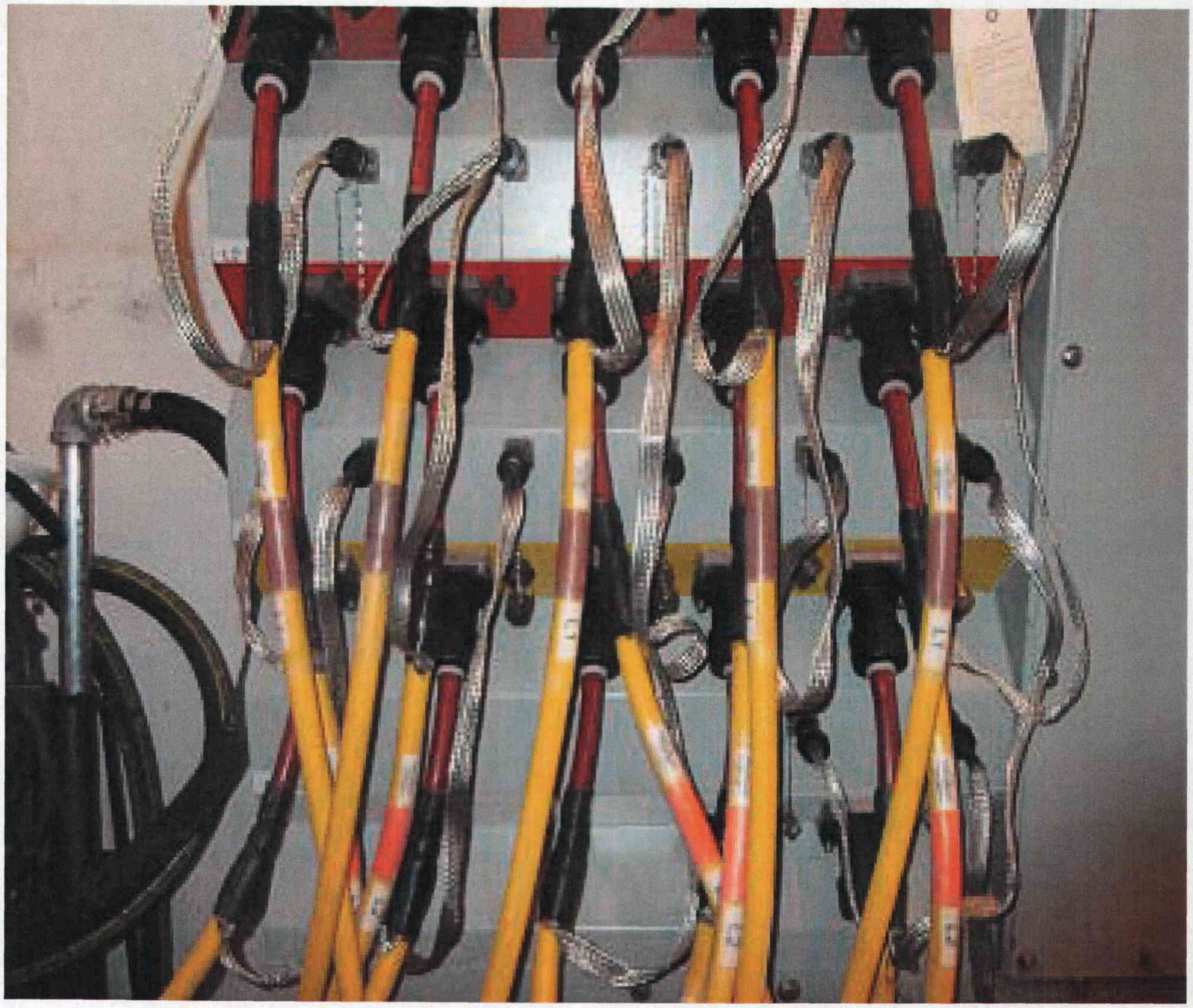


60.0 APPENDIX: Figure E-18-A: FLEX Electrical Equipment and Modification Photos:
Page 1 of 24



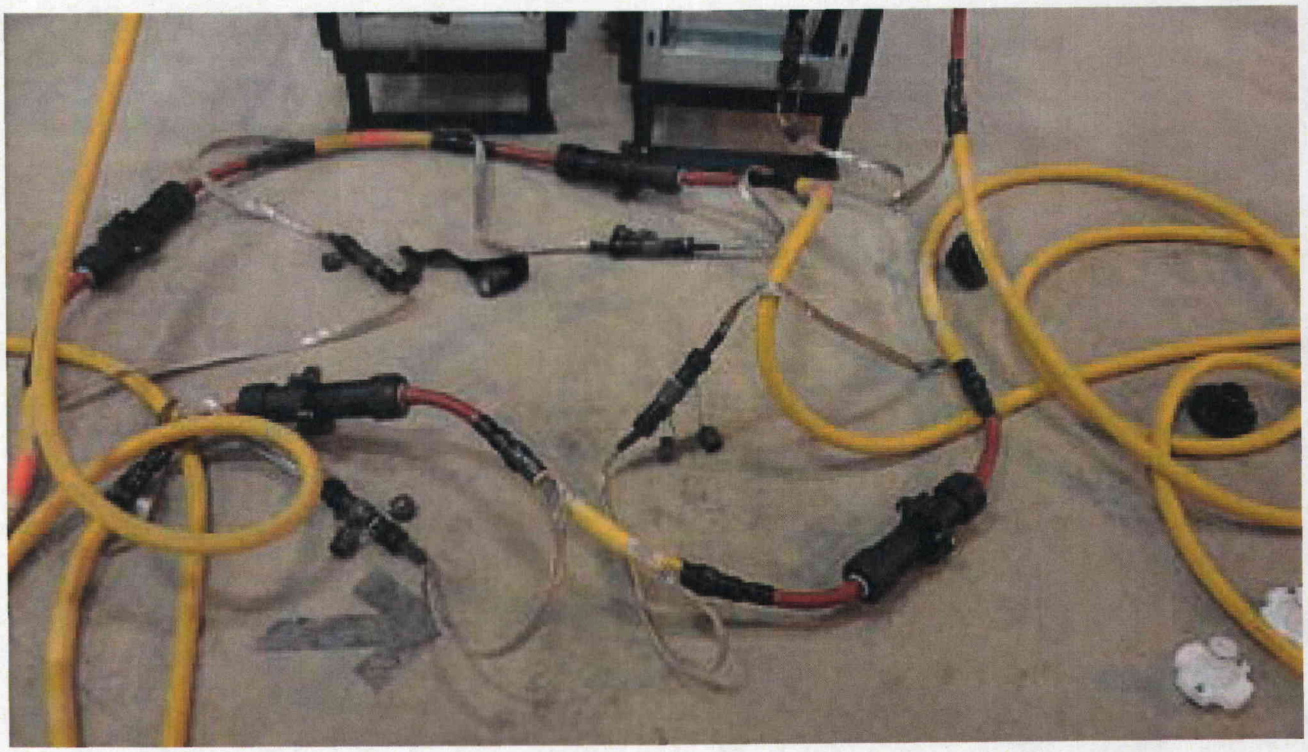
ESW Pumphouse Termination Enclosure

Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos: Page 2 of 24



FLEX Storage Bay 1 Termination Enclosure with cables attached during phase rotation test

Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos:
Page 3 of 24



Cable connection timing in warehouse

Detail of cable connection being made

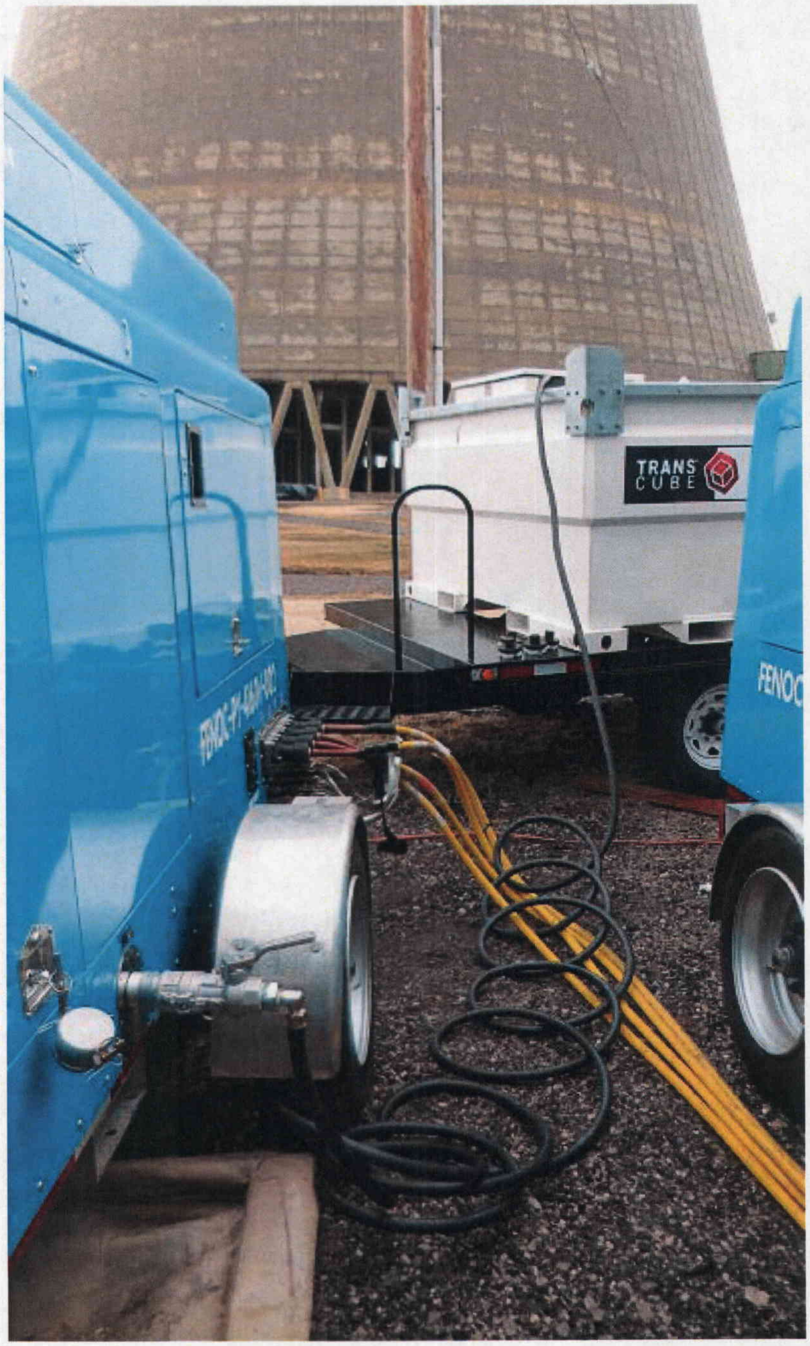
Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos:
Page 4 of 24

Cables laid out at ESW Pumphouse during FLEX Lake Water Pump testing

Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos:
Page 5 of 24

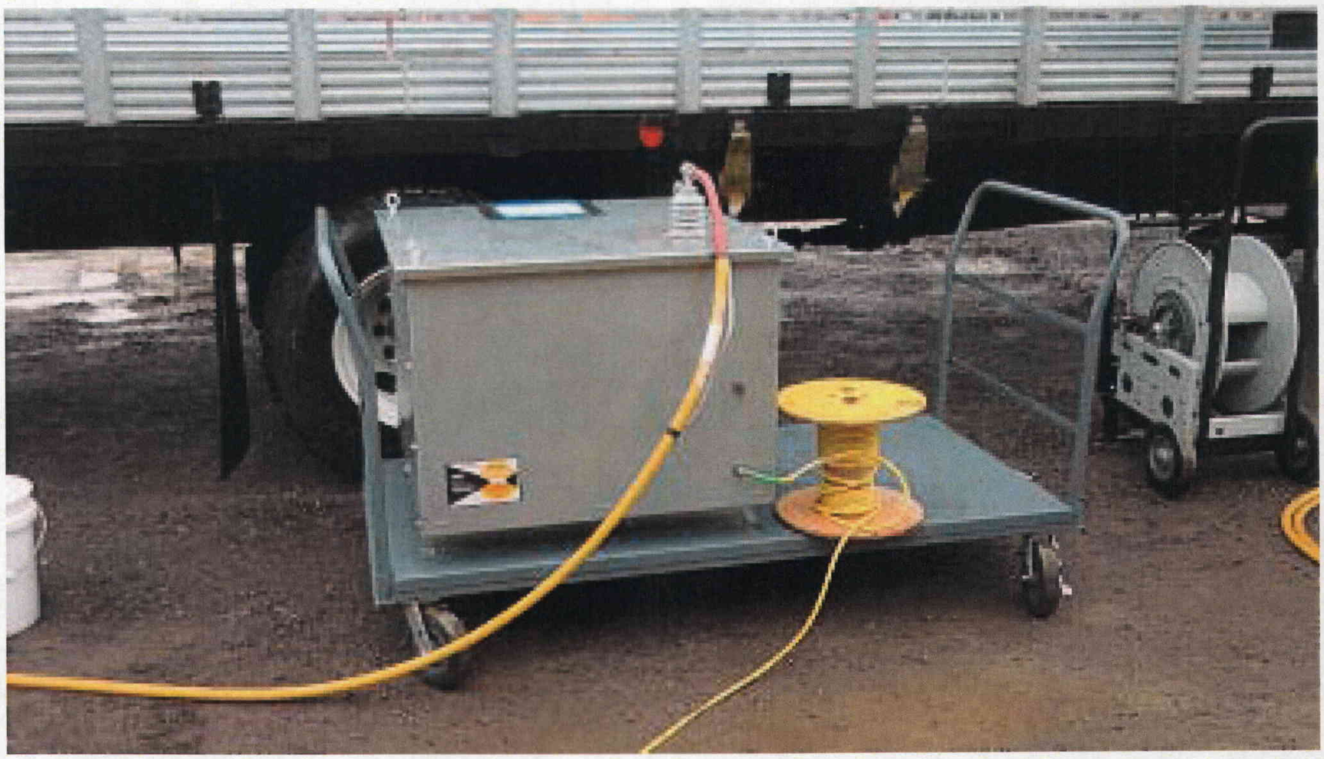
Cables connected to 4160 Vac Generator during FLEX Lake Water Pump Testing

Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos: Page 6 of 24



Fuel oil line connections from Transcube to 4160 Vac Generator during FLEX Lake Water Pump Testing

Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos: Page 7 of 24



Neutral Ground Resister connection during 4160 Vac Generator run for FLEX Lake Water Pump Testing

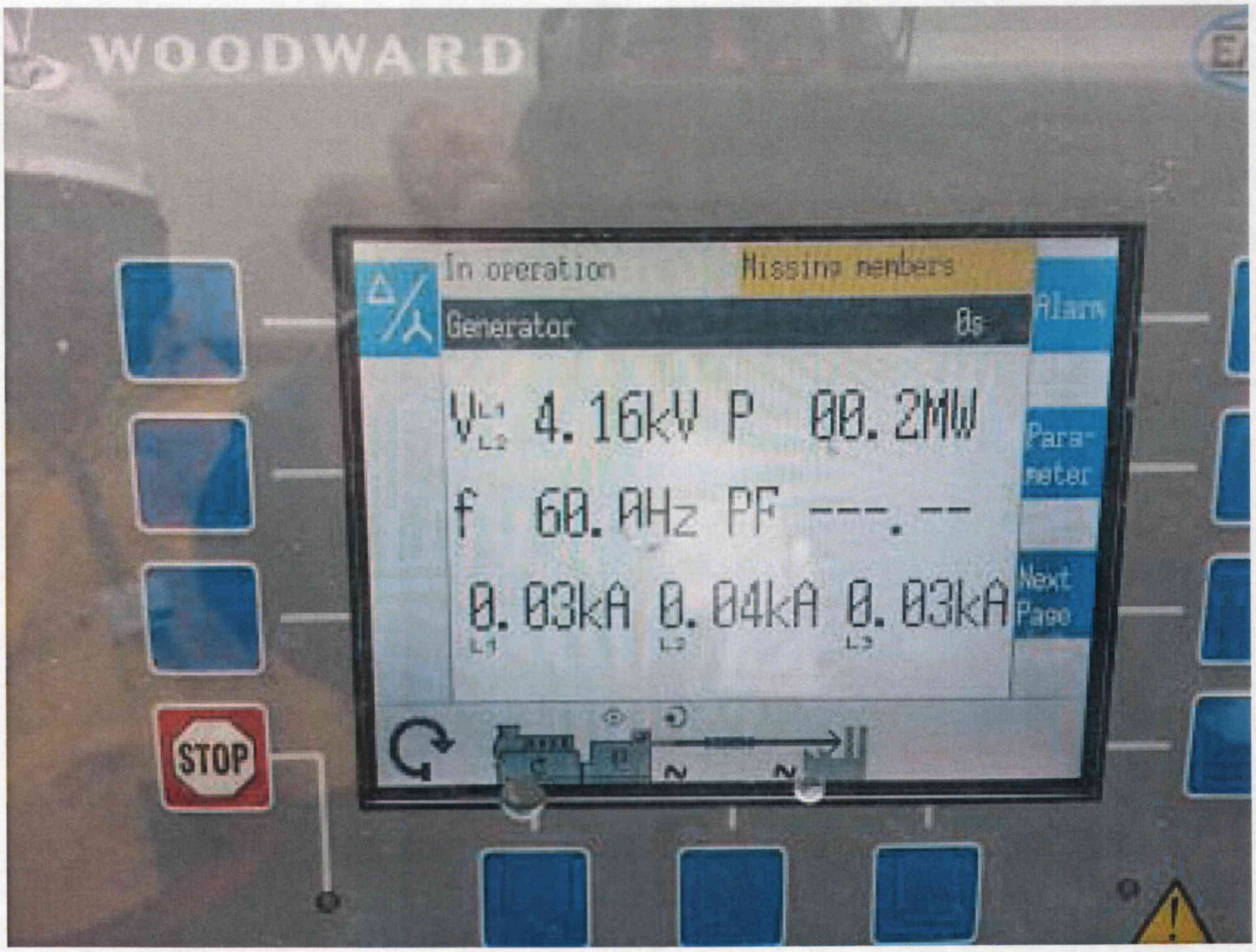
Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos:
Page 8 of 24

Cables and 4160 Vac Generator at ESW Pumphouse for Lake Water Pump Testing

Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos:
Page 9 of 24

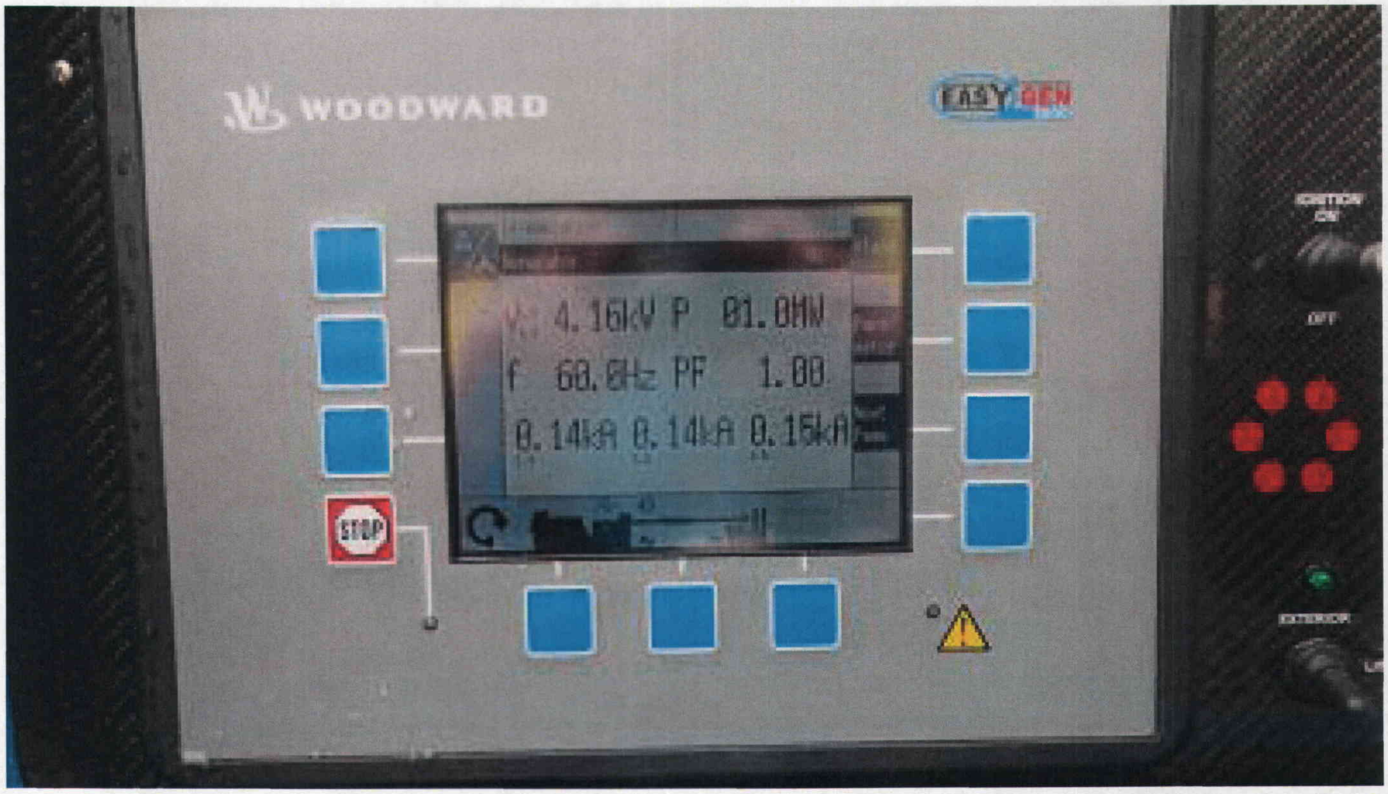
4160 Vac Generator in parking lot

Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos:
Page 10 of 24



FLEX 4160 Vac Generator Control Panel during run to support FLEX Lake Water Pump testing

Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos:
Page 11 of 24

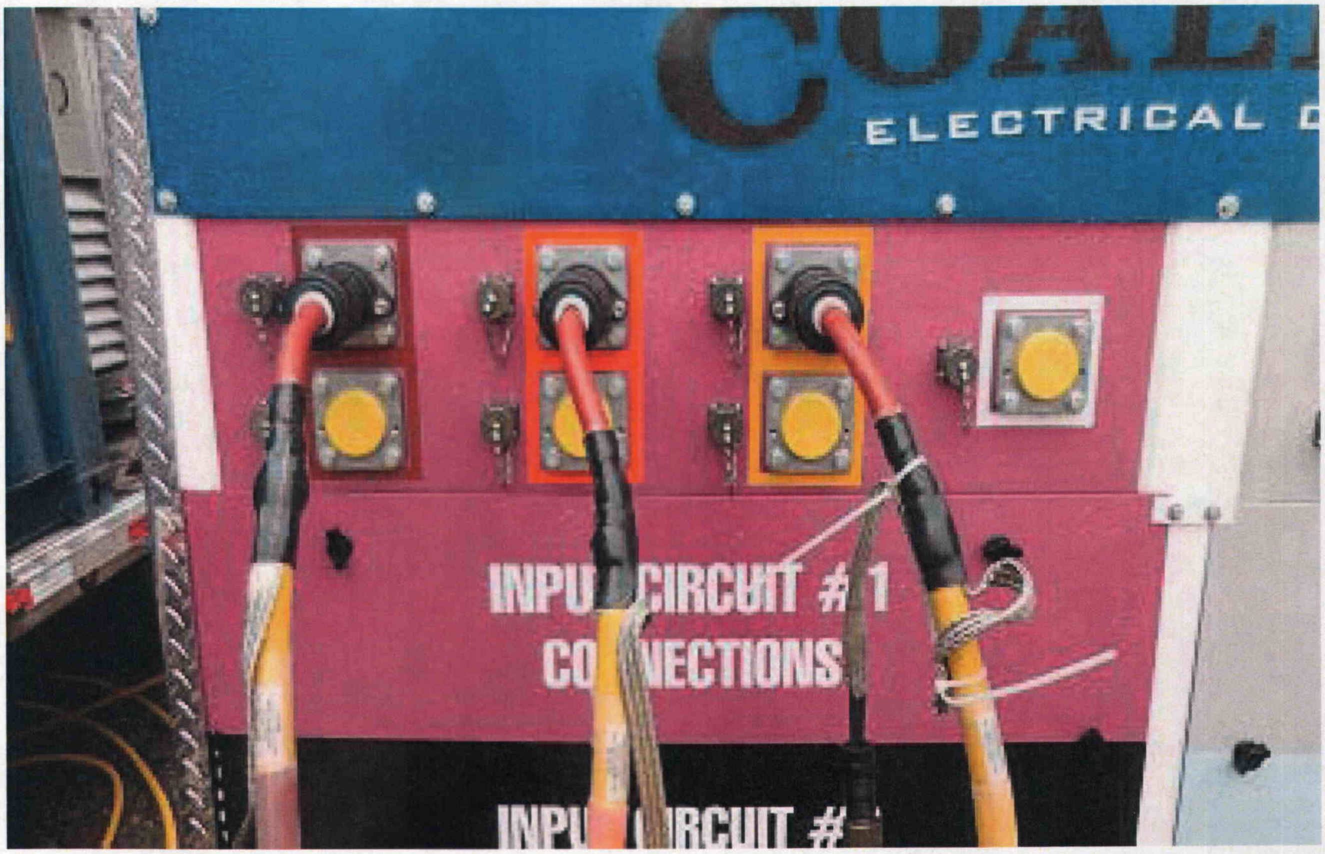


FLEX 4160 Vac Generator Control Panel during load test run

Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos: Page 12 of 24

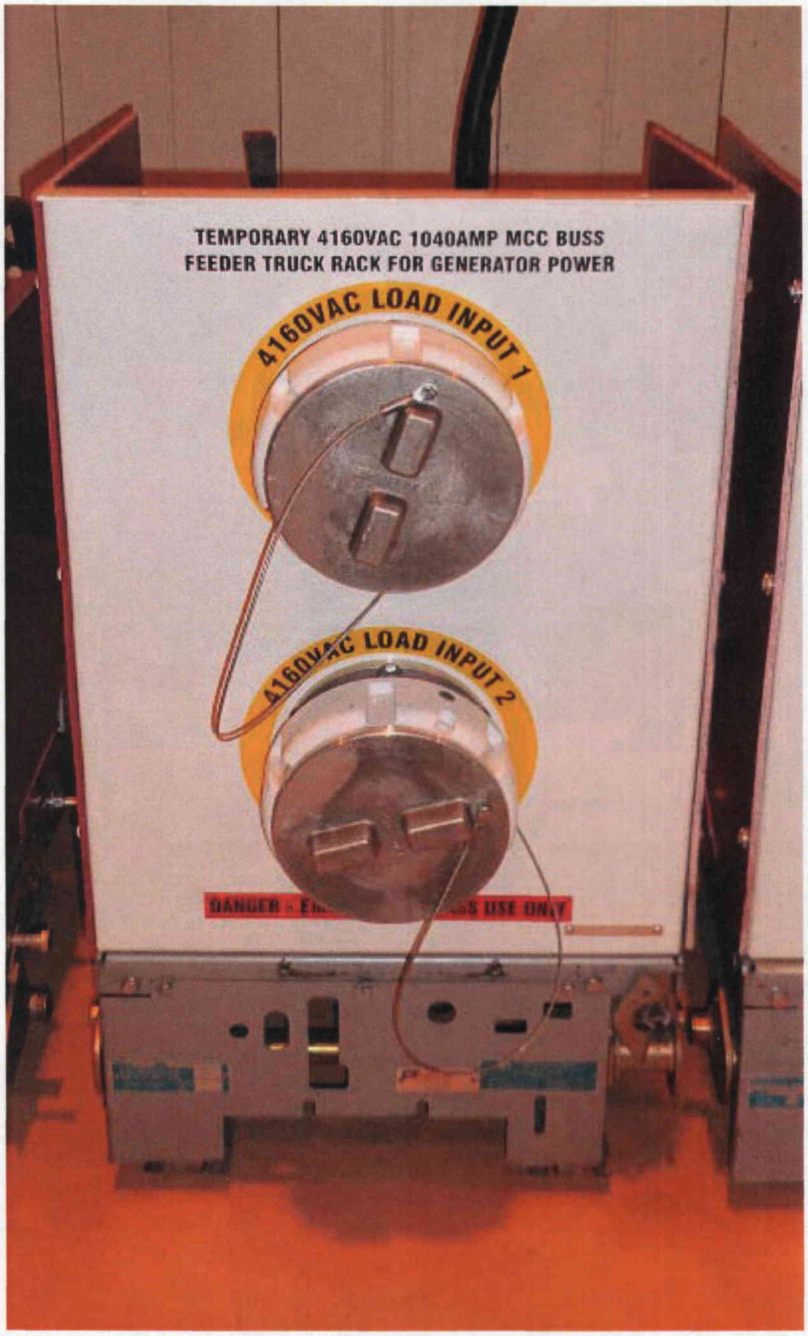
FLEX Storage Bay 1 Distribution Center with cables attached during phase rotation checks. NOTE: Color-coding on connections is brown, orange and yellow, the reflective quality of the tape and the flash causes distortion of the colors

Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos: Page 13 of 24



Close up of distribution center connections during FLEX 4160 Vac Generator load testing, note color-coding.

Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos: Page 14 of 24



Emergency Bus Feeder for use in EH 2101 and 2102

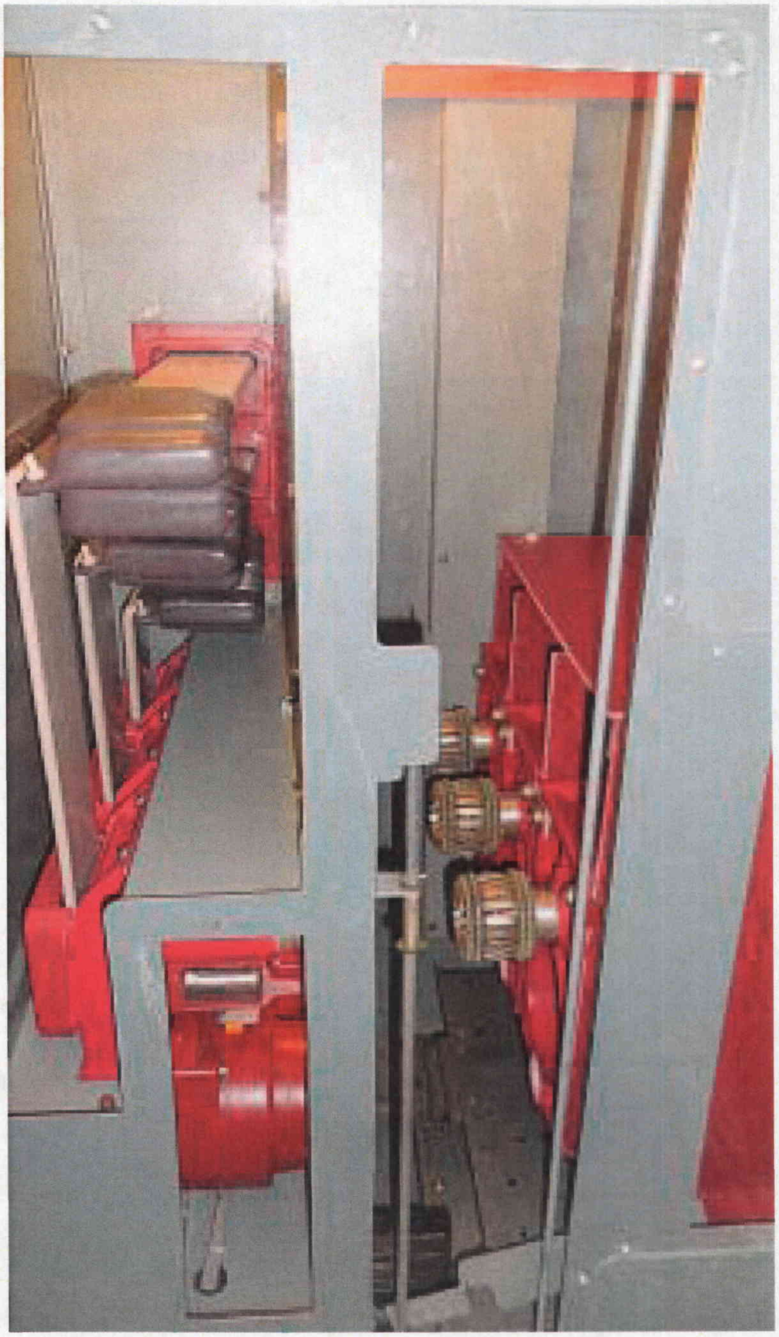
Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos:
Page 15 of 24

Close up of connection on Emergency Bus Feeder for use in EH 2101 and 2102

Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos:
Page 16 of 24

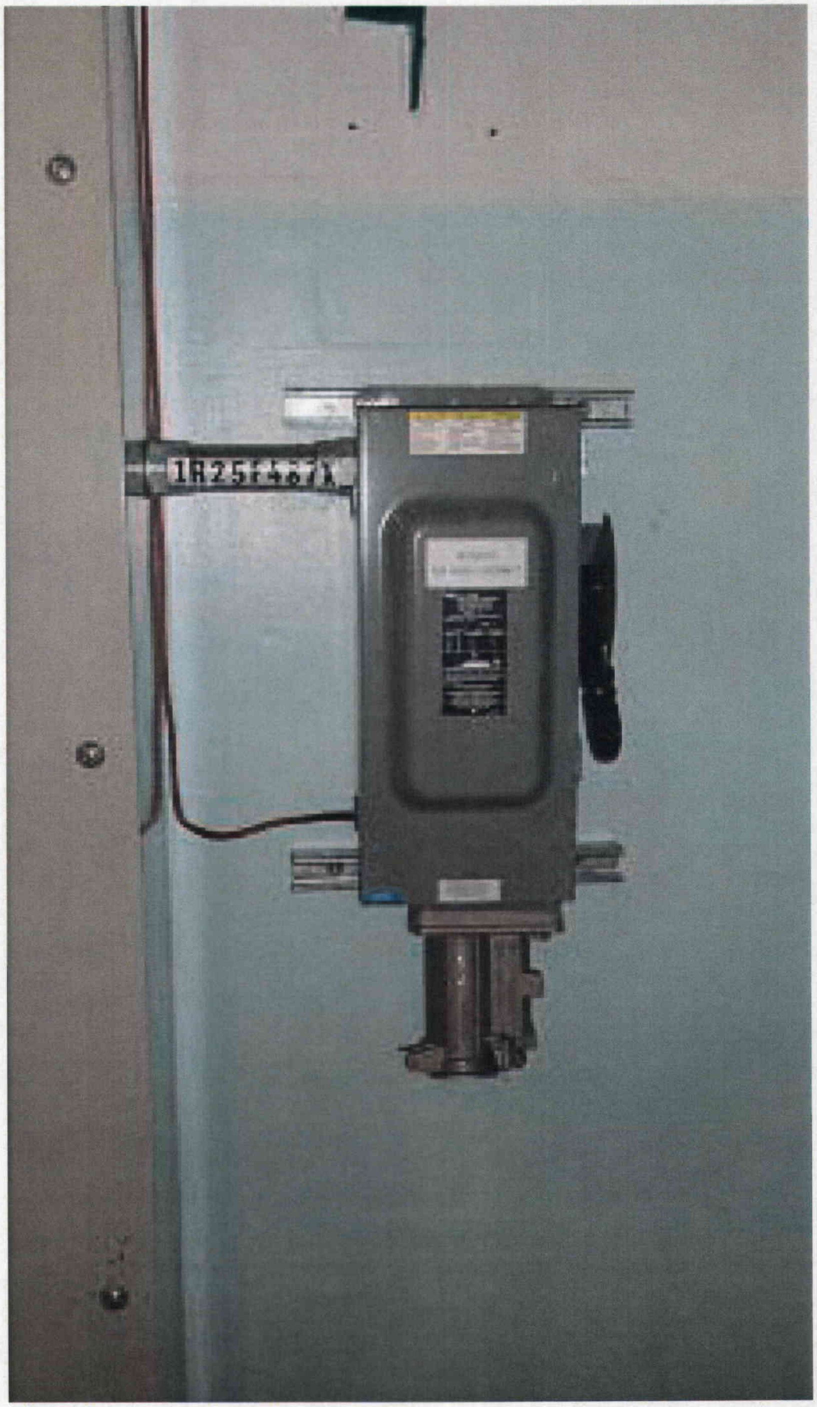
Emergency Buss Feeder during testing at Maintenance training facility

Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos: Page 17 of 24



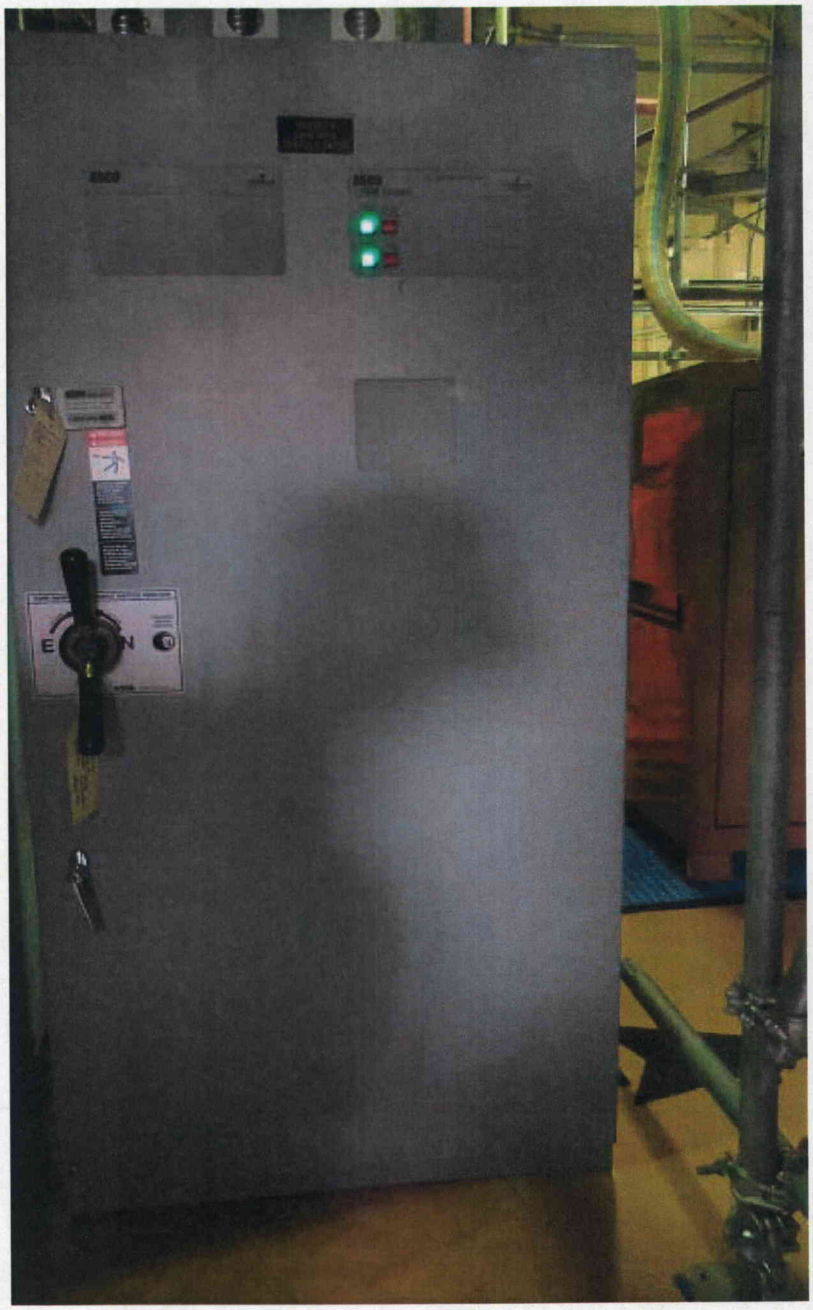
Emergency Buss Feeder side view being racked in during testing at Maintenance training facility, note: Plexiglas covers over side of panel

Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos: Page 18 of 24



FLEX Alternate CRD Injection Pump Disconnect

Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos: Page 19 of 24



Alternate Decay Heat Removal Power Transfer Switch

Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos:
Page 20 of 24

Suppression Pool Cleanup Power Transfer Switch

Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos: Page 21 of 24

Spent Fuel Pool Level Indication Primary Level Indicator

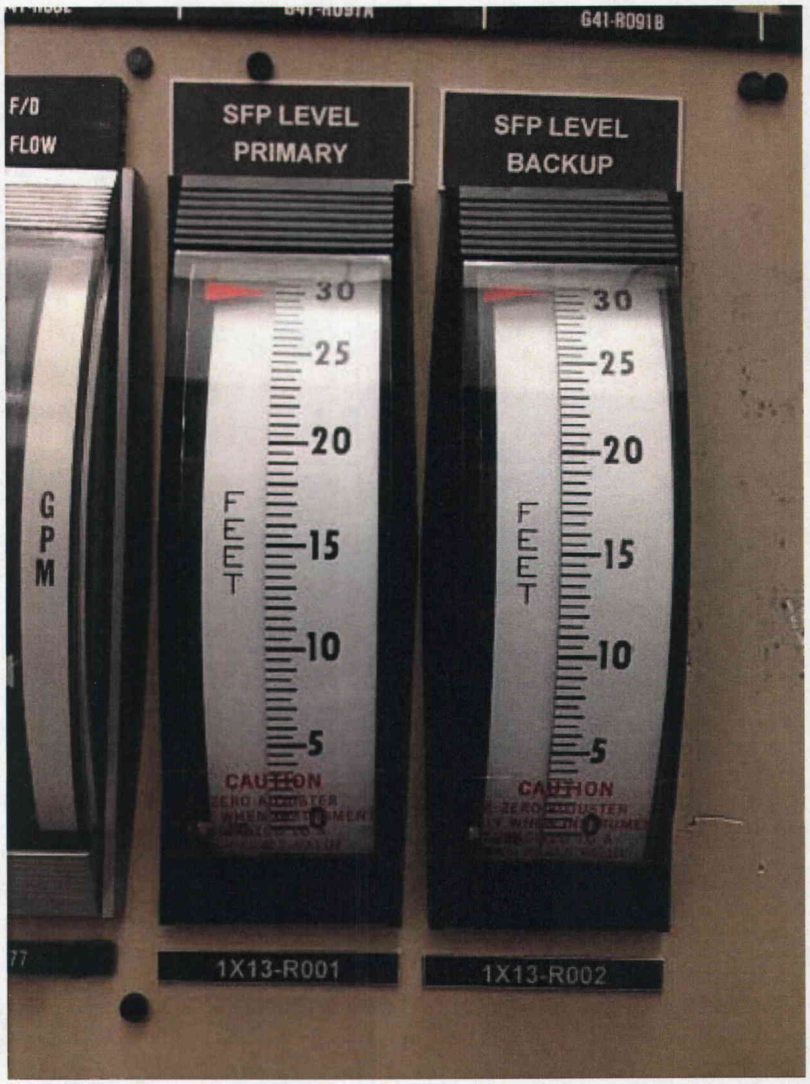
Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos:
Page 22 of 24

Spent Fuel Pool Level Indication Secondary Level Indicator

Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos:
Page 23 of 24

FLEX Spent Fuel Pool Sensor Arm

Figure E-18-A Continued: FLEX Electrical Equipment and Modification Photos: Page 24 of 24



Control Room Spent Fuel Pool Level Indication

61.0 APPENDIX: Figure E-19 Termination Enclosure 1X11-S0001 to Bus EH21 Feeder

Portions of this page have been
redacted per 10 CFR 2.390(d)(1).

62.0 APPENDIX: Figure E-20 Alternate Supply to Bus EH11

Portions of this page have been
redacted per 10 CFR 2.390(d)(1).

63.0 APPENDIX: Figure E-22 Alternate Supply to Bus EH12

Portions of this page have been redacted per 10 CFR 2.390(d)(1).

64.0 APPENDIX: Figure E-23 Alternate Supply to Bus EH13

Portions of this page have been
redacted per 10 CFR 2.390(d)(1).

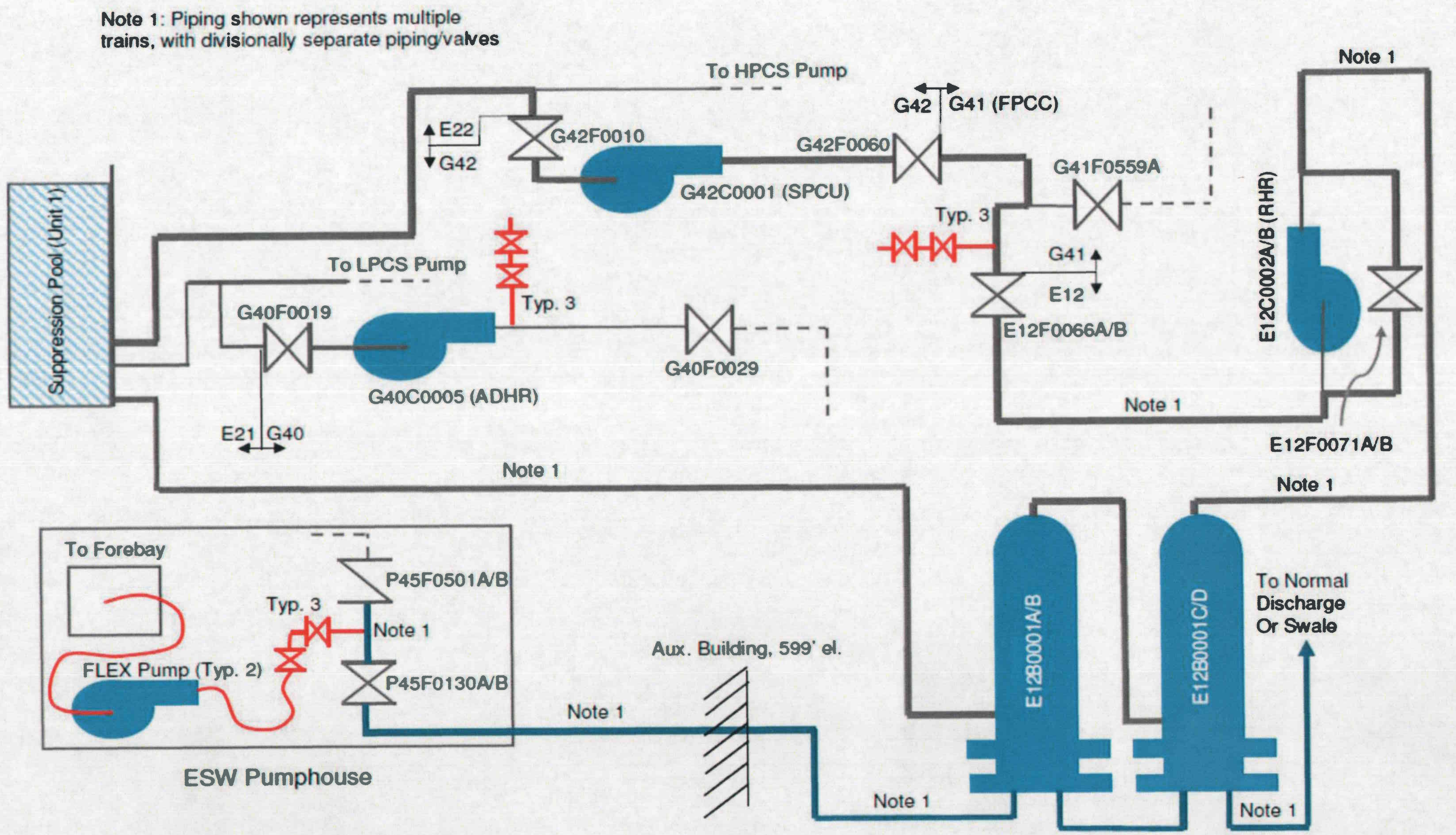
65.0 APPENDIX: Figure E-24 Alternate Supply to Bus TH21

Portions of this page have been
redacted per 10 CFR 2.390(d)(1).

66.0 APPENDIX: Figure E-25 Alternate Supply to Transformer EHF2A

Portions of this page have been redacted per 10 CFR 2.390(d)(1).

67.0 APPENDIX: Figure E-26 Primary Suppression Pool Closed Loop Cooling Flow Path



68.0 APPENDIX: F, FLEX Equipment Task Examples

Page 1 of 2

Notification		Notification type	Created on	Description	System status	User Status	Maintenance Plan	Maintenance item	Functional Location	Superior functional location	Main work center	Maint Activity Type	Over due date
600952403		NR	2/27/2015	FLEX/ECP 14-0714/3M OP TEST	ATCO NOPR NOPT	INIT	235647	346372	PY-1X11S0011	PY-1X11	OP	G07	7/30/2015
600953496		NR	3/5/2015	FLEX/ECP 14-0714/ANNUAL FULL LOAD TEST	NOPR OSTS	INIT			PY-1X11S0011	PY-1X11			
600953501		NR	3/5/2015	FLEX/ECP 14-0714/ANNUAL VIBE TEST	NOPR OSTS	INIT			PY-1X11S0011	PY-1X11			
600953704		NR	3/6/2015	FLEX/ECP 14-0714/OIL & AIR INTAKE MAINT	NOPR OSTS	INIT			PY-1X11S0011	PY-1X11			
600953744		NR	3/6/2015	FLEX/ECP 14-0714/FUEL FILTER CHANGE	NOPR OSTS	INIT			PY-1X11S0011	PY-1X11			
600953787		NR	3/7/2015	FLEX/ECP 14-0714/INSPECT COUPLING	NOPR OSTS	INIT			PY-1X11S0011	PY-1X11			
600953797		NR	3/7/2015	FLEX/ECP 14-0714/GEN OFF-LINE TESTING	NOPR OSTS	INIT			PY-1X11S0011	PY-1X11			
600953801		NR	3/7/2015	FLEX/ECP 14-0714/FLUID ANALYSIS	NOPR OSTS	INIT			PY-1X11S0011	PY-1X11			
600952477		NR	2/27/2015	FLEX/ECP 14-0714/3M OP TEST	ATCO NOPR NOPT	INIT	235648	346373	PY-1X11S0012	PY-1X11	OP	G07	7/30/2015
600953503		NR	3/5/2015	FLEX/ECP 14-0714/ANNUAL VIBE TEST	NOPR OSTS	INIT			PY-1X11S0012	PY-1X11			
600953705		NR	3/6/2015	FLEX/ECP 14-0714/OIL & AIR INTAKE MAINT	NOPR OSTS	INIT			PY-1X11S0012	PY-1X11			
600953745		NR	3/6/2015	FLEX/ECP 14-0714/FUEL FILTER CHANGE	NOPR OSTS	INIT			PY-1X11S0012	PY-1X11			
600953788		NR	3/7/2015	FLEX/ECP 14-0714/INSPECT COUPLING	NOPR OSTS	INIT			PY-1X11S0012	PY-1X11			
600953798		NR	3/7/2015	FLEX/ECP 14-0714/GEN OFF-LINE TESTING	NOPR OSTS	INIT			PY-1X11S0012	PY-1X11			
600953802		NR	3/7/2015	FLEX/ECP 14-0714/FLUID ANALYSIS	NOPR OSTS	INIT			PY-1X11S0012	PY-1X11			
600952480		NR	2/27/2015	FLEX/ECP 14-0714/3M OP TEST	ATCO NOPR NOPT	INIT	235649	346374	PY-1X11S0013	PY-1X11	OP	G07	7/30/2015
600953499		NR	3/5/2015	FLEX/ECP 14-0714/ANNUAL FULL LOAD TEST	NOPR OSTS	INIT			PY-1X11S0013	PY-1X11			
600953504		NR	3/5/2015	FLEX/ECP 14-0714/ANNUAL VIBE TEST	NOPR OSTS	INIT			PY-1X11S0013	PY-1X11			
600953706		NR	3/6/2015	FLEX/ECP 14-0714/OIL & AIR INTAKE MAINT	NOPR OSTS	INIT			PY-1X11S0013	PY-1X11			
600953746		NR	3/6/2015	FLEX/ECP 14-0714/FUEL FILTER CHANGE	NOPR OSTS	INIT			PY-1X11S0013	PY-1X11			

65.0 APPENDIX: F, FLEX Equipment Task Examples

Page 2 of 2

Notification	Notification Counter	Notification type	Created on	Description	System status	User Status	Maintenance Plan	Maintenance item	Functional Location	Superior functional location	Main work center	Maint Activity Type	Over due date
600953789	0	NR	3/7/2015	FLEX/ECP 14-0714/INSPECT COUPLING	NOPR OSTS	INIT			PY-1X11S0013	PY-1X11			
600953799	0	NR	3/7/2015	FLEX/ECP 14-0714/GEN OFF-LINE TESTING	NOPR OSTS	INIT			PY-1X11S0013	PY-1X11			
600953803	0	NR	3/7/2015	FLEX/ECP 14-0714/FLUID ANALYSIS	NOPR OSTS	INIT			PY-1X11S0013	PY-1X11			
600959223	0	NR	4/3/2015	FLEX/ECP 14-0714/1YR H2 IGN OP TEST	NOPT OSNO OSTS	INIT			PY-1X11S0016	PY-1X11			
600959216	0	NR	4/3/2015	FLEX/ECP 14-0714/1YR OP TEST	NOPR NOPT OSTS	INIT			PY-1X11S0017	PY-1X11			
600959217	0	NR	4/3/2015	FLEX/ECP 14-0714/1YR OP TEST	NOPT OSNO OSTS	INIT			PY-1X11S0018	PY-1X11			
600959218	0	NR	4/3/2015	FLEX/ECP 14-0714/1YR OP TEST 12.6 KW EDG	NOPR NOPT OSTS	INIT			PY-1X11S0031	PY-1X11			
600959219	0	NR	4/3/2015	FLEX/ECP 14-0714/1YR 120V GEN OP TEST	NOPR NOPT OSTS	INIT			PY-1X11S0032	PY-1X11			
600959220	0	NR	4/3/2015	FLEX/ECP 14-0714/1YR 120V GEN OP TEST	NOPT OSNO OSTS	INIT			PY-1X11S0033	PY-1X11			
600959221	0	NR	4/3/2015	FLEX/ECP 14-0714/1YR 120V GEN OP TEST	NOPT OSNO OSTS	INIT			PY-1X11S0034	PY-1X11			
600959222	0	NR	4/3/2015	FLEX/ECP 14-0714/1YR 120V GEN OP TEST	NOPT OSNO OSTS	INIT			PY-1X11S0035	PY-1X11			
600959300	0	NR	4/3/2015	FLEX TRUCK OP INSP/1YR	NOPT OSNO OSTS	INIT			PY-1X11Z0001	PY-1X11			
600959301	0	NR	4/3/2015	FLEX TRUCK OP INSP/1YR	NOPT OSNO OSTS	INIT			PY-1X11Z0002	PY-1X11			
600927780	0	NR	10/17/2014	Replace Cable, Couplers & Connectors	NOPT OSNO OSTS	INIT			PY-1X13N0001	PY-1X13			
600927781	0	NR	10/17/2014	Replace Cable, Coupler & Connector (HOLD)	NOPT OSNO OSTS	INIT			PY-1X13N0002	PY-1X13			
600925790	0	NR	10/7/2014	Replace Level Sensor electronics (HOLD)	NOPR NOPT OSTS	INIT			PY-1X13N0003	PY-1X13			
600925914	0	NR	10/7/2014	Level Sensor Calibration (HOLD)	NOPR NOPT OSTS	INIT			PY-1X13N0003	PY-1X13			
600925793	0	NR	10/7/2014	Replace Level Sensor electronics (HOLD)	NOPR NOPT OSTS	INIT			PY-1X13N0004	PY-1X13			
600925915	0	NR	10/7/2014	Level Sensor Calibration (HOLD)	NOPR NOPT OSTS	INIT			PY-1X13N0004	PY-1X13			

69.0 APPENDIX G Perry Nuclear Power Plant FLEX Overall Integrated Plan, Rev. 4

Not used, this report is now the Final Implementation Plan

70.0 APPENDIX: H, L-15-128, Completion of Required Action by NRC Order EA-12-051, Reliable Spent Fuel Pool Instrumentation (TAC No. MF0802)

June 12, 2015
L-15-128 10 CFR 2.202

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

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Completion of Required Action by NRC Order EA-12-051, Reliable Spent Fuel Pool Instrumentation (TAC No. MF0802)

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Order EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation, to FirstEnergy Nuclear Operating Company (FENOC). This Order was effective immediately and directed FENOC to have a reliable indication of the water level in associated spent fuel storage pools for the Perry Nuclear Power Plant (PNPP) as outlined in Attachment 2 of the Order. This letter, along with its attachments, 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 PNPP.

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 June _____, 2015.

Respectfully submitted,

Ernest J. Harkness

Perry Nuclear Power Plant
L-15-128
Page 2

Attachments:
1. Compliance with Order EA-12-051
2. NRC Requests for Information

cc: Director, Office of Nuclear Reactor Regulation (NRR)
NRC Region III Administrator
NRC Resident Inspector
NRC Project Manager
Ms. Lisa M. Regner, NRR/JLD/PMB, NRC
Mr. Blake A. Purnell, NRR/JLD/PMB, NRC