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NL-16-089

August 12, 2016

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
11555 Rockville Pike, OWFN-2 FL
Rockville, MD 20852-2738

SUBJECT: Notification of Full Compliance with Order EA-12-049 "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" and Order EA-12-051 "Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation" (TAC Nos. MF0744 and MF0737)
Indian Point Unit Number 2
Docket No. 50-247
License No. DPR-26

REFERENCES:

1. NRC Order Number EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, dated March 12, 2012 (ML 12054A736).
2. NRC Order Number EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation, dated March 12, 2012 (ML12054A682)
3. Entergy letter to NRC (NL-13-042), 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 28, 2013 (ML13079A348)
4. Entergy letter to NRC (NL-13-043), Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-043), dated February 27, 2013 (ML 13079A348)
5. NRC Letter Regarding Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Order EA-12-049 (Mitigation Strategies) (TAC Nos. MF0744 and MF0745), January 24, 2014 (ML13337A594)
6. NRC Letter Report for the Onsite Audit Regarding Implementation

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of Mitigating Strategies and Reliable Spent Fuel Instrumentation Related to Orders EA-12-049 and EA-12-051 (TAC Nos. MF0744, MF0745, MF0737, and MF0738), December 9, 2014 (ML14335A642)

7 NRC Letter Regarding Interim Staff Evaluation and Request for Additional Information Regarding the Overall Integrated Plan in Response to Order EA-12-051 (Spent Fuel Pool Instrumentation) (TAC Nos. MF0737 and MF0738), November 8, 2013 (ML 13298A805)

8 NRC Letter Report for the Onsite Audit Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Instrumentation Related to Orders EA-12-049 and EA-12-051 (TAC Nos. MF0744, and MF0737), February 25, 2016 (ML16042A388)

Dear Sir or Madam:

The purpose of this letter is to notify the NRC that Indian Pont 2 (IP2) is in compliance with Orders EA-12-049 and EA-12-051. On March 12, 2012, the Nuclear Regulatory Commission ("NRC" or "Commission") issued Orders EA-12-049 (Reference 1) and Order EA-12-051 (Reference 2) to Entergy Nuclear Operations Inc. (Entergy). Reference 1 was immediately effective and directed Entergy 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. Reference 2 was immediately effective and directed Entergy to install reliable spent fuel pool level instrumentation.

Order EA-12-049, Section IV.A.2 and Order EA-12-051, Section IV.A.2 requires completion of full implementation to be no later than two refueling cycles after submittal of the Overall Integrated Plan (OIP), as required by Condition C.1.a, or December 31, 2016, whichever comes first. In addition, Section IV.C.3 of Orders EA-12-049 and EA-12-051 require that Licensees and CP holders report to the NRC when full compliance is achieved. The OIP for EA-12-049 was submitted (Reference 3) on February 28, 2013 and the OIP for EA-12-051 was submitted (Reference 4) on February 27, 2013. On June 14, 2016, IP2 entered Mode 2 (startup) following the 2RO22 refueling outage which was two refuel cycles after submittal of the OIPs. Full compliance with Orders EA-12-049 and EA-12-051 was achieved at that time as discussed in the Attachments.

Attachment 1 provides a brief summary of the key elements associated with compliance to Order EA-12-049 for IP2. A listing of each item that has not been docketed as closed by the NRC from the Open and Confirmatory Items identified in the Interim Staff Evaluation (Reference 5), Open items in the OIP (Reference 3), and Audit questions and open items (Reference 6) is provided which references the responses. The responses are based on information and analyses that have been completed as of the date of full compliance. As such, Energy considers these items complete pending NRC closure following the last audit (Reference 8).

Attachment 2 provides a brief summary of the key elements associated with compliance to Order EA-12-051 for IP2. A listing of each item that has not been docketed as closed by the NRC from the Open and Confirmatory Items identified in the Interim Staff Evaluation (Reference 7), Open items in the OIP (Reference 4), and Audit questions and open items (Reference 6) is provided which references the responses. The responses are based on information and analyses that have been completed as of the date of full compliance. As such, Energy considers these items complete pending NRC closure following the last audit (Reference 8).

This letter contains no new regulatory commitments. Should you have any questions regarding this submittal, please contact Mr. Robert Walpole, Manager, Regulatory Assurance at (914) 254-6710.

I declare under penalty of perjury that the foregoing is true and correct; executed on August 12, 2016.

Sincerely,

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Attachments: 1. Indian Point 2 Summary of Compliance Bases for Order EA-12-049
2. Indian Point 2 Summary of Compliance Bases for Order EA-12-051

Enclosures: 1. Indian Point Energy Center Units 2 and 3 NEI 12-01 Phase 2 Staffing Assessment (Rev, 3), May 18, 2016
2. IPEC Final Integrated Plan (FIP)
3. SFPI Vendor – Indian Point Bridging Document

cc: Mr. Douglas V. Pickett, Senior Project Manager, NRC NRR DORL
Mr. Daniel H. Dorman, Regional Administrator, NRC Region 1
Mr. John Boska, Senior Project Manager, NRC NRR DORL
NRC Resident Inspectors Office
Mr. John B. Rhodes, President and CEO, NYSERDA
Ms. Bridget Frymire, NYS Public Service Commission

ATTACHMENT 1 TO NL-16-089

INDIAN POINT 2 SUMMARY OF COMPLIANCE BASES FOR ORDER EA-12-049

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NO. 2
DOCKET NO. 50-247

Indian Point Unit Two Compliance Letter for the Implementation of Order EA-12-049 Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events

BACKGROUND

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," (Reference 1) to Entergy Operations, Inc. (Entergy). This Order was effective immediately and Entergy developed an Overall Integrated Plan (OIP) (Reference 2) for Indian Point Energy Center (IPEC), documenting the diverse and flexible strategies (FLEX) required. The Order required compliance prior to plant startup from the second refueling outage following submittal of the OIP, or by December 31, 2016, whichever comes first. The compliance date for Indian Point 2 (IP2) was June 14, 2016. The NRC staff requested that the compliance report be submitted within 60 days of the compliance date. The information provided herein documents full compliance for IP2 in response to the Order.

Milestone Schedule - Items Complete

The following milestone(s) have been completed:

Milestone	Completion Date	Activity Status
Submit Overall Integrated Implementation Plan	Feb 2013*	Completed
Submit Six Month Updates		
Update 1	Aug 2013	Completed
Update 2	Feb 2014	Completed
Update 3	Aug 2014	Completed
Update 4	Feb 2015	Completed
Update 5	Aug 2015	Completed
Update 6	Feb 2016	Completed
Perform Staffing Analysis	Nov 2014*	Completed
Off-site FLEX Equipment		
Develop Strategies with NSRC	March 2015	Completed
Procedures		
PWROG issues NSSS-specific guidelines	Jan 2014	Completed
Modifications		
Engineering and Implementation	RO 2R22	Completed

Milestone	Completion Date	Activity Status
N-1 Walk down (Unit 2)	Spring 2014	Completed
Design Engineering	June 2015	Completed
On-site FLEX Equipment		
Purchase / Procure	Dec 2015	Completed
Procedures		
Create Indian Point FSG	April 2016	Completed
Create Maintenance Procedures	Oct 2015	Completed
Training:		
Develop Training Plan	Aug 2015	Completed
Implement Training	June 2016	Completed

* - These documents have been updated.

STRATEGIES – COMPLETE

Indian Point Unit 2 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 Indian Point Unit 2 have been fully implemented in accordance with the station design control process.

EQUIPMENT – PROCURED AND MAINTENANCE & TESTING – COMPLETE

The equipment required to implement the FLEX strategies for Indian Point Unit 2 has been procured in accordance with NEI 12-06, Section 11.1 and 11.2, received at IPEC, initially tested/performance verified as identified in NEI 12-06, Section 11.5, and is available for use. CR-IP2-2016-3658 was written to document the inability of 6 pumps to operate at the lowest temperatures in the strategies. The pumps are operable for all affected pumps will be modified before cold weather arrives (during October 2015 at the latest). The Flex SG make-up and CST Refill pumps are currently qualified by the vendor for a minimum temperature of 0 deg F and 5 deg F respectively. Per the temperature data from West Point, NY, dating back to 1911, the minimum temperature between June and September is approximately 37F. Based on the current summer climate for New York State and the data pulled from West Point, NY, the temperatures will not challenge the limits identified by the pump manufacturer.

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

PROTECTED STORAGE – COMPLETE

The storage facility/facilities required to implement the FLEX strategies for Indian Point Unit 2 has been completed and provides protection from the applicable site hazards. The equipment required to implement the FLEX strategies for Indian Point Unit 2 is stored in its protected configuration.

PROCEDURES – COMPLETE

FLEX Support Guidelines (FSGs), for Indian Point Unit 2 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 Indian Point Unit 2 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 IPEC has been completed in accordance with 10CFR50.54(f), "Request for Information Pursuant to Title 10 of the Code of Federal Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force review of Insights from the Fukushima Dai-ichi Accident," Recommendation 9.3, dated March 12, 2012 (Reference 1), as documented in letter dated November 3, 2014 which submitted the Phase 2 staffing study (Reference 8). The Staffing study has been revised and the current Revision is in Enclosure 1 of this letter for NRC information.

NATIONAL SAFER RESPONSE CENTERS – COMPLETE

Entergy 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 IPEC with Phase 3 equipment stored in the National SAFER Response Centers in accordance with the site specific SAFER Response Plan.

VALIDATION – COMPLETE

Entergy 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 Overall Integrated Plan (OIP) / Final Integrated Plan (FIP) for Order EA-12-049. The current Revision of the FIP is in Enclosure 2 of this letter for NRC information.

FLEX PROGRAM DOCUMENT – ESTABLISHED

The Indian Point Unit 2 FLEX Program Document has been developed in accordance with the requirements of NEI 12-06.

Open Items from Overall Integrated Plan and Interim Staff Evaluation

The following provide a summary and status of any open items documented in the overall integrated plan (Table 1), any open items or confirmatory items documented in the Interim Staff Evaluation (ISE) for IPEC Unit 2 (Table 2), a listing of all Audit Questions and the status of each item applicable specifically to IPEC Unit 2 (Table 3), and OIP Items (Table 4). Last are the FLEX related NRC Audit Visit (Reference 13) open items, which includes open items on previously issued ISE Open and Confirmatory Items and new Safety Evaluation (SE) Open Items that were not closed during the December 2015 NRC Audit Visit, and their status.

Table 1 - Overall Integrated Plan Open Item	Status
There were no open items documented in the IPEC Overall Integrated Plan	N/A

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
3.1.2.A	Review of the licensee's new flooding level evaluation results and its potential impact on the flooding hazard analyses previously provided in their Integrated Plan and during the audit process is identified as an Open Item. If the flooding levels are modified based on the results of this review, it may affect the evaluation of the deployment described in Section 3.1.2.2 of this evaluation.	This item was closed during the December 2015 NRC Audit Visit (associated with AQ IPEC-.006) **Entergy Response 10/23/2013** The flooding level evaluation for IPEC has not been completed to determine if flooding in the integrated plan is consistent with the existing licensing basis. The design basis for Unit 2 is based on Unit 2 UFSAR Section 2.5 and for Unit 3 the determination was based on Unit 3 UFSAR Section 2.5. Following completion of the new external flooding analysis and integration evaluation, design of storage facilities, specification of FLEX equipment, protection of FLEX equipment, control of FLEX equipment, implementation of FLEX strategies, and protection of safety related plant structures from FLEX equipment will be determined during the design development and procedure development phase. These procedures will address warning times and the persistence of an external flooding hazard. Studies to date characterize flooding times in days (typically associated with hurricanes) and a persistence of less than a day; this will be confirmed when the evaluations are completed. Response to this audit question will be provided in a future update. **Entergy Response Update to address ISE Open Item 3.1.2.A (08/28/2014):** The hazard assessment at IP2 and IP3 considered the potential for flooding from local intense precipitation, flooding from nearby rivers, high tides, hurricane and storm surge, and tsunami events. The Entergy Fleet Fukushima Program Flood Hazard Reevaluation Report for

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		Indian Point Energy Center (IPEC) Unit 2 and 3 described and evaluated flooding scenarios for the site ("51-9195289-000, Flood Hazard Reevaluation Report Required by 10 CFR 50.54(F) Near Term Task Force Recommendation 2.1", ADAMS Accession Nos. ML13364A006, ML13364A007, ML13364A008 and ML13364A009). The maximum water level resulting from combined effects on the Hudson River at IPEC was calculated to be 17.7 ft. elevation. The report also states that mitigation actions are in place that protect all vulnerable areas for external flooding up to an elevation of 17'-11". The flood hazard local intense precipitation (LIP) hydraulic model calculated localized depths inside the protected area ranging from 0.1 to 3.6 feet using a probable maximum precipitation of 15.3 inches over a 6-hour period. Conservatively, the hydraulic model did not include the concrete security barriers. The site topography is found on a terraced bedrock slope and the vehicle barrier system (concrete barrier system) redirects off-site surface water flow around the IPEC site. Specifically, an assessment performed by a debris assessment team concluded that the concrete barrier system will redirect an adequate amount of off-site surface water flow around the IPEC site to prevent localized flooding inside the PA in areas that would adversely impact the haul paths. In addition, haul routes and staging areas inside the PA were assessed using the localized flooding areas identified in the flood hazard reevaluation report and no adverse conditions impacting both the primary and alternate routes were identified since localized depths were short term in staging areas. Specifically, the staging location for the Phase 2 and Phase 3 FLEX generators in the IP2 transformer yard will not be impacted by local intense precipitation because the local flood level recedes to a reasonable level for area access within approximately one hour. Local intense precipitation was also assessed for haul pathways outside the protected area and adequate runoff exists in the haul path route. Therefore, no debris removal, transport delays or equipment staging impacts are anticipated as a result of local intense precipitation. Per NEI 12-01, the time to restore limited plant access is 6 hours from the

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		ELAP. It is assumed that deployment of FLEX equipment will also be possible starting at that time. Portions of the deployment which occur inside protected structures (e.g., running hoses / cables, making connections, lining up installed systems) will start earlier to optimize deployment times. Preparations to prevent flooding will begin per procedures 2-AOP-FLOOD-1, Rev. 10, Flooding and 3-AOP-FLOOD-1, Rev. 9, Flooding, on any indication of impending flood from river levels rising greater than 4.5 feet (for IP2) or greater than 7 feet (for IP3), or on a high tide advisory, at least 48 hours prior to a potential hurricane impact, rainfall greater than or equal to 5 inches per day, a NOAA flood warning, or actual plant flooding from plant systems. Preparations at the site which are made as part of these procedures include sandbagging vulnerable areas. In the event of a hurricane, the plant will be shutdown per severe weather procedures OAP-008, Rev. 18, Severe Weather Preparations, preparations will begin 72 hours prior to the projected arrival of tropical storm force winds. National Weather Service issues a Hurricane Warning for a hurricane with winds in excess of 100 miles per hour (87 knots). Therefore, prior to the arrival of hurricane induced flooding and high winds, the plant is shut down and well prepared to cope with the event. The results of the reevaluation of external flooding have been reviewed against the IPEC FLEX strategy to determine any possible impacts. The review determined that there is no impact on FLEX strategies or equipment as required mitigating actions will be done before a BDBEE would cause an ELAP and the flood mitigation equipment-materials will not rely on power/water supplied by FLEX equipment. There would also be no impact of the FLEX storage locations, staging locations or deployment methods, as described above. Flooding is still being evaluated in accordance with separate NRC requirements (see NRC letter regarding Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10 CFR 50.54(f) Information Request - Flood-causing Mechanism Reevaluation (CAC Nos.

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		MF 3313 and MF 3314), dated April 24, 2016). This increases the flood levels being evaluated.
3.2.4.7.A	It is noted that NEI 12-06 guidance only credits water supplies that are robust with respect to seismic events, floods, and high winds, and the associated missiles. The licensee should determine if a water supply for the SGs and RCS would be available after a tornado event by analyzing the tornado characteristics for the site compared to the separation characteristics of the tanks. This is an alternate approach from the strategies identified in NEI 12-06.	This item was closed during the December 2015 NRC Audit Visit (associated with AQ IPEC-041). **Entergy Response 10/23/2013** The Unit 2 and Unit 3 RWSTs and CSTs are seismically qualified. Protection from tornado missile is provided by alternate supplies. IPEC is currently compiling historical tornado information to determine historical tornado diameter and axis of movement. The steam generator feed requirements are assured by alternate water supplies: CST, City Water Tank and Hudson River. The water requirements of the primary systems are assured by the boric acid storage tanks (which are missile protected) and the refueling water tank. This is consistent with what is credited for the current licensing basis. (References: U3 FSAR, 16.2.2 and IPEC OIP) **Entergy Response Update to address ISE Open Item 3.2.4.7.A and ISE Confirmatory Item 3.2.4.7.B (08/28/2014):** The Indian Point 3 (IP3) design basis includes tornado protection criteria and credits a combination of Class I structures, a single tornado missile occurrence, and adequate separation and redundancy to meet the IP3 design basis (IP-RPT-13-00055). While NEI 12-06 allows using current station design bases, the IP Unit 2 tornado protection design basis was assessed when it comes to meeting the beyond design basis events. Evaluation ENTGIP2-RPT-001 was developed to provide the basis for tornado protection criteria. This report determined that reasonable protection of FLEX critical areas and components for a BDBEE is assured by the combination of: 1) the rare occurrence of tornados at the site, 2) the low tornado wind speed at site, 3) the low probability of a tornado generated missile striking equipment or structures needed for a BDBEE, and

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		4) the protection provided by adjacent buildings or geographic features. Therefore, no additional evaluations or modifications are necessary to comply with NRC Order EA-12-049. The IP2 FLEX strategy FLEX modifications will utilize the current design basis documented in the IP2 UFSAR and the NEI 12-06 definition of "robust." All IP2 FLEX strategies and IP2 FLEX modifications will be designed to meet the current IP2 tornado protection design basis (UFSAR Section 1.11.5) with the exception of IP2 components/modifications credited to support the current IP3 FLEX strategy. These IP2 components/modification designs will meet both the IP2 and IP3 design basis. Portable FLEX equipment stored onsite will be protected from tornado winds and missiles per NEI 12-06 guidance. Engineering reports IP-RPT-13-00055, Rev. 0, Indian Point Energy Center Unit 3 Tornado Wind and Missile Impact on Water Storage Tanks, January 2014, and ENTGIP2-RPT-001, Rev. 1, IP2 Tornado Protection, August 2014, are available on the ePortal. **Entergy Response Update to address ISE Open Item 3.2.4.7.A (10/27/2014):** The IP2 response (i.e., after the first paragraph of the 8/28/14 response) to this audit question is updated based on revised report ENTGIP2-RPT-001, IP2 Tornado Protection. While NEI 12-06 allows using current station design bases, the IP Unit 2 tornado protection design basis was assessed when it comes to meeting the beyond design basis events. Evaluation ENTGIP2-RPT-001 was developed to provide the basis for tornado protection criteria. This report determined that reasonable protection of FLEX critical areas and components for a BDBEE is assured by the combination of: 1) the rare occurrence of tornados at the site, 2) the low tornado wind speed at site, 3) the low probability of a tornado

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		generated missile striking equipment or structures needed for a BDBEE, 4) the protection (shielding) provided by adjacent buildings or geographic features or the separation distance based on a reasonable tornado width and the axis of separation relative to probable tornado paths. The IP2 licensing basis does not include tornado protection for the design of the buildings, structures and components. Therefore, no specific protection from the effects of tornados is required for components to be considered robust and credited in the IP Unit 2 Order EA 12-049 strategies. However, to provide a congruous strategy for tornado events, the Flex Strategy for addressing tornado and tornado missiles impact on critical areas and components credited for a BDBEE established with the Unit 3 Strategy was also evaluated for Unit 2. This does not constitute a new design bases criteria for Indian Point Unit 2, but is a conservatively consistent strategy for the site in that the overall Flex Strategy can address the loss of any single tank credited for FLEX strategies on site. Portable FLEX equipment stored onsite will be protected from tornado winds and missiles per NEI 12-06 guidance. Engineering report ENTGIP2-RPT-001, Rev. 2, IP2 Tornado Protection, October 2014, is available on the ePortal.
3.1.1.2.A	Confirm that at least one connection point for the FLEX AFW pump is accessible and is located inside a building that is seismically robust as described in Consideration 2 of NEI 12-06, Section 5.3.2.	This item was closed during the October 2014 NRC Audit Visit (associated with AQ IPEC-036). **Entergy Response 10/23/2013** The design of the alternate SG FLEX pump connection is in progress, therefore, the evaluation of flow through the connection has not been completed. This information will be provided in a future update. **Entergy Response Update to address ISE Confirmatory Items 3.1.1.2.A and 3.2.1.9.B for IPEC Unit 2 (02/27/2015):** The primary connection point for the FLEX SG pump is contained in the

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		Auxiliary Feed Water Building which is a structure with designs that are robust with respect to seismic events, floods, and high winds, and associated missiles per UFSAR Section 1.11, satisfying NEI-12-06. Therefore this connection is confirmed to comply with Consideration 2 of NEI-12-06, Section 5.3.2. Calculation IP-CAL-14-00046, Rev. 0, Hydraulic Model for Condensate Storage Tank (CST) for FLEX Strategies, August 2014, develops the hydraulic model for FLEX strategies that pertain to using the Condensate Storage Tank as the water source for various scenarios for Phase 2. The model determines the minimum requirements of the FLEX pumps for the required strategies and evaluates the proposed design and size requirements of the CST "manifold" that will be installed to provide the necessary flow requirements from the CST. This analysis demonstrates that the specified pump is capable of providing a combined 327 gpm through the alternate 2" connection to the steam generators. This hydraulic analysis was performed using the PROTOFLO computer program and accounts for the physical configuration of the FLEX strategy. Calculation IP-CAL-14-00046, Rev. 0, Hydraulic Model for Condensate Storage Tank (CST) for FLEX Strategies, August 2014, is available on the ePortal.
3.1.1.2.B	Confirm that the pickup trucks, forklifts or any other equipment that will be used to deploy the portable equipment for implementing FLEX strategies will be reasonably protected from the event as described in Consideration 5 of NEI 12-06, Section 5.3.2.	This item was closed during the October 2014 NRC Audit Visit. **Entergy Response to address ISE Confirmatory Item 3.1.1.2.B (08/28/2014):** Debris removal and towing equipment will be stored inside the FLEX storage building. An existing structure has been chosen to house the portable FLEX equipment for Units 2 and 3 on site As stated on the update to Audit Question 1 response above, modifications will be performed to this building to ensure that it will meet the requirements of NEI 12-06. After modified for FLEX, this building will be referred to as the FESB. Currently at IPEC, two (2) vehicles will be available for towing, and two (2) vehicles will also be available for debris

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		removal. These vehicles will be kept inside the FESB, therefore they will be reasonable protected from the event.
3.1.1.2.C	Confirm provisions will be made to ensure that access to all required areas will be assured in the event of a power failure as described in Consideration 5 of NEI 12-06, Section 5.3.2.	This item was closed during the December 2015 NRC Audit Visit (associated with AQ IPEC-023). **Entergy Response 10/23/2013** Procedures already exist or will be developed to ensure that operators can access the required areas in the event of a loss of power. Additional details on procedural controls for access to security controlled or internal locked areas where ELAP would disable normal controlled access will be provided later in the design / procedure development process. **Entergy Response Update to address ISE Confirmatory Item 3.1.1.2.C (02/27/2015)** 3-FSG-005, Initial Assessment and Flex Equipment, Step 4.2 notifies Security of ELAP and to expedite access per Security procedures listed (i.e., safeguards procedures 0-SE-001, Access Control, 0-SE-021, Integrated Response Plan, and 0-SE-301, Contingency Events). The FLEX Building is accessible by manual action using a come along. Security will be able to open vital areas, initially on uninterruptible power, when notified. Access through the SOCA and PA boundaries can be manually controlled by security. Truck barriers can be operated hydraulically using procedure 0-SE-005. The NRC Report (ML14335A642) for the onsite audit, issued on December 9, 2014, closed this item. **Entergy Response Update to address ISE Confirmatory Item 3.1.1.2.C for IPEC Unit 2 (08/28/2015)** 2-FSG-005, Initial Assessment and Flex Equipment, Step 4.2 notifies Security of ELAP and to expedite access per Security procedures listed (i.e.,

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		safeguards procedures 0-SE-001, Access Control, 0-SE-021, Integrated Response Plan, and 0-SE-301, Contingency Events). The FLEX Building is accessible by manual action using a come along. Security will be able to open vital areas, initially on uninterruptible power, when notified. Access through the SOCA and PA boundaries can be manually controlled by security. Truck barriers can be operated hydraulically using procedure 0-SE-005.
3.1.1.2.D	Confirm that the licensee has reviewed the deployment paths from the near site storage areas to the site and from the onsite storage areas to the deployment location to verify that these paths are not subject to soil liquefaction concerns as described in Consideration 1 of NEI 12-06, Section 5.3.2.	This item was closed during the October 2014 NRC Audit Visit (associated with AQ IPEC-002). **Entergy Response 10/23/2013** The referenced NEI 12-06 section (5.3.2) is intended to address deployment of onsite FLEX equipment. Refer to the response to Question 5 below regarding the delivery of FLEX equipment and FLEX support equipment to the plant from offsite following a seismic event, a flood, a hurricane or high wind event, or severe snow and ice. **Entergy Response Update to address ISE Confirmatory Item 3.1.1.2.D (08/28/2014):** Indian Point will utilize an existing structure to house Units 2 and 3 N+1 portable FLEX equipment used to support Phase 2 coping strategies. Modifications will be performed to this building to ensure that it will meet the requirements of NEI 12-06. After modified for FLEX, this existing structure will be referred as the FLEX Equipment Storage Building (FESB). A geotechnical exploration has been performed to evaluate the potential for soil liquefaction along the deployment route between the FLEX storage location and the FLEX equipment deployment location. The results of this exploration confirm that the soil liquefaction will not preclude FLEX implementation. Report IP-RPT-14-00010 (Report of Liquefaction Potential Assessment, June, 2014) .is available on the ePortal.
3.1.1.3.A	Confirm that the licensee's review	This item was closed during the December 2015 NRC Audit Visit (associated

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
	of the potential impacts of large internal flooding sources that are not seismically robust and do not require ac power has been completed per consideration 2 of NEI 12-06, Section 5.3.3.	with AQ IPEC-004). **Entergy Response 10/23/2013** Regarding NEI 12-06, Section 5.3.3, considerations 2, 3 and 4: 2. Potential impacts of large internal flooding sources that are not seismically robust and do not require ac power (this will be based on the current licensing basis internal flooding analysis): IPEC Unit 2 - Design for FLEX implementation has not begun, therefore, the internal flooding evaluation has not been completed at this time. IPEC Unit 3 - Design for FLEX implementation is in progress, however, the internal flooding evaluation has not been completed at this time. 3. Potential reliance on ac power to mitigate ground water: Indian Point 2 and 3 do not rely on AC power to mitigate ground water intrusion (IP2 & 3 FSAR Chapter 2.5). 4. Potential impacts of non-seismically robust downstream dams: There are no dams on the Hudson River downstream of Indian Point 2 and 3 (IP2 & 3 FSAR Section 2.5) as reflected in the tidal flow on the Hudson River at the site. **Entergy Response Update to address ISE Confirmatory Item 3.1.1.3.A for IPEC Unit 2 (02/27/2015):** In response to NRC Guidelines for Protection from Flooding of Equipment Important to Safety, Consolidated Edison identified the potential sources of flooding outside containment that could affect safety-related equipment. The areas containing safety-related equipment that could be subject to flooding from postulated failure of water systems that are not seismic Class I were evaluated. The plant is designed so as to minimize or eliminate the vulnerability of safety-related equipment to this flooding. Modifications were

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		made to install flap panels in doors from the Primary Auxiliary Building (PAB) and the auxiliary feed pump room. A later modification was made to install a flood control drain line and valve from the PAB to a manhole in the transformer yard. Additionally, operator action (opening the 15' elevation rollup doors to the yard) would be taken in the event of flooding from the circulating water system to prevent damage to the 480 volt switchgear in the control building. (Ref. FSAR 1.11.8) However, during an ELAP event, flooding from a circulating system piping or water box expansion joint would not be a concern since the circulating water pumps would not be operating. In their Safety Evaluation Report (SER), Susceptibility of Safety-Related Systems to Flooding from Failure of Non-Category I Systems, dated December 18, 1980, the NRC concluded that design features and operating procedures provide assurance that the plant can be safely shut down in the event of flooding outside containment from a non-seismic component or pipe and that their guidelines (contained in Appendix A to the SER) were satisfied. The SER goes on to say that Non-Class I tanks and other components which may potentially cause flooding have a combined volume that is so small that their failure would cause negligible flooding. Flooding consequences from failure of the other components and associated lines are also negligible. Indian Point Unit 2 design basis document, IP2-DBD-221, Section 2.3.2 provides the seismic design criteria applicable to the Fire Protection System. Sections 2.3.2 and 7.2 of the DBD provide summaries of calculations for fire protection piping and its supports which demonstrate that the water system piping in areas containing safety-related equipment is seismically robust. Therefore, flooding from Fire Protection System water piping failure coincident with spurious start of the diesel-driven fire pump is not a concern. Large external tanks are either seismically qualified, or are located away from safety-related structures and equipment such that their failure would not adversely affect safety-related equipment. Based on the above there are no large internal flood sources that are not

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		seismically robust and do not require ac power (i.e. gravity drain) for Unit 2 that require procedural interface for an ELAP event and FLEX strategy implementation.
3.1.1.4.A	Confirm that the intermediate staging area has been selected and implementing procedures have been developed.	This item was closed during the October 2014 NRC Audit Visit (associated with AQ IPEC-005). **Entergy Response 10/23/2013** The referenced NEI 12-06 sections deal with delivery of FLEX equipment and FLEX support equipment to a plant site following a seismic event, a flood, a hurricane or high wind event, or severe snow and ice. 1. In all cases plans are to deliver equipment from offsite sources via truck or air lift. These vehicles will follow preselected routes directly to the plant site staging area or to an intermediate staging area approximately 25 miles from the site. The delivery of equipment from the intermediate staging area will use the same methodology. Helicopter landing considerations are accounted for in selection of the areas. These areas are designed to accommodate the equipment being delivered from the Regional Response Center (RRC). 2. The RRC personnel will commence delivery of a preselected equipment set from the RRC center upon notification by the plant site. Typically it will go by truck with preselected routes and any necessary escort capabilities to ensure timely arrival at one of the staging areas. Depending on time constraints equipment can be flown commercially to a major airports near the plant site [Stewart Airport (primary) and Westchester County Airport (secondary)] and trucked or airlifted from there to the staging areas. The use of helicopter delivery is typically considered when routes to the plant are impassable and time considerations for delivery will not be met with ground transportation. Multiple pre-selected routes are one method to circumvent the affects of seismic issues, floods, etc. Bridges, rivers, heavily wooded areas, towns, etc. are considered in route selection. The drivers will have the routes marked and be in communication with the RRC to ensure that the equipment arrives on

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		time. **Entergy Response Update to address ISE Confirmatory Item 3.1.1.4.A (08/28/2014):** Two intermediate staging areas have been selected to deliver equipment from off-site sources. The first or "C" Staging Area will be located at Stewart International Airport (in New Windsor, NY). The second or "D" Staging Area will be located at the Danbury Airport (in Danbury, CT.). The implementing procedures will be developed as part of the RRC SAFER Response Plan.
3.1.2.2.A	Confirm that evaluations address: whether procedures have been established for actions to be taken upon receipt of a hurricane warning; ensuring that fuel in oil storage tanks would not be inundated or damaged by flooding; and, whether the means (e.g., trucks) for moving FLEX equipment is reasonably protected from the event.	This item was closed during the December 2015 14 NRC Audit Visit (associated with AQ IPEC-006). **Entergy Response 10/23/2013** The flooding level evaluation for IPEC has not been completed to determine if flooding in the integrated plan is consistent with the existing licensing basis. The design basis for Unit 2 is based on Unit 2 UFSAR Section 2.5 and for Unit 3 the determination was based on Unit 3 UFSAR Section 2.5. Following completion of the new external flooding analysis and integration evaluation, design of storage facilities, specification of FLEX equipment, protection of FLEX equipment, control of FLEX equipment, implementation of FLEX strategies, and protection of safety related plant structures from FLEX equipment will be determined during the design development and procedure development phase. These procedures will address warning times and the persistence of an external flooding hazard. Studies to date characterize flooding times in days (typically associated with hurricanes) and a persistence of less than a day; this will be confirmed when the evaluations are completed. Response to this audit question will be provided in a future update. **Entergy Response Update to address ISE Open Item 3.1.2.A (08/28/2014):**

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		The hazard assessment at IP2 and IP3 considered the potential for flooding from local intense precipitation, flooding from nearby rivers, high tides, hurricane and storm surge, and tsunami events. The Entergy Fleet Fukushima Program Flood Hazard Reevaluation Report for Indian Point Energy Center (IPEC) Unit 2 and 3 described and evaluated flooding scenarios for the site ("51-9195289-000, Flood Hazard Reevaluation Report Required by 10 CFR 50.54(F) Near Term Task Force Recommendation 2.1", ADAMS Accession Nos. ML13364A006, ML13364A007, ML13364A008 and ML13364A009). The maximum water level resulting from combined effects on the Hudson River at IPEC was calculated to be 17.7 ft. elevation. The report also states that mitigation actions are in place that protect all vulnerable areas for external flooding up to an elevation of 17'-11". [Note-Flooding is still being evaluated in accordance with separate NRC requirements (see NRC letter regarding Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10 CFR 50.54(f) Information Request - Flood-causing Mechanism Reevaluation (CAC Nos. MF 3313 and MF 3314), dated April 24, 2016). This increases the flood levels being evaluated.} The flood hazard local intense precipitation (LIP) hydraulic model calculated localized depths inside the protected area ranging from 0.1 to 3.6 feet using a probable maximum precipitation of 15.3 inches over a 6-hour period. Conservatively, the hydraulic model did not include the concrete security barriers. The site topography is found on a terraced bedrock slope and the vehicle barrier system (concrete barrier system) redirects off-site surface water flow around the IPEC site. Specifically, an assessment performed by a debris assessment team concluded that the concrete barrier system will redirect an adequate amount of off-site surface water flow around the IPEC site to prevent localized flooding inside the PA in areas that would adversely impact the haul paths. In addition, haul routes and staging areas inside the PA were assessed using the localized flooding areas identified in the flood hazard reevaluation report and no adverse conditions impacting both the primary and alternate

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		routes were identified since localized depths were short term in staging areas. Specifically, the staging location for the Phase 2 and Phase 3 FLEX generators in the IP2 transformer yard will not be impacted by local intense precipitation because the local flood level recedes to a reasonable level for area access within approximately one hour. Local intense precipitation was also assessed for haul pathways outside the protected area and adequate runoff exists in the haul path route. Therefore, no debris removal, transport delays or equipment staging impacts are anticipated as a result of local intense precipitation. Per NEI 12-01, the time to restore limited plant access is 6 hours from the ELAP. It is assumed that deployment of FLEX equipment will also be possible starting at that time. Portions of the deployment which occur inside protected structures (e.g., running hoses / cables, making connections, lining up installed systems) will start earlier to optimize deployment times. Preparations to prevent flooding will begin per procedures 2-AOP-FLOOD-1, Rev. 10, Flooding and 3-AOP-FLOOD-1, Rev. 9, Flooding, on any indication of impending flood from river levels rising greater than 4.5 feet (for IP2) or greater than 7 feet (for IP3), or on a high tide advisory, at least 48 hours prior to a potential hurricane impact, rainfall greater than or equal to 5 inches per day, a NOAA flood warning, or actual plant flooding from plant systems. Preparations at the site which are made as part of these procedures include sandbagging vulnerable areas. In the event of a hurricane, the plant will be shutdown per severe weather procedures OAP-008, Rev. 18, Severe Weather Preparations, preparations will begin 72 hours prior to the projected arrival of tropical storm force winds. National Weather Service issues a Hurricane Warning for a hurricane with winds in excess of 100 miles per hour (87 knots). Therefore, prior to the arrival of hurricane induced flooding and high winds, the plant is shut down and well prepared to cope with the event. The results of the reevaluation of external flooding have been reviewed against the IPEC FLEX strategy to determine any possible impacts. The review

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		determined that there is no impact on FLEX strategies or equipment as required mitigating actions will be done before a BDBEE would cause an ELAP and the flood mitigation equipment-materials will not rely on power/water supplied by FLEX equipment. There would also be no impact of the FLEX storage locations, staging locations or deployment methods, as described above.
3.2.1.A	Confirm which analysis performed in WCAP-17601-P is being applied to Indian Point. Also confirm the licensee has adequately justified the use of that analysis by identifying and evaluating the important parameters and assumptions demonstrating that they are representative of Indian Point and appropriate for simulating the ELAP transient.	This item was closed following the October 2014 NRC Audit Visit (associated with AQ IPEC-012). **Entergy Response 10/23/2013** Response to this question will be provided later in the design process as additional plant specific analyses are being performed. This information will be submitted in a future update **Entergy Response Update to address ISE Confirmatory Item 3.2.1.A (08/28/2014):** As stated in Entergy Letter NL-14-031, dated February 27, 2014, (Indian Point Energy Center's Second Six-Month Status Report for the Implementation of Order EA-12-049 Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, ADAMS Accession No. ML14070A365) the RCS makeup strategy to provide RCS inventory is required at 16.11 hours (based on WCAP-17601-P, Table 5.2.2-1). Currently Westinghouse is evaluating the results of the latest report issued by the PWROG in relation to the RCP seal flow rates for normal RCS conditions, as well as flow rates for lower pressures and temperatures, to determine the impacts on IPEC Unit 3. The results of this evaluation are not expected to impact the RCS makeup strategy to provide RCS inventory by 16.11 hours. An update will be provided once the results of the evaluation become available.

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		The analysis performed in Section 5.2.1 of WCAP-17601-P (Reactor Coolant System Response to the Extended Loss of AC Power Event for Westinghouse, Combustion Engineering and Babcox & Wilcox NSSS Designs, January 2013) is being used for the ELAP transient at IPEC Unit 3 as basis to provide RCS inventory control. IPEC Unit 3 has used this case in the development of the mitigating strategies. The parameters and assumptions utilized in the WCAP are representative in the values and actions taken in the current IPEC Unit 3 station blackout (SBO) procedures. Section 5.2.1 and 5.2.2 in WCAP 17601-P - initiates an operator controlled symmetric cooldown of the RCS at 75°F/hr at 2 hours following event initiation and RCS cooldown is terminated when SG pressure reaches 300 psia (RCS cold leg temperature of 425°F). This is done to prevent injection of accumulator cover gas into the RCS. IPEC Unit 3 applies the process described above via its procedures. IPEC Unit 3 will commence plant cooldown 30 minutes after an SBO and will stop at RCS pressure of 300 psia. By performing a cooldown and depressurization of the RCS earlier than the one described in Section 5.2.1 of WCAP-17601-P, IPEC strategy reduces RCP leakage, therefore this action provides additional margin with respect to RCS inventory control. **Entergy Response Update to address ISE Confirmatory Item 3.2.1.1.A (10/27/2014):** The analysis performed in Section 5.2.1 of WCAP-17601-P used the NOTRUMP computer code to develop the basis for the time lines in the Overall Integrated Plan for Indian Point Units 2 and 3. The PWROG submitted PWROG-14064-P, "Application of NOTRUMP Code Results for the Westinghouse Designed PWRs in Extended Loss of AC Power Circumstances", to the NRC on September 26, 2014. PWROG-14064-P is the position paper on the use of the NOTRUMP thermal hydraulic computer code for analyzing the Westinghouse and CE NSSS designed reactor system

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		response (RCS) to an extended loss of AC power (ELAP) event and addresses the USNRC questions relative to the applicability of the NOTRUMP code to the RCS analysis of an ELAP during various plant audits regarding flexible and diverse coping mitigating strategies (FLEX) implementation.
3.2.1.1.A	Confirm that the licensee is using NOTRUMP and has taken into account its limitations. Reliance on the NOTRUMP code for the ELAP analysis of Westinghouse plants is limited to the flow conditions prior to reflux condensation initiation. This includes specifying an acceptable definition for reflux condensation cooling.	This item was closed following the October 2014 NRC Audit Visit (associated with AQ IPEC-012). **Entergy Response 10/23/2013** Response to this question will be provided later in the design process as additional plant specific analyses are being performed. This information will be submitted in a future update **Entergy Response Update to address ISE Confirmatory Item 3.2.1.A (08/28/2014):** As stated in Entergy Letter NL-14-031, dated February 27, 2014, (Indian Point Energy Center's Second Six-Month Status Report for the Implementation of Order EA-12-049 Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, ADAMS Accession No. ML14070A365) the RCS makeup strategy to provide RCS inventory is required at 16.11 hours (based on WCAP-17601-P, Table 5.2.2-1). Currently Westinghouse is evaluating the results of the latest report issued by the PWROG in relation to the RCP seal flow rates for normal RCS conditions, as well as flow rates for lower pressures and temperatures, to determine the impacts on IPEC Unit 3. The results of this evaluation are not expected to impact the RCS makeup strategy to provide RCS inventory by 16.11 hours. An update will be provided once the results of the evaluation become available. The analysis performed in Section 5.2.1 of WCAP-17601-P (Reactor Coolant System Response to the Extended Loss of AC Power Event for Westinghouse,

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		Combustion Engineering and Babcox & Wilcox NSSS Designs, January 2013) is being used for the ELAP transient at IPEC Unit 3 as basis to provide RCS inventory control. IPEC Unit 3 has used this case in the development of the mitigating strategies. The parameters and assumptions utilized in the WCAP are representative in the values and actions taken in the current IPEC Unit 3 station blackout (SBO) procedures. Section 5.2.1 and 5.2.2 in WCAP 17601-P - initiates an operator controlled symmetric cooldown of the RCS at 75°F/hr at 2 hours following event initiation and RCS cooldown is terminated when SG pressure reaches 300 psia (RCS cold leg temperature of 425°F). This is done to prevent injection of accumulator cover gas into the RCS. IPEC Unit 3 applies the process described above via its procedures. IPEC Unit 3 will commence plant cooldown 30 minutes after an SBO and will stop at RCS pressure of 300 psia. By performing a cooldown and depressurization of the RCS earlier than the one described in Section 5.2.1 of WCAP-17601-P, IPEC strategy reduces RCP leakage, therefore this action provides additional margin with respect to RCS inventory control. **Entergy Response Update to address ISE Confirmatory Item 3.2.1.1.A (10/27/2014):** The analysis performed in Section 5.2.1 of WCAP-17601-P used the NOTRUMP computer code to develop the basis for the time lines in the Overall Integrated Plan for Indian Point Units 2 and 3. The PWROG submitted PWROG-14064-P, "Application of NOTRUMP Code Results for the Westinghouse Designed PWRs in Extended Loss of AC Power Circumstances", to the NRC on September 26, 2014. PWROG-14064-P is the position paper on the use of the NOTRUMP thermal hydraulic computer code for analyzing the Westinghouse and CE NSSS designed reactor system response (RCS) to an extended loss of AC power (ELAP) event and addresses the USNRC questions relative to the applicability of the NOTRUMP

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		code to the RCS analysis of an ELAP during various plant audits regarding flexible and diverse coping mitigating strategies (FLEX) implementation.
3.2.1.3.A	Confirm that the licensee has satisfactorily addressed the applicability of Assumption 4 on page 4-13 of WCAP-17601 which states that decay heat is per ANS 5.1-1979 + 2 sigma, or equivalent. If the ANS 5.1-1979 + 2 sigma model is used in the Indian Point ELAP analysis, address the adequacy of the use of the decay heat model in terms of the plant-specific values of the following key parameters: (1) initial power level, (2) fuel enrichment, (3) fuel burnup, (4) effective full power operating days per fuel cycle, (5) number of fuel cycles, if hybrid fuels are used in the core, and (6) fuel characteristics (addressing whether they are based on the beginning of the cycle, middle of the cycle, or end of the cycle). If a different decay heat model is used, describe the specific model and address the adequacy of the model and the analytical results.	This item was closed during the December 2015 NRC Audit Visit (associated with AQ IPEC-013). **Entergy Response 10/23/2013** The information requested is not readily available at this time. The requested information will be provided in a future update. **Entergy Response Update to address ISE Confirmatory Item 3.2.1.3.A (08/28/2014):** Refer to Attachment 1 to Westinghouse letter LTR-LIS-14-207, Rev. 0, "Response to an NRC Audit Question in Support of the Indian Point Units 2 and 3 FLEX Integrated Plan Submittal", dated April 17, 2014, uploaded to ePortal.
3.2.1.6.A	Confirm that the licensee has finalized its strategy for controlling the RCS pressure to prevent nitrogen from escaping from the	This item was statused as open during the December 2015 NRC Audit Visit (associated with AQ IPEC 035). See the December 2015 NRC Audit Visit FLEX Related Open Items table (below) Audit Item CI 3.2.1.6.A for additional information.

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	safety injection accumulators into the RCS until the isolation valves can be closed.	**Entergy Response 10/23/2013** The specific strategy has not been finalized. In general, the reactor coolant system pressure will be controlled to prevent nitrogen from escaping into the RCS until the isolation valves can be closed. This information will be provided in a future update. **Entergy Response Update to address ISE Confirmatory Item 3.2.1.6.A for IPEC Unit 3 (08/28/2014):** Initially, the SI accumulators will make-up for most of the reductions in the volume of coolant in the RCS as a result of leakage and contraction due to the cooldown of the plant. The SI accumulators are initially maintained at approximately 600 psig. As the plant is cooled down, RCS pressure decreases and eventually goes below 600 psig. At this point, the SI accumulators will begin injecting to make up for the decrease in water volume. Depressurization of the plant to 300 psia will not cause the SI accumulators to completely inject their inventory into the RCS. This trigger point or an equivalent trigger point will be added to 3-ECA-0.0 and/or appropriate FSG. Prior to the RCS further depressurization below 300 psia, the SI accumulator outlet isolation valves will be closed to prevent nitrogen injection into the RCS. Motor operated valves 894A, 894B, 894C and 894D are powered from MCC-36A (894A and 894C) and MCC-36B (894B and 894D) which will be repowered by the Phase 2 or Phase 3 FLEX Generator. The IPEC Unit 2 strategy to isolate the accumulators has not been completed at this time and will be provided in a future update. **Entergy Response Update to address ISE Confirmatory Item 3.2.1.6.A for IPEC Unit 2 (02/27/2015):** Initially, the SI accumulators will make-up for most of the reductions in the

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		volume of coolant in the RCS as a result of leakage and contraction due to the cooldown of the plant. The SI accumulators are initially maintained at approximately 600 psig. As the plant is cooled down, RCS pressure decreases and eventually goes below 600 psig. At this point, the SI accumulators will begin injecting to make up for the decrease in water volume. Depressurization of the plant to 300 psia will not cause the SI accumulators to completely inject their inventory into the RCS. This trigger point or an equivalent trigger point will be added to 2-ECA-0.0 and/or appropriate FSG. Prior to the RCS further depressurization below 300 psia, the SI accumulator outlet isolation valves will be closed to prevent nitrogen injection into the RCS. Motor operated valves 894A, 894B, 894C and 894D are powered from MCC-26A (894A and 894C) and MCC-26B (894B and 894D) which will be repowered by the Phase 2 or Phase 3 FLEX Generator.
3.2.1.8.A	The PWROG submitted to NRC a position paper, dated August 15, 2013, which provides test data regarding boric acid mixing under single-phase natural circulation conditions and outlined applicability conditions intended to ensure that boric acid addition and mixing would occur under conditions similar to those for which boric acid mixing data is available. During the audit process, the licensee informed the NRC staff of its intent to abide by the generic approach discussed above. The licensee should address the clarifications in the NRC endorsement letter dated January 8, 2014.	This item was statused as open during the December 2015 NRC Audit Visit (associated with AQ IPEC 050). See the December 2015 NRC Audit Visit FLEX Related Open Items table (below) Audit Item CI 3.2.1.8.A for additional information. **Entergy Response 10/23/2013** This question regarding boron mixing was identified as a generic concern or question which the nuclear industry will resolve generically through the Nuclear Energy Institute (NEI) and the applicable industry groups (e.g., PWROG, EPRI, etc.). Once this generic concern is resolved, Entergy will provide additional information in a future update. NEI will be coordinating with the NRC on the schedule for resolution. **Entergy Response Update to address ISE Confirmatory Item 3.2.1.8.A (08/28/2014):** The RCS cooldown for IPEC Unit 3 is bounded by the analysis described in Section 5.2.1 and Section 5.2.2 of WCAP-17601-P. The analysis described in

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		these sections assumed the highest applicable leakage rate for the reactor coolant pump seals (21 gpm/pump from 13 minutes after an ELAP until RCS depressurization commences) and unidentified reactor coolant system leakage (1 gpm) to determine when two-phase cooling would commence. The methodology of this analysis is consistent with clarification 1 of the NRC endorsement letter dated January 8, 2014 (Boron Mixing Endorsement Letter in Regards to Mitigation Strategies Order EA-12-049, ADAMS Accession No. ML13276A183). Based on this analysis, injection for RCS inventory control is required by 16.11 hours in order to maintain single-phase natural circulation. The current strategy at IPEC Unit 3 will initiate RCS makeup prior to this time to prevent two-phase natural circulation from occurring. This strategy satisfies clarification 2a of the NRC endorsement letter dated January 8, 2014. The IP3 reactivity calculation determined the RCS makeup volume required following accumulator isolation necessary to maintain shutdown margin. The calculation assumes no reactor coolant system leakage. The IP3 reactivity calculation determined that additional boron must be injected within 22.6 hours to ensure that adequate shutdown margin is maintained. This analysis was performed assuming no reactor coolant system leakage so that the maximum time required to have letdown through the reactor vessel head vents (to ensure adequate volume exists in the RCS to accommodate the less borated inventory of the RWST) would be calculated. This approach is consistent with clarification 1 of the NRC endorsement letter dated January 8, 2014. IPEC Unit 3 FLEX strategy will be modified to ensure that credit for increases in the reactor coolant system boron concentration will be delayed for a minimum of one hour to account for the mixing of the borated primary makeup following the addition of the targeted quantity of boric acid to the reactor coolant system consistent with clarification 3 of the NRC endorsement letter dated January 8, 2014. Clarification 2b does not apply to IPEC Unit 3 because the current strategy prevents two-phase natural circulation from occurring because of accumulator

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		injection and commencing RCS injection using the Phase 2 FLEX pump prior to the time when RCS leakage could cause significant void formation in the SG tubes. Currently Westinghouse is evaluating the results of report PWROG-14015-P, No. 1 Seal Flow Rate for Westinghouse Reactor Coolant Pumps Following Loss of All AC Power, June 2014, in relation to the RCP seal flow rates for normal RCS conditions, as well as flow rates for lower pressures and temperatures. The evaluation will determine the impacts on IPEC Unit 3 of the latest RCP seal flow models and calculations. The results of this evaluation are expected to impact the RCS makeup strategy and will decrease the margin IPEC Unit 3 has to provide RCS inventory to an as yet undetermined time before 16.11 hours to maintain single phase natural circulation. An update will be provided once the results of the evaluation become available. The IPEC Unit 2 analysis has not been completed at this time and will be provided in a future update. **Entergy Response Update (02/27/2015):** Indian Point Unit 2 and 3 RCS makeup strategy will be revised to provide RCS makeup prior to 11.3 hours and 11.9 hours for IP2 and IP3, respectively, to prevent reflux cooling. This strategy is supported by PWROG-14027-P, Revision 1, Table 6-1, Category 1, Time to Enter Reflux Cooling. The RCS makeup strategy revision will include a new time-dependent seal leakage profile based on PWROG-14027-P, Revision 1 results. IPEC will continue to follow PWROG FLEX efforts that may impact this response. **Entergy Response Update (08/28/2015):** Indian Point Unit 2 and 3 RCS makeup strategy has been revised to provide RCS makeup prior to 11.3 hours and 11.9 hours for IP2 and IP3, respectively, to prevent reflux cooling.
3.2.1.9.A	Confirm that the licensee has	This item was closed during the December 2015 NRC Audit Visit (associated

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	specified the required time for the operator to realign each of the above discussed pumps and confirm that the required times are consistent with the results of the ELAP analysis. Confirm that the licensee discussed the analyses that are used to determine the required flow rate and corresponding total developed head for each of the portable pumps and also to justify that that the required capacities of each of the above-discussed portable pumps are adequate to maintain core cooling and sub-criticality during phases 2 and 3 of ELAP. Confirm that the licensee has included a discussion and justification of computer codes/methods and assumptions used in the analyses above.	with AQ IPEC 017). **Entergy Response 10/23/2013** IPEC is using a site specific analysis to justify the required actions, pump design parameters and criticality requirements. The requested information will be provided in a future update. **Entergy Response Update (02/27/2015):** In regards to the RCS Inventory Response above, the Indian Point Unit 2 and 3 RCS makeup strategy will be revised to provide RCS makeup prior to 11.3 hours for IP2 and 11.9 hours for IP3 to prevent reflux cooling. This strategy is supported by the methodology developed on PWROG-14027-P, Revision 1, Table 6-1, Category 1, Time to Enter Reflux Cooling. The RCS makeup strategy revision will include a new time-dependent seal leakage profile based on PWROG-14027-P, Revision 1 results (see also updated response SE #13). IPEC will continue to follow PWROG FLEX efforts that may impact this response. **Entergy Response Update for IPEC Unit 2 to address ISE Confirmatory Item 3.2.1.9.A:** Preliminary Engineering Report IP-RPT-14-00006 contains the IP2 strategy timelines for each type of event and mode (example: Modes 1-4, Freezing Rain or Extreme Cold). These timelines specify the required time needed for operators to realign the applicable pumps. This timing will be validated during the procedure development phase. This report is available on the e-portal. <u>Core Cooling -</u> Draft calculation IP-CALC-14-00046, Rev. 0, develops the hydraulic model for IP2 FLEX strategies that pertain to using the Condensate Storage Tank as the water source for various scenarios for Phase 2. The model determines the minimum requirements of the FLEX pumps for the required strategies and

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		evaluates the proposed design and size requirements of the CST "manifold" that will be installed to provide the necessary flow requirements from the IP2 CST in order to maintain adequate core cooling during Phase 2. This calculation concludes that the minimum performance requirements of the Phase 2 Steam Generator Makeup Pump are to deliver 327 gpm at 1033 ft. total developed head (TDH) for the primary connection and 1,089 ft. TDH for the secondary connection to the Steam Generators when the plant is running in Modes 1-4. When the Steam Generators are not available for Modes 5 and 6 they do not need to be considered. This calculation includes a discussion and justification of the computer code used (PROTOFLO), as well as the methods and assumptions used to perform the hydraulic analysis. This calculation also determines the minimum performance requirements of the Phase 2 SFP Makeup Pump for the primary and secondary pipe connections and spray over the surface of the pool. The bounding flow requirements of this pump are for the SFP spray which requires the pump to be able to deliver 250 gpm at 212 ft. TDH. Draft calculation IP-CALC-14-00046, Rev. 0 includes a discussion and justification of the computer code used (PROTOFLO), as well as the methods and assumptions used to perform the hydraulic analysis. This calculation is available on the e-Portal. For Phase 3, indefinite core cooling would be provided by recovering the RHR and Component Cooling Water (CCW) systems. The Phase 3 strategy requires an offsite pump capable of removing heat from the reactor core in addition to other loads. The National SAFER Response Center (NSRC) can provide a low pressure / high flow dewatering pump that can be used for this purpose. The pump has a specified flow of 5000 gpm at 150 psi and will be able to support inlet water temperatures of up to 140°F with a 12' suction lift (Reference 1). Ideal flow paths for decay heat removal are to utilize piping in the RHR system and CCW system. The RHR system requires repowering the RHR pump via an offsite supplied generator to establish recirculation in the

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		RCS. Heat removal is through the RHR heat exchangers which are cooled by establishing flow through the CCW system. The CCW pumps would also be powered by the Phase 2 FLEX generator. The CCW heat exchangers transfer the heat from this and other loads to canal/river water which is supplied by a pump provided by the NSRC. The CCW system can provide cooling to not only the RHR heat exchangers but the SFP heat exchangers, and the RHR pump seal coolers as well. <u>RCS inventory and reactivity control</u>- For RCS inventory control, injection is required prior to 11.3 hours after the initiation of the BDBEE event to prevent entry to reflux cooling. The methods for injecting borated water into the RCS for RCS inventory control in Phase 1 (by the injection of the accumulators) and Phase 2 (by the use of the FLEX RCS injection pump from the RWST) will also provide sufficient negative reactivity to ensure that shutdown margin is maintained following cooldown and xenon decay. IP-CALC-14-00047, Rev. 0, determines the minimum performance requirements of the RCS makeup pump that rely on the RWST as a borated source of water in order to maintain RCS inventory control and ensure subcriticality during Phase 2. For RCS inventory control in Modes 1-4, the minimum performance requirements are 40 gpm at 724 ft. TDH and 40 gpm at 749 ft. TDH for the primary and secondary connections, respectively. For core cooling and heat removal during modes 5 and 6, the minimum pump performance requirements are 118.1 gpm at 504 ft. TDH and 118.1 gpm at 255 ft. TDH for the primary and secondary connections respectively. Finally for spent fuel pool make-up and spray during Modes 1-4, the minimum performance requirements are 114 gpm at 18 ft. TDH and 250 gpm at 207 ft. TDH for the primary/secondary and spray connections, respectively. This calculation also includes a discussion and justification of the computer code used (PROTO-FLO), as well as the methods and assumptions used to perform the hydraulic analysis. This calculation is available on the e-Portal.

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		Should the Unit 2 RWST be damaged by a tornado missile caused by a BDBEE, an alternate connection for supplying borated water for RCS inventory and reactivity control to Unit 2 from the Unit 3 RWST will be established. The Unit 3 RWST would remain available following a BDBEE which damages the Unit 2 RWST (See response to Audit Question 41). For RCS injection in Phase 3, boron mixing equipment will be available so inventory from a water source other than the RWST will be utilized. The NSRC can provide a 500 gpm water treatment plant which will be available to IP2 (Reference 1). The water will be processed by offsite water treatment plant provided by the NSRC prior to boric acid batching to makeup to the RWST and subsequent injection into the RCS. <u>References:</u> 1. AREVA Engineering Information Record 51-9199717-012, Rev. 012, National SAFER Response Center Equipment Technical Requirements. 2. Draft Engineering Report IP-RPT-14-00006, IP2 FLEX Strategy Development, October 2014. 3. Calculation IP-CAL-14-00046, Rev. 0, Hydraulic Model for Condensate Storage Tank (CST) for FLEX Strategies, August 2014. 4. IP-CALC-14-00047, Rev. 0, Hydraulic Analysis of FLEX Strategies Using the RWST as Source of Water, August 2014. **Entergy Response Update for IPEC Unit 2 (08/28/2015):** Engineering Report IP-RPT-14-00006 contains the IPEC Unit 2 strategy timelines for each type of event and mode (example: Modes 1-4, Freezing Rain or Extreme Cold). The report is final and it is available on the ePortal. Calculations IP-CALC-14-00046 and IP-CALC-14-00047 have been finalized and the final results of these calculations did not change the values provided on the response dated 02/27/2015 for IPEC Unit 2.

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
3.2.1.9.B	Confirm that the licensee has provided an evaluation that demonstrates flow through a 2-inch connection will be sufficient to provide adequate flow to maintain the SG level using the alternate SG FLEX pump.	This item was closed during the December 2015 NRC Audit Visit (associated with AQ IPEC-036). **Entergy Response 10/23/2013** The design of the alternate SG FLEX pump connection is in progress, therefore, the evaluation of flow through the connection has not been completed. This information will be provided in a future update. **Entergy Response Update to address ISE Confirmatory Items 3.1.1.2.A and 3.2.1.9.B for IPEC Unit 3 (08/28/2014):** The primary connection point for the FLEX AFW pump is contained in the Auxiliary Feed Water Building which is a structure with designs that are robust with respect to seismic events, floods, and high winds, and associated missiles satisfying NEI-12-06. Therefore this connection is confirmed to comply with Consideration 2 of NEI-12-06, Section 5.3.2. Calculation IP-CAL-13-00040, Rev. 1, Hydraulic Model for Condensate Storage Tank (CST) for FLEX Strategies, December 2013, develops the hydraulic model for FLEX strategies that pertain to using the Condensate Storage Tank as the water source for various scenarios for Phase 2. The model determines the minimum requirements of the FLEX pumps for the required strategies and evaluates the proposed design and size requirements of the CST "manifold" that will be installed to provide the necessary flow requirements from the CST. This analysis demonstrates that the specified pump is capable of providing a combined 327 gpm through the alternate 2" connection to the steam generators. This 2" line accounts for approximately 141 psi pressure drop which was accounted for in the analysis. This hydraulic analysis was performed using the PROTOFLO computer program and accounts for the physical configuration of the FLEX strategy.

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		The design of the IPEC Unit 2 SG FLEX pump connection is in progress, therefore, the evaluation of flow through the connection has not been completed at this time. An update will be provided in a future update. **Entergy Response Update to address ISE Confirmatory Items 3.1.1.2.A and 3.2.1.9.B for IPEC Unit 2 (02/27/2015):** The primary connection point for the FLEX SG pump is contained in the Auxiliary Feed Water Building which is a structure with designs that are robust with respect to seismic events, floods, and high winds, and associated missiles per UFSAR Section 1.11, satisfying NEI-12-06. Therefore this connection is confirmed to comply with Consideration 2 of NEI-12-06, Section 5.3.2. Calculation IP-CAL-14-00046, Rev. 0, Hydraulic Model for Condensate Storage Tank (CST) for FLEX Strategies, August 2014, develops the hydraulic model for FLEX strategies that pertain to using the Condensate Storage Tank as the water source for various scenarios for Phase 2. The model determines the minimum requirements of the FLEX pumps for the required strategies and evaluates the proposed design and size requirements of the CST "manifold" that will be installed to provide the necessary flow requirements from the CST. This analysis demonstrates that the specified pump is capable of providing a combined 327 gpm through the alternate 2" connection to the steam generators. This hydraulic analysis was performed using the PROTOFLO computer program and accounts for the physical configuration of the FLEX strategy. Calculation IP-CAL-14-00046, Rev. 0, Hydraulic Model for Condensate Storage Tank (CST) for FLEX Strategies, August 2014, is available on the ePortal.
3.2.2.A	Confirm that the licensee has satisfactorily explained the strategy to provide a secondary connection for SFP makeup if the building is	This item was closed during the December 2015 NRC Audit Visit (associated with AQ IPEC-034).

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
	inaccessible, and explain where these valves are and if access to these valves will be available during an ELAP event.	**Entergy Response 10/23/2013** The design of the Spent Fuel Pool secondary connection is under development. The secondary connection point will be designed such that any operator actions required to implement SFP makeup can be achieved. **Entergy Response Update to address ISE Confirmatory Item 3.2.2.A for IPEC Unit 2 (02/27/2015):** Makeup to the SFP without accessing the refueling floor is accomplished by using the existing SFP cooling piping which discharges into the pool. Portable hoses from the FLEX storage facility are connected from the FLEX SFP Pump to the hose connections to provide the required makeup without accessing the refueling floor. Suction to the SFP FLEX pumps is from the available sources of water. The primary connection in the SFP piping involves installation of the new 5" Storz to the Spent Fuel Pit Cooling (SFPC) System. The connection is on the existing safety related, Seismic Class I, line #327 just upstream of Spent Fuel Pit Heat Exchanger #21 at a 4" blind flange connection downstream of butterfly valve SFPC-1 labeled Emergency Cooling Connection (ECC). This modification replaces the existing blind flange and butterfly valve with a gate valve followed by a 90 degree elbow. The 90 degree elbow will then lead to a flanged connection, which is followed by a removable section of pipe, containing the vent (FLEX-004) and ending with a 5" Storz connection. The 5" Storz connection will have a cap on it for good FME practice. In addition, the normally closed gate valve, SFPC-1, performs a passive design function (i.e. maintain IP2 Spent Fuel Pool Cooling system pressure boundary). A normally closed, non-safety related ¾" manual globe vent valve with a treaded cap (FLEX-004) will also be added. The secondary connection involves the installation of a 5" Storz connection on the 95' of the Fuel Storage Building on the east side of the Spent Fuel Pool. A

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		new standalone, 4" pipe with a 45 degree elbow on each end is mounted to a support using a heavy duty turntable. A 4"x5" Storz fitting is threaded on the end of the 45 degree elbow on the inlet side of this new piping. This turntable design will allow for this new makeup system to have the capability to rotate 90 degrees to keep the pipe and Storz connection out of the way of the Spent Fuel Pool Crane during normal plant operation. This system will provide for a stable, quick connection option for Spent Fuel Pool makeup during a BDBEE. The heavy duty turntable comes with a lock pin to keep the pipe in place during operation, to secure the pipe in either position, and to prevent loose parts by the pool.
3.2.3.A	Confirm that a containment evaluation has been completed and, based on the results of this evaluation; required actions to ensure maintenance of containment integrity and required instrument function will be developed.	This item was statused as open during the December 2015 NRC Audit Visit. See the December 2015 NRC Audit Visit FLEX Related Open Items table (below) Audit Item CI 3.2.3.A for additional information. **Entergy Response Update to address ISE Confirmatory Item 3.2.3.A for IPEC Unit 2 (02/27/2015):** For a loss of AC while the Unit is in operating Modes 1 through 4, the containment is assumed to be isolated in accordance with 2-ECA-0.0, Rev. 8, Loss of all AC Power, (specifically Attachment 1 for Phase A and Phase B isolation valves). The event would result in the isolation of all applicable systems with valves that fail closed on a loss of electrical power or instrument air. In mode 1, following the event, with the reactor scrammed and containment isolated, the containment pressure and temperature would begin to slowly increase due to reactor coolant leakage and direct heat transfer from the RCS. Heat loss from the containment would be negligible without containment venting or the operation of containment sprays or cooling system. Thus, containment would eventually need to be either cooled directly using coolers or vented to reduce pressure. The rate of pressure increase will dictate the timing of these actions to reduce containment pressure.

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		The Modular Accident Analysis Program (MAAP) has been used to analyze the containment response to a BDBEE. The results of the MAAP analysis for IPEC Unit 2 indicate that the containment design pressure and design temperature, which values are 47 psig and 271°F respectively, will not be exceeded during Phase 1 or 2 of a FLEX event when the plant was initially in Modes 1-4. As such, there are no coping strategies required for maintaining containment integrity during Phase 1 or 2. The only action necessary is to monitor containment pressure to ensure that RCS leakage is minimal. When the RCS is in Modes 5 or 6, the MAAP analysis indicates that a BDBEE event may challenge containment pressure unless a vent path is established. The vent path has been determined to require an equivalent flow to that of a 4" hole in containment and to be opened within 10 hours of the event to guarantee that containment will not pressurize sufficiently to challenge containment pressure or temperature design limits under the assumed worst case boil-off conditions. 10 hours is adequate time to ensure that a vent path is established. The vent path will be established by using either the penetration U-U which is used during outages as an additional air supply, or by deflating the sealing ring of the equipment hatch (if installed), or by using other vent path identified and evaluated for the outage. Procedures to establish an emergency containment vent path for FLEX when in an outage will be implemented. IPEC 2 calculation IP-CALC-14-00042, Rev. 0, IP2 MAAP 4.0.5 Containment Analysis for an Extended Loss of all AC Power Event (ELAP), January 2015, is available on the e-Portal. Long term coping strategy required for maintaining containment integrity involves either venting containment or using Containment Recirculation Fans (CRFs) for indefinite containment cooling. Restoring containment cooling requires repowering a CRF and providing cooling water through its Service Water (SW) connections. Restoring CRFs requires power and a source of cooling water. Power can be restored to bus 2A, 3A or 6A. The source of cooling water would come from

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		the flow of service water via the NSRC low pressure / high flow dewatering pump. Heat removed via the CRF Unit and the eventual use of the RHR system as it cools down the RCS as part of the long term core cooling function will cause containment pressure to decrease. This strategy would allow containment integrity to be maintained indefinitely. **Entergy Response Update for IPEC Unit 2 (08/28/2015):** IPEC Unit 2 calculation IP-CALC-14-00042, Rev. 0, IP2 MAAP 4.0.5 Containment Analysis for an Extended Loss of all AC Power Event (ELAP), February 2015, is final and it is available on the e-Portal.
3.2.4.2.A	Confirm that the assessment of the predicted maximum temperatures in rooms with equipment that is required for FLEX strategies during the ELAP demonstrates that the equipment will continue to function as needed.	This item was closed during the December 2015 NRC Audit Visit (associated with AQ IPEC-020). **Entergy Response 10/23/2013** The IPEC FLEX OIP references procedure ECA-0.0 Loss of All AC Power for actions to mitigate control room and TDAFP room heatup. Assessment of the habitability/accessibility requirements at locations where operators will be required to perform local manual operations for FLEX strategies have not been completed at this time. Response to this question will be provided in a future update. **Entergy Response Update to address ISE Confirmatory Items 3.2.4.2.A and 3.2.4.6.A for IPEC Unit 2 (02/27/2015):** Calculation IP-CALC-14-00038 evaluates the IPEC Unit 2 Central Control Room temperature during the first 72 hours following a loss of AC power. It was determined that the control room temperature will remain below the temperature limit of 120 °F per guidance from NUMARC 87-00 over the 72 hour coping period during the FLEX event. The only required action is to open the doors within 30 minutes of the event. Calculation IP-CALC-14-00038, Rev. 0, Main Control Room Heat-up for FLEX Event (IP2), July 2014, is available on

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		the ePortal. See Response to Audit Question 45 for accessibility evaluation of the TDAFW pump room. The SFP is vented by opening the door to the maintenance outage building and maintenance outage building exit to the plant grounds. Onsite personnel actions include propping open doors to the spent fuel pool room and running hoses and spray monitors for portable makeup from the SFP FLEX pump staging area. Propping open these doors provides a ventilation pathway by venting steam created by pool boil off in addition to a pathway for laying hoses. Charging pump room accessibility is not applicable for IPEC. The charging pumps are not credited for IP2 BDBEE strategies. Additionally, to address the information requested by the NRC Audit Visit Report (ML14335A642) related to ISE Confirmatory Item 3.2.4.2.A, the following update to the response is provided for IPEC Unit 3: Control Room: Section 3.2.1.8 of NEI 12-06 states that the effects of loss of HVAC in an ELAP event can be addressed consistent with NUMARC 87-00 or by plant specific calculation utilizing software such as GOTHIC. Calculation IP3-CALC-13-00065 utilized the methodology for temperature limits as defined in NUMARC 87-00 and modeled the control room using GOTHIC. Section 2.7.1(a) of NUMARC 87-00 indicates the control room is considered a Condition 1 area. Per NUMARC 87-00, a Condition 1 area is considered of low concern with respect to elevated temperature effects as long as a steady state temperature of 120° F is not exceeded. As documented in calculation IP3-CALC-13-00065 the temperature of the control room did not exceed 120° F for the length of the analysis. Although specific equipment temperature ranges are not referenced in this calculation, the equipment in the control room is considered acceptable via the referenced sections of NUMARC 87-00. TDAFW Pump Room: Temperature switches are provided in the Auxiliary

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		Feedwater Pump Room to close steam supply isolation valves PCV-1310A and PCV-1310B to prevent adverse environmental conditions resulting from a high energy line break. The current normal process limit for the Auxiliary Feedwater Pump Room switches (TC-1112A and 1113A) to isolate the steam supply to the TDABFP is 150° F. The actual setting of the switches is 143° F to ensure that they actuate no higher than 150° F. Calculation IP-CALC-13-00064 justifies that the room heat-up, with the roll-up door opened at 30 minutes, stays below the setpoint level of 143° F for up to 168 hours after the BDBEE and therefore prevents adverse environmental conditions from occurring. For that reason the equipment in the Auxiliary Feedwater Pump Room is considered acceptable. **Entergy Response Update for IPEC Unit 2 (08/28/2015):** IPEC Unit 2 calculation IP-CALC-14-00038, Rev. 0, Main Control Room Het-up for FLEX Event, August 2014, is final and it is available on the e-Portal. **Entergy Response Update (02/27/2015):** For Indian Point Unit 2, results of calculation IP-CALC-14-00039 are available. This calculation determines the maximum temperature rise in the Unit 2 Auxiliary Feedwater Pump Room. It uses the results of the Station Blackout calculation (IP-CALC-07-00143) to linearly extrapolate the maximum temperature of the Auxiliary Feedwater Pump Room with an ambient temperature of 115°F. The Station Blackout calculation uses a GOTHIC model to determine the temperature rise in the Auxiliary Feedwater Pump Room for an ambient temperature of 93°F. For ELAP conditions (assumed 115°F ambient), the maximum temperature during the initial 8 hours is 133°F with the roll-up door closed and 125°F with the roll-up door open. The room temperature after seven days (with the roll up door open) is extrapolated to be 123°F. These room temperatures are acceptable for the Turbine Driven Auxiliary Feed Pump to operate and do not exceed the 143°F steam supply isolation temperature setpoint. Calculation IP-CALC-14-00039, Rev. 0, FLEX

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		Event Evaluation of Turbine Driven Auxiliary Feed Pump Room Heat-up, July 2014, is available on the ePortal.
3.2.4.2.B	Confirm that hydrogen concentration in the battery rooms during battery recharging would be maintained at an acceptable level.	This item was closed during the December 2015 NRC Audit Visit (associated with AQ IPEC-047). **Entergy Response Update (02/27/2015):** As stated on the response provided on 08/28/2014 for IPEC Unit 3, the battery rooms are located inside the control building and would not be exposed to extreme high and/or low temperatures. Therefore, at the onset of the event, the battery rooms would be at their normal operating temperature and the temperature of the electrolyte in the cells would build up due to the heat generated by the batteries discharging and during re-charging. The duty cycle calculation IP3-CALC-13-00056 assumes a minimum ambient temperature of 60°F. This is the temperature of the battery room based on the existing HVAC system design basis. During the worst assumed low temperature environmental conditions, the FLEX strategy starts with a temperature of -15°F and equipment de-energized, therefore the heat contribution from the equipment will dwindle over time as the equipment cools down. Based on engineering judgment, considering the thickness of the walls shared with outside environment, the change in temperature inside the battery rooms would be negligible during Phase 1 (approximately 8 hours). Therefore, it is reasonable to assume that the battery room will remain near its pre-event temperature during the first phase of the ELAP event until the FLEX generators are deployed and have energized the battery chargers. Once the battery charger is re- energized and is charging the battery, the charger is carrying the DC loads during Phase 2 and 3, which will provide some heating to the battery room. During the worst assumed high temperature environmental conditions, the

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		battery exhaust fans can be powered from the DC batteries which will maintain ventilation through Phase 1. Calculation IP3-CALC-13-00056, Rev. 0, Battery Sizing and Voltage Drop Calculation for Extended Loss of Power (ELAP), is available on the ePortal. For IPEC Unit 2, the battery room ventilation will be established by using electrical ventilation portable fans powered from a diesel powered lighting tower within 4 hours of beginning battery charging. The battery rooms would be at their normal operating temperature at the onset of the event and the temperature of the electrolyte in the cells would build up due to the heat generated by the batteries discharging and during re-charging. The battery rooms are located inside the control building and would not be exposed to extreme high and/or low temperatures. Therefore, it is reasonable to assume that the rooms will remain near their pre-event temperature during the relatively short period of time until the FLEX generators are deployed and have energized the battery chargers. Once the battery charger is re- energized and is charging the battery, the charger is carrying the DC loads during Phase 2 and 3. **Entergy Response Update to address ISE Confirmatory Item 3.2.4.2.B for IPEC Unit 2 (02/27/2015):** For IPEC Unit 2, calculation IP-CALC-14-00035 evaluated the hydrogen generation in battery rooms 21, 22, 23, and 24 during a Diverse and Flexible Coping Strategies (FLEX) event (extended loss of alternate current (AC) power (ELAP)). Specifically, this calculation establishes the amount of hydrogen generated within the battery rooms while the batteries are operating in discharge mode. The second part of this calculation is used to determine the amount of time available to reestablish room ventilation after battery charging is restored with the portable FLEX generators. This calculation concluded that no hydrogen is produced from the fully charged batteries while in the discharge mode of operation. Therefore, there is no

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		concern for Hydrogen buildup in the Battery rooms during Phase 1 of a FLEX event prior to start of the portable FLEX generators, which restore power to the chargers. Hydrogen generation is expected to begin once the batteries begin charging. Based on the results of the calculation, battery room ventilation for hydrogen removal will be re-established within four (4) hours of beginning battery charging operations to maintain Hydrogen below 1%. The ventilation is performed using the ventilation system procedure that states if an exhaust fan is out of service, then ventilate the affected battery room continuously with at least a 500 cfm fan or blower positioned to blow air into each affected battery room. The electrical ventilation portable fans are powered from a diesel powered lighting tower. Calculation IP-CALC-14-00035, Rev. 0, Battery Room 21, 22, 23 and 24 Hydrogen Generation for FLEX Event, May 2014, is available on the ePortal. **Entergy Response Update for IPEC Unit 2 (08/28/2015):** IPEC Unit 2 calculation IP-CALC-14-00035, Rev. 0, Battery Room 21, 22, 23 and 24 Hydrogen Generation for FLEX Event, June 2014, is final and it is available on the e-Portal.
3.2.4.3.A	Confirm that the need for heat tracing has been evaluated for the BAST and all other equipment necessary to ensure that all FLEX strategies can be implemented successfully.	**Entergy Response 10/23/2013** The need for heat tracing will be addressed in the design development and procedure development phase. Response to this audit question will be provided in a future update. **Entergy Response Update to address ISE Confirmatory Item 3.2.4.3.A for IPEC Unit 2 (02/27/2015):** The Boric Acid Storage Tank is no longer being credited in the IPEC Unit 2 FLEX strategy. Calculation IP-CALC-14-00043 identifies the credited storage tanks susceptible to freezing as the Condensate Storage Tank (CST), Fire Water Storage Tank (FWST), Primary Water Storage Tank (PWST), and

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		Refueling Water Storage Tank (RWST). Each of these tanks were evaluated using bounding temperature and wind speed conditions to determine the time at which each tank reached the freezing temperature. Additionally, the minimum flow rate required through the piping to prevent freezing and the time for stagnant water in the pipe to freeze as a function of pipe diameter, pipe material, initial water temperature, and ambient temperature are calculated. Over the 72 hours coping period, it was determined that the CST, FWST and RWST are the tanks susceptible to freezing. Although the results of the calculation determine that the CST, FWST and RWST begin icing before 72 hours, adequate time does exist to connect the water sources to Phase 2 FLEX pumps before freezing occurs. For the hoses, which have a significantly shorter time to freeze, an analysis was performed for the different hose sizes, lengths, and materials, and were analyzed for both the 6°F ambient and the -15°F lowest recorded temperatures. The bounding hose criteria came from the RCS makeup connection. This FLEX strategy requires 40 gpm makeup to the RCS. This calculation also determined the length required to prevent reaching the freezing temperature at 40 gpm for the RCS hose. This length is 350 feet. Therefore the RCS hose length exposed to ambient conditions must be 350 feet or less. All other hoses were found to be adequate given the flow rates provided for the other pumps. Even if the water temperatures reached 32°F in the hose, they would not be expected to freeze under flowing conditions due to the added kinetic energy of the flowing water and energy added from the pump. Calculation IP-CALC-14-00043 also determined the time to reach the freezing temperature of 32°F in hoses with stagnant water. These times are in the order of minutes under extreme cold temperatures, thus hoses need to be drained immediately once flow is stopped to prevent freezing. Calculation IP-CALC-14-00043, Rev. 0, Freezing of Unit 2 Coolant Sources for FLEX Event, July 2014, is available on the ePortal.

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		Additionally, to address the information requested by the NRC Audit Visit Report (ML14335A642) related to ISE Confirmatory Item 3.2.4.3.A, the following update to the response is provided for IPEC Units 2 and 3: During the extreme cold situation in a postulated FLEX event, the NRC had voiced concerns in the FLEX Audit that the FLEX connections at the various tanks proposed as sources for make-up may not be available (i.e., allow flow) due to internal ice formation. The problem is that the FLEX scenario involves an Extended Loss of AC Power (ELAP) which deactivates the heat trace (freeze protection) installed at the applicable tank connections. This heat trace is assumed not to be re-activated until power is restored to it from the FLEX diesel generator a maximum of eight (8) hours into the event. The piping extension from the tank and the first manual (CLOSED) isolation valve in the line will likely be filled with water, which can freeze without adequate insulation and/or heating. ENERCON has prepared calculations IP-CALC-13-00058 Rev 1 and IP-CALC-14-00043 Rev 0 to evaluate the potential for the tank contents themselves to freeze during the BDBEE. The conclusions of these calculations were that all sources of water will be available for a significant and sufficient period of time. ENERCON has also prepared calculations IP-CALC-14-00089 Rev 0 and IP-CALC-15-00007 Rev 0 to evaluate the potential for ice formation in the FLEX connection piping from the tank to the isolation valve upon loss of heat tracing. These calculations found that in some cases at both IP2 and IP3, some ice would form on the inner wall of the piping during the 8 hour period wherein no heat trace was operating. However, in all cases it was concluded that the particular tank connection was available for its intended function. The isolation valve at the connection will be initially closed. Some minor amount of water could be in the valve body or bonnet in such fashion that with internal icing, opening the said valve could be problematic. For IP2 and IP3, the heat trace will be active for approximately 2 hours or 4 hours (for the RWST and CST respectively) prior to the pumps beings connected for strategy

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		compliance. During this time, it is anticipated that the active heat trace will thaw ice formed in the valve body or bonnet and allow valve operation with no additional components. Use of the PWST and FWST FLEX connections is not credited until later in the event where the heat trace will be on for longer periods of time (at least 22 or 28 hours or later for Units 2 and 3, respectively). For that reason these tanks are also acceptable for use. **Entergy Response Update to address ISE Confirmatory Item 3.2.4.3.A for IPEC Unit 2 (08/28/2015):** For IPEC Unit 2, heat tracing for the FWST is not credited (non-safety related equipment) and therefore the Inventory Transfer Pump is connected to the FWST and water transfer initiated prior to 48 hours. A review was performed using an outdoor temperature of 6°F. This is consistent with the 99% ASHRAE Fundamentals Handbook which was used as a temperature basis in Calculation IP-CALC-14-00043. The methodology of Calculation IP-CALC-14-00089 was modified to perform a test case for an extended 6°F cold scenario for 48 hours. This is considered very conservative since it is expected that the temperature will rise for a period of time during the day. After 48 hours, all tanks are connected to a pump and flow is established. By establishing flow, the pipes will then stop freezing any further as document in Calculation IP-CALC-14-00043. The test scenario concluded that the FWST pipe will not freeze prior to a pump hookup. Therefore the heat trace is not required for a seismic event. Calculations IP-CALC-14-00043, Rev. 0, Freezing of Unit 2 Coolant Sources for FLEX Event and IP-CALC-14-00089, Rev. 0, Freezing Evaluation of Pipes for BDBE, are available on the ePortal.
3.2.4.6.A	Confirm that habitability limits will be maintained and/or operator protective measures will be employed in all Phases of an ELAP to ensure operators will be capable	This item was closed during the December 2015 NRC Audit Visit (associated with AQ IPEC-020 and 3.2.4.2A). **Entergy Response 10/23/2013** The IPEC FLEX OIP references procedure ECA-0.0 Loss of All AC Power for

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
	of FLEX strategy execution under adverse temperature conditions. Examples of areas of concern are the control room, TDABFW pump room, SFP area, and charging pump room.	actions to mitigate control room and TDAFP room heatup. Assessment of the habitability/accessibility requirements at locations where operators will be required to perform local manual operations for FLEX strategies have not been completed at this time. Response to this question will be provided in a future update. **Entergy Response Update to address ISE Confirmatory Items 3.2.4.2.A and 3.2.4.6.A for IPEC Unit 2 (02/27/2015):** Calculation IP-CALC-14-00038 evaluates the IPEC Unit 2 Central Control Room temperature during the first 72 hours following a loss of AC power. It was determined that the control room temperature will remain below the temperature limit of 120 °F per guidance from NUMARC 87-00 over the 72 hour coping period during the FLEX event. The only required action is to open the doors within 30 minutes of the event. Calculation IP-CALC-14-00038, Rev. 0, Main Control Room Heat-up for FLEX Event (IP2), July 2014, is available on the ePortal. See Response to Audit Question 45 for accessibility evaluation of the TDAFW pump room. The SFP is vented by opening the door to the maintenance outage building and maintenance outage building exit to the plant grounds. Onsite personnel actions include propping open doors to the spent fuel pool room and running hoses and spray monitors for portable makeup from the SFP FLEX pump staging area. Propping open these doors provides a ventilation pathway by venting steam created by pool boil off in addition to a pathway for laying hoses. Charging pump room accessibility is not applicable for IPEC. The charging pumps are not credited for IP2 BDBEE strategies. Additionally, to address the information requested by the NRC Audit Visit Report (ML14335A642) related to ISE Confirmatory Item 3.2.4.2.A, the

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		following update to the response is provided for IPEC Unit 3: Control Room: Section 3.2.1.8 of NEI 12-06 states that the effects of loss of HVAC in an ELAP event can be addressed consistent with NUMARC 87-00 or by plant specific calculation utilizing software such as GOTHIC. Calculation IP3-CALC-13-00065 utilized the methodology for temperature limits as defined in NUMARC 87-00 and modeled the control room using GOTHIC. Section 2.7.1(a) of NUMARC 87-00 indicates the control room is considered a Condition 1 area. Per NUMARC 87-00, a Condition 1 area is considered of low concern with respect to elevated temperature effects as long as a steady state temperature of 120° F is not exceeded. As documented in calculation IP3-CALC-13-00065 the temperature of the control room did not exceed 120° F for the length of the analysis. Although specific equipment temperature ranges are not referenced in this calculation, the equipment in the control room is considered acceptable via the referenced sections of NUMARC 87-00. TDAFW Pump Room: Temperature switches are provided in the Auxiliary Feedwater Pump Room to close steam supply isolation valves PCV-1310A and PCV-1310B to prevent adverse environmental conditions resulting from a high energy line break. The current normal process limit for the Auxiliary Feedwater Pump Room switches (TC-1112A and 1113A) to isolate the steam supply to the TDABFP is 150° F. The actual setting of the switches is 143° F to ensure that they actuate no higher than 150° F. Calculation IP-CALC-13-00064 justifies that the room heat-up, with the roll-up door opened at 30 minutes, stays below the setpoint level of 143° F for up to 168 hours after the BDBEE and therefore prevents adverse environmental conditions from occurring. For that reason the equipment in the Auxiliary Feedwater Pump Room is considered acceptable. **Entergy Response Update for IPEC Unit 2 (08/28/2015):** IPEC Unit 2 calculation IP-CALC-14-00038, Rev. 0, Main Control Room Het-up for FLEX Event, August 2014, is final and it is available on the e-Portal.
3.2.4.7.B	Confirm that the licensee has	This item was closed during the October 2014 NRC Audit Visit (associated

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
	evaluated the acceptability of the missile protection for the Unit 2 BAST.	with AQ IPEC-041). **Entergy Response 10/23/2013** The Unit 2 and Unit 3 RWSTs and CSTs are seismically qualified. Protection from tornado missile is provided by alternate supplies. IPEC is currently compiling historical tornado information to determine historical tornado diameter and axis of movement. The steam generator feed requirements are assured by alternate water supplies: CST, City Water Tank and Hudson River. The water requirements of the primary systems are assured by the boric acid storage tanks (which are missile protected) and the refueling water tank. This is consistent with what is credited for the current licensing basis. (References: U3 FSAR, 16.2.2 and IPEC OIP) **Entergy Response Update to address ISE Open Item 3.2.4.7.A and ISE Confirmatory Item 3.2.4.7.B (08/28/2014):** The Indian Point 3 (IP3) design basis includes tornado protection criteria and credits a combination of Class I structures, a single tornado missile occurrence, and adequate separation and redundancy to meet the IP3 design basis (IP-RPT-13-00055). While NEI 12-06 allows using current station design bases, the IP Unit 2 tornado protection design basis was assessed when it comes to meeting the beyond design basis events. Evaluation ENTGIP2-RPT-001 was developed to provide the basis for tornado protection criteria. This report determined that reasonable protection of FLEX critical areas and components for a BDBEE is assured by the combination of: 1) the rare occurrence of tornados at the site, 2) the low tornado wind speed at site, 3) the low probability of a tornado generated missile striking equipment or structures needed for a BDBEE, and 4) the protection provided by adjacent buildings or geographic features. Therefore, no additional evaluations or modifications are necessary to comply with NRC Order EA-12-049. The IP2 FLEX strategy FLEX modifications will

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		utilize the current design basis documented in the IP2 UFSAR and the NEI 12-06 definition of "robust." All IP2 FLEX strategies and IP2 FLEX modifications will be designed to meet the current IP2 tornado protection design basis (UFSAR Section 1.11.5) with the exception of IP2 components/modifications credited to support the current IP3 FLEX strategy. These IP2 components/modification designs will meet both the IP2 and IP3 design basis. Portable FLEX equipment stored onsite will be protected from tornado winds and missiles per NEI 12-06 guidance. Engineering reports IP-RPT-13-00055, Rev. 0, Indian Point Energy Center Unit 3 Tornado Wind and Missile Impact on Water Storage Tanks, January 2014, and ENTGIP2-RPT-001, Rev. 1, IP2 Tornado Protection, August 2014, are available on the ePortal. **Entergy Response Update to address ISE Open Item 3.2.4.7.A (10/27/2014):** The IP2 response (i.e., after the first paragraph of the 8/28/14 response) to this audit question is updated based on revised report ENTGIP2-RPT-001, IP2 Tornado Protection. While NEI 12-06 allows using current station design bases, the IP Unit 2 tornado protection design basis was assessed when it comes to meeting the beyond design basis events. Evaluation ENTGIP2-RPT-001 was developed to provide the basis for tornado protection criteria. This report determined that reasonable protection of FLEX critical areas and components for a BDBEE is assured by the combination of: 1) the rare occurrence of tornados at the site, 2) the low tornado wind speed at site, 3) the low probability of a tornado generated missile striking equipment or structures needed for a BDBEE, 4) the protection (shielding) provided by adjacent buildings or geographic features or the separation distance based on a reasonable tornado width and the axis of

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		separation relative to probable tornado paths. The IP2 licensing basis does not include tornado protection for the design of the buildings, structures and components. Therefore, no specific protection from the effects of tornados is required for components to be considered robust and credited in the IP Unit 2 Order EA 12-049 strategies. However, to provide a congruous strategy for tornado events, the Flex Strategy for addressing tornado and tornado missiles impact on critical areas and components credited for a BDBEE established with the Unit 3 Strategy was also evaluated for Unit 2. This does not constitute a new design bases criteria for Indian Point Unit 2, but is a conservatively consistent strategy for the site in that the overall Flex Strategy can address the loss of any single tank credited for FLEX strategies on site. Portable FLEX equipment stored onsite will be protected from tornado winds and missiles per NEI 12-06 guidance. Engineering report ENTGIP2-RPT-001, Rev. 2, IP2 Tornado Protection, October 2014, is available on the ePortal.
3.2.4.9.A	Confirm that method for supplying fuel oil has been finalized. Also confirm that the fuel required for each FLEX piece of equipment has been established and that the total fuel usage has been calculated to demonstrate that sufficient fuel with margin exists on site.	This item was closed during the December 2015 NRC Audit Visit (associated with AQ IPEC-025). **Entergy Response 10/23/2013** The main source of fuel oil for FLEX equipment is the Emergency Diesel Generator Fuel Oil which is maintained in accordance with the Technical Specifications. The quality of fuel oil in potential stored sources of fuel oil is maintained such that it can be used to fuel the emergency diesel generators. Fuel oil in the fuel tank for each portable FLEX equipment will be maintained in the Preventative Maintenance program in accordance with the manufacturer's guidance and existing site maintenance practices. The fuel transportation routes will avoid any areas subject to external flooding. The method of supplying fuel oil to FLEX equipment has not been finalized; this information will be provided in a future update.

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		Entergy Response Update to address ISE Confirmatory Item 3.2.4.9.A for IPEC Unit 2 (02/27/2015): For IPEC Unit 2 the main source of fuel oil for FLEX equipment is the Emergency Diesel Generator Fuel Oil which is maintained in accordance with the Technical Specifications Diesel Fuel Oil Testing Program (reference IPEC 2 Technical Specifications Administrative Program 5.5.11). IP-CALC-14-00037 calculates the total quantity of diesel fuel required for a FLEX event to be 7276 gallons for 72 hours duration. There are three tanks (21-FOST, 22-FOST and 23-FOST) of diesel fuel capable of withstanding seismic, flood and wind events available at IP2 site. At IP2, each EDG underground fuel oil storage tank (UFOST) must have a minimum volume of 6334 gallons of usable fuel in the tank. Therefore, a combination of three on-site diesel fuel tanks will provide adequate quantity for the FLEX event. IP-CALC-14-00037, Rev. 0, FLEX Event Diesel Fuel Usages, September 2014 is available on the ePortal. The FLEX equipment will be maintained in the Preventative Maintenance program in accordance with EPRI maintenance templates (refer to the response to Audit Question 27). The fuel transportation routes will avoid any areas subject to external flooding. Fuel Oil Transfer Pumps (FOTP), powered by the Phase 2 FLEX Diesel Generator, will be used to transfer fuel out of the Emergency Diesel Generator Fuel Oil tank to a trailer mounted fuel tank. Fuel is transferred from the FLEX trailer mounted fuel tank to the Phase 2 portable FLEX equipment through a battery powered pump integral to the tank. **Entergy Response Update to address ISE Confirmatory Item 3.2.4.9.A for IPEC Unit 2 (08/28/2015):** IPEC Unit 2 calculation IP-CALC-14-00037, Rev. 0, FLEX Event Diesel Fuel Usages, March 2015, has been issued final. The final results determined that the total quantity of diesel fuel required for a FLEX event is 7981 gallons for 72 hour duration. There are three tanks (21-FOST, 22-FOST and 23-FOST) of diesel fuel capable of withstanding seismic, flood and wind events available at

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		IPEC Unit 2. At IPEC Unit 2, each EDG underground fuel oil storage tank (UFOST) must have a minimum volume of 6334 gallons of usable fuel in the tank. Therefore, a combination of three on-site diesel fuel tanks will provide adequate quantity for the FLEX event. IP-CALC-14-00037, Rev. 0, FLEX Event Diesel Fuel Usages, March 2015, is available on the ePortal.
3.2.4.10.A	Confirm that analysis of the following aspects of the dc power requirements have been identified and evaluated: a. The dc load profile with the required loads for the mitigating strategies to maintain core cooling, containment, and spent fuel pool cooling; b. The loads that will be shed from the dc bus, the equipment location (or location where the required action needs to be taken), and the required operator actions and the time to complete each action c. The basis for the minimum dc bus voltage that is required to ensure proper operation of all required electrical equipment.	This item was closed during the December 2015 NRC Audit Visit (associated with AQ IPEC-026). **Entergy Response 10/23/2013** The design to implement the FLEX strategies is in development, therefore, the information for parts a. and b. of this question is not available at this time. A response to parts a. and b. of this audit question will be provided in a future update. Regarding part c. of this question, preliminary analysis to determine minimum battery voltage has been performed for IP3 (IP2 analysis has not been developed at this time). Preliminary results indicate that the minimum voltage that is required for the four batteries range from 105V to approximately 110V depending on the battery, the limiting load and associated voltage drop in the distribution system. Analysis for the dc power requirements will be made available as they are finalized. **Entergy Response Update to address ISE Confirmatory Item 3.2.4.10.A for IPEC Unit 2 (02/27/2015):** For Indian Point Unit 2, the direct current (DC) load profile with the required loads for mitigating strategies to maintain core cooling, containment, and spent fuel pool cooling, the loads that will be shed from the dc bus, and the minimum dc bus voltage are provided in calculation IP-CALC-14-00076. The results of

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		this calculation confirm that the minimum voltage that is required for the four batteries range from 107.10V to approximately 109.30V depending on the battery. Specifically at 8 hours following event the terminal voltage will be as follows: Battery 21 – 107.88v Battery 22 – 109.30v Battery 23 – 107.30v Battery 24 – 107.10v All required loads will have adequate voltage at their terminals throughout the 8 hour duty cycle. This calculation, IP-CALC-14-00076, Rev. 0, Battery Sizing and Voltage Drop Calculation for Extended Loss of Power (ELAP), October 2014, is available on the ePortal. **Entergy Response Update to address ISE Confirmatory Item 3.2.4.10.A for IPEC Unit 2 (08/28/2015):** IPEC Unit 2 calculation IP-CALC-14-00076, Rev. 0, has been issued final. The following is an update to the response provided on 02/27/2015. The results of this calculation confirm that the minimum voltage that is required for the four batteries range from 107.30V to approximately 108.46V depending on the battery. Specifically at 8 hours following event the terminal voltage will be as follows: Battery 21 – 107.88v Battery 22 – 107.88v Battery 23 – 108.46v Battery 24 – 107.30v All required loads will have adequate voltage at their terminals throughout the 8 hour duty cycle. Calculation, IP-CALC-14-00076, Rev. 0, Battery Sizing and Voltage Drop

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		Calculation for Extended Loss of Power (ELAP), January 2015, is available on the ePortal.
3.4.A	Confirm that the 480V portable/FLEX generators are adequately sized to supply loads assumed for implementing Phase 2 strategies.	This item was closed during the December 2015 NRC Audit Visit (associated with AQ IPEC-031). **Entergy Response 10/23/2013** Entergy is actively involved in industry initiatives to establish the Regional Response Centers (RRC) which are described in the OIP and required for implementation of Phase 3 per the IPEC FLEX strategy. The industry has contracted with the Strategic Alliance for FLEX Emergency Response (SAFER) organization through Pooled Equipment Inventory Company (PEICo) to establish and operate the Regional Response Centers as part of the PEICo's existing Pooled Inventory Management (PIM) Program. The SAFER proposal, as well as its subsequent acceptance by the industry and implementation, is based on the Phase 3 requirements of NEI 12-06. The SAFER Site-specific Response Plan will contain information on the specifics of generic and site specific equipment obtained from the RRC. It will also contain the logistics for transportation of the equipment, staging area set up, and other needs for ensuring the equipment and commodities sustain the site's coping strategies. Offsite equipment will be procured through the SAFER organization. SAFER plans to align with the EPRI templates for maintenance, testing and calibration of the equipment. **Entergy Response Update (02/27/2015):** To address the information requested by the NRC Audit Visit Report (ML14335A642) related to the revision of procedure FSG-100 and the SAFER Response Plan, the following update to the response is provided: Procedure FSG-100 revision to add a step to activate the offsite resource delivery is in progress.

Table 2 - Interim Staff Evaluation Open and Confirmatory Items (O.I and C.I)		Status
		Additionally a draft of the Indian Point Energy Center Response Plan has been issued and it is available on the ePortal. **Entergy Response Update (08/28/2015):** Procedure FSG-100 has been revised to add a step to activate the offsite resource delivery. In addition, the Indian Point Energy Center Response Plan has been issued and is available on the ePortal.

Table 3 - Audit Questions	Status	Completion or Target Date
IPEC-002	This item was closed during the December 2015 NRC Audit Visit (associated with ISE Confirmatory Item 3.1.1.2.D)	Closed
IPEC-003	This item was closed during the October 2014 NRC Audit Visit.	Closed
IPEC-004	This item was closed during the October 2014 NRC Audit Visit (associated with ISE Confirmatory Item 3.1.1.3.A)	Closed
IPEC-005	This item was closed during the October 2014 NRC Audit Visit (associated with ISE Confirmatory Item 3.1.1.4.A)	Closed
IPEC-006	This item was closed during the October 2014 NRC Audit Visit (associated with ISE Open Item 3.1.2.A and ISE Confirmatory Item 3.1.2.2.A)	Closed
IPEC-008	This item was closed during the December 2015 NRC Audit Visit.	Closed
IPEC-009	This item was closed during the October 2014 NRC Audit Visit.	Closed

Table 3 - Audit Questions	Status	Completion or Target Date
IPEC-010	This item was closed during the December 2015 NRC Audit Visit.	Closed
IPEC-011	This item was closed during the December 2015 NRC Audit Visit.	Closed
IPEC-012	This item was closed during the October 2014 NRC Audit Visit (see preceding table for status of ISE Confirmatory Item 3.2.1.A and ISE Confirmatory Item 3.2.1.1.A)	Closed
IPEC-013	This item was closed during the October 2014 NRC Audit Visit (see preceding table for status of ISE Confirmatory Item 3.2.1.3.A)	Closed
IPEC-014	This item was closed during the October 2014 NRC Audit Visit.	Closed
IPEC-017	This item was closed during the October 2014 NRC Audit Visit (see preceding table for status of ISE Confirmatory Item 3.2.1.9.A)	Closed
IPEC-020	This item was closed during the October 2014 NRC Audit Visit (see preceding table for status of ISE Confirmatory Item 3.2.4.6.A)	Closed
IPEC-021	This item was closed during the October 2014 NRC Audit Visit (see preceding table for status of ISE Confirmatory Item 3.2.4.3.A).	Closed
IPEC-022	This item was closed during the December 2015 NRC Audit Visit.	Closed
IPEC-023	This item was closed during the December 2015 NRC Audit Visit (see preceding table for status of ISE Confirmatory Item 3.1.1.2.C)	Closed
IPEC-025	This item was closed during the October 2014 NRC Audit Visit (see preceding table for status of ISE Confirmatory Item 3.2.4.9.A)	Closed
IPEC-026	This item was closed during the December 2015 NRC Audit Visit.	Closed

Table 3 - Audit Questions	Status	Completion or Target Date
IPEC-027	This item was closed during the December 2015 NRC Audit Visit.	Closed
IPEC-028	This item was closed during the December 2015 NRC Audit Visit.	Closed
IPEC-029	This item was closed during the December 2015 NRC Audit Visit.	Closed
IPEC-031	This item was closed during the October 2014 NRC Audit Visit (see preceding table for status of ISE Confirmatory Item 3.4.A)	Closed
IPEC-032	This item was closed during the December 2015 NRC Audit Visit.	Closed
IPEC-033	This item was closed during the December 2015 NRC Audit Visit.	Closed
IPEC-034	This item was closed during the October 2014 NRC Audit Visit (see preceding table for status of ISE Confirmatory Item 3.2.2.A)	Closed
IPEC-035	This item was closed during the October 2014 NRC Audit Visit (see preceding table for status of ISE Confirmatory Item 3.2.1.6.A)	Closed
IPEC-036	This item was closed during the October 2014 NRC Audit Visit (see preceding table for status of ISE Confirmatory Item 3.2.1.9.B)	Closed
IPEC-037	This item was closed during the October 2014 NRC Audit Visit.	Closed
IPEC-041	This item was closed during the October 2014 NRC Audit Visit (see preceding table for status of ISE Open Item 3.2.4.7.A and ISE Confirmatory Item 3.2.4.7.B)	Closed
IPEC-042	This item was closed during the October 2014 NRC Audit Visit (see preceding table for status of ISE Confirmatory Item 3.2.4.3.A).	Closed
IPEC-043	This item was closed during the October 2014	Closed

Table 3 - Audit Questions	Status	Completion or Target Date
	NRC Audit Visit (see preceding table for status of ISE Confirmatory Item 3.2.4.3.A).	
IPEC-045	This item was closed during the October 2014 NRC Audit Visit (see preceding table for status of ISE Confirmatory Item 3.2.4.2.A).	Closed
IPEC-046	This item was statused as open during the December 2015 NRC Audit Visit. See the December 2015 NRC Audit Visit FLEX Related Open Items table (below) Audit Item 46-B for status.	See the December 2015 NRC Audit Visit FLEX Related Open Items table (below)
IPEC-047	This item was closed during the October 2014 NRC Audit Visit (see preceding table for status of ISE Confirmatory Item 3.2.4.2.B).	Closed
IPEC-048	This item was closed during the December 2015 NRC Audit Visit.	Closed
IPEC-049a	This item was closed in the December 2015 NRC Audit report (had been pending information review).	Closed
IPEC-049b	This item was closed during the December 2015 NRC Audit Visit.	Closed
IPEC-049c	This item was closed during the December 2015 NRC Audit Visit.	Closed
IPEC-049d	This item was closed during the December 2015 NRC Audit Visit.	Closed
IPEC-049e	This item was closed during the December 2015 NRC Audit Visit.	Closed
IPEC-049f	This item was closed during the December 2015 NRC Audit Visit.	Closed
IPEC-049g	This item was closed during the December 2015 NRC Audit Visit.	Closed
IPEC-049h	This item was closed during the December 2015 NRC Audit Visit.	Closed

Table 3 - Audit Questions	Status	Completion or Target Date
IPEC-049i	This item was closed during the December 2015 NRC Audit Visit.	Closed
IPEC-050	This item was closed during the December 2015 NRC Audit Visit (see preceding table for status of ISE Confirmatory Item 3.2.1.8.A).	Closed
IPEC-051	This item was closed during the December 2015 NRC Audit Visit.	Closed

*Closed indicates that Entergy's response is complete.

Table 4	Licensee OIP	Status
SE #1	This item was closed during the December 2015 NRC Audit Visit.	Closed
SE #2	This item was closed during the December 2015 NRC Audit Visit.	Closed
SE #4	This item was closed during the December 2015 NRC Audit Visit.	Closed
SE #5	This item was statused as open during the December 2015 NRC Audit Visit. See the December 2015 NRC Audit Visit FLEX Related Open Items table (below) Audit Item 5-E for status.	See the December 2015 NRC Audit Visit FLEX Related Open Items table (below)
SE #6	This item was closed during the December 2015 NRC Audit Visit.	Closed
SE #7	This item was closed during the December 2015 NRC Audit Visit.	Closed
SE #8	This item was closed during the December 2015 NRC Audit Visit.	Closed
SE #9	This item was closed during the December 2015 NRC Audit Visit.	Closed
SE #10	This item was closed during the December 2015 NRC Audit Visit.	Closed
SE	This item was closed during the December 2015 NRC Audit Visit.	Closed

Table 4	Licensee OIP	Status
#11		
SE #12	This item was closed during the December 2015 NRC Audit Visit.	Closed
SE #13	This item was statused as open during the December 2015 NRC Audit Visit. See the December 2015 NRC Audit Visit FLEX Related Open Items table (below) Audit Item 13-E for status.	See the December 2015 NRC Audit Visit FLEX Related Open Items table (below)
SE #14	This item was statused as open during the December 2015 NRC Audit Visit. See the December 2015 NRC Audit Visit FLEX Related Open Items table (below) Audit Item 14-E for status.	See the December 2015 NRC Audit Visit FLEX Related Open Items table (below)
SE #15	This item was closed during the December 2015 NRC Audit Visit.	Closed
SE #16	This item was closed during the December 2015 NRC Audit Visit.	Closed
SE #17	This item was closed during the December 2015 NRC Audit Visit.	Closed

Table 5 - December 2015 NRC Audit Visit FLEX-Related Open Items		
Audit Item Reference	**Item Description**	**Status**
CI 3.2.1.6.A	The NRC staff needs further information on the licensee's plans to isolate the accumulators to prevent the injection of nitrogen	Open pending NRC review. Initially, the SI accumulators will make-up for most of the reductions in the volume of coolant in the RCS as a result of leakage and contraction due to the cooldown of the plant. The SI accumulators are initially maintained at approximately 600 psig. As the plant is cooled down, RCS pressure

Table 5 - December 2015 NRC Audit Visit FLEX-Related Open Items		
	gas into the RCS, which could impede the natural circulation cooling.	decreases and eventually goes below 600 psig. At this point, the SI accumulators will begin injecting to make up for the decrease in water volume. Depressurization of the plant to 300 psia will not cause the SI accumulators to completely inject their inventory into the RCS. This trigger point or an equivalent trigger point will be added to 2-ECA-0.0 and/or appropriate FSG. Prior to the RCS further depressurization below 300 psia, the SI accumulator outlet isolation valves will be closed to prevent nitrogen injection into the RCS. Motor operated valves 894A, 894B, 894C and 894D are powered from MCC-26A (894A and 894C) and MCC-26B (894B and 894D) which will be repowered by the Phase 2 or Phase 3 FLEX Generator. 2-ECA-0.0 has been revised to isolate the SI accumulators when reducing SG pressure below 270 psig. The timeline for this strategy is contained in Engineering Report IP-RPT-14-0006 Rev 1. The timeline for isolating the SI accumulators is prior to the 2nd cooldown with a required time of less than 23 hours (expected timeline is on the order of 13 to 15 hours).
CI 3.2.1.8.A	No input needed at this time. The NRC staff is reviewing the licensee's plan to increase the soluble boron in the RCS in order to ensure the reactor remains subcritical.	Open pending staff review. See Table 2.
CI 3.2.3.A	The calculation of the conditions inside the containment building was done by the licensee with an assumption of an initial leak rate of 21 gallons per minute (gpm) seal leakage per RCP. As the RCP seal leakage model has not been accepted yet by the NRC	Open pending staff review. Calculation IP-CALC-14-00042 (on Portal)"IP2 MAAP 4.05 Containment Analysis for an Extended Loss of AC Power Event (ELAP)" Rev 1 has been revised to include the new cooldown leakage profile contained in Engineering Report IP-RPT-14-0006 Rev 1. The leakage profile is bounded by PWROG-14015 and 14027. The leakage profile is as follows:

Table 5 - December 2015 NRC Audit Visit FLEX-Related Open Items		
	staff, it is not possible to perform a final evaluation of this calculation.	"For the pre-cooldown period (0-0.5 hours) the leakage is set at 68 gpm (16.75 gpm per each of the four RCPs and 1 gpm from unidentified sources, at time = 0 hours). At 0.5 hours (first cooldown period) the leakage is set at 47.4 gpm. At 3 hours (post-first cooldown period) the leakage is set at 23.8 gpm. Finally, at 24 hours (post-final cooldown), the leakage is set at 15 gpm."
46-B	The NRC staff requested the licensee to provide a technical basis to support the conclusion that the battery rooms would not exposed to extreme high and low temperatures during the first phase of the ELAP event.	Open pending NRC review of plant documentation for IP2 and 3. See Table 2, item 3.2.4.2.B
SE-5	Accuracy of the NOTRUMP Computer Code: Westinghouse used the NOTRUMP computer code to develop certain timelines for operator actions in an ELAP event (see WCAP-17601-P for example). NRC simulations using the TRACE code indicate some differences, which may be significant enough to affect the timeline for operator actions. The PWROG is working with the NRC on a resolution, which may be applicable to all PWRs. Provide PWROG resolution on accuracy of the NOTRUMP code. Provide a comparison chart to compare how the plant parameters assumed in the	The parameter data "Audit Item 5-E Comparison" on the portal requested during the FLEX Audit relative to IPEC application of generic calculations for Reactor Coolant Pump (RCP) seal leakage and time to loss of core cooling. Subsequent to the NRC Audit, IPEC transitioned from WCAP-17601 analysis to PWROG-14015 and PWROG-14027 Category 1 seal leak rate and time to reflux cooling analysis. The PWROG generic analysis methodology and results included use of the 4-Loop Westinghouse reference plant identified in WCAP-17601. Calculations determined some IPEC parameters were not bounded by the PWROG generic analysis used to determine the beginning of reflux cooling occurs at 15.6 hours. Specifically, IP2 accumulator mass injection was less than the generic analysis input parameters. Therefore, the PWROG-14027 methodology was utilized to apply unit-specific parameters for determining the time to reach reflux cooling. Generic analysis values and plant values including the addition of Items 30, 31, 32 and 33 to address PWROG generic analysis are on the Portal.

Table 5 - December 2015 NRC Audit Visit FLEX-Related Open Items		
	Westinghouse analyses compare to Indian Point parameters.	
SE-13	The NRC staff needs information to demonstrate that the current RCP seal leakage rate calculation is accurate or conservative. Please provide adequate justification for the seal leakage rates calculated according to the Westinghouse seal leakage model that was revised following the issuance of NSAL-14-1. The justification should include a discussion of the following factors: a. benchmarking of the seal leakage model against relevant data from tests or operating events, b. discussion of the impact on the seal leakage rate due to fluid temperatures greater than 550°F resulting in increased deflection at the seal interface,	Open pending NRC review This area continues to be a generic industry issue for Westinghouse seals; although there appears to be some recent resolution. The remaining items for IPEC are: 1. Overall Seal leakage rates – This issue appears to be resolved and the NRC has agreed to the new leakage rates in PWROG 14015-P. IP2-specific leak rates are even lower as determined in calculation IP-CALC-15-00017. 2. Seal O-Ring Material Type – Material Type "B" versus "C". Some of the O-ring material in RCP 21 is Type "B" which has a lower qualification temp (e.g., 550°F versus 570°F for Type "C"). This has been evaluated to be acceptable for FLEX situations. 3. Corrosion of No 1 Seal – This issue appears to have been resolved with the early cooldown from nominal operating temp and pressure. No 2 Seal degradation – 2nd Cooldown to 350°F within 24 hours (Westinghouse Bulletin TB-15-1). Recent information from Westinghouse indicates that TB-15-1 will be revised to a cooldown of 400°F/800 psi which will bound IPEC FLEX Strategy. Our FLEX Strategy was modified to cool the RCS cold legs to 350 degrees and 400 psig within 24 hours. The FLEX strategy at IP2 is to start early cooldown (within 30 minutes) and to cooldown to 400°F Cold Leg/300 psi within 3 hours. The 400°F/300 plateau is maintained until shutdown cooling can be established around 120 hours. FLEX Strategies comply with NEI 12-06. The installed TDAFW Pump is used for initial SG Cooling. FLEX portable diesel operated pumps are used for RCS Makeup, backup to SG Makeup, and SFP Makeup. A 600 KW portable diesel generator is used to supply electrical loads.

Table 5 - December 2015 NRC Audit Visit FLEX-Related Open Items		
	c. clarification whether the second-stage reactor coolant pump seal would remain closed under ELAP conditions predicted by the revised seal leakage model and a technical basis to support the determination, and d. Justification that the interpolation scheme used to compute the integrated leakage from the reactor coolant pump seals from a limited number of computer simulations (e.g., three) is realistic or conservative.	Westinghouse performed an Indian Point Unit 2 RCP Seal Leakoff Flow Analysis that reclassified IPEC from a Category 4 Plant to a Category 1 Plant which re-establishes seal leakage rates within acceptable values previously assumed. To re-classify Indian Point 2 to Category 1, flow orifices were installed within the outlet flanges of the high range rotameters under EC 56002 to add additional resistance in the line. The analysis provides seal leakoff orifice sizing to ensure that the No 1 seal leakoff rate is bounding for FLEX and other events (SBO, Appendix R, etc.).
SE-14	The NRC staff has asked the licensee to determine the expected maximum pressure in the #1 seal leakoff line during this event and to demonstrate that the components of this line will not fail in such a manner that will increase the seal leakage. The NRC staff understands that Westinghouse has recently recalculated seal leakoff line pressures under loss of seal cooling events based on a revised seal leakage model and additional design-specific	Open pending NRC closure review To address the information requested by the NRC Audit Visit Report (ML14335A642) related to the pressurization of the RCP #1 seal leakoff lines, the following update is provided : Figure 3 of PWROG-14015-P Rev 1 shows the expected pressure response in the No. 1 Seal and Leak-off Line for a Category 1 plant. The expected maximum steady state pressure in the leak-off line up stream of the flow elements (e.g., restriction orifice) is less than 1000 psia. The pressure downstream of the flow element is on the order of 150 psig, which corresponds to the relief valve setting. These values are less than the design values, so the leak-off line is expected to remain intact. The analysis for the leak-off rate assumes that the pressure downstream of the flow element (e.g., restriction orifice) goes to atmosphere, so even if the low pressure piping was to fail, the seal leakage rate will remain within analyzed values. To address the potential pulse situation concern wherein the peak pressure/temperature in the line may be high for a brief period of time before

Table 5 - December 2015 NRC Audit Visit FLEX-Related Open Items		
	information for certain plants. a. Please clarify whether the piping and all components (e.g., flow elements, flanges, valves, etc.) in your seal leakoff line are capable of withstanding the pressure predicted during an ELAP event according to the revised seal leakage model. b. Please clarify whether operator actions are credited with isolating low pressure portions of the seal leakoff line, and if so, please explain how these actions will be executed under ELAP conditions. c. If over pressurization of piping or components could occur under ELAP conditions, please discuss any planned modifications to the seal leakoff piping and component design and the associated completion timeline. d. Alternately, please identify the seal leakoff piping or components that would be	steady-state conditions assert themselves and pressures and temperatures stabilize at the more reasonable expected values described above, the 2045 psia peak pressure which was measured in the Montereau hot shock test (Appendix B to WCAP-10541) remains applicable to IPEC design. Therefore, because the seal leak off lines up to and including the location of the flow restricting orifice are designed for 2580 psig at 650 F and 2510 psig at 680 F, the potential pulse concern will not result in the seal leak off line failing thus preventing an increase in seal leakage. IPEC continues to participate in industry initiatives for analyzing the expected maximum pressure (currently 2045 psia) in the seal leak off line during a loss of seal cooling event. It is expected that if the WCAP-10541 peak pressure is revised, IPEC will remain bounding based on the current margin to exceeding the design criteria discuss above. PWROG-14015 Rev 2 Section 6.11 addresses the "Maximum Piping Pressure" and this is applicable to IPEC Units 2 and 3. As discussed in PWROG 14015 Rev 2, the maximum No 1 seal leak-off line piping pressure is 2045 psia. As indicated above, the piping and components in the RCP #1 seal leak-off line from the seal exit to the second rotameter isolation valve are classified as ANSI Class 2501. This means they are rated for 2580 psig at 650°F, well above the conditions the line would experience during the analyzed ELAP event. All the components in the seal leak-off line are predicted to be within required design parameters during the ELAP event. This calculation performs an operability assessment of the Indian Point 2 Reactor Coolant Pump Seal 1 leak-off piping and associated pipe supports for a postulated pump seal failure that would introduce high pressure and high temperature fluid into a system for which it has not otherwise been designed. The scope involved all seal leak-off piping extending from the four reactor coolant pumps out to containment penetration R. The bulk of the piping is identified as Line 17. The piping is determined to everywhere satisfy IPEC2 operability limits for secondary stresses. The piping support system consists of a range of support types, from standard type

Table 5 - December 2015 NRC Audit Visit FLEX-Related Open Items		
	susceptible to over pressurization under ELAP conditions, clarify their locations, and provide justification that the seal leakage rate would remain in an acceptable range if the affected piping or components were to rupture	supports to steel member and plate elements designed supports. These support system components were evaluated considering "Operability Acceptance Criteria", as outlined in Table 3- for pipe support components. These criteria are based on Entergy's standards for operability DG-07 developed for IPEC Unit 2], if necessary this criteria was supplemented by criteria of Appendix F of ASME Section III], endorsed in NRC RIS 2005-20 and NRC Inspection Manual Part 9900 "Technical Guidance". Such criteria is established to assess degraded conditions for short-term periods of operation. All supports were demonstrated to meet this criteria.

Margin Analysis

At this time the PWROG continues to resolve issues over the amount of RCP seal leakage that would be expected during an extended loss of ac power (ELAP) for reactors with the standard Westinghouse seals. The IP3 OIP RCP seal leak rate profile and the analysis to validate the capability to maintain natural circulation core cooling used Westinghouse WCAP-17601. The PWROG generic analysis methodology and results included use of the 4-Loop Westinghouse reference plant identified in WCAP-17601. Subsequent to the OIP, the IP3 analyses have used the Category 1 plant (based on the installation of RCP seal line orifice) analysis results and mass balance methodology of PWROG-14015 and PWROG-14027 with plant specific parameters. Margins were achieved regarding resolution of leak rate by the use of generic parameters and results as follows:

To utilize the PWROG RCP seal leak rates for a Category 1 plant and apply the reflux cooling analysis methodology, the following actions were taken to support the IP2 FLEX strategy timeline:

1. IP2 analysis using plant-specific parameters determined accumulator mass injection and initial RCS mass were less than the PWROG generic analysis input parameters. As a result, an IP2 parameter specific calculation (Reference 17) determined the time to onset of reflux cooling using the mass balance methodology was 12.7 hours in place of the generic analysis result of 15.6 hours (Reference 15).

2. IP2 calculations using IP2 parameters and Category 1 RCP seal leak rates plus 1 gpm unidentified RCS leakage were performed to determine the impact on RCS makeup inventory capability for 120 hours (Reference18) and that containment pressure / temperature responses (Reference19) remain less than design parameters. Results were incorporated into the FLEX strategy (Reference 23).

3. Installation of a flow orifice in each RCP seal leak-off line during the 2R22 Refueling Outage under EC 56002 (Reference 20) was performed to characterize IP2 as a Category 1 plant with respect to RCP No. 1 seal leakage.

4. To confirm that the installation of orifices in the RCP leak-off lines ensure Category 1 performance, the IP2 specific seal leak-off piping configurations were analyzed in calculation IP-CALC-15-00017 (Reference 21). The leak rates determined in this calculation were lower than References 14 and 15, except at the lowest cited temperature and pressure conditions. At 375°F and 200 psia, the calculation found that flow choking occurs at the installed orifice at a flow rate of 3.5 gpm when conservatively not crediting relief valve backpressure of 150 psig. References 14 and 15 credited the relief valve backpressure and thus flow choking actually occurred at a flow rate of 0.7 gpm (Reference 22).

The time to the onset of Reflux Cooling Margin represents another area of margin. The

Phase 2 Staffing Assessment contained in NL-2014-132 (Reference 8) identifies that RCS makeup will be started between 10 to 11 hours. This is prior to the onset of reflux cooling at 11.9 hours as determined in Reference 17. This calculation and the IP2 FLEX strategy contain the following conservative approaches different than the PWROG generic analysis that reported a time to onset of reflux cooling of 15.6 hours (Reference 15):

1. The IP2 analysis (Reference 17) uses IP2 parameters and therefore eliminates the concern of using non-conservative available RCS mass values.
2. The IP2 calculation (Reference 17) includes the loss of 1 gpm unidentified RCS leakage in addition to the Category 1 leak rate profile.
3. The IP2 FLEX strategy initiates plant cooldown 90 minutes earlier than the PWROG analysis.
4. The IP2 FLEX strategy cooldown is completed 60 minutes earlier than assumed in the PWROG analysis.

Subsequent to Reference 17, calculation IP-CALC-15-00035 quantifies additional margin gained as a result of using the IP2 specific RCP seal leak-off values (Reference 21) applied to Reference 17 results instead of the PWROG generic seal leak rates. Calculation IP-CALC-15-00035 determined the time to onset of reflux cooling was 15.12 hours. Therefore, using IP2 specific leak rates provide an additional 2.40 hours to the Reference 17 result (12.7 hours) for the onset of reflux cooling.

In summary, the FLEX strategy identifies that RCS makeup will be started between 10 to 11 hours (References 8 and 23) with the onset of reflux cooling occurring at 12.72 hours. Analyses and modifications ensure RCS makeup can be initiated prior to the onset of reflux cooling. Subsequently, using IP2 specific leak rates resulting from the orifice modification provides an additional 2.40 hours of margin added to the original 1.7 hours of margin assuming RCS makeup is initiated at 11 hours. Therefore, there exists 4.12 hours of margin from the conservative latest initiation of RCS makeup at 11 hours until the onset of reflux cooling at 15.12 hours.

The design of the RCP#1 seal leakoff line versus the expected pressure profile provides margin. The RCP #1 seal leakoff line pressurization spike creates a potential for a ruptured line and increased RCS leak rate. As noted in response to Table 5 SE-14, the potential pulse situation is a concern wherein the peak pressure / temperature in the line may be high for a brief period of time before steady-state conditions assert themselves and pressures and temperatures stabilize. The peak pressure of 2045 psia (measured in the
Montereau hot shock test, Appendix B to WCAP-10541) remains applicable to IPEC. Because the #1 seal leak off lines up to and including the location of the flow restricting orifice are designed for 2580 psig at 650 °F and 2510 psig at 680 °F, there is margin to assure that the potential pulse concern will not result in the seal leak off line failing and producing an increase in seal leakage. The #1 seal leak off line supports were evaluated for acceptability under the potentially elevated flow, pressure, and temperature conditions that may exist in the leak off lines following a loss of RCP seal cooling event. The evaluation, performed in calculation IP-CALC-16-00049 (Reference 24), concluded that the supports would not fail or degrade to the point of negatively

affecting seal leak off piping pressure boundary integrity, specifically up to and including the flow restricting orifice locations. This result, in combination with the piping's 2580 psig at 650 F design parameters already discussed, provides further evidence that the RCP seal leak off lines will not fail in such a way as to produce leakage values above those already conservatively calculated for the ELAP event.

This issue is considered closed based on this information.

8 References

The following references support the updates to the Overall Integrated Plan described in this enclosure.

1. NRC Order Number EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated March 12, 2012 (ML 12054A736).
2. Entergy Letter to NRC (NL-13-042), 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 28, 2013 (ML13079A348).
3. Entergy Letter to NRC (NL-13-110), Indian Point Energy Center's First Six-Month Status Report for the Implementation of Order EA-12-049 Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (TAC Nos. MF0744 and MF0745), dated August 27, 2013 (ML13247A032).
4. Entergy Letter to NRC (NL-13-031), Indian Point Energy Center's Second Six-Month Status Report for the Implementation of Order EA-12-049 Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (TAC Nos. MF0744 and MF0745), dated February 27, 2014 (ML14070A365).
5. Entergy Letter to NRC (NL-14-110), Indian Point Energy Center's Third Six-Month Status Report for the Implementation of Order EA-12-049 Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (TAC Nos. MF0744 and MF0745), dated August 27, 2014 (ML 14251A227).
6. Entergy Letter to NRC (NL-15-025), Indian Point Energy Center's Fourth Six-Month Status Report for the Implementation of Order EA-12-049 Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (TAC Nos. MF0744 and MF0745), dated February 27. 2015.
7. NRC Letter to Entergy, Indian Point Nuclear Generating Unit Nos. 2 and 3 – Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Order EA-12-049 (Mitigation Strategies) (TAC Nos. MF0744 and MF0745), dated January 24, 2014 (ML13337A594).
8. Entergy Letter to NRC (NL-14-132) Regarding Response to March 12, 2012,

Request for Information (RFI) Pursuant to Title 10 of the Code of Federal Regulation 50.54(f) Regarding Recommendations of the Near-Term Task Force (NTTF) Review of Insights from the Fukushima Dia-ichi Accident, Enclosure 5 Recommendation 9.3, Emergency Preparedness – Staffing, Requested Information Items 1, 2, and 6 – Phase 2 Staffing Assessment, dated November 3, 2014 (ML14328A631).

9. Entergy Letter to NRC (NL-13-042), 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 28, 2013 (ML13079A348).

10. NRC Letter to Entergy Regarding Plan for the Onsite Audit Regarding Implementation of Mitigating Strategies AND Reliable Spent Fuel Instrumentation Related To Orders EA-12-049 and EA-12-051 (TAC NOS. MF0744, MF0745, MF07371 AND MF0738), dated September 30, 2014 (ML14269A384)

11. NRC Interim Staff Guidance JLD-ISG-2012-01, Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, Revision 0, dated August 29, 2012 (ML12229A174).

12. NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 0, dated August 2012 (ML12242A378).

13. NRC Letter to Entergy Regarding Report for the Onsite Audit Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Instrumentation Related to Orders EA 12-049 and EA 12-051 (TAC Nos. MF0744, MF0745, MF0737 and MF0738), dated December 9, 2014 (ML14335A642).

14. Westinghouse Report PWROG-14015-P, Rev 2, No. 1 Seal Flow Rate for Westinghouse Reactor Coolant Pumps Following Loss of All AC Power Task 2, April 2015.

15. Westinghouse Report PWROG-14027-P, Rev 3, No. 1 Seal Flow Rate for Westinghouse Reactor Coolant Pumps Following Loss of All AC Power Task 3, April 2015.

16. WCAP-17601-P, Revision 1, Reactor Coolant System Response to the Extended Loss of AC Power Event for Westinghouse, Combustion Engineering and Babcock & Wilcox NSSS Designs, January 2013.

17. IP-CALC-15-00002, Rev. 1, IP2 Time to Reflux Cooling Calculation.

18. IP-CALC-14-00044, Rev. 1, IP2 RCS Inventory Evaluation for FLEX

19. IP-CALC-14-00042, Rev. 1, MAAP 4.0.5 Containment Analysis for an Extended Loss of all AC Power Event (ELAP)

20. EC 56002 Rev 0, Installation of an Orifice Plate on the Outer Flange of Flow Meters FIT-156B, -157B, -158B, -159B

21. IP-CALC-15-00017, Rev 0 (Westinghouse Number CN-SEE-I-15-2 Rev 0): Indian Point Reactor Coolant Pump Seal Leakoff Analysis with Flow Restricting Orifice

22. IP-CALC-15-00035, Rev. 1, Margin Gain in the Results of Applicable FLEX Calculations Using Input from IP CALC 15 00017

23. EC 50151, Rev. 1, IP2 FLEX Strategy Development.

24. IP-CALC-16-00049, Rev 0 (LPI Number A16070-C-001 Rev 0): Evaluation of Seal Leakage Effects on No. 1 Seal Leakoff Piping from Reactor Coolant Pumps to Containment Penetration R – Line 17.

ATTACHMENT 2 TO NL-16-089

INDIAN POINT 2 SUMMARY OF COMPLIANCE BASES FOR ORDER EA-12-051

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NO. 2
DOCKET NO. 50-247

Indian Point Unit Two's Compliance Letter for the Implementation of Order EA-12-051 Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

BACKGROUND

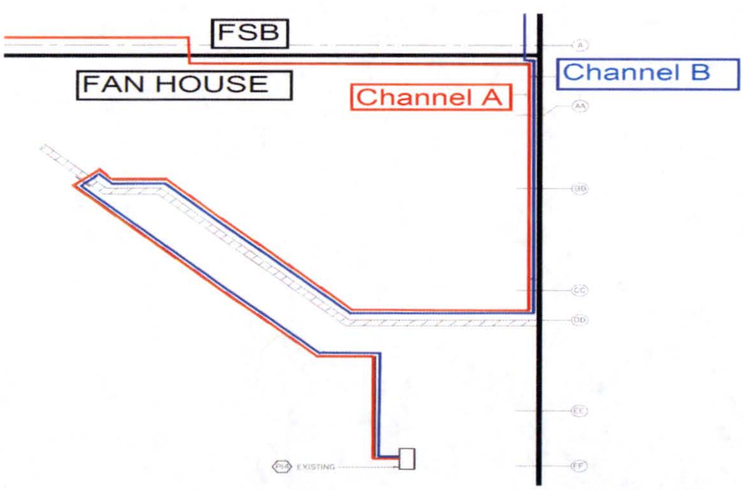
On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Order EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Reference 1) to Entergy. This Order was effective immediately and directed [Indian Point Units 2 and 3 to install reliable spent fuel pool instrumentation 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 Indian Point 2 (IP2) was June 14, 2016. The NRC staff requested that the compliance report be submitted within 60 days of the compliance date. The information provided herein documents full compliance for Indian Point 2 in response to the Order.

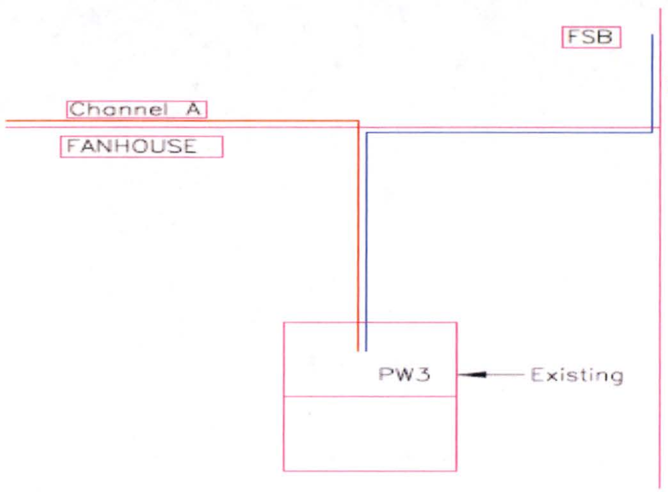
COMPLIANCE

IP2 has installed two independent full scale level monitors on the Unit 2 Spent Fuel Pool (SFP) in response to Reference 1. IPEC is a three unit site with Unit 1 decommissioned with an empty spent fuel pool and Units 2 and 3 each have a separate and associated spent fuel pool.

Entergy submitted the IPEC OIP by letter dated February 27, 2013 (Reference 2). Entergy responded to an NRC request for additional information (Reference 4) by letter dated August 20 2013 (Reference 5). The NRC letter of November 8, 2013 (Reference 6), the NRC provided its interim staff evaluations and requested additional information necessary for completion of the review. This information was uploaded to E-portal on September 30, 2014 with updates provided in the Entergy Status reports (References 7, 8, 9, and 10). The NRC conducted an Audit of the Entergy responses to Orders EA-12-049 and EA-12-051 and documented the results in Reference 9. Reference 10 contained a summary of the responses provided:

RAI #	IP2 Response Status	Status
1	Submitted in Reference 7	Closed During NRC Audit (Reference 9)
2	Uploaded to e-portal September 30, 2014 **RAI #2** **Please provide a description of the protection provided for the cabling routed along the exterior of the fuel building for Channel B of IP2 and IP3. Also, please provide a sketch to illustrate the remaining cable routing from the fuel building wall penetrations to the processor units for Channel A and Channel B for IP2 and IP3.** The immediately following response replaces what was provided in	Closed During NRC Audit (Reference 9)

RAI #	IP2 Response Status	Status
	the 3rd Six-Month Status Report. For IP3, Channel A will penetrate through the west wall into the Fan House approximately 30 ft north of the doorway into the Fan House. The Fan House is a Seismic Class 1 structure that is protected against adverse weather conditions. The Channel B route will follow the east wall to the south wall, follow along the south wall and penetrate on the south side of the doorway between the Fan House and the Fuel Storage Building (FSB). Once outside the FSB, the two conduit runs will converge near the door between the FSB and the Fan House. Each channel will maintain plant design channelization requirements by remaining in their dedicated conduits. The two channels will be run down to the 67'-6" Elevation of the PAB Fan House. Both conduits are to be routed through the existing penetration south of the door between the Fan House and the upper mezzanine of the pipe penetration area. Once through the penetration they will be routed down the hall to the Gas Analyzer Rack, which is part of the retired in place Hydrogen Recombiner Panel. The two indicators will be mounted on the panel by removing the retired in place equipment and installing the level indicators. The IP3 SFPI cable routing within the Fan House is shown graphically in Figure 1.  **Figure 1:** IP3 SFPI Fan House Cable Routing For IP2, Channel A originates along the north side of the pool. The conduit runs along the north wall until the west wall then heads south along the west wall. It will penetrate through the west wall into the Fan House approximately 30 ft north of the doorway into the Fan House. The Fan House is a Seismic Class 1 structure that is protected against adverse weather conditions. The Channel B route	

RAI #	IP2 Response Status	Status
	will follow the east wall to the south wall, follow along the south wall and penetrate on the south side of the doorway between the Fan House and the Fuel Storage Building (FSB). Once outside the FSB, the two conduit runs will converge approximately 30 ft north of the door between the FSB and the Fan House. Each channel will maintain plant design channelization requirements by remaining in their dedicated conduits. The two channels will be routed along to the retired in place Hydrogen Recombiner Panel. The two indicators will be mounted on the panel by removing the retired in place equipment and installing the level indicators. The IP2 SFPI cable routing within the Fan House is shown graphically in Figure 2.  **Figure 2:** IP2 SFPI Fan House Cable Routing	
3	The NRC staff needs additional information on the seismic qualification of plant mountings for the new SFP level instrument electronics. Calculation FCX-00102 addresses the seismic adequacy of the Hydrogen Recombiner Panel, which supports the Mohr signal processor and backup DC battery cabinets. The mounting details for the signal processor and backup DC battery were designed to match the hardware used during the seismic testing performed by MOHR. MOHR report 1-0410-6 details the mounting connections consisting of commercial grade 3/8" bolts installed with spring nuts to P1000 Unistrut channels, which were then welded to a vertical steel panel. The Indian Point configuration, shown on drawing 504012, uses the same 3/8" bolts but eliminated the intermediary Unistrut channel and fastened the instruments directly to the steel panel. This panel was qualified as a seismic	Open, pending NRC review of seismic calculations IP-CALC-14-00086, IP-CALC-14-00087, and FCX-00102, which have been uploaded to the e-portal

RAI #	IP2 Response Status	Status
	structure per IPEC calculation FCX-00102. This testing verified the structural adequacy of the components under seismic conditions. The test response spectra given in the report were verified to envelope the spectrum that applies to the equipment as installed at IPEC. IPEC specific response spectra were obtained from Technical Report TR-92128-TR-01. All references are on the PORTAL under IPEC/2016 Audit Responses.	
4	The NRC staff needs more information on the methodology used for the seismic qualification of the new SFP level instrument electronics. MOHR has prepared site-specific seismic qualification reports for the IP3 SFP level instrument, which also bound IP2's seismic criteria. The qualification reports envelop all components of the new SFP level instrumentation required to be operational during a BDBEE and post-event. Therefore, the SFP instrumentation and electronic units are acceptable for use at the site. The analyses are contained in proprietary MOHR Test and Measurement LLC Reports: 1. NAI-1725-005, "Seismic Induced Hydraulic Response in the Indian Point 3 Spent fuel Pool" 2. 1-0410-6, "MOHR EFP-IL SFPI System Seismic Test Report" 3. 1-0410-9.17, "MOHR SFP-1 Site-Specific Seismic Analysis Report: Indian Point Energy Center Unit 3 (IP3)" Mounting bracket design and Seismic Category 1 mounting analysis are included in modification package EC-50865. Calculation IP-CALC-14-00087 shows that the SFPI Probe Mounting Bracket is structurally adequate and seismically qualified as all Interaction Ratios (IR) are less than one (1.0). Calculation IP-CALC-14-00086 addresses the seismic evaluation of all applicable conduit supports from the probes to the Hydrogen Recombiner panel. All references are on the PORTAL under IPEC/2016 Audit Responses. See bridging document (enclosed) Topics #8, 9 and 12	Open, pending NRC review of seismic calculations IP-CALC-14-00086, IP-CALC-14-00087, and FCX-00102, which have been uploaded to the e-portal
5	Uploaded to e-portal September 30, 2014 **Please address how other hardware stored in the SFP will not create adverse interaction with the fixed instrument location(s).** The immediately following response replaces what was provided in the 3rd Six-Month Status Report. As a part of the Engineering Change (EC) process for IP3, SFPI probe locations in the northwest and southeast corners were verified	Closed During NRC Audit (Reference 9)

RAI #	IP2 Response Status	Status
	to be free of stored SFP hardware. The IP2 SFPI probe locations, also in the northwest and southeast corners, will be verified to be free of stored SFP hardware. Future hardware additions to the SFP are controlled by procedure.	
6a	Uploaded to e-portal September 30, 2014 Please provide the following: a) Information indicating a) the temperature ratings for all system electronics (including sensor electronics, system electronics, transmitter, receiver and display) and whether the ratings are continuous duty ratings; and, b) what will be the maximum expected temperature in the room(s) in which the sensor electronics will be located under BDB conditions in which there will be no ac power available to run Heating Ventilation and Air Conditioning (HVAC) systems. b) Information indicating the maximum expected relative humidity in the room in which the sensor electronics will be located under BDB conditions, in which there is no ac power available to run HVAC systems, and whether the sensor electronics is capable of continuously performing its required functions under this expected humidity condition. c) Documentation or analysis of the maximum expected radiological conditions (dose rate and total integrated dose) to which the equipment located within the fan house will be exposed. The immediately following response replaces what was provided in the 3rd Six-Month Status Report. a) See bridging document Topic #3. b) See bridging document Topic #3. c) See bridging document Topic #3. During a BDBEE for IP3, the indicator/display processor is located in a low dose area on the 67'-6" elevation in Fan House. This elevation is below the level of the top of the fuel racks in the Fuel Storage Building, Elevation 69-7 ½". Section 3.4 of NEI 12-02 states that level instrument channels should be qualified for radiation levels for a normal refueling quantity of freshly discharged fuel with the SFP	Closed During NRC Audit (Reference 9)

RAI #	IP2 Response Status	Status
	water level at Level 3. Since Level 3 (70-7 ½") is a foot above the top of the fuel racks, lowering water levels to this level would not result in a reduction in shielding between the spent fuel assemblies and the location of the SFPI display in the Fan House at Elevation 67'-6". Dose rates in the area of the indicator/display processor will remain unchanged and thus remain acceptable for both electronics and operators. During a BDBEE for IP2, the indicator/display processor is located in a low dose area on the 88' elevation of the Upper Fan House, which is adjacent to the Fuel Storage Building. The operating floor of the IP2 Fuel Storage Building is at Elevation 95'-0". Therefore the concrete surrounding the SFP can be credited for shielding. This is in addition to other sources of shielding such as the walls between the buildings, as well as the distance to the display. Therefore, the increase in dose rate due to a Level 3 scenario in the SFP is negligible.	
6b	Uploaded to e-portal September 30, 2014 See 6a	Closed During NRC Audit (Reference 9)
6c	Uploaded to e-portal September 30, 2014 See 6a	Closed During NRC Audit (Reference 9)
7	Uploaded to e-portal September 30, 2014 Please provide information describing the anticipated environment for shock, shock test method, and test results regarding the processor. Also, please provide information on the anticipated environment for shock, a description of any analysis, and description of modeling related to the probe assembly. The immediately following was updated from the 3rd Six-Month Status Report to include changes based on issuance of the NRC Audit Report for the SFPI vendor (MOHR). See bridging document Topic #14.	Closed During NRC Audit (Reference 9)
8	Uploaded to e-portal September 30, 2014 Please provide information describing the anticipated environment for vibration, vibration test method, and test results regarding the processor. Also, please provide information on the anticipated environment for vibration, a description of any analysis, and description of vibration modeling related to the probe assembly.	Closed During NRC Audit (Reference 9)

RAI #	IP2 Response Status	Status
	The immediately following was updated from the 3rd Six-Month Status Report to include changes based on issuance of the NRC Audit Report for the SFPI vendor (MOHR). See bridging document Topic #14.	
9	Uploaded to e-portal September 30, 2014 Please provide analysis of the vendor analysis and seismic testing results and show that the instrument performance reliability, following exposure to simulated seismic conditions representative of the environment anticipated for the SFP structures at Indian Point Energy Center Units 2 and 3, has been adequately demonstrated. The immediately following was updated from the 3rd Six-Month Status Report to include changes based on issuance of the NRC Audit Report for the SFPI vendor (MOHR). See bridging document Topics #8, 9, 12, and 13.	Closed During NRC Audit (Reference 9)
10	Uploaded to e-portal September 30, 2014 Please provide the NRC staff with the final configuration of the power supply source for each channel so that the staff may conclude that the two channels are independent from a power supply assignment perspective. For IP3, Instrument Channel A is being powered from Instrument Bus 31, Circuit 28, and Instrument Channel B is being powered from Instrument Bus 32, Circuit 28. The immediately following response was added to what was provided in the 3rd Six-Month Status Report. For IP2, Instrument Channel A is being powered 120V AC Distribution Panel #1, Circuit 6, and Instrument Channel B is being powered 120V AC Distribution Panel #2, Circuit 6.	Closed During NRC Audit (Reference 9)
11	Submitted in Reference 9	Closed During NRC Audit (Reference 9)
12	Submitted in Reference 9	Closed During NRC Audit (Reference 9)
13	Uploaded to e-portal September 30, 2014 Please describe the evaluation used to validate that the display	Closed During NRC Audit (Reference 9)

RAI #	IP2 Response Status	Status
	location can be accessed without unreasonable delay following a BDB event. Include the time available for personnel to access the display as credited in the evaluation, as well as the actual time (e.g., based on walk-throughs) that it will take for personnel to access the display. Additionally, please include a description of the radiological and environmental conditions on the paths personnel might take. Describe whether the display location remains habitable for radiological, heat and humidity, and other environmental conditions following a BDB event. Describe whether personnel are continuously stationed at the display or monitor the display periodically. The FLEX Strategy and Staffing plans account for personnel available following a BDB event. The display location can be reached without unreasonable delay utilizing the "normal" path to access the 67'-6" elevation of the Fan House which is through the RCA Access point into the PAB and then into the Fan House. The PAB is a Seismic Cat I building and the path consists of hallways which can be accessed following a BDB event. A walkdown was performed from the CCR to the display location on the 67'-6" elevation of the Fan House and it was timed at less than or equal to 20 minutes. There are also multiple other pathways (dependent upon the path obstruction) to access the display if this primary route was not available following the BDB event. Sections 3.1.9 and 3.1.13 of EC-45666 explains that the radiological conditions of the display location, pre and post BDB event, remain unchanged (a low dose area) based on the location of the displays being located at an elevation (67'-6") lower than the top of the fuel racks and thus maintaining the same amount of shielding as during normal operation. IP-CALC-00068, Rev.0 analyzes the temperature conditions of the display location and concludes that although the area will have a peak high temperature of approximately 125 deg F, in an extreme heat condition, it will remain habitable for an Operator to access the display and obtain the level information. Entergy does not plan to have an Operator continuously stationed at the display but to monitor the display on an as needed basis. The immediately following response was added to what was provided in the 3rd Six-Month Status Report. For IP2, the FLEX Strategy and Staffing plans account for personnel available following a BDB event. The display location can be reached without unreasonable delay utilizing the "normal" path to access the 88'-0" elevation of the Fan House which is through the RCA Access point into the PAB and then into the Fan House. The PAB is a Seismic Cat I building and the path consists of hallways	

RAI #	IP2 Response Status	Status
	which can be accessed following a BDB event. A walkdown was performed from the CCR to the display location on the 80'-0" elevation of the Fan House and it was timed at less than or equal to 20 minutes. There are also multiple other pathways (dependent upon the path obstruction) to access the display if this primary route was not available following the BDB event. EC-50865 will evaluate the habitability of this location with an evaluation similar to that which was performed for Unit 3. Entergy does not plan to have an Operator continuously stationed at the display but to monitor the display on an as needed basis.	
14	Submitted in Reference 8	Reference 10 Section 9 (See Note)
15a	Submitted in Reference 7	Closed During NRC Audit (Reference 9)
15b	Submitted in Reference 7	Closed During NRC Audit (Reference 9)
16	Submitted in Reference 8	Closed During NRC Audit (Reference 9)
17	Submitted in Reference 8	Closed During NRC Audit (Reference 9)
18a	Submitted in Reference 8	Reference 10 Section 9 (See Note)
18b	Submitted in Reference 8	Reference 10 Section 9 (See Note)
18c	Submitted in Reference 8	Reference 10 Section 9 (See Note)
19 (new)	New _ Please describe the impact of the recent MOHR's SFPI equipment failure (failure of the filter coil (or choke) in particular) on the Indian Point' s SFP level instruments. Also, any actions/measures Indian Point plans to implement to address this equipment failure. If the equipment has been modified by the vendor, the equipment qualification needs to be re-evaluated. This issue is applicable to both IP2 and IP3. The vendor MOHR has determined the source of the failures is a miniature surface mount common-mode choke component used on the Video and Digicomp printed circuit boards (PCBs) within EFP-II signal processor. The new boards have equivalent substitute components that are less susceptible to transient electrical events. The substitute components have equivalent size, mass and solder attachment technique as the original components such that there is	Closed During NRC Audit subject to NRC approval based on review of additional requested material uploaded to the e-portal

RAI #	IP2 Response Status	Status
	no impact to the system mechanical characteristics. The components demonstrate equivalent electrical performance such that EMC characteristics are not significantly changed. Proprietary MOHR Report 1-1010-2; EFP-IL Mod 1 Modification Package addresses continued equipment qualification following the repair. This report has been reviewed and accepted by the NRC. The vendor recommended repair has been implemented on the IP2 equipment before the equipment was delivered to IP2. The initial installation and startup testing of the spent fuel pool level indication for IP2 was completed prior to startup. The vendor repair of the IP3 equipment was performed under warrantee repair PO 10445066 and 10449598. The Channel B failure was completed May 2015. The Channel A was removed prior to failure and sent to the vendor for warranty repair which was completed July 2015. The Facility Acceptance Test Report are captured under the MOHR test procedure 2014.01. EFP-IL00024 dated May 1, 2015 and EFP—IL00025 dated June 30, 2015. At Grand Gulf, a new failure on the recently repaired Channel B level indicator, was not related to the previous issue discussed above. It is due to infant mortality rate relate to a cold solder joint and is believed to be isolated to the Grand Gulf unit there is no indication of this issue at IP2 or 3	

Note: Closed during audit exit (Reference 9) subject to NRC approval based on review of additional requested material uploaded to the e-portal.

Compliance with Order EA-12-051 was achieved using the guidance in Nuclear Energy Institute (NEI) document NEI 12-02 (Reference 3) which has been endorsed by the NRC (Reference 10). Enclosure 3 contains the Vendor – Indian Point Bridging Document requested by NRC.

REFERENCES

1. NRC Order Number EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation, dated March 12, 2012 (ML12054A682).
2. Entergy Letter to NRC (NL-13-043), Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation, dated February 27, 2013 (ML 13072A082).
3. NEI 12-02, Industry Guidance for Compliance with NRC Order EA-12-051, "To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation", Revision 1, dated August 2012.

4. NRC Letter Requesting Additional Information Regarding Reliable Spent Fuel Pool Instrumentation, Order no. EA-12-051 (TAC Nos. MF0737 and MF0738), dated June 25, 2013 (ML13169A127).

5. Entergy Letter to NRC (NL-13-103) Response to Request for Additional Information (RAI) Regarding Reliable Spent Fuel Pool (SFP) Instrumentation (Order No, EA-12-051) (TAC NOS. MF0737 and MF0738) dated August 20, 2013 (ML13239A238).

6. NRC Letter to Entergy 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 (TAC Nos. MF0737 and MF0738), Dated November 8, 2013. (ML13298A805).

7. Entergy letter to NRC (NL-14-109), Indian Point Energy Center's Third Six-Month Status Report for the Implementation of Order EA-12-051 Modifying Licenses with Regard to Requirements for to Reliable Spent Fuel Pool Instrumentation (TAC Nos. MF0737 and MF0738), dated August 27, 2014

8. Entergy letter to NRC (NL-15-026), Indian Point Energy Center's Fourth Six-Month Status Report for the Implementation of Order EA-12-051 Modifying Licenses with Regard to Requirements for to Reliable Spent Fuel Pool Instrumentation (TAC Nos. MF0737 and MF0738), dated February 27, 2015 (ADAMS Accession No. ML15065A123)

9. NRC Letter to Entergy Regarding Report for the Onsite Audit Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Instrumentation Related to Orders EA 12-049 and EA 12-051 (TAC Nos. MF0744, MF0745, MF0737 and MF0738), dated December 9, 2014 (ML14335A642).

10. NRC Interim Staff Guidance JLD-ISG-2012-03, Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation, Revision 0, dated August 29, 2012 (ML12221A339).

ENCLOSURE 1 TO NL-16-089

INDIAN POINT ENERGY CENTER UNITS 2 AND 3

NEI 12-01 PHASE 2 STAFFING ASSESSMENT (REV, 3), MAY 18, 2016

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NO. 2
DOCKET NO. 50-247

Entergy.

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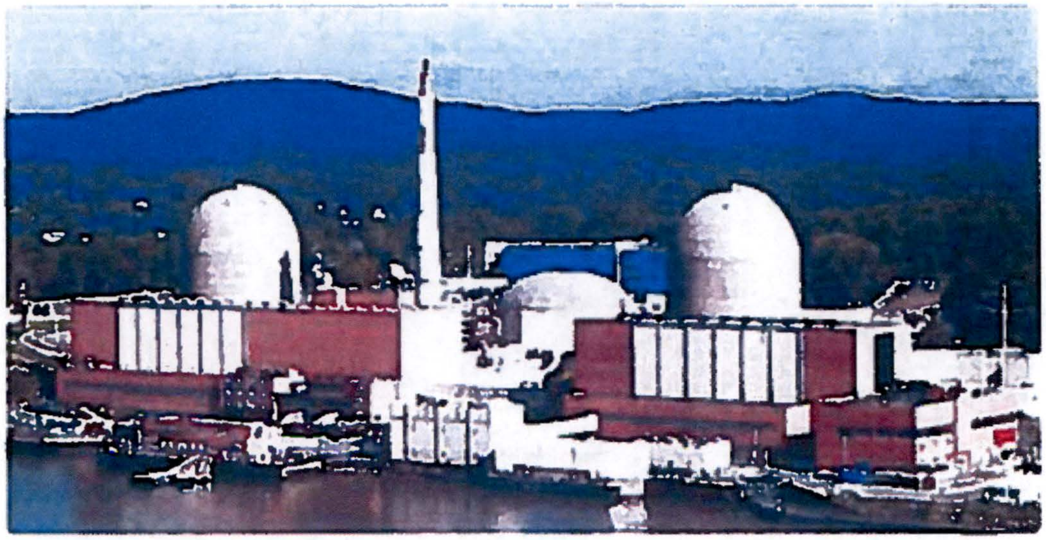

ENTERGY

INDIAN POINT ENERGY CENTER
UNITS 2 AND 3
NEI 12-01 PHASE 2
STAFFING ASSESSMENT (REV. 3)

MAY 18, 2016

Prepared: _______________ 5/18/16
Milton Fred Guynn, Fukushima ERO Logistics — Date

Reviewed: _______________ 5/26/16
David Powell, IPEC Operations, FLEX Marshal — Date

Table of Contents

1.0 EXECUTIVE SUMMARY

Beyond Design Basis External Events (BDBEE) are events initiated by natural phenomena that either exceed the protections provided by design basis features or involve natural phenomena within the design basis in combination with beyond design-basis failures leading to an extended loss of ac power (ELAP) and/or loss of access to the ultimate heat sink (LUHS).

Using the methodology of (Nuclear Energy Institute) NEI 12-01, Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities, this revised report (Rev. 3) presents the results of an assessment of the capability of the Indian Point Energy Center (IPEC) on-shift staff and augmented Emergency Response Organization (ERO) to respond to a BDBEE. Changes made in Rev. 3 were limited to adjustments to task assignments as detailed in the FLEX Implementation Timeline (Att. 2). The task assignment change eliminated the need to replace a damaged radio antenna at the onset of a BDBEE. Further evaluations identified sufficient redundant radio channels, each with separate antennas, are available and can be easily transferred between Units 2 and 3 to ensure radio communications remain available for both units if an antenna is damaged by the event. This revision does not change the overall conclusions of the assessment as detailed in the original report.

The assumptions for the NEI 12-01 Phase 2 scenario postulate that the BDBEE involves a large-scale external event that results in:

- an extended loss of AC power
- an extended loss of access to ultimate heat sink
- impact on all units (all units are operating at full power at the time of the event)
- impeded access to the units by off-site responders as follows:
  (1) 0 to 6 Hours Post Event – No site access.
  (2) 6 to 24 Hours Post Event – Limited site access. Individuals may access the site by walking, personal vehicle or via alternate transportation capabilities (e.g., private resource providers or public sector support).
  (3) 24 Hours Post Event – Improved site access. Site access is restored to a near-normal status and/or augmented transportation resources are available to deliver equipment, supplies and large numbers of personnel.

To conduct the on-shift portion of the assessment, a team of subject matter experts from Operations, Operations Training, Radiation Protection, Chemistry, Security, Emergency Planning and FLEX Project Team personnel performed a tabletop in July 2014. The participants reviewed the assumptions and applied procedural guidance, including applicable draft and approved FLEX Support Guidelines (FSGs) for coping with a BDBEE using minimum on-shift staffing. Particular attention was given to the sequence and timing of each procedural step, its duration, and the on-shift individual performing the step to account for both the task and the estimated time to prepare for and perform the task. A validation and verification of the time and resources needed to reasonably assure required tasks, manual actions and decisions for FLEX strategies are feasible and may be executed within the time constraints identified in the Overall Integrated Plan (OIP) / Final Integrated Plan (FIP) was also conducted.

The validated and verified Phase 2 Staffing Assessment concluded that the current minimum on-shift staffing as defined in the IPEC Emergency Plan is sufficient to support the implementation of the mitigating strategies (FLEX strategies) on Units 2 and 3, as well as the required Emergency Plan action, with no unacceptable collateral tasks assigned to the on-shift personnel during the first 6 hours. The assessment also concluded that the on-shift staffing, with assistance from augmented staff, is capable of implementing the FLEX strategies necessary after the 6 hour period within the constraints. It was concluded that the Emergency response function would not be degraded or lost.

This assessment also concluded that sufficient personnel resources exist in the current IPEC augmented ERO to fill positions for the expanded emergency response functions. Thus, the ERO resources and capabilities necessary to implement Transition Phase coping strategies performed after the end of the "no site access" 6-hour time exist in the current program.

2.0 INTRODUCTION

The Nuclear Regulatory Commission (NRC) issued a Letter to All Power Reactor Licensees and Holders of Construction Permits in Active or Deferred Status, dated March 12, 2012, *Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendation 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident.* Information requests related to Emergency Planning were contained in Enclosure 5 of the §50.54(f) letter. Enclosure 5 contained two requested actions; one involving performance of a staffing assessment and the other a communications assessment. The communications assessment is independent of the staffing assessment and not included as part of this report. The Phase 2 staffing assessment addresses Requested Information Items 1, 2, and 6 of NTTF Recommendation 9.3. The actions for the staffing assessment are summarized as follows:

> *It is requested that addressees assess their current staffing levels and determine the appropriate staff to fill all necessary positions for responding to a multi-unit event during a beyond design basis natural event and determine if any enhancements are appropriate given the considerations of Near-Term Task Force (NTTF) Recommendation 9.3.*

A two-phased approach was established by the industry to respond to the information requests contained in the §50.54(f) letter associated with staffing. Additionally, NEI developed a technical report (NEI 12-01, *Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities*) that includes the recommended criteria for use in performing the staffing assessment for a BDBEE. The criteria provides for documenting the organizational capabilities that will facilitate simultaneous performance of extended coping capabilities following a BDBEE.

Note – Use of the term ELAP throughout this report also assumes a loss of access to the ultimate heat sink as part of the event. The use of the terms Phases 1, 2, and 3 refers to Initial Phase, Transition Phase and Final Phase respectively as referenced in the Mitigating Strategies Order and NRC JLD-ISG-2012-1.

3.0 SCOPE OF THE ELAP ERO STAFFING ASSESSMENT

All sites with one or more operating units are required to perform a Phase 2 staffing assessment no later than 4 months prior to beginning of the second refueling outage (as used within the context of NRC Order EA-12-049). The Phase 2 assessment considers the staffing necessary to implement actions that address functions related to Fukushima NTTF Recommendation 4.2. Licensees of multi-unit sites have two options for providing the Phase 2 staffing assessment:

- Provide one Phase 2 staffing assessment applicable to all on-site units. This assessment should be provided 4 months prior to the first occurrence of a second refueling outage at the site (i.e., the first "second refueling outage"). This option may be used by sites that will employ essentially identical mitigation strategies for all on-site units.

- Provide two or more Phase 2 staffing assessments as applicable to the different on-site units. Each assessment should be provided 4 months prior to the occurrence of the second refueling outage of the unit to which the assessment is applicable. This option may be used by all sites that will employ different mitigation strategies for on-site units.

IPEC Unit 2 and Unit 3 staffing assessments were performed per the guidance of the first option to conduct one assessment applicable to both units with a submittal date no later than November 3, 2014 based on the Unit 3 FLEX implementation. The intent of this assessment was to perform the following:

1 Evaluate the ability of the on-shift staff to implement Initial Phase coping actions and, consistent with the site access assumption, evaluate Transition Phase actions that must be performed prior to the end of the "no site access" time period.
   - Initial Phase – Implementation of strategies that generally rely upon installed plant equipment.
   - Transition Phase – Implementation of strategies that involve the use of on-site portable equipment and consumables to extend the coping period, and prevent a loss of functions needed for core cooling, containment integrity, and spent fuel pool cooling. Setup for these strategies may be performed prior to the end of the Initial Phase as determined by procedure.

2 Evaluate the ability of the on-shift staff to implement the Station Blackout (SBO) coping strategies in place before ELAP is declared.

3 Evaluate the EOPs and FSGs for responding to an ELAP affecting both units. (Note: Draft FSGs and draft emergency operating procedures revised for FLEX implementation were used.)

4 Evaluate whether the ability of the on-shift staff to perform any required emergency response functions would be degraded or lost prior to the arrival of the augmented ERO.

5 Consistent with the site access assumption, evaluate the ability of the on-shift staff and augmented staff to implement Transition Phase coping strategies performed after the end of the "no site access" time period.

The staffing level determined as a result of the Phase 2 assessment was verified and validated to reasonably assure required tasks, manual actions and decisions for FLEX strategies are feasible and may be executed within the constraints identified in the Overall Integrated Plan (OIP) or order EA 12-049. The validation was performed and is documented in the report titled "Entergy Indian Point Station FLEX Validation" dated 12/02/2015 and follow-up evaluations titled "IPEC Unit 2 Strategy Changes and Impact to FLEX Validation" dated 03/15/2016 (CIN 2016-00030) and "IPEC Unit 3 Strategy Changes and Impact to FLEX Validation" dated 04/06/2016 (CIN 2016-00070).

4.0 EMERGENCY PLAN MINIMUM ON-SHIFT STAFFING

The IPEC Emergency Plan establishes the licensing basis for the on-shift staffing complement as determined by the staffing assessment performed as part of the overall Emergency Planning rulemaking published in November of 2011. Only personnel required to be on-shift are credited in the Phase 2 Staffing Assessment for the initial 6 hours of the event. The following table indicates the on-shift personnel necessary to perform Initial Phase plant operations and the required emergency planning functions.

Position	NUREG-0654 Functional Area/Tasks U2 staff	NUREG-0654 Functional Area/Tasks U3 staff	On-Shift Staffing U2	On-Shift Staffing U3
Shift Manager (SM)	Emergency Direction and Control/ Safe Shutdown / Assessment of Operational Aspects	Emergency Direction and Control/Safe Shutdown / Assessment of Operational Aspects	1	1
Control Room Supervisor (CRS)	Plant Operations/Safe Shutdown / Assessment of Operational Aspects	Plant Operations/Safe Shutdown / Assessment of Operational Aspects	1	1
Shift Technical Advisor (STA)	Plant System Engineering / Technical Support	Plant System Engineering / Technical Support	1	1
Reactor Operators (RO)	Plant Operations/Safe Shutdown / Assessment of Operational Aspects	Plant Operations/Safe Shutdown / Assessment of Operational Aspects	2	2
Nuclear Plant Operator (NPO)	Plant Operations/Safe Shutdown/Fire Brigade	Plant Operations/Fire Brigade	5	4
Nuclear Plant Operator (NPO)	Communicator / Notifications			1
Chemistry	Chemistry/Offsite Dose Assessment	Chemistry/Offsite Dose Assessment	1	1
Radiation Protection (RP)	Radiological Assessment / In-plant Protective Actions	Radiological Assessment / In-plant Protective Actions	1	1

Nuclear Plant Operator U1	(available for operations/safe shutdown where qualified / other as directed by Emergency Director)	1	
SRO	Fire Brigade Leader for both units (available for plant operations/safe shutdown in non-fire events on unit licensed on and other as directed by the Emergency Director)		1
Security	Access Control and Accountability	Per Security Contingency Plan	

Emergency plan tasks of repair and corrective action, first aid and rescue operations are provided by personnel assigned other functions as allowed by NUREG-0654 Table B-1 and NEI 10-05. The SM provides emergency direction and control of plant operations and assessment of operational aspects.

5.0 PHASE 2 STAFFING ASSESSMENT FOR BDBEE/ELAP

5.1 On-shift Staff Responsibilities

On-shift staff responsibilities and actions assumed in the tabletop are as follows:

- U2 SM assumed the Emergency Director (ED) function
- On-shift Communicator was available to perform off-site notifications
- The (2) CRSs, (4) ROs, (1) FBL SRO, and (10) NPOs were available to perform plant operations to establish and maintain core cooling, spent fuel pool level, and containment integrity as directed by each unit CRS using ECAs, and FSGs.
- Two RP Technicians and two Chemistry Technicians were available to perform their emergency plan functions and other tasks as directed by the Shift Manager in either unit.

  (1) One of the two Chemistry Technicians was responsible for the task of dose assessment should a release occur. Both are qualified and either may be called to the control room to perform the function should a release occur. Otherwise, they were available to perform tasks to implement FLEX as directed by SM/ED.
  (2) One of the two RP techs was available to perform job support, in-plant surveys, and onsite surveys as directed by the SM/RD. Either RP tech could be called upon for the task when needed; otherwise they were available to perform tasks to implement FLEX as directed by the Shift Manager.

- The U3 SM was available to assist the ED with other communications such as contacting the Corporate Duty Manager, or Corporate Emergency Center (CEC) and coordinating request for resources.
- Existing coping strategies do not anticipate the use of Security Officers other than to perform duties related to their assigned security roles. Tasks assigned for FLEX response are consistent with their normal duties such as monitoring and controlling sites access, providing site access for FLEX equipment staging, and providing

compensating measures for vital area doors that may need to remain open to facilitate room environmental conditions or staging and operation of FLEX equipment.

- It was assumed that the Emergency Director and Communicator functions and responsibilities remained in the Control Room throughout the duration of this assessment. It is recognized, however, that the augmented ERO would be expected to arrive on-site or at their designated off-site facilities and assume these functions from the Control Room as soon as possible.

5.2 Methodology

- The Phase 2 staffing assessment for response functions related to NTTF Recommendation 4.2 was based on the actions delineated in the procedures and guidelines developed in response to the Order to ensure accurate results.
- IPEC Unit 2 procedures were not available at the time of the original assessment however; the strategies are similar on both units so all transition strategies identified in the Implementation Plan for both units were considered. Once developed, the Unit 2 procedures were reviewed and found to be consistent with the assumptions used to develop the original assessment report and timeline. Unit 2 and Unit 3 procedures were used to perform the verification and validation.
- A tabletop was used to determine what plant actions and emergency plan implementation actions were required based on procedures during an ELAP. In cases where multiple tasks were assigned to an individual, the team evaluated the timing of the tasks to ensure that they could be performed by the individual in series within any specified time constraints. A team of Emergency Planning, Operations, Operations Training, Security, Chemistry, and FLEX Project Team personnel completed the assessment of the on-shift staff's response to a BDBEE and ELAP.
- The guidance of NEI 10-05 was used to determine if the number and composition of the on-shift staff is sufficient to implement the Emergency Plan, Initial Phase actions and, with assistance from augmented staff, implement Phase 2 mitigation strategies and repair or corrective actions intended to maintain or restore the functions of core cooling, containment integrity, and spent fuel pool makeup for both units.
- The guidance of NEI 10-05 was used but the tables were modified to include tasks to implement the FLEX strategies.
- Due to the lead time before Phase 3, it was assumed that offsite equipment would arrive on site and appropriate staff would be available to receive, stage, and operate the equipment. Therefore, the staffing assessment did not consider Phase 3 FLEX strategies.

5.3 NEI 12-01 General Assumptions and Limitations

- A large-scale external event occurs that results in:
  - all onsite units affected
  - extended loss of AC power with simultaneous LUHS
  - impeded access to all units
- Initially, all on-site reactors are operating at full power and are successfully shut down.
- A Hostile Action directed at the affected site does not occur during the period that the site is responding to the event.
- The event impedes site access as follows:

- Post event time: 0 to 6 hours - No site access. This duration reflects the time necessary to clear road way obstructions, use different travel routes, mobilize alternate transportation capabilities, etc.
- Post event time: 6 to 24 hours - Limited site access. Individuals may access the site by walking, personal vehicle or via alternate transportation capabilities.
- 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.

5.4 Other Assumptions for Staffing Assessment

- The result of the beyond-design-basis event may place the plant in a condition where it cannot comply with certain Technical Specifications and/or with its Security Plan, and as such, may warrant invoking 10 CFR 50.54(x) and/or 10 CFR 73.55(p).
- For purposes of assessing augmented staffing, it is assumed that the on-shift staff successfully performs all Initial Phase and any necessary Transition Phase coping actions during the 0-6 hour period. It is assumed an adequate number of augmented ERO members arrive on site between 6 hours and 24 hours to assist the on-shift staff to successfully implement the appropriate FLEX strategies and FSGs.

  ***Initial Phase** – Implementation of strategies that generally rely upon installed plant equipment.*
  ***Transition Phase** – Implementation of strategies that involve the use of portable equipment and consumables to extend the coping period, and maintain or restore the functions of core cooling, containment integrity, and spent fuel pool cooling.*

- On-shift personnel are limited to the minimum complement allowed by the site emergency plan (i.e., the minimum required number for each required position). This would typically be the on-shift complement present during a backshift, weekend, or holiday.
- Off-site emergency response facilities and staging areas are available, including those located within the 25 mile telecommunications blackout range.

5.5 NEI 12-06 Staffing Assumptions

- The FLEX strategies documented in the event sequence analysis assume:
  - No independent, concurrent events
  - All personnel onsite are available to support site response
  - All reactors on-site initially operating at power, unless site has procedural direction to shut down due to the impending event.

5.6 NEI 10-05 Applicable Assumptions to support Methodology

- On-Shift personnel can report to their assigned response locations within timeframes sufficient to allow for performance of assigned actions.
- The on-shift staff possesses the necessary Radiation Worker qualifications to obtain normal dosimetry and to enter Radiologically Controlled Areas (but not high, locked high or very high radiation areas unless allowed by procedure or Emergency Plan) without the aid of a Radiation Protection Technician.

- Performance of site and protected area access control function is regularly analyzed through other station programs and will not be evaluated here, unless a role or function from another major response area is assigned as a collateral duty.
- The task of making a simple and brief communication has minimal impact on the ability to perform other assigned functions/tasks, and is therefore an acceptable collateral duty for all positions. Examples include making a plant page announcement or placing a call for assistance to an offsite resource such as local law enforcement. This assumption does not apply to emergency notification to an Offsite Response Organization (ORO) or the NRC.
- The task of performing a peer check has minimal impact on the ability to perform other assigned functions/tasks, and is therefore an acceptable collateral duty for all positions. Examples include performing a peer check on a recommended emergency classification or notification form for transmittal to offsite authorities.
- The analyzed event occurs during off-normal work hours at a time when augmented ERO responders are not at the site (e.g., during a backshift, weekend or holiday).

5.7 Severe Accident Management Guideline (SAMG)

- It was concluded in the Phase 2 Staffing Assessment that the on-shift staff and augmented ERO would not be called upon to perform SAMG activities for the event analyzed for this report. The IPEC FLEX strategy is assumed to be successful to the extent that SAMG entry will not be necessary.

5.8 Assessment of the INITIAL PHASE Coping Strategies and Capability

- The Phase 2 staffing assessment for the Initial Phase actions during the first 6-hours concluded that there were no task overlaps for the activities assigned to the on-shift staff and the ability of the on-shift staff to perform any required emergency response functions were not degraded or lost. Refer to Attachment 1, Phase 2 Staffing Assessment NEI 10-05 Tabletop Data and Attachment 2, IPEC FLEX Implementation Timelines.

5.9 Assessment of TRANSITION PHASE Coping Strategies and Capability

- <u>On-shift Staff</u> Transition Phase Coping Actions (Hours 0 – 6)

  The Transition Phase requires providing sufficient, portable, on-site equipment and consumables to maintain or restore functions until they can be accomplished with resources brought from off site. Actions include:
  1) Initial Assessment and FLEX Equipment Staging (FSG-005)
  2) DC Load Shed (FSG-004)
  3) Debris removal (0-FSG-201)
  4) Deploy FLEX Phase 2 Generator, Connect cables and start DG (FSG-005)
  5) Deploy and stage additional FLEX equipment (0-FSG-201)
  6) Alternate AFW/EFW Suction Source (FSG-002)

- Augmented ERO and On-shift Staff Transition Phase Coping Actions

  The following tasks are assumed to be performed by the on-shift and augmented staff after the 6 hour no access period using limited augmented ERO members as shown in Attachment 2.
  1) Long Term RCS Inventory Control (FSG-001)
  2) Makeup to the Spent Fuel Pool (FSG-011)
  3) Alternate Low Pressure Feedwater (FSG-003)
  4) Alternate CST Makeup (FSG-006)
  5) Refuel FLEX equipment (FSG-005)

6.0 AUGMENTED ERO

6.1 ERO Response

- The methods to notify and augment the ERO was identified in *Entergy's 90-Day Response to the March12, 2012 Information Request, Action Plan for Completing Emergency Communication and Staffing Assessments* ((NL-12-075) and in Entergy Letter dated April 30, 2013, *Entergy's Response to the March 12, 2012, Information Request, Enclosure 5, Recommendation 9.3, Emergency Preparedness - Staffing, Requested Information items 1, 2, and 6 (Phase 1 Staffing Assessment).* (NL-13-70) The Phase 1 Staffing Assessment addressed site access for the augmented ERO.

6.2 Expanded Emergency Response

- The expanded emergency response was identified in the Phase 1 Staffing Assessment submitted in Entergy Letter dated April 30, 2013, *Entergy's Response to the March 12, 2012, Information Request, Enclosure 5, Recommendation 9.3, Emergency Preparedness - Staffing, Requested Information items 1, 2, and 6.*
- The Phase 2 Staffing Assessment revised the expanded emergency response table by including the recommended expanded response described in NEI 12-01 Table 3.2. The revised portion of the expanded response is shown in Attachment 3. The expanded response table and implementation guidance is provided in a FLEX Support Guideline.

7.0 PHASE 2 STAFFING ASSESSMENT CONCLUSION

7.1 Staffing Level

This validated and verified assessment concluded that the current minimum on-shift staffing as defined in the IPEC Emergency Plan, is sufficient to support the implementation of the ELAP strategies on Units 2 and 3, as well as the required Emergency Plan actions, with no unacceptable collateral duties. The staffing assessment did not identify the need for additional on-shift staff.

The NPOs performed tasks in series when necessary and were able to timely perform all assigned functions. The NPOs performed actions to ensure core cooling, containment integrity, and spent fuel pool makeup could be implemented as designed. The performance of coping strategies does not impact the ability of the on-shift staff to perform any required emergency response function. Emergency response functions would not be degraded or lost prior to the arrival of the augmented ERO.

The existing on-shift staff and augmented ERO is sufficient to implement existing BDBEE and ELAP strategies on both units simultaneously while continuing to perform required Emergency Planning tasks without unacceptable collateral duties. No change to the on-shift staffing level or augmented ERO is required. The emergency plan will not be changed as a result of the shift staffing assessment. No interim actions have been taken or are planned as a result of the assessment.

7.2 Task Analysis Results

Refer to Attachment 1, Phase 2 Staffing Assessment NEI 10-05 Tabletop Data, and Attachment 2, IPEC FLEX Implementation Timelines, for the analysis of on-shift staffing tasks.

- The task analysis did not identify any unassigned tasks.
- The task analysis did not identify any task overlaps that were performed by the on-shift staff.
- The time to perform the tasks was best estimate of the assessment team based on operating experience and for those tasks identified as being "time sensitive", were validated as being bounded by the time allotted for performing the tasks as noted in Att. 2.

7.3 Time Motion Study (TMS) Results

Collateral tasks were not identified, therefore a time motion study was not required. Refer to Attachment 2, IPEC FLEX Implementation Timelines, for the on-shift staffing task timing and sequence analysis results.

7.4 Augmented and Expanded ERO Assessment Results

The existing ERO is sufficient to fill augmented ERO positions and those positions needed to support expanded response positions assigned as necessary if responding to a BDBEE on both units. IPEC has four ERO teams that have been trained to respond to the site.

8.0 REFERENCES

8.1 NEI 12-01, Rev 0, *Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities*

8.2 NEI 10-05, Rev 0, *Assessment of On-Shift Emergency Response Organization Staffing and Capabilities*

8.3 NSIR DPR-ISG-01, *Interim Staff Guidance – Emergency Planning for Nuclear Power Plants*

8.4 NRC Letter to All Power Reactor Licensees and Holders of Construction Permits in Active or Deferred Status, dated March 12, 2012, *Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendation 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident.*

8.5 NRC Order Number EA-12-049, dated March 12, 2012, Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events

8.6 Entergy letter (NL-12-054) to the NRC dated May 11, 2012, *Entergy's 60-Day Response to the March 12, 2012, Information Request, Action Plan for Completing Emergency Communication and Staffing Assessments (ML12144A157)*

8.7 Entergy Letter (NL-12-075) dated June 8, 2012, *Entergy's 90-Day Response to the March 12, 2012, Information Request, Action Plan for Completing Emergency Communication and Staffing Assessments (ML12164A566)*

8.8 Entergy Letter (NL-13-070) dated April 30, 2013, *Entergy's Response to the March 12, 2012, Information Request, Enclosure 5, Recommendation 9.3, Emergency Preparedness - Staffing, Requested Information items 1, 2, and 6 (Phase 1 Staffing Assessment)*

8.9 NRC Interim Staff Guidance JLD-ISG-2012-01, Rev. 0, dated August 29, 2012, Compliance with Order EA-12-049, Order Modifying Strategies for Beyond-Design-Basis External Events

8.10 NEI 12-06 Rev. 0, August 2012, *Diverse and Flexible Coping Strategies (FLEX) Implementation Guide*

8.11 IP-RPT-13-00059 Rev 02, *IP3 FLEX Strategy Development*

8.12 Indian Point Energy Center Emergency Plan

8.13 Entergy Indian Point Station FLEX Validation dated 12/02/2015

8.14 Entergy Validation evaluation "IPEC Unit 2 Strategy Changes and Impact to FLEX Validation" dated 03/15/2016 (CIN 2016-00030).

8.15 Entergy Validation evaluation "IPEC Unit 3 Strategy Changes and Impact to FLEX Validation" dated 04/06/2016 (CIN 2016-00070).

9.0. ATTACHMENTS

ATTACHMENT 1	PHASE 2 STAFFING ASSESSMENT NEI 10-05 TABLETOP DATA
ATTACHMENT 2	IPEC FLEX IMPLEMENTATION TIMELINES
ATTACHMENT 3	EXPANDED EMERGENCY RESPONSE TABLE

Attachment 1 Phase 2 Staffing Assessment NEI 10-05 Tabletop Data

Note
NEI-10-05 Tables are modified to include Emergency Plan and FLEX implementation tasks.

1. Accident Summary:

- A large-scale external event occurs that results in:
  - All on-site units affected
  - ELAP/LUHS
  - Impeded access to the units
- Initially, both units are operating at full power and are successfully shut down.
- The event results in a Site Area Emergency based on EAL SS1.1. The event is upgraded to a General Emergency SG1.1 once it has been determined that power cannot be restored before the station blackout coping time will be exceeded.
- The most limiting hazard for on-shift staffing was used for the assessment. On-shift personnel respond as shown in Attachment 2.

2. Accident Assumptions:

- The start and load manual actions for SBO Diesel Generators are unsuccessful.
- Attachment 2 assumptions include:
  - SM/CRS are expected to use available staff to provide periodic relief (if needed) for individuals working in extreme environmental conditions (e.g., high heat areas).
  - Estimated task times include expected pre-job and safety briefings
  - Augmented Chemistry support is available to relieve Chemistry of Dose Assessment at T > 6 hours
- Assumptions are identified in Section 5.0 of this document.

3. Procedures Reviewed for Accident Response Include:

- <u>Common Control Room</u>
  IP-EP-115, Emergency Plan Forms
  IP-EP-120, Emergency Classification
  IP-EP-210, Central Control Room
  IP-EP-410, Protective Action Recommendation
- <u>U2 Procedures</u>
  2-ECA-0.0, Loss of All AC Power
  2-AOP-SFP.1, Loss of Spent Fuel Pit Cooling
- <u>U3 Procedures</u>
  3-ECA-0.0 Loss of All AC Power
  3-AOP-SFP.1, Loss of Spent Fuel Pool Cooling
- <u>U2 FLEX Support Guidelines</u>
  2-FSG-001, Long Term RCS Inventory Control
  2-FSG-002, Alternate AFW/EFW Suction Source
  2-FSG-003, Alternate Low Pressure Feedwater

2-FSG-004, ELAP DC Bus Load Shed /Management
2-FSG-005, Initial Assessment and FLEX Equipment Staging
2-FSG-006, Alternate CST Makeup
2-FSG-011, Alternate SFP Makeup and Cooling

- U3 FLEX Support Guidelines
  3-FSG-001, Long Term RCS Inventory Control
  3-FSG-002 Alternate AFW/EFW Suction Source
  3-FSG-003, Alternate Low Pressure Feedwater
  3-FSG-004, ELAP DC Bus Load Shed /Management
  3-FSG-005, Initial Assessment and FLEX Equipment Staging
  3-FSG-006, Alternate CST Makeup
  2-FSG-011, Alternate SFP Makeup and Cooling
- Common FLEX Support Guidelines
  0-FSG-100, BDBEE / ELAP Emergency Response
  0-FSG-101, BDBEE / Emergency Communications
  0-FSG-201, Staging FLEX Equipment
  0-FSG-202, Refueling FLEX Equipment

NOTE: NEI 10-05 Tables 1-5 shown here are modified to include Emergency Plan and FLEX implementation tasks

IPEC TABLE 1 – ON-SHIFT POSITIONS Multi-Unit ELAP/LUHS				
Line #	**On-shift Position**	**Role in Table # / Line #**	**Unanalyzed Task?**	**Collateral Tasks? (See Attachment 2 for Task sequence & timeline)**
1	U2 SM	T2/L1 T5/L1 T5/L2 T5/L3 T5/L5 T5/L8 T5/L10	No	No
2	U2 CRS	T2/L2	No	No
3	U2STA	T2/L3	No	No
4	U2 RO #1	T2/L4	No	No
5	U2 RO #2	T2/L5	No	No
6	U2 NPO #1	T2/L6	No	No
7	U2 NPO #2	T2/L7	No	No
8	U2 NPO #3	T2/L8	No	No
9	U2 NPO #4	T2/L9	No	No
10	U2 NPO #5	T2/L10	No	No
11	U2 Chemistry	T2a/L24	No	No
12	U2 RP	T4/L1 T4/L2 T2a/L22	No	No (Refer to ATT 2)
13	U3 SM	T2/L11 T5/L14	No	No
14	U3 CRS	T2/L12	No	No
15	U3 STA	T2/L13	No	No
16	U3 RO #1	T2/L14	No	No
17	U3 RO #2	T2/L15	No	No
18	U3 NPO #1	T2/L16	No	No
19	U3 NPO #2	T2/L17	No	No
20	U3 NPO #3	T2/L18	No	No
21	U3 NPO#4	T2/L19	No	No

22	U3 Chemistry	T2a/L25	No	No
23	U3 RP	T4/L4 T2a/L23	No	No (Refer to ATT 2)
24	U1 NPO	T2/L20	No	No
25	Communicator	T5/L6 T5/L9 T5/L13	No	No
26	SRO FBL	T2/L21	No	No
27	Security	T5/L15	No	No

IPEC TABLE 2 - PLANT OPERATIONS & SAFE SHUTDOWN Two Unit – Two Control Room Multi-Unit ELAP/LUHS Operations Crew Available to Implement AOPs, EOPs, SAMGs, or FSGs as Applicable			
Line #	**Generic Title/Role**	**On-Shift Position (Note 1)**	**Task Analysis Controlling Method (Note 2)**
1	Shift Manager	U2 SM	Licensed Operator Training Program
2	Unit Supervisor	U2 CRS	Licensed Operator Training Program
3	Shift Technical Advisor	U2STA	Licensed Operator Training Program
4	Reactor Operator #1	U2 RO #1	Licensed Operator Training Program
5	Reactor Operator #2	U2 RO #2	Licensed Operator Training Program
6	Auxiliary Operator #1	U2 NPO #1	Non-Licensed Operator Training Program
7	Auxiliary Operator #2	U2 NPO #2	Non-Licensed Operator Training Program
8	Auxiliary Operator #3	U2 NPO #3	Non-Licensed Operator Training Program
9	Auxiliary Operator #4	U2 NPO #4	Non-Licensed Operator Training Program
10	Auxiliary Operator #5	U2 NPO #5	Non-Licensed Operator Training Program
11	Shift Manager	U3 SM	Licensed Operator Training Program
12	Unit Supervisor	U3 CRS	Licensed Operator Training Program
13	Shift Technical Advisor	U3 STA	Licensed Operator Training Program
14	Reactor Operator #1	U3 RO #1	Licensed Operator Training Program
15	Reactor Operator #2	U3 RO #2	Licensed Operator Training Program
16	Auxiliary Operator #1	U3 NPO #1	Non-Licensed Operator Training Program
17	Auxiliary Operator #2	U3 NPO #2	Non-Licensed Operator Training Program
18	Auxiliary Operator #3	U3 NPO #3	Non-Licensed Operator Training Program
19	Auxiliary Operator #4	U3 NPO#4	Non-Licensed Operator Training Program
20	Auxiliary Operator	U1 NPO	Non-Licensed Operator Training Program
21	SRO Fire Brigade Leader	SRO FBL	Licensed Operator Training Program

*The Communicator NPO does not perform AOP, EOP, or FSG tasks.

Note 1: During a BDBEE that results in an ELAP/LUHS, all positions, except the SM, STA, and Communicator, are expected to be utilized if available to implement or assist in the implementation of FLEX strategies using Flex Support Guidelines (FSG) under the direction of the Control Room Supervisor and oversight by the Shift Manager.

Note 2: The controlling method put in place when FLEX is implemented will follow the guidance recommended by the industry. Each position receives the INPO initiated NANTEL Generic Basic FLEX Initial Course. Shift Managers and Control Room Supervisors will also receive the NANTEL Generic Advanced FLEX Training Course. A training plan developed using the systematic approach to training (SAT) process is in place for additional FLEX training.

IPEC Table 2a Other On-shift staff available to perform FLEX implementation tasks (not safe shutdown)			
Line #	**Generic Title/Role**	**On-Shift Position (Note 1)**	**Task Analysis Controlling Method (Note 2)**
22	U2 RP	U2 RP	N/A
23	U3 RP	U3 RP	N/A
24	U2 Chemistry	U2 Chemistry	N/A
25	U3 Chemistry	U3 Chemistry	N/A

Note 1: During a BDBEE that results in an ELAP/LUHS, these positions may to be utilized, if available, to assist in the implementation of FLEX strategies using FSGs under the instructions of Operations.

Note 2: The controlling method put in place when FLEX is implemented will follow the guidance recommended by the industry. Each position will receive the INPO initiated NANTEL Generic Basic FLEX Initial Course.

IPEC TABLE 3 – FIREFIGHTING Multi-Unit ELAP/LUHS		
Line #	**Performed by**	**Task Analysis Controlling Method**
1	N/A	N/A
2	N/A	N/A
3	N/A	N/A
4	N/A	N/A
5	N/A	N/A

Fire Brigade (No firefighting activities included in this accident.).
Staff filling fire brigade positions is shown in the minimum staffing table in Section 4.0.

IPEC TABLE 4 – RADIATION PROTECTION AND CHEMISTRY Multi-Unit ELAP/LUHS																			
LINE	Position Performing Function / Task	Performance Time Period After Event (hours)*																	
		0-.5	.5-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-6.0	6.0-7.0	7.0-8.0	8.0-9.0	9.0-10.0	10.0-11.0	11.0-12.0	12.0-13.0	13.0-14.0	14.0-15.0	15.0-16.0	16.0-24.0
1	In-Plant Survey: RP	As directed by SM*																	
2	On-site Survey: RP	As directed by SM*																	
3	Personnel Monitoring:																		
4	Job Coverage: RP	As directed by SM*																	
5	Offsite Rad Assessment: *(Included in Table 5)*																		
6	Other site specific RP (describe):																		
7	Chemistry Function task #1 (describe)																		
8	Chemistry Function task #2 (describe)																		

*The team determined there are no time sensitive RP or Chemistry tasks and that task performance is directed and prioritized by the Shift Manager. The time RP or Chemistry is directed to perform a task and the amount of time taken to complete tasks are estimated. No Chemistry samples are taken due to the loss of power to the equipment necessary to analyze samples. No fuel damage or release is anticipated since core cooling, containment integrity, and spent fuel pool makeup are maintained. RP and Chemistry are available to assist with staging and setup of FLEX equipment when not performing dose assessment, surveys, or job support. Both Chemistry Technicians are qualified to perform dose assessment. RP Technicians may perform RP tasks at either unit.

IPEC TABLE 5 – EMERGENCY PLAN IMPLEMENTATION Multi-Unit ELAP/LUHS			
Line#	Function / Task	On-Shift Position	Task Analysis Controlling Method
1	Declare the emergency classification level (ECL)	U2 SM	Emergency Planning Training Program / EP Drills
2	Approve Offsite Protective Action Recommendations	U2 SM	Emergency Planning Training Program / EP Drills
3	Approve content of State/local notifications	U2 SM	Emergency Planning Training Program
4	Approve extension to allowable dose	N/A	N/A
5	Notification and direction to on-shift staff (e.g., to assemble, evacuate, etc.)	U2 SM	Licensed Operator Training Program / Emergency Planning Training Program
6	ERO notification	Communicator	Emergency Planning Training Program
7	Abbreviated NRC notification for DBT event	N/A	N/A
8	Complete State/local notification form	U2 SM	Emergency Planning Training Program
9	Perform State/local notifications	Communicator	Emergency Planning Training Program
10	Complete NRC event notification form	U2 SM	Licensed Operator Training Program
11	Activate ERDS	(Note 1)	N/A
12	Offsite radiological assessment	(Note 2)	N/A
13	Perform NRC notifications	Communicator	Emergency Planning Training Program
14	Perform other site-specific event notifications (e.g., Duty Plant Manager, INPO, ANI, etc.)	(Note 3)	Licensed Operator Training Program
15	Personnel Accountability	Security	Security Training Program / EP Drills

Note 1: ERDS at both units normally operates 24/7 and therefore does not require specific actions to activate the system. It is recognized, however, that the BDBEE is assumed to result in the loss of normal communication paths for ERDS. If ERDS capability is lost, critical information would be communicated directly to the NRC over other communication paths, such as satellite phones.

Note 2: U2 (U3) Chemistry reports to the U2 (U3) Control Room to assist the SM/ED as directed and be available for offsite radiological assessment if needed. A release is not anticipated since core cooling, spent fuel pool cooling and containment integrity are maintained during the 24 hour period. If no release is expected, the SM is expected to direct Chemistry to assist with FLEX strategy implementation.

Note 3: The SM will not make these communications. The Duty Plant Manager reports to the site or the staging area and is responsible for other site specific event notifications.

ATTACHMENT 2 IPEC FLEX IMPLEMENTATION TIMELINES

Timeline

It is assumed on-shift staff will be relieved after +6 hours as personnel are able to access the site. The relief staff will continue the tasks for the job position as shown. The intent of this table is to identify the job position, tasks, and estimated timeline to complete the Emergency Plan, initial phase and transition phase tasks and to demonstrate that no collateral duties have an adverse impact on implementing the Emergency Plan or FLEX strategies.

JOB POSITION	TIME	TASK	Collateral Duty?
U3 Shift Manager	(1) T = 0 – 15 min (2) T = 15- 30 min (3) T = 1.0 hr. (4) T = 1.0 – 1.5 hrs. (5) T = 1.5 – 2.0 hrs. (6) T = 0 – until EOF is operational	(1) Assess event and coordinate with U2 SM (ED) to declare SAE (2) Coordinate with U2 SM (ED) to ensure NMF reflects correct emergency declaration (3) Declare ELAP (4) Coordinate with U2 SM (ED) to declare GE / Develop PAR / Direct notifications (GE expected to be declared when ED determines restoration of at least one safeguards bus within 4 hours is not likely) / Coordinate with U2 SM (ED) of status of U3 and the need for FLEX equipment implementation (5) Coordinate actions of FSG-100 for U2 and U3 as directed by the ED (6) Perform SM oversight and assist U2 ED	No
U3 Control Room Supervisor	(1) T = 0 – 1.0 hr. (2) T = 1 hr. -duration	(1) Direct immediate plant actions per SBO AOP, Loss of SFP cooling, and EOP (2) Direct and coordinate EOP/ELAP actions	No
U3 Shift Technical Advisor	(1) T = 0 – until mode 4 entered (2) T = 1.0 – 1.5 hrs.	(1) Technical Support / Plant monitoring and assessment (2) Initial plant assessment for FLEX per FSG-5 Att. 1	No

JOB POSITION	TIME	TASK	Collateral Duty?
U3 SRO (Fire Brigade Leader)	(1) T = 0 – 1.0 hr. (2) T = 1.0 – 4.0 hrs. (3) T = 4.0 – 4.5 hrs. (4) T = 4.5 – 6.0 hrs. (5) T = 6.0 – 7.0 hrs. (6) T = 7.0 – 8.0 hrs. (7) T = 8.0 – 9.0 hrs. (8) T = 9.0 – 10 hrs. (9) T = 10 – 12 hrs. (10) T = 12 – 16 hrs. (11) T = 16 – 18 hrs. (12) T = 18 - duration	(1) No Assignment (2) Transit to the FLEX Storage Bldg. and perform debris removal (3) Transfer U3 FLEX DG to staging area (4) Transfer Mechanical Trailer #2 with discharge hoses to staging areas (5) Transfer Mechanical Trailer #1 with suction hoses to staging areas (6) Transfer U3 RCS and U3 SG makeup pumps to staging area (7) Transfer refuel tank trailer to staging area (8) Transfer light trailers #2 and #4 to staging areas as needed (9) Align hoses and FLEX CST makeup pump for U3 CST makeup (10) No assignment (11) Deploy N2 bottles for ADV operation (12) No assignment	No
U3 RO #1	(1) T = 0 – 0.5 hrs. (2) T = 0.5 – 3.0 hrs. (3) T = 10 – 18 hrs. (4) T = 13 – 15 hrs. (5) T = 20 - 22 hrs. (6) T = 1.0 – duration	(1) Immediate plant actions / Coordinate RCS cooldown with NPO#3 (2) Perform RCS cooldown to 415 degrees (3) Head vent valve operations as needed for letdown (4) Isolate SI Accumulators (5) Perform RCS cooldown to 340 degrees (6) Plant monitoring	No
U3 RO #2	(1) T = 0 – 0.5 hrs. (2) T = 0.5 – 1.0 hrs. (3) T = 1. 0 – 2.0 hrs. (4) T = 2.0 – 4.0 hrs. (5) T = 4.0 – 4.5 hrs. (6) T = 4.5 – 6.0 hrs. (7) T = 6.0 – 7.0 hrs. (8) T = 7.0 – 8.0 hrs. (9) T = 8.0 – 10 hrs. (10) T = 10 - duration	(1) Immediate plant actions / open CR panel doors / open PCV-1188 (2) Perform SBO Load shed (3) Monitor channel – train indications / initiate DC Deep load shed (CR only) (4) Coordinate damage assessment (5) No assignments (6) Layout discharge hoses from Mechanical Trailer #2 (7) Layout suction hoses from Mechanical Trailer #1 (8) Connect RCS suction and discharge hoses, vent system and start pump (9) Connect SFP suction and discharge hoses, vent system and start pump (10) No assignment	No

JOB POSITION	TIME	TASK	Collateral Duty?
U3 NPO #1	(1) T = 0 – 0.5 hrs. (2) T = 0.5 – 1.0 hrs. (3) T = 1.0 – 2.0 hrs. (4) T = 2.0 – 3.5 hrs. (5) T = 3.5 – 4.5 hrs. (6) T = 4.5 – 5.5 hrs. (7) T = 5.5 – 6.0 hrs. (8) T = 6.0 – 6.5 hrs. (9) T = 6.5 - duration (10) T = 8.0 – 10 hrs.	(1) Attempt to start EDG, evaluate bus work for damage, travel to Appendix R DG (2) Attempt to start Appendix R DG, perform SBO load shed in field (3) Perform Deep Load Shed / Verify DC bus voltage (4) Perform breaker alignment in prep for energizing busses by FLEX DG (5) Stage electrical cables from electrical trailer (6) Connect electrical cables to FLEX DG, start FLEX DG, energize 480V buses, reenergize normal control room lighting, place battery chargers in service (7) No assignment (break for fatigue) (8) Verify master FSB vent fans control switch in STOP and charcoal filter bypass panel assemblies are closed (9) Periodic monitoring of FLEX DG (10) Setup portable light trailers (as needed)	No
U3 NPO #2	(1) T = 0 – 0.5 hrs. (2) T = 0.5 – 1.0 hrs. (3) T = 1.0 – 1.5 hrs. (4) T = 1.5 – 2.5 hrs. (5) T = 2.5 – 3.5 hrs. (6) T = 3.5 – 4.5 hrs. (7) T = 4.5 – 6.0 hrs. (8) T = 6.0 – 7.0 hrs. (9) T = 7.0 – 8.0 hrs. (10) T = 8.0 – 10 hrs. (11) T = 10 – duration	(1) Isolate RCP Seal Injection (2) No assignment (3) Monitor SFP level and temperature (4) Perform flush of BAST line (5) Establish FSB natural circulation (6) No assignment (7) Deploy discharge hoses from Mechanical Trailer #2 (8) Deploy suction hoses from Mechanical trailer #1 (9) Connect RCS suction and discharge hoses, connect to pump and start pump (10) Connect SFP suction and discharge hoses, vent system and start pump (11) Monitor FLEX RCS pump and makeup / available for SFP makeup (if needed)	No
U3 NPO #3	(1) T = 0 – 0.5 hrs. (2) T = 0.5 – 1.0 hrs. (3) T = 1.0 – 1.5 hrs. (4) T = 8.0 – 10.0 hrs. (5) T = 1.5 - duration	(1) Check MSIV bypass valves closed / Install N2 backup jumper and blocking device to PCV-1188 (2) Travel to Aux Boiler feed pump room / monitor N2 / lineup N2 to atmospheric dumps (3) Support Aux Feed Bldg. / monitor N2 pressure for ADV's / manual control of AFW (4) Layout and hookup hoses for FLEX SG makeup / available for manual control of AFW (as needed) (5) Support Aux Feed Bldg. (as needed)	No

JOB POSITION	TIME	TASK	Collateral Duty?
U3 NPO #4	(1) T = 0 – 0.5 hrs. (2) T = 0.5 – 1.0 hrs. (3) T = 1.0 – 2.0 hrs. (4) T = 2.0 – 3.5 hrs. (5) T = 3.5 – 4.5 hrs. (6) T = 4.5 – 5.5 hrs. (7) T = 5.5 – 8.0 hrs. (8) T = 8.0 – 10 hrs. (9) T = 10 – 12 hrs. (10) T = 12 – 13 hrs. (11) T = 13 – 15 hrs. (12) T = 15 – 16 hrs. (13) T = 16 - 18 hrs. (14) T = 18 - duration	(1) Break condenser vacuum / Close CST to Hotwell isolation valve (2) Vent generator H2 / secure seal oil pump (3) No assignment (4) Perform breaker alignment in prep for energizing busses by FLEX DG (5) Stage electrical cables from electrical trailer (6) Connect electrical cables to FLEX DG, start FLEX DG, energize 480V buses, reenergize normal control room lighting, place battery chargers in service (7) Not assigned (break for fatigue and available to provide relief of others if needed) (8) Layout and hook-up hoses for FLEX SG makeup pump (9) Align hoses and FLEX CST makeup pump for U3 CST makeup (10) No assignment (11) Isolate Safety Injection Accumulators (12) No assignment (13) Deploy N2 bottles for ADV operation (14) No assignment	No
U3 NPO #5	(1) T = 0 – duration	(1) Report to CR / Offsite Communicator / Make offsite and NRC notifications as directed by the ED / make ERO notification (by satellite phone if needed)	No
U3 RP	(1) T = 0 – 2.5 hrs. (2) T = 2.5 - 3.5 hrs. (3) T = 3.5 – 4.5 hrs. (4) T = 4.5 – 6.0 hrs. (5) T = 6.0 – 7.0 hrs. (6) T = 7.0 – 8.0 hrs. (7) T = 8.0 – 10 hrs. (8) T = 10 – duration	(1) Report to CR / no specific task assignment / RP support as needed (2) Assist Ops - Establish FSB natural circulation (3) RP support as needed (4) Assist staging of discharge hoses from Mechanical Trailer #2 (5) Assist staging of suction hoses from Mechanical Trailer #1 (6) Assist Ops connect RCS suction and discharge hoses, connect to pump and start pump (7) Assist Ops connect SFP suction and discharge hoses and start pump (8) RP support as needed	No
U3 Chemistry Technician	(1) T = 0 – 8.0 hrs. (2) T = 8.0 – 10 hrs. (3) T = 10 – 12 hrs. (4) T = 12 - duration	(1) Reports to the Control Room / available for dose assessment (as needed) / available for FLEX support (as needed) (2) Support Operations layout and hookup hoses for FLEX SG makeup pump (3) Commence refuel strategy by connecting hoses and filling fuel trailer (4) Refuel FLEX equipment	No

JOB POSITION	TIME	TASK	Collateral Duty?
U2 Shift Manager	(1) T = 0 – 15 min (2) T = 15- 30 min (3) T = 1.0 hr. (4) T = 1.0 – 1.5 hrs. (5) T = 0 – duration	(1) Assess event and declare SAE (2) Approve NMF & Direct communicator make notifications / Direct SAE evacuation & accountability (3) Declare ELAP / Coordinate with U3 SM on U3 status and need for FLEX equipment implementation (4) Declare GE / Develop PAR / Direct notification (GE expected to be declared when ED determines restoration of at least one safeguards bus within 4 hours is not likely / Call SAFER / Direct Security to enable FLEX equipment access (5) Perform oversight and ED responsibilities	No
U2 Control Room Supervisor	(1) T = 0 – 1.0 hrs. (2) T = 1.0 hr. – duration	(1) Direct immediate plant actions per SBO AOP, Loss of SFP cooling, and EOPs (2) Direct and coordinate EOP / ELAP actions	No
U2 Shift Technical Advisor	(1) T = 0 – duration (2) T = 0.5 – 1.0 hrs. (3) T = 1.0 – 1.5 hrs.	(1) Technical Support / Plant monitoring and assessment (2) Contact Con-ED to determine power availability (3) Initial plant assessment for FLEX per FSG-5 Att. 1	No
U2 RO #1	(1) T = 0 – 0.5 hrs. (2) T = 0.5 – 3.0 hrs. (3) T = 1.0 – duration (4) T = 10 – 18 hrs. (5) T = 13 – 15 hrs. (6) T = 20 – 22 hrs.	(1) Immediate plant actions (2) Perform RCS Cooldown to 415 degrees / plant monitoring (3) Plant monitoring (4) Head vent valve operation as needed for letdown (5) Isolate SI accumulators (6) Perform RCS cooldown to 340 degrees	No
U2 RO #2	(1) T = 0 – 0.5 hrs. (2) T = 0.5 – 1.0 hrs. (3) T = 1.0 – 1.5 hrs. (4) T = 1.5 – 3.5 hrs. (5) T = 3.5 – 4.5 hrs. (6) T = 4.5 – 6.0 hrs. (7) T = 6.0 – 7.0 hrs. (8) T = 7.0 – 8.0 hrs. (9) T = 8.0 – 10 hrs. (10)T = 10 – duration	(1) Open PCV-1188 on loss of CST / Open CR panel doors per 2-ECA0.0 / Coordinate attempt to restore power (2) Perform SBO DC load shed (3) Monitor channel and train indications per FSG-004 / Perform deep load shed per FSG-004 (CR only) (4) Coordinate and conduct initial damage assessment (5) No assignment (6) Deploy discharge hoses from Mechanical Trailer #2 (SFP & RCS) (7) Deploy suction hoses from Mechanical Trailer #1 (8) Connect RCS suction and discharge hoses, vent discharge line and start pump. Available for RCS makeup by T+8 hrs. (9) Deploy and hookup hoses and pump for SFP makeup. Available for SFP makeup by T+10 hrs. (10) Available to start and control Alternate SG makeup when needed	No

JOB POSITION	TIME	TASK	Collateral Duty?
U2 NPO #1	(1) T = 0 – 1.0 hrs. (2) T = 1.0 – 1.5 hrs. (3) T = 1.5 – 2.0 hrs. (4) T = 2.0 – 3.5 hrs. (5) T = 3.5 – 4.5hrs. (6) T = 4.5 – 5.5 hrs. (7) T = 5.5 – 6.5 hrs. (8) T = 6.5 – 8.0 hrs. (9) T = 8.0 – 10 hrs. (10)T = 10 - duration	(1) Investigate DG failure /Attempt to start Appendix R DG/ perform DC load shed per 2-AOP-DC-1and 2-AOP-IB-1 (2) Perform DC deep load shed (3) Not assigned (4) Perform breaker alignment in preparation for FLEX DG (5) Stage electrical cables from electrical trailer (6) Connect electrical cables to FLEX DG, start FLEX DG, energize 480V buses, place battery chargers in service (7) Setup fans and power cords for battery room ventilation (8) Not assigned (break for fatigue) (9) Periodic monitoring of FLEX DG / setup of portable lights (10)Periodic monitoring of FLEX DG	No
U2 NPO #2	(1) T = 0 – 0.5 hrs. (2) T = 0.5 – 1.0 hrs. (3) T = 1.0 – 1.5 hrs. (4) T = 1.5 – 3.0 hrs. (5) T = 3.0 – 8.0 hrs. (6) T = 8.0 – 10 hrs. (7) T = 20 – 22 hrs. (8) T = 10 - duration	(1) Open AFW roll-up doors (2) Line up N2 to ADV to allow control from CR / install manual blocking device on PCV-1188 (if CST lost) / Coordinate with U2RO1 for support of RCS cooldown (3) Available for local manual control of aux feed regulator valves as needed / Support Aux Feedwater Bldg. tasks / Coordinate with U2RO1 for support of RCS cooldown (4) Support Aux Feedwater Bldg. tasks as needed / Coordinate with U2RO#1 for support of RCS cooldown (5) Support Aux Feedwater Bldg. tasks as needed (6) Layout hoses and hookup Alternate low pressure Feedwater makeup / available for local control of Aux Feedwater if needed (7) Coordinate with U2RO#1 for support of RCS cooldown (8) Support Aux Feedwater Bldg. tasks as needed	No

JOB POSITION	TIME	TASK	Collateral Duty?
U2 NPO #3	(1) T = 0 – 1.0 hrs. (2) T = 1.0 – 1.5 hrs. (3) T = 1.5 – 2.5 hrs. (4) T = 2.5 – 3.5 hrs. (5) T = 3.5 – 4.5 hrs. (6) T = 4.5 – 6.0 hrs. (7) T = 6.0 – 7.0 hrs. (8) T = 7.0 – 8.0 hrs. (9) T = 8.0 – 10 hrs. (10)T = 10 – 11 hrs. (11)T = 11 – duration	(1) Isolate RCP seals per 2-ECA-0.0 (2) Monitor SFP level and temperature (3) Perform BAST line flush (4) Perform FSG-011 actions to establish FSB natural circulation ventilation (5) No assignment (6) Deploy discharge hoses from trailer #2 (SFP & RCS) (7) Deploy suction hoses from trailer #1 (8) Connect RCS suction and discharge hoses, vent discharge line and start RCS makeup pump. Available for RCS makeup by T+8. (9) Deploy hoses and pump for SFP makeup. Available for SFP makeup by T+10 hrs. (10)Available for SFP and RCS makeup as needed / Close or verify closed breakers HCV-3101 and HCV-3100 for Reactor Head Vent operations (11) Available for SFP and RCS makeup as needed.	No
U2 NPO #4	(1) T = 0 – 0.5 hrs. (2) T = 0.5 – 1.0 hrs. (3) T = 1.0 – 2.0 hrs. (4) T = 2.0 – 3.5 hrs. (5) T = 3.5 – 4.5 hrs. (6) T = 4.5 – 5.5 hrs. (7) T = 5.5 – 6. 5 hrs. (8) T = 6.5 – 8.0 hrs. (9) T = 8.0 – 10 hrs. (10)T = 10 – 12 hrs. (11)T = 12 – duration	(1) Isolate Hotwell per 2-ECA-0.0 / verify FW reg. valves, bypass valves, and blowdown isolation valve closed. (2) Vent Generator H2 and secure seal oil (3) No assignment (4) Perform breaker alignment in preparation for FLEX DG (5) Stage electrical cables from electrical trailer (6) Connect electrical cables to FLEX DG, start DG and energize 480V bus, place battery chargers in service (7) Setup fans and power cords for battery room ventilation (8) No assignment (9) Layout hoses and hookup Alternate low pressure Feedwater makeup (10)Set-up hoses and FLEX CST makeup pump for U2 CST makeup (11)Available for CST makeup when needed	No

JOB POSITION	TIME	TASK	Collateral Duty?
U2 NPO #5	(1) T = 0 – 1.0 hrs. (2) T = 1.0 – 4.0 hrs. (3) T = 4.0 – 4.5 hrs. (4) T = 4.5 – 7.0 hrs. (5) T = 7.0 – 8.0 hrs. (6) T = 8.0 – 9.0 hrs. (7) T = 9.0 – 10 hrs. (8) T = 10 – 12 hrs. (9) T = 12 - 13 hrs. (10) T = 13 – 15hrs. (11)T = 15 – 24 hrs.	(1) Equipment monitoring (2) Transit to FLEX storage bldg. and perform initial debris removal (3) Transfer U2 FLEX DG to staging area (4) Transfer U2 suction and discharge hoses to staging areas (5) Transfer U2 FLEX RCS makeup pump and U2 FLEX SG MU pump to staging areas (6) Assist U1 NPO transfer and energize light tower #1, establish battery toom ventilation and move N2 bottles for extended ADV operation (7) Transfer light trailers #3& #5 to staging areas (8) Set up hoses and FLEX CST makeup pump for CST makeup (9) No assignment (10) Isolate Safety Injection Accumulators (11)No assignment	No
U1 NPO	(1) T = 0 – 1.0 hrs. (2) T = 1.0 – 3.5 hrs. (3) T = 3.5 – 4.0 hrs. (4) T = 4.0 – 4.5 hrs. (5) T = 4.5 – 7.0 hrs. (6) T = 7.0 – 8.0 hrs. (7) T = 8.0 – 9.0 hrs. (8) T = 9.0 – 10 hrs. (9) T = 10 - 12 hrs. (10)T = 12 – 13 hrs. (11)T = 13 – 14 hrs. (12)T = 14 – 16 hrs. (13)T – 16 – 18 hrs. (14)T = 18 – 24 hrs.	(1) No assignment (2) Transit to FLEX storage bldg. and support initial debris removal (3) Transfer U2FLEX electrical cables to staging areas (4) Transfer U2 FLEX DG to staging area (5) Transfer U2 suction and discharge hoses to staging areas (6) Transfer U2 FLEX SFP and U2 FLEX CST makeup pumps to staging areas (7) Transfer light tower trailer #1 (power supply for battery room vent fans) and N2 bottles for extended ADV operation to staging area. Energize light tower and establish battery room ventilation (8) Transfer light trailers #6 & #8 to staging areas (9) Set up hoses and FLEX CST makeup pump for CST makeup (10)Transfer light trailer #7 (11)Transfer U2 diesel driven air compressor and hoses (12)No assignment (13)Connect N2 bottles for extended ADV operation (14)No assignment	No

JOB POSITION	TIME	TASK	Collateral Duty?
U2 RP	(1) T = 0 – 2.5 hrs. (2) T = 2.5 – 3.5 hrs. (3) T = 3.5 – 4.5 hrs. (4) T = 4.5 – 6.0 hrs. (5) T = 6.0 – 7.0 hrs. (6) T = 7.0 – 8.0 hrs. (7) T = 8.0 – 10 hrs. (8) T = 10 - 12 hrs. (9) T = 12 - duration	(1) Report to the U2 CR / Perform RP support actions as directed by the SM or ED since no release or fuel damage. (2) RP support to establish FSB natural circulation ventilation (3) RP support as needed (4) RP support to deploy discharge hoses from trailer #2 (SFP & RCS) (5) RP support to deploy suction hoses from trailer #1 (6) RP support to align hoses and pump for RCS makeup (7) RP support to align hoses and pump for SFP makeup (8) Commence FLEX equipment refueling strategy by filling 500 gallon fuel trailer (9) Implement FLEX equipment refueling strategy	No
U2 Chemistry Technician	(1) T = 0 – 1.0 hrs. (2) T = 1.0 – 3.5 hrs. (3) T = 3.5 - 4.5 hrs. (4) T = 4.5 – 6.0 hrs. (5) T = 6.0 - 7.0 hrs. (6) T = 7.0 – 8.0 hrs. (7) T = 8.0 – 9.0 hrs. (8) T = 9.0 – 10 hrs. (9) T = 10 – 12 hrs. (10) T = 12 - duration	(1) Report to CR. Provides support as directed by SM (2) Travel to FLEX Bldg. and support debris removal (3) Transfer U3 FLEX DG cable trailer and U3 FLEX DG to staging area (4) Transfer and stage discharge hoses from Mechanical Trailer #2 (5) Transfer and stage suction hoses from Mechanical Trailer #1 (6) Transfer U3 SFP and U3 CST makeup pumps to staging areas (7) Transfer refueling trailer to staging areas (8) Transfer light trailers #2 & #4 to staging areas (9) Support alignment of hoses and FLEX CST makeup pump for U3 CST makeup (10) Support as directed by the ED	No
Security	(1) T = 0 – 0.5 hrs. (2) T = 0.5 – 1.0 hrs. (3) T = 1.0 – 2.0 hrs. (4) T = 2.0 – 3.0 hrs. (5) T = 3.0 – 3.5 hrs. (6) T = 3.5 - duration	(1) Access control / accountability / Open CR access doors / ABFP room doors and roll-up door for U2 & U3 (2) Access control / On-site personnel accountability (3) Open security gates manually to allow delivery of FLEX equipment (4) Security functions as needed (5) Security functions as needed / support opening FSB rolling door and doors 306 & 319 for FSB natural circulation (6) Security functions as needed	No
Augmented Staff	Assumes augmented staff is available after 6 hours and will assist as directed. Augmented staff will setup and establish communications per FSG-101.		N/A

ATTACHMENT 3 Expanded Emergency Response Table

NOTE

ERO positions are filled in accordance with the applicable facility emergency implementing procedure. Selected ERO positions are shown in the Table to show comparable responsibilities for NEI 12-01 Table 3.2 recommended expanded emergency response individuals. Expertise from both units is desired, but not required, for those positions.

Expanded Response Function from NEI 12-01, Table 3.2	Location	Key Roles and Staffing Considerations	TOTAL Number required U2 and U3	ERO Available to Implement Coping Strategies for 2 units
Evaluation of Transition Phase Coping Strategy	TSC	• One team for each unit to evaluate selection of Transition Coping strategies; team performs evaluations not done by the Control Room • Team composition (i.e., number and represented disciplines) as described in governing site programs, procedures and guidelines. • Team may include personnel responsible for performing other functions for the same assigned unit.	No additional team members	Unit Operations Coordinator Unit Engineering Coordinator TSC Engineering Team
Implementation of Transition Phase Coping Strategies	OSC	• Number and composition of personnel capable of simultaneous implementation of any 2 Transition Phase coping strategies at each unit. • Should not include personnel assigned to other function (e.g., emergency repair and corrective actions); however, may include members of the on-shift staff and personnel responsible for implementation of SAM strategies.	U2 – 5 NPO U3 – 5 NPO	4 ERO OSC Teams

IPEC Simultaneous Implementation of 2 Transition Phase Coping Strategies

		Strategy	Required Staff to Implement	Available Staff
U2	FSG-003	Implement Alternate Low Pressure Feedwater	2 Operators	48 ROs* 55 NPOs*
U2	FSG-006	Implement CST Makeup	3 Operators	
U3	FSG-003	Implement Alternate Low Pressure Feedwater	2 Operators	
U3	FSG-006	Implement CST Makeup	3 Operators	

*Unit specific qualification is not required for running and connecting hoses/cables and operating FLEX equipment. Qualified on-shift staff is available to manipulate or operate installed plant valves or equipment.

ENCLOSURE 2 TO NL-16-089

IPEC FINAL INTEGRATED PLAN (FIP)

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NO. 2
DOCKET NO. 50-247

FINAL INTEGRATED PLAN DOCUMENT

INDIAN POINT ENERGY CENTER Units 2 & 3

August 2016

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1. Background

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

The United States (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 (Reference 3.1) 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 3.2) on March 12, 2012 to implement mitigation strategies for beyond-design-basis external events (BDBEEs). The order provided the following requirements for strategies to mitigate BDBEEs:

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

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

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

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

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

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

- Phase 1 - The initial phase requires the use of installed equipment and resources to maintain or restore core cooling, containment and SFP cooling capabilities.
- Phase 2 - The transition phase requires providing sufficient, portable, on-site equipment and consumables to maintain or restore these functions until they can be accomplished with resources brought from off site.
- Phase 3 - The final phase requires obtaining sufficient off-site resources to sustain those functions indefinitely.

NRC Order EA-12-049 (Reference 3.2) required licensees of operating reactors to submit an overall integrated plan, including a description of how compliance with these requirements would be achieved by February 28, 2013. The order also required licensees to complete implementation of the requirements no later than two refueling cycles after submittal of the overall integrated plan or December 31, 2016, whichever comes first.

The Nuclear Energy Institute (NEI) developed NEI 12-06 (Reference 3.3), which provides guidelines for nuclear stations to assess extreme external event hazards and implement the mitigation strategies specified in NRC Order EA-12-049. The NRC issued Interim Staff Guidance JLD-ISG-2012-01 (Reference 3.4), dated August 29, 2012, which endorsed NEI 12-06 with clarifications on determining baseline coping capability and equipment quality.

NRC Order EA-12-051 (Reference 3.5) required licensees to install reliable SFP instrumentation with specific design features for monitoring SFP water level. This order was prompted by NTTF Recommendation 7.1 (Reference 3.1).

NEI 12-02 (Reference 3.6) provided guidance for compliance with Order EA-12-051. The NRC determined that, with the exceptions and clarifications provided in JLD-ISG-2012-03 (Reference 3.7), conformance with the guidance in NEI 12-02 is an acceptable method for satisfying the requirements in Order EA-12-051.

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

2.1 General Elements

2.1.1 Assumptions

The assumptions used for the evaluations of Indian Point Energy Center (IPEC) Unit 2 (IP2) and Unit 3 (IP3) extended loss of alternating current power (ELAP)/loss of normal access to the ultimate heat sink (LUHS) event and the development of diverse and flexible coping strategies (FLEX) are stated below.

Assumptions are consistent with those detailed in NEI 12-06, Section 3.2.1 (Reference 3.3). Analysis has been performed consistent with the recommendations contained within the Executive Summary of the Pressurized Water Reactor Owners Group (PWROG) Core Cooling Position Paper (OG-12-482) and the assumptions from that document are incorporated into the plant-specific analytical bases.

The initial plant conditions are assumed to be the following:

- Prior to the event the reactors have been operating at 100 percent rated thermal power for at least 100 days, or have just been shut down from such a power history as required by plant procedures in advance of the impending event.
- For BDB hurricanes, the plant will have been cooled down prior to the event. Conservatively, it will be assumed that the plant would have been shut down for 6 hours prior to the event.
- For core cooling and containment essential functions for Mode 5 with reactor coolant system (RCS) vented and Mode 6, the reactor is assumed to have been shut down for 72 hours following a full operating cycle prior to the ELAP/LUHS.
- 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. Plant staffing is at its minimum level allowed.

- For the SFP cooling essential function, the plant is assumed to have the design basis heat load.
- Severe weather preparations at IPEC would top off major water tanks and other consumables. In addition, augmented staff is resident at the station in preparation for and during the event (e.g., hurricane).
- Although all analyses are performed from the time of the ELAP and LUHS, the plant will follow station blackout (SBO) procedures until the SBO has lasted for one hour and is deemed unlikely to return. This provides adequate time for FLEX strategies to be implemented to ensure that the key FLEX safety functions are maintained while also preventing the unnecessary implementation of FLEX guidelines for momentary SBOs which may be easily resolved through troubleshooting.

The event initial conditions are as follows:

- No specific initiating event is used. The initial condition is assumed to be a loss of off-site power (LOOP) for the entire plant site affecting both IPEC units simultaneously. The LOOP is assumed to result from an external event that affects the off-site power system either throughout the grid or just at the plant with no prospect for recovery of off-site power for an extended period.
- All installed sources of emergency on-site alternate current (AC) power and SBO alternate AC power sources are assumed to be not available and not imminently recoverable.
- 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.
- Normal access to the ultimate heat sink is lost, but the water inventory in the ultimate heat sink (UHS) remains available and seismic Class I piping (References 3.76 and 3.77) connecting the UHS to plant systems remains intact. The motive force for UHS flow, i.e., service water pumps, is assumed to be lost with no prospect for recovery.

- Fuel for FLEX equipment stored in structures with designs, which are robust with respect to seismic events, floods and high winds and associated missiles, remains available.
- Permanent plant equipment that is contained in structures with designs that are robust with respect to seismic and flood events are available. For high winds and associated missiles events, see Section 2.6.3.
- 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 protected from the applicable external hazards per Sections 5 through 9 and Section 11.3 of NEI 12-06 and has predetermined hookup strategies with appropriate procedures/guidance and the equipment is stored on-site.
- Installed electrical distribution systems, including inverters and battery chargers that are protected consistent with current station design remain available.
- No additional events or failures (including security events) are assumed to occur immediately prior to the BDBEE.

The following boundary conditions are applied for the reactor transient:

- Following the loss of all AC power, the reactor automatically trips and all rods are inserted.
- The main steam system valves (such as main steam isolation valves, turbine stops, atmospheric dumps, main steam safety valves (MSSVs) etc.) necessary to maintain decay heat removal functions operate as designed.
- Safety/relief valves or power operated relief valves (PORVs) initially operate in a normal manner, as required by the RCS conditions.
- No independent failures, other than those causing the BDBEE, are assumed to occur in the course of the transient.

Reactor coolant system conditions:

- IPEC procedures initiate plant cooldown at approximately 30 minutes after an SBO. Sources of expected reactor coolant inventory loss include normal reactor coolant pump seal leakage. Reactor coolant pump (RCP) seal leakage varies based on the temperature and pressure of the fluid at the RCP seals. The maximum total leakage rate (RCP seal leakage rate plus 1 gpm unidentified RCS leakage rate) profile for each minute after the SBO/ELAP is developed from the methodology described in PWROG-14015 (Reference 3.21) and PWROG-14027 (Reference 3.22) for a Category 1 plant. PWROG-14015 identifies IP2 and IP3 as a Category 4 plant which has higher seal leakage rates than a Category 1 plant because of less seal leak-off line resistance. Therefore, each RCP Number 1 seal leak-off line has been modified by installation of a flow orifice to increase the flow resistance such that IP2 and IP3 transition from a Category 4 plants to a Category 1 plants. The specific RCP leakage for IP2 and IP3 (References 3.31 and 3.32) is summarized in Section 2.3.8.

- In the event that the letdown flowpath fails to automatically isolate, standard operating procedures direct manual isolation; thus, no reactor coolant losses from letdown are assumed.

- The determination of RCS parameters and the capability of the FLEX RCS inventory makeup pump to meet FLEX strategy timelines is provided in calculation IP-CALC-16-00015 (Reference 3.89).

The initial SFP conditions are:

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

- 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.

- SFP cooling system piping is intact, (seismic Category II).

- SFP heat load assumes the maximum design basis heat load for the site applicable to the specific Mode.

Initial containment conditions:

- The containment is initially isolated in operating Modes 1 through 4 in accordance with plant technical specifications.
- The containment is initially not isolated in operating Modes 5 and 6 but is manually isolated following the event (or in advance of a hurricane event).
- All containment isolation features that are automatically initiated as the result of a loss of power are completed successfully.
- It is assumed that the containment isolation actions delineated in the current station blackout coping capabilities are sufficient.
- It is assumed that operators would return any manually controlled isolation valves which were operated because of other procedures being performed at the time of the BDBEE to their safe positions.

The following are additional assumptions used in the evaluation of the BDBEE:

- IPEC will declare an ELAP within 1 hour in order to enable actions which place the plant outside of the current design and licensing basis.
- This plan defines strategies capable of mitigating a simultaneous loss of all AC power and loss of normal access to the UHS resulting from a BDBEE by providing adequate capability to maintain or restore core cooling, containment, and SFP cooling capabilities at all units on a site. Though specific strategies are developed, due to the inability to anticipate all possible scenarios, the strategies are also diverse and flexible to encompass a wide range of possible conditions. These pre-planned strategies developed to protect the public health and safety are incorporated into the unit emergency operating procedures in accordance with established emergency operating procedure (EOP) change processes, and their impact to the design basis capabilities of the unit evaluated under 10 CFR 50.59. The plant technical specifications contain the limiting conditions for normal unit operations to ensure that design safety features are available to respond to a design

basis accident and direct the required actions to be taken when the limiting conditions are not met. The result of the BDBEE may place the plant in a condition where it cannot comply with certain technical specifications and/or with its security plan, and, as such, may warrant invocation of 10 CFR 50.54(x) and/or 10 CFR 73.55(p).

- Deployment resources are assumed to begin arriving at hour 6 and fully staffed by 24 hours.
- The design hardened connections applicable to FLEX strategies are protected against external events or are established at multiple and diverse locations.
- Instrumentation on FLEX equipment will be used to confirm continual performance.

2.2 Strategies

The objective of the FLEX strategies is to establish an indefinite coping capability in order to 1) prevent damage to the fuel in the reactors, 2) maintain the containment function and 3) maintain cooling and prevent damage to fuel in the SFP using installed equipment, on-site portable equipment, and pre-staged off-site resources. This indefinite coping capability will address an ELAP, loss of off-site power, emergency diesel generators and any alternate AC source, but not the loss of AC power to buses fed by station batteries through inverters – with a simultaneous loss of access to the UHS.

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

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

- Phase 1 – Initially cope by relying on installed plant equipment. During the initial coping period, only installed plant equipment and the normal station operating staff are used to maintain the essential functions of core cooling, containment integrity, and SFP cooling. The duration of Phase 1 at IPEC is expected to be less than 8 hours. Eight hours accounts for the longest expected time for debris removal and deployment of the first piece of Phase 2 FLEX equipment.

- Phase 2 – Transition from installed plant equipment to on-site FLEX equipment. During the transition phase, on-site FLEX equipment is deployed by the station staff augmented with emergency personnel responding from off-site to maintain essential functions. Phase 2 durations begin once the Phase 2 equipment is deployed and operating to meet plant needs. Note that, just because the plant is in Phase 2 because of this deployment does not mean that it cannot continue to use installed plant equipment identified in Phase 1. Phase 2 equipment and strategies will continue to be used until no longer required. This could be in as little time as 24 hours (earliest availability of Phase 3 equipment from off-site per NEI 12-06 (Reference 3.3)) or the Phase 2 equipment could be used indefinitely.

- Phase 3 – Obtain additional capability and redundancy from off-site equipment and resources until power, water, and coolant injection systems are restored. For the long term (indefinite) phase, off-site FLEX equipment from the National Strategic Alliance for FLEX Emergency Response (SAFER) Response Center (NSRC) is deployed to maintain essential functions. Phase 3 durations begin once off-site equipment is deployed and operating to meet plant needs. Phase 3 equipment is assumed to be available as early as 24 hours after the BDBEE or as late as 72-120 hours after the BDBEE. No NSRC equipment is credited for operation prior to 72 hours.

The specific duration of each phase is established based on prudent and realistic response times for the station staff to mobilize and implement applicable strategies in a manner that does not inhibit the emergency response. These times ensure that substantial margin exists in maintaining or restoring core cooling, containment, and spent fuel pool cooling to accommodate the many unknowns associated with BDBEE.

The strategies described below are capable of mitigating an ELAP/LUHS resulting from a BDBEE by providing adequate capability to maintain or restore core cooling, containment, and SFP cooling capabilities at Indian Point Units 2 & 3. Though specific strategies have been developed, due to the inability to anticipate all possible scenarios, the strategies are also diverse and flexible to encompass a wide range of possible conditions. These pre-planned strategies developed to protect the public health and safety are incorporated into the IP2 and IP3 emergency operating procedures in accordance with established EOP change processes, and their impact to the design basis capabilities of the unit evaluated under 10 CFR 50.59.

2.3 Reactor Core Cooling and Heat Removal Strategy

The FLEX strategy for reactor core cooling and decay heat removal is to release steam from the steam generators (SG) using the atmospheric dump valves (ADVs) and the addition of a corresponding amount of feedwater to the SGs via the turbine driven auxiliary boiler feedwater (TDABF) pump or the FLEX SG makeup pump. The auxiliary feedwater (AFW) system includes the condensate storage tank (CST) as the initial water supply to the TDABF pump.

RCS cooldown will be initiated after approximately 0.5 hours following a BDBEE that initiates an ELAP/LUHS event.

DC bus load shedding will ensure battery life is extended to 8 hours. FLEX Phase 2 generators will repower instrumentation prior to battery depletion.

RCS makeup and boron addition will be initiated within 12.7 hours for IP2 and 11.6 hours for IP3 to ensure natural circulation, reactivity control, and boron mixing is maintained.

2.3.1 Phase 1 Strategy

Immediately following the occurrence of an ELAP/LUHS event, the reactor will trip and the plant will initially stabilize at no-load reactor coolant system temperature and pressure conditions, with reactor decay heat removal via steam release to the atmosphere through the ADVs or MSSVs. Natural circulation of the reactor coolant system will develop to provide core cooling and the TDABF pump will provide flow from the CST to the SGs to makeup for steam release.

Operators will respond to the event in accordance with emergency operating procedures to confirm reactor cooling system, secondary system, and containment conditions. A transition to 2/3-ECA-0.0, "Loss of All AC Power," will be made upon the diagnosis of the total loss of AC power. This procedure directs isolation of RCS letdown pathways to conserve inventory, confirmation of natural circulation cooling, verification of containment isolation, reducing DC loads on the station Class 1E batteries, and establishment of electrical equipment alignment in preparation for eventual power restoration.

The Phase 1 strategy for reactor core cooling and heat removal relies upon installed plant equipment and water sources for AFW supply to the steam generators and steam release to the atmosphere. The main active component associated with this strategy is the TDABF pump. All FLEX strategy components associated with AFW operations remain powered in Phase 1. The TDABF pump is automatically actuated on undervoltage to 480V buses 5A and 6A (for IP2) and 3A or 6A (for IP3), coincident with a unit trip without safety injection, to provide feedwater to the steam generators for the removal of reactor core decay heat following a loss of main feedwater. Although the TDABF pump automatically actuates, additional operator actions are required to control the feed to the SGs. The TDABF pump can supply 100% of the required flow to all 4 steam generators through individual air-operated flow control valves (FCVs). Remote control and operation of the FCVs uses instrument air or can be switched to an installed backup nitrogen supply if needed. Manual operation of the FCVs via handwheels is available if necessary. Cooldown of the plant using the ADVs commences after approximately 0.5 hours. This cooldown will be symmetric, using all four SG ADVs.

Two RCS cooldowns will be performed to reach approximately 340°F cold leg temperature within 24 hours following the initiation of the event. The first cooldown stabilizes the plant at a steam generator pressure of approximately 270 psig for IP2 and 275 psig for IP3 (References 3.85 and 3.86) which correlates to an RCS pressure of approximately 310 psia and RCS core (hot leg) temperature of approximately 420°F and approximately 415°F cold leg temperature. The TDABF pump can operate until the available steam pressure from the steam generator drops below 110 psig for IP2 and 100 psig for IP3, therefore, this plant condition provides adequate steam pressure for continued operation of the TDABF pump. Following isolation of the SI accumulators in Phase 2 (to prevent nitrogen injection) (Reference 3.101), completion of required boration for 340°F cold leg temperature (to satisfy shutdown margin requirements) and one hour delay for boron mixing, the RCS is cooled to 340°F cold leg temperature within 24 hours resulting in the plant being stabilized at approximately 345°F core (hot leg) temperature and approximately 126 psia (111.3 psig) RCS saturation pressure. During Phase 1 the TDABF pump is the preferred method for steam generator inventory control and may be used if capable to provide required steam generator inventory makeup flow. However, based on the design specified steam pressure for TDABF pump operation and expected steam generator pressure being less than the design specified pressure, an alternate credited method is available to provide steam generator makeup for all BDBEE's. Specifically, prior to commencing the second cooldown, the Phase 2 FLEX SG makeup pump is connected and available to provide makeup to the steam generators, when desired or needed as described in Section 2.3.2.

Suction to the TDABF pump is from either the CST or the city water storage tank (CWST). The CST has a minimum required inventory of 295,150 gallons for IP2 and 292,000 gallons for IP3, and a capacity of up to 600,000 gallons. The CWST has a capacity of 1.5 million gallons with a minimum usable volume of 655,000 gallons. For missile events (e.g. tornadoes and hurricanes) only one of these tanks is assumed to survive. The basis that one of these tanks survive is provided in Section 2.6.3. For seismic and other non-missile events, both the CST and CWST are assumed to survive though the inventory in the CWST is not credited for meeting the guidance in NEI 12-06 (Reference 3.3) following a seismic event because the CWST system is not fully qualified for a seismic event.

Using the minimum usable CST inventory available at the start of the event, assuming the RCS is cooled down to 400°F, and using decay heat values calculated from ANS 5.1-1979 + 2 sigma uncertainty and decay heat values calculated for the general model for loss of residual heat removal (RHR), the SGs can be supplied with water for approximately 24 hours for IP2 and 23 hours for IP3 (Reference 3.33 and 3.34). Thus, the minimum inventory in a CST is adequate to cooldown the plant and remove decay heat throughout Phase 1.

If the CST is unavailable following the event (tornado missile), the TDABF pump is capable of drawing water from the CWST. In the case of IP2, if instrument air is unavailable following the BDBEE, the TDABF pump suction is aligned to the city water system within 30 minutes (via PCV-1188). Operation of PCV-1188 from the central control room (CCR) is maintained by AFW nitrogen backup system until a manual blocking device is installed to maintain PCV-1188 open. Conservatively, for IP2 the manual blocking device is installed within 2 hours, eliminating a need for a subsequent nitrogen supply to maintain the CWST available to the suction of the TDABF pump. In the case of IP3, for a loss of the CST with instrument air unavailable a modification was performed to maintain operation of PCV-1188 from the CCR. This modification consisted in the installation of a dedicated nitrogen backup supply for valve operation (Reference 3.82). This dedicated nitrogen backup supply maintains PCV-1188 open to align the CWST to the suction of the TDABF pump until a manual blocking device is installed. Based on nitrogen usage provided by this dedicated nitrogen backup supply, the manual blocking device is installed within 24 hours, eliminating a need for a subsequent nitrogen supply to maintain the CWST available to the suction of the TDABF pump.

Hurricane Scenario - IPEC has substantial defense-in-depth preparation plans for the hazards posed by hurricanes and tropical storms. IPEC has procedural guidance to mitigate potential impacts due to such storms. FLEX equipment (pumps/hoses) will not be pre-staged, unless protected as applicable for the BDBEE, because of potential damage from extreme high winds. The severe weather plant procedure (Reference 3.88) states that the cool down should be stopped at approximately 400°F cold leg temperature for a BDBEE that may cause an ELAP to support appropriate operation of the TDABF pump. This procedure also increases on-site staffing, maximizes CST and fire water storage tank (FWST) levels, and verifies CWST level is normal. However, identical to a non-hurricane event, following the loss of all AC power, 2/3-ECA-0.0 is entered which stabilizes the unit at 270 psig (IP2) and 275 psig (IP3) steam generator pressure. Subsequently, a second cooldown is performed as described above.

RCS - Initially, the safety injection (SI) accumulators will make up for most of the reductions in the volume of coolant in the RCS as a result of leakage and contraction due to the cooldown of the plant. The SI accumulators are initially maintained at a minimum of 630 psig (IP2) and 600 psig (IP3). As the plant is cooled down, RCS pressure decreases and eventually goes below SI accumulator pressure. At this point, the SI accumulators begin injecting to make up for the decrease in water volume. Depressurization of the RCS to approximately 310 psia will not cause the SI accumulators to completely inject their inventory into the RCS. This is important because following complete injection of the inventory in the SI accumulator into the RCS subsequent injection of the nitrogen cover gas from the accumulators into the RCS could occur. Should nitrogen be injected into the RCS, partial or complete disruption of natural circulation may occur which would severely reduce the ability to remove decay heat and would likely lead to core damage. This is one of the reasons why RCS cooldown and depressurization in Phase 1 is stopped at an RCS pressure of approximately 310 psia. Electrical/Instrumentation – Load stripping of non-essential loads will begin within 30 minutes after the occurrence of an ELAP/LUHS and completed within 2 hours into the event. This extended load shedding will extend the battery powered monitoring function to at least 8 hours following the event initiation for IP2 and IP3 station batteries. (See Section 2.3.11)

2.3.2 Phase 2 Strategy

Several actions are required during Phase 2 following the event for reactor core cooling. The Phase 1 strategy is dependent upon the continued operation of the TDABF pump. However, near the end of the second cooldown the anticipated TDABF pump steam pressure will be less than the design specified steam pressure for TDABF pump operation. As a result, prior to commencing the second cooldown, the FLEX SG makeup pump is connected and available to provide makeup to the steam generators, when desired or needed. The TDABF pump is the preferred method for steam generator inventory control and may be used if capable to provide required steam generator inventory makeup flow.

The Phase 2 FLEX inventory transfer pump will refill the CST from other alternate cooling sources (ACS) of water for the duration of the Phase 2 coping time using hose connections provided at each of the tanks.

For IP2, if the CST is lost due to a tornado missile event and the TDABF pump is not available, the inventory of the CWST remains available via inventory transfer using installed piping from the CWST to the FWST.

If the IP2 FWST is lost (tornado missile event) and the TDABF pump is not available, then one IP3 FWST is credited in the strategy. To supply adequate inventory to the IP3 FWST, a flow path between the CWST and the IP3 FWST is used. Then, the suction of the FLEX inventory transfer pump can be hooked up to the IP3 FWST FLEX connection to provide inventory to the IP2 PWST or CST. The FLEX inventory transfer pump is staged near the applicable IP3 FWST FLEX connection.

For IP3, an installed flow path does not exist to refill the CST from the CWST and the CWST does not include connections for using the FLEX inventory transfer pump. Therefore, if the TDABF pump is not available, the loss of one of the FWSTs or the CST from a tornado missile event uses an alternative robust flow path from an available source to refill any remaining FWST(s) from the CWST.

For the loss of CST, if the TDABF pump remains in operation following the second cooldown to 340°F cold leg temperature, installation of the manual blocking device on PCV-1188 is required within 2 hours for IP2 and within 24 hours for IP3.

The preferred order of tanks to be used to refill the CST is based on using those with water quality and chemistry which most closely matches that found in the condensate and feed system. The tanks which will be used to refill the CST (if available) in order from most preferred to least preferred and the bases for the order are:

1. PWST – contains demineralized water but does not have volatile chemicals found in condensate water.

2. CWST - contains treated water (i.e., water which has been made potable at a water treatment facility) and can be connected to the AFW system without the use of the FLEX inventory transfer pump (note that this tank and its piping has limited robustness and may not survive the BDBEE).

3. FWSTs – contains treated water (one FWST for IP2 and two FWSTs for IP3)

4. Refueling Water Storage Tank (RWST) contains demineralized water with boric acid (the water in this tank will only be used for feeding the SGs if borated water inventory required for RCS makeup and reactivity control from other available sources is adequate and assured). This is not the preferred source if either IP2 or IP3 RWST is not available

Additionally, per guidance of NEI 12-06, Phase 2 also requires a baseline capability for reactor core cooling to connect an on-site, portable pump (FLEX SG makeup pump) for providing water to the SGs in the event that the TDABF pump fails or when sufficient steam pressure is no longer available to drive the TDABF pump turbine. A portable, diesel-driven pump capable of providing the required feed rate to the steam generators will be used. Hoses will be provided to connect the suction of the FLEX SG makeup pump to the CST hose manifold and the discharge manifold of the pump to either the primary or alternate FLEX connection.

The RCS inventory control and long term sub-criticality, involves the use of the RWST inventory through a portable FLEX RCS inventory makeup pump. To maintain natural circulation and prevent reflux cooling, RCS makeup is initiated prior to 12.7 hours for IP2 and 11.6 hours for IP3 following the ELAP/LUHS event using a FLEX RCS inventory makeup pump. Two portable diesel-driven FLEX RCS inventory makeup pumps (one pump per unit) will be transported from the on-site FLEX equipment storage building (FESB) and deployed for delivery of RCS inventory makeup from the RWST or another borated suction source for the remainder of the event (See Section 2.3.4.8).

To ensure adequate boric acid concentration is provided to support the second cooldown to 340°F cold leg temperature, injection for shutdown margin is required within 22 hours for IP2 and IP3 (See Section 2.3.9). Completion of boration within 22 hours allows one hour for boron mixing prior to performing the subsequent cooldown from 415°F cold leg temperature to 340°F cold leg temperature that reduces RCS cold leg temperature to less than 350°F within 24 hours to satisfy Westinghouse Technical Bulletin TB-15-1 recommendations (Reference 3.84).

Before proceeding to the second RCS cooldown to 340°F cold leg temperature, the following tasks should be completed:

- SI accumulators are isolated,
- Boration for 340°F cold leg temperature (including one hour delay for boron mixing) has been completed, and
- FLEX SG makeup pump is connected and available to provide makeup to the steam generators.

For IP2, suction for the FLEX RCS inventory makeup pump will come from a RWST hose connection. Its discharge will be to connections in the reactor coolant pump alternate seal water injection piping of the chemical and volume control system (CVCS) (primary) and upstream of SI-7302 in the safety injection (SI) system (alternate). For IP3, suction for the FLEX RCS inventory makeup pump will come from a

RWST hose connection. Its discharge will be to connections upstream of the boron injection tank (primary) or at the discharge of the charging pumps (alternate). Both connections (primary and alternate for both units) include a vent valve to allow trapped air in the pump and hoses to be expelled prior to commencing injection into the RCS.

The electrical portion of the Phase 2 coping strategy has the main goal of repowering the 480V AC emergency distribution system (EDS) consisting of four switchgear distribution buses 2A, 3A, 5A, and 6A. For IP2, the FLEX diesel generator (DG) is connected to safety related 480V AC switchgear bus 2A for the primary connection. For the alternate connection the FLEX DG is connected in parallel to bus 5A and bus 3A. For IP3, the FLEX DG is connected to safety related 480V AC switchgear bus 5A for the primary connection. For the alternate connection the FLEX DG is connected in parallel to bus 5A and bus 3A. After repowering from one of these locations, buses may be cross-tied through operator manipulation of breakers to allow powering of any battery charger or other essential and optional loads. A single FLEX diesel generator per unit is designated to allow powering of battery chargers or other loads.

Repowering essential instrumentation will be achieved by repowering battery chargers 21/31, 22/32, 23/33 and 24/34 for IP2/IP3. These chargers are connected to the 480V AC vital buses through the motor control centers (MCCs). Note: battery charger 34 is non-safety related and is not credited. It can be loaded if it is available. Instead of loading battery charger 34, instrument buses 34 and 34A can alternatively be powered as desired from MCC 36B, or MCC 36C.

The primary connection for IP2 enables a quick connection of the FLEX DG feeder cables to the 480V AC EDS via a power inlet panel. This panel is connected to cubicle 23A on bus 2A (Figure 9). The primary connection point for IP3 includes a permanently installed connection between the load side of compartment 19C on switchgear bus 5A and easily accessible power inlet panel outside the switchgear room (Figure 11). The portable 480V AC FLEX DGs and the required power cables will be transported from the FESB to their positions in the transformer yard (Figure 2).

Deployment of the 480V AC FLEX DGs from the FESB will be completed within 6 hours after the ELAP event (this includes an estimated three hour time allotment for debris removal, and an additional hour for transportation). Placing the 480V AC FLEX DGs into service can be accomplished within 2 hours of deployment. It is therefore reasonable to expect the 480V AC FLEX DGs to be supplying power to the key instrumentation within 8 hours of a BDBEE event which initiates an ELAP event.

2.3.3 Phase 3 Strategy

The Phase 3 strategy for core cooling and decay heat removal requires an off-site pump capable of removing heat from the reactor core in addition to other loads. The NSRC can provide a low pressure/high flow dewatering pump for this purpose (Figures 5 and 6). A booster pump will also be provided by the NSRC to provide additional suction lift as needed. Additionally, a water filtration system will be provided from the NSRC to provide a method to remove impurities from alternate fresh water supplies to the TDABF pump or the FLEX SG makeup pump.

Using the steam generators for core cooling and decay heat removal is dependent on reactor core decay heat generation and the available supply of clean water from on-site sources or from water processing units provided from the NSRC. Restoring RHR provides an alternate method for removing decay heat and/or cooling down the RCS to cold shutdown. Restoration of RHR requires repowering the RHR pump via an NSRC generator to establish recirculation in the RCS. Heat removal is through the RHR heat exchangers which are cooled by establishing flow through the component cooling water (CCW) system. For each unit, one CCW pump will be powered by the Phase 2 FLEX diesel generator.

For RCS injection in Phase 3, boron mixing equipment is available to provide makeup capability to the RWST. If the plant is in Mode 1-4 when the FLEX event occurred, cool down below 340°F will require additional boron injection (if not already provided during Phase 2) to ensure adequate shutdown reactivity and RCS inventory control. Isolation of the SI accumulators occurs prior to the second cooldown. The NSRC can provide a 500 gpm water treatment filtration unit and a mobile boration unit including a 1,000-gallon capacity tank (Figures 7 and 8).

Phase 3 strategies involve the use of a large (1100 kW capacity, derated to 1000 kW), 480V turbine generator from the NSRC. For IP2 and IP3, other diesel generator alignment options are available by implementing the following restrictions based on analysis performed in IP-CALC-14-00056 (Reference 3.90) and IP-CALC-14-00098 (Reference 3.91) to ensure starting currents on the Phase 2 FLEX DG and Phase 3 NSRC generator are not exceeded:

- The Phase 2 FLEX DG has the capacity to start one CCW pump.
- The Phase 3 NSRC generator has the capacity to start a CCW pump, RHR pump and containment recirculation fan (CRF) sequentially.

For IP2, options are available to ensure load sharing for integration of the Phase 2 FLEX DG and the Phase 3 NSRC generator to supply power to buses 2A, 3A, 5A and 6A in Phase 3 depending on the availability of the primary connection (bus 3A) or alternate connection (bus 6A).

For IP3, power is restored to bus 2A, 3A or 6A from the Phase 3 NSRC generator, which will be connected directly to either bus 3A (primary) of bus 6A (alternate) and then connected to other buses as needed. Power to bus 5A will be maintained on the Phase 2 FLEX DG.

Procedures 2/3-FSG-014 (Reference 3.97) provide the lineup and sequence for connecting the NSRC diesel generator.

The primary and alternate generator locations for IP2 and IP3 are in two separate areas, the primary staging location is in the transformer yard. The alternate staging location is west of the turbine loading bay.

2.3.4 Systems, Structures, Components

2.3.4.1 Turbine Driven Auxiliary Boiler Feedwater Pump

The TDABF pump will automatically start on a loss of AC power and will deliver the required AFW flow to all 4 steam generators through individual air-operated flow control valves. Remote control and operation of the FCVs uses instrument air or can be switched to an installed backup nitrogen supply. Manual operation of the FCVs via handwheels is available. The TDABF pump is sized to provide the design basis AFW flow requirements and is located in a safety related structure (the auxiliary boiler feed pump building) designed for protection for all applicable external events.

2.3.4.2 Steam Generator Atmospheric Dump Valves

During an ELAP / LUHS event with the loss of all AC power and instrument air, reactor core cooling and decay heat will be removed from the SGs for an indefinite time period by depressurizing the SGs via the ADVs. The valves have safety related air supplies and are provided with a source of safety related nitrogen to ensure operability following a loss of instrument air. The ADVs are provided with an additional backup source of nitrogen to ensure RCS cooldown capability should a loss of instrument air and the primary nitrogen backup system occur.

For IP2, ADV operation utilizes four installed standby nitrogen bottles that are placed in service via hose connections (Reference 3.27). IP-CALC-14-00036 (Reference 3.28) determined the installed four bottles will provide the needed compressed air to maintain ADV operation for 20 hours prior to requiring bottle replacements. Additional bottles are stored in the FESB to provide an adequate nitrogen supply for 72 hours. A total of 14 cylinders are required for 72 hours of ADV operation.

For IP3, ADV and associated pressure relief valve (PRV) operation utilizes four installed standby nitrogen bottles that are placed in service using 3-SOP-ESP-001 (Reference 3.29). IP-CALC-13-00059 (Reference 3.30) determined the installed four bottles will provide the needed compressed air to maintain ADV operation for 24 hours prior to requiring bottle replacements. Additional bottles are stored in the FESB to provide an adequate nitrogen supply for 72 hours. A total of 11 cylinders are required for 72 hours of ADV operation

2.3.4.3 Batteries

The safety related batteries and associated DC distribution systems are located within robust structures designed to meet applicable design basis (see Section 2.6.3) external hazards and will be used to initially power required key instrumentation and applicable DC components. Load shedding of non-essential equipment provides an estimated total service time of approximately 8 hours of operations (References 3.35 and 3.36).

2.3.4.4 Condensate Storage Tank

The condensate storage tanks (one per unit) meet the requirements in NEI 12-06 (Reference 3.3) for protection from seismic, high winds, extreme heat, extreme cold, and flooding events. The CSTs are susceptible to tornado missile strikes.

For IP3, the CST is physically located in an area mostly surrounded by Category I structures (Unit 1 and Unit 3 containment buildings), separated from the CWST by approximately 1,650 ft., and is due north of the primary auxiliary building (PAB) (such that a single tornado is not capable of disabling off-site power, all EDGs, service water, the CST, and the CWST). This coincides with the position of the IP3 licensing basis. The IP3 licensing and design basis is that only one missile was considered acting at any time simultaneously with a 360 mph wind load (Reference 3.14). Consistent with this licensing and design basis, all tanks credited for IP3 to comply with NRC Order Number EA-12-049 strategies are designed to or were evaluated to survive 360 mph wind loading. In addition, the effects of one missile acting at any time have been addressed by ensuring that two water sources are available to support each required strategy. This ensures no single missile will prevent the fulfillment of the IP3 strategy. Since the IP3 credited tanks have been evaluated to meet the current licensing basis, they are considered robust sources of water (see Section 2.6.3). Therefore, if the CST is lost during a missile event, other sources of water are available to feed the SGs (e.g., the CWST, PWST, and FWSTs) to allow the plant to be safely shutdown. Should the IP3 CST be damaged by a tornado missile, the CWST would be available to provide water to the TDABF pump (See Section 2.3.1) until the FLEX inventory transfer pump can be used to supply a source of water for use in feeding the FLEX SG makeup pumps.

IP2 UFSAR states that the licensing basis does not include tornado protection for the design of buildings, structures and components, and that tornado protection is not a design criterion for IP2. Therefore, no specific protection from the effects of tornadoes is required for tanks to be considered robust and credited in the IP2 FLEX strategies. To provide additional protection over and above the current design and licensing basis, all tanks credited for the IP2 FLEX strategies have been designed to or have been evaluated to survive a 360 mph wind loading (Reference 3.14). In addition, the effects of one missile acting at any time have been addressed by ensuring that two water sources are available to support each required strategy to provide defense in depth. This ensures that no single tornado missile occurring at the IPEC site will prevent the fulfillment of the strategy. As the credited tanks have been evaluated to exceed the current licensing basis they are considered robust sources of water (see Section 2.6.3). In the event the IP2 CST was impacted by a tornado missile, the CWST, located approximately 1,700 ft. from the CST, would be available to provide water to the IP2 TDABF pump until the FLEX inventory transfer pump can be used to supply a source of water for use in feeding the FLEX SG makeup pumps. In case the IP2 FWST is impacted by a missile event with the TDABF pump not available, one IP3 FWST connection is credited for the CWST inventory flow path to the suction of the FLEX inventory transfer pump for makeup capability to either the PWST or CST.

2.3.4.5 City Water Storage Tank

The CWST meets the requirements in NEI 12-06 (Reference 3.3) for protection from seismic, high winds, extreme heat, extreme cold, and flooding events. The CWST is susceptible to tornado missile strikes. In addition, the city water storage system has limited seismic robustness and may not survive the BDBEE. The normal alternate supply to the CST is the seismically qualified CWST common to both units. This tank has pipe connections to the suctions of the TDABF pump to provide alternate feedwater supply to the steam generators. The CWST contains treated water with a minimum usable inventory of 655,000 gallons. The CWST inventory is also provided as a makeup flow to the FWSTs.

2.3.4.6 Fire Water Storage Tank

The FWSTs (one for IP2 and two for IP3) meet the requirements in NEI 12-06 (Reference 3.3) for protection from seismic, high winds, extreme heat, extreme cold and flooding events. They are susceptible to tornado missile events. The minimum usable inventory for IP2 FWST is approximately 279,000 gallons, and for IP3 FWSTs is approximately 600,000 gallons (both tanks combined).

2.3.4.7 Primary Water Storage Tank

The PWSTs (one per unit) meet the requirements in NEI 12-06 (Reference 3.3) for protection from seismic, high winds, extreme heat, extreme cold and flooding events. They are susceptible to tornado missile events. The PWSTs contain demineralized water with a minimum usable inventory of approximately 50,000 gallons (IP2) and 47,000 gallons (IP3).

2.3.4.8 Refueling Water Storage Tank

The refueling water storage tanks (one per unit) meet the requirements in NEI 12-06 (Reference 3.3) for protection from seismic, high winds, extreme heat, extreme cold, and flooding events. The RWSTs are susceptible to tornado missile strikes.

During a BDBEE missile event, it is assumed only one RWST is impacted resulting in the loss of either the IP2 or IP3 RWST, but not both. The basis that at least one RWST survives is provided in Section 2.6.3.

Should the RWST of one unit be damaged by the BDBEE missile, an alternate connection for supplying borated water for RCS inventory and reactivity control to the affected unit is available from the unaffected RWST unit. The inventory in one RWST has been shown to be sufficient to makeup for losses from both plants' reactor coolant systems for approximately 120 hours when the plant is in Modes 1-4, and SGs are available.

2.3.5 FLEX Modifications

2.3.5.1 Primary FLEX SG Makeup Pump Discharge Connection

The primary FLEX SG makeup pump discharge connection for SG injection is located on the common discharge line downstream of the TDABF pump in the auxiliary feedwater system (Figures 3 and 4). A hose will be routed from the FLEX SG makeup pump discharge to the primary connection located inside the auxiliary feedwater building. This is a structure with a robust design with respect to seismic events, floods, high winds, and associated missiles satisfying NEI 12-06. Hydraulic analysis of the flowpath from the CST connection to the primary FLEX SG makeup pump discharge connection has confirmed that applicable performance requirements are met (References 3.37 and 3.38).

2.3.5.2 Alternate FLEX SG Makeup Pump Discharge Connection

In the event that the primary FLEX SG makeup pump discharge connection is not available, an alternate connection location is provided. The alternate discharge connection for SG injection is located in the main feedwater system inside the turbine building, which is separate from the AFW building. For IP2, the alternate connection does not involve a permanent connection. A pre-fabricated assembly with a check and a vent valve will be available with a hose connection on one end and a threaded connection on the other end to be connected to drain valve BFD-28 when needed (Figure 3). The pre-fabricated assembly is stored in the FESB. For IP3, the alternate connection consists of a globe valve, a check valve and a capped threaded connection for use as a hose connection point (Figure 4). A hose will be routed from the FLEX SG makeup pump discharge to the alternate connection hose adapter. The flow will be controlled to each SG by opening the associated main feedwater regulating valves. Makeup flow is controlled by adjusting the speed of the FLEX SG makeup pump. Hydraulic analysis of the flowpath from the CST connection to the alternate FLEX SG makeup pump discharge connection confirmed that applicable performance requirements are met (References 3.37 and 3.38).

2.3.5.3 CST Connection

Three FLEX storz connections have been installed to facilitate refill of the CST or provide a suction source to the FLEX portable equipment. The connections are seismically designed and include a hose coupling suitable for easy connection of hoses (Figures 3 and 4). The preferred sources to be used to refill the CST are the PWST and the FWST.

2.3.5.4 PWST Connection

There are two FLEX storz connections per tank. These connections can be used to refill the CST, or can be used to enable the PWST to be used as a transfer storage tank in case the CST is not available (Figures 3 and 4). The connections are seismically designed and include a hose coupling suitable for easy connection of hoses.

2.3.5.5 FWST Connection

There is one FLEX connection per tank that can be used to refill the CST, or to connect to the suction of the FLEX SG makeup pump (when the CST is not available (due to a missile strike) and the TDABF pump is no longer available). The connection is seismically designed and includes a hose coupling suitable for easy connection of hoses (Figures 3 and 4).

2.3.5.6 Primary RCS Connection

For IP2, the primary connection for the discharge of the FLEX RCS inventory makeup pump is a permanently installed hose connection in the CVCS as shown in Figure 3. For IP3, the primary connection for the discharge of the FLEX RCS inventory makeup pump is a permanently installed hose connection located upstream of the boron injection tank as shown in Figure 4.

The primary supply to the FLEX RCS inventory makeup pump are the RWSTs.

In the event one unit's RWST is damaged, the suction hose to the FLEX RCS inventory makeup pump can be routed from the other unit's RWST to provide a borated water source to the FLEX RCS inventory makeup pump (Reference 3.104). Each hose connection is capable of providing flow to the suction of both FLEX RCS inventory makeup pumps at the same time (References 3.39 and 3.40).

2.3.5.7 Alternate RCS Connection

For IP2, the alternate connection for the discharge of the FLEX RCS inventory makeup pump is a permanently installed connection in the safety injection system (Figure 3). For IP3, the alternate connection is located in the CVCS on a direct path to the RCS downstream of the charging pumps (Figure 4). The FLEX RCS inventory makeup pump can deliver borated water from the RWST to the RCS via these connections. These connections are located in the PAB, at their respective units, which is a structure with designs that are robust with respect to seismic and flood events. For wind and missile events, see Section 2.6.3. Also, these connections provide the physical and train separation required per NEI 12-06 from the primary connections for both units.

2.3.5.8 RWST Suction Connection

Four FLEX storz connections from the RWST are installed in a 6-in. nozzle that was not in use, and suitable for delivering flow rates for both units if required. This four FLEX storz connection allows borated water from the RWST to be supplied to a portable FLEX RCS inventory makeup pump (Figures 3 and 4).

2.3.5.9 Primary Electrical Connection

For IP2, the primary connection point includes a permanently installed connection between a new breaker within cubicle 23A at bus 2A and a new power input panel. The primary connection point for Phase 2 is designed based on locating the FLEX DG in the IP2 transformer yard. This location is suitable for all applicable hazard scenarios (Section 2.6) with the exception of flooding. A sequence for creating the common "ring" bus using the primary connection point is to close breaker 2AT5A (restoring power to bus 5A), then breaker 2AT3A (restoring power to bus 3A), and finally breaker 3AT6A (restoring power to bus 6A) (Figure 9).

For IP3, the primary connection point includes a permanently installed connection between the load side of compartment 19C on switchgear bus 5A, and power input panel outside the switchgear room. This power inlet panel would then be connected by temporary cables to the FLEX DG. The primary connection point for Phase 2 is designed based on locating the FLEX DG in the transformer yard. This location is suitable for all applicable hazard scenarios (Section 2.6) with the exception of flooding. A sequence for creating the common "ring" bus using the primary connection point is to close breaker 2AT5A (restoring power to bus 2A), then breaker 2AT3A (restoring power to bus 3A), and finally breaker 3AT6A (restoring power to bus 6A) (Figure 11).

2.3.5.10 Alternate Electrical Connection

The design for the alternate connection point is based on locating the FLEX DG in the yard to the north of the PAB. In this case, there are no permanent cable connections. Instead, the FLEX DG's cables are to be pulled into the PAB and directly connected to cable stored within the PAB. For IP2, these cables are stored on three cable carts that are located at El. 98' in the PAB. Additional cables and tools are also located within the FLEX Phase 2 alternate connection cable storage cabinet. For IP3, all of the cables and tools necessary for the alternate connection are within the storage cabinet. The alternative connection requires the lighting bus feeder cables to be removed from the transformers and spliced to the cables from the FLEX DG. Using these feeder cables will allow the FLEX DG to back-feed switchgear buses 3A and 5A via trip circuit breakers (52/LT2 and 52/LT3 for both units). NEI 12-06 (Reference 3.3) allows the alternate connection to be reconfigured provided it can be shown that adequate time is available and adequate resources are available. The tools and parts required for splicing will be available in the FLEX Phase 2 alternate connection cable storage cabinet. The use of the alternate connection is designed specifically for the case of a BDB flood during which access to the primary connection may not be available. A sequence for creating the common “ring” bus using the alternate connection point is to close breaker 2AT3A (restoring power to bus 2A) and then breaker 3AT6A (restoring power to bus 6A). Finally, closing the trip circuit breakers establish the “ring” bus. The actions necessary to splice the cables are contained in the FLEX procedures and Operations have been trained to perform the activity. Use of the alternate connection will de-energize lighting switchgear 22/32 and 23/33. As a result, earlier deployment of the Phase 2 FLEX diesel light towers may be chosen to support other operations and FLEX strategy considerations.

In addition, for IP2 fans are required to be staged for hydrogen removal from battery rooms. These fans are powered from a portable diesel powered lighting tower stored in the FESB.

2.3.5.11 <u>480 VAC Phase 3 NSRC Generator Electrical Connections</u>

Phase 3 strategies involve the use of a large (1.1 MWe derated to 1.0 MWe), 480V turbine generator from the NSRC (one per unit). The 480V AC electrical distribution system (EDS) consists of a distribution bus arrangement. The 480VAC EDS includes four 480VAC buses; 2A, 3A, 5A, and 6A. These switchgear buses distribute power to Engineered Safety Feature (ESF) loads, and to safety-related MCCs.

The primary connection points are on the load connection terminals of cubicle 4B on bus 3A (for IP2) and cubicle 4D on bus 3A (for IP3), which have a FLEX load connection device installed rated at 1600A. The device connects to the switchgear bus and does not connect to any load connected to the cubicle terminals. The alternate connection points are on the load connection terminals of cubicle 12B bus 6A (for IP2) and cubicle 14C bus 6A (for IP3), which have a FLEX load connection device installed rated at 1600A.

The primary and alternate NSRC generator locations are in two separate areas, the primary staging location is in the transformer yard. The alternate staging location is west of the turbine loading bay. Either primary or alternate connection breaker can be reached from either generator location. These connection points are suitable for all applicable hazard scenarios.

2.3.6 Key Reactor Parameters

The following instrumentation or alternative actions are utilized as applicable to support monitoring of key parameters during all phases of the reactor core cooling and decay heat removal strategy for IP2 and IP3 (Reference 3.102):

- Core exit thermocouples (CETCs) or RCS wide range T_{Hot}
- RCS wide range T_{Cold}
- RCS wide range pressure
- Reactor vessel level indication system or pressurizer level
- Steam generator narrow range level
- Steam generator pressure
- Condensate storage tank level
- Refueling water storage tank level
- Auxiliary feedwater flow
- For IP3, environmentally qualified low level ex-core neutron flux monitoring is available. For IP2, environmentally qualified ex-core instrumentation is not available. The ex-core neutron detectors and cables are designed to operate continuously in an ambient temperature of 135°F and for a period of at least 8 hours in an ambient temperature of 175°F (Reference 3.76, Section 7.2.4.2). However, if ex-core instrumentation is rendered unavailable, 2-FSG-008 (Reference 3.95) ensures boron injection occurs to ensure shutdown margin is met. This is consistent with current EOPs and licensing basis with alternate indications (e.g., CETC, T_{Hot} and T_{Cold}) and action (e.g., boration injection) in place that precluded the need to upgrade the neutron flux monitoring instrumentation, which remains, for IP2, a Type B, Category 3, Regulatory Guide 1.97 variable (Reference 3.92 and 3.96). In Reference 3.96, the NRC concluded the existing post-accident neutron flux monitoring instrumentation is acceptable based on appropriate

environmentally qualified alternate indication (i.e., CETCs, T_{Hot} and T_{Cold}) and boron injection capability as directed by plant EOPs. During a BDBEE, the environmentally qualified alternate indication and boron injection capability remain available.

- Battery capacity by monitoring DC bus voltage remains available based on being directly connected to each DC power panel

Adequate instrumentation is available prior to and after load stripping of the DC and AC buses during Phase 1. Availability during Phases 2 and 3 is dependent on the strategy to re-power the vital 480V AC buses including the Class 1E battery chargers. Indication is available by use of either environmentally qualified instrumentation, robust instrumentation, contingency actions or alternate capability provided by an installed mechanical device (References 3.93 and 3.94).

Portable FLEX equipment is supplied with the local instrumentation needed to operate the equipment. The use of these instruments is detailed in the equipment procedures or quick references.

2.3.7 Thermal Hydraulic Analyses

2.3.7.1 Secondary System Analysis

Thermal hydraulic calculations were performed to determine the inventory required to maintain steam generator levels and times associated with the volumes. The conclusions from these analyses showed that the existing condensate storage tank minimum usable inventory of 295,150 gallons for IP2 and 292,200 gallons for IP3 would be able to remove the sensible heat and decay heat for approximately 24 hours for IP2 and 23 hours for IP3 (References 3.33 and 3.34). If the CST is damaged by the BDBEE, the CWST will be used until the FLEX inventory transfer pump can be used to supply a source of water for use in the SGs. If instrument air is unavailable following the BDBEE, nitrogen backup is being provided such that the CWST can be lined up from the unit's central control room (See Section 2.3.1). This provides adequate time for assessing and managing water from all available credited water sources (e. g., FWST, PWST) including the use of the discharge canal/Hudson River until Phase 3 equipment is operational.

2.3.7.2 RCS Analysis

Injection for RCS inventory control is required prior to 12.7 hours for IP2 and 11.6 hours for IP3 after the FLEX event to prevent initiation of reflux cooling. Time to reflux cooling is developed from the methodology described in PWROG-14015 (Reference 3.21) and PWROG-14027 (Reference 3.22) for a Category 1 plants. The basis for using this methodology is described in Letter IP-DE-16-001 (Reference 3.41), IP-CALC-15-00002 for IP2 (Reference 3.42) and IP-CALC-15-00003 for IP3 (Reference 3.43). PWROG-14015 identified IP2 and IP3 as Category 4 plants which have higher seal leakage rates than a Category 1 plant because of less seal leak-off line resistance. Therefore, a modification was performed to each unit to provide additional resistance in the seal leak-off line. These modifications allow the transition of IP2 and IP3 from a Category 4 plant to a Category 1 plant.

Providing injection flow at 40 gpm with a total RCS inventory loss rate of 23.8 gpm (Section 2.3.8) prevents entry into reflux cooling and therefore maintains core heat removal with natural circulation as RCS inventory increases. As described in Section 2.3.8 below, 23.8 gpm is the highest total leak rate following the first cooldown and prior to initiating the second cooldown when the leak rate is reduced.

2.3.8 Reactor Coolant Pump Seals

IPEC is a Westinghouse 4-Loop plant with Westinghouse RCP seals Model 93. The maximum total leakage rate (RCP seal leakage rate plus 1 gpm unidentified RCS leakage rate) profile for each minute after the SBO/ELAP is developed from the methodology described in PWROG-14015 (Reference 3.21) and PWROG-14027 (Reference 3.22) for a Category 1 plant and will be as follows:

a. 68 gpm during pre-cooldown period (0 to 30 minutes). 30 minutes is based on the reasonable anticipated time expected before plant cooldown begins.

b. 47.4 gpm during the first cooldown period (30 minutes to 180 minutes) from approximately 547°F to approximately 415°F cold leg temperature and approximately 310 psia RCS pressure.

These values correlate to a steam generator pressure of approximately 270 psig for IP2 and 275 psig for IP3 to prevent SI accumulator nitrogen injection into the RCS.

i. Leak rate change because
   1. Rate is a function of the pressure in the RCS
   2. RCS pressure is decreasing as the plant cools down

ii. 180 minute time is stabilizing plant conditions
   1. Cooldown start time of 30 minutes
   2. Cooldown rate between 75°F/hr and 100°F/hr
   3. Cooldown stops at a steam generator pressure of approximately 270 psig for IP2 and 275 psig for IP3, which correlates to an RCS pressure of approximately 310 psia, and RCS core (hot leg) saturation temperature of approximately 420°F (Reference 3.31 and 3.32).

c. 23.8 gpm during the post-first cooldown period while maintaining approximately 415°F cold leg temperature and approximately 310 psia RCS pressure from 3 hours (180 minutes) until 23 hours. The subsequent cooldown may begin prior to 23 hours as described below.

d. 19.4 gpm during the second cooldown period between 23 and 24 hours when the RCS is cooled to approximately 340°F cold leg temperature and 126 psia. The cooldown may be commenced prior to 23 hours provided the safety injection accumulators are isolated, boration and one hour boron mixing requirements are met and the FLEX SG makeup pump is connected and ready for operation. Twenty-three hours is used (References 3.31 and 3.32) to provide the maximum possible seal leakage in determining RCS inventory makeup requirements. Completion of boron mixing requirement within 23 hours provides at least one hour to cooldown from 415°F cold leg temperature to less than 350°F cold leg temperature to satisfy Westinghouse Technical Bulletin TB-15-1 (Reference 3.84) recommendations.

e. 15 gpm during the post-second cooldown period between 24 hours and 120 hours at which time the NSRC equipment is operational to support placing the residual heat removal (RHR) system in operation. The 200 psia RCS pressure leak rate of 3.5 gpm is used from IP-CALC-15-00017 (Reference 3.79).

Westinghouse calculation IP-CALC-15-00017 (Reference 3.79) determined that the IPEC-specific seal leakage rates were lower for the following three pressure/temperature parameters (2250 psia/572°F = 14.2 gpm; 1500 psia/572°F = 15.2 gpm; and 310 psia/415°F = 4.9 gpm) than in the PWROG documents (References 3.21 and 3.22) (2250 psia/572°F = 16.0 gpm; 1500 psia/572°F = 17.5 gpm; and 310 psia/415°F = 5.7 gpm). However, the IPEC-specific seal leakage rate at 200 psia/375°F was 3.5 gpm per RCP as compared to 0.7 gpm per RCP described in the above PWROG documents.

The RCP leakage rates provided in items a) through e) above were used in the RCS inventory calculations (References 3.31 and 3.32), the time to reflux cooling calculations (References 3.42 and 3.43), and the containment analysis calculations (References 3.57 and 3.58).

2.3.9 Shutdown Margin Analysis

The methods for injecting borated water into the RCS for RCS inventory control in Phase 1 and Phase 2 will also provide sufficient negative reactivity to ensure that shutdown margin is maintained following cooldown and xenon decay. Injection for shutdown margin is required within 22 hours (for both IP2 and IP3) to ensure adequate boric acid concentration is provided to support the second cooldown to 340°F cold leg temperature (Reference 3.41). Completion of boration within 22 hours allows one hour for boron mixing prior to performing the subsequent cooldown from 415°F to 340°F cold leg temperature that reduces RCS cold leg temperature to less than 350°F within 24 hours to satisfy Westinghouse Technical Bulletin TB-15-1 (Reference 3.84). The primary method for reactivity control in Phase 2 is the use of the safety injection accumulators in Phase 1 followed by injection of borated water from the RWST using the FLEX RCS inventory makeup pump in Phase 2. The analysis determined that RCS makeup is required from the RWST to maintain subcriticality in the reactor core. References 3.23 and 3.24 show that injection of approximately 16,700 gallons (IP2) and 15,700 gallons (IP3) of 2400 ppm borated water from the RWST will be adequate to meet shutdown reactivity requirements at the limiting end-of-cycle condition. This makeup volume can be accommodated by RCS volume shrink and re-establishing letdown by energizing and opening the reactor vessel head vents as required. The reactor vessel head vents are powered from AC power (IP2) and DC power (IP3). Utilizing these valves for letdown will be delayed until the FLEX DG is available to supply power.

Since the RCS inventory makeup is initiated no later than 12.7 hours for IP2 and 11.6 hours for IP3 following an ELAP/LUHS event, the borated water injected into the RCS for inventory makeup bounds the boration requirements for maintaining core reactivity shutdown margin of 1.3% following an ELAP/LUHS.

To ensure adequate boron mixing occurs (References 3.15 and 3.16):

1. The required timing for providing borated makeup to the RCS (12.7 hours for IP2 and 11.6 hours for IP3) considers conditions with no RCS leakage (e.g., zero total leakage) and with the highest applicable leakage rate for the reactor coolant pump seals and unidentified RCS leakage (maximum total leakage);

2. For the highest leakage after the first cooldown, 40 gpm RCS makeup is established prior to entry into reflux cooling, therefore ensuring natural circulation is maintained. The RCS makeup rate (40 gpm) is greater than the leakage rate subsequent to the first cooldown (23.8 gpm) and therefore RCS inventory increases enabling the RCS to remain in or transition back to single phase natural circulation; and

3. Credit for increasing the RCS boron concentration prior to commencing the second cooldown is delayed for one hour to account for the mixing of the borated makeup with the RCS inventory. For IP2, since RCS makeup will be established by 12.7 hours and completion of boration for allowing one hour of mixing is required within 22 hours, then, approximately 9.3 hours is provided to ensure 1) adequate mixing occurs and 2) the required boration at the end-of-cycle is complete. IP-CALC-14-00041 (Reference 3.23) provides a conservative time to borate because all boration activities are assumed to be completed by 22 hours. For IP3, since RCS makeup will be established by 11.6 hours and boration for allowing one hour of mixing is required within 22 hours, then, approximately 10.4 hours is provided to ensure 1) adequate mixing occurs and 2) the required boration at the end-of-cycle is complete. In addition, IP-CALC-13-00073 (Reference 3.24) provides a

conservative time to borate because all boration activities are assumed to be completed by 22 hours.

2.3.10 Flex Pumps and Water Supplies

2.3.10.1 FLEX Inventory Transfer Pump

The FLEX inventory transfer pump has a performance criteria of 327 gpm (Reference 3.37) @ 165 psi and it is used to refill the CST from other available sources for the duration of Phase 2. The FLEX inventory transfer pump is a trailer-mounted, diesel driven pump that is stored in the FESB. The pump is deployed by towing the trailer to the designated locations near the selected water source from where suction will take place. There are three FLEX inventory transfer pumps available for the site, therefore complying with the requirements established in NEI 12-06.

Each FLEX inventory transfer pump is sized to provide makeup water supply of 327 gpm to the CST. Hydraulic analyses of the flowpath from each water source to the CST have confirmed that applicable performance requirements are met (References 3.45 and 3.46).

2.3.10.2 FLEX Steam Generator Makeup Pump

Consistent with NEI 12-06, Appendix D, SG water injection capability is provided using a portable FLEX pump through a primary and alternate connection (Reference 3.103). The FLEX SG makeup pump has a performance criteria of 327 gpm (@575 psi). The FLEX SG makeup pump is a trailer-mounted, diesel-driven pump that is stored in the FESB. The portable, diesel-driven FLEX SG makeup pump will provide a back-up SG injection method in the event that the TDABF pump can no longer perform its function due to low turbine inlet steam flow from the SGs. Hydraulic analyses have confirmed that the FLEX SG makeup pump is sized to provide the minimum required SG injection flowrate to support reactor core cooling and decay heat removal (References 3.37 and 3.38). Three FLEX SG makeup pumps are available to satisfy the requirements from NEI 12-06.

2.3.10.3 FLEX RCS Inventory Makeup Pump

Based on the recommendations of WCAP-17601 (Reference 3.48) and the analysis performed to determine the bounding pressure and flow conditions for the RCS inventory makeup pump, the required delivery pressure is approximately 310 psia. Accordingly, the FLEX RCS inventory makeup pump is capable of delivering a minimum flow of 40 gpm at a discharge pressure of up to 320 psi (Reference 3.98). Hydraulic analysis of the FLEX RCS inventory makeup pump with the associated hoses and installed piping systems confirm that the FLEX RCS inventory makeup pump minimum flow rate and head capabilities meet the FLEX strategy requirements for maintaining RCS inventory.

The capability of the FLEX RCS inventory makeup pump to meet FLEX strategy timelines is provided in calculation IP-CALC-16-00015 (Reference 3.89).

Three diesel-driven FLEX RCS inventory makeup pumps are available for IPEC site, thus meeting the requirements established in NEI 12-06. These pumps are stored in the FESB.

2.3.10.4 AFW Water Supplies

Condensate Storage Tank

The CST provides an AFW water source at the initial onset of the event. The CSTs meet the requirements in NEI 12-06 for protection from seismic, high winds, extreme heat, extreme cold, and flooding events. The CSTs are susceptible to tornado missile strikes in accordance with the plant's current licensing basis. In order to maintain a usable volume of approximately 295,000 gallons for IP2 and 292,000 gallons for IP3, the CST volume is maintained greater than or equal to 360,000 gallons per Surveillance Requirement 3.7.6.1 of the technical specifications and aligned to provide emergency makeup to the SGs. The total capacity of these tanks is up to approximately 600,000 gallons each.

City Water Storage Tank

The CWST has a capacity of approximately 1.5 million gallons (minimum usable volume of approximately 655,000 gallons). Suction to the TDABF pump can be aligned to the CWST in case the CST is damaged by a wind generated missile strike (See Section 2.3.4.4).

Primary Water Storage Tank

Each PWST has a capacity of 165,000 gallons (minimum usable volume of approximately 50,000 gallons for IP2 and 47,000 gallons for IP3) of demineralized water and it is the preferred source of water to refill the CST using the FLEX inventory transfer pump.

Fire Water Storage Tank

There are three FWST tanks at IPEC (one for IP2 and two for IP3). IP2 FWST has a capacity of approximately 324,900 gallons and each IP3 FWST has a capacity of 350,000 gallons (minimum usable volume of approximately 279,000 gallons for IP2 and 600,000 gallons combined between the two tanks for IP3) of treated water and it is the second choice of source water to refill the CST.

Discharge Canal/Hudson River

Provides an indefinite supply of untreated water. The discharge canal/Hudson River is credited with the mobile filtration unit from the NSRC during Phase 3.

2.3.10.5 Borated Water Supplies

One source of borated water has been evaluated for use during a BDBEE. The borated water source is discussed below.

- Refueling Water Storage Tank: Each unit is equipped with one RWST. The tanks are stainless steel, safety-related, seismically qualified storage tanks, but are not protected from missiles. During "at power" operations each operating unit's RWST borated volume is maintained greater than 345,000 gallons.

Based on this value and the level of the connection on the RWST, the minimum usable volume is approximately 324,000 gallons and 340,000 gallons for IP2 and IP3, respectively, (Reference 3.31 and 3.32) at a boron concentration between 2400 and 2600 ppm. The RWST is the preferred borated water source for the RCS injection strategies.

2.3.11 Electrical Analysis

The Class 1E battery duty cycle of 8 hours for IPEC was calculated in accordance with the IEEE-485 methodology (References 3.35 and3.36) using manufacturer discharge test data applicable to the licensee's FLEX strategy as outlined in the NEI white paper on extended battery duty cycles. The time margin between the calculated battery duration for the FLEX strategy and the expected deployment time for FLEX equipment to supply the DC loads (six hours after the event) is approximately 2 hours.

The strategy to re-power the stations vital AC/DC buses requires the use of a diesel powered generator. Each unit requires one 480V AC FLEX portable diesel generator that can be operational within 8 hours.

The FLEX DG has a prime duty rating of 545 kW (600 kW standby) (References 3.51 and 3.52) that is trailer mounted with a 350 gallon double wall diesel fuel tank. Three FLEX DG are available for the site and are stored in the FESB.

2.4 Spent Fuel Pool Cooling/Inventory

IPEC has two independent spent fuel pools. The pools for both units are similar in design and are not interconnected in any way. The basic FLEX strategy for maintaining SFP cooling is to monitor SFP level and provide makeup water to the SFP sufficient to maintain the fuel covered and makeup for boil-off.

2.4.1 Phase 1 Strategy

During non-outage conditions, the time to boiling in the pool can be as low as 8 hours (Reference 3.53). The initial coping strategy for spent fuel pool cooling is to monitor spent fuel pool level using instrumentation installed as required by NRC Order EA-12-051. If the BDBEE occurs following a full core offload (applicable during refueling outages), on-site personnel actions would need to be taken within 4 hours (References 3.54 and 3.55). These actions include propping open doors to the SFP room and running hoses (and spray monitors if required) for portable makeup (or spray) from the FLEX SFP pump staging area. Because the time to boiling may be less than the projected time for obtaining hoses/nozzle from the FESB, outage risk management procedures include consideration for obtaining hoses and spray nozzle from an available source (e.g., pre-staging of FLEX equipment or identify other qualified equipment available within 4 hours). The hose can either be connected to a pipe in the SFP cooling system via a hose connection in the SFP cooling piping (primary strategy), or connected to a section of hard pipe installed on the 95 ft. elevation that will discharge directly into the pool (alternate strategy).

2.4.2 Phase 2 Strategy

The Phase 2 baseline capabilities required for SFP cooling are: makeup via hoses on the fuel floor, makeup via connection to SFP cooling piping, vent pathway for steam from the SFP, and spray capability via monitor nozzles from refueling floor using a portable pump. Phase 2 strategy would be to initiate makeup to the SFP without accessing the refueling floor by using the existing SFP cooling piping which discharges into the pool. Hoses will be connected from the FLEX SFP pump to the hose connection to provide the required makeup without accessing the refueling floor. Suction to the FLEX SFP pumps will be from the available sources of water. The FLEX SFP pump is trailer mounted and will be towed to the staging area by towing vehicles also located within the protected FESB.

2.4.3 Phase 3 Strategy

The long-term phase of the FLEX cooling strategy is reliant on maintaining makeup as done in Phase 2. NSRC equipment would be used to provide filtered water as needed to makeup to the SFP until repairs to plant systems or procurement of alternate means of removing SFP decay heat are sufficient to allow the transition from the FLEX equipment to another means of SFP cooling.

2.4.4 Structures, Systems, and Components

2.4.4.1 Primary Connection

For IP2, the primary connection in the spent fuel pool cooling system involved the installation of a new 5 in. storz connection to the spent fuel pit cooling system (Figure 3).

The connection is located upstream of spent fuel pit heat exchanger 21. The 5 in. storz connection is located in an area that is easily accessible during a BDBEE and addition of the new connection does not impede normal plant operations, nor impedes the ability to perform maintenance on or near the spent fuel pit heat exchanger 21. The new hose connection is seismically robust and is located close to the floor and away from other equipment to ensure a clear path to the door for hose routing. The connection is contained on the 80 ft. elevation of the fuel storage building.

For IP3, the primary connection in the spent fuel pool cooling system involved the installation of a new 5 in. storz connection to the spent fuel pit cooling system (Figure 4). The connection is located upstream of spent fuel pit heat exchanger 31. The 5 in. storz connection is located in an area that is easily accessible during a BDBEE and addition of the new connection does not impede normal plant operations, nor impedes the ability to perform maintenance on or near the spent fuel pit heat exchanger 31. The new hose connection is seismically robust and located close to the floor and away from other equipment to ensure a clear path to the door for hose routing. The connection is contained on the 55 ft. elevation of the fuel storage building.

2.4.4.2 Alternate Connection

For both units, a new standalone pipe with a 45 degree elbow on each end is mounted to a support using a heavy duty turntable. A 4"x5" storz fitting is threaded on the end of the 45 degree elbow on the inlet side of this new piping. This turntable design allows for this new makeup system to have the capability to rotate 90 degrees to keep the pipe and storz connection out of the way of the spent fuel pool crane during normal plant operation. This system provides for a stable, quick connection option for spent fuel pool makeup during a BDBEE. The heavy duty turntable comes with a lock pin to keep the pipe in place during operation and a chain has been installed to secure the pipe in either position and to prevent loose parts by the pool. The connection is located on the 95 ft. elevation of the fuel storage building on the east side of the spent fuel pool.

An additional alternate strategy utilizes a spray option to achieve SFP makeup. The 50.54(hh)(2) spray strategy (as required by NEI 12-06 Table D-3 for providing spray at 250 gpm) is to provide flow through portable spray monitors set up on the north side of the SFP to maximize the coverage of the fuel bundles and minimize overspray.

These spray monitors with the collapsible discharge hose for the secondary connection will be deployed from its storage location in the FESB.

2.4.4.3 Ventilation

Ventilation requirements to prevent excessive steam accumulation in the spent fuel building include propping open doors to the spent fuel pool room. Propping open these doors provides a ventilation pathway to maintain room habitability by venting steam created by pool boil off in addition to a pathway for laying hoses. FLEX support guidelines (FSGs) support this method of ventilation for the fuel building.

2.4.5 Key SFP Parameters

The key parameter for the SFP makeup strategy is the SFP water level. The SFP water level is monitored by the instrumentation that was installed in response to Order EA-12-051, Reliable Spent Fuel Pool Level Instrumentation (Reference 3.5).

2.4.6 Thermal-Hydraulic Analyses

An analysis (Reference 3.53) was performed that determined with the maximum expected SFP heat load immediately following a core offload (applicable during refueling outages), the SFP will reach a bulk boiling temperature of 212°F in approximately 4 hours and boil off to a level 15 ft. above the top of fuel in ~ 14 hours unless additional water is supplied to the SFP. This analysis also determined that during non-outage conditions assuming normal decay heat, the time to boil is approximately 8 hours and approximately 27 hours to make up. Deployment of the FLEX SFP makeup pump from the FESB within 12 hours with a design flow of 250 gpm for the SFP will provide for adequate makeup to restore the SFP level and maintain an acceptable level of water for shielding purposes.

2.4.7 Flex Pump and Water Supplies

2.4.7.1 FLEX SFP Makeup Pump

The FLEX SFP makeup pump is a 250 gpm (@ 65 psi) pump. The pump is trailer-mounted, diesel-driven pump that is stored in the FESB. The pump is deployed by towing the trailer to the designated staging locations. Three FLEX SFP makeup pumps are available for the site, therefore complying with the requirements established in NEI 12-06.

2.4.7.2 RWST

The RWST is the primary makeup source of water for the FLEX SFP makeup pump. Boron addition will not be necessary to maintain subcriticality as described in IP2 UFSAR Section 14.2.1 (Reference 3.76), and in IP3 UFSAR Section 9.5 (Reference 3.77). Specifically, the IPEC SFPs are designed to remain subcritical if flooded with unborated water. The water in this tank will only be used for makeup to the SFP if borated water inventory required for RCS makeup and reactivity control from other available sources is adequate and assured.

2.4.7.3 PWST

The PWST is the secondary makeup source of water for the FLEX SFP makeup pump. The water in this tank will only be used for makeup to the SFP if demineralized water inventory required for SG feed from other available sources is adequate and assured.

2.4.7.4 CST

The CST is next in order of preference makeup source of water for the FLEX SFP makeup pump. The water in this tank will only be used for makeup to the SFP if demineralized water inventory required for SG feed from other available sources is adequate and assured.

2.4.8 Electrical Analysis

The Spent Fuel Pool will be monitored by instrumentation installed by Order EA-12-051. The power for this equipment has backup battery capacity for 7 days (Reference 3.56).

2.5 Containment Integrity

With an ELAP initiated while either IPEC unit is in Modes 1-4, containment cooling for that unit is lost for an extended period of time. Containment temperature and pressure will slowly increase. Structural integrity of the reactor containment building due to increasing containment pressure will not be challenged during the first 120 hours of a BDBEE/ELAP event. With no cooling in the reactor containment building, temperature and pressure in the containment are expected to rise, but will remain below design limits.

Since design limits are not exceeded, key parameters instrumentation will remain available.

2.5.1 Phase I

The Phase 1 coping strategy for Containment involves verifying containment isolation per 2/3 ECA-0.0, Loss of All AC Power, and monitoring containment pressure using installed instrumentation.

A containment evaluation (References 3.57 and 3.58) was performed based on the boundary conditions described in Section 3 of NEI 12-06. Based on the results of this evaluation, no actions are required to ensure maintenance of containment integrity through Phase 1 for an event which occurs when the SGs are available. In addition, these containment evaluations (References 3.57 and 3.58) indicate that a FLEX event which occurs when the RCS is in Modes 5 or 6, with the SGs not available, require the establishment of a vent path equivalent to a 4 in. hole in containment to be available within 10 hours of the event. The vent path is established using one of the following options:

1. 95' vapor containment (VC) airlock.
2. Deflating the sealing ring of the equipment hatch, if installed.
3. Other vent path equivalent to a 4 in. vent path identified and evaluated for the outage.
4. For IP2, penetration UU which is used during integrated leak rate testing.

2.5.2 Phase 2

Phase 2 coping strategy is to continue monitoring containment pressure using installed instrumentation.

A containment evaluation (References 3.57 and 3.58) was performed based on the boundary conditions described in Section 3 of NEI 12-06. Based on the results of this evaluation, since containment design temperature and pressure are not exceeded, no actions are required to ensure maintenance of containment integrity through Phase 2 for an event which occurs when the SGs are available (RCS in Modes 1-4). The evaluation also indicated that a FLEX event which occurs when the RCS is in Modes 5 or 6 with no SGs available, may challenge containment pressure unless a vent path is established. Containment venting through an identified penetration or access hatch is required within 10 hours of the event to guarantee that containment will not pressurize sufficiently to challenge containment pressure or temperature design limits under the assumed worst case boil-off conditions. Ten hours is adequate time to ensure that a vent path is established even considering that the vent path may require power from the Phase 2 FLEX DG to open an inboard containment isolation valve.

2.5.3 Phase 3

The Phase 3 coping strategy required for maintaining containment integrity involves either venting containment or using the containment recirculation fan (CRF) coolers for indefinite containment cooling. Restoring containment cooling requires repowering a CRF and providing cooling water through its service water connections.

For IP2, power may be restored to buses 2A, 3A, 5A or 6A which provides the capability to operate either CRF-23, CRF-24 or CRF-25 depending on the NSRC 480V generator bus alignment. The source of cooling water comes from the flow of service water via the NSRC low pressure/high flow dewatering pump and booster pump. The connection to the UHS impoundment will simply be a suction hose dropped into the discharge canal/Hudson River. The discharge connections use a manifold which is stored on-site in the FESB and is capable of connecting to a 14 in. flange connection (primary) or to a 20 in. flange connection (alternate) in the service water headers. The connection points are robust with respect to seismic and flooding events, and are adequately shielded against high winds and associated missiles events. To minimize excess flow diversion of service water to non-operating CRF coolers, either the service water supply isolation valves or block valves associated with CRF units not being operated for Phase 3 of the strategy will be closed. The SW supply isolation valves are motor operated valves (MOVs) powered from MCC-26AA (bus 5A breaker 17B, MCC 26A breaker CK7) and the SW supply block valves are powered from MCC-26BB.

For IP3, power may be restored to bus 2A, 3A, 5A or 6A from the NSRC 480V turbine generator, which will be connected directly to either bus 3A (primary) or bus 6A (alternate) and then connected to other buses as needed using normally racked out breakers 3AT6A and 2AT5A and racked in breaker 2AT3A. Under this configuration any of the CRFs can be operated.

The source of cooling water comes from the flow of service water via the NSRC low pressure/high flow dewatering pump and booster pump. The connection to the UHS impoundment will simply be a suction hose dropped into the discharge canal/Hudson River. The discharge connections use a manifold which is stored on-site in the FESB and is capable of connecting to 16 in. flange connection locations in the service water headers. The connection points are in a structure which protects them from seismic, missiles, high wind, or flooding events.

To minimize excess flow diversion of service water to non-operating CRF units, the four service water supply isolation valves associated with CRF units not being operated for Phase 3 of the strategy will be closed. In other words, of the five containment CRF supply isolation valves, four of them will be closed. These are manual valves located outside containment.

Heat removed via the CRF unit and the RHR system as it cools down the RCS as part of the Phase 3 core cooling function will cause containment pressure to decrease. This will allow containment integrity to be maintained indefinitely (Reference 3.97).

2.5.4 Structures, Systems, Components

The containment structure is a reinforced concrete vertical right cylinder with a flat base and hemispherical dome. A welded steel liner with a minimum thickness of 0.25-in. is attached to the inside face of the concrete shell to ensure a high degree of leak-tightness (References 3.76 and 3.77). The design maximum containment pressure is 47 psig (61.7 psia) and the design maximum containment temperature is 271 °F (References 3.76 and 3.77).

During Phase 3, a low pressure/high flow dewatering pump and booster pump from the NSRC will be connected to the connections in the service water headers using a pre-fabricated manifold (Section 2.5.3).

2.5.5 Key Containment Parameters

Instrumentation providing the following key parameters is credited for all phases of the containment integrity strategy:

- Containment Pressure: Containment pressure indication is available in the central control room throughout the event.

2.5.6 Thermal-Hydraulic Analyses

A containment evaluation (References 3.57 and 3.58) was performed for each unit based on the boundary conditions described in Section 3 of NEI 12-06. Based on the results of this evaluation, no actions are required to ensure maintenance of containment integrity through Phases 1 and 2 for an event which occurs when the SGs are available (RCS in Modes 1-4). The evaluation indicated that a FLEX event which occurs when the RCS is in Modes 5 or 6 with SGs not available, may challenge containment pressure unless a vent path, with an equivalent flow to that of a 4 in. hole in containment, is established. Containment venting through an identified penetration or access hatch may be required within 10 hours of the event to guarantee that containment will not pressurize sufficiently to challenge containment pressure or temperature design limits under the assumed worst case boil-off conditions. Ten hours is adequate time to ensure that a vent path is established even considering that the vent path may require power from the Phase 2 FLEX DG to open an inboard containment isolation valve.

2.5.7 FLEX Pump and Water Supplies

The NSRC will provide a low pressure/high flow dewatering pump and booster pump which will be used if required to provide cooling loads. Water supply will be provided by the discharge canal/Hudson River.

2.5.8 Electrical Analysis

The Phase 3 coping strategy described above requires power to restore the CRFs. The 480V AC NSRC turbine generator will provide adequate power to perform the noted strategies and is included in calculations to support the sizing of the 480V AC (1100 kW capacity, derated to 1000kW – Reference 3.59) power being provided.

2.6 Characterization of External Hazards

2.6.1 Seismic

The IPEC seismic hazard is considered to be the earthquake magnitude associated with the design basis seismic event.

Per NEI 12-06, all sites will consider the seismic hazard. Thus, the seismic event is acknowledged at IP2 and IP3.

IP2 UFSAR, Section 1.2.1, indicates seismic activity in the IPEC area is limited to low-level micro-seismicity. Detailed field investigations (e.g., Ratcliffe, 1976, 1980; Dames and Moore, 1977) have been conducted in the immediate vicinity of IPEC and along the major faults in the region. To date, no evidence has been found in the rocks exposed at the surface or sediments overlying fault traces or in cores obtained in the vicinity of IPEC that might support a conclusion that displacement has occurred along major fault systems within the New York Highlands, the Ramapo or its associated branches during Quaternary time (the last 1.5 million years). In addition, IP2 is designed to withstand an earthquake of Modified Mercalli Intensity VII.

IP3 UFSAR, Section 1.2.1, indicates seismic activity in the IPEC area is rare and no damage has resulted. UFSAR, Section 2.8.1, indicates that the IP3 facility was built to withstand an earthquake corresponding to an intensity VII of the Modified Mercalli Scale. The seismic design criteria for structures and components is provided in Section 16.1 of the FSAR.

In summary, the seismic hazard applies to IP2 and IP3. As a result, the credited FLEX equipment has been assessed based on the current IP2 and IP3 seismic licensing basis to ensure that the equipment remains accessible and available after a BDBEE. The FLEX strategies developed for the IPEC site include documentation ensuring that the FESB and primary deployment routes meet the FLEX seismic criteria. The design basis earthquake would produce specific ground acceleration values of 0.15g horizontal and 0.1g vertical.

2.6.2 External Flooding

Section 2.5 of IP2 and IP3 UFSAR provide the following summary:

- Various flooding conditions governing the maximum water elevation at the site were investigated, including the following:
    a. Flooding resulting from runoff generated by a probable maximum precipitation over the entire Hudson River drainage basin upstream of the site.
    b. Flooding caused by the occurrence of an upstream dam failure concurrent with heavy runoff generated by a standard project flood.
    c. Flooding due to the occurrence of a probable maximum hurricane concurrent with a spring high tide in the Hudson River.
- The most severe flooding conditions determined water level would reach 14 ft. above mean sea level. Local wave action, due to wind effects, has been determined to add 1 ft. to the river elevation, producing a maximum water elevation of 15 ft. above mean sea level at the IPEC site.
- Since this maximum water elevation is 3 in. lower than the critical elevation of 15'-3", it is reasonable to conclude that flooding in the Hudson River will not present a hazard to the safe operation of IP2 and IP3.

In addition to the UFSAR, flooding scenarios are described and evaluated in the flood hazard reevaluation report (FHRR) for IPEC (Reference 3.80). The maximum water level resulting from combined effects on the Hudson River at IPEC was calculated to be 17.7 ft. elevation. For normal operation, the report also states that mitigation actions are in place that protects all vulnerable areas for external flooding up to an elevation of 17.92 ft.

In summary, the flooding hazard applies to IP2 and IP3. As a result, the credited FLEX equipment has been evaluated to ensure that the equipment remains accessible and available after a flooding event.

At IP2 and IP3, preparations to prevent flooding will begin per procedure (2/3-AOP-FLOOD-1) on any indication of impending flood from river levels rising greater than 4.5 ft. (for IP2) or 7 ft. (for IP3) or on a high tide advisory, at least 48 hours prior to a potential hurricane impact, rainfall greater than or equal to 5 in. per day, a NOAA flood warning, or actual plant flooding from plant systems.

Regarding local intense precipitation (LIP), the IPEC FHRR states the site topography is found on a terraced bedrock slope and the vehicle barrier system (concrete barrier system) redirects off-site surface water flow around the IPEC site. The flood hazard LIP hydraulic model calculated localized depths inside the protected area ranging from 0.1 to 3.6 ft. using a probable maximum precipitation of 15.3 inches over a 6-hour period. The calculated localized depths are located inside the protected area. An assessment performed by a debris assessment team (Reference 3.60) concluded that the concrete barrier system will redirect an adequate amount of off-site surface water flow around the IPEC site to prevent localized flooding inside the PA in areas that would adversely impact the haul paths. In addition, haul routes and staging areas inside the PA were assessed using the localized flooding areas identified in the FHRR and no adverse conditions impacting both the primary and alternate routes were identified since localized depths were short term in staging areas. The local flood level recedes to a reasonable level for area access within approximately one hour. Local intense precipitation was also assessed for haul pathways outside the protected area and adequate runoff exists in the haul path route. Therefore, no debris removal, transport delays or equipment staging impacts are anticipated as a result of local intense precipitation.

Per NEI 12-01 (Reference 3.8), the time to restore limited plant access is 6 hours from the ELAP. The staffing assessment performed as part of NEI 12-01 starts deploying equipment as early as 4 hours after the event. Portions of the deployment which occur inside protected structures (e.g., running hoses / cables, making connections, lining up installed systems) will start earlier to optimize deployment times.

The hazard assessment at IPEC considered the potential for flooding from local intense precipitation, flooding from nearby rivers, high tides, hurricane and storm surge, and tsunami events. The hazard assessment above represents the bounding condition, which occurred because of the combined effect of high tide, hurricane storm surge, and local intense precipitation from the hurricane.

2.6.3 Severe Storms with High Wind

NEI 12-06 requires an evaluation of external hazards that are considered credible for a specific site. This includes evaluating storms (e.g., hurricanes, high winds, and tornadoes) for the protection and deployment of FLEX equipment and off-site resources. NEI 12-06, Section 3.2.1.3 also provides the following guidance:

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

The definition of "robust" provided in NEI 12-06 is, "The design of an SSC either meets the current plant design basis for the applicable external hazards or has been shown by analysis or test to meet or exceed the current design basis." Therefore, equipment and components that meet the current design basis could be assumed to be available post BDBEE and credited in the FLEX coping strategies. While NEI 12-06 allows using the current station design basis, it is prudent to assess the station's design basis with respect to meeting BDBEE considerations.

Reasonable protection of FLEX critical areas and components for a BDBEE is assured by the combination of: 1) the rare occurrence of tornadoes at the site, 2) the low tornado wind speed at the site, 3) the low probability of a tornado generated missile striking equipment or structures needed for a BDBEE, 4) the protection (shielding) provided by adjacent buildings or geographic features or the separation distance between critical FLEX components and the axis of separation relative to the probable tornado direction.

The IP2 licensing basis does not include tornado protection for the design of the buildings, structures and components. The IP2 wind protection design basis is a structural wind load evaluation because tornadoes were not included in the plant's design basis. The current design basis for the wind load assumed in the current wind load evaluation is 160 mph. NUREG/CR-4461, Table 6-1 "Tornado Wind Speed Estimates for United States Nuclear Power Plant Sites" (Reference 3.9) identifies the IPEC site wind speed as 166 mph. This wind speed is based on the 2° longitude and latitude boxes included in Appendix A of NUREG/CR-4461. However, the 1° boxes presented in Appendix C of NUREG/CR-4461 are more representative of the actual area around the site. Using the 1° boxes, the wind speed corresponding to a 10^{-6} per year recurrence is 158 mph, which is bounded by the current design basis wind speed. This demonstrates that a tornado wind speed approaching the design basis wind speed of 160 mph is a rare and infrequent event (return period of 1,000,000 years). In addition, this data demonstrates that the tornado wind speed at the site is very low (F3 or lower) even for highly unlikely tornadoes.

An evaluation (Reference 3.20) determined that reasonable protection of FLEX components is provided by the low tornado strike probability for the IPEC site which meets the intent of NEI 12-06.

Protection of FLEX components from high winds and tornado missiles is provided by adjacent structures and nearby geographic features.

The guidance given in NEI 12-06, Section 7.3.1, states that the axis of separation for storage structures should consider the predominant path of tornadoes in the geographical location of the site. The application of this guidance to evaluations of the potential for tornado damage to existing structures is an alternate method to meeting the order. Tornado tracks near IPEC were obtained from the Tornado History Project. The most likely general tornado path near IPEC is southwest to northeast. Some tornadoes also exhibit a west to east path. A review of historical tornado data within 70 miles of the site for the time period from1950 to 2012 was performed to establish a reasonable tornado width for the site. This review indicated that a reasonable separation distance that bounds a large majority of tornadoes in the region would be based on the 90th percentile tornado width value of 700 ft. (Reference 3.20).

The above discussions also apply to storage tanks in determining that the probability of tank failures due to a tornado at the IPEC site is exceedingly small. The IP3 tornado protection design basis is a single tornado missile. This allows separated systems or components that perform a redundant function to be credited when the system or components are not protected by a tornado proof structure. Consequently, separation of FLEX components such as the RWST, the extremely low probability of a severe tornado at the site, and shielding by adjacent structures insures that components remain available following a BDBEE.

The IP3 licensing and design basis is that only one missile was considered acting at any time simultaneously with the 360 mph wind load (Reference 3.14). Consistent with this licensing and design basis all tanks credited for IP3 Order EA 12-049 (Reference 3.2) strategies are designed to or have been evaluated to survive 360 mph wind loading. In addition, the effects of one missile acting at any time has been addressed by ensuring that two water sources are available to support each required strategy. This ensures no single missile will prevent the fulfillment of the strategy. Since the credited tanks have been evaluated to meet the current licensing basis they are considered a robust source of water.

The IP2 design and licensing basis as described in UFSAR Section 1.11.5 is that "The IP2 licensing basis does not include tornado protection for the design of the buildings, structures and components. Tornado protection is not a design criterion for IP2." Therefore, no specific protection from the effects of tornadoes is required for tanks to be considered robust and credited in the IP2 strategies. To provide additional protection over and above the current design and licensing basis, all tanks credited for the IP2 strategies have been designed to or have been evaluated to survive a 360 mph wind loading (Reference 3.14). In addition, the effects of one missile acting at any time has been addressed by ensuring that two water sources are available to support each required strategy to provide defense in depth. This ensures that no single tornado missile occurring at the IPEC site will prevent the fulfillment of the strategy. Since the credited tanks have been evaluated to exceed the current licensing basis they are considered a robust source of water.

Section 1.11.5 of the IP2 UFSAR further explains that the PAB, the control building and fuel storage building siding panels have a failure criteria equivalent to a wind speed of 162 mph. Application of the 360 mph wind loading from IP3 is overly conservative for the siding. Instead, Appendix C of NUREG/CR-4461 is used to determine a more appropriate tornado wind speed for Indian Point. Using the 1° boxes, the wind speed corresponding to a 10^{-6} per year recurrence is 158 mph which is less than the siding failure criteria. Therefore, for a common tornado at IPEC, the PAB, control building and fuel storage buildings are expected to have the siding remain intact.

An evaluation (Reference 3.20) determined that the separation distances, the orientation of the structures, and the shielding provided by adjacent structures provides protection of FLEX components from the dominant southwest to northeast and west to east tornado paths.

In summary, consideration of an IP2 tornado missile beyond the current IP2 design basis determined that reasonable protection of FLEX critical areas and components for a BDBEE is assured by the combination of: 1) the rare occurrence of tornadoes at the site, 2) the low tornado wind speed at site, 3) the low probability of a tornado generated missile striking equipment or structures needed for a BDBEE, 4) the protection (shielding) provided by adjacent buildings or geographic features or the separation distance based on a reasonable tornado width and the axis of separation relative to probable tornado paths. The IP2 licensing basis does not include tornado protection for the design of the buildings, structures and components. However, to provide a congruous strategy for tornado events, the FLEX strategy for addressing tornado and tornado missiles impact on tanks established with the IP3 strategy was also evaluated for IP2. This does not constitute a new design bases criteria for IP2, but is a conservatively consistent strategy for the site in that the overall FLEX strategy can address the loss of any single FLEX tank on site. Based on the above, IPEC buildings containing FLEX components and RWSTs are reasonably protected from missiles by shielding. In addition, loss of CST concurrent with loss of CWST for IP2 and IP3 is reasonably prevented by the separation distance based on a reasonable tornado width and the axis of separation relative to probable tornado paths.

In place of performing missile protection upgrades, the IPEC integrated FLEX strategy uses the above basis as an alternate method to provide an equivalent missile protection strategy from that described in NEI 12-06.

Portable FLEX equipment stored on-site is protected from tornado winds and missiles per NEI 12-06 guidance.

2.6.4 Ice, Snow and Extreme Cold

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

NEI 12-06 (Reference 3.3) states plants above the 35th parallel should provide the capability to address the impedances caused by extreme snowfall and cold. The IPEC site is located at approximately latitude 41°-16' N and longitude 73°-57' W, therefore, the FLEX strategies consider the impedances caused by extreme snowfall with snow removal equipment, as well as the challenges that the extreme cold temperature may present.

As defined by Figure 8-2 of NEI 12-06 (Reference 3.3), the IPEC site is located in a Level 4 region, which is described as susceptible to experience severe damage to power lines and/or the existence of large amounts of ice, therefore, the FLEX strategies consider the impedances caused by ice storms.

The lowest recorded temperature at IPEC was -15°F.

Analyses were performed to determine if the water in the CST, CWST, FWST, PWST and RWST tanks remains available and unfrozen for the duration of 72 hours at which time equipment from the NSRC will be made available (References 3.61 and 3.62). For the tanks, the analyses assumed an air temperature of 6°F and a wind velocity of 23 mph. These values are considered worst case since wind speeds greater than 23 mph and temperatures lower than 6°F will only be seen 1% of the time during the year per ASHRAE Fundamentals Handbook (Reference 3.63). For conservatism, the analyses assumed all tanks at their low level and minimum operating temperatures. The results of the analysis show that although the CST, FWST and RWST begin icing before 72 hours, the times indicate that adequate time does exist to connect the water sources to FLEX pumps before freezing occurs. In the case of the CWST, the results showed that it begins icing after 72 hours. Using the CST makeup pump to move water between tanks would add heat from the pumps. The analysis also determined the quantity of ice buildup as a function of time. The volume of water lost due to freezing for a period of 120 hours (Phase 3 boration and water filtration equipment would be assured of being available at this time) is within the limits of the available water to implement the FLEX Phase 2 strategies. Additionally, heat tracing, if needed, can be restored to the tank connections once the Phase 2 DG is available to provide power with exception of IP2 FWST. In this specific case, during extreme cold events, water transfer starts within 48 hours.

These analyses (References 3.61 and 3.62) also determined if the flowing water through the hoses remains unfrozen and how rapidly any stagnant water in the hoses would freeze. For the hoses, which have a significantly shorter time to freeze, the analyses were performed for the different hose sizes, lengths, and materials, and were analyzed for both the 6°F ambient and the -15°F lowest recorded temperatures. All hoses were found to be adequate given the flow rates provided for the pumps. Note that the aforementioned calculations determined the flow rates required to preclude the temperature from reaching the freezing temperature in the hose. Even if the water temperatures reached 32°F in the hose, they would not be expected to freeze under flowing conditions due the added kinetic energy of the flowing water and energy added from the pump. This analysis also determined the time to reach the freezing temperature of 32°F in hoses with stagnant water. These times are in the order of minutes under extreme cold temperatures, thus hoses need to be drained immediately once flow is stopped under extreme cold conditions.

All Phase 2 FLEX equipment is stored in the FESB such that initial exposure to the extreme temperature prior to ELAP will be mitigated. All FLEX pumps and the FLEX DGs are specified to ensure they are capable of starting and operating while exposed to -15°F temperatures.

2.6.5 High Temperatures

Per NEI 12-06 (Reference 3.3), all sites will address extreme high temperatures. Therefore, for FLEX equipment, the IPEC site will consider the site maximum expected temperatures in their specification, storage, and deployment requirements, including ensuring adequate ventilation or supplementary cooling, if required. The available NPSH to the FLEX pumps address these high temperatures. At IPEC, the maximum temperature recorded was 115°F. This maximum temperature was factored into all extreme heat up calculations (Section 2.11.1).

All Phase 2 FLEX equipment is stored in the FESB such that initial exposure to the extreme temperature prior to ELAP will be mitigated. All FLEX pumps and the FLEX DGs are specified to ensure they are capable of starting and operating while exposed to 115°F temperatures.

2.7 Planned Protection of FLEX Equipment

FLEX equipment is stored in a single 10,000 sq. ft. tornado-missile protected structure that meets the plant's design basis for the safe shutdown earthquake (SSE). The FESB is located south of the IP3 facility (Figure 1) at elevation 115.25 ft. mean sea level (MSL). The maximum flood level at IPEC is 17.7 ft. MSL. Therefore, the FESB will not be impacted by external flooding. The FESB was designed to prevent water intrusion and built to protect the equipment from other hazards identified in Section 2.6 above.

Section 5.3.1 of NEI 12-06 states that large portable FLEX equipment should be tied down as appropriate and that it should be evaluated and protected from seismic interactions as to ensure that unsecured components do not damage the equipment. An evaluation determined that the minimum separation distance between equipment within the building to ensure that they will not interact with each other due to tipping or sliding during a seismic event is 15 in. Therefore, as long as the large portable FLEX equipment housed in the FESB is stored at a distance equal to or greater than 15 in., it is not required to be tied down.

The FESB was evaluated based on Section 5.3.1 of NEI 12-06, which states that FLEX equipment should be stored in a structure that meets the plant's design basis for the safe shutdown earthquake (SSE). The FESB was evaluated for loads associated with a safe shutdown earthquake. The evaluations use 0.15g as the horizontal peak ground acceleration and 0.1g as the vertical peak ground acceleration. Both values are in accordance with the plant's design basis for SSE (Reference 3.77)

Debris removal equipment is also stored inside the FESB in order to be protected from the applicable external events such that the equipment is likely to remain functional and deployable to clear obstructions from the pathway between the FLEX equipment's storage location and its deployment location(s). This includes mobile equipment such as a front end loader, or utility vehicle that are stored inside the FESB.

Deployments of the FLEX and debris removal equipment from the FESB are not dependent on off-site power. All actions are accomplished manually.

NEI 12-06, Rev 0, stipulates that provisions for an additional set of portable onsite equipment is essential to provide reasonable assurance that N set of FLEX equipment would remain deployable to assure success of the FLEX strategies. A subset of this portable onsite equipment includes hoses and cables required to implement the FLEX strategies. The N set of hoses and cables are protected from all extreme external hazards. As an alternate approach, an additional length of hoses and cables would be stored with the N set of equipment rather than storing a complete second set (for each unit) in the FESB. This spare capability supports the safety functional requirements beyond the minimum necessary to support the N-units onsite, and is consistent with the NRC endorsement (Reference 3.99) of the NEI guidance entitled "Alternative Approach to NEI 12-06 Guidance for Hoses and Cables" (Reference 3.100).

The additional length of hoses and cables to be stored with the N set of equipment would be the longer of 10% of the total hose/cable run or the longest segment of hose/cable. The 10% criterion extends separately to each size or type of hoses and cables. The hoses and cables utilized by the IPEC FLEX strategy are not one continuous hose or cable but rather are composed of smaller sections joined together to form a sufficient length.

Hoses and cables are passive devices unlikely to fail provided they are appropriately inspected and maintained. The hoses and cables for IPEC are stored in robust storage locations, accessible following an extreme external hazard, and are maintained in accordance with industry recommendations. The storage of additional spare cables and hoses along with the "N" set provides additional assurance that the FLEX strategy can be implemented for all events even if a segment of the hoses or cables were to be damaged during the strategy implementation. This method is considered an alternate approach as the NEI guidance does not specifically define "N" as the entire length of cables and hoses.

2.8 Planned Deployment of FLEX Equipment

2.8.1 Haul Paths and Accessibility

Pre-determined, preferred haul paths have been identified and documented in the FLEX support guidelines (FSGs). Figures 1 and 2, show the haul paths from the FESB to the various deployment locations. These haul paths have been reviewed for potential soil liquefaction and have been determined that soil liquefaction will not preclude FLEX implementation (Reference 3.64). Additionally, the preferred haul paths attempt to avoid areas with trees, power lines, narrow passages, etc. when practical. However, high winds can cause debris from distant sources to interfere with planned haul paths. Debris removal equipment is stored inside the FESB to be protected from the severe storm and high wind hazards such that the equipment remains functional and deployable to clear obstructions from the pathway between the FESB and its deployment location(s).

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

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

The ability to open doors for ingress and egress, ventilation, or temporary cables/hoses routing is necessary to implement the FLEX coping strategies. Security doors and gates that rely on electric power to operate opening and/or locking mechanisms are barriers of concern. The Security force will initiate an access contingency upon loss of the security diesel and all AC/DC power as part of the Security Plan. Access to the owner controlled area, site protected area, and areas within the plant structures will be controlled under this access contingency as implemented by security personnel.

The deployment of on-site FLEX equipment to implement coping strategies beyond the initial plant capabilities (Phase 1) requires that pathways between the FESB and various deployment locations be clear of debris resulting from BDB seismic, high wind (tornado), or flooding events.

The stored FLEX equipment includes a front end loader to clear obstructions from haul paths and heavy duty pickup trucks to tow FLEX equipment from the FESB location to the point of use.

Vehicle access to the protected area is via the sally-port at the security building. As part of the security access contingency, the sally-port gates will be manually controlled to allow delivery of FLEX equipment (e.g., generators, pumps) and other vehicles such as debris removal equipment into the protected area.

Phase 3 of the FLEX strategies involves the receipt of equipment from off-site sources including the NSRC and various commodities such as fuel and supplies. Transportation of these deliveries can be through airlift or via ground transportation. Debris removal for the pathway between the site and the NSRC receiving location and from the various plant access routes may be required. The same debris removal equipment used for on-site pathways will be used to support debris removal to facilitate road access to the site.

2.9 Deployment of Strategies

2.9.1 AFW Makeup Strategy

The Phase 2 FLEX inventory transfer pump will refill the CST from other available sources of water for the duration of the Phase 2 coping time using hose connections provided at each of the tanks. The preferred order of tanks to be used to refill the CST is based on using those with water quality and chemistry which most closely matches that found in the condensate and feed system. The tanks which will be used to refill the CST in order from most preferred to least preferred and the bases for the order are identified in Section 2.3.2. If the CST does not survive, and the TDABF pump is available, then the CWST will be used to provide water to the suction of the TDABF pump.

As described in Section 2.3.2, before commencing the second cooldown the FLEX SG makeup pump will be connected and available to provide an alternate cooldown method in case the TDABF pump is no longer available. Section 2.3.2 provides the strategy to provide inventory to the FLEX SG makeup pump in case the CST is not available. The FLEX SG makeup pump will be transported from the FESB to a location near the CST, or the FWST (in case the CST is not available due to a missile strike). A hose will be routed from the pump suction to the CST connection or the FWST connection, and a hose will be routed from the FLEX SG makeup pump discharge to either the primary or alternate connection.

The FLEX connections are qualified to seismic Category I requirements. The primary FLEX SG makeup pump discharge connection is located within the seismic Category I, tornado missile protected AFW building of each unit. The alternate FLEX SG makeup pump discharge connection is located within the non-seismic Category I, non-missile protected portion of the turbine building of each unit. Although this connection may be unavailable in high wind or seismic events, the primary connection will be available. NEI 12-06 Section 3.2.2 states that both the primary and secondary connection points do not need to be available for all applicable hazards, but the location of the connection points should provide reasonable assurance of at least one connection being available.

Regardless of the event scenario, during Phase 3 suction could be taken from the discharge canal/Hudson River to provide water for the steam generators. The Hudson River is the UHS for IPEC. This source is considered available for this FLEX function, but should be used only if the water sources from the tanks are no longer available. If the discharge canal/Hudson River must be used, no hose connection is provided at this location, therefore the NSRC pumps provide water to the NSRC mobile water filtration unit to the FLEX CST refill connection.

2.9.2 <u>RCS Strategy</u>

The FLEX RCS inventory makeup pumps are stored in the FESB and are protected against snow, ice, high and low temperatures, seismic, flood, high wind and associated wind-driven missiles.

The primary and the alternate RCS inventory makeup pump discharge connections are located inside of the PAB of each unit. Accordingly, these connections are protected against all hazards described in Section 2.6.

The connections from the RWST for the RCS inventory makeup pumps are qualified to seismic Category I requirements. Should the RWST of one unit become unavailable (tornado missile is the only credible BDBEE which would accomplish this – see Section 2.3.4.8), an alternate connection for supplying borated water to the affected unit uses a connection from the other unit's RWST. The RWST from one unit would remain available following a BDBEE which damages the other unit's RWST.

2.9.3 Electrical Strategy

The primary connection point will include a permanently installed connection that enables a quick connection of the Phase 2 FLEX DG to the 480V AC emergency distribution system. The power inlet panels are located inside and directly outside the switchgear room for IP2 and IP3, respectively. These power inlet panels will be connected by temporary cables to the Phase 2 FLEX DG. The primary connection point for Phase 2 is designed based on locating the FLEX DG in the transformer yard. This location is suitable for all applicable hazard scenarios with the exception of flooding.

The design for the alternate connection point is based on locating the FLEX DG in the yard to the north of the PAB, near the doors of the containment access facility. The use of the alternate connection is designed specifically for the case of a BDB flood during which access to the primary connection may not be available. In this case, there are no permanent cable connections. Instead the Phase 2 FLEX DG cables are to be pulled into the PAB and directly connected to cable stored within the Phase 2 FLEX alternate connection cable storage cabinet. The alternate connection requires the lighting bus feeder cables to be removed from the transformers. The Phase 2 FLEX DG cables are plugged into Y adapters that are connected via lugs to the transformer connection. NEI 12-06 allows the alternate connection to be reconfigured provided it can be shown that adequate time is available and adequate resources are available. The tools and parts required for splicing are available in the Phase 2 FLEX alternate connection cable storage cabinet. As mentioned above, the use of the alternate connection is designed specifically for the case of a BDB flood during which access to the primary connection may not be available. The actions necessary to perform the alternate connections are contained in the FLEX procedures and personnel has been trained to perform the activity.

The FLEX 480V AC diesel generators are stored in the FESB and they are protected from the BDB external event hazards identified in Section 2.6.

2.9.4 Fueling of Equipment

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

The source of fuel oil for portable equipment is from the emergency diesel generator (EDG) fuel oil storage tanks (FOST). There are three underground storage tanks per unit, capable of withstanding seismic, flood and wind events. At IP2 each EDG underground fuel oil storage tank must have a minimum volume of 6,334 gallons of usable fuel in the tank (Reference 3.17). At IP3 each EDG underground fuel oil storage tank must have a minimum stored volume of 5,712 gallons of usable fuel in the tank (Reference 3.18). The total quantity of diesel fuel required for 72 hours of continuous operation of all FLEX diesel fuel oil components is 7,981 gallons for IP2 (this value includes one lighting tower) and 7,981 gallons for IP3 (References 3.65 and 3.66). The emergency preparedness (EP) communication diesels' total fuel consumption for continuous operation requirement for a 72 hour period is 249 gallons (Reference 3.74). Therefore, the three fuel oil storage tanks per unit provide adequate fuel quantity for Phase 1 & 2 of the FLEX event for their respective unit.

For IP2, fuel from the FOSTs will be transferred to a FLEX trailer-mounted diesel fuel transfer tank via fuel oil transfer pump (FOTP) No. 23. FOTP No. 23 discharge piping includes a 1.5" emergency fill connection which can be used as a transfer source to the trailer-mounted diesel fuel transfer tank. Once the trailer-mounted diesel fuel transfer tank has its hose connected to the fill connection, the operator will close valve DF-9, verify closed DF-8 and DF-10-2 and open DF-20 to line up the fuel transfer path. FOTP No. 23 will be powered once the Phase 2 FLEX DG is connected to bus 6A and then power is restored to MCC 26B.

For IP3, fuel from the IP3 fuel oil storage tanks will be transferred to a trailer-mounted diesel fuel transfer tank via FOTP No. 33. FOTP No. 33 has a 1.5" emergency fill connection located in the FOTP pit which can be used to obtain oil from the tank. Once the trailer-mounted diesel fuel transfer tank has its hose connected to the fill connection, the operator will close valve DF-11-3 and open DF-20 to line up the fuel transfer path. FOTP No. 23 will be powered once the Phase 2 FLEX DG is connected to bus 5A and then power is restored to MCC 36E.

After fuel has been transferred to the trailer-mounted diesel fuel transfer tank, the trailer will be transported to supply fuel to the Phase 2 portable FLEX equipment which require diesel fuel to operate. Fuel is transferred from the FLEX trailer-mounted fuel tank to the Phase 2 portable FLEX equipment through a battery powered pump integral to the tank. There are 2 mounted-trailer diesel fuel transfer tanks available for the site and each tank has a capacity of 500 gallons. These tanks are stored inside the FESB.

The Phase 2 FLEX DG and all other Phase 2 portable FLEX equipment are stored in the FESB with adequate fuel for 8 hours of full load operation to ensure that they are able to operate until they can be refueled.

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

The above fuel oil sources will be used to fill the fuel oil tank on a fuel trailer that is stored in the FESB. It has a capacity of approximately 500 gallons and has a battery powered transfer pump integral to the tank. The fuel trailer will be deployed from the FESB facility to refill the fuel oil tanks of the FLEX equipment and to the fuel oil storage tank locations where it will be pumped filled from the fuel oil storage tanks.

Based on the results of the total fuel consumption required for a period of 72 hours (References 3.65, 3.66 and 3.74), the six underground EDG fuel oil storage tanks, which are protected from BDB hazards, have adequate capacity to provide the on-site FLEX equipment with diesel fuel. This on-site FLEX equipment includes the EP communications diesels and one lighting tower. The fuel trailer has sufficient capacity to support continuous operation of the major FLEX equipment expected to be deployed and placed into service following a BDBEE.

The diesel fuel consumption information above does not include fuel requirements for the equipment to be received from the NSRC. Equipment provided in Phase 3 from the NSRC (e.g., the low pressure / high flow dewatering pump and the 480V turbine generator) will either use on-site diesel fuel oil or will have their own fuel provided from off-site.

2.10 Off-Site Resources

2.10.1 National SAFER Response Center

The industry has established two NSRCs to support utilities during BDBEE. Each NSRC holds 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. In addition, on-site FLEX equipment hose and cable end fittings are standardized with the equipment supplied from the NSRC. In the event of a BDBEE and subsequent ELAP/LUHS condition, equipment will be moved from the NSRC to a local assembly area established by the SAFER team. Two local intermediate staging areas have been selected. The first, staging area "C", will be located at Stewart International Airport (in New Windsor, NY). The second, staging area "D", will be located at the Danbury Airport (in Danbury, CT). From those two intermediate staging areas, the NSRC equipment can be taken to the IPEC site and staged at the FESB by helicopter if ground transportation is unavailable. Communications will be established between the IPEC plant site and the SAFER team via satellite phones and required equipment moved to the site as needed. First arriving equipment will be delivered to the site within 24 hours from the initial request. The order at which equipment is delivered is identified in the IPEC's "SAFER Response Plan" (Reference 3.81).

2.10.2 Equipment List

The equipment stored and maintained at the NSRC for transportation to the local assembly area to support the response to a BDBEE at IPEC is listed in Table 3. Table 3 identifies the equipment that is specifically credited in the FLEX strategies for IPEC.

2.11 Habitability and Operations

2.11.1 Equipment Operating Conditions

Following a BDBEE and subsequent ELAP event at IPEC, ventilation providing cooling to occupied areas and areas containing FLEX strategy equipment will be lost. Per the guidance given in NEI 12-06, FLEX strategies must be capable of execution under the adverse conditions (unavailability of installed plant lighting, ventilation, etc.)

expected following a BDBEE resulting in an ELAP/LUHS. The primary concern with regard to ventilation is the heat buildup which occurs with the loss of forced ventilation in areas that continue to have heat loads. Loss of ventilation analyses were performed to quantify the maximum steady state temperatures expected in specific areas related to FLEX implementation to ensure the environmental conditions remain acceptable for personnel habitability and within equipment qualification limits.

The key areas identified for all phases of execution of the FLEX strategy activities are the SFP area (to ensure hoses/spray is routed prior to pool boiling), the TDABF pump room and the central control room (CCR). These areas have been evaluated to determine the temperature profiles following an ELAP/LUHS event. Results of the calculations have concluded that, during Phase 1, temperatures remain within acceptable limits based on conservative input heat load assumptions for all areas with the only action to open the doors within 30 minutes of the event for the CCR and the TDABF pump room.

Ventilation of the SFP will be provided by opening the roll-up door and a door to the refueling deck at approximately 8 hours for a normal heat load. Opening the doors will be required within 4 hours following a full core off load in Mode 6. Opening these doors will prevent SFP room pressurization and the presence of excessive quantities of steam and condensate. The SFP level instrumentation is located inside the fan house. The operational temperature upper limit of the SFP level instrumentation is 131°F. Calculations determined that the fan house area will remain within the required functional temperature range of the SFP level instrument by opening the door within 24 hours (for IP2) and 20 hours (for IP3) into the FLEX event (References 3.67 and 3.68).

An evaluation of the temperature inside the TDABF pump room concluded that it will stay below the 143°F setpoint (at which the steam supply valves could automatically close) with only the action of opening the roll-up door within 30 minutes of the event initiation. The temperature was conservatively calculated to not exceed 125.2°F and 129.4°F for IP2 and IP3, respectively, at any time during the 168 hours (7 days) with outside ambient temperature as high as 115°F (References 3.71 and 3.72). As this space would not be continuously occupied by operators, but only entered as needed and for short durations to control the TDABF pump or the flow control valves, the temperatures are acceptable. As such, additional ventilation is not required for the continued remote operation of components in this room. Operation of the TDABF pump can be suspended once the Phase 2 SG makeup pump is available, if desired. This would allow temperatures in the AFW pump room to become more moderate, though continued TDABF pump operations without heating ventilating and air conditioning (HVAC) are still possible.

An evaluation of the temperature inside the CCR concluded that the temperature will stay below 110°F for IP2 and 120°F for IP3 with only the action to open the doors within 30 minutes into the event (References 3.69 and 3.70). The temperature was conservatively calculated to stay below 110°F (IP2) and 120°F (IP3) for 72 hours after the FLEX event without additional ventilation. For IP2, in the case of an extreme high temperature BDBEE, the non-credited CCR HVAC system is anticipated to be available and may be restored once the Phase 2 FLEX DG is available to provide power. For IP3, during an extreme high temperature event, the auxiliary CCR HVAC system is available, and credited after 72 hours into the event, to provide supplemental cooling once the Phase 2 FLEX DG is available.

An additional ventilation concern applicable to Phase 2 is the potential buildup of hydrogen in the battery rooms. Off-gassing of hydrogen from batteries is only a concern when the batteries are charging. For IP2, battery room ventilation for hydrogen removal will be accomplished by use of a portable fan or blower within 4 hours of beginning battery charging operations. The ventilation rate is consistent with the ventilation system procedure (Reference 3.19) that states if an exhaust fan is out of service, then ventilate the affected battery room continuously with at least a 500 cfm fan or blower positioned to blow air into each affected battery room. These fans are powered from a portable diesel powered lighting tower stored in the FESB. For IP3, once the Phase 2 FLEX DG is available and the station Class 1E batteries begin re-charging, power is also restored to the battery exhaust fans to maintain hydrogen accumulation below 1%.

2.11.2 Heat Tracing

With exception of IP2 FWST, tank connection heat tracing for the CSTs, RWSTs, IP3 FWSTs and PWSTs is credited for the extreme cold BDBEE and will be restored during Phase 2 when the FLEX DG is available to prevent further freezing of tank connections. Heat tracing for IP2 FWST is not credited during an extreme cold event and therefore the FLEX inventory transfer pump is connected to the IP2 FWST and water transfer is initiated prior to 48 hours.

2.12 Personnel Habitability

Personnel habitability was evaluated in Section 2.11 above and determined to be acceptable.

2.13 Lighting

Lighting during Phase 1 will be limited to the 8 hour battery backed emergency lights and portable flashlights and lanterns.

Phase 2 equipment will also include diesel powered lighting towers. These towers are not credited for plant lighting. Portable flashlights will be required for work in some areas of the plant.

2.14 Communications

IPEC has communication capabilities with off-site response organizations, the NRC, between emergency response facilities, with field and off-site monitoring teams, and with in-plant and off-site emergency response organization staff. An assessment of communications assuming a large-scale natural event, which would lead to an extended loss of all AC power (Reference 3.13) was performed. As part of this assessment, IPEC identified enhancements/changes to maintain communications capabilities for responding to emergency events.

Entergy has distributed satellite phones to the emergency response facilities (ERFs) including the emergency operations facility (EOF), technical support center (TSC)/operations support center (OSC), control rooms, and joint information center (JIC). Additional radios and spare batteries for the site have been purchased. The site radios have the capability to communicate without repeaters; however, backup power is available for the on-site repeater. User aids for the satellite phones and an existing site personnel familiarity with the radios are in place. The satellite phones are stored in hardened/cushioned cases within the ERFs for protection while the radios and batteries are staged in the TSC/OSC.

Portable satellite telephones or radio communications are available for each communication link outlined in Section 4 of NEI 12-01 (Reference 3.8). After a BDBEE, three radio channels will be relied upon for on-site communications. Radio communications capability are available in the central control rooms using a console and outside the CCR using portable radios (2 fixed and 49 handheld radios will be available). The minimum channels credited during a BDBEE include Channels 4 (on site), 6 (Unit 2 Operations) and 7 (Unit 3 Operations). Satellite phone capability in each CCR will be available (14 deployable and 21 handheld satellite phones will be available).

A combination of batteries and uninterruptible power supplies (UPSs) to power site communications equipment is available. The site strategies will result in: (1) each satellite phone has a 24 hour power supply capability through batteries; (2) radios have a 24 hour power supply capability through batteries, and (3) radio repeater systems back-up power is provided by a combination of UPS units and portable diesel generators to support long term operation..

Communications between Entergy ERFs will also utilize radios in addition to portable satellite phones. Entergy implemented improvements for communications with off-site response organizations by ensuring each organization has a portable satellite phone.

2.15 Water sources

2.15.1 Secondary Water Sources

Section 2.3.10.4 provides a list of credited water sources that may be used to provide cooling water to the SGs, and/or to refill the CST. An assessment of availability following the applicable hazards identified in Section 2.6 is provided in this section. The CST, CWST, FWST, and PWST meet the requirements in NEI 12-06 for protection from high winds, extreme heat, extreme cold, and flooding events. Additionally, the CST, FWST, and PWST are qualified to meet the seismic requirement in NEI 12-06. However these tanks are susceptible to tornado missile strikes.

For IP3, the CST is physically located in an area mostly surrounded by Category I structures (Unit 1 and Unit 3 containment buildings) and separated from the CWST by approximately 1,650 ft., such that a single tornado capable of disabling the CST and the CWST is highly unlikely. This coincides with the position of IP3 licensing basis. This position states that only one structure/component (including tanks) would be lost due to a tornado missile event. This licensing basis became the basis for what is considered "robust" in NEI 12-06 (Reference 3.3). Therefore, if the CST was lost during a tornado event, other sources of water which would be used to feed the SGs (e.g., the

CWST, PWST, and FWSTs) would survive and would allow the plant to be safely shutdown. Should the IP3 CST be damaged by a tornado missile, the CWST would be available to provide water to the TDABF pump until the FLEX inventory transfer pump can be used to supply a source of water for use in feeding the FLEX SG make up pumps.

Unit 2 UFSAR states that the IP2 licensing basis does not include tornado protection for the design of buildings, structures and components and that tornado protection is not a design criterion for IP2. An evaluation was performed (Reference 3.14) to determine the acceptability of the IP2 CST for tornado wind loading. The tornado wind pressure load was determined in accordance with the methodology of ASCE 7 using a tornado wind velocity of 360 mph (IP3 tornado wind velocity design basis). This methodology determined the CST would remain functional during the calculated wind loading which exceeds the expected IPEC wind speed of approximately 160 mph identified in Reference 3.20.

While NEI 12-06 allows using the current design basis, the IP2 design basis was evaluated for meeting the BDBEE for tornado winds and tornado missiles. The evaluation (Reference 3.20) included consideration of an IP2 tornado missile beyond the current design basis and determined that reasonable protection for a BDBEE is assured (Section 2.6.3).

To provide additional protection over and above the current design and licensing basis, all tanks credited for the IP2 strategies have been designed to or have been evaluated to survive 360 mph wind loading. In addition, to provide defense in depth, the effects on one missile acting at any time has been addressed by ensuring that two water sources are available to support each required strategy. Thereby, ensuring no single missile will prevent the fulfillment of the strategy.

As a contingency, in case the IP2 CST was impacted by a tornado missile, the CWST, located approximately 1,700 ft. from the CST, would be available to provide water to the TDABF pump until the FLEX inventory transfer pump can be used to supply a source of water for use in feeding the FLEX SG makeup pumps.

An evaluation was performed (References 3.54 and 3.55) to determine if the amount of water contained in these tanks is adequate to provide cooling water to the SGs and the SFP. The results show that the water reserves on the tanks, assuming minimum usable volumes, provide an adequate supply of water for at least a period of 72 hours for IP2 and 120 hours for IP3, after the event (limiting event is the loss of the CWST).

Another inventory source of auxiliary feedwater that is not credited but may be used, if available after a BDBEE, is the hotwell. The hotwell contains condensate water and is not assumed to survive a seismic or high wind event. If the hotwell survives, access to the water may not be immediately available. However, when time and access allows, water in the hotwell could provide a higher quality of water then the other options listed in Section 2.3.10.4.

2.16 Shutdown and Refueling Analysis

Indian Point Energy Center abides by the Nuclear Energy Institute position paper entitled "Shutdown/Refueling Modes" addressing mitigating strategies in shutdown and refueling modes. This position paper is dated September 18, 2013 (Reference 3.11) and has been endorsed by the NRC staff (Reference 3.12). These mitigating strategies are defined below.

Gravity injection of the RWST may not be available throughout Phase 1. This is really only of concern when the plant is in Mode 5 with the RCS vented. Depending on the decay heat in the reactor at the time of the FLEX event, the boil-off rate could exceed the rate at which steam could escape from the vent(s) in the RCS. This would cause RCS pressure to increase which will reduce the gravity injection rate from the RWST and eventually stopping the gravity injection into the RCS. Because of this, gravity injection will not be relied on to provide makeup to the RCS when the plant is in Mode 5 with the RCS vented. If plant operations require placing the reactor in a configuration such that following a BDBEE the ability to make up for RCS inventory losses could be challenged, then in accordance with the NEI position paper on Shutdown/Refueling Modes (Reference 3.11), in order to further reduce shutdown risk, the shutdown risk process and procedures have been enhanced through incorporation of the FLEX equipment.

Decay heat removal, inventory control, and reactivity control for Phase 2 with the plant in Modes 5 or 6 are all accomplished by injecting borated water from the RWST into the RCS using the FLEX RCS inventory makeup pump. Because the RCS is vented, pressure will be lower. However, the vented RCS also results in a higher leakage rate of the boiled off steam than that which occurred from the RCP seals at 310 psia. Therefore a larger flow rate of RWST water into the RCS is required to maintain inventory control.

Additionally, the boil off of the borated water which is in the RCS in Modes 5 and 6 results in concentration of the boron within the reactor vessel. This concentration of boron could result in blockage of flow channels in the reactor because of boron precipitating out of solution. Connections for the FLEX RCS inventory makeup pump in Modes 5 and 6 are the same as those listed in Sections 2.3.5.6 and 2.3.5.7 above. To prevent flow blockage, an analysis determined a flushing flow rate of 118.1 gpm is required (Reference 3.73).

When the plant is in Mode 5 and 6 without the SGs available, the RWST inventory is not shared between the units. The tornado protection basis provided in Section 2.3.4.8 applies to all plant modes and is further supported during refueling outage conditions based on tornado activity during the time of year refueling outages are normally scheduled (February and March). Typically, a plant will only vent the RCS when preparing for a refueling outage. At Indian Point, the reactors are refueled every 2 years and always during the months of February and March. Data from the National Oceanic and Atmospheric Administration (NOAA) indicates that no tornadoes were recorded during those months within the analysis period between 1991 and 2010. During that 20 year period, there were no recorded tornadoes in states as far away as Ohio, West Virginia, and Virginia, much less the states immediately neighboring the plant. Therefore, the probability of a tornado occurrence when IP2 or IP3 has its RCS vented is exceedingly unrealistic and is not considered as a credible event.

In operating Modes 5 and 6, technical specifications require the capability to isolate containment during specific conditions (References 3.54 and 3.55). Following the event, with the reactor scrammed and containment isolated, the containment pressure and temperature would begin to slowly increase due to reactor coolant leakage and direct heat transfer from the RCS. Thus, containment would eventually need to be either cooled directly using coolers or vented to reduce pressure. A containment evaluation (References 3.57 and 3.58) determined that a vent path is required (See Section 2.5.2) to maintain the containment pressure under the design limits.

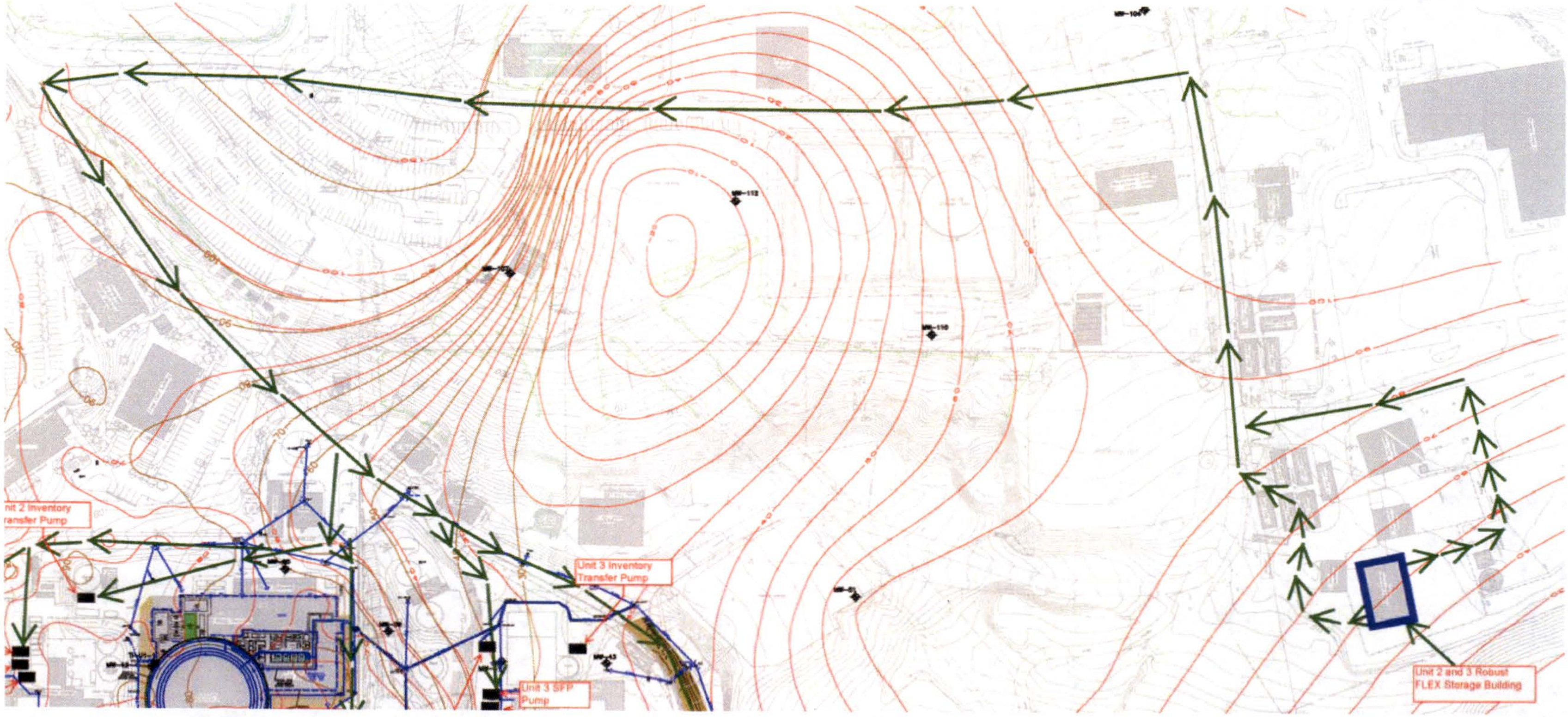

Figure 1 - Site Deployment Pathway – FLEX Equipment Storage Building to Sally Port Area

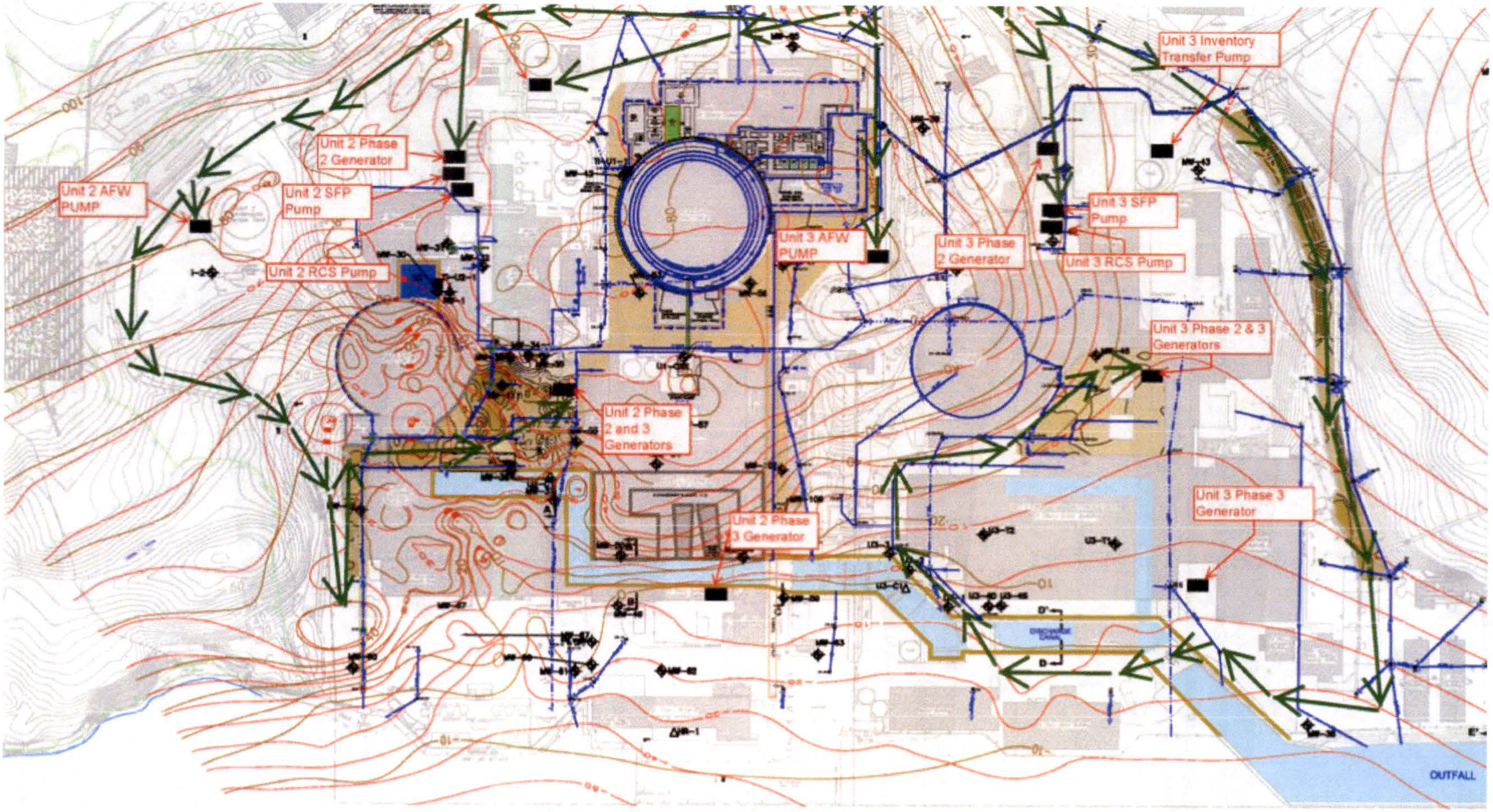

Figure 2: Site Deployment Pathway – Sally Port Area to Various Haul Paths

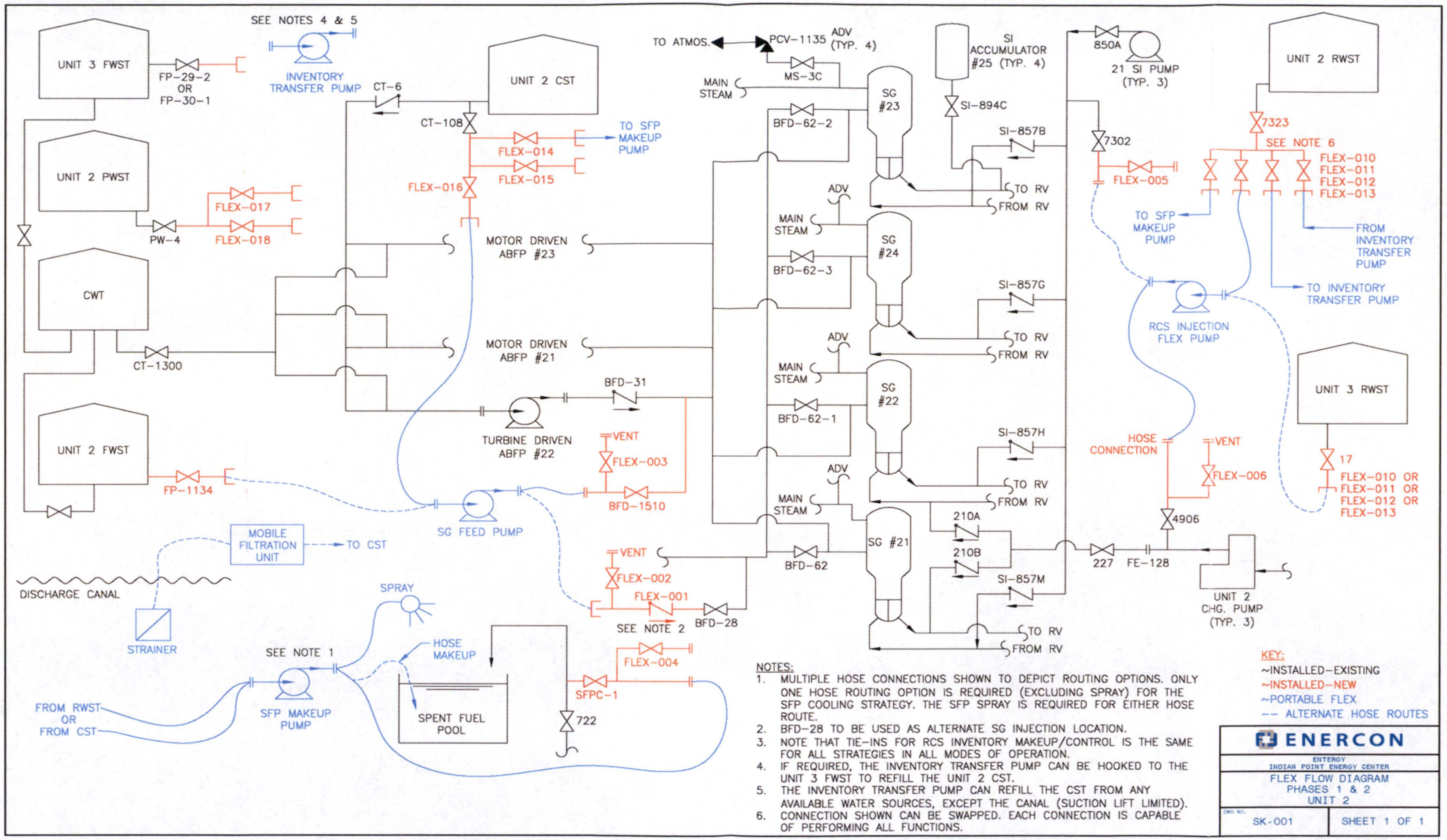

Figure 3: IP2 FLEX Flow Diagram Phases 1 and 2

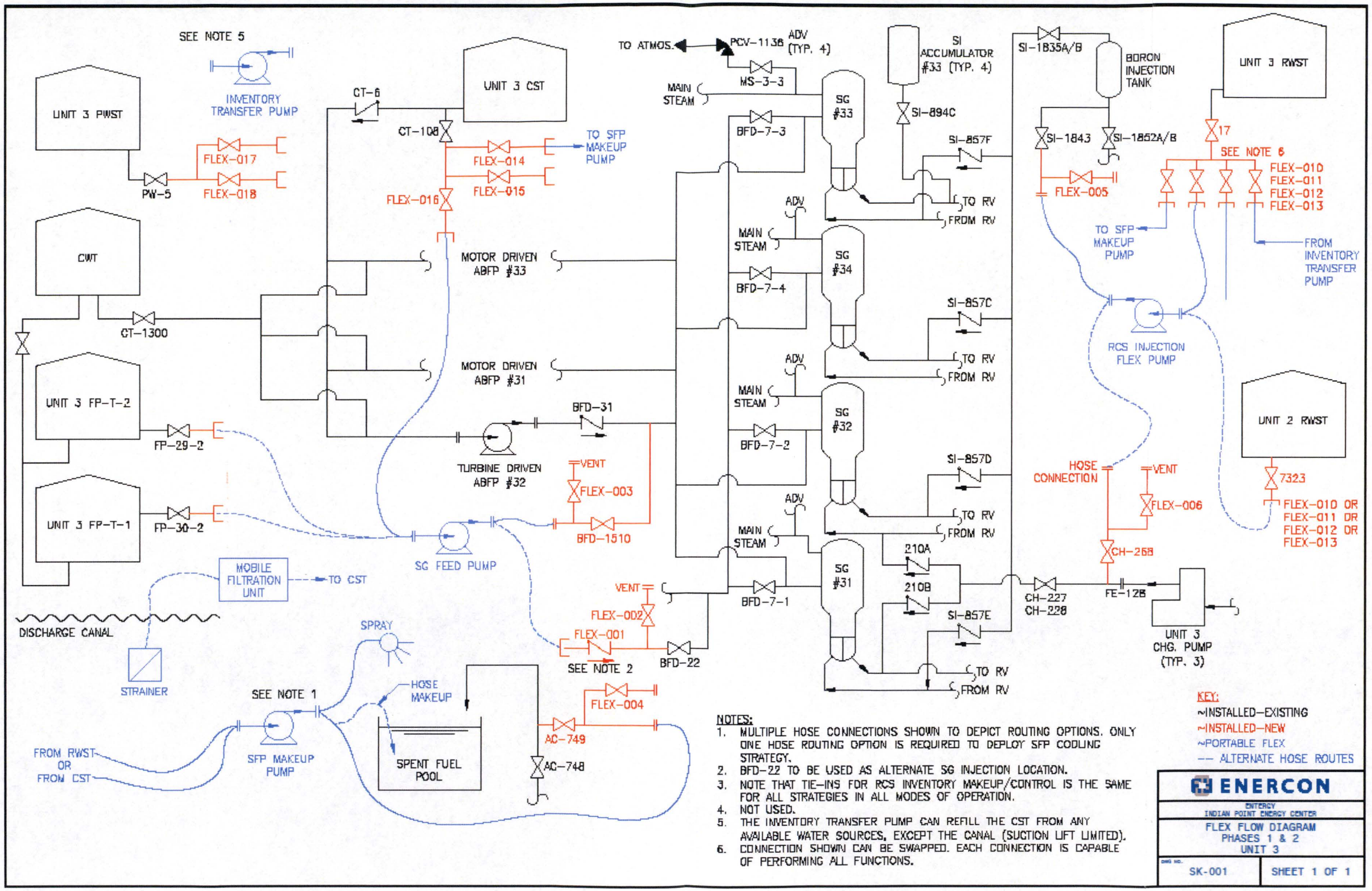

Figure 4: IP3 FLEX Flow Diagram - Phases 1 and 2

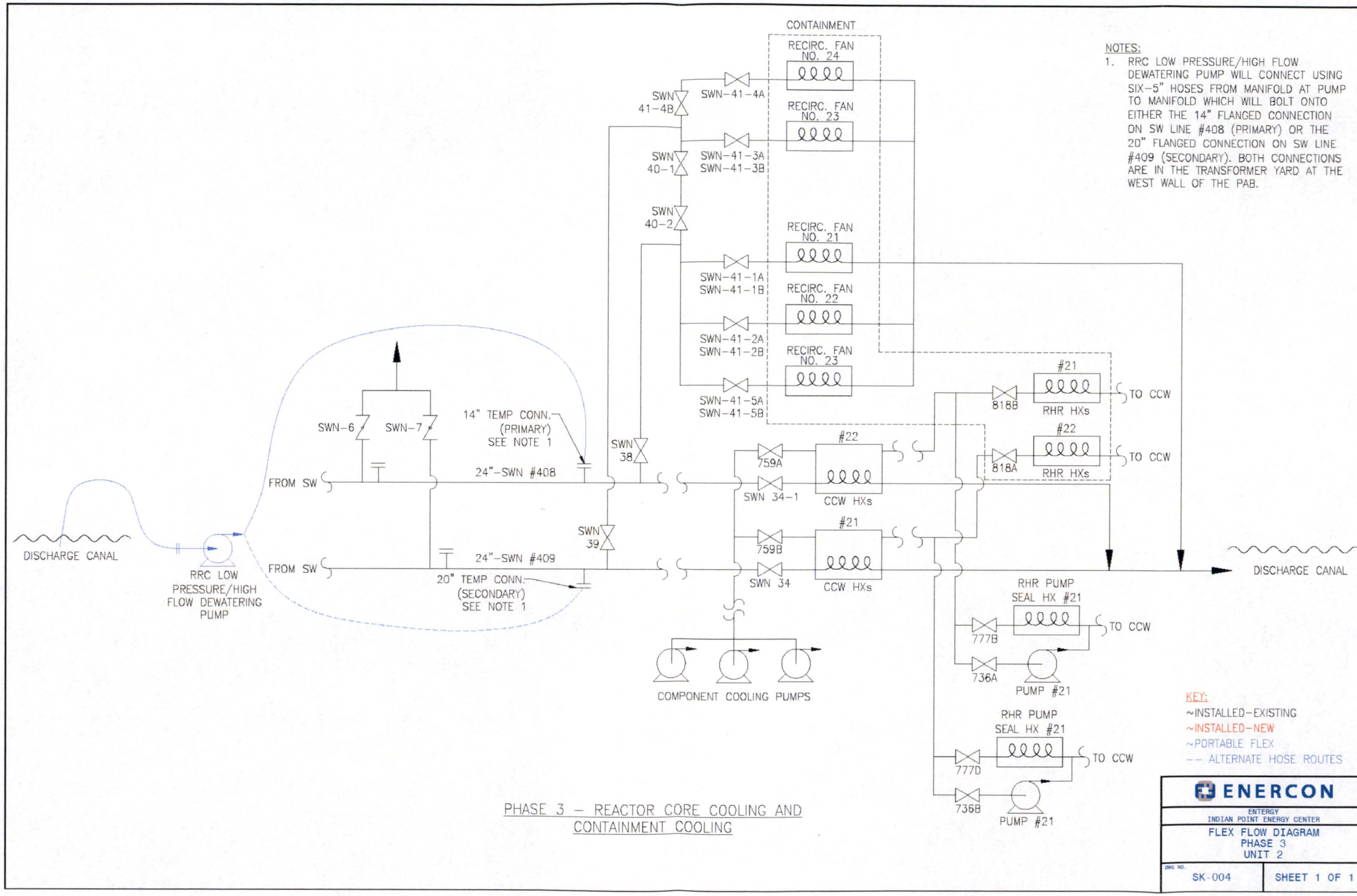

Figure 5: IP2 Reactor Core Cooling and Containment Cooling – Phase 3

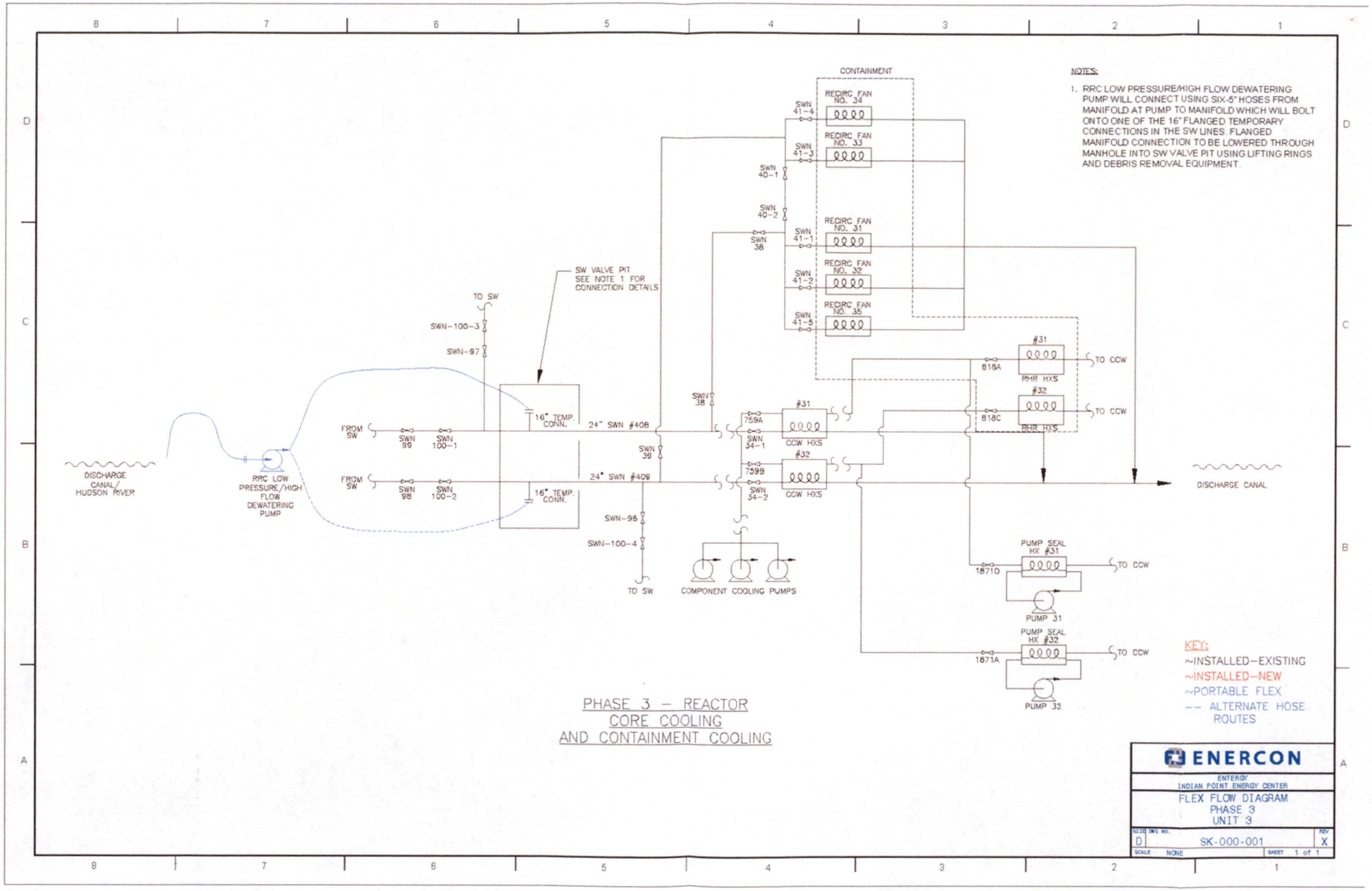

Figure 6: IP3 Reactor Core Cooling and Containment Cooling – Phase 3

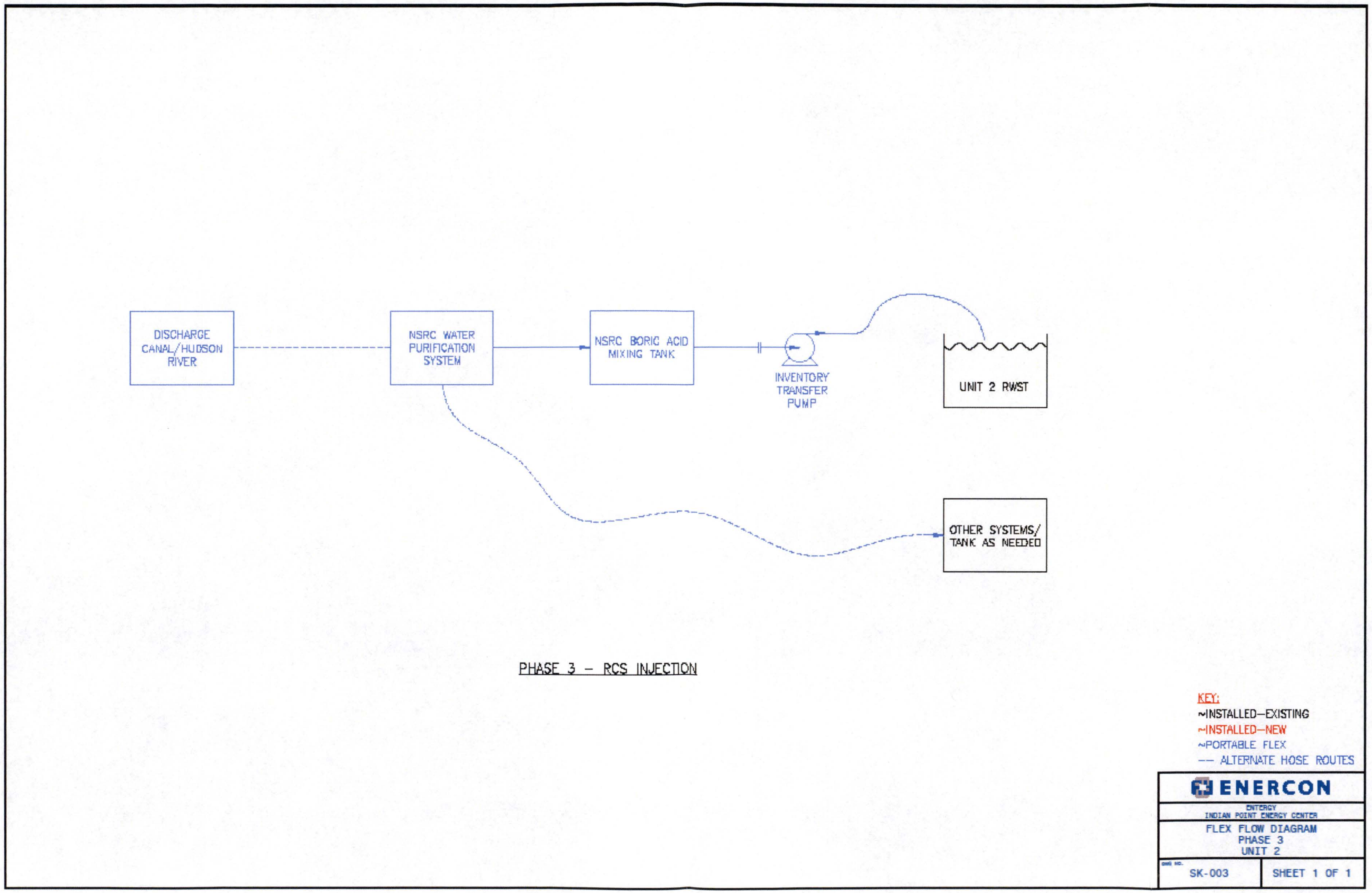

Figure 7: IP2 RCS Injection – Phase 3

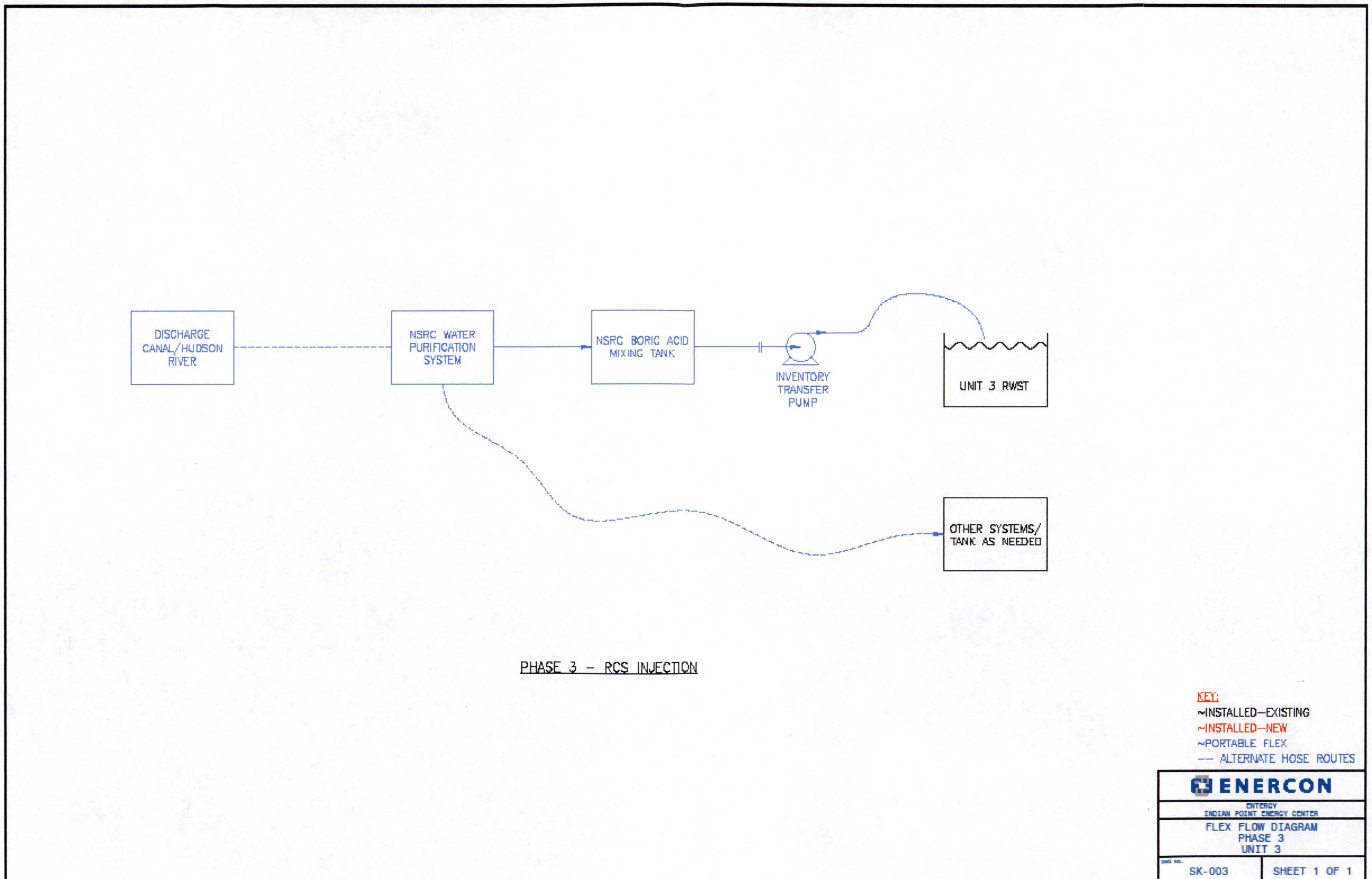

Figure 8: IP3 RCS Injection – Phase 3

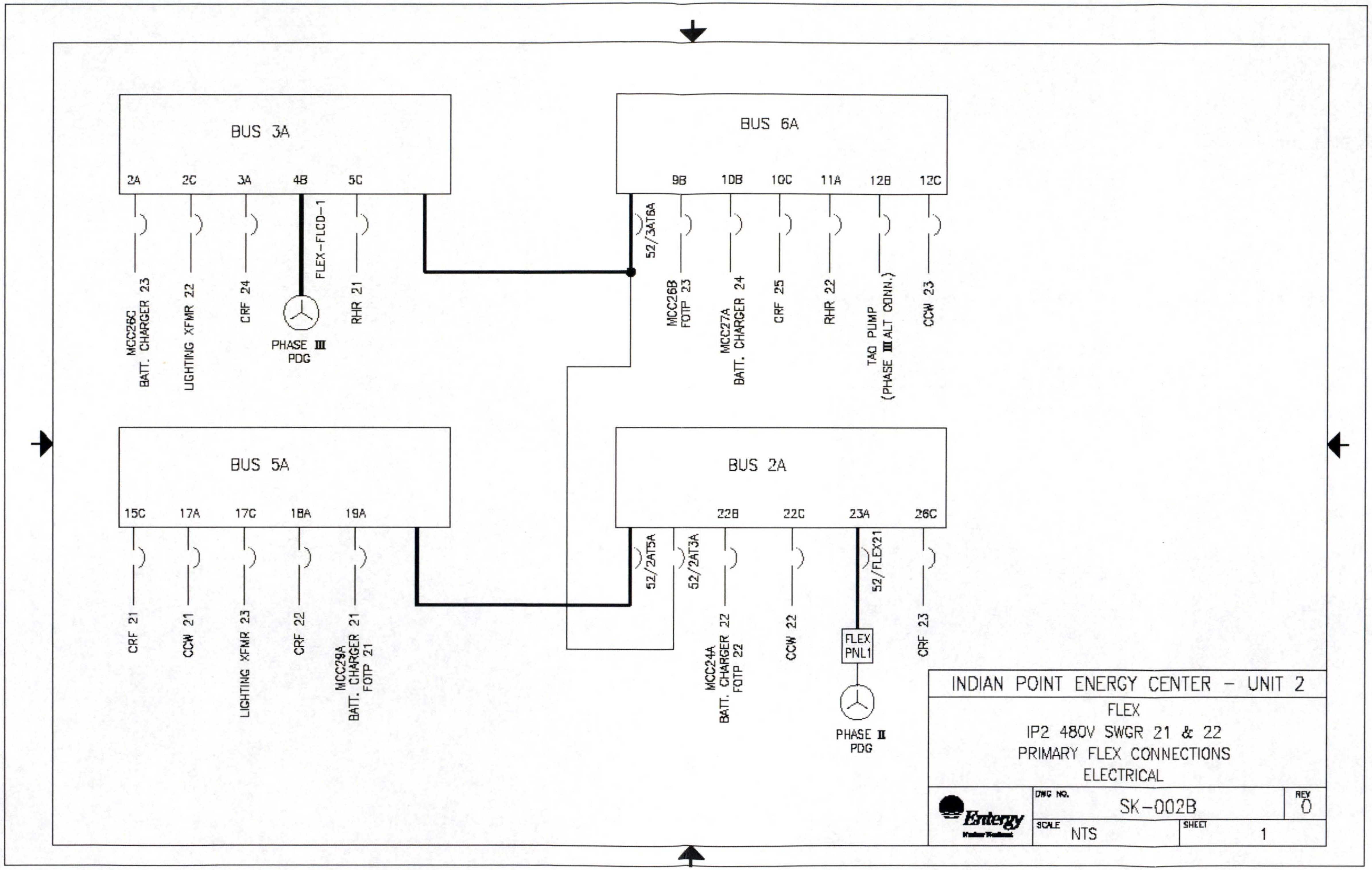

Figure 9: IP2 Primary Electrical Connections (Phase 2 FLEX DG and Phase 3 NSRC DG)

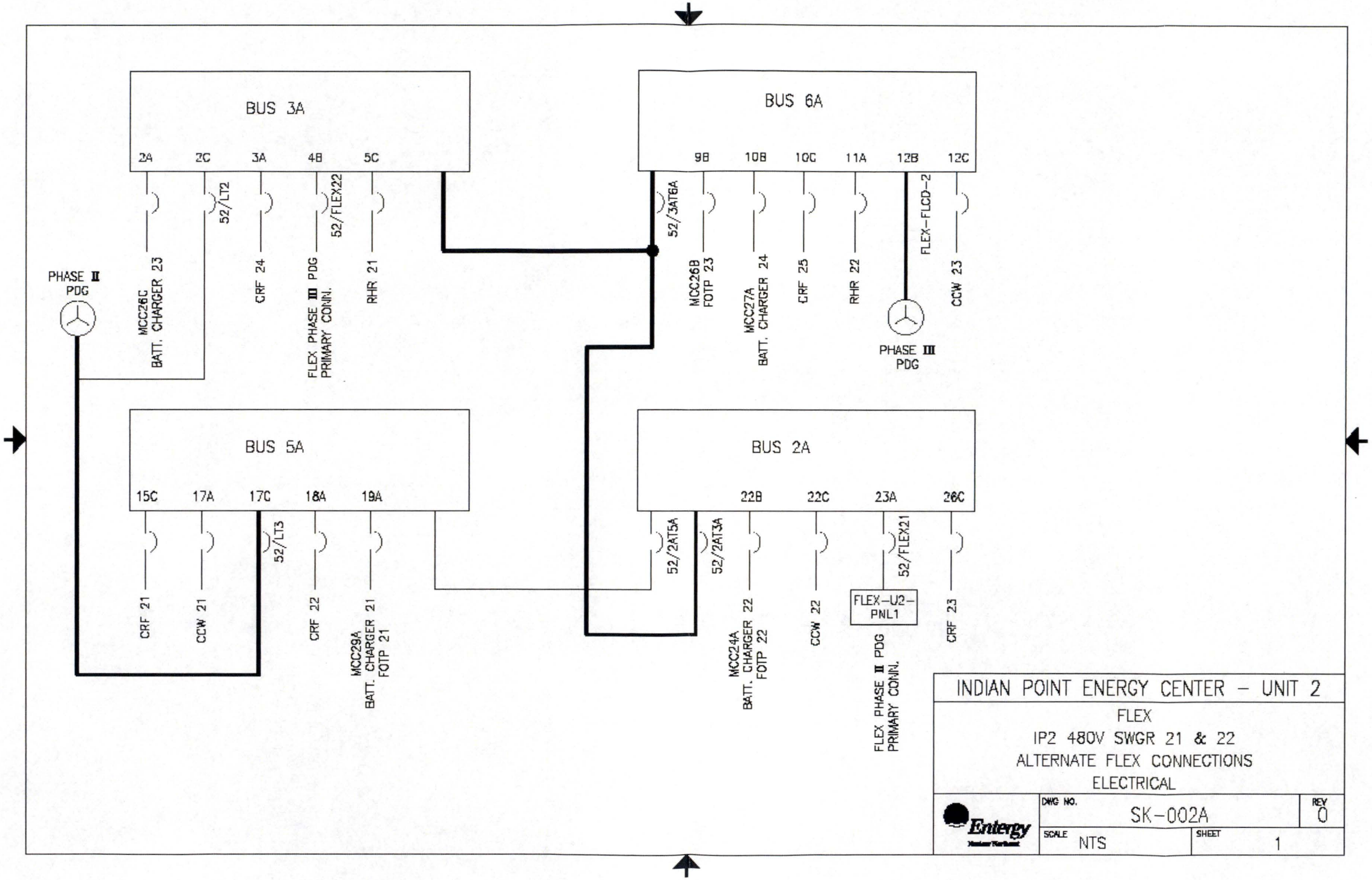

Figure 10: IP2 Alternate Electrical Connections (Phase 2 FLEX DG and Phase 3 NSRC DG)

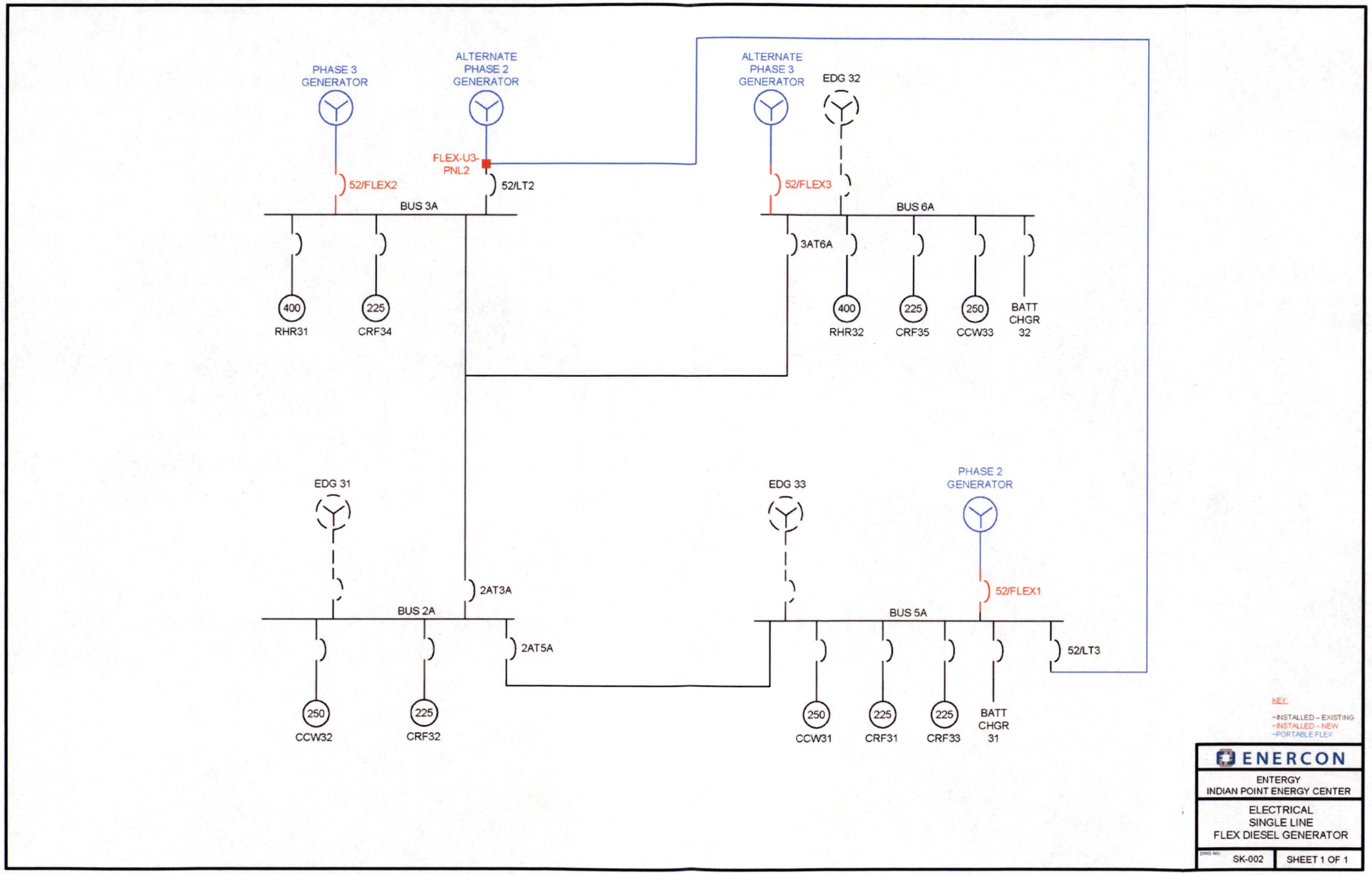

Figure 11: IP3 Electrical Connections (Phase 2 FLEX DG and Phase 3 NSRC DG)

Sequence of Events

The Table 1 below presents a sequence of events (SOE) timeline for an ELAP/LUHS event at IPEC. Validation of each of the FLEX time constraint actions has been completed in accordance with the FLEX validation process document issued by NEI and includes consideration for staffing. At hour 4 after the initiation of the event, the debris removal to allow equipment deployment is assumed to be completed, in such a way that by hour 6 the FLEX diesel generators and equipment trailers are deployed to their respective staging locations. This time is considered to be reasonable based on site reviews and the location of the FESB. Debris removal equipment is stored in the FESB.

Table 1: Sequence of Events Timeline

Action Item	Elapsed Time (hours)	Action	FLEX Time Constraint (Y/N)	Time Constraint (hours)	Remarks / Applicability
0	N/A	Event Starts	N/A	N/A	Plant at 100% Power
0	N/A	Perform SBO Coping Action	N/A	N/A	SBO actions are proceduralized SBO Procedures ECA 0.0
1	0.3	Transfer AFW Suction Source to CWST	Y	0.5	This action is required just in the case the CST is ruptured/damaged. An alternate source of water to provide suction to the TDABF pump is via CWST by operation of PCV-1188 in the CCR.
2	0.4	Control Room Ventilation (Open Room/Cabinet Doors)	Y	0.5	Ventilation is created by opening control room door(s) as recommended in 2/3 ECA-0.0.
3	0.4	Ensure TDAFW Pump Room Door Open for Ventilation	Y	0.5	When the temperature in the TDAFW pump room is above 143°F, the reliability of the pump may be affected. The temperature in the

Action Item	Elapsed Time (hours)	Action	FLEX Time Constraint (Y/N)	Time Constraint (hours)	Remarks / Applicability
					TDAFW pump room will be less than 143°F for at least 168 hours if the door is left open by the first hour after the event. The door will be open within 30 minutes of the start of the event.
4	0.8	SBO Load Shed	Y	1	Load shedding increases battery life beyond 8 hours – for duration of Phase 1 (8 hours).
5	0.5	Commence Plant Cooldown to Approximately 415°F	Y	3	This analysis assumes cooldown commences at 0.5 hours to minimize RCS leakage prior to capability to initiate RCS makeup. The first cooldown will be completed in 2 – 2.5 hours (3 hours after the ELAP event) to a cold leg temperature of approximately 415°F.
6	0.5	Operate AFW and ADVs in manual to cool down to and maintain 270 psig for IP2 and 275 psig for IP3 steam generator pressure which corresponds to approximately 415°F cold leg temperature	Y	23	Symmetric cooldown is performed. 23 hours represents the maximum time prior to commencing second cooldown. These plant parameters are maintained until; (1) SI accumulators are isolated, (2) complete boration for 340^{0}F cold leg temperature, (3) one hour delay for boron mixing, and (4) FLEX SG makeup pump is connected and available to

Action Item	Elapsed Time (hours)	Action	FLEX Time Constraint (Y/N)	Time Constraint (hours)	Remarks / Applicability
					provide makeup to the steam generators.
7	1	Declare ELAP	Y	1	ELAP declaration time line (IPEC assumption).
8	1.5	IP2 – Install Manual Blocking Device	Y	2	IP2 – For a loss of CST, blocking device installed prior to depletion of installed nitrogen bottles. Blocking device installed for a loss of FWST with the TDABF pump to be utilized following the second cooldown.
9	1.5	Deep Load Shed	Y	2	Load shedding increases battery life beyond 8 hours – for duration of Phase 1 (8 hours).
10	8	Debris Removal (Access)	Y	8	Earliest need for FLEX equipment or deployment paths. This is needed to deploy the Phase 2 FLEX DG.
11	4	Perform Damage Assessment	Y	8	FSG requirement
12	3	Deploy FLEX Phase 2 DG and Cables to Connection Points	Y	8	Includes prep, fuel, stage, connect, and start. Required completion time accounts for additional conservatism and margin associated with deploying generator and longest timeline for debris removal to repower the battery chargers.
13	6.5	Establish SFP	Y	8	Establish SFP vent

Action Item	Elapsed Time (hours)	Action	FLEX Time Constraint (Y/N)	Time Constraint (hours)	Remarks / Applicability
		Area Vent			area such as opening the door. Need time based on SFP time to boil without a break. This time to boil is based on an initial SFP temperature of 140°F, assumes pipe penetrating the SFP remains intact and assumes normal decay heat load.
14	7	Deploy SFP Makeup Hose Connections	Y	8	Need time based on SFP time to boil without a break. This time to boil is based on an initial SFP temperature of 140°F, assumes pipe penetrating the SFP remains intact and assumes normal decay heat load.
15	8	Power Up Phase 2 Loads	Y	8	IP2 – Restoration of battery chargers is the only 8-hour time critical load IP3 - Restoration of battery chargers and ventilation fans.
16	10	Align FLEX RCS Inventory Makeup Pump From RWST	Y	12.7 IP2 11.6 IP3	Required end time based on ensuring adequate inventory injected by RWST to maintain natural circulation.
17	12	Deploy On-Site Phase 2 FLEX Fuel Supply Tank And Start Fuel Deliveries.	Y	13	Fuel tanks for all Phase 2 FLEX equipment will have enough capacity to support continued operation at maximum load for greater than 8 hours. This ensures adequate time to

Action Item	Elapsed Time (hours)	Action	FLEX Time Constraint (Y/N)	Time Constraint (hours)	Remarks / Applicability
					refuel all support devices
18	12	Stage FLEX SG Makeup Pump and Hoses	Y	23	Prior to the second cooldown the FLEX SG Feed Pump is connected and available to provide makeup to the steam generators. 23 hours represents the maximum time prior to commencing second cooldown. The FLEX SG makeup pump is operationally ready prior to commencing the second cooldown because subsequent steam pressure will be decreased enough to potentially compromise TDABF pump performance.
19	14	Open Head Vent Valves as Needed for Letdown	Y	22 IP2 22 IP3	Letdown required to ensure the required borated water is injected from RWST at end-of-life core conditions. If total RCS and RCP seal leakage remains greater than 49.12 gpm for IP2 and 45.91 gpm for IP3, then head vent operation is not required for boration requirements.
20	14	Align FLEX Inventory Transfer Pump From Available ACS to the CST	Y	20/24 IP2 19/23 IP3	<u>This action is required when the CST has not been ruptured/damaged</u>. Water management is performed depending on available tanks to minimize time during

Action Item	Elapsed Time (hours)	Action	FLEX Time Constraint (Y/N)	Time Constraint (hours)	Remarks / Applicability
					which treated water is used in the steam generators by lining up other available pure water. IP2 - Transfer required to begin before 20 hours if CST is supplying water to both SGs and SFP or before 24 hours if CST is just supplying water to the SGs. IP3 - Transfer required to begin before 19 hours if CST is supplying water to both SGs and SFP or before 23 hours if CST is just supplying water to the SGs
21	15	Isolate SI Accumulators	Y	23	Post-first cooldown plant parameters are maintained until SI accumulators are isolated and other conditions met as described in Section 2.3.1.
22	18	Deploy Nitrogen Bottles for ADV Operation	Y	20 IP2 24 IP3	Installed nitrogen bottles supply 20 hours (IP2) and 24 hours (IP3) of ADV operation and addition bottles deployed from FESB to ADV installed bottle location for change-out when needed.
23	18	Align FLEX SFP Makeup Pump	Y	27.83	Supporting evaluations demonstrate a time to makeup of 27.83 hr.
24	18	IP3 - Install Manual Blocking	Y	24	This action is required just in the case the

Action Item	Elapsed Time (hours)	Action	FLEX Time Constraint (Y/N)	Time Constraint (hours)	Remarks / Applicability
		Device on PCV-1188 to Maintain Open			CST is ruptured/damaged. An alternate source of water to provide suction to the TDABF pump is via CWST by operation of PCV-1188 in the CCR.
25	22	Perform Second Plant Cooldown to Approximately 340^{0}F Cold Leg Temperature	Y	24	The cooldown is initiated following completion of; (1) SI accumulator isolation, (2) complete boration for 340^{0}F cold leg temperature, (3) one hour delay for boron mixing, and (4) FLEX SG makeup pump is connected and available to provide makeup to the steam generators. Expected to commence at 20 hours based on RCS makeup initiation at 10 hours, plus 7 hours end-of-cycle boration, plus one hour mixing, plus two hour operator RCS inventory management margin. Latest delayed time is 23 hours.
26	30	Deploy Phase 3 NSRC 480 VAC Generator	Y	120	A Phase 3 480 VAC generator from the NSRC will be brought in to support powering a 480 VAC bus to supply power for one RHR pump, one CRF Unit, and some of the Phase 2 loads. Availability / use of these generators is not required until

Action Item	Elapsed Time (hours)	Action	FLEX Time Constraint (Y/N)	Time Constraint (hours)	Remarks / Applicability
					Phase 3 UHS pump is operable. Deployment includes stopping running generator, opening breakers, staging, making connections, starting & repowering equipment (closing breakers).
27	60	Obtain Consumable Nitrogen Bottles for ADV Operation	Y	72	Obtain additional nitrogen bottles (consumable items). Installed and FESB credited nitrogen last for 72 hours.
28	76	Establish Large Fuel Trailer Delivery Service	Y	120	Fuel strategy verified that IPEC has adequate diesel fuel to support expected operation through Phase 1 and 2. Fuel delivery to support Phase 3 generator required for initial refueling of generator.
29	88	Align UHS Pump / Alternate Service Water	Y	120	UHS pump will be needed to support mobile filtration and boration units to provide makeup to the RWST and move from SG cooling to RHR for achieving/maintaining cold shutdown.
30	96	Establish Mobile Boration Unit and Water Filtration Unit for Makeup and Decay Heat Removal	Y	120	Adequate RWST inventory is available for 120 hours. If the CWST is lost, without using canal/Hudson River, the CST, PWST and FWST are available providing inventory for at least 72 hours for IP2 and 120 hours for

Action Item	Elapsed Time (hours)	Action	FLEX Time Constraint (Y/N)	Time Constraint (hours)	Remarks / Applicability
					IP3. Therefore, if the CWST is lost, the IP2 strategy credits the mobile boration unit and the water filtration unit from the NSRC to be provided by 72 hours. Using the canal/Hudson River will provide a non-borated water source using the mobile filtration system until RHR is placed on-service at 120 hours.
31	120	Reduce RCS Temperature Below 350°F To Transition To RHR Cooling	N/A	120	End time includes margin for slower cooldown rates and other delays

2.17 Programmatic Elements

2.17.1 Overall Program Document

The IPEC Program Document provides a description of the Diverse and Flexible Coping Strategies (FLEX) Program for Indian Point Energy Center. The key program elements provided in the Program Document include:

- Description of the FLEX strategies and basis
- Provisions for documentation of the historical record of previous strategies and the basis for changes
- The basis for the ongoing maintenance and testing programs chosen for the FLEX equipment
- Designation of the minimum set of parameters necessary to support strategy implementation

In addition, the program description includes a list of the FLEX basis documents that will be kept up to date for facility and procedure changes.

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

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

2.17.2 Procedural Guidance

The inability to predict actual plant conditions that require the use of FLEX equipment makes it impossible to provide specific procedural guidance. As such, the FSGs will provide guidance that can be employed for a variety of conditions. Clear criteria for entry into FSGs will ensure that FLEX strategies are used only as directed for BDBEE conditions, and are not used inappropriately in lieu of existing procedures.

FLEX strategy support guidelines have been developed in accordance with PWROG guidelines. FLEX support guidelines provide available, pre-planned FLEX strategies for accomplishing specific tasks. FSGs are used to supplement (not replace) the existing procedure structure that establishes command and control for the event.

Procedural Interfaces have been incorporated into 2/3-ECA-0.0, "Loss of All AC Power" to the extent necessary to include appropriate reference to FSGs and provide command and control for the ELAP. Additionally, procedural interfaces have been incorporated into the emergency response guidelines procedures and the emergency preparedness procedures to include appropriate reference to FSGs.

FSG maintenance is performed by the station procedures group. In accordance with site administrative procedures, NEI 96-07, Revision 1, and NEI 97-04, Revision 1 are to be used to evaluate changes to current procedures, including the FSG, to determine the need for prior

NRC approval. However, per the guidance and examples provided in NEI 96-07, Rev. 1, changes to procedures (EOPs, AOPs, SAMGs, or FSGs) that perform actions in response events that exceed a site's design basis should screen out. Therefore, procedure steps which recognize the BDB ELAP/LUHS has occurred and which direct actions to ensure core cooling, SFP cooling, or containment integrity should not require prior NRC approval.

FSGs are reviewed and validated by the involved groups to the extent necessary to ensure the strategy is feasible. Validation may be accomplished via walk-throughs or drills of the guidelines.

2.17.3 <u>Staffing</u>

Using the methodology of (Nuclear Energy Institute) NEI 12-01 (Reference 3.8), an assessment of the capability of the Indian Point Energy Center on-shift staff and augmented Emergency Response Organization (ERO) to respond to a BDBEE was performed. The results were provided to the NRC on November 3rd, 2014 (Reference 3.75).

The assumptions for the NEI 12-01 Phase 2 scenario postulate that the BDBEE involves a large-scale external event that results in:

- an extended loss of AC power
- an extended loss of access to ultimate heat sink
- impact on units (all units are in operation at the time of the event)
- impeded access to the units by off-site responders as follows:
  - 0 to 6 Hours Post Event – No site access.
  - 6 to 24 Hours Post Event – Limited site access. Individuals may access the site by walking, personal vehicle or via alternate transportation capabilities (e.g., private resource providers or public sector support).
  - 24+ Hours Post Event – Improved site access. Site access is restored to a near-normal status and/or augmented transportation resources are available to deliver equipment, supplies and large numbers of personnel.

A team of subject matter experts from Operations, Operations Training, Radiation Protection, Chemistry, Security, Emergency Planning and FLEX Project Team personnel performed a tabletop in July 2014. The participants reviewed the assumptions and applied existing procedural guidance, including applicable draft and approved FLEX support guidelines for coping with a BDBEE using minimum on-shift staff. Particular attention was given to the sequence and timing of each procedural step, its duration, and the on-shift individual performing the step to account for both the task and the estimated time to prepare for and perform the task.

The Phase 2 staffing assessment concluded that the current minimum on-shift staff as defined in the IPEC Emergency Plan is sufficient to support the implementation of the mitigating strategies (FLEX strategies) on Units 2 and 3, as well as the required Emergency Plan actions, with no unacceptable collateral tasks assigned to the on-shift personnel during the first 6 hours. The assessment also concluded that the on-shift staff, with assistance from augmented staff, is capable of implementing the FLEX strategies necessary after the 6 hour period within the constraints. It was concluded that the emergency response function would not be degraded or lost.

The IPEC Phase 2 staffing assessment in NL-14-132 (Reference 3.75) was performed assuming that site access is restored to a near normal status and/or augmented transportation resources are available to deliver equipment, supplies, and large number of personnel within 24 hours. Attachment 2 of the NEI 12-06 Phase 2 Staffing Assessment contained in NL-14-132 identifies that FLEX support guidelines can be successfully performed by on-site staffing without reliance on additional personnel to implement the Phase 2 strategy. In addition, it is assumed, but not credited, that between 6 to 24 hours post-event, an adequate number of individuals arrive on site (e. g., by walking, personal vehicle or via alternate transportation capabilities) to assist the on-shift staff with FSG implementation.

This assessment also concluded that sufficient personnel resources exist in the current IPEC augmented ERO to fill positions for the expanded emergency response functions. Thus, the ERO resources and capabilities necessary to implement transition phase coping strategies performed after the end of the “no site access” 6-hour time exist in the current program.

2.17.4 Training

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

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

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

"ANSI/ANS 3.5, Nuclear Power Plant Simulators for use in Operator Training" certification of simulator fidelity is considered to be sufficient for the initial stages of the BDBEE scenario until the current capability of the simulator model is exceeded. Full scope simulator models will not be upgraded to accommodate FLEX training or drills.

2.17.5 Equipment List

The equipment stored and maintained at the IPEC FESB necessary for the implementation of the FLEX strategies in response to a BDBEE at IPEC is listed in Table 2. Table 2 identifies the quantity, applicable strategy, and capacity/rating for the FLEX equipment components, as well as, various clarifying notes.

2.17.6 Equipment Maintenance and Testing

Maintenance and testing of FLEX equipment is governed by the Entergy Preventive Maintenance (PM) Program as described in EN-DC-324. The Entergy PM Program is consistent with INPO AP-913 and utilizes the EPRI Preventive Maintenance Basis Database as an input in development of fleet specific Entergy PM Basis Templates. Based on this, the Entergy fleet PM program for FLEX equipment follows the guidance NEI 12-06, Section 11.5.

PMs have been developed for both the "Standby" condition and the "Deployed" condition for the FLEX portable and support equipment.

The Entergy PM Basis Templates include activities such as:

- Periodic static inspections
- Operational inspections
- Fluid analysis
- Periodic functional verifications
- Periodic performance validation tests

The Entergy PM Basis Templates provide assurance that stored or pre-staged FLEX equipment is being properly maintained and tested. In those cases where EPRI templates were not available for the specific component types, PM actions were developed based on manufacturer provided information/ recommendations.

Additionally, the ERO performs periodic facility readiness checks for equipment that is outside the jurisdiction of the normal PM program and considered a functional aspect of the specific facility (EP communications equipment such as UPS', radios, batteries, battery chargers, satellite phones, etc.). These facility functional readiness checks provide assurance that the EP communications equipment outside the jurisdiction of the PM Program is being properly maintained and tested.

The unavailability of equipment and applicable connections (FLEX fluid and electrical connections) that directly perform a FLEX mitigation strategy for core, containment, and SFP is managed such that risk to mitigating strategy capability is minimized.

IPEC Technical Requirements Manual (TRM) has been revised to reflect allowed out-of-service time and compensatory actions for unavailable FLEX equipment or connections. The TRM also specifies that actions to restore redundancy immediately be taken if portable equipment or connections are not functional and the potential for a site specific external event is identified.

Work Management procedures were revised to reflect allowed outage time (AOT) as outlined above.

Table 2							
PWR Portable Equipment Phase 2							
Use and (potential/flexibility) Diverse Uses						***Performance Criteria***	***Maintenance***
List Portable Equipment	**Core**	**Containment**	**SFP**	**Instrumentation**	**Accessibility**		**Maintenance/PM Requirements**
Three (3) SG Makeup Pumps	X					327 gpm @ 575 psi	Will follow EPRI template requirements
Three (3) RCS Inventory Makeup Pumps	X					40 gpm @ 320 psi, 118.1 gpm @ 219.5 psi	Will follow EPRI template requirements
Three (3) Inventory Transfer Pumps	X		X			327 gpm @ 165 psi	Will follow EPRI template requirements
Three (3) SFP Makeup Pumps			X			250 gpm @ 65 psi	Will follow EPRI template requirements
Three (3) 480 Vac Generators (FLEX DG)				X	X	600 kW standby	Will follow EPRI template requirements
Two (2) Debris Removal Equipment					X	4 Wheel Loader with fork, blade and bucket attachment.	Will follow EPRI template requirements
Two (2) Pickup Trucks	X		X	X	X	Diesel, >22,000 lbs. towing capacity	Will follow EPRI template

Table 2							
PWR Portable Equipment Phase 2							
Use and (potential/flexibility) Diverse Uses						***Performance Criteria***	***Maintenance***
List Portable Equipment	**Core**	**Containment**	**SFP**	**Instrumentation**	**Accessibility**		**Maintenance/PM Requirements**
							requirements
Two (2) Fuel Transportation Equipment	X		X	X	X	500 gallons, trailer mounted, 12 Vdc transfer pump and hose reel	Will follow EPRI template requirements
Hose	X		X				Will follow EPRI template requirements
Cable				X	X		Will follow EPRI template requirements
Two (2) Diesel Air Compressors	X					300 cfm @ 200 psi	Will follow EPRI template requirements. Note: This component is identified as an option to provide added convenience by restoring remote valve operation to the central control room
Eight (8) Diesel Light					X		Will follow EPRI template

Table 2							
PWR Portable Equipment Phase 2							
Use and (potential/flexibility) Diverse Uses						***Performance Criteria***	***Maintenance***
List Portable Equipment	**Core**	**Containment**	**SFP**	**Instrumentation**	**Accessibility**		**Maintenance/PM Requirements**
Towers							requirements Note: For IP2, only two light towers are credited to support battery room ventilation.

Table 3							
PWR Portable Equipment Phase 3							
Use and (potential/flexibility) Diverse Uses						***Performance Criteria***	***Notes***
List Portable Equipment	**Core**	**Containment**	**SFP**	**Instrumentation**	**Accessibility**		
Two (2) UHS Pumps	X	X				5,000 gpm @ 150 psig	Will follow EPRI template requirements
Two (2) Suction Booster Lift Pumps	X	X				5,000 gpm with 26-foot head	Will follow EPRI template requirements
Two (2) 480 Vac Generators	X	X		X	X	1100 kW standby derated to 1000 kW	Will follow EPRI template requirements
Mobile Boration Unit	X		X			1,000-gallon capacity tank	Will follow EPRI template requirements
Water Filtration Unit	X		X			500 gpm output flow	Will follow EPRI template requirements
Hose	X	X	X				Will follow EPRI template requirements
Cable	X	X	X	X	X		Will follow EPRI template requirements

3. References

3.1 SECY-11-0093, Near-Term Report and Recommendations for Agency Actions Following the Events in Japan, (ADAMS Accession No. ML 11186A950).

3.2 NRC Order EA-12-049, Order to Modify Licenses With Regard to Requirements for Mitigation Strategies For Beyond-Design-Basis External Events, dated March 12, 2012, (ADAMS Accession No. ML 12056A045).

3.3 Nuclear Energy Institute (NEI) 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 0, dated August 2012 (ADAMS Accession No. ML12221A205)

3.4 NRC Interim Staff Guidance JLD-ISG-2012-01, Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, Revision 0, dated August 29, 2012 (ADAMS Accession No. ML 12229A174).

3.5 NRC Order Number, EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation, dated March, 12, 2012 (ADAMS Accession No. ML12054A679)

3.6 Nuclear Energy Institute (NEI) 12-02, Industry Guidance for Compliance with NRC Order EA-12-051, To Modify Licenses with Regard to Reliable SFP Instrumentation, Revision 1, dated August 2012 (ADAMS Accession No. ML12240A307)

3.7 NRC Interim Staff Guidance JLD-ISG-2012-03, Compliance with Order EA-12-051, Reliable SFP Instrumentation, Revision 0, dated August 29, 2012 (ADAMS Accession No. ML12221A339)

3.8 Nuclear Energy Institute (NEI) 12-01, Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities, Revision 0, dated May 3, 2012 (ADAMS Accession No. ML12125A410)

3.9 NUREG/CR-4461, Rev. 2, PNNL-15112, Rev. 1, Tornado Climatology of the Contiguous United States.

3.10 NRC Regulatory Issue Summary 2015-06, Tornado Missile Protection, dated June 10, 2015 (ADAMS Accession No. ML15020A419)

3.11 Nuclear Energy Institute, Position Paper: Shutdown/Refueling Modes, dated September 18, 2013 (ADAMS Accession No. ML13273A514)

3.12 NRC letter, dated September 30, 2013 (ADAMS Accession No. ML13267A382)

3.13 Entergy Letter NL-13-036, Entergy Response to NRC Technical Issues for Resolution Regarding Licensee Communication Submittals Associated with Near-Term Task Force Recommendation 9.3 (TAC No. ME7951) Indian Point Unit Numbers 2 and 3, (ADAMS ML 13064A360)

3.14 IP-RPT-13-00055, Rev. 0, Indian Point Energy Center Unit 3 Tornado Missile Impact on Water Storage Tanks.

3.15 Westinghouse Letter LTR-FSE-13-46, Rev. 0, Westinghouse Response to NRC Generic Request for Additional Information (RAI) on Boron Mixing in Support of the Pressurized Water Reactor Owners Group (PWROG), dated August 15, 2013.

3.16 NRC Letter, Boron Mixing Endorsement Letter in Regards to Mitigation Strategies Order EA-12-049, dated January 8, 2014 (ADAMS Accession No. ML13276A183)

3.17 Indian Point 2 Improved Technical Specifications, Amendment No. 274

3.18 IP3-CALC-EG-00217, Rev. 5, Emergency Diesel Generator Storage Tank Level Setpoints

3.19 2-SOP-11.1, Rev. 59, Ventilation System Operation

3.20 IP-RPT-15-00031, Rev. 0, IP2 Tornado Protection, October 2014.

3.21 PWROG-14015-P, Rev. 2, No. 1 Seal Flow Rate for Westinghouse Reactor Coolant Pumps Following Loss of All AC Power, Task 2: Determine Seal Flow Rates.

3.22 PWROG-14027-P, Rev. 3, No. 1 Seal Flow Rate for Westinghouse Reactor Coolant Pumps Following Loss of All AC Power, Task 3: Evaluation of Revised Seal Flow Rate on Time to Enter Reflux Cooling and Time at which the Core Uncovers.

3.23 IP-CALC-14-00041, Rev. 1, Indian Point Unit 2 FLEX Reactivity Calculation,

3.24 IP-CALC-13-00073, Rev. 2, Indian Point Unit 3 FLEX Reactivity Calculation,

3.25 Not used

3.26 Not used

3.27 2-SOP-ESP-001, Rev. 11, Local Equipment Operation and Contingency Actions-

3.28 IP-CALC-14-00036, Rev. 0, Nitrogen Backup to AFW Valves & Atmospheric Dump Valves for FLEX Event

3.29 3-SOP-ESP-001, Rev. 25, Local Equipment Operation and Contingency Actions

3.30 IP-CALC-13-00059, Rev. 0, Nitrogen Backup to AFW Valves & Atmospheric Dump Valves for FLEX Event

3.31 IP-CALC-14-00044, Rev. 1, IP2 RCS Inventory Evaluation for FLEX

3.32 IP-CALC-14-00012, Rev. 1, IP3 RCS Inventory Evaluation for FLEX

3.33 IP-CALC-14-00045, Rev. 1, Steam Generator and SFP Inventory Evaluation for FLEX

3.34 IP-CALC-14-00013, Rev. 1, IP3 Steam Generator and SFP Inventory Evaluation for FLEX

3.35 IP-CALC-14-00076, Rev. 0, Battery Sizing and Voltage Drop Calculation for Extended Loss of Power (ELAP)

3.36 IP-CALC-13-00056, Rev. 0, Battery Sizing and Voltage Drop Calculation for Extended Loss of Power (ELAP)

3.37 IP-CALC-14-00046, Rev. 0, Hydraulic Model for Condensate Storage Tank (CST) for FLEX Strategies

3.38 IP-CALC-13-00040, Rev. 1, Hydraulic Model for Condensate Storage Tank (CST) for FLEX Strategies

3.39 IP-CALC-14-00047, Rev. 0, Hydraulic Analysis of FLEX Strategies Using the RWST as a Source of Water

3.40 IP-CALC-13-00045, Rev. 0, Hydraulic Analysis of FLEX Strategies Using the RWST as a Source of Water

3.41 Letter IP-DE-16-001, January 12, 2016, Additional Information Requested from ENERCON for FLEX Calculations

3.42 IP-CALC-15-00002, Rev. 1, IP2 Time to Reflux Cooling Calculation

3.43 IP-CALC-15-00003, Rev. 1, IP3 Time to Reflux Cooling Calculation

3.44 Not used

3.45 IP-CALC-14-00048, Rev.0, Hydraulic Model for the Primary Water Storage Tank (PWST) and the Fire Water Storage Tank (FWST) for FLEX Strategies

3.46 IP-CALC-13-00055, Rev.0, Hydraulic Model for the Primary Water Storage Tank (PWST) and the Fire Water Storage Tank (FWST) for FLEX Strategies

3.47 IP-CALC-13-00084, CN-SEE-III-12-71, Rev. 1, Indian Point Units 2 & 3 FLEX Conceptual Design AFT Fathom Models

3.48 WCAP-17601-P, Revision 1, Reactor Coolant System Response to the Extended Loss of AC Power Event for Westinghouse, Combustion Engineering and Babcock & Wilcox NSSS Designs, January 2013

3.49 Not used

3.50 Not used

3.51 IP-CALC-14-00055, Rev. 0, IP2 FLEX Phase 2 Portable Diesel Generator Sizing Calculation

3.52 IP-CALC-14-00002, Rev. 0, IP3 FLEX Phase 2 Portable Diesel Generator Sizing Calculation

3.53 IP-CALC-13-00087, CN-SEE-II-12-44, Rev. 0, Determination of the Time to Boil in the Indian Point Units 2 and 3 Spent Fuel Pools after an Earthquake

3.54 IP-RPT-14-00006, Rev. 1, IP2 FLEX Strategy Development

3.55 IP-RPT-13-00059, Rev. 4, IP3 FLEX Strategy Development

3.56 MOHR Document 1-0410-7 MOHR EFP-IL SFPI System Battery Life Report

3.57 IP-CALC-14-00042, Rev. 1, MAAP 4.0.5 Containment Analysis for an Extended Loss of all AC Power Event (ELAP)

3.58 IP-CALC-13-00081, Rev. 2, IP3 MAAP 4.0.5 Containment Analysis for an Extended Loss of all AC Power Event (ELAP)

3.59 51-9199717-013, National SAFER Response Center Equipment Technical Requirements

3.60 IP-RPT-14-00011, Rev. 1, FLEX Debris Removal Assessment for Indian Point Energy Center

3.61 IP-CALC-14-00043, Rev. 0, Freezing of Unit 2 Coolant Sources for FLEX Event

3.62 IP-CALC-13-00058, Rev. 1, Freezing of Unit 3 Coolant Sources for FLEX Event

3.63 ASHRAE Fundamentals Handbook, 2001 Edition

3.64 IP-RPT-14-00010, Report of Liquefaction Potential Assessment FLEX Equipment Travel Paths

3.65 IP-CALC-14-00037, Rev. 0, FLEX Event Diesel Fuel Usages

3.66 IP-CALC-13-00057, Rev. 0, FLEX Event Diesel Fuel Usages

3.67 IP-CALC-14-00088, Rev. 0, Fan House Temperature Evaluation for FLEX Event SFP Level Instrument Function

3.68 IP-CALC-13-00068, Rev. 0, Fan House Heat-Up Evaluation with SFP Level Instruments for FLEX Event

3.69 IP-CALC-14-00038, Rev. 0, Main Control Room Heat-Up for FLEX Event

3.70 IP-CALC-13-00065, Rev. 0, Main Control Room Heat-Up for FLEX Event

3.71 IP-CALC-14-00039, Rev. 0, FLEX Event Evaluation of Turbine Driven Auxiliary Feed Pump Room Heat-Up

3.72 IP-CALC-13-00064, Rev. 0, FLEX Event Evaluation of Turbine Driven Auxiliary Feed Pump Room Heat-Up

3.73 IP-CALC-13-00085, CN-LIS-12-103, Rev. 1, Indian Point Unit 2 and Unit 3 (IPP/INT) Reactor Coolant System (RCS) Inventory, Shutdown Margin and Mode 5/6 Boric Acid Precipitation Control (BAPC) Analyses to Support the Diverse and Flexible Coping Strategy (FLEX)

3.74 IP-CALC-14-00010, Rev. 0, Diesel Fuel Requirement for EP Communication Diesel

3.75 Letter NL-14-132, Response to March 12, 2012, Request for Information (RFI) Pursuant to Title 10 of the Code of Federal Regulation 50.54(f) Regarding Recommendations of the Near-Term Task Force (NTTF) Review of Insights from the Fukushima Dia-ichi Accident, Enclosure 5 Recommendation 9.3, Emergency Preparedness – Staffing, Requested Information Items 1, 2, and 6 – Phase 2 Staffing Assessment Indian Point Energy Center – Units 2 and 3, dated November 3, 2014

3.76 UFSAR, Indian Point Energy Center (IPEC) Unit 2 Updated Final Safety Analysis Report (UFSAR).

3.77 UFSAR, Indian Point Energy Center (IPEC) Unit 3 Updated Final Safety Analysis Report (UFSAR)

3.78 Not used

3.79 IP-CALC-15-00017, Rev. 0, (Westinghouse Number CN-SEE-I-15-2 Rev 0): Indian Point Reactor Coolant Pump Seal Leakoff Analysis with Flow Restricting Orifice

3.80 Entergy Letter, NL-13-156, Entergy's Required Response for NTTF Recommendation 2.1: Flooding Hazard Reevaluation Report (FHRR) Indian Point Unit Numbers 2 and 3, dated December 23, 2013 (Accession No. ML13364A006)

3.81 51-9233069-001, Indian Point Energy Center SAFER Response Plan

3.82 EC 54432, Nitrogen Backup for PCV-1188

3.83 IP-CALC-15-00035, Rev. 1, Margin Gain in the Results of Applicable FLEX Calculations Using Input from IP-CALC-15-00017

3.84 Westinghouse Technical Bulletin TB-15-1, Reactor Coolant Temperature and Pressure Limits for the No.2 Reactor Coolant Pump Seal, dated March 3, 2015

3.85 IP-CALC-15-00046, Rev. 0, IP2 FLEX Support Guideline Setpoints

3.86 IP-CALC-14-00063, Rev. 1, IP3 FLEX Support Guideline Setpoints

3.87 Not used.

3.88 OAP-008, Rev. 23, Severe Weather Preparations

3.89 IP-CALC-16-00015, Rev. 0, IPEC FLEX Core Thermal Response and Basis

3.90 IP-CALC-14-00056, Rev. 0, IP2 FLEX Phase 3 Portable Diesel Generator Sizing Calculation

3.91 IP-CALC-14-00098, Rev. 0, IP3 FLEX Phase 3 Portable Diesel Generator Sizing Calculation

3.92 Letter to NRC, Supplemental Submittal Regarding Regulatory Guide 1.97 Qualification of Neutron Flux Instrumentation, dated September 18, 1995.

3.93 2/3-FSG-007, Loss of Vital Instrumentation or Control Power

3.94 2/3-IC-SI-87, Contingency Action to Provide Instrument Information During Loss of Power

3.95 2/3-FSG-008, Alternate RCS Boration

3.96 NRC letter, Conformance to Regulatory Guide 1.97, Revision 2, Post Accident Neutron Flux Monitoring Instrumentation for Indian Point Nuclear Generating Unit No. 2, dated November 27, 1995

3.97 2/3-FSG-014, Extended Loss of AC Power – Phase 3

3.98 IP-CALC-13-00094, Rev. 0, Indian Point ELAP RCS Makeup Pump Bounding Requirements.

3.99 NRC Endorsement Letter of NEI Alternate Approach Hoses and Cables, dated May 18, 2015 (ML 15125A442)

3.100 NEI Letter "Alternative Approach to NEI 12-06 Guidance for Hoses and Cables", dated May 1, 2015 (ML15126A135)

3.101 2/3-FSG-010, Passive RCS Injection Isolation

3.102 2/3-FSG-004, ELAP DC Bus Load Shed Management

3.103 2/3-FSG-003, Alternate Low Pressure Feedwater

3.104 2/3-FSG-001, Long Term RCS Inventory Control

ENCLOSURE 3 TO NL-16-089

SFPI VENDOR – INDIAN POINT BRIDGING DOCUMENT

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NO. 2
DOCKET NO. 50-247

IPEC Bridging Document Between Vendor Technical Information and Licensee Use Based on NRC Staff Requests for Additional Information (RAIs) and NRC Vendor Audit

#	Topic	Parameter Summary	Vendor Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
1	Design Specification	SFPI Requirements derived from References 1, 2, & 3	References 4-14, 24-25, 37-39			Evaluation of the vendor information is within the scope of EC 45666 for IP3 (Reference 22) and EC 50865 for IP2 (Reference 42).
2	Test Strategy	Per Requirements in References 1, 2, & 3	References 4, 6-14, 24-25, 37-39			The equipment testing performed for the SFPI has been found to be acceptable based on the current design requirements.
3	Environmental Qualification for Electronics Enclosure with Display	50-127.5°F (IP3) 50-122.6°F (IP2) (References 1, 2, 19, 20, & 47)	Reference 4		14-131°F	The IP3 signal processor/display panels will be installed in the Fan House next to the retired Hydrogen Recombiner Panel on Elevation 67'-6" of the PAB Fan House, to make reliable information readily available regarding the status of the SFP level. Calculation IP-CALC-13-00068 (Reference 32) documents that the spent fuel pool level instrumentation will remain functional during a FLEX scenario, i.e. during extreme summer and winter ambient conditions, since the local ambient temperatures will remain within the allowable operating temperature rangers of the instruments. The initial peak temperature determined in IP-CALC-13-00068 is 127.5 °F and reaches as high as 125.7 °F after 20 hours into a FLEX event. Therefore, it is reasonable to conclude that conditions in this area will not exceed the 131°F (55°C) which the SFPI was qualified to in MOHR Report 1-0410-1 (Reference 4). The area will not require prolonged operator occupancy for SFPI.

#	Topic	Parameter Summary	Vendor Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
						Also, operators will be required to pass through the area for other FLEX functions. There is reasonable assurance that the temperature in the area will remain at a safe level. The IP2 signal processor/display panels will be installed on Elevation 90' of the IP2 Upper Fan House, to make reliable information readily available regarding the status of the SFP level. Calculation IP-CALC-14-00088 (Reference 47) documents that the spent fuel pool level instrumentation will remain functional during a FLEX scenario, i.e. during extreme summer and winter ambient conditions, since the local ambient temperatures will remain within the allowable operating temperature rangers of the instruments. The maximum temperature determined in IP-CALC-14-00088 is 122.6 °F. Therefore, it is reasonable to conclude that conditions in this area will not exceed the 131°F (55°C) which the SFPI was qualified to in MOHR Report 1-0410-1. The area will not require prolonged operator occupancy for SFPI. The SFP is expected to remain at or above the minimum ambient temperature (50°F) as called out in the UFSARs (References 19 & 20) Section 5.1.1.1.7 and Section 1.3.5.
		5-95% RH	Reference 4		5-95% RH	The SFPI vendor, MOHR, has successfully tested its system electronics to operate in a humidity range of 5% to 95% relative humidity. Results of the vendor testing are available in proprietary MOHR Report 1-

#	Topic	Parameter Summary	Vendor Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
						0410-1 Rev. 0, MOHR EFP-IL SFPI System Temperature and Humidity Report (Reference 4). During an extended loss of AC power, the Fan House HVAC systems will no longer be available. Prior to the Fan House access doors being opened (if opened to regulate temperature or allow FLEX hose connections) the relative humidity in the Fan Houses are expected to drop because the heat loads are dominated by the sensible heat of electrical equipment (fans). Under circumstances in which extreme heat is anticipated at IPEC, the worst case outside conditions in the plant's design basis are temperatures of 93°F dry bulb and 75°F wet bulb (Reference 19, Section 9.0), with coincident relative humidity of approximately 43%. Thus, in the event a Fan House door is opened to outdoors, the relative humidity is not expected to challenge the bounding MOHR test case. These conditions are bounded by the 55 °C (131 °F) and 50 percent RH test case presented in MOHR Report 1-0410-1 (Reference 4) which was endorsed by The NRC Audit Report for MOHR (Reference 41). In the case of high humidity, ASHRAE (Reference 43, Chapter 14 Appendix: Design Conditions for Selected Locations) defines a 0.4% dehumidification condition to be 79.8 °F db, 73.5 °F dew point, and ~81% RH for White Plains, New York. Similarly, 85.4 °F db, 76.6 °F wb, and ~67% RH is defined for a

#	Topic	Parameter Summary	Vendor Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
						0.4% evaporation condition. These conditions are also bounded by the test cases presented in MOHR Report 1-0410-1 (Reference 4). Therefore, the operational humidity range of 5% to 95% encompasses all expected conditions for the SFPI display location. The sensor electronics are capable of continuously performing their required function under the expected humidity conditions.
		Mild radiation environment			N/A	According to Entergy Engineering Standard IPEC EQ Program Manual EN-EQ-S-002-01 (Reference 44, Section 5.5.2.5), a total integrated radiation dose (TID) of 1.0E+04 rads is used as a threshold above which an environment is considered harsh. This applies to all equipment and materials at IPEC. This procedure acknowledges that USNRC Regulatory Guide 1.89, Section B suggests a lower threshold limit for electronic devices, but counter argues that other studies, including those sponsored by the NRC and EPRI, as well as various vendor test reports indicate that solid state electronic equipment typically used in nuclear power plants will support equipment operation at doses higher than 1.0E+04 rads and therefore this is conservative. Areas not considered harsh are designated as mild environments, such as the control rooms. This procedure is intended for safety-related equipment and therefore is acceptable to use for SFPI, which is non safety-related equipment. For IP3, calculation IP3-CALC-RAD-0004 (Reference 45) indicates that the hydrogen

#	Topic	Parameter Summary	Vendor Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
						recombiner, where the SFPI electronics enclosure and display is located, receives a dose contribution due to normal operation of about 2 mrem/hr. This results in a 40 year TID of 7.0E+02 rads, which is significantly lower than the harsh environment limit. This supports the designation of this area as a mild environment and therefore is an acceptable location for the electronics enclosure and display. For IP2, calculation PGI-00412-00 (Reference 46, Section III) also concludes that the IP2 hydrogen recombiner is located in a mild environment and therefore is an acceptable location for the electronics enclosure and display.
4	Environmental Testing for Level Sensor components in SFP area-Submerged Portion of Probe Body	50-212°F (References 1, 2, 19, & 20)	Reference 5	RAD TID is the total 40 yr dose plus the 7 day worst case accident dose at the lowest spacer location on the Probe body	480°F long-term for PEEK Insulators	The NRC Audit Report for MOHR (Reference 41) concludes that the SFP-1 probe is suitable for operation in the SFP environment. The SFP is expected to remain at or above the minimum ambient temperature (50°F) as called out in the UFSARs (References 19 & 20) Section 5.1.1.1.7 and Section 1.3.5. Maximum accident condition of the spent fuel pool is taken to be 212°F boiling borated water/steam at atmospheric pressure. Based on the vendor analysis results, the sensitive materials in the probe body will not be challenged under the required conditions of References 1, 2, 19, & 20, and are acceptable.
		Submerged Component (References 1 & 2)	Reference 5		PEEK Insulators capable of long term submergence	
		1.51E+07 rad TID (IP3)	Reference 5		10 Grad for PEEK Insulators	The NRC Audit Report for MOHR (Reference 41) concludes that the SFP-1 probe is suitable for operation in the SFP environment.

#	Topic	Parameter Summary	Vendor Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
		3.87E+07 rad TID (IP2) (References 1, 2, 23, & 48)				Calculation IP-CALC-13-00072 (Reference 23) defines a worst case dose of approximately 1.51E+07 rad to the probe via the applicable requirements of References 1 and 2. As such, the PEEK spacers are suitable for the application. Note this calculation is applicable only to IP3. Calculation IP-CALC-14-00079 (Reference 48) defines a worst case dose of approximately 3.87E+07 rad to the probe via the applicable requirements of References 1 and 2. As such, the PEEK spacers are suitable for the application. Note this calculation is applicable only to IP2.
5	Environmental Testing for Level Sensor Electronics Housing-Probe Head Located Above the SFP	50-212°F (References 1, 2, 19, & 20)	Reference 5	Rad TID is the total 40 yr dose plus the 7 day worst case accident dose at the location	PEEK: 480°F EPDM: 194°F long-term, 12 day @ 311°F Sylgard 170: 392°F long-term	The NRC Audit Report for MOHR (Reference 41) concludes that the SFP-1 probe is suitable for operation in the SFP environment. The SFP area is expected to remain at or above the minimum ambient temperature (50°F) as called out in the UFSARs (References 19 & 20) Section 5.1.1.1.7 and Section 1.3.5. Maximum accident condition temperature and humidity directly above the spent fuel pool is taken to be a condensing steam environment which conservatively will be no greater than 212°F, the temperature of boiling water at atmospheric pressure. Based on the vendor analysis results, the sensitive materials in the probe head will not be challenged under the required conditions of References 1, 2, 19, & 20, and are acceptable.

#	Topic	Parameter Summary	Vendor Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
						For coaxial transmission cable beyond the Probe Head, MOHR uses Class 1E Nuclear Safety Related RSCC Wire & Cable RSS-6-110A/LE which meets the requirements of Institute of Electrical and Electronic Engineers (IEEE) 383-1974, "IEEE Standard for Type Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations" and is acceptable (Reference 41).
		0-100% RH Condensing (References 1 & 2)	Reference 5		0-100% RH for PEEK, EPDM and Sylgard 170	The NRC Audit Report for MOHR (Reference 41) concludes that the SFP-1 probe is suitable for operation in the SFP environment. 100% non-condensing RH is a conservative humidity range for normal operating conditions. Based on the vendor analysis results, the sensitive materials in the probe head will not be challenged under the required conditions of References 1 & 2 and are acceptable.
		1.07E+05 rad TID (IP3) 1.15E+05 rad TID (IP2) (References 23 & 48)	Reference 5		PEEK: 10 Grad EPDM: 2 Grad Sylgard 170:200 Mrad	The NRC Audit Report for MOHR (Reference 41) concludes that the SFP-1 probe is suitable for operation in the SFP environment. IP-CALC-13-00072 (Reference 23) defines a worst case dose of approximately 1.07E+05 rad. Based on the vendor analysis results, the sensitive materials in the probe head will not be challenged under the required conditions of References 1 & 2 and are acceptable. Note this calculation is applicable only to IP3. IP-CALC-14-00079 (Reference 48) defines a worst case dose of approximately 1.15E+05 rad. Based on

#	Topic	Parameter Summary	Vendor Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
						the vendor analysis results, the sensitive materials in the probe head will not be challenged under the required conditions of References 1 & 2 and are acceptable. Note this calculation is applicable only to IP2.
6	Thermal & Radiation Aging-organic components in SFP area	See Topics #4 & 5 above	Reference 5		See above Topics #4 and 5	Acceptable, vendor test/analysis bound licensee parameters, see discussion above in Topics #4 and 5.
7	Basis for Dose Requirement	References 1 & 2	N/A			Entergy Calculation Procedure EN-DC-126 (Reference 21) was used to develop IP3 calculation IP-CALC-13-00072 (Reference 23) and IP2 calculation IP-CALC-14-00079 (Reference 48), based on the requirements of NEI-12-02 (Reference 2) and EA-12-051 (Reference 1). The calculations determine conservative source terms and dose rates at key instrument locations, for both a 7 day accident scenario and 40-year TID.
8	Seismic Qualification	Seismic Class I (References 1, 2, 3, 19, & 20)	References 8, 9, 12, & 13		Seismic Class 1	Acceptable, MOHR has prepared a site specific seismic analysis for IP3 which bounds IP3's and IP2's seismic criteria. The qualification report envelops all components of the new SFP level instrumentation required to be operational during a BDBEE and post-event. This document is MOHR Report 1-0410-9.17 (Reference 13). MOHR Reports 1-0410-6 (Reference 9) and 1-0410-9 (Reference 12), are also available for review. IP3 calculation IP-CALC-13-00082 (Reference 33) accounts for seismic loads and shows that the SFPI Probe Mounting Bracket is structurally adequate and

#	Topic	Parameter Summary	Vendor Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
						seismically qualified as all Interaction Ratios (IR) are less than one (1.0). IP2 calculation IP-CALC-14-00087 (Reference 49) accounts for seismic loads and shows that the SFPI Probe Mounting Bracket is structurally adequate and seismically qualified as all Interaction Ratios (IR) are less than one (1.0).
9	Sloshing	Water induced motion from seismic event does not cause equipment structural failure	References 12, 13, 24, & 25	See Topic #8		Acceptable, the MOHR seismic qualification reports (References 9, 12, & 13) in combination with NAI Report # NAI-1725-003 (Reference 24), NAI Report # NAI-1725-004 (Reference 25) and NAI Report # NAI-1791-005 (Reference 37) adequately bound the hydrodynamic loads associated with sloshing for IP3 and IP2. Note NAI-1791-005 was developed specifically for IP3 but is also bounding for IP2. IP3 calculation IP-CALC-13-00082 (Reference 33) was prepared in accordance with EN-DC-126 (Reference 21) and accounts for hydrodynamic loads. It shows that the SFPI Probe Mounting Bracket is structurally adequate and seismically qualified as all Interaction Ratios (IR) are less than one (1.0). Reference 33 is available on the e-portal for review. IP2 calculation IP-CALC-14-00087 (Reference 49) was prepared in accordance with EN-DC-126 (Reference 21) and accounts for hydrodynamic loads. It shows that the SFPI Probe Mounting Bracket is structurally adequate and seismically

#	Topic	Parameter Summary	Vendor Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
						qualified as all Interaction Ratios (IR) are less than one (1.0). Reference 49 is available on the e-portal for review.
10	Spent Fuel Pool Instrumentation System Functionality	System must allow for routine, in situ functionality	References 16, 17, & 18			The system features onboard electrical diagnostics. SFPI channel/equipment maintenance/preventative maintenance and testing program requirements to ensure design and system readiness will be established in accordance with Entergy's processes and procedures and in consideration of vendor recommendations to ensure that appropriate regular testing, channel checks, functional tests, periodic calibration, and maintenance is performed (and available for inspection and audit). The instrument automatically monitors the integrity of its level measurement system using in-situ capability. Revision 0 of the manuals have been provided by the vendor (References 16, 17, & 18) for use, although it is possible these could be amended by the vendor in the future based on installation experience.
11	Boron Build-Up	Buildup cannot produce error greater than 1' including all other error source terms (References 1 & 2)	Reference 11		Boron buildup can produce a maximum error of 2.5 inches	Acceptable, MOHR Report 1-0410-8 (Reference 11) concludes that the presence of borated water and/or boric acid deposits will not significantly impair the ability of the MOHR EFP-IL SFPI system to accurately measure water level in the SFP environment. Previous Topic #10 already discusses maintenance / preventative maintenance requirements being established in consideration of vendor recommendations (which includes and bounds those associated with boron build-up). Similarly, Topic #20

#	Topic	Parameter Summary	Vendor Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
						below discusses overall calibration or channel functional testing methodology expected to be based on vendor stated accuracy along with comparison of SFPI channels to actual pool level (which would also bound boron build-up effects specified in Reference 41). Visual inspection and/or wash down of the probe assembly could be initiated by accuracy requirements or routine inspection. The probe head assembly includes a connection mechanism for flushing water to remove boron build-up as may be necessary. Alternatively, the SFP water level can be raised until it covers and dissolves the boric acid deposit (Reference 18).
12	Pool-side Bracket Seismic Analysis (References 1, 2, 19, & 20)	Seismic Class I (References 1, 2, 19, & 20)	References 12 & 13	See Topic #8	Seismic Class I	IP3 calculation IP-CALC-13-00082 (Reference 33) accounts for seismic loads and shows that the SFPI Probe Mounting Bracket is structurally adequate and seismically qualified as all Interaction Ratios (IR) are less than one (1.0). Reference 33 is available on the e-portal for review. IP2 calculation IP-CALC-14-00087 (Reference 49) accounts for seismic loads and shows that the SFPI Probe Mounting Bracket is structurally adequate and seismically qualified as all Interaction Ratios (IR) are less than one (1.0). Reference 49 is available on the e-portal for review.
13	Additional Brackets (Sensor Electronics and Electronics Enclosure)	Seismic Class I (References 1, 2, 3, 19, & 20)	Reference 9	See Topic #8	Seismic Class I	For IP3, calculations IP-CALC-13-00083 and IP3-NPD-10077-003.001 (References 34 & 35) show the conduit supports are designed for seismic loads and seismically mounted to seismic structures.. References 34 & 35 are available on the e-portal for review.

#	Topic	Parameter Summary	Vendor Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
						For IP2, calculation IP-CALC-14-00086 (Reference 50) addresses the seismic evaluation of all applicable conduit supports from the probes to the Hydrogen Recombiner panel. Calculation FCX-00102 (Reference 51) addresses the seismic adequacy for mounting of the MOHR signal processor and backup DC battery cabinets on the Hydrogen Recombiner panel.
14	Shock & Vibration	(References 1, 2, 3) MIL-STD-167-1 for vibration and MIL-STD-901D for shock (References 30 & 31)	References 8, 12, 13, & 39		IEC 60068-2-27 (2008-02) (Reference 26) IEC 60068-2-6 (2007-12) (Reference 27)	The NRC Audit Report for MOHR (Reference 41) concludes that the shock and vibration test results were satisfactory. The report also acknowledges that the testing performed in MOHR Report 1-0410-16 (Reference 39) is sufficient to close the open item identified during the MOHR audit. Acceptable, the vendor testing provided adequately addresses the requirements for general robustness of the enclosures. The probe and repairable head are essentially a coax cable system that is considered inherently resistant to shock and vibration. The probes and repairable head were evaluated to be adequately designed for resilience against shock and vibration (Reference 39). The new probe mounting components and fasteners are seismically qualified and designed as rigid components inherently resistant to vibration effects. The probes will be affixed to the bracket using a machine screw connection designed with proper thread engagement and lock washers.

#	Topic	Parameter Summary	Vendor Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
						The signal processor/display panels and battery backups will be installed in the Fan House. The equipment is not affixed or adjacent to any rotating machinery that would cause vibration effects in the area of installation. The new instrument mounting components and fasteners are seismically qualified and designed as rigid components inherently resistant to vibration effects. Similarly, the effects of shock on the supporting fixtures for the Fan House instruments are not a credible threat; all equipment in the area is qualified seismically such that there are no expected impacts from adjacent objects during the BDBEE or design basis earthquake requirements imposed by NEI 12-02. Even though shock and vibration is not credible for Fan House equipment, it is adequately addressed by vendor test reports.
15	Requirements Traceability Matrix	Software Traceability Matrix Required for Software Evaluation of equipment				The instrument software Verification and Validation was performed by MOHR per Revision 2 of MOHR Report 1-0410-11 (Reference 15).
16	Factory Acceptance Test	Must demonstrate functionality of full EFP-IL and SFP-1	Reference 52			Acceptable, channel factory acceptance tests have been completed successfully.
17	Channel Accuracy	+- 1 foot (Reference 2)	References 16 & 38		3.0 inches max, not including boric acid	Appendix A of Reference 16 states that the absolute accuracy is 76.2 mm or 3.0 in, not including boric acid deposition effects. This error complies with the

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					deposition or boiling effects	limit of ±1 foot set by NEI 12-02 (Reference 2). See Topic # 11 for boric acid deposition effects. Additionally, the probe is designed to produce accurate level indication in boiling and frothing (multiphase) environments (Reference 38)
18	Power consumption	120 VAC, 60 Hz (References 19 & 20)	References 10, 14, & 36		85-264 VAC 47-63 HZ Maximum 18.83 W, average 11.48 W	The NRC Audit Report for MOHR (Reference 41) concludes that no deficits were identified with respect to function reliability, accuracy, or calibration as a result of power interruption. Acceptable, the power requirements for the instrument are met by the power supply that will provide normal AC power to the units. MOHR Report 1-0410-10 (Reference 14) concludes that the accuracy is not affected by an interruption in power.
		7 day battery life required	Reference 10		7 day battery life @ 15 samples per hour rate	The NRC Audit Report for MOHR (Reference 41) concludes that battery life capability is satisfactory. Acceptable, the instrument testing demonstrates the battery capacity is sufficient for the maximum duration required by References 1 & 2.
19	Technical Manual	N/A	References 17 & 18			Revision 0 of the manuals have been provided by the vendor (References 17 & 18) for use, although it is possible these could be amended by the vendor in the future based on installation experience.
20	Calibration	Must allow for in-situ calibration	References 16, 17, & 18	System is calibrated using CT-100 device		Revision 0 of the manuals have been provided by the vendor (References 16, 17, & 18) for use, although it is possible these could be amended by the vendor in the future based on installation

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				and processing of scan files by vendor. Dry scan from original installation must be maintained		experience. Previous Topic #10 already discusses maintenance / preventative maintenance requirements being established in consideration of vendor recommendations. Overall calibration or channel functional testing methodology is based on vendor stated accuracy and incorporates a comparison of SFPI channels to actual pool level as well as a SFPI cross channel comparison.
21	Failure Modes and Effects Analysis (FMEA)	System provides reliable indication of fuel pool level, consistent with the requirements of References 1 & 2	Reference 40		SFPI system will meet requirements of References 1 & 2 when installed as required	Acceptable, the FMEA provided adequately addresses failure modes and effects for the full instrument channel with credit taken for the use of two redundant channels provided the installation meets all requirements stipulated in References 1 & 2.
22	Emissions Testing	EPRI TR-102323, Rev 3 (Reference 29)	Reference 6		EPRI TR-102323, Rev 3 (Reference 29)	Acceptable, MOHR reports 1-0410-4 (Reference 6) and 1-0410-4-S1 (Reference 7) demonstrate the new SFPI satisfies the EMI/RFI compliance guidelines of Revision 3 of EPRI TR-102323 (Ref. 29) in accordance with Entergy Engineering Standard EN-IC-S-004-MULTI (Reference 28). As demonstrated in the MOHR System EMC Test Report and Supplemental Information (References 6 & 7), the SFPI system passed the High Frequency Radiated and Conducted Emissions testing.

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						FLEX Strategy Guidelines (FSG) governing the use of the SFPI are expected to include a cautionary statement to preclude radio usage within close proximity to the displays.

References:

1. ML12054A682, NRC Order EA-12-051, "ORDER MODIFYING LICENSES WITH REGARD TO RELIABLE SPENT FUEL POOL INSTRUMENTATION", Nuclear Regulatory Commission, March 12, 2012
2. ML12240A307, 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, 2012.
3. ML12221A339, Revision 0, JLD-ISG-2012-03, Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation, August 29, 2012, Nuclear Regulatory Commission Japan Lessons-Learned Project Directorate.
4. 1-0410-1 "MOHR EFP-IL SFPI System Temperature and Humidity Test Report"
5. 1-0410-2 "MOHR SFP-1 Level Probe Assembly Materials Qualification Report"
6. 1-0410-4 "MOHR EFP-IL SFPI System EMC Test Report"
7. 1-0410-4-S1 "MOHR EFP-IL SFPI System Supplemental EMC Information"
8. 1-0410-5 "MOHR EFP-IL SFPI System Shock and Vibration Test Report"
9. 1-0410-6 "MOHR EFP-IL SFPI System Seismic Test Report"
10. 1-0410-7 "MOHR EFP-IL SFPI System Battery Life Report"
11. 1-0410-8 "MOHR EFP-IL SFPI System Boric Acid Deposition Report"
12. 1-0410-9 "MOHR SFP-1 Level Probe Assembly Seismic Analysis Report"
13. 1-0410-9.17, Rev 0, "MOHR SFP-1 Site-Specific Seismic Analysis Report: Indian Point Energy Center Unit 3 (IP3)"
14. 1-0410-10 "MOHR EFP-IL SFPI System Power Interruption Report"
15. 1-0410-11 "MOHR EFP-IL SFPI System Software Verification and Validation"
16. 1-0410-12 "EFP-IL Signal Processor Operator's Manual "
17. 1-0410-13 "EFP-IL Signal Processor Technical Manual"
18. 1-0410-14 "SFP-1 Level Probe Assembly Technical Manual"
19. UFSAR, Rev 23, "Indian Point Unit 2"
20. UFSAR, Rev 4, "Indian Point Unit 3 Update Final Safety Analysis Report"
21. EN-DC-126, Rev 5, "Engineering Calculation Process"
22. IP3 EC 45666, Rev 0, "INSTALL NEW SPENT FUEL POOL LEVEL INSTRUMENTATION IN SUPPORT OF FUKUSHIMA NRC ORDER EA-12-051 FLEX"
23. IP-CALC-13-00072, Rev 0, "Spent Fuel Pool Instrumentation Shielding Calculation" (IP3)

24. NAI-1725-003, Rev 0 "GOTHIC Verification and Sensitivity Studies for Predicting Hydrodynamic Response to Acceleration in Rectangular Shaped Pools"
25. NAI-1725-004, Rev 3 "Seismic Induced Hydraulic Response in the CGS Spent Fuel Pool"
26. IEC 60068-2-27 (2008-02), "Environmental Testing-Part 2-27: Tests-Test Ea and Guidance: Shock"
27. IEC 60068-2-6 (2007-12), "Environmental Testing-Part 2-6: Tests-Test Fc: Vibration (sinusoidal)"
28. EN-IC-S-004-MULTI, Rev 1, "EMI/RFI Design Considerations"
29. EPRI TR-102323, Rev 3, "Guidelines for Electromagnetic Interference of Power Plant Equipment"
30. MIL-STD-167-1, "Mechanical Vibrations of Shipboard Equipment (Type 1-Environmentally and Type II-Internally Excited)", May 1, 1974
31. MIL-S-901D, "Shock Tests H.I.(High Impact) Shipboard Machinery, Equipment, and Systems, Requirements for", March 17, 1989
32. IP-CALC-13-00068, Rev 0, "Fan House Temperature Evaluation for FLEX Event SFP Level Instrumentation Function"
33. IP-CALC-13-00082, Rev 0, "Spent Fuel Pool Instrument Mounting Bracket"
34. IP-CALC-13-00083, Rev 0, "Evaluation of Conduit Supports for FLEX Program Spent Fuel Pool Level Instrumentation"
35. IP3-NPD-10077-003.001, Rev 8, " Qualification of Conduit Supports"
36. MOHR drawing 1-0430-20, "EFP-IL System Electrical Diagram"
37. NAI-1791-005, Rev. 0, "IP3 GOTHIC Hydrodynamic Analysis"
38. 1-0410-15, "MOHR-EFP-IL SFPI system Uncertainty Analysis"
39. 1-0410-16, "MOHR SFP-1 Level Probe Assembly Shock and Vibration Test Report"
40. EVAL-194-4812-01 "MOHR EFP-IL Liquid Level Measurement System Failure Modes and Effects Analysis (FMEA)"
41. Donald C. Cook Nuclear Plant, Units 1 and 2 - Report for the Onsite Audit of MOHR Regarding Implementation of Reliable Spent Fuel Pool Instrumentation Related to Order EA-12-051 (TAC NOS. MF0761 and MF0762) dated August 27, 2014 (ADAMS Accession No ML14216A362)
42. IP2 EC 50865, Rev 0, "INSTALL NEW SPENT FUEL POOL LEVEL INSTRUMENTATION IN SUPPORT OF FUKUSHIMA NRC ORDER EA-12-051 FLEX"
43. 2009 ASHRAE Handbook Fundamentals, I-P Edition
44. EN-EQ-S-002-1, Rev. 1, "IPEC EQ Program Manual"

45. IP3-CALC-RAD-00004, Rev. 0, "Radiological Analysis for Hydrogen Recombiner Control Cabinet Modification #89-03-166"
46. Calculation PGI-00412-00, Rev. 0, "Engineering Review of Plant Design to Determine Whether Any Non-Safety Related Equipment Requires Qualification Pursuant to 10CFR50.49"
47. IP-CALC-14-00088, Rev. 0, "Fan House Temperature Evaluation for FLEX Event SFP Level Instrumentation Function"
48. IP-CALC-14-00079, Rev. 0, "Spent Fuel Pool Instrumentation Shielding Calculation"
49. IP-CALC-14-00087, Rev. 0, "Unit 2 Spent Fuel Pool Instrument Mounting Bracket"
50. IP-CALC-14-00086, Rev. 0, "Spent Fuel Pool Level Instrumentation Conduit Supports"
51. FCX-00102, Rev. 0, "Operability Analysis of Hydrogen Recombiner Cabinets in the Fan House at Elevation 92'"
52. MOHR Procedure 2014.01, Rev. 0.5, "Factory Acceptance Test Liquid Level Sensing System"