Exelon Generation®

Order No. EA-12-049

RS-16-087
TMI-16-039

June 29, 2016

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Three Mile Island Nuclear Station, Unit 1
Renewed Facility Operating License No. DPR-50
NRC Docket No. 50-289

Subject: Report of Full Compliance with 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)

References:

1. NRC Order Number EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements For Mitigation Strategies For Beyond-Design-Basis External Events," dated March 12, 2012
2. NRC Interim Staff Guidance JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," Revision 0, dated August 29, 2012
3. NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 0, dated August 2012
4. Exelon Generation Company, LLC's Initial Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated October 25, 2012
5. Exelon Generation Company, LLC 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 (RS-13-026)
6. Exelon Generation Company, LLC First Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated August 28, 2013 (RS-13-131)
7. Exelon Generation Company, LLC Second Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 28, 2014 (RS-14-016)

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8. Exelon Generation Company, LLC Third Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated August 28, 2014 (RS-14-214)
9. Exelon Generation Company, LLC Fourth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 27, 2015 (RS-15-025)
10. Exelon Generation Company, LLC Fifth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated August 28, 2015 (RS-15-216)
11. Exelon Generation Company, LLC Sixth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated February 26, 2016 (RS-16-030)
12. NRC letter to Exelon Generation Company, LLC, Three Mile Island Nuclear Station, Unit 1 – Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Order EA-12-049, (Mitigation Strategies) (TAC No. MF0803), dated December 17, 2013
13. NRC Letter, Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated March 12, 2012
14. Exelon Generation Company, LLC letter to USNRC, Response to March 12, 2012, Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, Enclosure 5, Recommendation 9.3, Emergency Preparedness – Staffing, Requested Information Items 1, 2, and 6 - Phase 2 Staffing Assessment, dated June 29, 2015 (RS-15-147)
15. NRC letter to Exelon Generation Company, LLC, Three Mile Island Nuclear Station, Unit No. 1 – Report for the Audit Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Pool Instrumentation Related to Orders EA-12-049 and EA-12-051 (TAC Nos. MF0893 and MF0866), dated January 11, 2016
16. Exelon Generation Company, LLC letter to USNRC, Request for Schedule Relaxation from NRC Order EA-12-049, "Order Modifying Licenses With Regard to Requirements For Mitigation Strategies For Beyond-Design-Basis External Events," dated October 29, 2015 (RS-15-273)
17. NRC letter to Exelon Generation Company, LLC, Three Mile Island Nuclear Station, Unit No. 1 – Relaxation of Certain Schedule Requirements for Order EA-12-049, "Issuance of Order to Modify Licenses With Regard to Requirements For Mitigation Strategies For Beyond Design Basis External Events" (TAC No. MF0803), dated November 18, 2015

On March 12, 2012, the Nuclear Regulatory Commission ("NRC" or "Commission") issued Order EA-12-049, "Order Modifying Licenses with Regard to Requirements For Mitigation Strategies For Beyond-Design-Basis External Events," (Reference 1) to Exelon Generation Company, LLC (EGC). Reference 1 was immediately effective and directed EGC to develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities in the event of a beyond-design-basis external event. Specific requirements are outlined in Attachment 2 of Reference 1.

Reference 1 required submission of an initial status report 60 days following issuance of the final interim staff guidance (Reference 2) and an Overall Integrated Plan (OIP) pursuant to Section IV, Condition C. Reference 2 endorsed industry guidance document NEI 12-06, Revision 0 (Reference 3) with clarifications and exceptions identified in Reference 2. Reference 4 provided the EGC initial status report regarding mitigation strategies. Reference 5 provided the Three Mile Island Nuclear Station, Unit 1 OIP.

Reference 1 required submission of a status report at six-month intervals following submittal of the OIP. References 6, 7, 8, 9, 10, and 11 provided the first, second, third, fourth, fifth, and sixth six-month status reports, respectively, pursuant to Section IV, Condition C.2, of Reference 1 for Three Mile Island Nuclear Station, Unit 1.

In Reference 17, the NRC granted a relaxation of the schedule requirement of the Order for full implementation for Three Mile Island Nuclear Station, Unit 1 until no later than April 30, 2016 to allow sufficient time for completion and subsequent review by the NRC staff of the Three Mile Island Nuclear Station, Unit 1 turbine building structural analyses and main steam line integrity evaluations, as requested in Reference 16.

The purpose of this letter is to provide the report of full compliance with the 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) (Reference 1) pursuant to Section IV, Condition C.3 of the Order for Three Mile Island Nuclear Station, Unit 1.

Three Mile Island Nuclear Station, Unit 1 has developed, implemented, and will maintain the 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 in response to Order EA-12-049. The information provided herein documents full compliance for Three Mile Island Nuclear Station, Unit 1 with Reference 1.

EGC's response to the NRC Interim Staff Evaluation (ISE) open and confirmatory items identified in Reference 12 have been addressed and closed as documented in References 6, 7, 8, 9, 10, 11, and Enclosure 1 to this letter, and are considered complete pending NRC closure. OIP open items have been addressed and closed as documented in References 6, 7, 8, 9, 10, 11, and Enclosure 1 to this letter, and are considered complete pending NRC closure. EGC's response to the NRC audit open items documented in Reference 15 have been addressed in Enclosure 1 to this letter and are considered complete pending NRC closure. The following tables provide completion references for each OIP open item, NRC ISE open or confirmatory item, and NRC Audit report open item.

Overall Integrated Plan Open Items	Completion Reference
Key Site Assumptions (pg 3) and Strategy Deployment (pg 5): Routes from the storage locations have not yet been assessed for hazard impact. This will be completed and communicated in a future 6-month update following evaluation.	Closed to ISE Open & Confirmatory Item No. 6 (3.1.1.2.A)
Sequence of Events (pg 4): The times to complete actions in the Events Timeline are based on operating judgment, the conceptual designs, and the current supporting analyses. The final timeline will be validated once detailed designs are completed, procedures are developed, and the results will be provided in a future six (6) month update.	Enclosure 2, Attachment 5
Maintain RCS Inventory (pg 17): Core cooling and RCS inventory analysis is not complete at this time. Completion of this analysis is an open item. Closure of this item will be documented in a future six (6) month update.	Reference 7
Maintain Core Cooling and Heat Removal (pg 10): ECR 13-00071 FLEX Feedwater System is not finalized. Changes will be provided in a 6-month update.	Reference 8
Maintain Core Cooling and Heat Removal (pg 10): ECR 13-00074 FLEX Storage Building is not finalized. Changes will be provided in a six (6) month update.	Reference 10
Maintain RCS Inventory (pg 16): ECR 13-00099 RC-P Low Leakage Seals is not finalized. Changes will be provided in a six (6) month update.	Reference 8
Maintain Core Cooling and Heat Removal (pg 14): A portable refueling vehicle with a large diesel oil bladder will be available on site to support refilling our portable equipment diesel tanks. An additional means (river makeup is available) of delivering condensate may also be developed, details to be provided in a future 6-month update.	Reference 7

Overall Integrated Plan Open Items	Completion Reference
Maintain Spent Fuel Pool Cooling (pg 29): Spent Fuel Pool - These strategies utilize a vent path for steam. The effects of this steam on other systems and equipment will be evaluated, and the results will be provided in a future six month update.	Closed to ISE Open & Confirmatory Item No. 30 (3.2.2.A)
Maintain Spent Fuel Pool Cooling (pg 30): ECR 13-00084 for Spent Fuel Pool Instrumentation. This ECR is an open item. Closure of this item will be documented in a future six (6) month update.	Reference 10
Maintain RCS Inventory (pg 18): ECR 13-00072, FLEX RCS Make-up System - This ECR is an open item. Closure of this item will be documented in a future six (6) month update.	Reference 8
Maintain RCS Inventory (pg 22): A plan will be developed to re-supply borated water to the BWST or SF pool.	Reference 7
Maintain RCS Inventory (pg 17): TM-FLEX-001, *Core Cooling Analysis*, DRAFT, is not approved. The results of this analysis will be integrated into a future 6-month update.	Reference 7
Maintain Containment (pg 26): Completion of TMI-FLEX-002, *MAAP Containment Pressure Analysis*, is an open item. Any required modifications will be documented in a future 6-month update.	Reference 6
Safety Function Support (pg 37): ECR 13-00070 FLEX Electrical Power Supply. This ECR is an open item. Closure of this item will be documented in a future six (6) month update.	Reference 10

Overall Integrated Plan Open Items	Completion Reference
Safety Function Support (pg 37): Within the Main Control Room, habitability conditions will be evaluated and a strategy will be developed to maintain Main Control Room habitability. The strategy will be provided in a future six (6) month update.	Reference 9

Interim Staff Evaluation Open or Confirmatory Items	Completion Reference
Item No. 3.2.1.1.B	Reference 7 and updated with this submittal as provided in Enclosure 1
Item No. 3.2.1.1.C	Reference 7 and updated with this submittal as provided in Enclosure 1
Item No. 3.2.4.7.A	Reference 7 and updated with this submittal as provided in Enclosure 1
Item No. 3.2.4.8.B	Reference 7
Item No. 3.1.1.1.A	Reference 7 and updated with this submittal as provided in Enclosure 1
Item No. 3.1.1.2.A	References 7, 10 and updated with this submittal as provided in Enclosure 1
Item No. 3.1.1.3.A	Reference 10
Item No. 3.1.1.4.A	Reference 10
Item No. 3.1.2.2.A	Reference 7
Item No. 3.1.3.2.A	Reference 7
Item No. 3.1.5.3.A	Reference 9
Item No. 3.2.1.A	Reference 7 and updated with this submittal as provided in Enclosure 1
Item No. 3.2.1.B	Reference 7
Item No. 3.2.1.1.A	Reference 7
Item No. 3.2.1.1.D	Reference 7
Item No. 3.2.1.2.A	Reference 7 and updated with this submittal as provided in Enclosure 1
Item No. 3.2.1.2.B	Reference 7 and updated with this submittal as provided in Enclosure 1
Item No. 3.2.1.2.C	Reference 7 and updated with this submittal as provided in Enclosure 1
Item No. 3.2.1.2.D	Reference 7
Item No. 3.2.1.4.A	Reference 7 and updated with this submittal as provided in Enclosure 1
Item No. 3.2.1.5.A	Reference 7

Interim Staff Evaluation Open or Confirmatory Items	Completion Reference
Item No. 3.2.1.6.A	Reference 7 and updated with this submittal as provided in Enclosure 1
Item No. 3.2.1.6.B	Reference 7
Item No. 3.2.1.6.C	Reference 7
Item No. 3.2.1.6.D	Reference 7
Item No. 3.2.1.9.A	Reference 7 and updated with this submittal as provided in Enclosure 1
Item No. 3.2.1.9.B	Reference 7 and updated with this submittal as provided in Enclosure 1
Item No. 3.2.1.9.C	Reference 7
Item No. 3.2.1.9.D	Reference 7
Item No. 3.2.2.A	Reference 7 and updated with this submittal as provided in Enclosure 1
Item No. 3.2.4.1.A	Reference 9
Item No. 3.2.4.2.A	Reference 9
Item No. 3.2.4.2.B	Reference 9
Item No. 3.2.4.2.C	Reference 9
Item No. 3.2.4.2.D	Reference 7
Item No. 3.2.4.3.A	Reference 7 and updated with this submittal as provided in Enclosure 1
Item No. 3.2.4.4.A	Reference 7
Item No. 3.2.4.4.B	Reference 9
Item No. 3.2.4.5.A	Reference 10
Item No. 3.2.4.6.A	Reference 9
Item No. 3.2.4.8.A	Reference 7
Item No. 3.2.4.10.A	Reference 7
Item No. 3.2.4.10.B	Reference 7
Item No. 3.3.2.A	Reference 7
Item No. 3.3.3.A	Provided with this submittal in Enclosure 1
Item No. 3.4.A	Reference 9

NRC Audit Report Open Items	Completion Reference
AQ 2	Provided with this submittal in Enclosure 1
AQ 13	Provided with this submittal in Enclosure 1
AQ 19	Provided with this submittal in Enclosure 1
AQ 20	Provided with this submittal in Enclosure 1
AQ 40	Provided with this submittal in Enclosure 1
AQ 51	Provided with this submittal in Enclosure 1
AQ 56	Provided with this submittal in Enclosure 1
AQ 59	Provided with this submittal in Enclosure 1
AQ 64	Provided with this submittal in Enclosure 1

NRC Audit Report Open Items	Completion Reference
OIP OI 9	Provided with this submittal in Enclosure 1
OIP OI 13	Provided with this submittal in Enclosure 1
SE 2	Provided with this submittal in Enclosure 1
SE 3	Provided with this submittal in Enclosure 1
SE 4	Provided with this submittal in Enclosure 1
SE 6	Provided with this submittal in Enclosure 1
SE 14	Provided with this submittal in Enclosure 1
SE 18	Provided with this submittal in Enclosure 1
SE 20	Provided with this submittal in Enclosure 1
SE 21	Provided with this submittal in Enclosure 1
SE 22	Provided with this submittal in Enclosure 1

Enclosure 1 to this letter documents the completion of the remaining open items listed above. As previously stated, EGC considers these items to be complete for Three Mile Island Nuclear Station, Unit 1.

MILESTONE SCHEDULE – ITEMS COMPLETE

Milestone	Completion Date
Submit 60 Day Status Report	October 25, 2012
Submit Overall Integrated Plan	February 28, 2013
Contract with National SAFER Response Center	February 14, 2013
Submit 6 Month Updates:	
Update 1	August 28, 2013
Update 2	February 28, 2014
Update 3	August 28, 2014
Update 4	February 27, 2015
Update 5	August 28, 2015
Update 6	February 26, 2016
Modification Development:	
Phase 2 modifications	November 15, 2015
National SAFER Response Center Operational	August 18, 2015
Procedure Development:	
Strategy procedures	April 26, 2016
Validate Procedures (NEI 12-06, Sect. 11.4.3)	November 20, 2015
Maintenance procedures	April 26, 2016
Staffing analysis	June 29, 2015
Modification Implementation	
Phase 2 modifications	November 15, 2015
Storage plan and construction	March 23, 2016
FLEX equipment acquisition	November 15, 2015
Training completion	September 30, 2015
Unit 1 implementation date	April 30, 2016

ORDER EA-12-049 COMPLIANCE ELEMENTS SUMMARY

The elements identified below for Three Mile Island Nuclear Station, Unit 1 as well as the site OIP response submittal (Reference 5), the 6-Month Status Reports (References 6, 7, 8, 9, 10, and 11), and any additional docketed correspondence, demonstrate compliance with Order EA-12-049.

Strategies - Complete

Three Mile Island Nuclear Station, Unit 1 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. The Three Mile Island Nuclear Station, Unit 1 Final Integrated Plan for mitigating strategies is provided in Enclosure 2 of this letter. The Final Integrated Plan provides the final description of the strategy and all elements of compliance as implemented, and supersedes the plan described in the OIP and six-month updates.

Modifications - Complete

The modifications required to support the FLEX strategies for Three Mile Island Nuclear Station, Unit 1 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 Three Mile Island Nuclear Station, Unit 1 has been procured in accordance with NEI 12-06, Sections 11.1 and 11.2, received at Three Mile Island Nuclear Station, Unit 1, initially tested/performance verified as identified in NEI 12-06, Section 11.5, and is available for use.

Maintenance and testing will be conducted through the use of the Three Mile Island Nuclear Station, Unit 1 Preventative Maintenance program such that equipment reliability is achieved.

Protected Storage – Complete

The storage facilities required to implement the FLEX strategies for Three Mile Island Nuclear Station, Unit 1 have been completed and provide protection from the applicable site hazards. The equipment required to implement the FLEX strategies for Three Mile Island Nuclear Station, Unit 1 is stored in its protected configuration.

Procedures – Complete

Emergency procedures to implement the FLEX strategy for Three Mile Island Nuclear Station, Unit 1 have been developed and integrated with existing procedures. The new and revised emergency procedures have been verified and are available for use in accordance with the site procedure control program.

Training – Complete

Training for Three Mile Island Nuclear Station, Unit 1 has been completed in accordance with an accepted training process as recommended in NEI 12-06, Section 11.6.

Staffing – Complete

The Phase 2 staffing study for Three Mile Island Nuclear Station, Unit 1 has been completed in accordance with 10CFR50.54(f), "Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force review of Insights from the Fukushima Dai-ichi Accident," Recommendation 9.3, dated March 12, 2012 (Reference 13), as documented in Reference 14.

National SAFER Response Center – Complete

EGC 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 Three Mile Island Nuclear Station, Unit 1 with Phase 3 equipment stored in the National SAFER Response Centers in accordance with the site specific SAFER Response Plan.

Validation – Complete

EGC 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 Final Integrated Plan (FIP) for Order EA-12-049.

FLEX Program Document - Established

The Three Mile Island Nuclear Station, Unit 1 FLEX Program Document has been developed in accordance with the requirements of NEI 12-06.

This letter contains no new regulatory commitments. If you have any questions regarding this report, please contact David P. Helker at 610-765-5525.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 29th day of June 2016.

Respectfully submitted,

James Barstow
Director - Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Enclosures:

1. Three Mile Island Nuclear Station, Unit 1 Completion Response Information for Remaining OIP Open Items, NRC ISE Open and Confirmatory Items, and NRC Audit Report Open Items

2. Three Mile Island Nuclear Station, Unit 1 Final Integrated Plan Document – Mitigating Strategies NRC Order EA-12-049, dated June 2016

cc: Director, Office of Nuclear Reactor Regulation
NRC Regional Administrator - Region I
NRC Senior Resident Inspector – Three Mile Island Nuclear Station
NRC Project Manager, NRR – Three Mile Island Nuclear Station
Mr. Jeremy S. Bowen, NRR/JLD/JOMB, NRC
Mr. John D. Hughey, NRR/JLD/JOMB, NRC
Director, Bureau of Radiation Protection – Pennsylvania Department of Environmental Resources
Chairman, Board of County Commissioners of Dauphin County, PA
Chairman, Board of Supervisors of Londonderry Township, PA
R. R. Janati, Chief, Division of Nuclear Safety, Pennsylvania Department of Environmental Protection, Bureau of Radiation Protection

Enclosure 1

Three Mile Island Nuclear Station, Unit 1

Completion Response Information for Remaining OIP Open Items, NRC ISE Open and Confirmatory Items, and NRC Audit Report Open Items

(33 pages)

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ISE Item No. 3.2.1.1.B - Status Complete

Provide the analysis supporting the licensee's mitigation strategy (WCAP-17792-P) for NRC staff review, identify the specific calculation(s) in WCAP-17792 considered applicable to demonstrating the feasibility of the proposed strategy, and justify the applicability of the calculation(s) relied upon in WCAP-17792 to TMI-1.

Response Description

The TMI FLEX strategy is to restore RCS makeup within 4 hours i.e. prior to the loss of RCS heat transfer. A FLEX RCS makeup Pump (FX-P-1A or B) can deliver sufficient flow to maintain RCS inventory with the loss through the RCP seals and simultaneously support a cooldown of up to 37^{0}F/HR. Previous analysis and testing demonstrates that if RCS inventory is sufficient, sub-cooled natural circulation can provide stable effective core cooling.

The conclusion that restoration of a RCS makeup capability (with capacity significantly greater than the potential RCS loss rate) within four hours would maintain continuous core cooling is based upon the analysis presented in WCAP 17792-P.

In Section C.5 of WCAP 17792-P, a method to determine a conservative estimate for the time between ELAP and loss of primary to secondary heat transfer is provided. This method used generic bounding plant design parameters, and conservatively ignores the water inventory in the pressurizer below 0" indication. The inputs to apply this method are:

(1) Pressurizer level rate of change
The rate of pressurizer level change is based on assumed RCS loss rate and is converted to pressurizer level rate of change based on cross sectional area of the pressurizer. The assumed loss rate is 11 GPM. This includes the pre-event Tech Spec maximum allowable RCS leak rate of 1 GPM, plus 2.5 GPM per reactor coolant pump. The 2.5 GPM per pump is based on the design of Flowserve N-9000 seals. The actual flow at normal operating RCS pressure (2155 psig) is less. The pressurizer rate of change was determined to be 0.46 inches/min.

(2) Pressurizer level during the initial stabilization conditions following reactor shutdown
When a LOOP occurs, reactor coolant system average temperature will be controlled by the OTSG pressure. The OTSG pressure is controlled by the atmospheric dump valve with an automatic set point of 1010 psig. The emergency procedure (OP-TM-EOP-012) will ensure OTSG pressure is maintained above 1000 psig. Saturation temperature for this pressure is 546.4^{0}F. T_{COLD} must be above this temperature or approximately 549^{0}F. Prior analysis and testing of natural circulation shows that the primary temperature differential ($T_{HOT} - T_{COLD}$) initially following reactor shutdown may be as high as 50^{0}F, but a conservative differential temperature of 30^{0}F is assumed. This results in a post shutdown T_{AVG} of 564^{0}F. The operating T_{AVG} is 579^{0}F. The change in primary system fluid volume from 579^{0}F to 564^{0}F is approximately 261 ft3. The normal operating pressurizer level is 220 inches. Therefore, pressurizer level would initially stabilize at approximately 138 inches after a Loss of Offsite Power (LOOP).

Using these inputs (i.e. 0.46 inches/min and 138" initial pressurizer level), WCAP 17792P Figure C.5-2 "ELAP Estimated Time to LOHT for 400" Pressurizer Scale Plants" provides an estimate for the time until loss of heat transfer following an ELAP of greater than 5.5 hours. (Reference Tech Eval 15-00325 "ELAP – Time to restore RCS makeup").

The TMI emergency response to an ELAP will provide borated water (> 2500 ppmB) at a rate in excess of RCS losses within 4 hours. This ensures RCS conditions can be maintained to support continued sub-cooled natural circulation and RCS heat removal via the OTSG, and raises RCS boron concentration to ensure the reactor

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remains shutdown. The RCS temperature at the seals (T_{COLD}) will be cooled to less than 375^{0}F and stabilized within 10 hours. This time is dependent upon isolation of CBO within 6 hours.

Cycle specific reactivity analysis has been completed (Reference C-1101-202-E620-471 "TMI-1 Shutdown Margin Verification during Emergency Cooldown") which demonstrates that when all control rods insert and RCS inventory is maintained during cooldown using borated water of at least 2500 ppmB, then the reactor will remain shutdown at cold (72F) conditions without any credit for Xenon.

The reactivity analysis conservatively assumes no removal or loss of any RCS inventory, and the only borated water added is that required to maintain RCS water level for density changes below 555F. The TMI strategy injects additional boron (1) to compensate for RCS losses and (2) to raise pressurizer level when the cooldown is complete. This adds significantly more boron than credited in the analysis. For events occurring at 100% power, this boron addition is completed before Xenon would reduce below the initial equilibrium Xenon concentration.

A strategy which maintains single phase natural circulation ensures adequate boron mixing within the RCS.

The ELAP emergency response strategy is dependent upon the ability to stabilize RCS temperature and not cooldown until RCS makeup is restored. The OTSG pressure boundary integrity will be maintained as described in the response to SE-18.

Additional questions:

(1) What does the applicable FLEX procedure specify as the pressure control band for controlling the ADV manually to prevent cycling of MSSVs?

Q1 Response: Post ELAP OTSG pressure with be initially stabilized between 1000 and 1020 psig (Reference: OP-TM-EOP-012 "Station Blackout"). This pressure maximizes the time available to restore RCS makeup but maintains the OTSG pressure at least 20 psig below the lowest MSSV setpoint.

(2) Are there are any negative consequences if the RCS cooldown were completed slightly beyond 10 hours? What if the cooldown completion time were at 11 or 12 hours into the event, which may better reflect assumed analysis boundary conditions? Need to confirm mitigating strategy still successful assuming postulated ground rules.

Q2 Response: The time to cooldown is based on conservative design principles. Conservative margins were included in the time to restore makeup and the cooldown rate capability used in the analysis which determined the cooldown can be completed in 9.6 hours (Reference: TM-FLEX-001). If it is assumed that CBO can not be isolated, the cooldown time estimate increases to 11.5 hours (The cooldown rate is reduced proportionally to the change in the effective RCS makeup capacity (25 gpm/35 gpm)).

The strategy elements most sensitive to the time to complete the RCS cooldown are the Reactor Coolant Pump seals and availability of the Spent Fuel pool as a RCS makeup source (if a tornado has damaged the BWST). The Flowserve evaluation of ELAP performance of the N-9000 RCP seals ((Reference: Flowserve "White Paper on the Response of the N-Seal Reactor Coolant Pump (RCP)) used generally conservative assumption for the TMI design and ELAP mitigation strategy (temperature vs time profile shown in Flowserve Evaluation Figure 6) and concluded that cooldown within 9 hours would not cause any seal elastomer failures. The uncertainty in predicting such failures is addressed by the conservative approach to this evaluation. A time to the desired temperature was delayed by 4 hours, the probability of failure increase but a failure would remain unlikely. As described in Flowserve Evaluation Table 3, even if such a seal failure occurred, the maximum RCS loss rate would be less than the actuation limit for the abeyance seal (~ 4.25 GPM per RCP). Even assuming such unexpected failures occurred on all four RCP the total RCS loss rate remains well within the capacity of the FLEX RCS makeup pump (Reference:

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Flowserve "White Paper on the Response of the N-Seal Reactor Coolant Pump (RCP). Seal Package to Extended Loss of All Power (ELAP)"). The FLEX strategy utilizes the BWST as the primary borated water source for RCS makeup. If a tornado damaged the BWST, the spent fuel pool would be used. In such an event, the spent fuel pool can only be pumped into the RCS while the water temperature remains below 150^{0}F. Using conservation assumptions for the spent fuel pool heat load and spent fuel pool water level, the pool would remain below 150F for 17 hours (Reference: Tech Eval 14-00218 "FLEX Borated Water Supply Plan"). Therefore, a delay of more than 4 hours in the planned post ELAP cooldown time would not prevent successful implementation of the FLEX strategy

(3) *The RCS makeup flowrate assumed in staff's confirmatory analysis was 40 gpm. What was the basis for this flowrate? This flowrate was stated verbally (and we believe it had to do with the alternate connection flow capacity. Note that the FLEX pump itself was earlier stated to provide 60-gpm makeup capacity in OIP) but the assumed flowrate and basis are not clear in the written material available to the staff. Need to document.*

Q3 Response: The FLEX RCS makeup pumps (FX-P-1A & FX-P-1B) have a capacity of 40 GPM. These are positive displacement pumps and the flow path to the RCS supports a flow of 40 GPM without excessive head loss. Either FX-P-1A or FX-P-1B can deliver 40 GPM from the BWST or Spent Fuel Pool to the Reactor Coolant System. This flow rate exceeds the flow required restore RCS inventory with a stable RCS temperature and support a cooldown as described above.

The OIP described that new FLEX RCS makeup pumps would be installed in the Control Bldg at 322' elevation with the capability required to restore RCS inventory. The OIP did not specify the tag no. (FX-P-1A or B) or the pump capacity (40 GPM). The OIP description of Phase 3 offsite support equipment included a pump with a 60 GPM capacity.

(4) *Is reactor vessel level indication available during Phase 1? If reactor vessel level indication needs to be repowered, please discuss the creditable timeframe for this action. (Desire to avoid situation where operators have no direct indication of RCS level available, as it runs counter to accepted guidance for satisfying order and may cause undesirable procedural escalation, e.g., from EOPs to SAMGs.)*

Q4 Response: Reactor vessel level (or hot leg level) indication is provided through the plant process computer. This indication should remain available for approximately 2 hours after the ELAP. After that point, Reactor Vessel Level Indication will not be available or recovered.
If a delay in restoration of makeup or other unexpected condition caused pressurizer level indication to go off-scale the mitigating strategy would not change. The TMI EOP SBO strategy is not affected if pressurizer level drops below zero in the initial hours after an ELAP. SAMG entry criteria is solely based on clad temperature (Reference: OP-TM-EOP-012 "Station Blackout")

(5) *Can you confirm the instrument zero elevation for pressurizer? Or, what pressurizer volume exists below the instrument-zero elevation? (We have made a reasonable estimate based on information available in your calculation, but would like to have direct confirmation if possible.) Because of nodalization approximations in our analytical input deck, please provide the elevation relative to an obvious reference point on pressurizer itself rather than RCS nozzles.*

Q5 Response: Pressurizer level instrument ZERO reference is at the lower sensing line elevation. The sensing line elevation is 15" above the transition from the lower head to the cylindrical section (Reference B&W drawing 24894F).

(6) *What assumptions are appropriate concerning the isolation of normal letdown? The TMI plant-specific calculation did not appear to have an allowance for RCS losses due to letdown, whereas the generic B&W calculations in WCAP-17601-P applied a generic letdown outflow of 75 gpm for 10 minutes prior to*

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isolation. This is a major difference that affects the pressurizer draindown time by approximately one hour.

Q6 Response: There is no significant inventory loss due to letdown. Letdown is automatically isolated by high temperature after a loss of offsite power where automatic restoration of AC power does not occur. The isolation valve (MU-V-3) is controlled by DC power and closed by venting air pressure. MU-V-3 will close as designed following an ELAP.

Item No. 3.2.1.1.C - Status Complete

As applicable, provide additional analyses for core cooling, RCS makeup, and shutdown margin that are relied upon, but not included in WCAP-17792-P.

Response Description

The response to ISE OI 3.2.1.1.B provides the complete response. The integrity of the Main Steam lines is addresed in the reponse to SE-18.

Item No. 3.2.4.7.A - Status Complete

The licensee appears to use a probabilistic approach to reach a conclusion that at least one of the three tanks depended on for RCS makeup will survive an ELAP event. NEI 12-06 guidance does not include this option. Provide further justification for this alternate approach.

Response Description

FLEX RCS Makeup Sources
The FLEX RCS Makeup Strategy utilizes the Borated Water Storage Tank (BWST). The BWST is a Safety-Related Seismic Class I structure and is fully protected from all applicable hazards except for high winds. In an extreme cold event, the BWST immersion heater will be energized from the FLEX power supply to maintain this source available. If the BWST is unavailable, the Spent Fuel Pool would be utilized. It is fully protected from all applicable hazards. The Spent Fuel Pool is a Seismic Class I structure located within the tornado protected and aircraft hardened Fuel Handling Building.(Reference: Technical Evaluation 14-00218 "FLEX Borated Water Supply Plan").

FLEX Condensate Sources

The FLEX Condensate Supply Strategy can use either of two Condensate Storage Tanks (CO-T-1A or B) or the Demineralized Water Storage Tank (DW-T-2) (Reference: Technical Evaluation 13-00502 "FLEX Condensate Plan" and Technical Evaluation 13-00476 "FLEX Strategy Design Evaluation for CO-T-1A, CO-T-1B and DW-T-2"). Of these three sources, only CO-T-1A is fully protected from all applicable hazards.

Earthquake: CO-T-1A and CO-T-1B are seismic class I structures.
Flood: CO-T-1A, CO-T-1B and DW-T-2 can withstand the hydrodynamic forces for CLB flood (313.5') and the failure of a tank at higher water level (320' elevation) would temporarily affect the water quality but not prevent successful implementation of the FLEX strategy.

Tornado:
CO-T-1A and CO-T-1B are designed to withstand the RG 1.76 R1 wind load. CO-T-1A and CO-T-1B can withstand the impact of tornado missile defined in RG 1.76 R1. The nozzles and interfacing piping for CO-T-1A

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are adequately protected against all tornado missiles. CO-T-1A will remain intact if subjected to the forces of the RG 1.76 R1 wind and missiles.

In addition, the three condensate source tanks are spatially distributed: CO-T-1B is located northwest, CO-T-1A is located northeast and DW-T-2 is located southeast of the TMI-1 Class 1 tornado hardened structures. Based on a review of historical records, the predominant tornado pathway for TMI is from southwest toward northeast (Reference: Technical Evaluation 13-00477). Considering the spatial separation of the three tanks, the robust structures between them with the predominant tornado pathway for TMI, the maximum width of historical tornados and the condensate tanks' capability to withstand missile impact, there is reasonable assurance that more than one tank will be available. However, only CO-T-1A is credited for the success of the strategy.

Extreme Cold:
Condensate water sources will be maintained in an extreme cold event as described in the response to ISE CI 3.2.4.3.A.

Item No. 3.1.1.1.A - Status Complete

The licensee stated that protection of associated portable equipment from external hazards would be provided in structures that will be constructed to meet the requirements of NEI 12-06 Section 11. However the licensee did not specify the type of configuration, how FLEX equipment would be secured, or how stored equipment and structures would be protected from all external hazards.

Response Description

The TMI FLEX Strategy is an alternate approach to NEI 12-06, Rev. 0 because (1) installed equipment is used and NEI 12-06, Rev. 0 does not recognize use of installed equipment for FLEX and (2) analytical methods beyond those defined in NEI 12-06, Rev. 0 were required to confirm the structural adequacy of the Turbine Building for the FLEX Strategy. The installed FLEX equipment is located in the Turbine Building (TB) and Control Building. The portable FLEX equipment is primarily stored in the FLEX Storage Facility (FSF).

Turbine Building:
The TMI FLEX Strategy and use of the Turbine Building for the mitigation strategies was developed to ensure the Turbine Building structure satisfied NEI 12-06, Rev. 0, Section 2.3 "Considering the external hazards applicable to the site, the FLEX mitigation equipment should be stored in a location or locations such that it is reasonably protected such that no one external event can reasonably fail the site FLEX capability. Reasonable protection can be provided...through storage in structures designed to reasonably protect from applicable external events." TMI followed the NEI 12-06 standard for design and evaluation of structures after a BDBEE which states that "Acceptance criteria would be based on building serviceability requirements not strict compliance with stress or capacity limits. This would allow for some minor plastic deformation, yet assure that the building would remain functional." ASCE 41-13 "Seismic Evaluation and Retrofit of Existing Buildings" was used to provide a quantitative method to evaluate "serviceability" as described in NEI 12-06, Rev 0.

The evaluation supports the conclusion that the Turbine Building is capable to withstand the BDBEE hazards defined in NEI 12-06, Rev. 0 and maintain its FLEX functions to support, protect and allow access for FLEX actions within the TB and satisfy the intent of the NEI 12-06, Rev. 0 serviceability requirements for structures after a BDBEE. The TB is capable to support the FLEX strategy for mitigation of BDBEE as required by NRC Order EA 12-049 (Reference: Calculation C-1101-919-E410-011, Rev 1 and ECR 14-00501).

The structural capability of the Turbine Building supports the Turbine Building main steam piping tornado and seismic evaluations and modifications (Reference: ECR 15-00328 and ECR 15-00330) and the Turbine Building Access and deployment evaluation (Reference: ECR 14-00126).

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The protection and accessibility of all equipment in the Turbine Building which has a credited FLEX function was evaluated to ensure successful implementation of the strategy after a BDBEE tornado or earthquake. Accessibility to the diesel fuel supply connections and hose paths were addressed in (Reference: Technical Evaluation 14-00126). Additional protection for the diesel fuel supply valve (FX-V-2) in the Turbine Building was installed (Reference: ECR 13-00164).

FLEX Storage Facility:
The FSF is the former TMI Unit 2 screen house which was modified to provide portable equipment storage for BDBEE. This structure is tornado hardened and seismically qualified. The process used to ensure temporary equipment is properly stored within Class I buildings is applied to ensure FLEX equipment is not damaged during a seismic event. (Reference: ECR 13-00074 and 1015 "Equipment Storage within Class I Buildings") .

BDBEE Flood Mitigation Strategy:
To support the mitigation strategies for BDBEE flood events up to 320' elevation, some equipment will be moved to higher ground if a flood is predicted because the floor elevation of the FSF is 312' elevation. The re-evaluated (post Fukushima) PMF has peak water level with waves below 312' elevation. The CLB flood is a peak water level of 313.3. There is no hydrologic analysis that postulates a flood above the PMF.
NEI 12-06, Section 6.2.3.1.1.c recognizes storage of FLEX equipment below postulated flood level as acceptable if the time is available and guidance is institutionalized to move the equipment to a protected location in advance of a predicted flood.

OP-TM-AOP-002 "Flood" is the administrative control which directs all flood event related actions. This includes moving equipment (at least one truck and one condensate re-supply pump (FX-P-3)) from the FSF to the training center across the river which has a ground elevation above 330' elevation in advance of a flood. One truck and one pump provides the necessary capability to re-supply condensate if necessary. The action to move equipment from the FSF to the training center is taken for any serious flood threat. OP-TM-AOP-002 is conservatively initiated at a river level of 284' elevation or a flow of 200,000 Cfs. The action to protect FLEX equipment is not dependent upon a specific determination that a "severe" flood is predicted. This action and all pre-flood mitigation actions are completed prior to the start of inundation. This provides the redundancy described in NEI 12-06. OP-TM-AOP-002 also directs when and which equipment to use to resupply condensate after the flood water recedes from the site. (Reference: OP-TM-AOP-002).

Item No. 3.1.1.2.A - Status Complete

The licensee did not specifically address deployment considerations with respect to the deployment of FLEX equipment through areas subject to liquefaction, routing only through seismically robust buildings, power required to deploy or move equipment, and protection of the means to move equipment.

Response Description

The potential for earthquake induced liquefaction has been evaluated. Deployment of TMI-1 FLEX equipment will not be adversely impacted (Technical Evaluation ECR 14-00218, "FLEX Borated Water Supply Plan").

Evaluation of all actions performed within non-seismic structures is complete. The strategy was revised to eliminate reliance upon actions within the condenser pit due to the potential for internal flooding (Technical Evaluation ECR 14-00126, "BDBEE Impact on FLEX Strategy in the Turbine Building").

A vehicle stored in the FLEX Storage Facility (FSF) will be used to deploy FLEX equipment. The FSF protects the equipment within from BDBEE hazards except for flood. The truck and essential equipment is moved to a higher ground in advance of the flood. The availability of power does not prevent the timely deployment of

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equipment (Enclosure 2, Section 9).

Item No. 3.2.1.A - Status Complete

The licensee needs to confirm that the transition to the backup feedwater system will occur without a significant interruption of feedwater to the steam generators.

Response Description

If the transition to the backup feedwater system is planned, there will be no interruption of feedwater. The primary and backup systems can be operated in parallel. If the transition to the backup feedwater system is not planned (i.e., a failure of the primary feedwater source), then the impact on core cooling should be insignificant. Before the plant reaches the conditions where the backup feedwater capability is enabled, the backup feedwater pumps (FX-P-2A & B) will be configured and all valves will be lined up, leaving one valve to each OTSG to control backup FW flow. If EF-P-1 fails, FX-P-2A or B will be started and flow can be re-established within minutes. OTSG water level will be maintained high enough such that an interruption for several minutes would have only a minor effect on RCS temperature, and core cooling would be maintained.

Transition to FLEX Feedwater system using the installed FLEX Feedwater Pumps, FX-P-2A and FX-P-2B, is required if EF-P-1 fails. This pump is qualified for the seimic event, and protected from tornado hazrads. In advance of a flood threat, FX-P-2A & B are prepared for operation if needed.

As part of the FLEX implementation strategy, the FLEX Feedwater system will be placed in a condition to support start, by performance of OP-TM-919-924, Pre-operational Lineup of FX-P-2A or FX-P-2B. This aligns the system such that a single pump start, and opening one valve to each OTSG, are the only manipulations required to initiate flow from the FLEX feedwater system to both OTSGs. The pump controller and control valve manifold are in relative close proximity.

OP-TM-919-921, "Alternate Low Pressure Emergency Feed of OTSG's using FLEX Pumps FX-P-2A or FX-P-2B", describes the actions necessary to transition from Emergency Feedwater using the EF-P-1 to FX-P-2A or FX-P-2B. The Emergency Feedwater and FLEX Feedwater systems are operated in parallel, which assures there will be no interruption of feedwater flow during the planned transition.

The normal alignment of the Condensate system was revised to limit the effects of a seismic event. Valves (CO-V-103A, CO-V-103B, CO-V-111A and CO-V-14A) are now maintained closed to provide isolation between the seismic and non-seismic sections of the system and minimize the potential loss of condensate after a seismic event. Following a seismic event, additional isolation valves (CO-V-24, CO-V-108, and CO-V-8) are closed to further reduce losses from non-seismic components of Condensate system. As a result there is a minimum of 214,320 gallons available after a seismic event. This provides a 27-hour supply of condensate.

The revised normal alignment of the Condensate system also limits the effects of tornado damage. With CO-V-111A and CO-V-14A closed, CO-T-1A is isolated from components which may be damaged by tornado driven missiles. Following a tornado event, additional isolation (CO-V-176) is implemented to further reduce losses if CO-T-1B is damaged. As a result, at a minimum CO-T-1A and hotwell will be available after a tornado event. This provides a 29-hour supply of condensate.

The primary and backup feedwater systems can be operated in parallel which assures there will be no interruption of feedwater flow if a planned transition occurs.

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Item No. 3.2.1.2.A - Status Complete

The 1A and 1B ES motor control center (MCC) will be energized using the FLEX diesel generators as described in Safety Functions Support section and the FLEX RCS makeup pump will be started within 4 hours. The analysis to confirm the timeline is not yet complete.

Response Description

The TMI FLEX strategy is to restore RCS makeup within 4 hours i.e. prior to the loss of RCS heat transfer. This approach is founded on previous analysis and testing which demonstrates sub-cooled natural circulation can provide stable effective core cooling. The TMI FLEX strategy objective to restore RCS makeup within 4 hours is supported by PWROG analysis described in WCAP 17792P and MAAP analysis. The procedures to initiate the response, energize the 1A and 1B ES MCC, line up the flow path and start FX-P-1A or FX-P-1B have been validated to confirm these actions can be reliably completed within 4 hours of the event.

Refer to ISE OI 3.2.1.1.B for complete response and basis for 4 hour time requirements for powering the FLEX diesel generators.

Refer to SE-18 for the basis of the conclusion that the main steam line pressure boundary integrity will be maintained.

Item No. 3.2.1.2.B - Status Complete

Information should be provided to justify that the procedures are effective to keep the RCS temperatures within the limits of the seal design temperatures, and address the adequacy of the seal leakage rate (2 gallons per minute (gpm)/seal) used in the ELAP analysis.

Response Description

Flowserve described the capabilities of the N-9000 seal in their "White Paper on the Response of the N-Seal Reactor Coolant Pump (RCP) Seal Package to Extended Loss of All Power (ELAP)" endorsed by NRC in letter on Nov 12, 2015.

The application of the Flowserve white paper to TMI is addressed in the response to ISE OI 3.2.1.2.C.

The N-9000 seal design and testing demonstrates that the seals will not be degraded if water temperature at the seal is maintained below 560F. In the event of an ELAP, the seal temperature will rise to RCS cold leg temperature after 10 or more minutes. Automatic control (which is backed up by remote manual control) will maintain OTSG pressure between 1000 and 1020 psig (Reference: OP-TM-EOP-012 "Station Blackout"). The peak cold leg temperature will remain below 555^{0}F. The RCP seal temperature will remain below 555F throughout the event.

The initial RCS loss rate due to seal leakage and controlled bleed off flow will be less 2.5 GPM/ RCP. This is a conservative value for the flow at normal operating conditions (i.e. RCS pressure at 2155 psig). After an ELAP, RCS pressure will be lower and losses will be less. Once CBO flow is isolated, the total loss rate per RCP will be much less than 1 GPM. A conservative RCS loss rate of 11 GPM (i.e. 4 pumps at 2.5 GPM plus an additional 1 GPM) was used for the ELAP analysis per WCAP 17792 (Reference response to 3.2.1.1.B - OI – ISE)

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Refer to SE-18 for the basis of the conclusion that the main steam line pressure boundary integrity will be maintained.

Item No. 3.2.1.2.C - Status Complete

For plants such as TMI-1 that credit low leakage seals to maintain the initial maximum leakage rate of 2 gpm/seal for the ELAP analyses of the RCS response, a discussion of the information (including seal leakage testing data) should be provided to justify the use of 2 gpm/seal in the ELAP analysis.

Response Description

In the November 12, 2015 (ADAMS Accession No. ML15310A094) letter, NRC provided the following guidance:

The NRC staff has considered the information submitted by Flowserve and concluded that the leakage rates proposed for the N-Seal design, as documented in Table 3 in the white paper, are acceptable for use in beyond-design-basis ELAP evaluations for demonstrating compliance with Order EA-12-049, with the following limitations and conditions:

(1) Each licensee should confirm that its plant design and planned mitigation strategy are consistent with the information assumed in the calculation performed by Flowserve, which is summarized in Table 1 of the white paper.

The values used in the Flowserve evaluation are consistent with TMI design and emergency procedures for ELAP mitigation.

	FlowServe Evaluation	TMI Design & ELAP Response	Basis
Initial RCS Pressure, psig	2155	2155	
Peak Cold Leg Temperature, ^{0}F	555	551	As described in response #2 below, 551 is a conservative value for RCP seal fluid temperature
CBO isolation Hr	< 6	< 6	Emergency procedures have been developed and validated to complete this action in less than 6 hours.
Cooldown Initiation Time, hr	< 4	< 4	Emergency procedures have been developed and validated to complete this action in less than 4 hours.
Cooldown rate, ^{0}F/Hr	37	33 to 37	This cooldown rate varies with the capacity of FXP1A/B. The cooldown rate is 37 F/HR at 40 GPM and 33 F/HR at 35 GPM.
Cooldown plateau, ^{0}F (T_{COLD})	360	360 to 370	These temperatures are based on saturation temperature for OTSG pressure The operating band for OTSG pressure post ELAP is 140 to 160 psig.

(2) *Each licensee should confirm that the peak cold-leg temperature prior to the cooldown of the reactor coolant system assumed in Flowserve's analysis is equivalent to the*

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saturation temperature corresponding to the lowest setpoint for main steam line safety valve lift pressure.

Response: The peak cold-leg temperature prior to the cooldown assumed in the Flowserve analysis is 555^{0}F. The lowest nominal lift pressure for the main steam safety valves is 1040 psig for MS-V-21A & B. Saturation temperature for 1054.7 psia is 551.1^{0}F.

(4) *In its white paper, Flowserve has generally specified leakage rates in volumetric terms. For converting the specified volumetric flow rates to mass flow rates, licensees should use a density of 62 lbm/ft3 (approximately 993 kg/m3) throughout the ELAP event. This condition reflects observations made during testing conducted by Flowserve that simulated a loss of seal cooling, wherein the seal leakage mass flow rate remained roughly constant as the test apparatus underwent a significant cooldown and depressurization.*

NRC Letter Item #4 Response: The assumed RCS loss rate during the ELAP used to determine required response time to restore RCS makeup was determined in accordance with WCAP 17792-P as described in the response to ISE OI 3.2.1 1.B. RCS loss rates in all other evaluations (e.g borated water inventory requirements) used a density of 62 lbm/ft^3 to convert RCP seal loss rates into mass flow rates when required.

Items # 3 and 5 in the NRC letter did not require a response.

Item No. 3.2.1.4.A - Status Complete

The licensee did not provide any further description of specific initial key plant parameters specified in NEI 12-06, Sections 3.2.1.2 and 3.2.1.3 except the assumption regarding SSC's [safety systems and components], and the items from the Sequence of Events (SOE) Attachment 1A. The licensee did not provide the initial conditions used in the RCS and SFP calculations used in the TMI Training and Reference Manual, ER-TM-TSC-0016, the TMI.

Response Description

For RCS core decay heat generation rates, earthquake or tornado analysis is based upon (1) reactor operation for at least 100 days at 100% power, (2) the reactor has been shut down for at least 4 hours for the initial conditions where OTSG steam pressure below the design EFW pump turbine steam supply pressure (Reference: Technical Evaluation 14-00352 "Other Initial Conditions") or (3) the reactor has been shutdown at least 72 hours before the OTSG is unavailable, and gravity drain core cooling methods are required (Reference: ECR 13-00208 FLEX design Specification Appendix 5).

For flood event analysis, if the reactor had been at 100% power when the flood condition was recognized, then the reactor will be shut down for at least 18 hours when the ELAP occurs. For flood event analysis, if the reactor had been in refueling conditions when the flood condition was recognized, then the reactor will be shut down for at least 96 hours when the ELAP occurs.

For the spent fuel pool heat generation rates: (1) If there is a full load of fuel in the core, then the spent fuel pool heat load is based upon the long term fuel load plus a normal core offload (72 FA) from the reactor which was shutdown 20 days ago. (2) At any other time, the design basis spent fuel pool heat load is assumed. This is the maximum postulated heat load which is based on (1) a full core offload 134 hours after reactor shutdown and (2) a conservative core offload (80 FA) 36 days after reactor shutdown and (3) the long term

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heat load. No exception is taken to any of the requriements for initial conditions as specified in NEI 12-06, Rev. 0 Sections 3.2.1.2 and 3.2.1.3.
Item No. 3.2.1.6.A - Status Complete During the ELAP and LUHS [Loss of Ultimate Heat Sink] beyond-design-basis external event, the licensee has identified that times to complete actions in the Events Timeline are based on operating judgment, the conceptual designs, and the current supporting analyses. The TMI mitigation strategy is not based upon the PWROG [Pressurized Water Reactor Owners Group] WCAP-17601-P ELAP mitigation strategy. In the audit process, the licensee stated that the current SOE is for the seismic event only and that another SOE would be developed for the flood event. Based on the information provided by the licensee, it is not possible to determine the validity of the time constraints provided in the preliminary sequence of events timeline for all hazards. The final timelines will be validated once detailed designs are completed and procedures are developed. The results will be provided in a future 6-month update. **Response Description** A sequence of events timeline was developed to support the ELAP strategy for all external events with the exception of the flood event. This timeline supports an event with no advanced warning, and can be implemented with minimum staffing available at the stations. The time constraints of this timeline were validated using the FLEX developed procedures and are documented in the "Three Mile Island Nuclear Station Unit 1, NEI 12-06 FLEX Validation Plan", approved on November 20, 2015. This validation was developed and conducted using the NEI Validation Guidance. In addition, a separate sequence of events timeline was developed for the flood scenario. The flood scenario is different from the no warning timeline discussed above. The flood conditions can be predicted well in advance of the event that would cause an extended loss of ac event. This allows the station to provide additional resources to perform the preparation activities. The major activities include: ◦ Pumping 5000 gallons of fuel oil from DF-T-1(30K underground fuel oil tank) into FX-T-2 (FLEX Flood Fuel oil Tank) to support fueling the FLEX diesels, ◦ Set up of the low pressure pump in the 305' TB to support OTSG feed and spent fuel pool makeup. ◦ Line up of high pressure injection pump suction and discharge paths in the Auxiliary Building. These activities are similar and therefore bounded by the validation effort conducted in the no warning timelines.
Item No. 3.2.1.9.A - Status Complete The licensee stated that the FLEX diesel generators (FX-Y-1A & B), fuel storage tank (FX-T-2) and FLEX MCC will be located north of the turbine pedestals on the Turbine Building 322' elevation. The FLEX diesel generators and FLEX MCC will be designed for operation if subjected to twice the Safe Shutdown Earthquake (SSE), as part of the "augmented approach." Protective barriers will be installed to ensure this equipment remains functional following a tornado. Feasibility analysis has been completed which shows that the Turbine Building should be adequate to support these loads during an SSE. Further analysis is being performed to determine if any structural modifications are necessary to support that conclusion.

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Response Description

The FLEX diesel generators, fuel tank and all FLEX equipment were designed and installed to meet the requirements of the "Expedited Seismic Evaluation Process to ensure functionality after a seismic event. The re-evaluated seismic hazard was used as required in the ESEP (Reference: Letter to NRC, December 17, 2014 "Exelon Generation Company, LLC Expedited Seismic Evaluation Process Report (CEUS Sites), Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident").

The FLEX diesel generators, motor control center and fuel oil tank are protected from tornado missiles. An evaluation was completed to identify where existing structures provide adequate missile protection (Reference: Technical Evaluation 14-00270). New missile barriers were designed and installed to provide protection where there were gaps between existing structures (Reference: ECR 14-00501).

The TB structural integrity will be maintained to support the FLEX strategy as described in the response to ISE CI 3.1.1.1.A.

Item No. 3.2.1.9.B - Status Complete

The Integrated Plan table titled, "PWR [Pressurized Water Reactor] Portable Equipment Phase 2," lists two diesel driven pumps. The second table titled, "PWR Portable Equipment Phase 3," lists several pumps to be obtained from the RRC [NSRC]. The licensee did not discuss how the operator actions are modeled in the ELAP to determine the required flow rates of the portable pumps listed in the "PWR Portable Equipment Phase 3", or justify that the capacities of each of the above discussed pumps are adequate to maintain core cooling during phases 2 and 3 of ELAP.

Response Description

The OIP (Feb 2014) Tables for "PWR Portable Equipment Phase 2" and "PWR Portable Equipment Phase 3" identified the equipment which was planned to be used at that time and other equipment which was available and might potentially be used.

In the Final Integrated Plan, the only pump from the original OIP "PWR Portable Equipment Phase 2" table with a required FLEX function is the portable diesel driven pump (FX-P-3A or FX-P-3B) (240 GPM at 250 psid). This pump is used for indefinite coping to pump river water to resupply the condensate source. The installed condensate supply will be suffcient for at least 24 hours. FX-P-3A or FX-P-3B have the capacity to deliver the required flow to Condensate Storage Tank CO-T-1B or to the condenser hotwell (Reference: C-1101-919-E410-001 "FLEX System Hydraulic Evaluation")

In addition to this primary function, FX-P-3A or FX-P-3B is capable of directly supplying feedwater to the OTSG and spent fuel pool makeup, as described in the contingency strategy for failure of EF-P-1, FX-P-2A and FX-P-2B (Reference: Enclosure 2, Section 4.11.5 and Technical Evaluation 15-00345 FLEX – Diverse Flow Paths).

The pumps listed in the OIP "PWR Portable Equipment Phase 3" table are not required for the TMI FLEX strategy. Other equipment is available from SAFER but only provides defense in depth for the mitigation strategy.

Item No. 3.2.2.A - Status Complete

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The licensee stated that initial SFP cooling calculations were used to determine the fuel pool timelines and that formal calculations will be performed to validate this information during development of the detailed design. The licensee also stated that these strategies utilize a vent path for steam, and that the effects of this steam on other systems and equipment will be evaluated, and the results will be provided in a future 6-month update.

Response Description

Cooling of the spent fuel is accomplished by providing makeup water to maintain the pool level after boiling begins. The FLEX feedwater pumps (FX-P-2A or FX-P-2B) provide redundant capability to provide the required makeup flow. The additional contingency has been implemented where FX-P-3A or FX-P-3B can provide makeup to the spent fuel pool.

The bounding values for the spent fuel pool heat load in operating or outage conditions are described in the response to ISE CI 3.2.1.4.A. The time for the spent fuel pool to reach boiling was evaluated using ER-TM-TSC-0016 "RCS AND SFP HEATUP AND INVENTORY BOILOFF FOLLOWING LOSS OF ACTIVE DECAY HEAT REMOVAL". To address the potential that the spent fuel pool may also be used as borated water souce for RCS makeup, the following times are based on a spent pool water inventory below the minimum level allowed during operation. When there is a full load of fuel in the reactor vessel, the minimum time to spent fuel boiling is more than 34 hours. In the limiting design basis case, which includes a full core off load, the minimum time to spent fuel boiling is more than 9.7 hours (Reference: Technical Evaluation 13-00208 Appendix 5)

The spent fuel pool heat is removed by relieving steam to atmosphere. In an ELAP event, a vent path through the Unit 2 FHB will be established before boiling occurs.

The vent path has no interfaces with equipment relied upon for the FLEX strategy. Environmental isolation barriers are present to prevent potential leakage paths between the Unit 1 refueling floor from the Unit 1 Auxiliary Building and from the Control Access Building (UFSAR 1.3.2.41). The new spent fuel pool level instrument is designed to function in a low pressure steam environment (Reference: ECR 13-00084). The steam flow path from Spent Fuel Pool evaporation will not adversely interact with any systems or equipment relied upon to successfully accomplish the FLEX function for core cooling, spent fuel cooling or containment.

Condensation from the boiling will flow to the floor drains which are routed to the Auxiliary Building Sump. The Auxiliary Building sump and overflow volumes (RCBT room (180,000 gallons to 281' elevation) and Heat Exchanger Vault (519,000 gallons to 281' elev.) can contain over 700,000 gallons (OP-TM-108-115) of water without adverse impact on the FLEX strategy. The condensation from the spent fuel pool boiling will not adveresly interact with any systems or equipment relied upon to successfully accomplish the FLEX function for core cooling, spent fuel cooling or containment.

Item No. 3.2.4.3.A - Status Complete

The licensee specified that a strategy for extreme cold, snow and ice events is being developed. Preliminary plans include the use of heat tracing for some piping and tanks, e.g. the Borated Water Storage Tank, and minimum flow paths or steam heating in other situations (e.g. the CST's). The final plans will be reviewed when complete.

Response Description

The Extreme Cold event does not alter the basic initial coping strategy for core cooling, spent fuel cooling or containment. The FLEX Strategy actions for MODE A (100% power) which are unique for the Extreme Cold

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event are: (1) provide power to the BWST immersion heater, (2) connect a hose to route steam into condensate tank "B" to maintain the water temperature above freezing, AND (3) drain additional condensate (DW-T-2 or CO-T-1A) into the hotwell, and direct steam to the Hotwell to maintain the water temperature above freezing. To maintain an indefinite condensate supply if the river is covered with ice or the access ramp is blocked by snow accumulation, submersible pumps (FX-P-6A or FX-P-6B) will be used in the Intake Screen and Pump House to transfer river water to condensate tank "B". All other FLEX actions for this event are typical for other events. References: Technical Evaluation 13-00502 "FLEX Condensate Supply Strategy" OP-TM-919-904 "Energize 1A ESF VENT MCC to supply BWST Immersion Heaters" OP-TM-919-923 "Condensate Heating" OP-TM-919-922 "Makeup from Raw Water Sources"
Item No. 3.3.3.A - Status Complete The specific procedures for training, new or revised, have not yet been completed. The requirements from the analysis will be used to develop and to validate the new and revised procedures. This includes the existing design and licensing basis requirements and the new FLEX requirements. Validation of time response is performed using a composite of field simulation and performance/simulator exercises. **Response Description** The FLEX implementing procedures for HSB, HSD and PWR OPS MODEs have been validated and issued. This includes physical validation to ensure that all procedure actions can be performed as written. In addition, validation was performed 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 Final Integrated Plan (FIP) for Order EA-12-049. References: "TMI NEI 12-06 FLEX Validation Plan" document ID 2494447-07
AQ 2 - Status Complete A review was conducted of Exelon's plans for the development of mitigating strategies with respect to the procedural interfaces considerations for seismic hazards associated with large internal flooding sources that are not seismically robust and do not require ac power, the use of ac power to mitigate ground water in critical locations, or the existence of non-seismically robust downstream dams, but it was determined that there was insufficient information in the plans to conclude that there is reasonable assurance that these aspects of the requirements of Order EA-12-049 and NEI 12-06, Section 5.3.3, consideration 2-4 will be met. Please provide a discussion of these considerations in the appropriate six-month update. **Response Description** The Turbine Building structural integrity will provide protection and support access and deployment for FLEX actions as described in the response to ISE CI 3.1.1.1.A. 1) Response to NEI 12-06, Section 5.3.3.2: The FLEX strategy can be sucessfully implemented with internal flooding caused by a seismic event as evaluated in (1) Technical Evaluation 15-00142 "FLEX Impact evaluation – Non Seismic Eqpt Failures in Class I Buildings" and (2) Technical Evaluation

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14-00126 "FLEX Impact evaluation – Turbine Building".

The technical evaluation of the Turbine Building (14-00126) was a comprehensive evaluation that considered potential adverse effects other than internal flooding concerns from a seismic event. This evaluation reviewed the effects of tornado or earthquake on systems in the Turbine Building and evaluated the potential adverse impact on the FLEX strategy. This review considered the potential adverse interactions between other systems and (1) equipment required for FLEX and (2) access for required FLEX actions. This evaluation considered potential flooding, spray, or other effects on equipment, and considered impairments to access including personnel environmental hazards (Reference: Technical Evaluation 14-00126 "FLEX Impact evaluation – Turbine Building").

This evaluation utilized elements of EPRI methods which were developed to seismically qualify equipment where seismic capability was not an orginal design consideration (i.e. Generic Implementation Procedure (GIP) for Seismic Verification of Nuclear Plant Equipment", EPRI 1019199, "Experience-Based Seismic Verification Guidelines for Piping and Tubing", and EPRI 1014608, "Seismic Evaluation Guidelines for HVAC Duct and Damper Systems"). This inspection and evaluation process utilized technical criteria deemed applicable to assess structural integrity. The purpose of this evaluation was not to qualify the equipment to function after a seismic event and the use of the EPRI method was limited accordingly. This evaluation was focused on adverse interactions with FLEX equipment or with personnel performing FLEX actions.

Additionally, in response to a question regarding accessibility of stairs and doors in the Turbine building following a seismic event, the Turbine Building structural integrity will provide protection and support access and deployment for FLEX actions as described in the response to ISE CI 3.1.1.1.A. Additionally, the adjacent TMI-1 Control Building (Class 1 and Aircraft Hardened) contains a protected stairwell with access to each elevation of the Turbine Building structure, with the personnel access doors installed in the Class 1 structure, ensuring personnel access to all elevations of the Turbine Building.

2) Response to NEI 12-06, Section 5.3.3.3: The TMI flood protection strategy does not rely on active means of water removal. However, key sump pumps can provide defense in depth during external flooding events. The ability to operate key sump pumps is included in the design of the FLEX power system and flood event mitigation procedures (Reference: OP-TM-AOP-002 "Flood") .

3) Response to NEI 12-06, Section 5.3.3.4: The failure of the York Haven Dam (downstream of TMI) in a seismic event is assumed in development of the TMI FLEX strategy. Such a failure could cause river water level to be as low 272' elevation. In this case, submersible pumps (FX-P-6A or FX-P-6B) will be used in the ISPH to provide an indefinite condensate supply (Reference: OP-TM-919-922 "Makeup from Raw Water Sources" and Technical Evaluation 13-00502, "FLEX Condensate Supply").

AQ 13 - Status Complete

The integrated plan for TMI-1 did not provide any information regarding how decay heat rates were determined in the analyses for reactor core and spent fuel pool cooling. Please identify how decay heat was modeled for these analyses and provide justification for its adequacy.

Response Description

The reactor core and spent fuel decay heat generation rates were obtained from plant Procedure ER-TM-TSC-0016, "RCS & SFP Heatup & Inventory Boil off following a loss of active decay heat removal". The curves in

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this procedure were determined using a best estimate methodology per ANSI/ANS 5.1-1979. These decay heat curves include the decay of Np-239 and U-239 and the effects of neutron capture in fission products.
AQ 19 - Status Complete The FLEX emergency feedwater pumps and two diesel generators and fuel tanks are located in the Turbine Building which is apparently a non-seismic Class 1 building. As noted on page 11 of the submittal the pumps are only designed for the flood condition. It is not clear if these pumps will be available in a seismic event due to their location. Please clarify the availability of these pumps during a seismic event, including accessibility of any instrumentation and controls needed to support their operation, and identify how makeup to the steam generators would be provided for such an event. If the FLEX emergency feedwater pumps are credited for a seismic event, please provide adequate justification. Please clarify whether the diesel generators and fuel tanks located in a protected enclosure in the Turbine Building (reference page 37 of submittal) will be adequately protected from damage from beyond-design-basis external events (e.g., seismic, tornado, etc.). Please further clarify whether access to the protected enclosure could be restricted by damage to non-seismic structures and equipment. **Response Description** The FLEX feedwater tanks (FX-T-1A/B) and pumps (FX-P-2A/B) and associated piping have been designed to perform their FLEX function following all BDBEE, including earthquake and tornado. (Reference: ECR 14-00031, FLEX FW System, and ECR 13-00070, FLEX Electrical Power Supply). This design is dependent upon the Turbine Building structural integrity. The TB structural integrity is maintained to support the FLEX strategy as described in the response to ISE CI 3.1.1.1.A. Accessibility for operation of the FLEX feedwater pumps is maintained after a tornado or seismic event as described in the response to AQ-2. The FLEX diesel generators (FX-Y-1A & B) (Reference: ECR 13-00070) and fuel supply tank (FX-T-3) (Reference: ECR 13-00164) have been designed to perform their FLEX function following all BDBEE. An evaluation was completed to identify where existing structures provide adequate missile protection (Reference: Technical Evaluation 14-00270). New missile barriers were designed and installed to provide protection where there were gaps between existing structures (Reference: ECR 14-00501). The pathways through the Turbine Building to the FLEX diesel generators and associated equipment and controls, and all FLEX actions within the Turbine Building have been evaluated (Reference: Technical Evaluation 14-00126). This evaluation shows that there are primary and alternate pathways for access to all FLEX action locations. Turbine Building access is also addressed in response to AQ-2.
AQ 20 - Status Complete Since the FLEX Emergency Feedwater pumps and the Emergency RCS Charging Pumps are permanently installed they do not appear to qualify for portable status per NEI 12-06. The rationale for having portable equipment is that it can be stored or located in such a way that it is protected from all of the external events listed in NEI 12-06 (seismic, flooding, high wind, extreme cold and heat). The FLEX Emergency feedwater pumps do not appear to be protected from seismic events. A justification is needed related to how these two permanently installed systems qualify as FLEX equipment under NEI 12-06, Section 3.1.2.12. Also, a discussion of how these two systems and their respective power supplies are any more survivable than the normally installed plant equipment, is needed. Please discuss this issue.

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Response Description

The FLEX strategy meets the requirements of Order EA 12-049 using an alternate approach to NEI 12-06. New installed equipment qualified for the external hazards as defined in NEI 12-06 is used in place of portable equipment to simplify emergency response and reduce the time to restore RCS makeup following an ELAP. The requirements of NEI 12-06 are applied to the TMI design as applicable for installed versus portable equipment.

NEI 12-06, Rev. 0, Section 3.2.1.12, Qualification of Installed Equipment, states "Equipment relied upon to support FLEX implementation does not need to be qualified to all extreme environments that may be posed, but some basis should be provided for the capability of the equipment to continue to function."

The FLEX RCS makeup pumps are designed to function following all BDBEE (Reference: ECR 14-00032, "FLEX RCS Makeup System"). The FLEX feedwater tanks (FX-T-1A/B) and pumps (FX-P-2A/B) and associated piping have been designed to perform their FLEX function following all BDBEE, including earthquake and tornado. (Reference: ECR 14-00031, FLEX FW System, and ECR 13-00070, FLEX Electrical Power Supply). The FLEX diesel generators (FX-Y-1A/B) and required electrical distribution equipment have been designed to perform their FLEX function following all BDBEE, including earthquake and tornado. (Reference: ECR 13-00070, FLEX Electrical Power Supply). The strategy is dependent upon the Turbine Building structural integrity. The TB structural integrity will be maintained to support the FLEX strategy as described in the response to ISE CI 3.1.1.1.A. Accessibility for operation of the FLEX feedwater pumps will be maintained after a tornado or seismic event as described in the response to AQ-2.

AQ 40 - Status Complete

Provide a discussion on the diesel fuel oil supply (e.g., fuel oil storage tank volume, supply pathway, etc.) for the diesel driven FLEX pumps and generators and how continued operation to ensure core and spent fuel pool cooling is maintained indefinitely (i.e., Phase 2 and 3). Also, explain how fuel quality will be assured if stored for extended periods of time. The staff also requests the licensee provide a refueling strategy for the diesel driven FLEX equipment, to include fuel consumption estimates for the FLEX diesel driven FW pumps taking suction from the UHS [ultimate heat sink], and the time for refueling, and how the fuel will be provided.

Response Description

The Engineered Safeguards (ES) underground diesel fuel supply tank DF-T-1 is the primary fuel oil supply for the FLEX strategy. DF-T-1 contains a minimum of 25,000 gallons. The procurement and periodic sampling program ensure the fuel quality meets standards for safety related systems. Fuel will be transferred from DF-T-1 to FX-T-2, FX-T-3 or FX-T-4 using one of two transfer pumps (DF-P-1C and DF-P-1D). One of these pumps is powered from station ES AC power and one is powered from the station DC system (which will be supplied from the FLEX Diesel Generator within 4 hours of an ELAP).

This fuel source is protected from all BDBEE hazards. In the case of an external flood > 5000 gallons of fuel is transferred to an elevated tank (FX-T-2) in advance of the flood (Reference: OP-TM-AOP-002,"Flood"). Fuel will be transferred from FX-T-2 to the FLEX diesel generator suppy tank (FX-T-3). The supply in FX-T-2 will provide approximately a 6-day supply for full load operation of a FLEX Diesel Generator. In addition, procedures are in place to utilize SAFER 500 gallon fuel container to transport fuel to the Control Tower roof where it can be drained to FX-T-2. This provides an indefinite fuel re-supply capability.

FX-T-3 (120 gallon tank located on the platform with FX-Y-1A & B) provides the direct supply to the FLEX

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diesel generators. The FLEX DG (500 kW diesel generator) full load consumption rate is 34.4 GPH. A minimum of 105 gallons in maintained in FX-T-3 (i.e. > "7/8" full). This provides for three hours of diesel generator operation which ensures a 3-hour supply prior to the need to refill. Emergency procedure validation has confirmed that following an ELAP the fuel suppy from DF-T-1 to FX-T-3 can be established within 3 hours of start of the FLEX Diesel Generator.

In addition, diesel fuel is supplied to the following portable equipment:
The fuel storage capacity and full load consumption rate for the portable equipment is as follows:

- Portable diesel driven pumps (FX-P-3A and FX-P-3B) each have a 175 gallon fuel tank and consume approximately 7.6 gph.
- Portable Diesel Generator (FX-Y-3) has a 200 gallon fuel tank and consumes approximately 25 gph.
- Portable Diesel Generators (FX-Y-4) have a 3.4 gallon fuel tank and consume approximately 0.6 gph.
- The SAFER Mobile Water Treatment Unit includes a diesel generator. The unit has a 90 gallon fuel tank and consumes approximately 6.7 gph.
  The SAFER Mobile Boration unit includes a diesel generator. The unit has a 70 gallon fuel tank and consumes approximately 17.5 gph.

The FLEX truck with a 200 gallon storage tank (FX-T-4) and associated transfer pump in the truck bed are used to distribute fuel to portable equipment. If all outside equipment is in service at the same time, the total fuel consumption is approximately 60 gph. With a 200 gallon capacity, FX-T-4 can reasonably refuel all equipment within approximately 3 hours. Once the SAFER equipment is provided an additional fuel tank will be available to provide additional margin. The emergency procedures for using this portable equipment have been validated. This process confirmed that given the tank sizes, rate of consumption and delivery capability using FX-T-4, a reliable fuel supply can be maintained indefinitely.

For each combination of external hazard and initial plant condition, a consumption rate of 100 gph is conservative. At this rate of consumption, the onsite fuel supply (DF-T-1) would last more than 9 days. This provides adequate time to arrange for off-site fuel delivery.

Programmatic controls have been established to maintain the quality of stored fuel. The foundation of the program is the existing controls for the safety related fuel source (DF-T-1) and all fuel used in the FLEX equipment will be obtained from this source. Each storage location has been evaluated to ensure that quality is maintained through one of four approaches: (1) The tank is maintained empty and filled from DF-T-1 when needed (e.g. FX-T-2 & SAFER eqpt), (2) The fuel in the tank is consumed in one year or less through required equipment testing (e.g. FX-T-3 & FX-T-4), (3) The fuel stored in the tank is sampled and replaced based on sample results or (4) The fuel stored in the tank is replaced within one year or within period justified through use of fuel stabilizers. The specific programmatic requirements to fuel quality are described in the FIP (Enclosure 2) PM & Testing requirements (section 11.5).

References: Techncial Position Paper 2494447-04 "FLEX Equipment Fuel Supply Plan"

AQ 51 - Status Complete

Please clarify whether a single FLEX pump will be used to provide cooling flow to multiple destinations (e.g., the reactor core, steam generators, and the spent fuel pool). If so, please confirm that the FLEX pump can

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supply adequate flow and clarify whether the pumped flow will be split and simultaneously supplied to all destinations or whether the flow will be alternated between them. If simultaneous flow will be used, then clarify how the flow splits will be measured and controlled (i.e., whether control exists for the total flow on a common line or on lines to individual destinations) to ensure that adequate flow (i.e., sufficient but not excessive) reaches each destination.

Response Description

The FLEX Feedwater pumps (FX-P-2A & B) are used for multiple applications. These include steam generator feedwater (when OTSG is available), makeup to RCS (when OTSG is NOT available), and spent fuel pool makeup (in either case). FX-P-2A or FX-P-2B is sufficient for each combination of requirements (i.e. OTSG & SFP or RCS & SFP). RCS makeup with FX-P-2 is only used when the RCS is open to the RB atmosphere. The flow to the OTSG, flow to the RCS and flow to the SFP is independently controlled based on level indication.

OTSG level control: OP-TM-EOP-012 defines the level control band (75 to 95% operating range). OP-TM-919-921, "Alternate Low Pressure Feed of OTSG's using FX-P-2A or FX-P-2B", identifies the control valves (FX-V-206A & FX-V-206B).

SFP level control: OP-TM-919-914 defines the level control band (between 23.334 and 24.667 feet) and identifies the control valve (FX-V-101).

The FLEX feedwater pumps (FX-P-2A & B) are required to support the following performance requirements. The basis for these requirements is described in more detail in ECR 13-00208, "FLEX Design Specification".

1. Supply Feedwater at 10 hours after the ELAP. Supply 110 GPM to both OTSGs at 200 psig
2. Supply Feedwater and Spent Fuel Pool makeup at 34 hrs. after the ELAP. Supply 72 GPM to both OTSGs at 150 psig and concurrently supply 16 GPM to the SFP
3. When OTSG is not available, then supply RCS and Spent Fuel Pool Makeup. Supply 70 GPM to RCS with RB pressure at 10 psig

The first requirement is a bounding requirement for pump capability (i.e., satisfying requirement 1 ensures the pump can perform any of these functions).

Hydraulic analysis was completed (C-1101-919-E410-001), which shows that the required head for FX-P-2 to deliver 70 GPM to the SFP or RCS is approximately 87 ft. TDH. Since the pump (FX-P-2A/B) is at 296' elevation and makeup to the Spent Fuel pool is at 348' elevation, the pump must overcome an elevation head of 52'. The evaluation also assumes 10 psig back pressure in the RB (or another 23 ft) . The piping head loss due to flow at 70 GPM is approximately 12 ft. of water. In requirement 2, where the flow to the SF pool is 16 GPM, the head loss will be negligible. The pump capacity for requirement 2 is simply the additional flow (i.e. 72 plus 16 or 88 GPM). Therefore, requirement 1 is the limiting requirement for the capability of FX-P-2A or B.

The pump capability to meet these performance requirements is documented in ECR 14-00031, Section 3.5. The minimum Total Dynamic Head (TDH) requirements for FX-P-2A or B are: (1) 150 GPM at 419.7 ft, and (2) 110 GPM at 515.3 ft, as determined in C-1101-919-E410-001. The FX-P-2A/B pump has (1) a head margin of approximately 80 feet for the flow of 150 GPM and (2) a head margin of approximately 15 feet for the flow of 110 GPM as determined from the pump performance curve for Sulzer SJS-7APC-6S with a 5.21 inch impeller (Reference ECR 14-00031, Attachment 15). Individually, FX-P-2A or FX-P-2B meet the minimum performance requirement."

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AQ 56 - Status Complete

The licensee plans to secure the main generator seal oil pump when the hydrogen pressure decreases to 15 psig. The staff requests the licensee to explain why the pressure decrease is stopped at 15 psig and the main generator is not purged with CO_2. The licensee is also requested to describe the consequences of securing the seal oil pump with 15 psi of hydrogen remaining in the generator casing.

Response Description

The main generator hydrogen gas will be vented to atmosphere as soon as possible. The venting is not suspended at 15 psig. After the main generator hydrogen gas has been vented, carbon dioxide will be lined up to the generator. A proper purge with CO_2 will be conducted after power has been restored to the CO_2 vaporizer.

The DC Generator seal oil pump (GN-P-2) will be operated for 2 hours. Well before the 2 hour point, hydrogen pressure in the main generator will be less than 1 psig.

These actions are directed by OP-TM-322-901, "Emergency Vent of Main Generator Hydrogen".

AQ 59 - Status Complete

The licensee's strategy for RCS includes using water from the spent fuel pool. The staff requests the licensee provide an evaluation of the consequences on the spent fuel pool using this strategy and the consequential actions required by the operators to maintain adequate spent fuel pool cooling.

Response Description

The FLEX strategy relies on the BWST as the preferred source for borated water for RCS make-up. However, if a tornado missile damages the BWST, the spent fuel pool water can be used for RCS makeup.

The use of spent fuel pool water for RCS makeup does not affect how spent fuel cooling is maintained. Operators will maintain SF pool level after boiling occurs with the FLEX feedwater pumps. The reduction in available spent fuel inventory due to the use for RCS makeup has a small effect on when boiling occurs and therefore how soon operator action is required.

To determine the spent fuel pool heat up rate, a conservative spent fuel pool volume was used. The assumed spent fuel pool level change is greater than that required for continuous use of the spent fuel pool for RCS makeup for more than 24 hours. With the assumed loss of inventory the spent fuel pool time to boil is reduced from ~ 40 to 34 hours. The strategy to restore makeup to the SF pool can be reliably established well within 34 hours. (References: Technical Evaluation 13-00208, FLEX Design Spec Appendix 5, and Technical Evaluation 14-00218, FLEX borated water supply plan).

AQ 64 - Status Complete

The table titled, "PWR Portable Equipment Phase 2," lists two diesel driven pumps. The pumps have flow rates and required head of 240 gpm and 250 psid [pounds per square inch differential], and 600 gpm and 245 psid, respectively. The second table titled, "PWR Portable Equipment Phase 3," cites a positive displacement high

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pressure pumps with the specifications of 1000-3000 psi shutoff head and 60 gpm capacity and three low pressure pumps of 300 psi shutoff head and 2500 gpm max flow, 500 psi shutoff head and 500 gpm max flow, and 150 psi shutoff head and 5000 gpm max flow. Specify the required times 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. Discuss how the operator actions are modeled in the ELAP to determine the required flow rates of the portable pumps, and justify that the capacities of each of the above discussed pumps are adequate to maintain core cooling during phases 2 and 3 of ELAP.

Response Description

The only equipment listed in the "PWR Portable Equipment Phase 2" table with a required FLEX function is the portable diesel driven pump (FX-P-3A/B) (240 GPM at 250 psid). This pump is used for indefinite coping to pump river water to resupply the condensate source. Condensate resupply is not required in less than 27 hours (Reference: 13-00502, "FLEX Condensate Plan"). The performance requirement for this function is conservatively satisfied with a flow of 120 GPM. The limiting minimum pump capacity to deliver water from the river to condensate sources was determined by hydraulic analysis to be 120 GPM at 165 ft TDH (Reference: C-1101-919-E410-001). FX-P-3A or FX-P-3B has more than adequate capability to maintain the condensate resupply and support the mitigation strategy.

The equipment listed in the "PWR Portable Equipment Phase 3" table is not required for the TMI FLEX strategy. The listed equipment only provides defense in depth to the mitigation strategy.

Refer to the response to ISE CI 3.2.1.9.B for related discussion.

OIP OI 9 - Status Complete

A portable refueling vehicle with a large diesel oil bladder will be available on site to support refilling our portable equipment diesel tanks. An additional means (river makeup is available) of delivering condensate may also be developed; details to be provided in a future 6-month update.

Response Description

The FLEX truck has a 200 gallon tank (FX-T-4) and fuel transfer equipment installed in the bed. The FLEX Truck is stored in the FLEX Storage Facility.

Technical Evaluation ECR 13-00502, "FLEX Condensate Supply Strategy", decribes condensate makeup water by the following two methods:

Method 1 involves use of diesel driven pumps FX-P-3A or B located at the bottom of the ramp next to the river west of the NOB to deliver water through hoses to CO-T-1B or the hotwell.

Method 2 is used to ensure a river water supply with ice on the river, a failure of the York Haven Dam or other access problems with the river road next to the NOB. A submersible pump (FX-P-6A or B) will be lowered into the Unit 1 ISPH pump bay to re-supply condensate to CO-T-1B or the hotwell. The pump is powered by FX-Y-3 as described in Technical Evaluation 14-00134, "FLEX: Technical Evaluation for Electrical Supply to FX-P-6A/B".

Both methods are implemented by procedure OP-TM-919-922, "Makeup from Raw Water Sources".

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OIP OI 13 - Status Complete

A plan will be developed to re-supply borated water to the Borated Water Storage Tank or SFP.

Response Description

The FLEX strategy includes a plan to maintain an adequate borated water supply for RCS makeup. Condensate water will be used to maintain the Spent Fuel Pool level and compensate for evaporation. The plan does not resupply the BWST but maintains a continuous RCS makeup capability using river water and SAFER equipment for water treatment and creating a borated water supply (Reference: Technical Evaluation 14-00218, FLEX Borated water supply plan", and Technical Evaluation 13-00502, FLEX Condensate supply plan). These plans have been implemented.

SE 2 - Status Complete

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

Response Description

There are two river water supply strategies. For either application, a continuous flow of 150 GPM exceeds the requirements of the mitigation strategy.

Using FX-P-3A or B, a 6-inch suction pipe is connected to a strainer submerged in the river. The strainer is a 9-inch diameter by 9-inch long cylinder, with a closed end and perforations around the circumference. There are 8 rows of 23, 1-inch diameter holes for a total flow area of greater than 144 square inches. There are two complete sets of suction piping and strainers. If debris clogs the strainer, a clean strainer could be placed in service in less than one hour.

Using FX-P-6A or B, both pumps are submerged in the Unit 1 intake screen and pump hose pump bay. The river enters the pump bay through three channels which trap debris at three sizes. The bars, rakes and screens are designed to support flows greater than 10,000 GPM. This ensures that the elevation head loss across these channels will be minimal at the desired flow of 150 GPM. The final stage of filtration is with screens which will trap objects larger than 3/8". The pumps (Tsurumi Model LH311W) are designed for raw water service. Redundant pumps (FX-P-6A and FX-P-6B) are ready for service. If debris affects the performance of a pump, the other pump could be placed in service in less than one hour.

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In the limiting case, condensate resupply must be established within 27 hours (Reference Technical Evaluation 13-00502, FLEX Condensate Supply Plan). Offsite personnel will be available to support establishing either condensate resupply method. The plan is to initiate configuration of this equipment within 10 to 12 hours of the event.

The flow from FX-P-3A(B) or FX-P-6A(B) is routed to either CO-T-1B or the hotwell. The maximum condensate usage rate after resupply is required is 110 GPM. Once resupply is established at 150 GPM, the tank levels will be refilled while core cooling and spent fuel pool cooling continues (i.e. the resupply flow exceeds the OTSG and SFP demand and the tanks will be refilled). The level restored in the tank, allows that if resupply flow were interrupted (e.g. to clean the strainer), core or spent fuel pool cooling would not be interrupted.

SE 3 - Status Complete

Discuss all areas of where local manual actions are credited in FLEX strategies (e.g., SG atmospheric dump valves, auxiliary feedwater flow control, making connection points, control room, etc.).
Can Operators safety enter these areas to complete necessary actions during extreme hot and cold hazard during an ELAP? (Heat, cold, humidity, etc.) Are these actions feasible based on ELAP conditions and time constraint restrictions?
Will sufficient lighting be available to complete tasks (e.g., portable lighting, headlamps, flashlights, etc.)?
Is communication with the control room possible based on noise in area of local manual actions?
Will portable ventilation be established? When will they be established?

Response Description

The locations for all manual FLEX Actions in the plant are as follows:

LOAD SHEDDING (OP-TM-919-906)

1. Secondary AO would Break Condenser Vacuum (Open VA-V-8) This action would be conducted from TB 322 on West side of the condenser.

2. Vent Main Generator Hydrogen. This action would be conducted from TB 322 on West side of the condenser. This would be conducted by the same operator that performs Action 1.

3. Operator would strip loads in the Vital Bus Rooms on 322 of the Control Tower for load shedding. This would include loads on VBA; Transfer ATA (ICS Auto Pwr) to 1E Inverter; De-energizing the 1C Inverter.

REPOWERING 1P/1S 480V POWER(OP-TM-919-901)

4. Operators would take actions in the 1P/1S Switchgear room in the 322' of the Control Tower. This includes stripping loads (opening breakers) on the 1P, 1S, 1A ES MCC and 1B ES MCC; racking out normal feeder breakers to the 1P/1S 480V ES SWGR; manually closing the 1P and 1S Cross Tie Breakers; and closing EE-1P-12-Bkr when FX-Y-1A or B is started.

5. Secondary AO will perform prestart checks of FX-Y-1A/B and Start FX-Y-1A or 1B. This is located in 322' CT Patio area.

PROVIDE MAKEUP TO RCS (OP-TM-919-911)

6. The primary AO will lineup the suction of FLEX high-pressure pumps (Most actions will be in 281' AB).

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The primary AO will then line up the discharge of FLEX high-pressure pumps. This is in the 305' of the AB and will require a ladder to access the valves. REPOWER 1A RADWASTE AND 1B RADWASTE MCC (OP-TM-919-903) 7. Maintenance Tech (Electrician) will route Cable FX-Cable-A and Cable adapter FX-Cable-A1, located in AOP box 2 (305 AB near SFP Cubicle) from Weld receptacle A-9 (AB 305' just south of 1A ESV MCC) to Weld receptacle A-3(AB 281' above DH-P-1B vault). Loads will be stripped on 1A ESV MCC, 1A Radwaste MCC and 1B Radwaste MCC. TAKE MANUAL CONTROL OF ADVS AND EFW REGULATING VALVES 8. Secondary Operator stationed at Emergency Feedwater will need to take local manual control of MS-V-4A/B (Atmospheric Dump Valves) and EF-V-30 A/B (Emergency Feedwater Regulating Valves) prior to 2 hour air is exhausted. Operator will be required to make adjustments as necessary during cooldown of both ADV and EF-V-30's. FLEX DIESEL FUEL OIL (OP-TM-919-931) 9. Operator will be required to route fuel oil hoses in the B EDG Room (305'). 10. Operator will be required to route fuel oil hoses on 322' TB from North End at FX-V-2 to South End to FX-T-3. Operator will set up FX-T-3 overflow line from FX-T-3 to FX-T-2. 11. Once fuel oil lines are installed, Operators stationed at FX-Y-1 and the B Diesel room will be in communication via red page phone and coordinate filling FX-T-3 using DF-P-1C or DF-P-1D. SET UP FX-P-2A OR B FOR BACKUP OTSG FEED OR SFP MAKEUP (OP-TM-919-924) 12. Maintenance will run the cable for FX-P-2A/B from the Flex Distribution panel to the Pump starters on the 322' TB West Side. 13. Operators will run FX-Hose-A from FX-V-203 to FX-V-205 in the 305' TB. 14. Operator will open FX-V-67A and FX-V-67B in the EFW Area on 295' Elevation of the IB. This will require a ladder for Access. Ladder is stored in the 295' IB hallway. 15. Operator will start FX-P-2A or B and adjust FX-V-206A or FX-V-206B to Feed OTSG with FX-P-2A or B if required. (322' TB) 16. Operator will run a FX-Hose X from FX-V-208 to FX-V-113 to support SFP makeup. (TB 322' West Side) FEED OTSG (OP-TM-919-921) 17. Operator will start FX-P-2A or B and Throttle FX-V-206A and FX-V-206B as necessary. (322' TB) FEED SFP (OP-TM-919-914) 18. Line up path from FX-V-208 to SFP.(322' TB) Throttle FX-V-101 to maintain SFP Level. (322' CT Patio area) Portable ventilation was evaluated in Technical Evaluation 13-00310, Flex Ventilation Strategy, and is installed per OP-TM-919-952; FLEX Ventilation of Control Building, and OP-TM-919-953, FLEX Ventilation of Intermediate and Turbine Buildings.

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A communication plan (TPP 294447-01) demonstrates that adequate ability is available to provide communications to perform each FLEX action. Refer to Item 3.2.4.4.A-CI-ISE.

The lighting plan (TPP 294447-05) demonstrates that adequate lighting is available to perform each FLEX action. Refer to Item 3.2.4.4.B-CI-ISE.

SE 4 - Status Complete

Identification of FLEX pump (RCS makeup, FW and SFP makeup) connection points and diverse flowpaths. Confirmation that the connection points are reasonably protected from all applicable, external hazards and will remain accessible when needed during an ELAP event.

Response Description

Contingency strategies have been implemented to provide diverse flowpaths. These strategies provide alternate capabilities to address failures beyond those postulated in the development of the FLEX strategy. (Reference: Technical Evaluation 15-00345, "FLEX Diverse Flow Paths")

Failure of FX-P-1A or B discharge piping to the RCS

If a BDBEE has damaged the FX-P-1 discharge piping in the Control Building, Turbine Building or Fuel Handling Building, then the following alternate path will be used for RCS makeup.

Threaded fittings on FX-P-1A or FX-P-1B discharge will be dis-assembled, and temporary fittings will be used to attach the discharge of FX-P-1A or B to a hose. The hose (FX-HOSE-B1) will be connected to an installed high pressure standpipe (FX-HOSE-B-X2). The standpipe will route flow from the south end of CB 322 patio to the FHB 305 area below. Additional hose sections will be used to connect FX-HOSE-B-X2 to MU-V-143C and MU-V-143D (at RB wall at north end of FHB 305' elevation). These connection points are located inside a Class I aircraft protected structure.

This path provides an alternative to the installed high pressure piping with the following variances from the TMI FLEX design specfication (Reference: ECR 13-00208): (a) time to restore makeup will be within 5.5 hours, and (b) this path can deliver 40 GPM against RCS pressure below 2100 psig.

Failure of FX-P-1A or B suction piping from SF-V-87

If a BDBEE has damaged the FX-P-1 suction piping in the Control Building or Fuel Handling Building, then the following alternate path will be used for RCS makeup.

The installed hose on FX-P-1A or FX-P-1B suction will be disconnected and the pump suction will be adapted to connect hose (FX-HOSE-B1). The hose (FX-HOSE-B1) will be connected to an installed high pressure standpipe (FX-HOSE-B-X2). The standpipe will route flow from the south end of CB 322 patio to the FHB 305 area below. Sections of hose (FX-HOSE-Z) will be used to connect FX-HOSE-B-X2 to an adaptor (FX-HOSE-Z-X3) near SF-V-87. The flanged pipe section which includes SF-V-87 will be removed to allow the adaptor (FX-HOSE-Z-X3) to connect to a 4 inch pipe flange from the BWST (SF-V-36) or Spent Fuel Pool (SF-V-37). These

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connection points are located inside a Class I aircraft protected structure. This path provides an alternative to the installed piping with the following variances from the TMI FLEX design specfication (Reference: ECR 13-00208): The time to restore makeup will be less than 5.5 hours. Loss of ability to feed OTSG with FX-P-2A, FX-P-2B or EF-P-1 If EF-P-1 has failed and a BDBEE has damaged the FX-P-2A/B discharge piping to EFW, then the following alternate method will be used to feed the OTSGs. FX-P-3A or B will be set up to use river water, or fire service water. The discharge will be routed using FX-HOSE-X into the Turbine Building. FX-HOSE-X will be connected to the Main FW header through adaptor FX-HOSE-F-X6. Main Feedwater valve FW-V-5A will be manually opened (if the valve is not already open), and FW-V-17A will be locally throttled open to control flow to the OTSG "A" Main FW nozzles. A similar flow path through FW-V-5B and FW-V-17B can be used to feed OTSG "B". The connection point for FW is located inside the Turbine Building in area shielded from tornado missiles. This connection point will remain accessible after a BDBEE. This method provides an alternative for OTSG feedwater. Raw water is used until NSRC water treatment equipment is functional. Loss of ability to makeup to the Spent Fuel Pool with FX-P-2A or FX-P-2B If a BDBEE has damaged the FX-P-2A/B common discharge pipe or hose connections to the FW header in the Turbine Building, then the following alternate method will be used to makeup to the spent fuel pool. A parallel path from the discharge from FX-P-3A (or B) can be established using a tee (FX-HOSE-F-X4), a valve (FX-V-306) and hose sections (FX-HOSE-X) connected to the SFP makeup standpipe. The existing SFP makeup standpipe provides the flow path to a hose (FX-HOSE-X) which is routed from the standpipe into the SF pool. The connection point to SF is located inside a Class I aircraft protected structure. This method provides an alternative for Spent Fuel Makeup. NSRC water treatment equipment should be in service before makeup is required. Integrity of Spent Fuel Pool NEI 12-06 Table D-3 states with respect to spent fuel pool spray capability "This capability is not required for sites that have SFPs that cannot be drained." The TMI UFSAR (Section 9.4.7) evaluated the spent fuel pool and concluded "it is not considered credible that any accident or series of accidents could violate the integrity of the system" because all the equipment and piping of the spent fuel cooling system are designed to meet seismic class I requirements and housed in Class I structures designed to withstand aircraft impact. In addition, "The most serious failure of the Spent Fuel Cooling System would be complete loss of water from both spent fuel storage pools. To protect against this possibility, the cooling water inlet and outlet connections to spent fuel pool B all enter slightly below, or at, the normal water level in the pool. Fuel Pool A has a drain connection from the spent fuel cooling system extending downward from elevation 330 ft (10 ft above the top of fuel stored in this pool) to 2-inches above the bottom of the pool. This line has a syphon breaker with a

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normally locked open valve to prevent water from syphoning from the pool below elevation 330 ft in the highly unlikely event that the line should break outside the pool." And "A combination drain/fill line enters the spent fuel cask pit at elevation 332 ft (approximately 12 ft above the top of the spent fuel stored in Pool B). This line extends down inside the pit to elevation 332 ft 6 inches. There is a syphon breaker on this line with a normally locked open valve to prevent draining the spent fuel cask pit below elevation 332 ft in the unlikely event that the line should break outside the pit."

An external event causing the spent fuel pool to be drained is not considered credible and the capability to spray the spent fuel (which is available as required by B.5.b strategies) is not a required FLEX function.

SE 6 - Status Complete

Verify that appropriate human factors are applied for the implementation of the FLEX strategies.

Response Description

Operator response may be complicated by the environmental conditions, lack of lighting, and limited communications. Several human factors considerations, described below, have been incorporated into the FLEX strategy to assist in overcoming these adverse conditions.

Labeling
All FLEX components are labeled in accordance with the fleet standard labeling procedure (OP-AA-116-101, Equipment Labeling, and Site Supplement, OP-TM-116-101-1001) and INPO Good Practice OP-208, INPO 88-009. The INPO good practice document conforms to NUREG-0700, Human System Interface Review Guidelines. FLEX equipment has been identified with a unique designation of FX (i.e., FX-P-1). FLEX equipment identified as needed prior to restoring power using the FLEX Diesel Generators was labeled with "reflective" labeling materials to assist in identification in low light environments. Orange reflective tape was used to label all FLEX components.

Storage
Major equipment required to implement the FLEX strategy is permanently installed and requires no staging, with the exception of certain hoses and power cables. Equipment to be staged is stored in secure metal boxes throughout the plant in close proximity to where it is to be employed. The boxes are locked to prevent loss of items. Equipment operators have a key to the locked boxes on the duty key rings.

Equipment required for long term response is stored in the FLEX Storage Facility. The FLEX Storage Facility is normally locked. Operators, Maintenance Supervisors and Security personnel have a key to gain access to this facility. In addition to housing equipment to support implementation of the longer term strategy, the FLEX Storage Facility also contains:

- debris removal equipment such as shovels, hand tools, and chain saws
- communications gear, such as back up satellite equipment, spare radios and batteries.
- spare portable lighting such as flood lights
- personnel habitability items such as bottled water and cots

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- and, portable diesel electric generators

FLEX equipment utilized for any other purpose will be limited and administratively controlled. If FLEX equipment is used for a non-FLEX function it will be tracked using the control room unavailability tracking log.

Procedures
Implementation of the FLEX strategy will be through approved emergency operating procedures, and support procedures. The procedures have been developed in accordance with the guidance of NEI 12-06, and the station procedure writer's guide. The procedures provide detailed instructions for the operators and have incorporated learnings from walkdowns with respect to environmental concerns.

Validation
Validation of all FLEX tasks was conducted in accordance with the NEI validation template. Validation took into account adverse environment conditions, such as extreme temperature conditions, low lighting and reduced communication ability.

Training
Qualified operators will operate all FLEX equipment. All operators have been trained on the modifications made to support implementation of the FLEX strategy. All operators have completed the initial FLEX training with classroom training on the strategies and procedures, and a field walkdown of all installed equipment. The FLEX tasks were evaluated for continuing training. Operator long range training plans have incorporated required FLEX recurring training.

All key ERO personnel have received FLEX overview training. A computer based training program is in place for FLEX overview training as part of new hire inprocessing.

SE 14 - Status Complete

The licensee needs to confirm that the temperature and pressure within containment, other areas within the plant (i.e., electrical switchgear room), and atmospheric dump valve rooms will not exceed the qualification of electrical equipment that is being relied upon as part of the FLEX strategy. The licensee needs to ensure that the qualification of the required electrical equipment remains bounding during the entire duration of the event (i.e., indefinitely).

Response Description

The ventilation and cooling requirements for all FLEX equipment were addressed in Technical Evaluation 13-00310, "FLEX Ventilation Plan". Appendix A of that document lists all of the equipment credited in the FLEX strategy, and provides the evaluation to determine whether additional cooling is required. Where additional cooling is required, the required air flow and peak temperature assuming extreme ambient conditions was determined.

The ventilation requirements were determined assuming an outside ambient temperature of 100^0F (Reference: ECR 13-00208, FLEX Design Specification, Section 2.17). The electrical switchgear rooms and instrumentation cabinets, on the Control Building 322 elevation will be maintained at or below 104F using portable ventilation. The battery chargers, inverters and station batteries on the Control Building 322 elevation will be maintained at or below 111F using portable ventilation. The instrumentation cabinets, on the Control Building 338 elevation will be maintained at or below 111F using portable ventilation. The instrumentation on the Control Building 355 elevation (control room) will be maintained at or below 107F using portable ventilation. Portable ventilation in

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the Turbine Building will maintain the building ambient near outside ambient of 100F. The FLEX equipment in these areas will function reliably with these maximum temperatures. Portable ventilation will be established to improve personnel access to control EFW equipment and the Atmospheric Dump Valves in the Intermediate Building. There is no electrical equipment in the Intermediate Building credited to function in the long term for the FLEX strategy except for communications (COM-H-09R). COM-H-09R is designed for operation with temperature above 130F. The equipment within the Reactor Building (RB) has been qualified for post LOCA conditions IAW 10CFR50.49. The post LOCA containment pressure is significantly above the peak pressure following an ELAP. The equipment was qualified to a peak temperature of 280°F. The RB post LOCA temperature profile is shown on UFSAR Fig. 6B-16. The post ELAP RB temperature was determined in FLEX-TM-002, "FLEX RB Pressure Analysis". That analysis used a conservative assumption for RCS leakage. A leak rate of 20 GPM into containment (at normal operating pressure) was assumed. That analysis shows RB temperature ("lower compartment") slowly rises and reaches a peak of ~ 220°F after seven days. RB Cooling can be restored within seven days. The qualification test data for the RB instruments was compared with the ELAP RB temperature profile using the Arrhenius method and instrument functionality at seven days is supported with significant margin (Reference: Technical Evaluation 15-00341, "RB ENVIRONMENTAL EVAL FOR FLEX INSTRUMENTS"). This plan provides reasonable assurance that the instrumentation and electrical equipment required for the FLEX strategy will remain functional throughout the event.
SE 18 - Status Complete Clarify MSIV [main steam isolation valve] behavior during ELAP at TMI. Understand that MSIVs are motor-operated and that the operator cabling may not be qualified during seismic event. Understand position of MSIVs during different scenarios. Open MSIVs implies potential for cross-tied SG pressure. Closed MSIVs implies potential for independent pressures in SGs [steam generators]. Obviously this could influence RCS loop temperatures and flows for cases where asymmetry may arise. Also, because of potential inability to close MSIVs if electrical power unavailable to valve operator, confirm whether downstream piping is robust to turbine stop valves, or whether there is potential for uncontrolled cooldown that must be addressed. This situation could arise if downstream steam lines or connected piping is non-robust in one or more ELAP scenarios. **Response Description** The FLEX Strategy does not rely upon closure of the MSIV after an ELAP. The strategy utilizes downstream boundary valves to maintain the integrity of the OTSG pressure boundary as described below. The FLEX strategy as described in OI 3.2.1.1.B and elsewhere is dependent upon OTSG pressure control so RCS temperature can be maintained stable until RCS makeup is restored.. All piping on the OTSG pressure boundary which is outside of Class I Seismic and Tornado protected design basis structures was evaluated for this BDBEE function. Analysis and modifications have been completed which ensure the integrity the main steam and feedwater piping after an earthquake (Reference: ECR 15-00330, "Main Steam BDBEE Seismic Evaluation and Mods") or a tornado (Reference: ECR 15-00328, "Main Steam BDBEE Missile Protection Mods"). These analyses are dependent upon the integrity of the Turbine Building structural frame which was qualified

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for all BDBEE hazards (Reference: ECR 14-00501, "Turbine Building Modifications for BDBEE").

The OTSG pressure boundary in the Turbine Building extends to the following isolation devices. These isolation devices close automatically in response to the event or will be closed by an operator following the referenced emergency procedure:

- Isolation of 24"Ø MS supply to the Main Turbine: TG-SV-1,2,3 & 4.
- Isolation of 3" Ø MS supply to Gland Steam: MS-V-7 is closed by an operator in response to an ELAP
- Isolation of 2" Ø MS drains from 24"Ø MS Piping: MS-ST-2A,B,C,D or if a tornado warning is issued MS-V-36A,B,C,D will be closed by an operator in accordance with OP-TM-AOP-004, "Tornado / High Winds"
- Isolation of 6"Ø MS supply to Main FW Pump Turbine: MS-V-56A, B
- Isolation of drains from Main FW Pump Turbine steam supply: MS-ST-3A, B.
- Isolation of 12"Ø MS Turbine Bypass Piping: MS-V-3A,B,C,D,E,F.
- Isolation of drains from MS Turbine Bypass Piping : MS-ST-5A,B.
- Isolation of 20" Ø Feedwater Piping: FW-V-12A.

SE 20 - Status Complete

The licensee's strategy relies on a single connection point for the Phase 2 DGs to provide power to the TMI 480 V electrical distribution system.

Response Description

The electrical power design for TMI FLEX strategy includes redundant installed diesel generators which are fully qualified and protected from all of the external hazards. The design of the electrical distribution system from the generators to the ES power trains ensures that power can be delivered from either DG to the ES power system within the required time assuming the failure of a single active component. There are two connection points to the ES power distribution system (1) installed connection to the ES Bus Tie and (2) installed connection for temporary cable connection at 1A ES MCC Unit 15A. This design provides a reliable method to restore power to vital instruments and FLEX equipment.

DIVERSE PATHWAY

If the pathway from FX-PNL-FX-XFR (Switch that selects FLEX DG output) to the ES bus where it is routed through the Turbine Building is damaged, then the alternate temporary power scheme will provide power from the diesel generator output (EE-PNL-FX-3A for FX-Y-1A or EE-PNL-FX-3B for FX-Y-1B) to the ES 480V power train and to the 480V FLEX MCC in the Turbine Building.

Eight (8), 300' portable (two conductors for each phase and the neutral) cables will be routed from the FLEX diesel generator platform at 322' elevation to 1A ES MCC Unit 15A (Control Building 322' elevation) to provide power to the FLEX Equipment on the ES switchgear and MCCs. A second power jumper (one conductor per phase and a neutral) will be routed on the FLEX platform to supply power to the FLEX 480V MCC.

The current transmission capacity of the temporary cables and overload device settings were confirmed to be sufficient for this function assuming an ambient temperature of 50°C. The voltage drop in the cables to the ES power train at the limiting design conditions (i.e., 300A per cable) is 2.6%. If this method of power supply is implemented, the operator will raise FLEX DG voltage regulator setpoint to 103%. (Reference: Technical Evaluation 15-00345, "FLEX Diverse Flow Paths".)

This method is implemented in emeregency procedure OP-TM-919-901, "Repower 1P and 1S 480V Swgr from FX-Y-1A or FX-Y-1B". This procedure was validated in accordance with the site process for maintaining

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emergency procedures (1001E "Maintenance Program for "EP" Usage Level Procedures").

EVALUATION OF CABLES SUBMERGENCE:

The FLEX electrical power supply will function with a water level up to 320' elevation. There are no splices or connections in the FLEX power distribution system below 321' elevation. The cable (below 320') is Firewall III-J which is jacketed with CSPE (Chlorosulfonated Polyethylene) and has superior long term water resistance. It is qualified for direct burial without conduit. Submergence of the conduits and cables for the BDBEE flood event period of less than one week will not adversely affect the function. (Reference: ECR 13-00070, "FLEX Electrical Power Supply", Section 3.13).

SE 21 - Status Complete

Licensee needs to provide an analysis that shows that staging the N and N+1 Phase 2 FLEX DGs in close proximity to one another does not reduce the reliability of either Phase 2 FLEX DG to perform its required function (i.e., a catastrophic failure on one Phase 2 FLEX DG will not adversely impact the other FLEX DG or its associated equipment (cabling, connections, etc.).

Response Description

Potential common cause failure modes which could result in a failure of both FLEX DGs to perform when required were reviewed. This review included:

(1) Catastrophic mechanical failure of one DG potentially impacting the other
(2) Fire on one FLEX DG affecting the other FLEX DG.

1. Catastrophic Engine Failure

The FLEX diesel generator sets, in addition to being protected from all pertinent external events, are designed, constructed and installed in a manner that ensures a high degree of reliability. They have been procured as high-quality commercial-grade items. Comprehensive testing of the new units was completed at the vendor's facility. The engines were operated under loaded conditions for 24 hours. Testing of the same diesel generator model was performed which confirmed the diesel generator should remain functional following a seismic event. Significant additional site acceptance and pre-service functional testing was completed (Reference: ECR 13-00070, "FLEX Electrical Power Supply").

The TMI FLEX diesel generators are Cummins Model DFEK 480V 500kW diesel generators with a straight 6 cylinder engine design. The primary concerns for a "catastrophic mechanical" failure are typically related to either the pistons or the turbocharger. In both cases engine protective features would result in engine shut down.

If a piston were ejected it would travel up, would not be directed at the redundant diesel generator or associated equipment (cabling, connections etc.). The catastrophic failure of the turbocharger is prevented by the engine controls and backed up by automatic shutdown features. Based on the specific attributes of the diesel generator design and TMI installed arrangement, the equipment designer and manufacturer (Cummins) concluded that mechanical failure of one FLEX diesel generator affecting the adjacent FLEX diesel generator was not a credible failure mode.

Item
Event Operational Experience – Cummins and Catastrophic Failure: Exelon performed a search of operating experience (OE) with Cummins Diesel Generators of this type and size. Many similar sized Cummins engines have been used for fire pumps for many years. The OE search identified six engine problems. Most required engine shutdown but were minor in nature. None of the historical failures resulted in major damage to the engine or ejected parts. Documented instances of catastrophic failure of diesel engines are rare. Historical catastrophic failures found were limited to much larger limited-production engines (i.e. Cooper Bessemer, Fairbanks-Morse, and Transamerica Delaval). Such failures were the result of control system failures. In these cases, the ejected components (i.e. connecting rods & crankshaft counterweights) are of considerable mass (~500 to 1000 lbm) and consequently have significant potential energy to unleash on adjacent equipment. By comparison, the potential energy available in reciprocating components of the size of the TMI FLEX diesel engines is sufficiently small that it is extremely unlikely that ejected parts could adversely affect adjacent equipment. Therefore, catastrophic mechanical failure of one TMI FLEX Diesel Generator potentially impacting the capability of the redundant diesel generator is not considered credible. 2. Fire on One FLEX DG Affecting the Other FLEX DG at TMI-1 The FLEX diesel generator area is protected by fire suppression sprinklers. The fire service system is supplied by two diesel driven pumps which would not be affected by the ELAP event. The system and piping was constructed in accordance with the NFPA 13 and 24. The fire suppression system may not be available if a BDBEE damaged the system. The FLEX diesel generator area will be frequently monitored during an ELAP event. Both CO2 and dry powder ABC type extinguishers are staged just East and West of the FLEX diesels on the walkway immediately adjacent to the platform (i.e. nearby but a fire on the diesel would not prevent accessing the extinguisher). The FLEX Diesel Generators would only be required during an ELAP. The probability of a fire during this event was estimated using standard PRA techniques. Event Frequency = ELAP Frequency x Fire Ignition Frequency x Number of DGs x Mission Time ELAP Frequency – A conservative estimate of ELAP frequency was obtained by reviewing existing PRA models and selecting the bounding case which was External Flooding at 9E-5 / year as determined by TMI-PRA-028.2, Rev. 0 (Draft). Fire Ignition Frequency - This value represents the ignition frequency for all components in NUREG-2169, Table 4-4, Bin 8, for all diesel generators at the site. In total there are 5 diesel generators at TMI-1 that can be used to mitigate the event; 2 EDGs, 1 SBO DG and the 2 FLEX diesel generators which are the subject of this evaluation. As such the fire ignition frequency for a single diesel generator at TMI-1 may be calculated as: Fire Ignition Frequency = (NUREG Frequency)/(Number of Components) Fire Ignition Frequency = (7.81E-3 /yr.) / (5) = 1.562E-3/yr. Number of DGs – There are 2 FLEX diesel generators – FX-Y-1A & B. Mission Time – Off site access for SAFER can readily be obtained within 5 days. 120 hours or 5 days is the assumed mission time for this calculation. To convert these hours to portion of a year requires multiplying by 1 year/ 8760 hrs.

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Event Frequency = (9E-5/yr.)*(1.562E-3/yr.)*(2)*(120 hr.)*(yr./8760hr) = 3.85E-9/yr. This evaluation shows that a fire on the diesel concurrent with an ELAP is very unlikely. The diesel generator sets are installed on a metal platform and the area below the diesel generators is controlled to prevent storage of combustible materials. There are no combustible materials on the platform or below it which would provide a path for the fire to travel from one diesel to the other. If such an event did occur, the installed fire suppression system or an operator with a portable extinguisher would be expected to control and extinguish the fire prior to any damage to the adjacent diesel. In summary, this review of the potential for a common mode failure of both TMI FLEX diesel generators due to their proximity in the installed location has not identified any such failure mode. There is reasonable assurance that such a failure mode does not exist. (Reference: ECR 13-00070, "FLEX Electrical Power Supply", Section 3.10).
SE 22 - Status Complete How will seismic water sources (e.g. condensate storage tanks CO-T-1A / 1B) be protected from the impact of a seismic or tornado event on other connected tanks? **Response Description** The cross connect valve between the Condensate Tanks (CO-V-111A) is maintained in the closed position. The isolation valve (CO-V-14A) between Seismic Class I CO-T-1A and non-seismic piping is maintained in the closed position. This ensures that the full contents of CO-T-1A will remain available after a BDBEE earthquake or tornado (Reference: Technical Evaluation 13-00476). For additional defense in depth, operators will close CO-V-13 and CO-V-24 in response to an earthquake. This action will isolate the hotwell and piping not seismically qualified from CO-T-1B, and minimize the potential losses from CO-T-1B. (Reference: OP-TM-AOP-003, "Earthquake"). The initial inventory in CO-T-1B is not credited for the FLEX strategy.

Enclosure 2

Three Mile Island Nuclear Station, Unit 1

Final Integrated Plan Document – Mitigating Strategies NRC Order EA-12-049

June 2016

(167 pages)

Exelon Generation®

THREE MILE ISLAND NUCLEAR STATION UNIT 1

FINAL INTEGRATED PLAN DOCUMENT – MITIGATING STRATEGIES NRC ORDER EA-12-049

June 2016

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1 BACKGROUND

1.1 Purpose

This document describes the mitigation strategies for TMI-1 for the mitigating strategies required by NRC order EA 12-049. The NRC has endorsed NEI 12-06 Rev. 0 as an acceptable approach to satisfy the order (Reference 29). This document identifies the equipment (installed or portable), materials and instrumentation required to accomplish those strategies. This document provides links to the technical basis for each element of the strategy. The TMI-1 strategies were developed to meet the requirements described in NEI 12-06 Rev 0 (Reference 2) with alternate approaches as described in section 2.2 below.

This document is a complete current description of the TMI-1 Mitigating Strategies, and supersedes preliminary descriptions of the strategy in the "Overall Integrated Plan" and subsequent six month updates (Reference 47).

The content of this document will be maintained as a current description of the FLEX strategies and associated information in the site program document (Reference 67).

1.2 NRC Order 12-049 – Mitigation Strategies (FLEX)

NRC Order EA 12-049 describes the following requirements.

REQUIREMENTS FOR MITIGATION STRATEGIES FOR BEYOND-DESIGN BASIS EXTERNAL EVENTS AT OPERATING REACTOR SITES

This Order requires a three-phase approach for mitigating beyond-design-basis external events. The initial phase requires the use of installed equipment and resources to maintain or restore core cooling, containment and spent fuel pool (SFP) cooling capabilities. 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. The final phase requires obtaining sufficient off-site resources to sustain those functions indefinitely.

(1) Licensees or construction permit (CP) holders shall develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment and SFP cooling capabilities following a beyond-design-basis external event.

(2) These strategies must be capable of mitigating a simultaneous loss of all alternating current (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 this Order.

(3) Licensees or CP holders 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 this Order.

(4) Licensees or CP holders 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.

NRC endorsed NEI 12-06 Rev 0 "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide" as an acceptable means to comply with order EA 12-049 (reference 29). The following requirements are derived from NEI 12-06 R0 and NRC Order EA 12-049.

2 GENERAL ELEMENTS

2.1 Requirements

2.1.1 Acceptance Criteria

NRC order 12-049 and NEI 12-06 requires TMI-1 to have a strategy which can maintain CORE COOLING, SPENT FUEL COOLING and CONTAINMENT in an event where an Extended Loss of AC Power (ELAP) and a loss of the ultimate heat sink (LUHS) are assumed to occur and are not recoverable.

The minimum acceptable condition for "core cooling" is maintaining the water level in the core above the top of the active fuel (TAF) region. The minimum acceptable condition for "spent fuel cooling" is maintaining the water level in the spent fuel pool above the top of the active fuel region. The minimum acceptable condition for "containment" is maintaining the integrity of the containment boundary capable of preventing direct release of radioisotopes from the containment atmosphere or the Reactor Coolant System (RCS).

The FLEX strategy uses (1) installed equipment for the initial coping period (with no offsite assistance for at least 6 hours), (2) uses additional on-site equipment and (3) uses off site resources from the National SAFER Response Center

(NSRC) (not available for at least 24 hours) or other sources to satisfy the acceptance criteria indefinitely.

Recovery from the event (i.e. restoration of normal AC power and safety systems) is beyond the scope of the FLEX mitigation strategy.

2.1.2 Assumed failures (ELAP & LUHS)

There are TWO assumed failures: ELAP & LUHS

ELAP is a Loss of Offsite Power (LOOP) with loss of both Engineered Safeguards (ES) emergency diesels and the Station Blackout (SBO) diesel. For the evaluation of the strategies, this equipment is not assumed to be recovered. The only AC power initially available is provided by station batteries and inverters.

LUHS is the assumed failure of all of the river water screen house pumping capability. For the evaluation of the strategies, this equipment is not assumed to be recovered.

Equipment which is vulnerable to damage from the Beyond Design Basis External Event (BDBEE) hazards (in section 2.1.3) is assumed to be unavailable for the evaluation of the strategies.

No other equipment unavailability or other hazards (e.g. security event, fire, LOCA, etc.) are assumed to occur (Reference: NEI 12-06 Section 3.2.1). The events assumed in NEI 12-06 do not include a fire. Fire suppression capability is not required. The fire service system may not be available after an earthquake or a tornado and is not relied upon to meet FLEX requirements.

2.1.3 External Event Hazards

The ELAP & LUHS are caused by and coincident with one of the following external events. Additional details on the hazard definitions and basis for applicability at TMI are described in the "FLEX Design Specification" (Reference 23).

A. Flooding: The FLEX strategy has been developed for successful performance during a river flood event where the river water level reaches 320 ft elevation. The flood is a caused by a Susquehanna River watershed precipitation event.

   For FLEX performance evaluations, to have some causal relationship with the flood, the ELAP & LUHS are assumed to occur when the river level exceeds the protection provided by the dike. The Abnormal Event Operating Procedure (AOP) is assumed to be initiated a maximum of 24 hours before the river water

level exceeds the protection provided by the dike and the period of site inundation is assumed to be at least 72 hours.

The FLEX design flood hazard for river flooding is more conservative in all aspects in comparison to the current design basis hazard or the reevaluated flood hazard (Reference 138). The FLEX strategy can be successfully implemented in the event of Local Intense Precipitation (Reference 141).

B. Earthquake: The FLEX strategy has been developed for successful performance during and after the Safe Shutdown Earthquake (SSE).

The post Fukushima re-evaluated seismic hazard has been applied to the FLEX strategy design, as applicable per the Expedited Seismic Evaluation Process (ESEP) (Reference 102 and 92).

For FLEX performance evaluations, the SSE, ELAP and LUHS are assumed to occur concurrently without any warning.

C. High Wind / Tornado: The FLEX strategy has been developed for successful performance in the event of a tornado as defined in Reg. Guide 1.76 Rev 1 for a plant in Region II.

For FLEX performance evaluations, a tornado warning is assumed to occur one hour prior to the tornado, ELAP and LUHS.

D. Extreme Heat: The FLEX strategy has been developed for successful performance in an extreme heat event where the average daily temperature is 100 °F.

For FLEX performance evaluations, the extreme hot condition is predicted 24 hours prior to the occurrence of the ELAP and LUHS.

E. Extreme Cold: The FLEX strategy has been developed for successful performance in the event of an extreme cold event where the average daily temperature is -15 °F and there is concurrent 24" inch snowfall.

For FLEX performance evaluations, the extreme cold and snow conditions are predicted 24 hours prior to the occurrence of the ELAP and LUHS.

2.1.4 Plant Mode Definitions

An effective FLEX strategy is required for any initial plant condition. The following defined MODEs cover all plant conditions, and an effective FLEX mitigation strategy has been established for each. These plant mode definitions were specifically developed for the FLEX strategy.

MODE "A": The Decay Heat Removal (DH) system is not service. This includes conditions with the reactor at power and with the reactor shutdown. The FLEX strategy for this mode has been evaluated for the 100% reactor power condition.

MODE "B": The DH system is in service and the RCS is filled (RCS pressure > 20 psig).

MODE "C": The RCS is not filled (RCS pressure < 20 psig) and the "RCS Minimum Vent Area" is not available.

MODE "D": The RCS is open to Reactor Building (RB) atmosphere through an area greater than the "RCS Minimum Vent Area". This condition is not applicable until the reactor has been shut down for at least 60 hours.

NOTE: The bases for the MODE definitions are documented in Reference 52.

2.2 Alternate approach to NEI 12-06

The TMI BDBEE Mitigation Strategies were developed to meet the requirements of NEI 12-06 R0 except for two areas where an alternate approach was required for compliance with NRC Order EA 12-049:

2.2.1 Installed vs. portable equipment

The Once Through Steam Generator (OTSG) used in B&W NSSS design does not support single phase natural circulation if primary water level is below the hot leg U-bend (359' elevation at TMI). OTSG heat removal using two phase natural circulation can be established at lower levels but only after RCS water level is below the OTSG upper tube sheet (345' elevation at TMI). Therefore, the TMI ELAP mitigation strategy is highly dependent upon RCS inventory control i.e. RC pump seal performance without seal cooling and the capability to restore sufficient RCS makeup to maintain RCS inventory. A reliable ELAP mitigation strategy must restore RCS makeup capability before natural circulation is interrupted when primary water level reaches the bottom of the hot leg U-bend (i.e. within 4 hours).

Additionally, for the ELAP mitigation strategy to address all external events, the equipment must be elevated above the maximum predicted flood height because the Probable Maximum Flood results in a peak river water level above the dike and access around the site is thereby restricted.

To implement a successful reliable ELAP mitigation strategy, the TMI reactor coolant pump seals were replaced with a design which can continue to minimize RCS losses without an active means of seal cooling (Reference 20). To provide the capability to establish an alternate RCS makeup capability within four hours after an ELAP and provide a capability which is effective with a flood, the TMI strategy relies on equipment that is installed, elevated, and protected. This use of installed versus portable equipment is an alternate approach to NEI 12-06 R0.

2.2.2 Analytical approach for the Turbine Building

The structural integrity of the Turbine Building (an existing non-safety structure) after a BDBEE was necessary to support the following FLEX functions:

- Support and protect the FLEX electrical power supply and other FLEX equipment in the Turbine Building
- Support and protect the OTSG pressure boundary (Main Steam & Feedwater System piping) in the Turbine Building.

- Provide access for operators to perform FLEX actions in the Turbine Building or traverse through the Turbine Building.

The existing building structure was evaluated for the seismic hazard (design basis SSE) as specified in NEI 12-06 R0, as well as the post-Fukushima reevaluated seismic hazard (Reference 90). NEI 12-06 R0 establishes ASCE 7-10 as an acceptable design code and sets a minimum standard of "serviceability" for structures which provide reasonable protection from applicable external events. ASCE 7-10 provides performance-based evaluation methodologies to demonstrate structural capability, which includes ASCE Standard 41-13 "Seismic Evaluation and Retrofit of Existing Buildings" (Reference 43). ASCE 41-13 provides acceptance criteria equivalent to ASCE 7-10 called "Basic Performance Objective Equivalent to New Building Standards". The method of using ASCE 41-13 to demonstrate the serviceability of the Turbine Building (TB) structure after a BDBEE seismic event is an alternate approach to NEI 12-06 R0.

With the modifications completed (Reference 50), the Turbine Building meets the serviceability requirements equivalent to ASCE 7-10 using ASCE 41-13 for the seismic BDBEE.

2.3 FLEX Component Design & performance capabilities

2.3.1 FLEX Design Specification

Specific design requirements and the basis for requirements for the installed or portable FLEX equipment are described in ECR 13-00208 "FLEX Design Specification" (Reference 23).

The design specification includes:

1) More detailed definitions of the external hazards and basis for those hazards.

2) FLEX system and component design protection and performance requirements

3) QA Requirements for technical analysis and equipment procurement

4) Standard for reliability: With exceptions as described therein, the general standard is to ensure each function (core cooling, spent fuel cooling and containment) can be accomplished with a single active component failure. The standard established includes the reliability requirement defined in NEI 12-06 section 3.2.2 (i.e. "N+1") and extends this requirement beyond the portable equipment to include all required equipment.

2.3.2 FLEX Component List (Attachment 2A & 2B)

All of the active components and key passive components utilized for the FLEX strategy are listed in Attachment 2. Attachment 2 identifies those components essential to successful mitigation and describes its "FLEX Function". The list also describes components with significant mitigation value but not essential. For those components, the "FLEX Function" is listed as "DID" (i.e. Defense in Depth). The list also includes components which do not have an essential FLEX function but that conclusion may not be apparent. For those components, the "FLEX Function" is listed as "NO".

The component(s) which provide the redundant capability are identified. This is the basis for the conclusion that the FLEX strategy can meet the reliability standard in the FLEX Design Specification.

The component may be required for the FLEX Strategy in some or all BDBEE or Plant Modes. The specific modes for which a component function is required are described in Attachment 2.

The evaluation of the availability of each component in these external events is documented (typically by reference). The basis for availability during an earthquake, tornado or external flood is addressed in the "External Hazard Protection" and "Seismic Classification" columns. The basis for equipment availability in harsh environments (i.e. high temperature or humidity) is addressed in the "Environmental Availability" column.

The effects on the ELAP on component specific functional requirements were reviewed (Reference 70). That review is summarized in Attachment 2A.

The stored location for portable equipment is specified in Attachment 2B. The design document which established required capability for each portable component is specified in Attachment 2B.

The specific requirements for component unavailability are described in Attachment 2. The basis for these requirements is described in Section 11.4.

2.3.3 Plant Modifications

The following plant modifications were completed to implement the FLEX strategy and meet the requirements of NRC Order EA 120-049:

ECR 13-00070, FLEX Electrical Power Supply

ECR 13-00074, FLEX Storage Facility (FSF)

ECR 13-00078, FLEX Platform

ECR 13-00084, Spent Fuel Pool (SFP) Level Instrument

ECR 13-00099, Low Leakage RCP Seals

ECR 13-00164, FLEX Fuel Oil Supply

ECR 14-00031, FLEX Feedwater (FW) System

ECR 14-00032, FLEX RCS & SFP Makeup System

ECR 14-00033, FLEX Reactor Building (RB) Pressure Control

ECR 14-00501, Turbine Building Structural Improvements

ECR 15-00031, Red Page Phone for FLEX

ECR 15-00328, Main Steam (MS) System Integrity – BDB Tornado

ECR 15-00330, Main Steam System Integrity – BDB Earthquake

2.3.4 FLEX Equipment Capabilities

The following section summarizes the design & performance capabilities of the major FLEX SSCs.

2.3.4.1 FX-Y-1A or FX-Y-1B

The FLEX diesel generators are Cummins DFEK with a capacity of 500 kW (Reference 78). This equipment is qualified for operation after an SSE or with ambient temperature of 50^0C. The FLEX electrical distribution system can deliver 390 kW at the FLEX design maximum outside ambient temperature (Reference 112) or 500 kW with ambient temperature below 68^0F. This equipment is located on the FLEX platform in the Turbine Bldg. (321 elev.). This equipment is above 320 ft elevation, in a structure which was qualified for the SSE or tornado wind load, and is protected from tornado generated missiles.

A single generator can supply all FLEX strategy requirements to maintain vital instruments and operate FLEX equipment.

2.3.4.2 FX-P-1A or FX-P-1B

The FLEX RCS makeup pumps are CAT Pumps 68PFR1 (triplex plunger positive displacement pump) with the capacity to deliver 40 gpm at 2600 psig. The pump is driven by a 75HP 480VAC motor (Reference 79). This equipment is qualified for operation after an SSE or with ambient temperature of 50^0C. This equipment is located on the Control Building (CB) 322 patio area. This equipment is above 320 ft elevation, in a structure which was designed for the SSE, tornado wind load, or aircraft impact.

2.3.4.3 FX-P-2A or FX-P-2B

The FLEX feedwater pumps are Sulzer SJS-7APC (submersible multi-stage centrifugal pumps) with the capacity to deliver 175 gpm against 460 ft. TDH. The pump is driven by a 40HP 480VAC motor (Reference 80). This equipment is qualified for operation after an SSE or with ambient temperature of 110^0F. This equipment is located in the condenser pit in the Turbine Bldg. (292' elev.). This equipment is designed for submersible operation, in a structure which was qualified for the SSE or tornado wind load, and is protected from tornado generated missiles.

A single pump can supply all FLEX strategy requirements to maintain OTSG water level, SFP water level, and RCS water level when the RCS is open to atmosphere or any concurrent requirements for those functions.

2.3.4.4 FX-P-3A or FX-P-3B

These portable diesel driven pumps are Godwin HL110M with the capacity to deliver 240 gpm against 575 ft. with a 20 ft. suction lift. The pump is driven by a 144HP diesel engine (Reference 81). This equipment is stored in the FLEX Storage Facility. The FSF was designed for the SSE or tornado wind load, and protects equipment from tornado generated missiles.

A single pump can supply all FLEX strategy requirements to maintain Condensate tank level, OTSG water level, SFP water level, or SFP spray or any concurrent requirements for those functions.

2.3.4.5 FX-Y-3 and FX-P-6A or FX-P-6B

Two portable submersible pumps (FX-P-6A & 6B) are Tsurumi LH311W with the capacity to deliver 150 gpm at 200 ft. TDH. The pump is driven by a 15HP 480AC motor [Reference 82]. The pumps are stored in the Unit 1 Intake Screen and Pump House (ISPH). The ISPH was designed for the SSE or tornado wind load, and protects equipment from tornado generated missiles. The power for the motor is provided by a Cummins 350kW diesel generator (FX-Y-3) [Reference 83]. The electrical power equipment is stored in the FLEX Storage Facility.

A single pump can supply all FLEX strategy requirements to maintain Condensate tank level, Hotwell level, or SFP water level or any concurrent requirements for those functions.

2.3.4.6 Turbine Building (TB)

The Turbine Building structural integrity is essential to the FLEX strategy. The modifications completed (Reference 50) ensure the building will support access, provide tornado missile protection and support the FLEX strategy during all BDBEE.

2.3.4.7 FLEX Storage Facility (FSF)

The FLEX Storage Facility (formerly the Unit 2 River Water Pump House) provides protected storage for portable FLEX equipment (Reference 19). The structure (including access) is designed to withstand the forces of the BDBEE tornado or earthquake. Some equipment will be moved from the FSF in advance of an external flood to ensure all required equipment remains available when needed.

3 STRATEGY

3.1 FLEX Strategy Overview

ATTACHMENT 1 provides a brief overview of the strategy applicable to each combination of initial conditions and external event hazards.

SECTIONS 4, 5, 6 AND 7 of this document describe the TMI FLEX Strategy. Section 4 describes the MODE "A" "100% Power" initial condition strategy and variations applicable for each external event. Section 5 does the same for the MODE "D" "RCS Open to Atmosphere" initial condition. Section 6 and 7 describes the strategy for "Other Initial Conditions" (i.e. MODE "B" & "C").

Composite flow diagrams showing the primary equipment and flow paths used for the FLEX strategy are provided in Attachment 4.

The TMI strategy was developed using site experience with a concept similar to FLEX (Reference 5), industry initiatives in response to Fukushima (Reference 3), an independent assessment of the requirements of NRC Order EA 12-049 (Reference 4), and PWROG analysis (Reference 30 and 31).

4 MODE A FLEX Strategy

MODE "A": The Decay Heat Removal (DH) system is not service. This includes conditions with the reactor at power and with the reactor shutdown. The FLEX strategy for this mode has been evaluated for the "100% power" condition. The MODE "A" Sequence of Events is shown in Attachment 5A.

4.1 Reactor Core Cooling Strategy

4.1.1 Phase 1

All control rods are inserted due to the loss of power. This ensures the reactor is initially shutdown.

RCS letdown is isolated following the loss of offsite power. Air operated containment isolation valve, MU-V-3, closes automatically as letdown temperature rises due to the loss of Intermediate Closed Cooling water flow.

RCS temperature is stabilized within the desired band (i.e. no cooldown) until pressurizer level has been restored. RCS temperature is maximized to conserve RCS inventory and to maximize the time before the loss of inventory would interrupt single phase natural circulation.

The primary loss of RCS inventory is through the Reactor Coolant Pump (RCP) seal package. N-9000 RCP seal leakage is less than 1 gpm per pump with the pump shutdown, no cooling for the seals, RCS temperature at 550°F and RCS pressure at 2150 psig (Reference 22). Normal Controlled Bleed Off (CBO) flow is < 2.5 gpm per RCP @ RCS pressure of 2155 psig. The RCS inventory loss through the CBO path will continue until AC power and resources are available to close the CBO isolation valves (MU-V-33A, B, C, & D). The plan is to restore power to 1A Radwaste MCC and close MU-V-33A, B, C & D within six hours.

RCS pressure, temperature and rate of temperature changes will be maintained within normal operating limits. RCS temperature will be controlled with the Atmospheric Dump Valves (MS-V-4A & MS-V-4B).

The steam turbine driven emergency feedwater pump (EF-P-1) and the emergency feedwater control valves (EF-V-30A & B) will be automatically actuated to maintain adequate OTSG level for natural circulation.

RCS temperature will be maintained stable until RCS makeup has been restored. Analysis has been completed which demonstrates the conditions for natural circulation can be maintained for at least five and one-half hours without RCS makeup capability (Reference 73 and 10).

The ability to stabilize RCS temperature is dependent upon the ability to control OTSG pressure and the integrity of the pressure boundary. That boundary includes the Main Steam system piping in the Turbine Building up to the Main Turbine Stop Valves, Main FW Pump Turbine Stop Valves, Gland Steam Isolation Valve, the Turbine Bypass Valves and the "A" Main FW Piping between RB and the Main Feedwater Line A Check Valve (FW-V-12A) (Reference 74 and 75). The Main Turbine Stop Valves (TG-SV-1/4), Main FW Pump Turbine Stop Valves (MS-V-56A & B) and the Turbine Bypass Valves (MS-V-3A/F) will close automatically in response to the ELAP. Excessive steam flow paths can adversely affect RCS temperature control. If steam traps are not functioning properly, then the trap will be isolated.

The turbine gland sealing steam supply from Main Steam will be isolated (by closing MS-V-7 or GS-V-4) to ensure control of RCS temperature is maintained (Reference 59)

The 2-Hr Instrument Air system is utilized to provide remote control of Emergency Feedwater (EFW) and the Atmospheric Dump Valves (ADV) in the initial mitigation phase.

The ELAP response for an initial condition of 100% power was described above. For all other conditions in MODE "A" (i.e. DH not in service), the strategy is essentially the same, except when initial OTSG pressure less than 100 psig. In that case (OTSG pressure < 100 psig), EF-P-1 and EFW flow will not be initially available. The OTSG steam paths will be controlled to raise OTSG pressure and then place EF-P-1 in service. Core cooling will be maintained (Reference 52).

4.1.2 Phase 2

The reactor will be maintained shutdown indefinitely by injecting borated water (>2500 ppmb) to recover and maintain pressurizer level. If RCS makeup boron concentration is greater than 2500 ppmb, and RCS inventory is maintained, then the reactor will be maintained shutdown even if RCS temperature is lowered to 72F without any credit for Xenon (Reference 6). The FLEX RCS Makeup pumps (FX-P-1A or B) will use water from the BWST to restore and maintain pressurizer level.

RCS makeup with borated water will continue until the pressurizer level is raised above 300". The borated water volume added to the RCS to compensate for RCS losses and to raise pressurizer level is significantly greater than the volume assumed in Reference 6. This additional boron significantly increases reactor shutdown margin. This RCS makeup is completed before Xenon concentration is reduced significantly below the initial operating concentration.

RCS temperature is minimized to ensure the reliability of the RCP seals. Reducing the RCS temperature at the seals to less than 400^{0}F within 12 hours maintains the reliability of the seal materials and leakage remains significantly less than one GPM per RCP (Reference 66). The values for cooldown initiation time and cooldown rate used in the Flowserve evaluation (Reference 66) are consistent with and supported by the design and emergency procedures for ELAP mitigation (Refer to section 4.1.5).

The FLEX RCS makeup pumps (FX-P-1A or B) will be started within four hours to ensure RCS heat removal via the OTSG is not interrupted. Independent analyses (References 73 and 10) support the conclusion that four hours is a conservative time response requirement.

Makeup from Core Flood is not required or expected, but core flood will be maintained as a backup for RCS makeup until a reliable means to maintain a pressurizer steam bubble is established. Core Flood will be isolated when pressurizer heaters are functional to eliminate the risk of Core Flood Tank (CFT) nitrogen interrupting primary to secondary heat transfer.

When the target RCS temperature (400^{0}F) is achieved, then pressurizer level will be raised to approximately 300" to provide a significant inventory margin in case makeup capability is interrupted.

RCS temperature will not be reduced below the Low Temperature Over Pressure (LTOP) temperature limit (313^{0}F) until the recovery phase. OTSG Pressure will not be reduced below 140 psig.

Pressurizer heaters will be energized to maintain or restore a pressurizer steam bubble. If pressurizer heaters are not available, then hydraulic control of RCS pressure with makeup (using FX-P-1A or B) will be used to maintain the RCS sub-cooled.

The initial RCS pressure reduction will be accomplished by pressurizer ambient heat losses. This will be supplemented with use of the Pressurizer vent valves (RC-V-28 and RC-V-44) if necessary.

The PORV (RC-RV-2) will be maintained available as a contingency measure for limiting RCS pressure rise if cooling is temporarily interrupted.

The stable post ELAP RCS pressure is maintained at approximately 400 psig. This pressure is well above the maximum RCS pressure at which core flood tank nitrogen injection could occur (256 psig) (Response to ISE item 3.2.1.B and Reference 11).

When power is available to 1C ES Valves MCC, the Main Steam Isolation Valves will be closed. This minimizes the OTSG pressure boundary and the risk of an uncontrolled OTSG depressurization.

MS-V-4A & B will be used to control OTSG pressure and RCS temperature. A RCS cooldown will be controlled and the rate will be limited by the capability to maintain pressurizer level.

RCS conditions will be stabilized at the conditions described below within approximately 12 hours of the event:

The strategy for all MODE "A" events is to stabilize the plant in the following conditions, ensure actions are in progress to address consumable materials (condensate, fuel oil and borated water), and develop an event specific recovery plan.

Reactor Coolant System Conditions:

- Reactor Shutdown
- Core Heat Removal via single phase natural circulation with both OTSGs
- Incore temperature 390 to 400^{0}F
- RCS Pressure 375 to 400 psig (Pressurizer temperature ~ 440^{0}F), controlled with pressurizer heaters
- Pressurizer Level is above 300 inches, controlled using FX-P-1A or B
- Core Flood Isolation Valves (CF-V-1A & B) are CLOSED
- MU-V-33A, B, C & D Closed
- Total RCS leakage is less than 1 GPM

Steam Generator Conditions:

- OTSG pressure A & B is at 140 to 160 psig (OTSG temp ~ 360^{0}F), locally controlled with MS-V-4A and MS-V-4B
- OTSG A & B level is being maintained 220 to 310 inches (full range), using local control with EF-V-30A and EF-V-30B
- EF-P-1 steam supply pressure @ 150 psig. Valves (MS-V-6, MS-V-10A & B) are open under local control.
- MS-V-1A, B, C and D are CLOSED.

After OTSG pressure is below 200 psig, the FLEX feedwater pumps (FX-P-2A & B) can provide sufficient feedwater for core heat removal. FX-P-2A & B remain in standby as a backup to EF-P-1.

Local control of EF-V-30 A & B, & MS-V-4A & B and MS-V-6 will be utilized before the 2 HR air system is exhausted.

4.1.3 Phase 3

The quality condensate inventory will last at least one day (Reference 35). Before the quality condensate is depleted, FX-P-3A or B will be configured to maintain CO-T-1B inventory.

NSRC water treatment equipment will be used when available to reduce the minerals and suspended solids in the water being injected into the OTSG and spent fuel pool [Reference 35].

The BWST contains a sufficient volume of borated water to maintain RCS inventory for more than a week [Reference 39]. NSRC mobile boration equipment can be used to provide an indefinite supply.

The fuel oil supply in DF-T-1 (> 25,000 gallons) is sufficient for all FLEX strategy needs for more than a week. NSRC can provide an indefinite supply.

4.1.4 Thermal Hydraulic Analysis

RCS makeup will be restored before single phase natural circulation is interrupted. The capability of single phase natural circulation has been demonstrated by analysis, testing and experience.

The initial response to the ELAP is to stabilize RCS temperature until RCS makeup can be restored. The effect of Reactor Coolant Pump controlled bleed off (CBO) and seal leakage, and assumed initial RCS unidentified leakage at the Technical Specification limit (Reference 91) was analyzed to determine the minimum time to the point water single phase natural circulation would be interrupted.

The initial RCS loss rate due to seal leakage and controlled bleed off flow will be less 2.5 GPM/ RCP. This is a conservative value for the flow at normal operating conditions (i.e. RCS pressure at 2155 psig). After an ELAP RCS pressure will be lower and losses will be less. Once CBO flow is isolated the total loss rate per RCP will be much less than 1 GPM. A conservative RCS loss rate of 11 GPM (i.e., 4 pumps at 2.5 GPM plus an additional 1 GPM) was used for the ELAP analysis per WCAP 17792.

The analysis (Reference 73 and 10) demonstrated there is at least 5.5 hours after an ELAP before single phase natural circulation would be interrupted..

4.1.5 Reactor Coolant Pump Seals

To comply with NRC Order EA 12-049 and successfully implement the FLEX strategy at TMI1, the reactor coolant pump seals were replaced (Reference 20). The RCP seals were replaced with Flow Serve three stage N-9000 seals with an abeyance seal.

Flowserve described the capabilities of the N-9000 seal in their "White Paper on the Response of the N-Seal Reactor Coolant Pump (RCP) Seal Package to Extended Loss of All Power (ELAP)" (Reference 66).

The N-9000 seal design and testing demonstrates that the seals will not be degraded if water temperature at the seal is maintained below 560F. In the event of an ELAP, the seal temperature will rise to RCS cold leg temperature after 10 or more minutes. Automatic control (which is backed up by remote manual control) will maintain OTSG pressure between 1000 and 1020 psig (Reference 110). The peak cold leg temperature will remain below 555^0F. The RCP seal temperature will remain below 555F throughout the event.

NRC accepted the Flow Serve ELAP evaluation for N-9000 seals and requested that the following specific issues be addressed (Reference 66):

The NRC staff has considered the information submitted by Flowserve and concluded that the leakage rates proposed for the N-Seal design, as documented in Table 3 in the white paper, are acceptable for use in beyond-design-basis ELAP evaluations for demonstrating compliance with Order EA-12-049, with the following limitations and conditions:

(1) Each licensee should confirm that its plant design and planned mitigation strategy are consistent with the information assumed in the calculation performed by Flowserve, which is summarized in Table 1 of the white paper.

The values used in the Flowserve evaluation are consistent with TMI design and emergency procedures for ELAP mitigation.

	Flow Serve Evaluation	TMI Design & ELAP Response	Basis
Initial RCS Pressure, psig	2155	2155	
Peak Cold Leg Temperature, °F	555	551	As described in response #2 below, 551 is a conservative value for RCP seal fluid temperature
CBO Isolation Time, hr.	< 6	< 6	Emergency procedures have been developed and validated to complete this action in less than 6 hours.
Cooldown Initiation Time, hr.	< 4	< 4	Emergency procedures have been developed and validated to complete this action in less than 4 hours.
Cooldown Rate, °F/hr.	37	33 to 37	This cooldown rate varies with the capacity of FXP1A/B. The cooldown rate is 37 F/HR at 40 GPM and 33 F/HR at 35 GPM.
Cooldown plateau, °F (T_{COLD})	360	360 to 370	These temperatures are based on saturation temperature for OTSG pressure The operating band for OTSG pressure post ELAP is 140 to 160 psig.

(2) *Each licensee should confirm that the peak cold-leg temperature prior to the cooldown of the reactor coolant system assumed in Flowserve's analysis is equivalent to the saturation temperature corresponding to the lowest setpoint for main steam line safety valve lift pressure.*

The peak cold-leg temperature prior to the cooldown assumed in the Flowserve analysis is 555°F. The lowest nominal lift pressure for the main steam safety valves is 1040 psig for MS-V-21A & B. Saturation temperature for 1054.7 psia is 551.1°F.

(4) *In its white paper, Flowserve has generally specified leakage rates in volumetric terms. For converting the specified volumetric flow rates to mass flow rates, licensees should use a density of 62 lbm/ft3 (approximately 993 kg/m3)*

throughout the ELAP event. This condition reflects observations made during testing conducted by Flowserve that simulated a loss of seal cooling, wherein the seal leakage mass flow rate remained roughly constant as the test apparatus underwent a significant cooldown and depressurization.

The assumed RCS loss rate during the ELAP used to determine required response time to restore RCS makeup was determined in accordance with Reference 31. RCS loss rates in all other evaluations (e.g. borated water inventory requirements) used a density of 62 lbm/ft^3 to convert RCP seal loss rates into mass flow rates.

4.1.6 Shutdown Margin Analysis

Cycle specific reactivity analysis has been completed (Reference 6) which demonstrates that when all control rods insert and RCS inventory is maintained during cooldown using borated water of at least 2500 ppmb, then the reactor will remain shutdown at cold (72^{0}F) conditions without any credit for Xenon.

The reactivity analysis conservatively assumes no removal or loss of any RCS inventory, and the only borated water added is that required to maintain RCS water level for density changes below 555^{0}F. The TMI strategy injects additional boron (1) to compensate for RCS losses and (2) to raise pressurizer level when the cooldown is complete. This adds significantly more boron than credited in the analysis. For events occurring at 100% power, this boron addition is completed before Xenon would reduce below the initial equilibrium Xenon concentration.

A strategy which maintains single phase natural circulation ensures adequate boron mixing within the RCS.

4.2 Containment Strategy

4.2.1 Phase I

An active means of Reactor Building (RB) cooling is not required to maintain RB pressure below design (Reference 11).

CBO Containment isolation valve (MU-V-26) will be closed to contain RCP controlled bleed off flow (~ 10 GPM) within the RB.

At least one isolation valve is closed on each containment penetration which provides a direct path from containment atmosphere or from the RCS to the outside environment (Reference 117). Confirmation of ESAS "Reactor Trip Isolation" and closure of MU-V-3 and MU-V-26 satisfy this requirement.

4.2.2 Phase 2

No additional action is required to maintain the containment boundary.

4.2.3 Phase 3

No additional action is required to maintain the containment boundary.

4.2.4 Thermal-Hydraulic Analyses

Conservative analysis with MAAP version 4.0.6 was completed (Reference 11) to determine the peak containment pressure post ELAP. RCS leakage into containment was assumed to be 20 GPM with no active means of RB heat removal. The peak containment pressure at 7 days was less than 20 psig compared with a containment design pressure of 55 psig.

4.3 Spent Fuel Cooling Strategy

4.3.1 Phase 1

The spent fuel pool heat load will be 2.5 MW_{TH} or less. The time to boil in the spent fuel pool is greater than 40 hours (Reference 23 Appendix 5).

The spent fuel pool is a seismic class I structure located within a seismic class aircraft impact hardened structure. The BDBEE will not adversely affect the integrity of the pool, and therefore, spent fuel pool spray is not a required mitigating strategy (Reference: NEI 12-06 R0 Table D-3).

4.3.2 Phase 2

A spent fuel pool steam vent path to atmosphere will be established through the Unit 2 fuel pool area (Reference 119).

After spent fuel pool boiling occurs, FX-V-101 is used to throttle FX-P-2A or B flow to the spent fuel pool to maintain SFP Level between 23.334 and 24.667 feet.

4.3.3 Phase 3

The spent fuel pool makeup supply comes from CO-T-1B (or alternates). The tank inventory will be maintained with clean condensate as described above (section 4.1.3).

4.3.4 Thermal-Hydraulic Analyses

When the reactor is fully loaded with fuel, the maximum spent fuel pool heat load would be from a fresh refuel (i.e. 72 Fuel Assemblies (FA) replaced and it is 20 days after reactor shutdown) plus the long term spent fuel pool heat load (0.75 MW_{TH}). The heat load 2.5 MW_{TH} is conservative value determined using those assumptions and Reference 135.

Minimum spent fuel pool water level is 343.5 ft. elevation. This is the spent fuel pool low level alarm set point. To account for the effect of using spent fuel pool water, the times are also computed using a level of 339.5 ft. elevation.

The Spent fuel pool "time to boil" and "time to TAF" (top of active fuel) are shown below (Reference 23).

SFP Condition	**Heat Load (MW_{TH})**	**Makeup for boil-off (GPM)**	**SFP Water Level (Elevation)**	**Time to Boil (HR)**	**Time to TAF (HR)**
FULL CORE IN REACTOR VESSEL (MODE A,B,C) NORMAL SFP LEVEL	2.5	15.6	343.5	40.6	330.3
FULL CORE IN REACTOR VESSEL (MODE A,B,C) REDUCED SFP LEVEL	2.5	15.6	339.5	34.7	246.1

4.4 Key Systems, Structures, Components (MODE A)

4.4.1 Steam Turbine Driven Emergency Feedwater Pump (EF-P-1)

EF-P-1 is a multistage centrifugal pump driven by 835 HP steam turbine, which can supply 920 GPM at 2750 ft. of water. The pump is normally lined up to take suction from either CO-T-1A or CO-T-1B, and the discharge is routed to the EFW control valves (EF-V-30A/D) for each OTSG. The steam supply is established automatically after a loss of offsite power trips the reactor coolant pumps. The steam supply has redundant capability (i.e. either OTSG can provide the steam supply). The pump and all required support are located within a Seismic Class I Aircraft Impact hardened structure with external flood protection up to 313.5 ft elevation. The pump and all required support are designed to function during and after a Safe Shutdown Earthquake. The turbine and steam supply use local mechanical and pneumatic controls. No active support systems are required. The pump and turbine are not challenged by ambient temperatures below 150^{0}F, and the Turbine Driven EFW Pump room post ELAP is not expected to exceed 110^{0}F (Reference 123).

Before the initial instrument air supply is depleted (after approximately 3 hours), local control of the steam pressure control valve (MS-V-6) will be established. To continue to provide adequate steam supply to the turbine when OTSG pressure is lowered, local control of larger steam supply valves (MS-V-10A or MS-V-10B) is used.

Based on conservative assumptions for RCS energy losses, and other OTSG pressure boundary leakage, the EF-P-1 steam relief would not exceed core heat generation rates and challenge the ability to maintain a stable RCS temperature within 48 hours of an ELAP.

4.4.2 EFW Control Valves (EF-V-30A and EF-V-30B)

There are redundant flow paths with remote operated flow control valves to each OTSG. EF-V-30A or EF-V-30D can control flow to OTSG A, and EF-V-30B or EF-V-30C can control flow to OTSG B.

These valves and controls are designed to with seismic (SSE) forces, and are located within a Seismic Class I aircraft hardened structure (Intermediate Building (IB)). The IB is flood protected for water level up to 313.5 ft elevation.

Air pressure works against spring force to open these valves. A compressed air bottle bank provides a minimum of 2 hours of motive in an event where no air compressors are operable. Local manual operation is utilized after the air pressure source is depleted.

When the ELAP occurs, the valves are remotely controlled automatically by the Heat Sink Protection System (HSPS) to maintain OTSG water level above 50% in the operating range. The control room operator can take manual control if desired.

4.4.3 Atmospheric Dump Valves (MS-V-4A and MS-V-4B)

MS-V-4A and MS-V-4B provide remote automatic or manual control of OTSG pressure when the Main Condenser is unavailable.

These valves and controls are located on the 295 elevation of the Intermediate Building.

Air pressure works against spring force to open these valves. A compressed air bottle bank provides a minimum of 2 hours of motive force in an event where no air compressors are operable. Local manual operation is utilized after the air pressure source is depleted.

When the ELAP occurs, the valves are remotely controlled automatically by the Integrated Control System (ICS) to maintain OTSG pressure at 1010 psig. The control room operator can take manual control if desired.

4.4.4 Vital AC Instrument Power

The vital AC power system supplies power for all critical instrument and control systems. In the event of an ELAP, the vital AC power system will be energized through the inverters from the station batteries. When the ES 480VAC power systems are energized from the FLEX diesel generator the inverters will transfer to the AC source and the battery chargers will restore the station batteries.

The inverters, vital 120 VAC distribution panels, battery chargers, batteries and critical instrument systems are all designed to withstand seismic (SSE) forces, and are located within a Seismic Class I aircraft hardened structure (Control Building) above the 322 elevation.

4.4.5 Station Batteries

The vital DC power system has redundant subsystems. Each subsystem is made up of two 125VDC batteries. Each battery has a design capacity to maintain voltage for two hours with design DC load including ESAS actuation. A DC load management plan has been implemented (Reference 7 and 134) to extend the battery service up to six hours. The FLEX diesel generator will be used to restore power to the vital AC and DC power system within 4 hours.

4.5 Key Parameters (Instrumentation)

The FLEX strategy will provide electrical power to maintain the following instruments:

- A source range nuclear instrument to confirm adequate reactivity control
- A pressurizer level instrument to monitor and control RCS inventory
- A RCS pressure instrument to monitor and control RCS pressure to maintain subcooled conditions, remain above CFT nitrogen injection pressure and remain within RCS integrity limits
- Incore Temperature, OTSG pressure and OTSG level instruments available to control RCS heat removal.
- A RB pressure instrument to monitor RB conditions.
- A containment (RM-G-22 or 23) and spent fuel pool (RM-G-9) area radiation monitor.
- A spent fuel pool level instrument (SF-LI-1219 A or B).

The instruments located inside the RB which are required for the FLEX strategy have been evaluated to confirm functionality with the expected RB ambient conditions (Reference 76).

A portable radiation monitor will be used to monitor the steam effluent from the spent fuel pool (Reference 119).

A contingency plan has been established to obtain essential instrument readings without vital AC power or vital instrument systems, as required by NEI 12-06 5.3.3.1 (Reference 120).

4.6 MODE A Strategy Modifications for External Flood

4.6.1 In response to rising river water levels and prior to the ELAP & LUHS, the reactor will be shut down (Reference 96). For evaluation of the FLEX strategy, only 24 hours of preparation time is assumed before the river level exceeds the height of the dike.

The following plant conditions will be established before the river level exceeds the height of the dike (304.5' elevation at the ISPH) (i.e. would be the initial conditions if the ELAP or LUHS occurred):

- Flood Barrier System in place

- Alternate air supply (EG-P-20A & B) for Aux & FH Building Missile Shield Door Seals is connected
- Reactor Shutdown (for > 18 hours). RCS is borated to CSD boron concentration
- OTSG pressure at approximately 150 to 165 psig (ADV or TBV control).
- Incore temperature at 375°F (with RC-P-1A & B operating) or 400°F (if RCP are not operating).
- Main or Emergency FW is being used to maintain OTSG level 97 to 99% Operating Range.
- CF-V-1A & B are closed
- Pressurizer level is between 200 to 220 inches
- Pressurizer heater groups 8 and 9 are connected to ES power
- CBO Isolation valves (MU-V-33A/D) are closed on all shutdown RCP
- Turbine speed < 4 RPM and Main Generator is filled with CO2 or air.
- FLEX preparations are complete
  - FX-T-2 fuel oil tank is filled (> 5000 gallons)
  - Power cables are connected to FX-P-2A/B and FX-P-5A/B
  - FX-P-5A or B discharge hose is connected to FX-T-3
  - FX-P-7 discharge hose is connected to FX-T-2
  - FX-P-2A & B discharge hose is installed to FX-V-205
  - FX-V-203 is open and FX-V-213 is Closed
  - Blind flanges removed at FX-V-210A & B
  - HOSE from FX-V-208 to FX-V-113 is installed
  - EF-V-67A & B are open
  - SF valves from BWST to FX-P-1A & B are opened

- FX-P-3A, one FX-P-4 and one FX-Y-4 are relocated to the training center. FX-TRUCK, FX-P-3B, at least one FX-P-4 and at least one FX-Y-4 remain in the FSF.

Prior to the river level exceeding 305 ft elevation (with or without ELAP),

- Condenser vacuum will be broken
- MS-V-7 is closed.
- Condensate lineup (all sources to both EF-P-1 and FX-T-1A & B) is completed. CO-T-1A, CO-T-1B and DW-T-2 will be lined up to the hotwell, FX-T-1 and EF-P-1 (CO-V-111A, DW-V-35, DW-V-30 & CO-V-8 OPEN).
- Unprotected DC loads are isolated

4.6.2 Phase 1

The ELAP & LUHS are assumed to occur when the river level exceeds to top of the dike (i.e. river level at 304.5' elevation at ISPH).

If the ELAP & LUHS occur, then operators will throttle MS-V-4A and MS-V-4B to control steam pressure to 150 psig to minimize the rise in T_{AVG} and pressurizer level as natural circulation develops. Operator throttles EF-V-30 valves to maintain OTSG level. EF-P-1 provides the capability to feed the OTSGs.

With the initial pressurizer conditions (pressurizer temperature @ 450°F and level between 200 to 220 inches) RCS inventory will support natural circulation for much greater than six hours without makeup.

Basis: The analysis for an event at 100% power (reference 73) demonstrates there is at least five and one-half hours. There are two significant differences: (1) In this case, there is no RCS temperature reduction or shrinkage. Therefore, a much greater RCS inventory loss must occur before Natural Circulation is lost and (2) the total RCS leakage is less than 3 GPM(CBO has been isolated on two RC pumps and the leak rate from the other two pumps is greatly reduced due to lower RCS pressure.) versus 11 GPM assumed in Reference 73.

4.6.3 Phase 2

RCS heat removal continues using EF-P-1. Well within 4 hours, FX-Y-1A or 1B has been placed in service. FX-P-2A & B are available to provide a backup feedwater capability, at any time.

Pressurizer heaters are energized to maintain RCS pressure. Either FX-P-1A or FX-P-1B (taking suction from the BWST) can be used to maintain pressurizer level.

Prior to river level exceeding 313' elevation, the following actions will be completed:

- MU-V-251 is opened and FX-V-108 is closed
- MU-V-16C and MU-V-16D are opened
- 1A Radwaste MCC will be energized and remaining CBO isolation valves (MU-V-33A/D) are closed.
- Spent Fuel Pool area vent path is has been established
- SF-V-41 and SF-V-88 are OPEN (SFP Makeup Path)

- MS-V-4A and MS-V-4A are placed in local manual control

As river level approaches 313' elevation, operators will withdraw from the Intermediate Building, Auxiliary Building and lower elevation of Control

- FX-P-2A or B will be started
- EF-V-30A & B will be closed.
- OTSG level will be controlled using FX-V-206A & B
- With MS-V-4 in a fixed position, OTSG Pressure will slowly decrease as core decay heat generation rate decreases

4.6.4 Phase 3:

The FLEX design flood hazard period of inundation is 3 days. The quality condensate inventory will last approximately six days. After this time, flood water can be used indefinitely.

After the river level has receded below 305' elevation, the flood water in the condenser pit provides a water supply for at least 5 days (Reference 35). FX-P-3A or FX-P-3B (or similar equipment from NSRC or another Exelon site) will be lined up to pump river water into condensate tank "B" to replenish the condensate inventory indefinitely.

NSRC water treatment equipment will be used when available to reduce the minerals and suspended solids in the water being injected into CO-T-1B, the OTSG and spent fuel pool.

The fuel oil supply in FX-T-2 will last approximately six days (Reference 21). The fuel supply in FX-T-2 can be replenished using an NSRC air lifted 500 gallon fuel oil container placed on the Control Building roof. Fuel can be drained from there into FX-T-2.

4.7 MODE A Strategy Modifications for Earthquake

4.7.1 Phase 1

After an earthquake CO-V-13 and CO-V-24 are closed to minimize the potential loss of condensate due to a loss of main condenser hotwell integrity or other non-seismic condensate piping failures.

Fire Service pumps will be shut down or piping isolated, if required, to prevent spray or flooding from failed FS piping from threatening the capability to accomplish FLEX functions.

4.7.2 Phase 2

Operators may not be able to be close MU-V-33 A, B, C or D if the 1A Radwaste MCC or power cables routed to these valves are damaged by the earthquake. With the additional RCS loss rate without CBO isolation, the BWST contains a borated water supply to FX-P-1A or B which will last more than a week (Reference 39).

Hydraulic control of RCS pressure will be required if the emergency pressurizer heaters or their power supply are damaged by the earthquake.

4.7.3 Phase 3

If the earthquake caused a failure of York Haven Dam, then FX-P-6A or B will be utilized to pump river water from ISPH into CO-T-1B to replenish the condensate inventory.

4.8 MODE A Strategy Modifications for Tornado

4.8.1 Phase 1

If the National Weather Service (NWS) establishes a tornado "warning" in the TMI area, then the main steam drain valves (MS-V-36A, B, C, & D) will be closed.

If CO-T-1B is damaged by tornado missiles, then (1) the EFW pump recirculation isolation valve (CO-V-176) is closed to limit the loss of condensate and (2) the tank will isolated (by closing CO-V-10B) or the supply will be controlled to prevent losses when FX-P-2A or B are used.

4.8.2 Phase 2

If a tornado missile damages the BWST, then the Spent Fuel Pool will be used for RCS makeup. Within 4 hours, FX-Y-1A or 1B has been placed in service to provide RCS makeup. When RCS temperature is at 400^{0}F, RCS makeup will continue until Pressurizer level is above 360 inches.

FX-P-1A or B remains available for RCS makeup while spent fuel pool temperature remains below 150^{0}F. It will be more than 20 hours after ELAP before Spent Fuel pool temperature exceeds 150^{0}F [Reference 39].

The "C" Reactor Coolant Bleed Tank (WDL-T-1C) normally contains greater than 50,000 gallons of borated water (> 2200 ppmb). The "C" Waste Transfer Pump (WDL-P-6C) can be used to transfer water from a WDL-T-1C to FX-P-1A/B suction header (via FX-V-111) [Reference 39]. This provides an alternate

borated water supply until the river water and NSRC borated water supply is available.

4.8.3 Phase 3

By raising pressurizer level above 360 inches prior to securing FX-P-1A & B due to high SFP temperature, pressurizer level can be maintained above the pressurizer heater operation limit (80 inches) until 66 hours after ELAP (without use of WDL-T-1C) [Reference 39].

NSRC equipment will be used to add boron to treated river water and mix, heat and store the borated water. FX-P-4 will be used to transfer the borated water to FX-P-1A or B suction header. The NSRC equipment should be on site after approximately 24 hours and borated water source will be available within 48 hours [Reference 39].

FX-P-3A or 3B can be utilized to pump river water into CO-T-1B to replenish the condensate inventory, and to supply water to the NSRC borated water skid. If a tornado should damage CO-T-1B, an alternate path is available through EX-T-1 to the hotwell.

4.9 MODE A Strategy Modifications for Extreme Cold

4.9.1 Phase 1

When extreme cold weather is predicted, actions are taken to minimize risk and ensure adequate preparations (Reference 94).

4.9.2 Phase 2

CO-T-1A and DW-T-2 will be drained into the hotwell where steam from the OTSG (via local control of Turbine Bypass Valve MS-V-3C) can be used to maintain the water temperature above 40^0F (Reference 124).

Power will be restored to the BWST immersion heater (powered from 1A ESF MCC) to maintain BWST temperature above 40^0F (Reference 35). MU Pump suction pressure indication can be used to monitor BWST level if required (Reference 120).

A temporary connection from Main Steam to CO-T-1B will be used to maintain CO-T-1B temperature above 40^0F (Reference 35 and 124).

If ice or snow prevents practical use of FX-P-3A or B, then FX-P-6A or B can be utilized to pump river water into CO-T-1B to replenish the condensate inventory (Reference 35 & 41).

4.9.3 Phase 3

No modifications

4.10 MODE A Strategy Modifications for Extreme Heat

4.10.1 Phase 1

When extreme hot weather is predicted, actions are taken to minimize risk and ensure adequate preparations (Reference 94).

4.10.2 Phase 2

No modifications

4.10.3 Phase 3

No modifications

4.11 MODE A Contingency Strategies

Additional contingency strategies have been implemented to address failures beyond those described in section 2 to provide additional "defense in depth". These failures and the contingency strategy are not part of the baseline strategies (described in section 4.1 through 4.10). One of these additional failures can be mitigated as described below.

4.11.1 Failure of EF-P-1 (or any unrecoverable loss of EFW before cooldown is completed to enable use of FX-P-2A or FX-P-2B):

In an ELAP, if EFW is lost and OTSG pressure is less than 300 psig, then the Atmospheric Dump Valves will be opened to lower OTSG pressure to 150 psig and FX-P-2A or FX-P-2B will be used to maintain OTSG water level and single phase primary to secondary heat transfer.

In an ELAP, if EFW is lost and OTSG pressure is above 300 psig, then the single phase natural circulation will be lost when OTSG water level is no longer adequate. The loss of primary to secondary heat transfer will cause RCS temperature and pressure to rise. The PORV and RCS code safety valves will lift and discharge steam to the RCDT & eventually the RB. During this time, the Atmospheric Dump Valves will be opened fully and FX-P-2A or FX-P-2B will be placed in service to feed the de-pressurized OTSGs. When the loss of RCS inventory lowers RCS water level such that there is steam within the OTSG tubes, boiler condenser cooling (BCC) will be used for RCS heat removal and core cooling (Refer to section 4.11.8).

Establishing RCS makeup remains a high priority.

4.11.2 Failure of FX-P-1A or B discharge piping to the RCS

If a BDBEE has damaged the FX-P-1 discharge flow path in the Control Building, Turbine Building or Fuel Handling Building, then the following alternate path will be used for RCS makeup.

Threaded fittings on FX-P-1A or FX-P-1B discharge will be dis-assembled, and temporary fittings (FX-HOSE-B-X1) will be used to attach a hose (FX-HOSE-B1) to the discharge of FX-P-1A or B. The other end of the hose (FX-HOSE-B1) will be connected to an installed high pressure standpipe (FX-HOSE-B-X2). The standpipe will route flow from the south end of CB 322 patio to the Fuel Handling Building (FHB) 305 area below. Sections of hose (FX-HOSE-B2) will be used to connect the standpipe (FX-HOSE-B-X2) to a hose splitter (FX-HOSE-B-X3) and hoses (FX-HOSE-B3) to MU-V-143C and MU-V-143D (at RB wall at north end of FHB 305' elevation).

This path provides an acceptable alternative to the installed high pressure piping with the following limitations: (a) time to restore makeup will be within 5.5 hours, and (b) this path can deliver 40 GPM with against RCS pressure below 2100 psig (Reference 88).

4.11.3 Failure of FX-P-1A or B suction piping from SF-V-87

If a BDBEE has damaged the FX-P-1 suction flow path in the Control Building or Fuel Handling Building, then the following alternate path will be used for RCS makeup.

The installed 1.5 inch suction hose at FX-P-1A or FX-P-1B will be disconnected and adaptor (FX-HOSE-Z-X2) will be used to connect hose (FX-HOSE-B1) to FX-P-1 suction. The other end of the hose (FX-HOSE-B1) will be connected to the installed high pressure standpipe (FX-HOSE-B-X2). The standpipe will route flow from the south end of CB 322 patio to the FHB 305 area below. Sections of hose (FX-HOSE-Z) will be used to connect the standpipe (FX-HOSE-B-X2) to an adaptor (FX-HOSE-Z-X3) installed near SF-V-87. The flanged pipe section which includes SF-V-87 will be removed to allow the adaptor (FX-HOSE-Z-X3) to connect to a 4 inch pipe flange from the BWST (SF-V-36) or Spent Fuel Pool (SF-V-37) to hose FX-HOSE-Z.

This path provides an acceptable alternative to the installed piping with the following limitation. The time to restore makeup will be less than 5.5 hours (Reference 88).

4.11.4 Failure of cable between EE-PNL-FX-XFR and EE-PNL-FX-2 in the Turbine Building

If a BDBEE has damaged the FX-Y-1A/B output cable to the ES bus where it is routed through the Turbine Building, then the following alternate paths will be used to provide FLEX electrical power.

Eight 300' lengths of 4/0 cable with TPC connectors (FX-CABLE-D) will be used to connect to EE-PNL-FX-3A (or EE-PNL-FX-3B) (at FLEX Platform) to 1A ES MCC Unit 15A (EE-MCC-ES-1A-BK1). Eight adapter cables (FX-Cable-B1) are also required. Both ES 480V power systems can be supplied for all FLEX needs using this alternate connection strategy.

To isolate the failed cable, EE-PNL-FX-BK1 will be opened. EE-PNL-FX will be energized by connecting four 30' lengths of 4/0 cable with TPC connectors (FX-CABLE-B) between EE-PNL-FX-3A (or EE-PNL-FX-3B) to EE-PNL-FX-4 (both at FLEX Platform). Four adaptor cables (FX-CABLE-D2) will also be required. EE-PNL-FX can be energized to supply FX-P-2A or FX-P-2B, and FX-Y-1A/B auxiliary loads using this alternate connection strategy. If this power supply method is used the FLEX diesel generator voltage will be controlled at 103%.

This path provides an acceptable alternative to the installed power cable with the following limitation, the time to restore makeup will be within 5.5 hours (Reference 88).

4.11.5 Loss of ability to feed OTSG with FX-P-2A, FX-P-2B or EF-P-1

If EF-P-1 has failed and FX-P-2A and FX-P-2B are also unable to provide feedwater to the OTSG, then the B.5.b strategy (OP-TM-424-921) or the following alternate method will be used to feed the OTSGs.

FX-P-3A or B will be set up to use river water. The discharge will be routed into the Turbine Building using hose (FX-HOSE-X). The hose (FX-HOSE-X) will be connected to the Main FW header using an adaptor (FX-HOSE-F-X6).

Main Feedwater valve FW-V-5A will be manually opened, and FW-V-17A will be locally throttled open to control flow to the OTSG "A" Main FW nozzles. A similar flow path through FW-V-5B and FW-V-17B can be used to feed OTSG "B".

This method provides an acceptable alternative for OTSG feedwater with the limitation that raw water is used until NSRC water treatment equipment is functional (Reference 88).

4.11.6 Loss of ability to makeup to the Spent Fuel Pool with FX-P-2A or FX-P-2B

If a BDBEE has damaged the FX-P-2A (B) flow path through the Turbine Building to the spent fuel pool, then the following alternate method will be used to makeup to the spent fuel pool.

A parallel path from the discharge from FX-P-3A (or B) can be established using a tee (FX-HOSE-F-X4), a valve (FX-V-306) and hose sections (FX-HOSE-X) connected to the SFP makeup standpipe (located in the Fuel Handling Building). The SFP makeup standpipe (reference 87) provides the flow path to a hose (FX-HOSE-X) which is routed from the standpipe into the Spent Fuel pool.

This method provides an acceptable alternative for Spent Fuel Makeup. NSRC water treatment equipment should be in service before makeup is required (Reference 88).

4.11.7 "Asymmetric Cooldown": If damage to equipment, or other conditions delay the restoration of RCS Makeup (i.e. it is not expected to be restored within 5 hours), then the following actions will be performed to maximize the availability of single phase natural circulation and RCS heat removal using one OTSG.

- CLOSE MS-V-4A, MS-V-10A and MS-V-13A
- THROTTLE OPEN MS-V-4B to establish 5 to 10^0F/hr cooldown rate

If single phase Natural Circulation is maintained, RCS makeup is available and pressurizer level has been restored to 100 inches, then operators will (1) Throttle closed MS-V-4B and throttle open MS-V-4A to stabilize RCS temperature and restore Natural Circulation in both loops.(2) Resume primary FLEX strategy using both OTSGs for RCS cooldown to conditions in section 4.1.2.

If BOTH hot legs become saturated, then Boiler Condenser Cooling (Section 4.11.8) will be used for core cooling.

Basis: RCS heat removal from the "A" OTSG is temporarily terminated and a very slow cooldown is initiated using the "B" OTSG. As RCS pressure continues to lower, the fluid in the top of the "A" hot leg will flash to steam. This process can be accelerated by the hot fluid being pushed out of the pressurizer, and rising to the top of the "A" hot leg. The "A" hot leg inventory is used like the pressurizer to minimize the RCS pressure reduction and makeup inventory to maintain the reactor vessel (RV) and "B" hot leg subcooled (Reference 100, Vol. 3 Chapter III.I, Section 3.5).

4.11.8 "Boiler Condenser Cooling (BCC)": If loss of RCS inventory, an undesired RCS cooldown or another cause results in saturated conditions in BOTH hot legs, then the actions described below will be implemented to maintain RCS heat removal and core cooling.

BCC is a condition where the RCS is saturated and the RCS water level is above the top of the active fuel and below OTSG upper tube sheet. Feedwater and OTSG steam pressure control are available. Steam bubbles are generated in the RV and flow up through the hot legs to the OTSG. The primary side steam in the OTSG tubes is condensed in the OTSG.

In this ELAP contingency, when complete steam voiding of the hot leg "candy canes" initially occurs, stable single phase natural circulation mode of RCS heat removal will be interrupted.

The loss of primary to secondary heat transfer will cause RCS temperature and pressure to rise. The PORV and RCS code safety valves will lift and discharge steam to the RCDT and eventually to the RB (NOTE: Operators will "deep cycle" the PORV to minimize PORV cycles).

During this period, the Atmospheric Dump Valves will be opened fully and FX-P-2A or FX-P-2B will be placed in service to feed the de-pressurized OTSGs.

When the loss of RCS inventory lowers RCS water level such that there is steam within the OTSG tubes (and EFW is available), boiler condenser cooling (BCC) will begin.

If RCS inventory is controlled, BCC will maintain a stable RCS temperature at the desired condition. The RCS remains saturated. The mitigation objective is to lower RCS temperature and pressure as low as possible to maximize RCP seal reliability without lowering RCS pressure to the pressure where Core Flood Tank nitrogen injection could occur (256 psig) (Reference 36 result modified by the assumption that CFT has heated up the RB ambient temperature at 24 hours after ELAP (from Reference 11)). If CF-V-1A & B are closed, then there is not a lower bound on RCS temperature. If CF-V-1A or B is open, then the hot leg vent valves will be opened (i.e. to minimize the accumulation of non-condensable gases in the top of the hot legs) and RCS pressure will be stabilized above 250 psig. If EF-P-1 is not available, then feedwater flow (versus OTSG pressure and water level) will be adjusted to control RCS temperature.

After RCS temperature is stabilized, RCS makeup will refill the RCS and can interrupt BCC. Loss of Primary to Secondary Heat Transfer (PSHT) and RCS pressurization to the safety valves can be avoided by reducing RCS makeup and limiting RCS water level below the point where RCS pressure and temperature begin to rise.

Basis: Reference 100, Vol. 3 Chapter III.B

5 MODE D FLEX Strategy

MODE "D": The RCS is open to Reactor Building (RB) atmosphere through an area greater than the "RCS Minimum Vent Area". The MODE "D" Sequence of Events is shown in Attachment 5D.

5.1 Reactor Core Cooling Strategy

5.1.1 Phase 1

If the fuel transfer canal is not filled, then BWST gravity drain provides the initial means of core cooling and RCS inventory control (Reference 8).

At the most limiting initial condition (72 hours after reactor shutdown and RCS water level at 24" above cold leg centerline), RCS will boil in as little at 15 minutes. Gravity drain flow from the BWST or SFP will be established to maintain RCS water level. The flow will be controlled outside the reactor building using local valve operation and remote level indication.

After an ELAP, the RCS will heat up to a boiling condition and water level will be maintained. Core heat will be removed via steam flow through RCS openings. A steam flow path capable of preventing any significant rise in RCS pressure can be achieved with two OTSG upper inspection port covers removed or through the spacer openings in one OTSG upper manway cover depending (Reference 8).

5.1.2 Phase 2

RB venting (using LR-V-3) will be initiated to limit RB Pressure to ensure gravity drain RCS makeup capability remains adequate (References 11 and 8).

When the FLEX power supply is energized, FX-P-2A & B can be used to maintain RCS water level. A flow rate of 56 gpm is sufficient to maintain RCS and spent fuel pool level (Reference 23 Attachment 5).

5.1.3 Phase 3

Core is being cooled by steam relieved to RB atmosphere. RCS water level is being controlled using non-borated makeup from a condensate source (CO-T-1B) propelled by FX-P-2A or B. Based on different initial conditions, RCS water level could be anywhere between 316' elevation (24" on Drain Down level Instrument) and 346' elevation (Pressurizer Level at 376")

RB pressure is less than 7.5 psig. Steam is being released to atmosphere via LR-V-3 (Reference 11)

The quality condensate inventory will last at least one day (Reference 35). FX-P-3A or B will be used to maintain CO-T-1B inventory.

NSRC water treatment equipment will be used when available to reduce the minerals and suspended solids in the water being injected into the RCS and spent fuel pool [Reference 35].

The fuel oil supply in DF-T-1 is sufficient for all FLEX strategy needs for more than a week. NSRC can provide an indefinite supply.

5.1.4 Thermal Hydraulic Analysis

Analysis has been completed which demonstrates the feasibility and capability of gravity drain core cooling from the BWST or the Spent Fuel Pool (Reference 8).

The following table provides the minimum BWST or SFP level, for a reactor shutdown at least 60 hours, for a given RCS vent area (either one OTSG upper primary manway open with 2" spacer and NES shield installed OR TWO OTSG upper hand hole covers removed and fan/filter rig (Reference 140) installed).

	Rx SD Greater than 60 hours
Minimum BWST LEVEL (feet) for adequate core cooling (RCS vent through spacers for one upper OTSG manway)	28.6
Minimum SFP LEVEL (feet) for adequate core cooling (RCS vent through spacers for one upper OTSG manway)	335.8
Hr. of core cooling per foot of BWST	1.71
Duration (hr.) if BWST initial level is 52 feet	40.0
Hr. of core cooling per foot of SF Pool	4.21
Duration (hr.) if SFP initial level is 346 feet	43.0

These times demonstrate there is adequate time to place the FLEX power supply and FLEX feedwater pumps (FX-P-2A & B) in operation.

5.1.5 Shutdown Margin Analysis

The reactor is shutdown and the RCS boron concentration is above Cold Shut Down (CSD) boron concentration when the event begins.

The RCS water level is maintained stable. When boiling occurs, RCS makeup will be from a water source with boron concentration above 2500 ppmb (i.e. BWST or Spent Fuel Pool) for less than 12 hours.

A highly borated water source is used initially to ensure RCS conditions (i.e. water level) are stable. The evaporation process and highly borated makeup will raise the boron concentration in the RV. To preclude potential core cooling problems caused by boron precipitation, a non-borated water source is preferred after 8 hours (Reference 57).

Process controls for recovery of DH system operation will ensure non-borated water in DH system piping is managed to prevent a reactivity challenge when forced flow with DH is restored (Reference 111).

5.2 Containment Strategy

5.2.1 Phase I

The equipment hatch is installed whenever the time to boil is less than 45 minutes. When the hatch is removed, then maintenance personnel are prepared to install the hatch within 45 minutes of notification (Reference 116). Emergency operating procedures will ensure the hatch is installed and containment isolation valves are closed as needed to provide a barrier between containment and the outside environment (Reference 118).

5.2.2 Phase 2

RB venting (through LR-V-3) will maintain RB pressure below the pressure rating of any temporary RB closures (Reference 11 and 115).

If failures beyond the design considerations for FLEX occur and radioactive material release is detected, then containment can be isolated by closure of LR-V-3.

5.2.3 Phase 3

RB pressure is less than 7.5 psig. Steam is being released to atmosphere via LR-V-3 (Reference 11).

5.2.4 Thermal-Hydraulic Analyses

Analysis completed using MAAP shows that venting the RB using LR-V-3 alone can limit the peak RB pressure to 7.3 psig assuming the event occurs with the reactor shutdown for 60 hours (Reference 11).

5.3 Spent Fuel Cooling Strategy

5.3.1 Phase 1

With minimum spent fuel pool water level (at low level alarm) and core offloaded into the spent fuel pool, the spent fuel pool would take more than 11 hours to boil and there is at least 93 hours before the spent fuel pool water level would reach the top of the active fuel.

5.3.2 Phase 2

The fuel in the spent fuel pool is being cooled by steam relieved to FHB atmosphere. FHB pressure is maintained near atmospheric by releasing steam to atmosphere through the U2 FHB stairwell and access to FHB roof. Spent fuel pool water level is being controlled using non-borated makeup from a condensate source (CO-T-1B) propelled by FX-P-2A or B. Spent fuel water level is between 20 and 24.7' (SF-LI-1219). A flow rate of 56 gpm is sufficient to maintain RCS and spent fuel pool water level. (Reference 23 Attachment 5)

A spent fuel pool steam vent path to atmosphere will be established through the Unit 2 fuel pool area (Reference 119).

The spent fuel pool is a seismic class I structure located within a seismic class aircraft impact hardened structure. The BDBEE will not adversely affect the integrity of the pool, and therefore, spent fuel pool spray is not a required mitigating strategy (Reference: NEI 12-06 R0 Table D-3).

5.3.3 Phase 3

See section 5.1.3

5.3.4 Thermal-Hydraulic Analyses

When the reactor is not fully loaded, the "design basis" spent fuel pool heat load is used (Reference 136 and section 9.4.1 in reference 53). This is the maximum postulated heat load which is based on (1) a full core offload 134 hours after shutdown and (2) a normal core offload (80 FA) 36 days after reactor shutdown and (3) the long term heat load. The heat load of 8.9 MWTH is documented in reference 136 Table 6.1. The spent fuel pool time to boil and time to TAF were determined (Reference 23).

SFP Condition	Heat Load (MW_{TH})	Makeup for boil-off (GPM)	SFP Water Level (Elevation)	Time to Boil (HR)	Time to TAF (HR)
FULL CORE IN SFP (MODE D) SFP at LOW LEVEL ALARM	8.9	55.6	343.5	11.6	93
FULL CORE IN SFP (MODE D) SFP LEVEL REDUCED for RCS Makeup	8.9	55.6	339.5	9.7	71.9

5.4 Key Systems, Structures, Components

The station batteries and vital instrument systems as described in section 4.4.

5.5 Key Parameters (Instrumentation)

The FLEX strategy will provide electrical power to maintain the following instruments:

- A source range nuclear instrument to confirm adequate reactivity control
- A pressurizer level or RCS drain down instrument to monitor and control RCS inventory
- Incore Temperature (consistent with commitment in GPUN response to GL 88-17), available to monitor core heat removal.
- A RB pressure instrument to monitor RB conditions.
- A containment (RM-G-22 or 23) and spent fuel pool (RM-G-9) area radiation monitor.
- A spent fuel pool level instrument (SF-LI-1219 A or B).

The instruments located inside the RB which are required for the FLEX strategy have been evaluated to confirm functionality with the expected RB ambient conditions (Reference 76).

The installation process for temporary RCS water level instruments (RC-LT-1037 & RC-LT-1138) will ensure electrical connections in the RB are sufficient for the instrument function in post ELAP environment (Reference 126).

A portable radiation monitor will be used to monitor the steam effluent from the spent fuel pool (Reference 119).

A portable radiation monitor will be used to monitor the steam effluent from the reactor building (Reference 121).

A contingency plan has been established to obtain essential instrument readings without vital AC power or vital instrument systems, as required by NEI 12-06 5.3.3.1 (Reference 120).

5.6 MODE D Strategy Modifications for External Flood

For evaluation of the FLEX strategy, only 24 hours of preparation time is assumed before the river level exceeds the height of the dike. The following plant conditions will be established before the river level exceeds the height of the dike (304.5' elevation at the ISPH) (i.e. would be the initial conditions if the ELAP or LUHS occurred):

- RCS inventory will be maximized. The most desirable condition is to have the Fuel Transfer Canal filled. The minimum RCS water level is above 321' elevation (i.e. top of RV flange or 76" Pressurizer Level or 84" Drain Down Level). If the Fuel Transfer Canal (FTC) was filled, then FH-V-1A and B will be open.
- RB equipment hatch is installed
- Containment closure has been completed
- Flood Barrier System in place
- Alternate air supply (EG-P-20A/B) for Aux & FH Bldg. Missile Shield Door Seals is connected
- Reactor Shutdown (for > 84 hours)
- RCS is borated to RSD boron concentration

FLEX Preparations are completed:

- FX-T-2 is filled (approximately 5000 gallons)
- Power cables connected from EE-PNL-FX to FX-P-2A or B and from EE-PNL-FX-1 to FX-P-5A or B

- FX-P-5A or B discharge hose is connected to FX-T-3
- FX-P-7 discharge hose is connected to FX-T-2
- FX-P-2A & B discharge hose is installed
- FX-V-203 is open and FX-V-213 is Closed
- Blind flanges removed at FX-V-210A & B
- HOSE from FX-V-208 to FX-V-113 is installed
- Minimum of 200,000 gallons in CO-T-1A or CO-T-1B or Hotwell. Flow path to FX-T-1 is lined up (e.g. CO-V-8 and CO-V-13 open)
- If DW-T-2 level > 15' then open DW-V-30 and DW-V-35, to make DW-T-2 available to FX-P-2A/B.
- Power cable connected from FLEX 480V panel to 1A RB H&V MCC (for Industrial Cooler operation) is installed
- FX-P-3A, one FX-P-4 and one FX-Y-4 are relocated to the training center. FX-TRUCK, FX-P-3B, at least one FX-P-4 and at least one FX-Y-4 remain in the FSF.

Prior to the river level exceeding 305 ft elevation (with or without ELAP),

- Condensate lineup (to FX-T-1A & B) is completed. CO-T-1A, CO-T-1B and DW-T-2 will be lined up to the hotwell and FX-T-1 (CO-V-111A, DW-V-35, DW-V-30 & CO-V-8 OPEN).

- Unprotected DC loads are isolated

5.6.1 Phase 1

When ELAP & LUHS occurs, DH cooling is lost. If the FTC is filled, then it will be greater than 10 hours until either the RCS or SFP reaches boiling (Reference 23 Appendix 5). If RCS water level is at the minimum (321' elev.) at the minimum time after reactor shutdown, then RCS boiling begins in 40 minutes (It would take 6 hours to reach TAF). Gravity drain from the BWST will be used to initially maintain core cooling if FTC is not filled.

5.6.2 Phase 2

Prior to river level exceeding 313' elevation, the following actions will be completed

- Lineup for FX-P-2A & B is completed
- If FTC is filled, then when boiling begins, RCS & SFP water level is controlled at FX-V-101 using FX-P-2
- If FTC is not filled, then after 8 hours, RCS makeup is transitioned from gravity drain to FX-P-2A & B with flow controlled at FX-V-101

As river level approaches 313' elevation, operators will withdraw from the Intermediate Building, Auxiliary Building and lower elevations of the Control Building:

- If the FTC is not filled, then SF-V-41 is opened prior to exiting the building.

Containment conditions are not significantly affected until after RCS boiling begins. Normal containment cooling (AH-C-1 or AH-C-1B) will be placed in service within 4 hours to cool the containment atmosphere and limit the rise in RB pressure to less than 5 psig.

5.6.3 Phase 3

No modifications

5.7 MODE D Strategy Modifications for Earthquake

If the earthquake caused a failure of York Haven Dam, FX-P-6A or B can be utilized to pump river water from ISPH into CO-T-1B to replenish the condensate inventory.

5.8 MODE D Strategy Modifications for Tornado

If tornado damage causes loss of the BWST inventory, the spent fuel pool is used for gravity drain core cooling.

5.9 MODE D Strategy Modifications for Extreme Cold

DW-T-2, CO-T-1A or CO-T-1B will be drained into the hotwell. Portable propane heaters will be located around the hotwell in the condenser pit to maintain the hotwell temperature above 40F.

If ice and snow prevent use of FX-P-3 to draw water from the river, FX-P-6A (6B) will be utilized to pump river water into the hotwell to replenish the condensate inventory. A portable propane heater will be used in the ISPH. The river channel to the ISPH is well below river level and would not be obstructed by surface ice.

6 MODE B FLEX Strategy

MODE "B": The DH system is in service (DH-V-1, 2 & 3 were open) AND the RCS is Filled (RCS Pressure > 20 psig). The MODE B Sequence of Events is shown in Attachment 5B.

The Containment and Spent Fuel cooling strategy is the same as for MODE "A"

6.1 Reactor Core Cooling Strategy

These conditions occur both during plant cooldown and during plant heat-up. The OTSG will be used for RCS heat removal. The core cooling strategy is similar to MODE "A" except as described below.

In all MODE "B" conditions, the OTSG water level is maintained at "flooded nozzle" conditions (between 97 and 99% operating range) (Reference 131 and 132). If an ELAP occurred, the steam turbine driven EFW pump (EF-P-1) is not available to maintain core cooling. In MODE "B", the initial water level in the OTSG provides RCS heat removal and core cooling. Actions will be initiated to promptly establish feedwater to the OTSG using FX-P-2A or B. In any MODE "B" event there is at least 2.5 hours to initiate feedwater before natural circulation is interrupted (Reference 52).The core will heat up the RCS, and the water in the OTSG will cool the water in the tubes and initiate natural circulation. FX-P-2A or B will be used to restore feedwater within 2.5 hours.

In a MODE "B" event, the heat-up of RCS fluid will cause RCS pressure to rise. To prevent a challenge to RCS integrity outside containment (i.e. DH system) DH-V-12A and DH-V-12B will be closed. A conservative evaluation of the peak RCS pressure in these events concluded that RCS pressure would be less than 570 psig (Reference 52). The instruments and controls for the PORV are powered from 120V vital power and the PORV is available for further defense in depth to limit RCS pressure as needed.

In this event, RCS makeup must be restored but the priority is reversed from MODE "A" events. FX-P-1A or FX-P-1B will be placed in service to maintain Pressurizer water level. Emergency pressurizer heaters will be energized to control the Pressurizer steam bubble and RCS pressure.

The post ELAP conditions are similar to MODE "A" but at lower RCS temperature and pressure.

The strategy objective is to stabilize the reactor systems in the following conditions, ensure actions are in progress to address consumable materials (condensate, fuel oil and borated water), and develop an event specific recovery plan.

- Core Heat Removal via single phase natural circulation with one or both OTSGs
- Incore temperature 350 to 400^{0}F
- RCS Pressure 375 to 430 psig (PRESSURIZER temperature 440 to 450^{0}F)
- PORV available to mitigate rising pressure transient
- Pressurizer Level is 200 to 220 inches
- Core Flood Isolation Valves (CF-V-1A & B) are CLOSED
- MU-V-33A, B, C & D closed (if available)
- Total RCS leakage less than 3 GPM
- Reactor Shutdown (boron concentration is sufficient at 72^{0}F)
- Cycle pressurizer heaters to maintain RCS Pressure
- FX-P-1A or B is operating. Recirc flow (FX-V-103A or B) is throttled or FX-P-1A or B is operated periodically to maintain pressurizer level between 200 and 220 inches.
- FX-T-3 level is maintained above ¼ full using DF-P-1C or DF-P-1D
- OTSG pressure A & B is being controlled between 10 & 30 psig locally with ADVs
- OTSG Level A & B is 285 to 305 inches (full range) is being maintained FX-P-2A or B with flow control by FX-V-206A and FX-V-206B (TB 322)
- After spent fuel pool boiling occurs, throttle FX-V-101 (FX-P-2A or B flow to the spent fuel pool) to maintain a constant SFP Level between 23.3 and 24.7 ft

6.2 Thermal-Hydraulic Analysis

Mode "B" conditions were evaluated (Reference 52) to establish the maximum acceptable time for action to establish FW flow using FX-P-2A & B. The evaluation of plant cooldown conditions provides bounding conclusion for the plant heat up conditions because of the higher decay heat generation rate during plant cooldown. An overview of the cases evaluated and the conclusions follows:

CASE #2: Plant cooldown is in progress and the Decay Heat System has just been placed in service

CASE#3: Plant cooldown has progressed to the end point, RC pumps have been shut down and RCS draining (1103-11) is about to commence.

	CASE 2	CASE 3
Initial Conditions		
OTSG Pressure (psig)	15	-10
Assumed Time after Rx Shutdown (hr.)	7	12
T_{HOT} °F	252	140
T_{COLD} °F	250	138
RCS Pressure (psig)	250	45
DH status	In Service	In Service (no cooling from OTSG)
RCP status	2 pumps operating	All shutdown
Final Conditions		
OTSG Pressure (psig)	105	85
T_{HOT} °F	361.4	346.3
T_{COLD} °F	331.4	316.3
Time for RCS to reach "final condition" (min.)	80.3	190.7
Time before NC is interrupted (min.)	162.3	287.4

7 MODE C FLEX Strategy

MODE "C": The RCS is not filled (RCS pressure < 20 psig) and the "RCS Minimum Vent Area" is not available. There are two different strategies for MODE C. The MODE C Sequence of Events for an ELAP during initial RCS draining is shown in Attachment 5C-1 "BCC". The MODE C Sequence of Events for an ELAP during preparations for RCS fill is shown in Attachment 5C-2 "FLEX PORV Cooling".

The Containment strategy is the same as for MODE "D", and Spent Fuel cooling strategy is the same as for MODE "A".

7.1 MODE C-1 During Initial RCS draining – "Boiler Condenser Cooling"

7.1.1 Reactor Core Cooling Strategy

The activity to remove BOTH OTSG upper primary inspection port covers will be prepared before RCS draining begins to minimize the duration in MODE "C". The manway removal process will be managed to (1) ensure the time from the initiation of RCS draining (RCS press < 20 psig) until BOTH OTSG upper primary inspection port covers are removed is as short as possible, (2) ensure the manway is removed before RCS water level is reduced below 136" in the Pressurizer, (3) and ensure the Control Room is aware of critical status changes, in advance of the potential loss of DH (Reference 126 and 130).

If a loss of DH occurs before BOTH OTSG upper primary inspection port covers are removed, then the removal of the inspection port covers will continue (Reference 126). Plant operating procedures should prevent MODE "C" conditions during initial RCS draining. However, if the RCS vent area cannot be established, then boiler condenser cooling (two phase RCS natural circulation and heat removal via the OTSG) will be used to maintain core cooling.

The following actions will be implemented within 150 minutes to establish the conditions for Boiler Condenser Cooling (BCC).

1. Restore power to vital instruments, and ES buses using the FLEX diesel generators
2. Maintain RCS water level between 200 and 220" (Pressurizer level) to support "boiler condenser cooling (BCC)" with the OTSG
    a. Initially use gravity drain methods to maximize RCS water inventory
    b. Open the hot leg vents
    c. START FX-P-1A or B and THROTTLE to maintain PRESSURIZER level

3. Maintain OTSG secondary side conditions which support BCC

    a. OPEN the ADVs

    b. Using FX-P-2A or B maintain flow and OTSG Level > 75%

7.1.2 Thermal-Hydraulic Analysis

Analysis has shown that the expansion of the RCS inventory and steam displacement of the water in the RV head is sufficient to intermittently transfer hot RCS fluid over the top of the hot leg piping loop into the OTSG tubes which forces colder water in the OTSG tubes back to the core. This heat transfer is sufficient to prevent the RCS pressure from exceeding 30 psig and maintains core cooling, with no additional RCS makeup or active OTSG cooling for more than 3 hours. With the most limiting initial conditions (Pressurizer level at 136 inches, RCS temperature at 100F and reactor shutdown for 72 hours), it would take more than 8 hours for RCS water level to boil down to TAF (Reference 52). Therefore, there is adequate time to complete the actions to establish a power source, and place the FLEX RCS makeup and FLEX OTSG feedwater pumps in service.

7.2 MODE C-2 During preparation for RCS fill – "FLEX PORV Cooling"

7.2.1 Reactor Core Cooling Strategy

Before the last RCS opening is closed (e.g. OTSG upper manway), RCS temperature will be less than 100F, Pressurizer level will be above 90 inches and the reactor will have been shut down for more than 10 days. In these conditions, if an ELAP occurred and no action was taken, the RCS water level could boil down to the top of the active fuel (TAF) within 12 hours. For this event, the mitigation strategy is to restore power to the vital power system and FX-P-1A or B, and relieve core heat via steam flow through the PORV.

The BWST provides sufficient inventory for MODE "C" PORV cooling for more than 100 hours (Reference 52), but efforts should continue to establish OTSG secondary side heat removal capabilities. If the BWST is not available (tornado damage), the Spent Fuel Pool will be used supply FX-P-1A or FX-P-1B until water from an RCBT can be used for the borated water supply.

When the OTSG is available, then CLOSE the PORV, THROTTLE FX-P-1A(B) to control RCS pressure and FEED & STEAM OTSG to establish RCS heat removal

NOTE: If the reactor has NOT been shut down more than 10 days and the RCS minimum vent area will be closed up (i.e. to support RCS fill), then contingency actions will be implemented (until the RCS is filled) which ensure that if a loss of decay heat removal occurs, both OTSG upper primary inspection port covers will be removed before RCS boiling begins (i.e. MODE D ELAP strategy applies).

7.2.2 Thermal-Hydraulic Analysis

The PORV has the capacity to relieve the steam flow to match the core decay heat generation rate at 10 days after reactor shutdown even if the reactor was NOT refueled (Reference 52).

The RCS makeup flow required 10 days after reactor shutdown is less than 34 GPM(Reference 52). FX-P-1A or B can provide > 35 GPM makeup to the RCS with RCS pressure at 2500 psig (Reference 16).

8 ALL MODES design considerations

8.1 Electrical Analysis

DC load shedding after ELAP will maintain essential instrument power (Vital Buses (VBA and VBB)) available for more than 6 hours (Reference 7). This strategy is contingent upon actions to decelerate Main Turbine rotation, vent hydrogen from the main generator and shutdown the DC powered main turbine lube oil pump (LO-P-6). In plant conditions other than MODE "A", these actions are not required and the station battery capacity is not challenged by these large DC motors.

FX-Y-1A or FX-Y-1B will be started, and 1P 480V switchgear, 1S 480V switchgear, 1A ES MCC, 1B ES MCC and A & B battery chargers will be energized in less than 4 hours.

The FLEX diesel generator (FX-Y-1A or B) has the capacity to handle all FLEX power requirements including instrumentation power, emergency lighting, portable ventilation and FLEX pump motors (References 23 Appendix 3, 14 and 61).

FX-Y-1A or B will be started with fuel oil stored in the FLEX diesel generator day tank (FX-T-3). The minimum tank volume will support full load operation for 3 hours (Reference 21). After 1B ES MCC is energized from FX-Y-1A or B, ES Diesel Fuel Transfer DF-P-1C is used to transfer fuel to FX-T-3 from DF-T-1.

8.2 Consumable Fluid Sources

8.2.1 Condensate

The Condensate Storage Tanks (CO-T-1A and CO-T-1B) each contain a minimum of 216000 gallons which is immediately available (normal line up) to EF-P-1. CO-T-1B is normally lined up to FX-T-1A & B. CO-T-1A can be made available to FX-T-1A & B by opening CO-V-111A. These tanks are designed to withstand seismic forces (SSE) and are capable of withstanding the external hydrostatic forces from a Probable Maximum Flood. These tanks can withstand the BDBEE tornado hazard wind load. Both tanks can withstand most BDBEE tornado missile, but only CO-T-1A is fully protected (Reference 33).

The Main Condenser hotwell (CO-C-1) contains more than 31,000 gallons of secondary condensate following an ELAP. The hotwell can be made available to FX-T-1A & B or EF-P-1 by opening CO-V-8. This tank is not designed to withstand seismic forces. The hotwell is located within a structure which is qualified for the BDBEE seismic or tornado event. The hotwell (below 320' elevation) is shielded from tornado missiles by surrounding structures and components.

The demineralized water storage tank (DW-T-2) typically contains more than 232,000 gallons. This inventory can be made available to FX-T-1A & B or EF-P-1 by opening DW-V-35. This tank is not designed to withstand seismic forces or tornado missiles.

The Susquehanna River provides the long term water supply. NSRC water treatment equipment will be used when it is available. The short term effects of the use of poor quality water for OTSG feedwater or Spent Fuel Pool Makeup will not prevent successfully maintaining core cooling and spent fuel cooling (Reference 35).

8.2.2 Borated Water

The Borated Water Storage Tank (BWST) contains a minimum of 237,000 gallons of water with a minimum boron concentration of 2500 ppmb above 324' elevation. The BWST can be made available to FX-P-1A or FX-P-1B by opening four valves located in the Fuel Handling Building basement (SF-V-19, 20, 36 and SF-V-87). This tank is designed to withstand seismic forces (SSE) and is capable of withstanding the external hydrostatic forces from a BDBEE flood (Reference 39). The BWST is not protected from tornado missiles.

The Spent Fuel Pools (SF-T-2A and SF-T-2B) are a common source (the gate between the pools is not installed) which contains more than 15,725 gallons per foot of water with a boron concentration above 2500 ppmb. Between 339.5 ft. elevation and the minimum normal level (343.5 ft. elevation), the pool contains more than 62000 gallons which is available to FX-P-1A or FX-P-1B by opening three valves located in the Fuel Handling Building (SF-V-38, 37 and SF-V-87). The spent fuel pool is designed to withstand seismic (SSE) forces and is located within a Seismic Class I aircraft impact hardened structure and is not adversely affect by river flood water up to 320' elevation.

Reactor Coolant Bleed Tank (WDL-T-1C) typically contains more than 50,000 gallons of water with a boron concentration above 2200 ppmb. This inventory can be made available to FX-P-1A or FX-P-1B using WDL-P-6C and temporary hose connections. WDL-T-1C is designed to withstand seismic (SSE) forces and is located within a Seismic Class I aircraft impact hardened structure (Auxiliary Building) which is protected for river level up to 313.5 ft elevation.

8.2.3 Fuel Oil

The Diesel Fuel Storage Tank (DF-T-1) contains at least 25000 gallons of diesel fuel. The fuel can be distributed to the FLEX diesel generator or portable equipment needs using a diesel fuel transfer pump (DF-P-1C or DF-P-1D) and temporary hoses. DF-T1 is designed to withstand seismic (SSE) forces and is

located underground where it is protected from the effects of tornado. Fuel is transferred to an above ground storage location (FX-T-2) in advance of a flood event (Reference 69).

8.3 Equipment Operating Conditions

Ambient temperatures for FLEX equipment operation in the Control Building (CB), Intermediate Building (IB) and Turbine Building (TB) will be maintained within acceptable limits using passive and active means of portable ventilation (Reference 13 and 123).

Fresh air from outside the facility will be circulated through each of the following areas to limit ambient temperature and prevent accumulation of undesired gases (e.g. CO_2 in control room or hydrogen in battery rooms):

CB 355: Control Room

CB 338: Vital Instrument systems

CB 322: FLEX RCS makeup pumps, AC power distribution, AC and DC Instruments and power supplies

TB 322: FLEX Diesel Generators and electrical distribution equipment

IB 295/305: EFW and ADV (not required in MODE B,C or D)

8.4 Deployment of portable equipment

8.4.1 Long term Borated Water Supply (RCS Makeup)

Reference 69 and Attachment 4 Sheets 4 & 5

Borated water for RCS makeup is primarily obtained from the BWST. The limiting condition to resupply borated water occurs if a tornado makes the BWST unavailable, and the spent fuel pool is used as the borated water source. After the initial makeup from the spent fuel pool, adequate RCS inventory can be maintained without RCS makeup for greater than 72 hours (Reference 39).

Condensate will be obtained from the river (Attachment 4 sheet 5). The river water will be filtered and demineralized using NSRC water treatment equipment. The clean condensate will be used with NSRC mobile boration equipment to prepare borated water. Borated water from the NSRC tank will be pumped to FX-P-1A or FX-P-1B using FX-P-4 (Reference 39). The NSRC water treatment and borated water addition equipment will be on site within approximately 24 hours, and can be placed in service within 48 hours.

8.4.2 Long term Condensate Supply (OTSG Feedwater & SFP Makeup)

Reference 35 and Attachment 4 Sheets 3 & 5

Condensate is used for OTSG heat removal and spent fuel pool makeup. One or more of the primary sources (CO-T-1A, CO-T-1B & DW-T-2) will be available depending on the effects of the external event hazard (Reference 33). In any event, the installed condensate sources will provide at least a 24 hour supply. Before the available condensate supply (CO-T-1A, CO-T-1B and DW-T-2) is depleted a long term supply will be established [Reference 35].

If the river is accessible and level is sufficient, then a portable diesel driven pump (FX-P-3A or FX-P-3B) will be placed on the ramp adjacent to the river across from the North Office Building (NOB) and used to supply river water to CO-T-1B or the hotwell.

The alternate method is to stage a portable diesel generator (FX-Y-3) outside the ISPH to provide power to a portable electric submersible pump (FX-P-6A or B) suspended in the Intake Screen and Pump House (ISPH) intake channel at 268' elev. This pump and hose can supply river water to CO-T-1B or the hotwell.

8.4.3 Fuel Supply for FLEX Diesel Generators & Portable Equipment

Reference 69 and Attachment 4 Sheet 1

After an ELAP, fuel will be transferred from DF-T-1 to FX-T-2, FX-T-3 or FX-T-4 using one of two transfer pumps (DF-P-1C and DF-P-1D). One of these pumps is powered from station ES AC power and one is powered from the station DC system. Each of these positive displacement pumps has a nominal capacity of 10 gpm.

Fuel supply to FX-Y-1A & B (non-flood)

After the event occurs, operators connect hoses to provide a flow path from DF-P-1C & DF-P-1D to fill FX-T-3. The fuel supply from DF-T-1 to FX-T-3 can be established within 2 hours of the start of the FLEX Diesel Generator. The full load fuel consumption rate of FX-Y-1A or FX-Y-1B is 35 GPH (Reference 3). The standby minimum inventory of 105 gallons in FX-T-3 (> 7/8 full) will provide at least 3 hours before resupply is required

Fuel supply to FX-Y-1A & B (flood)

In preparation for a flood, FX-T-2 is filled from DF-T-1 using DF-P-1C or DF-P-1D (Reference 96). More than 5,000 gallons will be transferred into FX-T-2 and this action will be completed before the river level exceeds the height of the dike. If

operation of FX-Y-1A or B is required, FX-T-3 level will be maintained by gravity drain and by using fuel transfer pumps FX-P-5A or 5B. These pumps have a nominal capacity of 4.5 gpm

Fuel supply for portable FLEX equipment:

FX-T-4 (200 gallon fuel tanks in the bed of FLEX truck) is used to distribute fuel to the portable equipment. FX-T-4 can be filled from DF-T-1 using DF-P-1C or DF-P-1D and hoses to the truck outside the service building. The FX-T-4 fuel oil transfer pump (FX-P-8) has a capacity of at least 15 gpm. The largest portable tank (FX-Y-3 is 200 gallons) can be refilled in less than 15 minutes. This fuel distribution method can be established in time to support all required FLEX functions:

a. Portable diesel driven pumps (FX-P-3A and FX-P-3B) each have a 175 gallon fuel tank and a full load consumption rate of approximately 7.6 gph. One of these pumps is required no sooner than 26 hours into the event (Reference 19) and the initial fuel supply will last 23 hours.

b. Portable Diesel Generator (FX-Y-3) has a 200 gallon fuel tank and a full load consumption rate of approximately 25 gph. This diesel generator is required no sooner than 48 hours into the event (Reference 19) and the initial fuel supply will last 8 hours.

c. Portable Diesel Driven Pumps (FX-P-4) have approximately 1 gallon fuel tank and a full load consumption rate of approximately 0.4 gph. This diesel generator is required no sooner than 48 hours into the event. The tank will be maintained empty and filled prior to use.

d. Portable Diesel Generators (FX-Y-4) have a 3.4 gallon fuel tank and a full load consumption rate of approximately 0.6 gph. This diesel generator is required no sooner than 24 hours into the event. The diesel fuel tank will be maintained empty and filled from FX-T-4 when required.

e. The SAFER Mobile Water Treatment Unit includes a diesel generator. The unit has a 90 gallon fuel tank and consumes approximately 6.7 gph. The SAFER Mobile Boration unit includes a diesel generator. The unit has a 70 gallon fuel tank and consumes approximately 17.5 gph. The SAFER Mobile Water Treatment and Mobile Boration Units are required no sooner than 48 hours into the event and the tanks will be initially filled when the equipment arrives at TMI.

8.5 Personnel Habitability

Portable fans will be used to provide cooling and ventilation of the control room (Reference 13). The ambient conditions in the EFW and ADV area (IB 295) will remain within acceptable limits without active means (Reference 123), and will be improved by use of portable fans (Reference 13).

8.6 Lighting

All field operators carry a flashlight while on duty. Battery backed emergency lighting is available in most plant areas where action is required during the initial hours. Installed AC emergency lighting will be energized by FLEX diesel. Portable lighting is staged for emergency use. The complete FLEX lighting plan is described in Reference 62.

8.7 Communications

Ops radios in "talk around" mode, the "Red" page system (VBB) and sound powered phones will be used to provide communications for mitigation actions. The complete FLEX On Site Communications plan is described in Reference 63.

Satellite phones will be used by control room to notify offsite governmental agencies and emergency support resources. The Off Site Communications plan after a BDBEE is described in Reference 65. This plan and the response to NTTF recommendation 9.3 (Reference 109) are outside the scope of NRC Order EA 12-049 but emergency response actions are coordinated.

9 Protection and Deployment of Portable Flex Equipment

9.1 All portable components used for FLEX are described in Attachment 2B. This list includes the component description, the engineering basis for the component design, the FLEX function, the external hazards & plant mode in which this component is required, the basis for protection in the stored location, and the action required if the component is not available.

9.2 Exelon has committed to the domestic nuclear industry to make their portable FLEX equipment available to other utilities that may need it during a BDBEE event. INPO is maintaining the Phase 2 portable FLEX equipment lists for all nuclear utilities in the U.S.

9.3 Access and deployment concerns

9.3.1 Access through security barriers

The site security staff will respond to an external event by attempting to communicate with the Ops Shift Manger. If communications systems are not functioning, the security staff will send a representative to the control room.

The security staff will assist operations by (1) ensuring access for operators or equipment and (2) opening doors for ventilation (Reference 72).

9.3.2 Potential Effects of Soil Liquefaction

Geomatrix Consultants performed an assessment for the potential for earthquake-induced liquefaction and associated ground failure at Three Mile Island. For this analysis, several scenarios that varied ground shaking and ground water levels were examined to assess the sensitivity of liquefaction under different soil conditions. The primary consequence of liquefaction at the site is expected to be ground settlement. Higher river water levels increase the magnitude of settlement. For a licensing basis flood river level, the magnitude of ground settlement is expected to be 1-in or less. With settlement of this magnitude, there is reasonable assurance that the FLEX equipment and the deployment of the temporary FLEX equipment will not be adversely affected during an earthquake (Reference 37).

9.3.3 "External Flood Event"

All FLEX actions for an external flood event (1) are performed prior to the ELAP event based on FLEX design flood period of preparation (24 hours), (2) are performed above 320 ft elevation or (3) are were evaluated in the following:

After the water recedes below site grade, a portable diesel driven pump (FX-P-3A or B) will be moved from the training center (or Flex Storage Facility) to the ramp next to the river located west of the NOB. The pump and NSRC supplied water filtration equipment will be used to provide a continuous condensate supply to CO-T1B. Debris removal may be required on the road or the river ramp. There is sufficient time. There is at least five days of water in the condensate pit after the water recedes to reliably accomplish this task. (Reference 35)

9.3.4 "Earthquake"

All FLEX actions for an earthquake (1) are accessed and performed inside structures designed for a SSE or (2) were evaluated to ensure there is reasonable assurance the actions can be completed in the time frame required. Where earthquake damage could impede travel paths alternate pathways are available.

Accessibility for actions within the Turbine Building was confirmed (Reference 42).

Accessibility for actions within Class I building was confirmed (Reference 71).

9.3.5 "Tornado"

All FLEX actions for a tornado event (1) are accessed and performed inside tornado hardened structures or (2) were evaluated to ensure there is reasonable assurance the actions can be completed in the time frame required.

Accessibility for actions within the Turbine Building was confirmed (Reference 42).

9.3.6 "Snow, Ice and Extreme Cold"

Pathways have been incorporated into the site snow removal plan (reference 133). MA-TM-1003 "Snow and Ice Removal Plan"

9.4 An assessment of the requirements to ensure adequate pathways was performed for all areas with FLEX actions outside of plant structures. Based on that review, there is reasonable assurance that pathways will be available. In addition, and equipment is staged for debris removal if required (Reference 64 and 127).

9.5 Fuel Supply for Portable Equipment

The FLEX Truck with the diesel fuel tank (FX-T-4) and transfer pump (FX-P-8) in the truck bed will be used to transport fuel obtained from DF-T-1 (or FO-T-1 or FO-T-2) to each portable diesel component. The fuel supply plan reviewed fuel delivery capability and equipment fuel consumption rates to ensure an adequate fuel supply is maintained for all required functions (Reference 69).

10 Offsite Resources

10.1 The National SAFER Response Center (NSRC) will be contacted by the Exelon Duty Manager and a significant inventory of equipment will be transported to the TMI staging area at Lancaster Airport. The complete list of equipment available is described in references 56 and 68.

10.2 Any equipment delivered to Lancaster Airport can be transported to TMI. The Lancaster Airport Staging Area will be prepared to use helicopter transport of any of the equipment to the TMI South Parking Lot.

10.3 To support the transfer of NSRC equipment from Lancaster Airport to TMI, a Special Congested Area Plan was prepared and approved by the Federal Aviation Agency (FAA) (Reference 103). The initial plan was approved on June 25, 2015 and is updated annually.

10.4 The TMI strategy utilizes NSRC support for long term consumables and support for recovery efforts. NSRC equipment is not required within 72 hours except for water treatment and the mobile boration skid (Reference 128). NSRC will deliver the equipment to the site within 24 hours of notification.

10.4.1 Water treatment equipment (Reference 54) will be delivered and staged outside of PA Gate 12. This equipment will be used (Reference 122) to remove particulate, dissolved solids and minerals from river water before it is transferred into CO-T-1B or the hotwell. This clean water source will also be used to prepare borated water.

10.4.2 A mobile boration skid (Reference 55) will be delivered and staged outside of Protected Area gate 12. This equipment will be used (Reference 122) to prepare borated water (between 2500 and 2700 ppmb) and transfer borated water to the suction of FX-P-1A or B.

10.4.3 In a flooded condition or if Three Mile Island is otherwise not accessible, a fuel container with 500 gallons of diesel fuel will be transported by air and placed on the south east area of the control building roof. A hose connected to the container will be routed into the Turbine Building through the personnel door at the south end of the Turbine Building 355' elevation and down the southwest stairwell to FX-T-2.

11 Programmatic Elements

11.1 Overall Program Document

TMI document CC-TM-118-1001 (Reference 67) will include the content of the FIP and maintain a current description of the FLEX strategy. This document will be used along with Exelon fleet document CC-AA-118 (Reference 98) to maintain the site specific and industry wide commitments.

The processes for changes to plant design or operating procedures will maintain the FLEX strategy as described in this document or changes in strategy will be screened to ensure that any changes meet the standard in NEI 12-06 R0 11.8.3.

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.

11.2 Implementing Procedures

The procedures for implementing the FLEX strategy are maintained using the standards for emergency procedures. The requirements of 1001E "Maintenance Program for EP Usage Level Procedures" (Reference 139) apply.

TMI performed 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 Final Integrated Plan (FIP) for Order EA-12-049 (Reference 104). The performance of the FLEX mitigating strategy was validated based on the administrative required minimum shift staffing level (Reference 137).

The FLEX equipment lineup is shown in OP-TM-919-000 (Reference 107). The procedures which implement the major elements of the FLEX strategy are listed in the table below.

PROCEDURE #	TITLE	DESCRIPTION OF THE FLEX STRATEGY ELEMENT(S) IMPLEMENTED
OP-TM-AOP-002	Flood	This procedure implements preparations to mitigate an ELAP/LUHS during an external flood event (Reference section 4.6 and 5.6).
OP-TM-AOP-003	Earthquake	This procedure implements actions in response to an earthquake. 1) Close CO-V-13 and CO-V-24 2) Isolate failed piping if the event causes a Fire Service piping rupture in a Class I bldg.
OP-TM-AOP-004	High Winds / Tornado	This procedure implements actions for a tornado 1) If a tornado WARNING is issued, then CLOSE MS-V-36A, B, C, & D. 2) If CO-T-1B is damaged, then CO-V-176 is closed to minimize the loss of condensate.
OP-TM-AOP-034	Loss of CB Cooling	This procedure directs initial actions to manage CB temperature after a loss of ventilation or cooling, and initiates OP-TM-919-952 to utilize portable ventilation. (Reference 13)
OP-TM-AOP-035	Loss of Spent Fuel Pool Cooling	This procedure 1) Initiates procedures to use of FX-P-2A or B for SFP makeup 2) Establish a monitored vent path of SFP area to prevent pressurizing FHB 3) If spent fuel pool reaches boiling, then SFP level is maintained in a stable band
OP-TM-EOP-012	Station Blackout	This is the primary emergency procedure for the ELAP event (for events which occur when DH is not in service) (Reference Section 4).
OP-TM-EOP-030	Loss of Decay Heat Removal	This is the primary emergency procedure for the ELAP event if it occurs when DH is in service (Reference sections 5,6 and 7)

PROCEDURE #	TITLE	DESCRIPTION OF THE FLEX STRATEGY ELEMENT(S) IMPLEMENTED
1102-1	Plant Heat-up to 525F	Ensure OTSG level remains > 97% until OTSG pressure is greater than 150 psig
1102-11	Plant Cooldown	Ensure OTSG level remains > 97% when OTSG pressure is less than 150 psig
1103-11	RCS Water Level Control	Ensures plant conditions are controlled to support ELAP mitigation strategy, if it should occur at any time. • Ensure removal of BOTH OTSG upper primary inspection port covers is closely coordinated with the initiation of RCS draining • Ensure "RCS MINIMUM VENT AREA" is established whenever RCS is drained. • Ensure RCS temperature is less than 100F, PRESSURIZER level above 136" and OTSG level > 97%, UNTIL "RCS MINIMUM VENT AREA" is available • Ensure RB Vent (LR-V-3) is enabled prior to draining RCS When RCS is open to RB atmosphere and RV "time to boil" is less than ONE hour, then ensure BWST & SFP lineup and operator briefing supports the ability to initiate gravity drain core cooling within 15 minutes. Ensure Reactor has been shut down for > 10 days, PZR level > 90" and PORV is operable prior to reducing RCS vent area below MINIMUM (i.e. installing last OTSG upper primary manway or hand hole covers), or specific contingency plan has been implemented where BOTH OTSG upper primary inspection covers could be removed after a loss of DHR but prior to RCS boiling.

PROCEDURE #	TITLE	DESCRIPTION OF THE FLEX STRATEGY ELEMENT(S) IMPLEMENTED
1401-4.4C	Remove OTSG Upper Primary Inspection Port Covers	Ensure covers are removed if task is in progress and a loss of DH occurs
1410-Y-60	Reactor Building Equipment Hatch Removal and Installation	Provides direction to re-install hatch with 4 bolts following a loss of decay heat removal
OP-TM-108-111-1001	Severe Weather	This procedure implements proactive actions which enhance the reliability of the ELAP mitigation strategy in extreme temperature events. • Avoid MODE "C" if severe weather is forecast. • Ensure ELAP mitigation material are available (e.g. propane) if severe cold is forecast • Consider staff augmentation during periods of severe weather
OP-TM-122-901	Inflate AUX & FHB Door Seals	Includes use of portable air compressors (EG-P-20A & B) to maintain adequate air pressure at the door seals during a flood with an ELAP
OP-TM-220-917	BWST Gravity Drain Core Cooling	This procedure describes how to maintain core cooling using the BWST if the RCS minimum vent area is available.
OP-TM-220-918	SFP Gravity Drain Core Cooling	This procedure describes how to maintain core cooling using the SFP inventory if the RCS minimum vent area is available.
OP-TM-244-901	Containment Isolation	Provides direction to complete containment isolation with ELAP condition. This process is applicable when RCS temperature is initially above 200F.
OP-TM-244-911	Containment Closure	Provides direction to complete close the containment boundary with ELAP condition. This process is applicable when RCS temperature is initially below 200F.

PROCEDURE #	TITLE	DESCRIPTION OF THE FLEX STRATEGY ELEMENT(S) IMPLEMENTED
OP-TM-322-901	Emergency Vent & Purge of Main Generator Hydrogen	Provides the direction to vent the hydrogen from the main generator and minimize the risk of a hydrogen explosion after an ELAP.
OP-TM-823-901	RB Normal Cooling without offsite power	This procedure reenergizes 1A RBHV MCC using FLEX diesel and describes operation of RB normal cooling (closed cooling & evaporative coolers) for use during a flood and ELAP condition with RCS open to RB atmosphere.
OP-TM-919-901	Energize 1P and 1S 480V ES SWGR from FX-Y-1A or FX-Y-1B	Prep and start FX-Y-1A (B) and energize FLEX distribution Panels, 1P 480V SWG, 1S 480V SWG, 1A ES MCC and 1B ES MCC. Monitor & control DG operation
OP-TM-919-902	Energize 1C ESV MCC from FX-Y-1A or FX-Y-1B	Provides direction to energize the 1C ESV MCC to allow operation of CF-V-1A and CF-V-1B and MSIV's.
OP-TM-919-903	Energize 1A and 1B Radwaste MCC from 1A ESV MCC	Provides direction to energize 1A and 1B Radwaste MCC using jumper & cross tie. 1A Radwaste MCC is needed for MU-V-33A, B, C, or D. The possible 1B Radwaste MCC loads include WDL-P-6C and EG-P-20A/B.
OP-TM-919-904	Energize 1A ESF Vent MCC and BWST Immersion Heaters	Provide power to BWST immersion heaters
OP-TM-919-906	DC Load Management	Provide direction necessary to strip DC loads to preserve battery capacity until FX-Y-1A or FX-Y-1B is placed in service. This procedure implements to DC load shed plan described in Reference 7 for an ELAP event in any mode.

PROCEDURE #	TITLE	DESCRIPTION OF THE FLEX STRATEGY ELEMENT(S) IMPLEMENTED
OP-TM-919-907	Alternate Methods for obtaining Critical Parameters	This procedure provides direction for how to obtain the following parameters without vital AC power or vital instrument systems. • RCS Pressure • Core Exit Thermocouples • Pressurizer Level • RCS drain down level • OTSG A & B full range level • OTSG A or B Pressure • RB Pressure
OP-TM-919-911	RCS Makeup using FX-P-1A or FX-P-1B	Provides direction for using FX-P-1A or FX-P-1B for RCS makeup through HPI lines C & D. Suction to FX-P-1A or FX-P-1B may be aligned from the BWST (preferred), Spent Fuel Pool, or NSRC (National SAFER Response Center) equipment.
OP-TM-919-912	RCS or SFP Makeup using FX-P-2A or FX-P-2B (OTSGs NOT Available)	Provides direction to using FX-P-2A or FX-P-2B for RCS or SFP makeup. This non-borated water source is only used to maintain level to compensate for steam losses after boiling.
OP-TM-919-913	Using WDL-T-1C as Alternate Source to FX-P-1A or B	This procedure provides direction to lineup WDL-T-1C as an alternate suction source to FX-P-1A or FX-P-1B.
OP-TM-919-914	Spent Fuel Pool Makeup using FX-P-2A or B (OTSGs Available)	Provides direction to using FX-P-2A or FX-P-2B for Spent Fuel Pool makeup. This non-borated water source is only used to maintain SFP level to compensate for steam losses after boiling.
OP-TM-919-921	OTSG Feedwater using FX-P-2A or FX-P-2B	Provides direction to feed OTSG's using FX-P-2A or FX-P-2B from the CO-T-1A, CO-T-1B, DW-T-2 or Hotwell.

PROCEDURE #	TITLE	DESCRIPTION OF THE FLEX STRATEGY ELEMENT(S) IMPLEMENTED
OP-TM-919-922	Makeup from Raw Water Sources	1. This procedure provides direction to makeup to CO-T-1B or the Hotwell from Fire Service, river water using FX-P-3A or B (taking suction at ramp outside gate 128), or river water using FX-P-6A or B (taking suction from ISPH). This includes provisions for use of NSRC water treatment equipment. 2. This procedure provides direction to provide feedwater for RCS heat removal using FX-P-3A or FX-P-3B drawing water from the river, temporary connection to Main Feedwater and control using FW-V-17A & B 3. This procedure provides direction to provide Spent Fuel Pool makeup using FX-P-3A or FX-P-3B drawing water from the river 4. This procedure provides direction to utilize NSRC mobile boration equipment, FX-P-4 and connection to FX-V-111 to provide a borated water supply for using FX-P-1A or FX-P-1B for high pressure RCS makeup.
OP-TM-919-923	Condensate Heating	1. This procedure provides direction to transfer CO-T-1A and DW-T-2 to the hotwell, and provide heating for CO-T-1B and the hotwell from Main Steam in a Cold Weather Event with OTSG available. 2. This procedure provides direction to transfer CO-T-1A, CO-T-1B and DW-T-2 to the hotwell, and provide heating for the hotwell using temporary propane heaters in a Cold Weather Event with OTSG not available.
OP-TM-919-924	Pre-Operational Lineup for FX-P-2A or FX-P-2B	Provides direction to prepare to use FX-P-2A or FX-P-2B. This includes installation of hoses and temporary cable, as well as valve lineup, AND removing blind flanges on pump suction if preparation is in advance of a predicted flood.

PROCEDURE #	TITLE	DESCRIPTION OF THE FLEX STRATEGY ELEMENT(S) IMPLEMENTED
OP-TM-919-931	Maintain fuel oil level in FX-T-3 using DF-P-1C or DF-P-1D	Provides direction to transfer fuel oil from DF-T-1 to FX-T-3 or FX-T-4 using DF-P-1C or DF-P-1D.
OP-TM-919-932	FX-T-2 Fill using DF-P-1C or DF-P-1D	Provides direction to fill FX-T-2 from DF-T-1 using DF-P-1C or DF-P1D during flood preparation phase
OP-TM-919-933	Maintain Level in FX-T-3 using FX-P-5A or B	Provide direction to transfer Fuel Oil to FX-T-3 from FX-T-2 using FX-P-5A or FX-P-5B during ELAP conditions.
OP-TM-919-941	Vent of RB Atmosphere	This procedure describes use of RB vent path to limit the rise in RB pressure after an ELAP which occurs when the OTSGs are not available for core cooling. Portable radiation monitoring of the effluent is established.
OP-TM-919-952	FLEX Ventilation for Control Buildings.	This procedure provides guidance to maintain control room habitability, limit hydrogen concentration in station battery rooms and provide cooling for FLEX equipment and vital instrument systems, after an ELAP.
OP-TM-919-953	FLEX Ventilation for Intermediate and Turbine Buildings.	This procedure provides guidance to open doors and to use portable ventilation in the Turbine and Intermediate Buildings to provide equipment cooling and maintain personnel accessibility, after an ELAP.

11.3 Training

Licensed and non-licensed operator initial and continuing training programs provide training on FLEX strategy implementing procedures. Continuing training on FLEX strategy implementing procedures will be completed every two years.

11.4 Unavailability management

The component specific "unavailability response" is described in Attachment 2.

The unavailability response in Attachment 2 is required during plant conditions when the component is credited for mitigation. The "External Event Hazard" and "Plant MODE" column distinguishes the scope of hazards and plant conditions

where a given FLEX component is credited. The plant MODES are described in Section 2.1.4.

Unavailability management applies to components which are required for successful implementation of the FLEX strategy. Components with a Defense in Depth (DID) function or "NO" FLEX Function" do not have additional unavailability management requirements.

Basis: The component specific "unavailability response" described in Attachment 2 was derived from the standards in NEI 12-06 section 11.5.3.

1. If a FLEX component also has a Tech Spec limited out of service duration, then the TS clock is applied, and the FLEX unavailability is not independently tracked.

2. FLEX or SFPI equipment may be unavailable for 90 days provided the capability to perform the function is available (i.e. a loss of redundancy is allowed for 90 days). If a component cannot be restored within 90 days and redundancy would not be restored, then compensatory measures should be implemented to restore redundancy BEFORE exceeding 90 days.

3. If FLEX or SFPI equipment is expected to be unavailable for more than 90 days or expected to be unavailable during forecast site specific external events (e.g., hurricane), then an suitable alternative for the function should be employed.

4. If FLEX or SFPI equipment becomes unavailable such that the FLEX function is unavailable, initiate actions within 24 hours to restore the functional capability and implement compensatory measures (e.g., use of alternate suitable equipment or supplemental personnel) within 72 hours.

5. If FLEX equipment is unprotected but otherwise functional and available (e.g. portable equipment is temporarily outside the FSF), then restore the equipment to a protected configuration within 45 days. (Although an alternative approach from NEI 12-06, Rev. 0, this provision has been endorsed in NEI 12-06, Rev. 2)

11.5 Equipment Maintenance and Testing

11.5.1 Periodic maintenance and testing of equipment relied upon for FLEX strategy is performed to confirm this equipment remains capable of performing its FLEX function.

The PM and Testing Program for FLEX equipment was developed using existing procedures and processes (ER-AA-200 and WC-AA-120). The program satisfies NEI 12-06 section 11.5.2 by utilizing the following sources for maintenance and testing requirements:

A. EPRI templates which were developed for FLEX equipment (Reference 95)

B. OEM Recommendations (References 78 through 84)

C. Exelon Corporate PM Templates which were developed using INPO AP-913 process (Reference 97)

D. Operating Experience

E. Material Aging and Shelf Life (including consumables and fluids)

These requirements were applied to equipment which "directly performs FLEX mitigation strategy for core cooling, containment or spent fuel cooling" (NEI 12-06 11.5.2). Attachment 3 describes the Preventive Maintenance and Testing requirements and implementing documents for the FLEX equipment. A 25% grace period is applicable to all frequencies on Attachment 3.

Any revisions to the scope or frequency of preventive maintenance or testing of FLEX equipment will be evaluated and authorized in accordance with ER-AA-200 and WC-AA-120 (References 105 and 106).

11.5.2 FLEX equipment was determined to be within Maintenance Rule scope per 10 CFR 50.65 (b)(2):

"Non-safety related structures, systems, or components: (i) that are relied upon to mitigate accidents or transients or are used in plant emergency operation procedures (EOPs);"

The specific FLEX functions within MR scope are those essential to the EOP purpose to ensure core cooling. The FLEX functions and specific equipment within MR program scope is described in the TMI MR program.

11.5.3 At least once every year, an inspection will be completed to confirm all temporary equipment and materials staged for FLEX (Attachment 2B) are available in the proper location (PM211679)

12 References

12.1 NRC Order EA 12-049 "Order Modifying Licenses With Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events", March 12, 2012

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

12.3 Technical Evaluation 1246536-41, INPO IER 11-4 Evaluation of TMI response to an ELAP, Nov 13, 2011

12.4 Three Mile Island Nuclear Generating Station, NRC Order EA-12-049, GAP Analysis Report, Nexus Document No.: 12-4032.TMI001, Revision: 0, 12 November 2012

12.5 Severe Flood Mitigation System Conceptual Design Report, Worley Parsons, November 9, 2012, Revision 0

12.6 C-1101-202-E620-471, "TMI-1 Cycle-Specific Shutdown Margin Verification during Emergency Cooldown"

12.7 C-1101-734-E420-009, "TMI-1 Extending Battery Life to 6 hours under ELAP"

12.8 C-1101-212-5360-020, "BWST gravity feed after loss of DHR"

12.9 C-1101-122-E410-005, "Structural Adequacy of DH-T-1, CO-T-1A/B and DF-T-1 during a PMF"

12.10 TM-FLEX-001, "RCS Inventory Analysis for FLEX"

12.11 TM-FLEX-002, "Reactor Building Pressure Analysis for FLEX"

12.12 C-1101-919-E410-001, "FLEX system hydraulic analysis"

12.13 Technical Evaluation ECR 13-00310, "FLEX ventilation Plan"

12.14 ECR 13-00070, "FLEX Electrical Power Supply"

12.15 ECR 14-00031, "FLEX Feedwater System"

12.16 ECR 14-00032, "FLEX RCS & SFP Makeup System"

12.17 ECR 14-00033, "FLEX Reactor Building Pressure Control"

12.18 ECR 13-00078, "FLEX Platform in Turbine Bldg."

12.19 ECR 13-00074, "FLEX Storage Facility"

12.20 ECR 13-00099, "RC-P-1A/B/C/D Low Leakage seals"

12.21 ECR 13-00164, " FLEX Fuel Oil Supply & Diesel Exhaust Pipe"

12.22 SP-1101-12-170 R0 "Design Specification for TMI-1 N-9000 RCP Seals"

12.23 ECR 13-00208 "FLEX Design Specification"

12.24 1E-919-21-001 "FLEX OVERVIEW - DIESEL GENERATOR & FUEL OIL"

12.25 1E-919-21-002 "FLEX OVERVIEW - ELECTRICAL POWER DISTRIBUTION"

12.26 1E-919-21-003 "FLEX OVERVIEW - FEEDWATER SUPPLY"

12.27 1E-919-21-004 "FLEX OVERVIEW – REACTOR COOLANT & SPENT FUEL MAKEUP"

12.28 1E-919-21-005 "FLEX OVERVIEW – LONG TERM WATER SUPPLY"

12.29 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, 8/29/2012"

12.30 WCAP-17601-P "Westinghouse Reactor Coolant System Response to the Extended Loss of AC Power Event for Westinghouse, Combustion Engineering and Babcock & Wilcox NSSS Designs", 8/2012

12.31 WCAP-17792-P "Emergency Procedure Development Strategies for Extended Loss of AC power Event for all Domestic Pressurized Water Reactor Designs", draft Sept 2013

12.32 C-1101-251-E410-010, "Spent Fuel Pool gravity feed after Loss of DHR"

12.33 Technical Evaluation ECR 13-00476, "FLEX Strategy Design Evaluation for CO-T-1A/1B and DW-T-2"

12.34 Technical Evaluation ECR 13-00477, "TMI-1 Tornado Study For FLEX Strategy"

12.35 Technical Evaluation ECR 13-00502, "FLEX condensate supply Strategy"

12.36 C-1101-213-5450-002 "Potential for CFT Nitrogen Injection in RCS"

12.37 990-2179 "Assessment of earthquake-induced liquefaction potential and associated ground failure hazards, for Three Mile Island, Unit 1", Geomatrix Consultants.

12.38 ECR 13-00084 "Spent Fuel Pool Level Indicator"

12.39 Technical Evaluation ECR 14-00218, "FLEX Borated Water Supply Plan"

12.40 Technical Evaluation ECR 14-00133, "Alternate Methods to obtain critical parameters"

12.41 Technical Evaluation ECR 14-00134, "Electrical Power Supply for FX-P-6A or B"

12.42 Technical Evaluation ECR 14-00126, "BDBEE Impact on FLEX Strategy in the Turbine Building""

12.43 C-1101-919-E410-011 "Turbine Building Structural Analysis for BDBEE"

12.44 Technical Evaluation ECR 14-00243, "Turbine Building Siding Evaluation (wind impact)"

12.45 Technical Evaluation ECR 14-00270, "FLEX Equipment Platform - Missile Protection Evaluation"

12.46 C-1101-919-E410-006, "FLEX Platform (TB 322) Structural Analysis"

12.47 Preliminary communications with NRC for TMI FLEX strategy

12.47.1 RS-13-026 TMI-13-004, February 28, 2013, 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). (alias "OIP")

12.47.2 RS-13-131 TMI-13-072 August 28, 2013, First Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design Basis External Events (Order Number EA-12-049)

12.47.3 RS-14-016 TMI-14-006, February 28, 2014, Second Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design Basis External Events (Order Number EA-12-049)

12.47.4 RS-14-016 TMI-14-006, August 28, 2014, Third Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design Basis External Events (Order Number EA-12-049)

12.47.5RS-15-025 TMI-15-011, Feb 27, 2015, Fourth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design-Basis External Events (Order Number EA-12-049)

12.47.6RS-15-216 TMI-15-083, Aug 28, 2015, Fifth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design-Basis External Events (Order Number EA-12-049)

12.47.7RS-16-030 TMI-16-009, Feb 26, 2016, Sixth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design-Basis External Events (Order Number EA-12-049)

12.47.8NRC Letter to Exelon, Dec 17, 2013 TMI-1 Interim Staff Evaluation and Audit Relating to the Overall Integrated Plan and Response to Order EA 12-049 (ML13225A552)

12.47.9NRC letter to Exelon, Jan 11, 2016 TMI-1 Report for the Audit Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Pool Instrumentation Related to Orders EA 12-049 and EA 12-051. (ML15357A102)

12.48 RS-16-087 TMI-16-039, June 29, 2016, Three Mile Island Nuclear Station, Unit 1, Report of Full Compliance with 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)

12.49 ECR 15-00031 "Red page phone modification for FLEX"

12.50 ECR 14-00501 "Turbine Building Structural Modifications for BDBEE"

12.51 Technical Evaluation ECR 15-00044, "Sound Powered Phones for FLEX"

12.52 Technical Evaluation ECR 14-00352 "FLEX Strategy for OTHER Initial Conditions"

12.53 TMI Updated Final Safety Analysis Report

12.54 201343S01, AREVA, NSRC Equipment Spec for Water Treatment Equipment

12.55 201335S01, AREVA, NSRC Equipment Spec for Mobile Boration Skid

12.56 51 - 9199717, AREVA, NSRC Generic & Site Specific Equipment Technical Requirements

12.57 86-5022029-00, AREVA, "Boron Concentration Following a Loss of DHR Cooling"

12.58 C-1101-919-E410-012, "FSF Tornado Missile Protection Barrier"

12.59 Technical Evaluation ECR 15-00113, "Gland Steam Impact on RCS temperature control"

12.60 Technical Evaluation ECR 15-00155, "Alternate air source for Flood door seals"

12.61 C-1101-919-E420-009, "FLEX Electrical Power Distribution Analysis (ETAP)"

12.62 2494447- 02, Technical Position Paper, "FLEX Lighting Plan"

12.63 2494447- 01, Technical Position Paper, "FLEX On Site Communications Plan"

12.64 2494447- 03, Technical Position Paper, "FLEX Debris Removal Plan"

12.65 2494447- 05, Technical Position Paper, "Off Site Communication Plan"

12.66 Flowserve White Paper on the Response of the N-Seal Reactor Coolant Pump (RCP) Seal Package to Extended Loss of All Power (ELAP) (Attachment 1 of PWROG Letter to NRC, OG-15-313, August 5, 2015) (ML 15222A536), AND NRC Letter to PWROG, November 12, 2015 which accepts the Flowserve analysis for BDBEE mitigating strategies(ML15310A094).

12.67 CC-TM-118-1001, "TMI Diverse and Flexible Coping Strategy (FLEX) Program Document"

12.68 38-5237994, AREVA, TMI Station NSRC Response Plan (EDMS doc # CC-TM-118-1002)

12.69 2494447-04 R1, Technical Position Paper, "FLEX Equipment Fuel Supply Plan"

12.70 2494447-06, Technical Position Paper, "Evaluation of effects of ELAP on FLEX Strategy"

12.71 Technical Evaluation ECR 15-00142, "FLEX Impact evaluation – Non Seismic Eqpt Failures in Class I Buildings"

12.72 SY-TM-101-102-1001, "Security system component degradation compensatory measures" (SAFEGUARDS INFO)

12.73 Technical Evaluation ECR 15-00325, "ELAP Time to restore RCS Make Up"

12.74 ECR 15-00328, "Integrity of Main Steam Piping in TB with BDBEE Tornado"

12.75 ECR 15-00330, "Integrity of Main Steam Piping in TB with BDBEE Earthquake"

12.76 Technical Evaluation ECR 15-00341,"RB Environmental evaluation for FLEX Instruments"

12.77 Technical Evaluation ECR 15-00208, "Interlock bypass direction for FLEX"

12.78 VM-TM-3136, Cummins Diesel Generator 500kW Model DFEK

12.79 VM-TM-3134, CATPumps, High Pressure pump & 75HP 480V motor

12.80 VM-TM-3135, Sulzer submersible multi-stage centrifugal pump

12.81 VM-TM-3025, Godwin HL110M, portable diesel driven pump

12.82 VM-TM-2614, Tsurumi LK311, portable submersible pump

12.83 VM-TM-2620, Cummins portable Diesel Generator 350kW

12.84 VM-TM-3141, Flowserve fuel oil pumps (FX-P-5A/B)

12.85 VM-TM-3142, FLEX storage facility

12.86 VM-TM-3145, FLEX Diesel Fuel Tank (FX-T-3)

12.87 ECR 07-00695, "B5B Modifications"

12.88 Technical Evaluation ECR 15-00345, "FLEX Diverse Flow Paths"

12.89 990-3096, Flood Hazard Reevaluation Report, Rev 2

12.90 EXLNTM039-PR-001, Rev 1, "Seismic Hazard and Screening Report", dated 3/26/14

12.91 TMI Unit 1 Technical Specifications

12.92 14Q4239 - RPT-004, Rev 3, "Expedited Seismic Evaluation Process Report", dated 12/15/14

12.93 Technical Evaluation 1467688-04, "Local Intense Precipitation Impact Evaluation"

12.94 OP-TM-108-111-1001 , "Severe Weather"

12.95 EPRI Report 3002000623 "Nuclear Maintenance Applications Center: Preventive Maintenance Basis for FLEX Equipment"

12.96 OP-TM-AOP-002, "Flood"

12.97 INPO AP-913, Rev 3 "Equipment Reliability Process Description"

12.98 CC-AA-118, Diverse and Flexible Coping Strategies (FLEX) and Spent Fuel Pool Instrumentation Program Document

12.99 Westinghouse Technical Bulletin 04-22 Rev 1 "Reactor Coolant Pump Seal Performance"

12.100 VM-TM-826, "B&W Unit EOP Technical Bases Document"

12.101 NRC Letter to Exelon, Nov 18, 2015 TMI-1 – Relaxation of certain schedule requirements for Order EA 12-049 "Issuance of Order modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond Design Basis External Events" (ML15299A040).

12.102 EPRI 3002000704, "Seismic Evaluation Guidance, Augmented Approach for the Resolution of Fukushima Near Term Task Force Recommendation 2.1: Seismic" (alias "Expedited Seismic Evaluation Process (ESEP)

12.103 Congested Area Plan, Lancaster Airport (KLNS) to TMI Nuclear Station, Croman Corporation, (EDMS doc id # CC-TM-118-1003)

12.104 2494447-07, Validation of FLEX Strategy emergency procedures

12.105 ER-AA-200 "PREVENTIVE MAINTENANCE PROGRAM"

12.106 WC-AA-120 "PREVENTIVE MAINTENANCE (PM) DATABASE REVISION REQUIREMENTS"

12.107 OP-TM-919-000, "FLEX & b.5.b Systems"

12.108 NEI 12-06 Rev 2 "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide", January 2016

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

12.110 OP-TM-EOP-012 "Station Blackout"

12.111 OP-TM-EOP-030 "Loss of Decay Heat Removal"

12.112 Technical Evaluation ECR 16-00067 "FLEX Diesel Generator Electrical Load Limit"

12.113 ASCE 41-13 "Seismic Evaluation and Retrofit of Existing Buildings"

12.114 2494447-08, Technical Position Paper, "FLEX PM Basis Document"

12.115 1101-3, "Containment Integrity and Access Limits"

12.116 1410-Y-60, "Remove and Install RB Equipment Hatch"

12.117 OP-TM-244-901, "Containment Isolation"

12.118 OP-TM-244-911, "Containment Closure"

12.119 OP-TM-AOP-035, "Loss of Spent Fuel Cooling"

12.120 OP-TM-919-907, "Alternate Methods for obtaining Critical Parameters"

12.121 OP-TM-919-941, "Vent of RB Atmosphere"

12.122 OP-TM-919-922, "Makeup from Raw Water Sources"

12.123 2494447-09, Technical Position Paper, "TDEFP Room Post ELAP Evaluation"

12.124 OP-TM-919-923, "Condensate Heating"

12.125 EXC-WP-007 "Main Generator Hydrogen Venting after an ELAP"

12.126 MA-TM-144-103, "Installation, Calibration, and Removal of Temporary Reactor Vessel Drain Down Level Transmitters RC-LT-1037-Temp and RC-LT-1138-Temp"

12.127 EXC-WP-001 "BDBEE Debris Removal"

12.128 EXC-WP-008 "Timing of National SAFER Response Center Equipment Needs"

12.129 EXC-WP-013 "Diesel Fuel Use in FLEX Equipment"

12.130 1103-11, "RCS Water Level Control"

12.131 1102-1, "Plant Heat-up to 525F"

12.132 1102-11, "Plant Cooldown"

12.133 MA-TM-1003 "Snow and Ice Removal Plan"

12.134 OP-TM-919-906 "DC Load Management"

12.135 ER-TM-TSC-0016 "RCS and SFP Heat-up and inventory boil off following loss of active decay heat removal", Rev 4

12.136 HI-89402 R2 "Thermal Hydraulic Analysis of Spent Fuel Pool"

12.137 OP-TM-112-101-1002 REV 7, Shift Staffing Requirements

12.138 Exelon Generation Company, LLC letter to NRC, Response to March 12, 2012 Request for Information, Enclosure 2, Recommendation 2.1, Flooding, Required Response 2, Flood Hazard Reevaluation Report, dated August 14, 2015, RS-15-200

12.139 1001E, "Maintenance Program for "EP" Usage Level Procedures"

12.140 Technical Evaluation 698291-12, "Temporary modification for OTSG hand hole fan & filter configuration

12.141 Exelon Generation Company, LLC letter to NRC, Mitigating Strategies Flood Hazard Assessment (MSFHA) Submittal, dated June 29, 2016, RS-16-104

TMI1 – Final Integrated Plan - ATTACHMENT 2A "INSTALLED FLEX EQUIPMENT LIST"

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
AH-C-1	RB Normal Cooling Evaporative Cooler	DID for RB Pressure Control	AH-C-1B	FLOOD	D	This equipment is located above 320 ft. elevation.	Equipment is designed for outside environment and will be available for flood.	No interlock bypass. With power restored to 1A RB H&V MCC, one half of fans and spray pumps are operable.	W	Current Class	If the RCS is vented to the RB atmosphere AND AH-C-1 (with fans & spray per OP-TM-823-901) is not functional and AH-C-1B is functional, then no action is required. If the RCS is vented to the RB atmosphere AND AH-C-1 AND AH-C-1B are both not functional, then ensure one cooler be returned to functional status prior to a flood event or develop an alternate capability to limit post ELAP RB pressure within 72 hours.
AH-E-1A	Reactor Bldg Recirculation Fan	DID for RB Pressure Control	AH-E-1B	FLOOD	D	This equipment is located in Tornado, Seismic & Flood Protected structure. Power cables are spliced at RB penetration at 299' elevation in Aux Bldg.	Fan is qualified for RB post LOCA environment	No interlock bypass required. Fan can be operated in slow speed if ESAS is actuated.	W	Current Class	If the RCS is vented to the RB atmosphere AND AH-E-1A (slow speed) is not functional and AH-E-1B or AH-E-1C is functional, then no action is required. If the RCS is vented to the RB atmosphere AND AH-E-1A AND AH-E-1B AND AH-E-1C are not functional, then ensure one fan can be returned to functional prior to a flood event or develop an alternate capability to limit post ELAP RB pressure within 72 hours.
AH-P-2A	Circulate RB Normal Closed Cooling System water	DID for RB Pressure Control	No redundancy	FLOOD	D	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection.	Normal operating equipment is more challenging. This equipment will be available for flood.	No interlock bypass required when power is restored.	Z	Current Class	If the RCS is vented to the RB atmosphere AND AH-P-2A is not functional, then ensure the pump can be returned to functional prior to a flood event or develop an alternate capability to limit post ELAP RB pressure within 72 hours..
AH-V-1A	RB Purge Exhaust - CIV	Containment isolation	AH-V-1B	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	The valve function is complete within the first hour, and loss of air keeps CIVs closed	No interlock bypass required. Fails closed on loss of air or power	W	Current Class	Tech Specs control unavailability
AH-V-1D	RB Purge Supply - CIV	Containment isolation	AH-V-1C	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	The valve function is complete within the first hour, and loss of air keeps CIVs closed	No interlock bypass required. Fails closed on loss of air or power	W	Current Class	Tech Specs control unavailability
BS-PI-289	Reactor Building Pressure Measurement	DID - NEI 12-06 recommended monitoring	BS-PI-982B, RB-PI-1186	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and is protected from external flooding due to river water up to 313.5' elevation.	NA - mechanical eqpt.	NA	Y	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability for FLEX.
BS-PI-982B	RB Pressure Indication	DID - NEI 12-06 recommended monitoring	RB-PI-1186, BS-PI-289	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX function not evaluated.	NA	W	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability for FLEX.

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
CA-PI-5	RCS sample pressure	DID - NEI 12-06 5.3.3.1 - Monitor RCS pressure	RC-PI-949A, RC-PI-963, CA-PI-10	QUAKE	A,B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and is protected from external flooding due to river water up to 313.5' elevation.	NA - mechanical eqpt.	NA	V	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
CA-V-002	RCS sample - CIV	Containment isolation	CA-V-342	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	The valve function is complete within the first hour. Loss of air keeps CIVs closed.	Fails closed on loss of air or power	W	Current Class	Tech Specs control unavailability
CF1-PI-1	Core Flood Tank (CF-T-1A) Pressure Indication	DID	CF1-PI-2	ALL	A	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX function not evaluated.	NA	W	Current Class	Tech Specs control unavailability
CF1-PI-2	Core Flood Tank (CF-T-1A) Pressure Indication	DID	CF1-PI-1	ALL	A	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX function not evaluated.	NA	W	Current Class	Tech Specs control unavailability
CF1-PI-3	Core Flood Tank (CF-T-1B) Pressure Indication	DID	CF1-PI-4	ALL	A	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX function not evaluated.	NA	W	Current Class	Tech Specs control unavailability
CF1-PI-4	Core Flood Tank (CF-T-1B) Pressure Indication	DID	CF1-PI-3	ALL	A	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX function not evaluated.	NA	W	Current Class	Tech Specs control unavailability
CF2-LI-1	Core Flood Tank (CF-T-1A) Level Indication	DID	CF2-LI-2	ALL	A	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX function not evaluated.	NA	W	Current Class	Tech Specs control unavailability
CF2-LI-2	Core Flood Tank (CF-T-1A) Level Indication	DID	CF2-LI-1	ALL	A	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX function not evaluated.	NA	W	Current Class	Tech Specs control unavailability
CF2-LI-3	Core Flood Tank (CF-T-1B) Level Indication	DID	CF2-LI-4	ALL	A	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX function not evaluated.	NA	W	Current Class	Tech Specs control unavailability
CF2-LI-4	Core Flood Tank (CF-T-1B) Level Indication	DID	CF2-LI-3	ALL	A	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX function not evaluated.	NA	W	Current Class	Tech Specs control unavailability

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
CF-T-1A	Passive core cooling water injection source	DID	CF-T-1B	ALL	A	This equipment is located in Tornado, Seismic & Flood Protected structure	NA - mechanical eqpt.	NA	W	Current Class	Tech Specs control unavailability
CF-T-1B	Passive core cooling water injection source	DID	CF-T-1A	ALL	A	This equipment is located in Tornado, Seismic & Flood Protected structure	NA - mechanical eqpt.	NA	W	Current Class	Tech Specs control unavailability
CF-V-1A	Core flood tank A isolation valve	DID - Eliminate risk of CFT N2 injection	CF-V-3A	ALL	A	This equipment is located in Tornado, Seismic & Flood Protected structure	FLEX function not evaluated.	No interlock bypass required. Fails as is on loss of air or power	W	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
CF-V-1B	Core flood tank A isolation valve	DID - Eliminate risk of CFT N2 injection	CF-V-3B	ALL	A	This equipment is located in Tornado, Seismic & Flood Protected structure	FLEX function not evaluated.	No interlock bypass required. Fails as is on loss of air or power	W	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
CM-V-1	RB Atmosphere Rad Monitor - CIV	Containment isolation	CM-V-2	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	The valve function is complete within the first hour. Loss of air keeps CIVs closed.	Fails closed on loss of air or power	W	Current Class	Tech Specs control unavailability
CM-V-3	RB Atmosphere Rad Monitor - CIV	Containment isolation	CM-V-4	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	The valve function is complete within the first hour. Loss of air keeps CIVs closed.	Fails closed on loss of air or power	W	Current Class	Tech Specs control unavailability
CO-LI-1061	CO-T-1A Level indication	Control condensate supply to EFW or FX-P-2	CO-LI-1060	WIND	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	Instrument function is only required in first 3 hours after event. FX-LI-1001 provides long term function.	NA	W	Current Class	Tech Specs control unavailability
CO-LI-1063	CO-T-1B Level indication	Control condensate supply to EFW or FX-P-2	CO-LI-1062	WIND	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	Instrument function is only required in first 3 hours after event. FX-LI-1001 provides long term function.	NA	W	Current Class	Tech Specs control unavailability
COM-H-01R	Red Page in 1P SWGR Room	DID	Alternate communications as described in Reference 63	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	This equipment is similar to COM-H-15R	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
COM-H-05R	Red Page in Control Room	DID	Alternate communications as described in Reference 63	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	This equipment is similar to COM-H-15R	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
COM-H-09R	Red Page in IB 295 Hallway	DID	Alternate communications as described in Reference 63	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	This equipment is similar to COM-H-15R	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
COM-H-14R	Red Page in RSD Area	DID	Alternate communications as described in Reference 63	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	This equipment is similar to COM-H-15R	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
COM-H-15R	Red Page on FLEX Platform	DID	Alternate communications as described in Reference 63	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	This equipment is designed for 70^{0}C (ECR 15-00031)	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
CO-T-1A	Condensate Storage Tank "A",	Feedwater to OTSG, and RCS or SF Pool Makeup	CO-T-1B, DW-T-2	ALL EXC COLD	ALL	ECR 13-00476. The tank structural integrity has been confirmed for earthquake, tornado or flood up to 320' elevation.	NA - mechanical eqpt.	NA	W	Current Class	If water level is less than 16 feet, then restore level within 72 hours (MODE A). In MODE B,C or D a minimum of 200,000 gallons is required in CO-T-1A or CO-T-1B or the hotwell. If MODE B,C,D water level is insufficient, then restore level within 72 hours
CO-T-1B	Condensate Storage Tank "B"	Feedwater to OTSG, and RCS or SF Pool Makeup	CO-T-1A, DW-T-2	QUAKE, COLD	ALL	ECR 13-00476. The tank structural integrity has been confirmed for earthquake or flood up to 320' elevation.	NA - mechanical eqpt.	NA	W	Current Class	If water level is less than 16 feet, then restore level within 72 hours (MODE A). In MODE B,C or D a minimum of 200,000 gallons is required in CO-T-1A or CO-T-1B or the hotwell. If MODE B,C,D water level is insufficient, then restore level within 72 hours
CO-V-008	Emergency makeup to hotwell	DID Open to use hotwell condensate supply for EFW or FX-P-2	DW-V-34 and CO-V-12	COLD	D	This equipment is located in Tornado & Seismic qualified structure. This location is shielded from tornado missiles. The component will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	Fails OPEN on loss of air. Local control is available.	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
CO-V-010B	CO-T-1B isolation valve	DID - Isolate failed CO-T-1B	Level control for FX-P-2A & B suction	WIND	ALL	This equipment is located in a Seismic qualified structure. This location is shielded from tornado missiles. This component is not required for flood mitigation.	NA - mechanical eqpt.	FAI	W	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
CO-V-013	Isolates Flow Between CST "B" and Condenser	Isolate non-seismic hotwell from FX-T-1A & B	CO-V-8 & CO-V-108	QUAKE	ALL	This equipment is located in Tornado & Seismic qualified structure. This location is shielded from tornado missiles. The component will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	FAI - Valve can be operated locally	U	TECH EVAL 14-00219	If CO-V-13 cannot be closed, then within 72 hours establish interim provisions for local closure of CO-V-8 and CO-V-108 (post ELAP).
CO-V-024	Condensate Reject Line Isolation Valve	Isolate non-seismic piping from FX-T-1A & B	CO-V-23	QUAKE	ALL	This equipment is located in Tornado & Seismic qualified structure. This location is shielded from tornado missiles. This equipment will perform its function prior to potential flood damage.	NA - mechanical eqpt.	NA	U	TECH EVAL 14-00219	If this valve cannot be closed, then within 72 hours establish interim provisions to close CO-V-23 (post EARTHQUAKE).

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
CO-V-111A	CO-T-1A & CO-T-1B cross connect isolation valve	Control condensate supply to EFW or FX-P-2	Redundancy is not available (See reference 23 section 2.12.2)	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	FAI - Valve can be operated locally	W	Current Class	Tech Specs control unavailability NOTE: Valve may be open within the bounds described in OP-TM-424-501.
CO-V-176	EFW Recirc Line Isolation valve	Control condensate supply to EFW or FX-P-2	Redundancy is not available (See reference 23 section 2.12.2)	WIND	A	This equipment is located in Tornado & Seismic qualified structure, with missile protection and is protected from external flooding due to river water up to 313.5' elevation.	NA - mechanical eqpt.	NA	W	Current Class	Tech Specs control unavailability
DF-P-1C	Fuel Oil Transfer Pump from DF-T-1 to DF-T-2B	Fuel oil supply to FLEX DG	DF-P-1D	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	Component design temperature (104F) bounds the BDBEE outside ambient temperature (100F). There are no other heat sources in the area which would raise the local ambient.	Using FLEX AC power the pump can be operated locally. There are no interlocks.	W	Current Class	Tech Specs control unavailability
DF-P-1C-BK	DF-P-1C power supply	Fuel oil supply to FLEX DG	DF-P-1D-BK	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature within design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
DF-P-1D	Fuel Oil Transfer Pump from DF-T-1 to DF-T-2B	Fuel oil supply to FLEX DG	DF-P-1C	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	Component design temperature (104F) bounds the BDBEE outside ambient temperature (100F). There are no other heat sources in the area which would raise the local ambient.	This DC powered pump can be operated locally. There are no interlocks.	W	Current Class	Tech Specs control unavailability
DF-P-1D-BK	Power supply to DF-P-1D	Fuel oil supply to FLEX DG	DF-P-1C-BK	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	FLEX temporary ventilation will maintain ambient temperature less than 120F (ECR 13-00310)	NA	W	Current Class	Tech Specs control unavailability
DF-T-1	Fuel Oil Supply for EG-Y-1A & EG-Y-1B	Fuel oil supply to FLEX DG	PASSIVE	ALL	ALL	This an underground tank. The tank structural integrity has been confirmed for flood up to 313.5' elevation.	NA - mechanical eqpt.	NA	W	Current Class	Tech Specs control unavailability
DF-V-0040	DF-P-1C & 1D Discharge Isolation Valve	Fuel oil supply to FLEX DG	Redundancy is not available (See reference 23 section 2.12.2)	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	NA	W	SQ-T1-FX-VALVES	If valve cannot be closed, then restore valve within 72 hours.

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
DF-V-0041	DF-P-1C/1D SUPPLY to FLEX FUEL OIL TANK	Fuel oil supply to FLEX DG	Redundancy is not available (See reference 23 section 2.12.2)	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	NA	W	SQ-T1-FX-VALVES	If valve cannot be opened, then restore valve within 72 hours.
DH-T-1	Borated Water Storage Tank	RCS Makeup	PASSIVE	ALL EXC WIND	ALL	The tank structural integrity has been confirmed for flood up to 313.5' elevation with tank water level below 6 ft, or any flood level below the tank water level.	NA - mechanical eqpt.	NA	W	Current Class	Tech Specs control unavailability
DH-T-1-H1	Maintain BWST temperature above 40F	RCS Makeup	DH-T-1H2 (1B ESV MCC and 1B ESF MCC)	COLD	A,B,C	No protection required. Only required for Extreme Cold Event.	Only required in cold events. Electrical components are not challenged.	NA	X	Current Class	Tech Specs control unavailability
DH-T-1H1-BK	Power supply to BWST heater	RCS makeup	DH-T-1H2 (1B ESV MCC and 1B ESF MCC)	COLD	A,B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and is protected from external flooding due to river water up to 313.5' elevation.	Only required in cold events. Electrical components are not challenged.	The heater is locked out if ES/UV relay is actuated. Jumper required (Ref. 77). Low level Interlock is powered from SCC A3 . Interlock remains functional in EXT COLD event.	W	Current Class	Tech Specs control unavailability
DH-V-004A	"A" Train Low Pressure Injection Isolation Valve	RCS Makeup-LP	DH Train B	ALL	D	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	FAI - Valve can be operated locally	W	Current Class	Tech Specs control unavailability
DH-V-004B	"B" Train Low Pressure Injection Isolation Valve	RCS Makeup-LP	DH Train A	ALL	D	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	FAI - Valve can be operated locally	W	Current Class	Tech Specs control unavailability
DH-V-005A	BWST to A train DH suction header isolation valve	RCS Makeup-LP	DH Train B	ALL EXC WIND	D	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	FAI - Valve can be operated locally	W	Current Class	Tech Specs control unavailability
DH-V-005B	BWST to B train DH suction header isolation valve	RCS Makeup-LP	DH Train A	ALL EXC WIND	D	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	FAI - Valve can be operated locally	W	Current Class	Tech Specs control unavailability
DH-V-012A	RCS to A train DH suction header isolation valve	Isolate DH system from RCS	Redundancy is not available (See reference 23 section 2.12.2)	ALL	B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	NA	W	Current Class	Tech Specs control unavailability

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
DH-V-012B	RCS to B train DH suction header isolation valve	Isolate DH system from RCS	Redundancy is not available (See reference 23 section 2.12.2)	ALL	B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	NA	W	Current Class	Tech Specs control unavailability
DH-V-019A	A train DH flow control valve	DID - BWST Gravity Drain Core Cooling (use DH-V-4 or 5 to throttle, if necessary)	DH-V-19B	ALL EXC WIND	D	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	NA	W	Current Class	Tech Specs control unavailability
DH-V-019B	B train DH flow control valve	DID - BWST Gravity Drain Core Cooling (use DH-V-4 or 5 to throttle, if necessary)	DH-V-19A	ALL EXC WIND	D	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	NA	W	Current Class	Tech Specs control unavailability
DH-V-020A	"A" Train DH Cleanup/recirc control Valve	RCS Makeup-LP	DH-V-20B	ALL	D	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	NA	W	Current Class	Tech Specs control unavailability
DH-V-020B	"B" Train DH Cleanup/recirc control Valve	RCS Makeup-LP	DH-V-20A	ALL	D	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	NA	W	Current Class	Tech Specs control unavailability
DH-V-052	DH Cleanup to WDL Isolation Valve	RCS Makeup-LP	Redundancy is not available (See reference 23 section 2.12.2)	ALL	D	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	NA	W	Current Class	Tech Specs control unavailability
DW-T-2	Demin Water Storage Tank	DID - Condensate source	CO-T-1A, CO-T-1B	ALL	A	ECR 13-00476	NA - mechanical eqpt.	NA	Z	Current Class	If water level is less than 21 feet, then restore level within 14 days.
DW-V-030	DW-P-2 BYPASS ISOLATION	DID	DW-P-2	ALL EXC QUAKE	A	This equipment is located in Tornado & Seismic qualified structure. In Tornado, this valve will be available if DW-T-2 is available. This equipment will perform its function prior to potential flood damage.	NA - mechanical eqpt.	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
DW-V-035	DW-T-2 TO HOTWELL Isolation Valve	DID	DW-V-34	ALL EXC QUAKE	A	This equipment is located in Tornado & Seismic qualified structure. This location is shielded from tornado missiles. The component will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
EE-1P-12-BK	Remote Operated Breaker for 1P Cross Tie Breaker	Locally closed to energize A ES Power Train from FLEX DG	EE-1S-12-BK	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature within design (< 104F) ECR 13-00310	ES/UV interlock must be bypassed	W	Current Class	Tech Specs control unavailability
EE-1P-12-BK2	1P & 1S BUS TIE FDR from FX-Y-1A/B Output Transfer Switch	Closed to energize ES Power Trains from FLEX DG	Alternate strategy - Use FX-CABLE-B plugged into EE-PNL-FX-2 and 1A ES MCC Unit 15A	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature within design (< 104F) ECR 13-00310		W	S1515.2 Rev 0	If breaker cannot be closed, then restore this function within 90 days.
EE-1S-12-BK	Remote Operated Breaker for 1P Cross Tie Breaker	Locally closed to energize B ES Power Train from FLEX DG	EE-1P-12-BK	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature within design (< 104F) ECR 13-00310	ES/UV interlock must be bypassed	W	Current Class	Tech Specs control unavailability
EED-B-1A & EED-B-1C	Station Battery	Vital instrument power	EED-B-1B & EED-B-1D	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature < 110F (ECR 13-00310)		W	Current Class	Tech Specs control unavailability
EED-B-1B & EED-B-1D	Station Battery	Vital instrument power	EED-B-1A & EED-B-1C	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature < 110F (ECR 13-00310)		W	Current Class	Tech Specs control unavailability
EED-BC-1A	Charges "A" Station Battery	Vital instrument power	EED-BC-1E	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature < 110F (ECR 13-00310)	Using FLEX AC power this eqpt can be energized. There are no affected interlocks.	W	Current Class	Tech Specs control unavailability
EED-BC-1B	Charges "B" Station Battery	Vital instrument power	EED-BC-1F	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature < 110F (ECR 13-00310)	Using FLEX AC power this eqpt can be energized. There are no affected interlocks.	W	Current Class	Tech Specs control unavailability
EED-BC-1C	Charges "C" Station Battery	Vital instrument power	EED-BC-1E	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature < 110F (ECR 13-00310)	Using FLEX AC power this eqpt can be energized. There are no affected interlocks.	W	Current Class	Tech Specs control unavailability
EED-BC-1D	Charges "D" Station Battery	Vital instrument power	EED-BC-1F	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature < 110F (ECR 13-00310)	Using FLEX AC power this eqpt can be energized. There are no affected interlocks.	W	Current Class	Tech Specs control unavailability

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
EED-PNL-1A	Main DC Distribution Panel A	Power distribution for FLEX equipment and vital instruments	PASSIVE	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature < 110F (ECR 13-00310)	NA	W	Current Class	Tech Specs control unavailability
EED-PNL-1B	Main DC Distribution Panel B	Power distribution for FLEX equipment and vital instruments	PASSIVE	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature < 110F (ECR 13-00310)	NA	W	Current Class	Tech Specs control unavailability
EED-PNL-1E	ES DC Distribution Panel 1E	Power distribution for FLEX equipment and vital instruments	PASSIVE	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature < 110F (ECR 13-00310)	NA	W	Current Class	Tech Specs control unavailability
EED-PNL-1F	ES DC Distribution Panel 1F	Power distribution for FLEX equipment and vital instruments	PASSIVE	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature < 110F (ECR 13-00310)	NA	W	Current Class	Tech Specs control unavailability
EE-INV-1A	Convert Battery DC to Vital 120 VAC	Vital instrument power	EE-INV-1B	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature < 110F (ECR 13-00310)	Using DC or FLEX AC power this eqpt can be energized. There are no affected interlocks.	W	Current Class	Tech Specs control unavailability
EE-INV-1B	Convert Battery DC to Vital 120 VAC	Vital instrument power	EE-INV-1A	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature < 110F (ECR 13-00310)	Using DC or FLEX AC power this eqpt can be energized. There are no affected interlocks.	W	Current Class	Tech Specs control unavailability
EE-INV-1C	Convert Battery DC to Vital 120 VAC	NO - VBC is stripped to manage DC load	NA	NA	NA	NA	NA	NA	NA	NA	NA
EE-INV-1D	Convert Battery DC to Vital 120 VAC	Power to RC-LT-1037	EE-INV-1A	ALL	D	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature < 110F (ECR 13-00310)	Using DC or FLEX AC power this eqpt can be energized. There are no affected interlocks.	W	Current Class	Tech Specs control unavailability
EE-INV-1E	Convert Battery DC to Vital 120 VAC	Power to RC1-LT & LR for Pzr level	EE-INV-1B (RC-LT-777A)	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature < 110F (ECR 13-00310)	Using DC or FLEX AC power this eqpt can be energized. There are no affected interlocks.	W	Current Class	Tech Specs control unavailability
EE-MCC-ES-1A	1A ES Loads for Essential Safe Shutdown/Normal Components	Power distribution for FLEX equipment and vital instruments	PASSIVE	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature within design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
EE-MCC-ES-1A-BK	1A ES MCC FDR from 1P 480V Switchgear	Power distribution for FLEX equipment and vital instruments	EE-MCC-ES-1B-BK	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature within design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
EE-MCC-ES-1A-BK1	1A ES MCC (and both ES trains through cross tie) power supply from FLEX Diesel Generators	Power distribution for FLEX equipment and vital instruments	EE-1P-12-BK2	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
EE-MCC-ES-1B	IB ES Loads for Essential Safe Shutdown/Normal Components	Power distribution for FLEX equipment and vital instruments	PASSIVE	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature within design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
EE-MCC-ES-1B-BK	1B ES MCC FDR from 1S 480V Switchgear	Power distribution for FLEX equipment and vital instruments	EE-MCC-ES-1A-BK	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature within design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
EE-MCC-ESF-1A	ES Motor control center	RCS makeup	PASSIVE	COLD	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and is protected from external flooding due to river water up to 313.5' elevation.	This equipment is only required for events of extreme cold.	NA	W	Current Class	Tech Specs control unavailability
EE-MCC-ESV-1A	1A ES Valves MCC	Isolate CBO Flow or energize BWST heater	DH-T-1H2, ALT PATH for CBO ISOL is not available	ALL EXC QUAKE	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	Ambient temperature will remain < 104F due to minimal heat loads in AB.	NA	W	Current Class	Tech Specs control unavailability
EE-MCC-ESV-1C	1C Valves MCC	DID - Eliminate risk of CFT N2 injection, close MS-V-1 or energize PG-Z-1	No redundancy	ALL	A	This equipment is located in Tornado & Seismic qualified structure, with missile protection and is protected from external flooding due to river water up to 313.5' elevation.		NA	W	Current Class	Tech Specs control unavailability
EE-MCC-RBH-1A-BK2	Supply power 1A RB H&V MCC from FLEX Diesel	DID for RB Pressure Control	No redundancy	FLOOD	D	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	Not required for extreme heat event. Ambient will be within design during a flood.	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
EE-MCC-RDW-1A	1A Radwaste MCC	Isolate CBO Flow	Redundancy is not available (See reference 23 section 2.12.3)	WIND	A,B	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	Ambient temperature will remain < 104F due to minimal heat loads in AB.	NA	Z	Current Class	If this bus cannot be energized, then restore this capability within 90 days.
EE-MCC-RDW-1A-BK2	1A Radwaste MCC Unit 9E -- 1A to 1B Radwaste MCC Tie Breaker	DID - RCS Makeup from RCBT C	No redundancy	WIND	A,B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and is protected from external flooding due to river water up to 313.5' elevation.	FLEX function not evaluated.	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
EE-MCC-RDW-1B	1B radwaste MCC	DID - RCS Makeup from RCBT C	No redundancy	WIND	A,B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and is protected from external flooding due to river water up to 313.5' elevation.	FLEX function not evaluated.	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
EE-PNL-ATA	Power supply to ICS & NNI instruments, and others	Power to RC1-LT & LR for Pzr level	EE-PNL-VBB (RC-LT-777A)	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with < 110F) ECR 13-00310	NA	Y	Current Class	If this panel cannot be energized, then restore this capability within 90 days.
EE-PNL-ATB	Power supply to ICS & NNI instruments, and others	Power to RC1-LT & LR for Pzr level	EE-PNL-VBB (RC-LT-777A)	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with < 110F) ECR 13-00310	NA	Y	Current Class	If this panel cannot be energized, then restore this capability within 90 days.
EE-PNL-ATC	Spare AC panel	Power for temporary ventilation	Alternate strategy - Use FX-CABLE-A plugged into WELD-T-26-BK and power buggy in CB 322 and FX-CABLE-F to 355 elev.	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with < 110F) ECR 13-00310	NA	U	SQ-T1-EE-PNL-ATC	If this panel cannot be energized, then restore this capability within 90 days.
EE-PNL-ATC1	Power for FLEX functions only	Power for temporary ventilation and SFP Level Indication	Alternate strategy - Use FX-CABLE-A plugged into WELD-T-26-BK and power buggy in CB 322 and FX-CABLE-F to 355 elev.	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with < 110F) ECR 13-00310	NA	U	SQ-T1-EE-PNL-ATC1	If this panel cannot be energized, then restore this capability within 90 days.
EE-PNL-FX	FLEX Power distribution panel	Power distribution for FLEX equipment and vital instruments	PASSIVE	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	FLEX temporary ventilation will maintain ambient temperature less than design 122F. ECR 13-00310	NA	U	SQ-T1-EE-PNL-FX	If this panel cannot be energized, then within 72 hours provide an alternate power source for FX-Y-1A & B batteries, and restore this capability within 90 days.

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
EE-PNL-FX-1	FLEX Power distribution panel	Power distribution for FLEX equipment and vital instruments	PASSIVE	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	FLEX temporary ventilation will maintain ambient temperature less than design 122F. ECR 13-00310	NA	U	SQ-T1-EE-PNL-FX-1	If this panel cannot be energized, then within 72 hours provide an alternate power source for FX-Y-1A & B batteries, and restore this capability within 90 days.
EE-PNL-FX-1-BK	Feeder to FX-Y-1A/B auxiliaries (battery charger, receptacles, lights)	Power distribution for FLEX equipment and vital instruments	Alternate strategy - Use FX-CABLE-A plugged into WELD-T-26-BK and power buggy at FLEX platform	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	FLEX temporary ventilation will maintain ambient temperature less than design 122F. ECR 13-00310	NA	U	SQ-T1-EE-PNL-FX	See EE-PNL-FX-1
EE-PNL-FX-2	Power isolation to 1P/1S 480V Bus Bar or temporary connection to EE-MCC-ES-1A-BK1	Power distribution for FLEX equipment and vital instruments	PASSIVE	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature less than design 104F. ECR 13-00310	NA	W	SQ-T1-EE-PNL-FX-2	No active function
EE-PNL-FX-3A	Back Feed RRC Diesel or Feed Load Bank	DID - Phase 3 function	EE-PNL-FX-3B	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	FLEX temporary ventilation will maintain ambient temperature less than design 122F. ECR 13-00310	NA	U	SQ-T1-EE-PNL-FX-3A	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
EE-PNL-FX-3B	Back Feed RRC Diesel or Feed Load Bank	DID - Phase 3 function	EE-PNL-FX-3A	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	FLEX temporary ventilation will maintain ambient temperature less than design 122F. ECR 13-00310	NA	U	SQ-T1-EE-PNL-FX-3B	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
EE-PNL-FX-4	Provide Power to 1A RB H&V MCC / 1B PZR HTR MCC	DID for RB Pressure Control	No redundancy	FLOOD	D	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	FLEX temporary ventilation will maintain ambient temperature less than design 122F. ECR 13-00310	NA	U	SQ-T1-EE-PNL-FX-4	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
EE-PNL-FX-5	Connect power from FX-Y-4 to FSF receptacles	DID - Power can be directly routed to standby block heaters for FX-P-3A, 3B or FX-Y-3	No redundancy	COLD	ALL	This equipment is located in a Seismic qualified structure. This location is shielded from tornado missiles. This component is not required for flood mitigation.	FLEX temporary ventilation will maintain ambient temperature less than design 122F. ECR 13-00310	NA	Z	13-00070	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
EE-PNL-FX-BK1	Power supply to EE-PNL-FX from FX-Y-1A or B	Power supply to EE-PNL-FX from FX-Y-1A or B	Alternate strategy - Use FX-CABLE-D plugged into EE-PNL-FX-3A or B and plugged into EE-PNL-FX-4 .	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	FLEX temporary ventilation will maintain ambient temperature less than design 122F. ECR 13-00310	NA	U	SQ-T1-EE-PNL-FX	If this breaker cannot be closed, then restore this capability within 90 days.

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
EE-PNL-FX-BK2	Power supply to EE-PNL-FX from 1D TP MCC	Isolate normal power supply	EE-PNL-FX-BK5	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	FLEX temporary ventilation will maintain ambient temperature less than design 122F. ECR 13-00310	NA	U	SQ-T1-EE-PNL-FX	If this breaker cannot be closed, then restore this capability within 90 days.
EE-PNL-FX-BK3	Temporary Cable feeder to 1A/1B Pzr Htr MCC or 1A RB H&V MCC	DID for RB Pressure Control	No redundancy	FLOOD	D	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	Equipment will be operated with design limits during flood. The equipment is not required for extreme temperature events.	NA	U	SQ-T1-EE-PNL-FX	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
EE-PNL-FX-XFR	(1) Connect FX-Y-1A, FX-Y-1B or RRC diesel generator to EE-PNL-FX & ES Distribution panels. (2) Connect FX-Y-1A or FX-Y-1B to a test load bank	Connect FX-Y-1A, FX-Y-1B or RRC diesel generator to EE-PNL-FX & ES Distribution panels.	Transfer switch will be maintained lined up to an functional FLEX DG. (PASSIVE)	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	FLEX temporary ventilation will maintain ambient temperature less than design 122F. ECR 13-00310	NA	U	SQ-T1-EE-PNL-FX-XFR	If switch is lined up to an functional diesel, but cannot be transferred, then restore this capability within 90 days.
EE-PNL-FX-XFR-2	Switch between normal plant power and FX-Y-4 after event	DID - portable lighting can be used	No redundancy	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, and not required for a flood.	FLEX function not evaluated.	NA	Z	13-00074	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
EE-PNL-VBA	Vital Instrument 120V AC "A"	Vital instrument power	EE-PNL-VBB	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature < 110F (ECR 13-00310)	NA	W	Current Class	Tech Specs control unavailability
EE-PNL-VBB	Vital Instrument 120VAC "B"	Vital instrument power	EE-PNL-VBA	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature < 110F (ECR 13-00310)	NA	W	Current Class	Tech Specs control unavailability
EE-PNL-VBC	Vital Instrument Power "C"	NO - VBC is stripped to manage DC load	NA	NA	NA	NA	NA	NA	NA	NA	NA
EE-PNL-VBD	Vital Instrument Power "D"	Power to RC-LT-1037	EE-PNL-VBB	ALL	D	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature < 110F (ECR 13-00310)	NA	W	Current Class	Tech Specs control unavailability
EE-R-FX-1/48	Check phase rotation when Phase 3 DG is connected	DID - Phase 3 function	No redundancy	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	FLEX temporary ventilation will maintain ambient temperature less than design 122F. ECR 13-00310	NA	Z	13-00070	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.

TMI1 – Final Integrated Plan - ATTACHMENT 2A "INSTALLED FLEX EQUIPMENT LIST"

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
EE-SWG-480V-1P	A train ES 480V Switchgear	Power distribution for FLEX equipment and vital instruments	EE-SWG-480V-1S	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature within design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
EE-SWG-480V-1S	B train ES 480V Switchgear	Power distribution for FLEX equipment and vital instruments	EE-SWG-480V-1P	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature within design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
EE-VM-FX-1	Monitor FX panel voltage	DID - monitor bus voltage	No redundancy	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	FLEX temporary ventilation will maintain ambient temperature less than design 122F. ECR 13-00310	NA	Z	13-00070	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
EF-P-1	Turbine Driven EFW Pump	Emergency Feedwater to OTSG	Redundancy is not available (See reference 23 section 2.12.1)	ALL	A,B	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt	No interlocks except for mechanical overspeed trip device	W	Current Class	In addition to Tech Spec requirements, EF-P-1 should not be removed from service for planned maintenance UNLESS EG-Y-1A, EG-Y-1B and EG-Y-4 are OPERABLE.
EF-V-017	EFW Recirc line Drain Valve	Maintain CO-T-1B above 40F	Hotwell	COLD	A	This equipment is located in Tornado & Seismic qualified structure, with missile protection and is protected from external flooding due to river water up to 313.5' elevation.	NA - mechanical eqpt	NA	W	Current Class	Tech Specs control unavailability
EF-V-030A	Control EFW Flow to OTSG A	Control EFW Flow to OTSG A	EF-V-30D, FX-V-206A	ALL	A	This equipment is located in Tornado & Seismic qualified structure, and will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt	Fails Closed on loss of AIR, Valve can be controlled from CR while air is available (> 3 hrs).	W	Current Class	Tech Specs control unavailability
EF-V-030A-EX1	Remote control of EF-V-30A	Emergency Feedwater to OTSG	EF-V-30D	ALL	A	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	Remote control of EF-V-30s are required for the first three hours of the event, then local control is used.	See EF-V-30A	W	Current Class	Tech Specs control unavailability
EF-V-030B	Control EFW Flow to OTSG B	Control EFW Flow to OTSG B	EF-V-30C, FX-V-206B	ALL	A	This equipment is located in Tornado & Seismic qualified structure, and will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt	Fails Closed on loss of AIR, Valve can be controlled from CR while air is available (> 3 hrs).	W	Current Class	Tech Specs control unavailability
EF-V-030B-EX1	Remote control of EF-V-30B	Emergency Feedwater to OTSG	EF-V-30C	ALL	A	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	Remote control of EF-V-30s are required for the first three hours of the event, then local control is used.	See EF-V-30B	W	Current Class	Tech Specs control unavailability

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
EF-V-030C	Control EFW Flow to OTSG B	Control EFW Flow to OTSG B	EF-V-30B	ALL	A	This equipment is located in Tornado & Seismic qualified structure, and will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt	Fails Closed on loss of AIR	W	Current Class	Tech Specs control unavailability
EF-V-030C-EX1	Remote control of EF-V-30C	Emergency Feedwater to OTSG	EF-V-30B	ALL	A	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	Remote control of EF-V-30s are required for the first three hours of the event, then local control is used.	See EF-V-30C	W	Current Class	Tech Specs control unavailability
EF-V-030D	Control EFW Flow to OTSG A	Control EFW Flow to OTSG A	EF-V-30A	ALL	A	This equipment is located in Tornado & Seismic qualified structure, and will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt	Fails Closed on loss of AIR	W	Current Class	Tech Specs control unavailability
EF-V-030D-EX1	Remote control of EF-V-30D	Emergency Feedwater to OTSG	EF-V-30A	ALL	A	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	Remote control of EF-V-30s are required for the first three hours of the event, then local control is used.	See EF-V-30D	W	Current Class	Tech Specs control unavailability
EF-V-067A	FLEX Isolation from EFW system A	Feedwater to OTSG	EF-V-30A	ALL	A,B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	NA	W	Report W-1201	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability, within 90 days.
EF-V-067B	FLEX Isolation from EFW system B	Feedwater to OTSG	EF-V-30B	ALL	A,B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	NA	W	Report W-1201	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability, within 90 days.
EX-T-1	LP Moisture Drains Collection Tank	Long term condensate supply	CO-T-1B	WIND	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	Z	Current Class	No active function
EX-V-9	LP Moisture Drains Collection Tank drain to condenser	Long term condensate supply	CO-T-1B	WIND	ALL	This equipment is located in Tornado & Seismic qualified structure. This location is shielded from tornado missiles.	NA - mechanical eqpt.	Fails OPEN on loss of AIR	Z	Current Class	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability, within 90 days.
FS-V-043	isolate FS header to CB, AB & FHB	DID - isolate failed piping after a seismic event	Shutdown FS-P-1 & FS-P-3	QUAKE	ALL	This equipment is located in Tornado & Seismic qualified structure. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FS-V-051	isolate FS header to IB	DID - isolate failed piping after a seismic event	Shutdown FS-P-1 & FS-P-3	QUAKE	ALL	This equipment is located in Tornado & Seismic qualified structure. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
FS-V-233	isolate FS header to CB, AB & FHB	DID - isolate failed piping after a seismic event	Shutdown FS-P-1 & FS-P-3	QUAKE	ALL	This equipment is located in Tornado & Seismic qualified structure. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FS-V-256	isolate backup cooling water supply to IA-P-1A	DID - minimize internal flooding challenge	Isolated with FS-V-51 or shutdown FS-P-1 & 3	ALL	ALL	The equipment is located in a Tornado qualified structure and protected from tornado missiles.	NA - mechanical eqpt.	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FS-V-257	isolate backup cooling water supply to IA-P-1B	DID - minimize internal flooding challenge	Isolated with FS-V-51 or shutdown FS-P-1 & 3	ALL	ALL	The equipment is located in a Tornado qualified structure and protected from tornado missiles.	NA - mechanical eqpt.	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FW-LI-775B	OTSG B Full range Level Indication	Control Feedwater to OTSG	FW-LI-789B	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
FW-LI-776B	OTSG A Full range Level Indication	Control Feedwater to OTSG	FW-LI-788B	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
FW-LI-788B	OTSG A Full range Level Indication	Control Feedwater to OTSG	FW-LI-776B	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
FW-LI-789B	OTSG B Full range Level Indication	Control Feedwater to OTSG	FW-LI-775B	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
FW-V-005A	Main Feedwater Block Valve "A"	DID - alternate strategy to feed OTSG	FX-P-2 feed through EFW	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	NA - mechanical eqpt	Valve fails as is. The valve can be opened locally if required.	W	SQUG	Tech Specs control unavailability
FW-V-005B	Main Feedwater Block Valve "B"	DID - alternate strategy to feed OTSG	FX-P-2 feed through EFW	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	NA - mechanical eqpt	Valve fails as is. The valve can be opened locally if required.	W	SQUG	Tech Specs control unavailability
FW-V-017A	Main Feedwater Main Regulating Valve "A"	DID - alternate strategy to feed OTSG	FX-P-2 feed through EFW	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	NA - mechanical eqpt	Valve fails as is. The valve can be opened locally if required.	W	SQUG	Tech Specs control unavailability

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
FW-V-017B	Main Feedwater Main Regulating Valve "B"	DID - alternate strategy to feed OTSG	FX-P-2 feed through EFW	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	NA - mechanical eqpt.	Valve fails as is. The valve can be opened locally if required.	W	SQUG	Tech Specs control unavailability
FX-HOSE-B-X2	(1) Connect FX-HOSE-B1 to FX-HOSE-B or (2) Connect FX-HOSE-B1 to FX-HOSE-Z	DID - Alternate path for failure of HP piping between CB and FHB	Installed piping	ALL	A,B,C	This equipment is located in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	NA - mechanical eqpt.	NA	Z	14-00032	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-LI-1001	FX-T-1 Condensate Level Indicator	Feedwater to OTSG, and RCS or SF Pool Makeup	CO-LI-1060, 1063	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, and is not vulnerable to flood damage. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	Z	14-00031	No active function
FX-LI-1002A	FX-T-2 Lower Range Level Indication	Fuel oil supply to FLEX DG	Passive	FLOOD	ALL	This equipment will perform its function if subjected to river water level up to 320' elevation (ECR 13-00164).	NA - mechanical eqpt.	NA	Z	13-00164	No active function
FX-LI-1002B	FX-T-2 Upper Range Level Indication	Fuel oil supply to FLEX DG	FX-LI-1002A	FLOOD	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	Z	13-00164	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-LI-1003	FX-T-3 Level Indicator	Fuel oil supply to FLEX DG	Visual observation or dip stick	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	U	13-00164	If level indicator is not functional, then restore capability within 90 days.
FX-LS-1004	Control FX-P-7	NO - FX-P-7 provides overflow protection FX-T-3 and the level lights are redundant to FX-LI-1003.	NA	NA	NA	NA	NA	NA	NA	NA	NA
FX-LS-1005	FX-T-3 "Fuel in basin" Alarm	NO – Function is environmental protection only	NA	NA	NA	NA	NA	NA	NA	NA	NA
FX-P-1A	FLEX RCS MU Pump A	RCS Makeup-HP	FX-P-1B	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	The motor is designed for operation at 50C (122F) and FLEX temporary ventilation will maintain ambient temperature within design (< 120F) ECR 13-00310	NA	U	SQ-T1-FX-P-0001	If FX-P-1A cannot provide 35 GPM at 2100 psig and FX-P-1B is functional, then restore FX-P-1A within 90 days. If FX-P-1A and FX-P-1B are NON-functional, then initiate action to restore one pump to an functional condition (or develop an equivalent capability) within 72 hours.

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Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
FX-P-1A-BK	FX-P-1A supply breaker	RCS Makeup-HP	FX-P-1B	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature within design (< 104F) ECR 13-00310	NA	W	13-00070 Att #22B	See FX-P-1A
FX-P-1A-BK1	FX-P-1A supply breaker	RCS Makeup-HP	FX-P-1B	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature within design (< 104F) ECR 13-00310	NA	U	SQ-T1-FX-P-1A-EX4	See FX-P-1A
FX-P-1B	FLEX RCS MU Pumps B	RCS Makeup-HP	FX-P-1A	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	The motor is designed for operation at 50C (122F) and FLEX temporary ventilation will maintain ambient temperature within design (< 120F) ECR 13-00310	NA	U	SQ-T1-FX-P-0001	See FX-P-1A
FX-P-1B-BK	FX-P-1B supply breaker	RCS Makeup-HP	FX-P-1A	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature within design (< 104F) ECR 13-00310	NA	W	13-00070 Att #22B	See FX-P-1A
FX-P-1B-BK1	FX-P-1B supply breaker	RCS Makeup-HP	FX-P-1A	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature within design (< 104F) ECR 13-00310	NA	U	SQ-T1-FX-P-1A-EX4	See FX-P-1A
FX-P-2A	FLEX Feedwater Pump A (a) backup to EF-P-1 at low OTSG pressure, (b) Spent fuel pool makeup and c) RCS makeup at low pressures	Feedwater to OTSG, and RCS or SF Pool Makeup	FX-P-2B	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure. This location is shielded from tornado missiles. The component will function if submerged due to flood.	The motor is designed for operation at 50C (122F) and is submerged in condensate of 100F or less.	NA	U	PSV100161213 0010	If FX-P-2A cannot provide 120 GPM at 420 ft TDH and FX-P-2B is functional, then restore FX-P-2A within 90 days. If FX-P-2A and FX-P-2B are NON-functional, then initiate action to restore one pump to an functional condition (or develop an equivalent capability) within 72 hours. NOTE: EF-P-1 can feed OTSG. Alternates must address SF cooling and outage core cooling.
FX-P-2A/B-BK	Supply breaker for power cable to FX-P-2A or FX-P-2B	Feedwater to OTSG, and RCS or SF Pool Makeup	Alternate strategy - Use FX-CABLE-A plugged into WELD-T-26 to provide power to FX-P-2A/B	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	FLEX temporary ventilation will maintain ambient temperature less than design 122F. ECR 13-00310	NA	U	SQ-T1-EE-PNL-FX	see FX-P-2A

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
FX-P-2A-BK1	FX-P-2A supply breaker	Feedwater to OTSG, and RCS or SF Pool Makeup	FX-P-2B	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	FLEX temporary ventilation will maintain ambient temperature less than design 122F. ECR 13-00310	NA	U	SQ-T1-FX-P-2A-EX4	see FX-P-2A
FX-P-2B	FLEX Feedwater Pump B (a) backup to EF-P-1 at low OTSG pressure, (b) Spent fuel pool makeup and c) RCS makeup at low pressures	Feedwater to OTSG, and RCS or SF Pool Makeup	FX-P-2A	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure. This location is shielded from tornado missiles. The component will function if submerged due to flood.	The motor is designed for operation at 50C (122F) and is submerged in condensate of 100F or less.	NA	U	PSV100161213 0010	see FX-P-2A
FX-P-2B-BK1	FX-P-2B supply breaker	Feedwater to OTSG, and RCS or SF Pool Makeup	FX-P-2A	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	FLEX temporary ventilation will maintain ambient temperature less than design 122F. ECR 13-00310	NA	U	SQ-T1-FX-P-2B-EX4	see FX-P-2A
FX-P-5A	Transfer fuel from FX-T-2 to FX-T-3	Fuel oil supply to FLEX DG	FX-P-5B	FLOOD	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	Ambient temperatures during flood event won't exceed design 104F.	NA	Z	13-00164	If FX-P-5A cannot provide 3 GPM to FX-T-3 and FX-P-5B is functional, then restore FX-P-5A within 90 days. If FX-P-5A and FX-P-5B are NON-functional, then initiate action to restore one pump to an functional condition (or develop an equivalent capability) within 72 hours. NOTE: FX-T-2 can gravity feed FX-T-3 for > 60 hours. NSRC fuel container can be used for additional fuel.
FX-P-5A/B-BK	Supply breaker for power cable to FX-P-5A or FX-P-5B	Fuel oil supply to FLEX DG	Alternate strategy - Use FX-CABLE-A plugged into WELD-T-26-BK and power buggy at FLEX platform	FLOOD	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	Ambient temperatures during flood event won't exceed design 104F.	NA	U	SQ-EE-PNL-FX-1	See FX-P-5A
FX-P-5B	Transfer fuel from FX-T-2 to FX-T-3	Fuel oil supply to FLEX DG	FX-P-5A	FLOOD	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	Ambient temperatures during flood event won't exceed design 104F.	NA	Z	13-00164	See FX-P-5A
FX-P-7	FX-T-3 overflow or drain pump	NO - FX-P-7 provides overflow protection for FX-T-3	NA	NA	NA	NA	NA	NA	NA	NA	NA

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
FX-PI-1001	FLEX FW Header Pressure	DID - monitor pressure available to feed OTSG	No redundancy	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	Z	13-00164	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-PI-1002	FLEX RCS Header Pressure	DID - monitor FX-P-1 performance	No redundancy	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	NA - mechanical eqpt.	NA	Z	13-00164	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-PI-1003	FX-P-2A & B discharge pressure	DID - monitor FX-P-2 performance	No redundancy	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	Z	13-00164	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-PI-1004	FX-P-5 discharge and FX-T-3 Level Indication	DID - Enhance control of makeup to FX-T-3	No redundancy	FLOOD	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	Z	13-00164	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-T-2	Fuel Oil Storage Tank for Flood Events	Fuel oil supply to FLEX DG	Passive	FLOOD	ALL	This equipment will perform its function if subjected to river water level up to 320' elevation (ECR 13-00164).	NA - mechanical eqpt.	NA	Z	13-00164	No active function
FX-T-3	Fuel supply to FX-Y-1A or FX-Y-1B	Fuel oil supply to FLEX DG	Passive	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	U	13-00164 ATT 20	If the tank is less than 7/8 full, then restore the required level within 72 hours.
FX-TI-1001	FX-P-1A / B inlet temperature	Monitor FX-P-1 inlet water temperature	Portable temperature instrument	WIND	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	NA - mechanical eqpt.	NA	Z	14-00032	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-V-0001	FLEX Fuel Oil transfer pipe Isolation Valve	Fuel oil supply to FLEX DG	Redundancy is not available (See reference 23 section 2.12.2)	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	NA	U	SQ-T1-FX-VALVES	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability, within 72 hours.
FX-V-0002	FLEX Fuel Oil transfer pipe Isolation Valve	Fuel oil supply to FLEX DG	Redundancy is not available (See reference 23 section 2.12.2)	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	U	SQ-T1-FX-VALVES	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability, within 72 hours.
FX-V-0006A	FX-P-5A discharge isolation valve	Fuel oil supply to FLEX DG	FX-P-5B	FLOOD	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	Z	13-00164	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability, within 72 hours.

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
FX-V-0006B	FX-P-5B discharge isolation valve	Fuel oil supply to FLEX DG	FX-P-5A	FLOOD	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	Z	13-00164	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability, within 72 hours.
FX-V-0007	FX-T-2 fill connection isolation valve	Fuel oil supply to FLEX DG	Redundancy is not available (See reference 23 section 2.12.2)	FLOOD	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	Z	13-00164	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability, within 72 hours.
FX-V-0008	FX-P-5A/B Bypass valve	Fuel oil supply to FLEX DG	FX-V-0006A or B	FLOOD	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	Z	13-00164	If this valve cannot be opened, then see FX-P-5A
FX-V-0011A	FX-T-2 inlet backflow prevention on FILL Connection	Fuel oil supply to FLEX DG	FX-V-11B	FLOOD	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	Z	13-00164	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability, within 72 hours.
FX-V-0023A	FX-Y-1A Fuel Return Backflow Prevention	Fuel oil supply to FLEX DG	FX-Y-1B	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	U	SQ-T1-FX-VALVES	If valve cannot be opened, then initiate action consistent with an NON-functional FX-Y-1A.
FX-V-0023B	FX-Y-1B Fuel Return Backflow Prevention	Fuel oil supply to FLEX DG	FX-Y-1A	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	U	SQ-T1-FX-VALVES	If valve cannot be opened, then initiate action consistent with an NON-functional FX-Y-1B.
FX-V-0101	SF POOL or LPI FLOW CONTROL VALVE	RCS Makeup-LP	Redundancy is not available (See reference 23 section 2.12.2)	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	NA - mechanical eqpt.	NA	U	SQ-T1-FX-VALVES	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability, within 72 hours. NOTE: In MODE A, SF pool makeup can be achieved through FX-FI-1002..
FX-V-0103A	FX-P-1A RECIRC CONTROL VALVE	RCS Makeup-HP	FX-V-105A, FX-P-1B	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	NA - mechanical eqpt.	NA	U	SQ-T1-FX-VALVES	If valve cannot be operated, then initiate action consistent with an NON-functional FX-P-1A.
FX-V-0103B	FX-P-1B RECIRC CONTROL VALVE	RCS Makeup-HP	FX-V-105B, FX-P-1A	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	NA - mechanical eqpt.	NA	U	SQ-T1-FX-VALVES	If valve cannot be operated, then initiate action consistent with an NON-functional FX-P-1B.
FX-V-0105A	FX-P-1A DISCHARGE ISOLATION VALVE	RCS Makeup-HP	FX-V-105B	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	NA - mechanical eqpt.	NA	U	SQ-T1-FX-VALVES	If valve cannot be operated, then initiate action consistent with an NON-functional FX-P-1A.

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
FX-V-0105B	FX-P-1B DISCHARGE ISOLATION VALVE	RCS Makeup-HP	FX-V-105A	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	NA - mechanical eqpt.	NA	U	SQ-T1-FX-VALVES	If valve cannot be operated, then initiate action consistent with an NON-functional FX-P-1B.
FX-V-0106	FX-P-1A/B DISCHARGE VENT VALVE	RCS Makeup-HP	Use recirc and drain on opposite pump to fill pump	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	NA - mechanical eqpt.	NA	U	SQ-T1-FX-VALVES	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-V-0108	FLEX RCS MU DRAIN Valve	RCS Makeup-HP	Threaded pipe cap to isolate the drain path	ALL	A,B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	NA	U	SQ-T1-FX-VALVES	If this valve cannot be closed, then initiate action to provide alternate capability (e.g. cap pipe post ELAP) within 72 hours.
FX-V-0111	Isolation for hose connection on FX-P-1A/B suction	Long term borated water supply	Redundancy is not available (See reference 23 section 2.12.2)	ALL	A,B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	NA	U	SQ-T1-FX-VALVES	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability, within 72 hours.
FX-V-0113	Isolation for FW connection to SF POOL or RCS	Feedwater to RCS or SF Pool Makeup	Redundancy is not available (See reference 23 section 2.12.2)	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	U	SQ-T1-FX-VALVES	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability, within 72 hours.
FX-V-0203	FX-P-2A /B discharge hose connection isolation valve	Feedwater to OTSG, and RCS or SF Pool Makeup	Redundancy is not available (See reference 23 section 2.12.2)	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure. This location is shielded from tornado missiles. The component will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	NA	U	SQ-T1-FX-VALVES	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability, within 72 hours.
FX-V-0205	FLEX FW HEADER supply hose connection isolation valve	Feedwater to OTSG, and RCS or SF Pool Makeup	Redundancy is not available (See reference 23 section 2.12.2)	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	U	SQ-T1-FX-VALVES	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability, within 72 hours.
FX-V-0206A	Control Valve from FLEX FW Header to OTSG A	Feedwater to OTSG	FX-V-206B	ALL	A,B,C	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	U	SQ-T1-FX-VALVES	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability, within 90 days.
FX-V-0206B	Control Valve from FLEX FW Header to OTSG B	Feedwater to OTSG	FX-V-206A	ALL	A,B,C	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	U	SQ-T1-FX-VALVES	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability, within 90 days.

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
FX-V-0208	FLEX FW Header to RCS/SF Header Connection Isolation Valve	Feedwater to RCS or SF Pool Makeup	Redundancy is not available (See reference 23 section 2.12.2)	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	NA	U	SQ-T1-FX-VALVES	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability, within 90 days.
FX-V-0210A	FX-T-1A flood water makeup check valve	DID - River water is available with FX-P-3 before this path is required	FX-V-210B	FLOOD	ALL	This equipment is located in Tornado & Seismic qualified structure. This location is shielded from tornado missiles. The component will function if submerged due to flood.	NA - mechanical eqpt.	NA	U	PSV100161213 0010	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-V-0210B	FX-T-1B flood water makeup check valve	DID - River water is available with FX-P-3 before this path is required	FX-V-210A	FLOOD	ALL	This equipment is located in Tornado & Seismic qualified structure. This location is shielded from tornado missiles. The component will function if submerged due to flood.	NA - mechanical eqpt.	NA	U	PSV100161213 0010	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-V-0211A	FX-P-2A discharge Check Valve	Feedwater to OTSG, and RCS or SF Pool Makeup	FX-V-211B, FX-V-202B	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure. This location is shielded from tornado missiles. The component will function if submerged due to flood.	NA - mechanical eqpt.	NA	U	PSV100161213 0010	If valve is not functional, then initiate action consistent with an NON-functional FX-P-2A.
FX-V-0211B	FX-P-2B discharge Check Valve	Feedwater to OTSG, and RCS or SF Pool Makeup	FX-V-211A, FX-V-202A	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure. This location is shielded from tornado missiles. The component will function if submerged due to flood.	NA - mechanical eqpt.	NA	U	PSV100161213 0010	If valve is not functional, then initiate action consistent with an NON-functional FX-P-2A.
FX-V-0213	FX-P-2A /B recirculation path isolation	Feedwater to OTSG, and RCS or SF Pool Makeup	Redundancy is not available (See reference 23 section 2.12.2)	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure. This location is shielded from tornado missiles. The component will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	NA	U	SQ-T1-FX-VALVES	If valve cannot be closed, then initiate action to restore this function or provide equivalent capability, within 72 hours.
FX-Y-1A	FLEX power supply	FLEX power supply	FX-Y-1B	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	Designed for 120F ambient (ECR 13-00070)	NA	U	13-00070 Att #22a	If FX-Y-1A cannot provide 640 amps at 480VAC and FX-Y-1B is functional, then restore FX-Y-1A within 90 days. If FX-Y-1A and FX-Y-1B are NON-functional, then initiate action to restore one generator to an functional condition (or develop an equivalent capability) within 72 hours. NOTE: If ambient temperature remains above 40F, 533 amps at 480 VAC is sufficient for all FLEX requirements.

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
FX-Y-1B	FLEX power supply	FLEX power supply	FX-Y-1A	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	Designed for 120F ambient (ECR 13-00070)	NA	U	13-00070 Att #22a	See FX-Y-1A
GS-V-4	Isolate MS supply to GS	Isolate GS to maintain RCS temperature control	MS-V-7	ALL	A	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	FAI - Valve can be operated locally	Z	Current Class	If valve is not functional and MS-V-7 is functional, then restore function within 90 days.
HG-PI-1213	Main Generator Gas Pressure	DID - Minimize risk of generator H2 fire or explosion while minimizing DC loads	No redundancy	ALL	A	This equipment is located in Tornado & Seismic qualified structure. The component function will be completed prior to flood.	NA - mechanical eqpt.	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
HG-V-G0001	Line up Main Generator Gas space to Gas supply OR to Vent path to atmosphere	DID - Minimize risk of generator H2 fire or explosion while minimizing DC loads	No redundancy	ALL	A	This equipment is located in Tornado & Seismic qualified structure. The component function will be completed prior to flood.	NA - mechanical eqpt.	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
HG-V-G0002	Isolation Between H2 & CO2 Headers	DID - Minimize risk of generator H2 fire or explosion while minimizing DC loads	No redundancy	ALL	A	This equipment is located in Tornado & Seismic qualified structure. The component function will be completed prior to flood.	NA - mechanical eqpt.	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
HG-V-G0003	Generator Gas System Vent Valve	DID - Minimize risk of generator H2 fire or explosion while minimizing DC loads	No redundancy	ALL	A	This equipment is located in Tornado & Seismic qualified structure. The component function will be completed prior to flood.	NA - mechanical eqpt.	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
HG-V-G0015	CO2 Supply to Generator Isolation Valve	DID - Minimize risk of generator H2 fire or explosion while minimizing DC loads	No redundancy	ALL	A	This equipment is located in Tornado & Seismic qualified structure. The component function will be completed prior to flood.	NA - mechanical eqpt.	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
HR-R-1B-BK1	Power to temporary power buggy for receptacles in IB	Cooling and ventilation of Intermediate Bldg. 295 elev.	Alternate strategy uses FX-Y-4 to provide power to IB ventilation fan	ALL	A	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature within design (< 104F) ECR 13-00310	NA	W	Current Class	If this power supply is not functional, then restore function within 90 days.
IA-T-2A, 3A, 4A, 5A, 6A, 7A, 8A, 20, 21	Emergency Instrument Air Supply	Air supply to EF-V-30A, EF-V-30C & MS-V-4A & MS-V-6 (for first two hours)	2HR IA TRAIN B	ALL	A	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	NA	W	Current Class	Tech Specs control unavailability
IA-T-2B, 3B, 4B, 5B, 6B, 7B, 8B	Emergency Instrument Air Supply	Air supply to EF-V-30B, EF-V-30D & MS-V-4B & MS-V-6 (for first two hours)	2HR IA TRAIN A	ALL	A	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	NA	W	Current Class	Tech Specs control unavailability

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
ICS-AUTO-BK1	ICS NNI AUTO Power from ATA	Power to RC1-LT & LR for Pzr level	RC-LI-777A	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature < 110F (ECR 13-00310)	NA	Y	Current Class	See ATA, ATB
ICS-AUTO-BK2	ICS NNI AUTO Power from ATB	Power to RC1-LT & LR for Pzr level	RC-LI-777A	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature < 110F (ECR 13-00310)	NA	Y	Current Class	See ATA, ATB
ICS-AUTO-BK3	ICS AUTO Power from ATA or ATB	Power to RC1-LT & LR for Pzr level	RC-LI-777A	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature < 110F (ECR 13-00310)	NA	Y	Current Class	See ATA, ATB
LR-V-3	RB isolation for Leakrate testing	RB Pressure Control	Redundancy is not available (See reference 23 section 2.12.2)	ALL	D		NA - mechanical eqpt.	NA	W	Current Class	If this valve cannot be opened with the plant in MODE D, then restore this function with 72 hours.
LR-V-64	RB Vent Path drain valve	DID - Drain condensation and obtain sample for rad release assessment		ALL EXC FLOOD	D	This equipment is located in Tornado & Seismic qualified structure, with missile protection and is protected from external flooding due to river water up to 313.5' elevation.	NA - mechanical eqpt.	NA	U	SQ-T1-FX-VALVES	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
MS-PI-0021	A OTSG Pressure Indicator	OTSG Pressure Control	MS-PI-1180	ALL EXC FLOOD	A,B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and is protected from external flooding due to river water up to 313.5' elevation.	NA - mechanical eqpt.	NA	W	Current Class	Tech Specs control unavailability
MS-PI-0022	B OTSG Pressure Indicator	OTSG Pressure Control	MS-PI-0951A	ALL EXC FLOOD	A,B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and is protected from external flooding due to river water up to 313.5' elevation.	NA - mechanical eqpt.	NA	W	Current Class	Tech Specs control unavailability
MS-PI-0204A	EF-P-1 Inlet Steam Pressure	Emergency Feedwater to OTSG	Redundancy is not available (See reference 23 section 2.12.1)	ALL	A,B	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	NA	W	Current Class	Tech Specs control unavailability
MS-PI-0951A	"B" OTSG Pressure Indicator	OTSG Pressure Control	MS-PI-22	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
MS-PI-1180	"A" OTSG Outlet Pressure Indicator (HSPS)	OTSG Pressure Control	MS-PI-21	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
MS-V-001A	Isolate MS Line from Turbine Bldg.	DID - Containment is maintained by SG tube, FW, & MS integrity inside RB AND OTSG pressure control is dependent upon TSV & TCV closure	No redundancy	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	Normal operating environment is more challenging than post ELAP conditions.	FAI -OPEN	W	Current Class	Tech Specs control unavailability
MS-V-001B	Isolate MS Line from Turbine Bldg.	DID - Containment is maintained by SG tube, FW, & MS integrity inside RB AND OTSG pressure control is dependent upon TSV & TCV closure	No redundancy	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	Normal operating environment is more challenging than post ELAP conditions.	FAI -OPEN	W	Current Class	Tech Specs control unavailability
MS-V-001C	Isolate MS Line from Turbine Bldg.	DID - Containment is maintained by SG tube, FW, & MS integrity inside RB AND OTSG pressure control is dependent upon TSV & TCV closure	No redundancy	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	Normal operating environment is more challenging than post ELAP conditions.	FAI -OPEN	W	Current Class	Tech Specs control unavailability
MS-V-001D	Isolate MS Line from Turbine Bldg.	DID - Containment is maintained by SG tube, FW, & MS integrity inside RB AND OTSG pressure control is dependent upon TSV & TCV closure	No redundancy	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	Normal operating environment is more challenging than post ELAP conditions.	FAI -OPEN	W	Current Class	Tech Specs control unavailability
MS-V-003A,B,D,E,F	Turbine Bypass Valves	OTSG Pressure Control	Local isolation valve MS-V-11A-F can be used to isolate this line.	ALL	A	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	Remote closure is only required immediately following the ELAP.	If open, valve closes automatically after ELAP due to loss of CW pumps. Valve fails closed on loss of air.	Z	ECR 15-00330	Tech Specs control unavailability
MS-V-003C	Turbine Bypass Valve C	OTSG Pressure control and Maintain hotwell above 40F	CO-T-1B	ALL	A	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	Remote closure is only required immediately following the ELAP.	If open, valve closes automatically after ELAP due to loss of CW pumps. Valve fails closed on loss of air. Local manual operation is used for EXT COLD function.	Z	ECR 15-00330	Tech Specs control unavailability

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
MS-V-004A	OTSG A Atmospheric Dump Valve	OTSG Pressure Control	Redundancy is not available (See reference 23 section 2.12.2)	ALL	A,B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	Valve fails closed on loss of air. Power (VBB) is available for CR to manually control the valve while air is available (> 3 hrs).	W	Current Class	If valve is not remotely or locally functional, then restore this or equivalent capability with 72 hours
MS-V-004A-EX1 (alias HIC-005)	Remote control of MS-V-4A	OTSG Pressure Control	Local manual control is available	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	Remote control of MS-V-4A & B is required for the first three hours of the event, then local control is used.	See MS-V-4A	W	Current Class	If valve is not remotely or locally functional, then restore this or equivalent capability with 72 hours
MS-V-004B	OTSG B Atmospheric Dump Valve	OTSG Pressure Control	Redundancy is not available (See reference 23 section 2.12.2)	ALL	A,B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	Valve fails closed on loss of air. Power (VBB) is available for CR to manually control the valve while air is available (> 3 hrs).	W	Current Class	If valve is not remotely or locally functional, then restore this or equivalent capability with 72 hours
MS-V-004B-EX1 (alias HIC-006)	Remote control of MS-V-4B	OTSG Pressure Control	Local manual control is available	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	Remote control of MS-V-4A & B is required for the first three hours of the event, then local control is used.	See MS-V-4B	W	Current Class	If valve is not remotely or locally functional, then restore this or equivalent capability with 72 hours
MS-V-006	EF-U-1 Steam Supply Pressure Control Valve	Emergency Feedwater to OTSG	Redundancy is not available (See reference 23 section 2.12.1)	ALL	A,B	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	Valve fails open to limited open position on loss of air	W	Current Class	Tech Specs control unavailability
MS-V-007	Main Steam supply to Gland Steam	Isolate GS to maintain RCS temperature control	GS-V-4	ALL	A	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location of the valve is shielded from tornado missiles.	NA - mechanical eqpt.		Z	Current Class	If this valve cannot be closed with plant in MODE A, then confirm GS-V-4 is locally functional and restore capability within 90 days.
MS-V-010A	OTSG A Steam Inlet to EF-U-1	Emergency Feedwater to OTSG	MS-V-10B	ALL	A,B	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.		W	Current Class	Tech Specs control unavailability
MS-V-036A/D	Main Steam Line A Drain Isolation Valve	Maintain OTSG pressure boundary integrity	Boiler Condenser Cooling (Section 4.11.8).	WIND	A	ECR 15-00328	NA - mechanical eqpt.	None	Z	ECR 15-00330	If valve cannot be closed and plant is in MODE A, then restore valve or equivalent capability with 90 days.
MS-V-44A/B	Main Steam Header Steam Trap Drain Valve	Maintain CO-T-1B above 40F	MS-V-44B/A	COLD	A	This equipment is located in Tornado & Seismic qualified structure, with missile protection and is protected from external flooding due to river water up to 313.5' elevation.	NA - mechanical eqpt.	None	Y	Current Class	If valve cannot be opened or hose connected, then use MS-V-44B. If the flow path from MS to CO-T-1B cannot be established and storage and heating of the hotwell remains functional, then restore the CO-T-1B heating method within 90 days.

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
MU14/RC 1-LR	Pressurizer Level Indication (from RC1-LT-1)	RCS Water Level Control	RC-LI-777A	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
MU-TS-1	Close MU-V-3 if temperature greater than 145F	Containment isolation & RCS water level control	MU-V-99	ALL	A	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	Function is complete within the first hour. Loss of IA keeps valve closed.	NA	W	Current Class	Tech Specs control unavailability
MU-V-003	Letdown Line containment isolation valve	Containment isolation & RCS water level control	MU-V-99	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	Function is complete within the first hour. Loss of IA keeps valve closed.	Valve fails closed on loss of air	W	Current Class	Tech Specs control unavailability
MU-V-016C	High Pressure Injection Control Valve	RCS Makeup-HP	MU-V-16D	ALL	A,B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	Valve fails AS IS on loss of power. With power restored, ESAS interlock drives valve OPEN.	W	Current Class	Tech Specs control unavailability
MU-V-016D	High Pressure Injection Control Valve	RCS Makeup-HP	MU-V-16C	ALL	A,B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	Valve fails AS IS on loss of power. With power restored, ESAS interlock drives valve OPEN.	W	Current Class	Tech Specs control unavailability
MU-V-026	Containment isolation on controlled bleed return to MU system	Containment isolation	MU-V-189	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	Function is complete within the first hour. Loss of IA keeps valve closed.	Valve fails closed on loss of air	W	Current Class	Tech Specs control unavailability
MU-V-033A/D	RC Pump Controlled Bleed Flow Isolation Valves	Isolate CBO Flow	Redundancy is not available (See reference 23 section 2.12.3)	WIND	A,B	This equipment is located in Tornado, Seismic & Flood Protected structure	Motor is ONLY energized long enough for one valve stroke.	Valve fails as is. The valve can be remotely operated when 1A Radwaste MCC is energized (i.e. no interlocks).	W	Current Class	If any one of these valves cannot be remotely closed, then restore capability within 90 days.
MU-V-099	LD block orifice isolation valve	Backup to isolate letdown	MU-V-3	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	NA	W	Current Class	If valve cannot be closed, then restore capability within 90 days.
MU-V-143C	HPI Line "C" containment penetration test isolation valve	DID - Alternate path for failure of FXP1 discharge piping	Installed piping	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	NA	W	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
MU-V-143D	HPI Line "D" containment penetration test isolation valve	DID - Alternate path for failure of FXP1 discharge piping	Installed piping	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	NA	W	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
MU-V-189	MU-F-3 inlet isolation valve	Backup to isolate CBO containment penetration	MU-V-26	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	NA - mechanical eqpt.	NA	W	Current Class	If valve cannot be closed, then restore capability within 90 days.
MU-V-251	FLEX Isolation from MU system	RCS Makeup-HP	Contingency strategy per section 4.11.2	ALL	A,B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	NA	W	Current Class	If valve cannot be opened and contingency strategy per section 4.11.2 is available, then restore capability within 90 days.
NIYI11	Full range nuclear instrument	DID - NEI 12-06 recommended monitoring	NI12	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	NA	W	SQ-T1-FX-VALVES	Tech Specs control unavailability
NIYI12	Full range nuclear instrument	DID - NEI 12-06 recommended monitoring	NI11	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
PG-T-1	CO2 storage tank (275 to 325 psig)	DID - Minimize risk of generator H2 fire or explosion while minimizing DC loads	Passive	ALL	A	This component supports a desired but not essential function. The component or access could be damaged by tornado or earthquake.	NA - mechanical eqpt.	NA	W	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
PG-V-78	CO2 TANK to VAPORIZER	DID - Minimize risk of generator H2 fire or explosion while minimizing DC loads	No Redundancy	ALL	A	This component supports a desired but not essential function. The component or access could be damaged by tornado or earthquake.	NA - mechanical eqpt.	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
PG-V-90	CO2 Supply to generator gas control panel	DID - Minimize risk of generator H2 fire or explosion while minimizing DC loads	No Redundancy	ALL	A	This equipment is located in Tornado & Seismic qualified structure. The component function will be completed prior to flood.	NA - mechanical eqpt.	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
PG-Z-1	CO2 Vaporizer for main generator H2 purge	DID - Minimize risk of generator H2 fire or explosion while minimizing DC loads	No Redundancy	ALL	A	This equipment is located in Tornado & Seismic qualified structure. The component function will be completed prior to flood.	FLEX function not evaluated	NA	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
RB-PI-1186	RB Pressure Indication (from BS-PT-1186)	DID - NEI 12-06 recommended monitoring	BS-PI-982B, BS-PI-289	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX function not evaluated	NA	W	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
RC1-LT-1	Pressurizer Level Transmitter (to MU14/RC1-LR)	RCS Water Level Control	RC-LI-777A	ALL	ALL	This equipment is located in Tornado, Seismic & Flood Protected structure	Qualified for post ELAP RB environment (Reference 76)	NA	W	Current Class	Tech Specs control unavailability
RC2-TE-1	Pressurizer Temperature Sensor	Pzr Level (RC1) Temperature Compensation	RC-LI-777A	ALL	ALL	This equipment is located in Tornado, Seismic & Flood Protected structure	Qualified for post ELAP RB environment (Reference 76)	NA	W	Current Class	Tech Specs control unavailability
RC2-TE-2	Pressurizer Temperature Sensor	Pzr Level (LT-777) Temperature Compensation	MU14/RC1-LR1	ALL	ALL	This equipment is located in Tornado, Seismic & Flood Protected structure	Electrical components are qualified for post LOCA environment (i.e. EQ)	NA	W	Current Class	Tech Specs control unavailability
RC-HTR-GRP-8	Pressurizer Heater bank	RCS Pressure Control	RC-HTR-GRP-9	ALL EXC QUAKE	A	This equipment is located in Tornado, Seismic & Flood Protected structure	Heaters are designed for high ambient temperature service.	ES interlock must be BYPASSED (Reference 77).	W	Current Class	Tech Specs control unavailability
RC-HTR-GRP-8-BK5	ES power to Group 8 Heaters	RCS Pressure Control	RC-HTR-GRP-9	ALL EXC QUAKE	A	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	ES interlock must be BYPASSED (Reference 77).	Z	Current Class	Tech Specs control unavailability
RC-HTR-GRP-9	Pressurizer Heater bank	RCS Pressure Control	RC-HTR-GRP-8	ALL EXC QUAKE	A	This equipment is located in Tornado, Seismic & Flood Protected structure	Heaters are designed for high ambient temperature service.	ES interlock must be BYPASSED (Reference 77).	W	Current Class	Tech Specs control unavailability
RC-HTR-GRP-9-BK5	ES power to Group 9 Heaters	RCS Pressure Control	RC-HTR-GRP-8	ALL EXC QUAKE	A	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	ES interlock must be BYPASSED (Reference 77).	Z	Current Class	Tech Specs control unavailability
RC-LI-1037	RCS Draindown Level Indicator	RCS Water Level Control	RC-LI-1138	ALL	D	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
RC-LI-1138	RCS Draindown Level Indicator	RCS Water Level Control	RC-LI-1037	ALL	D	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
RC-LI-777A	Pressurizer Level Indication (0 - 400 inches)	RCS Water Level Control	MU14/RC1-LR1	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
RC-PI-949A	RCS Pressure Indicator	RCS Pressure Control	RC-PI-963	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
RC-PI-963	RCS Pressure Indicator	RCS Pressure Control	RC-PI-949A	ALL	A,B,C	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
RC-RV-2	Remote operated RCS pressure relief valve	Vent Path for RCS Heat Removal	RC-V-28 and 44	ALL	C	This equipment is located in Tornado, Seismic & Flood Protected structure	RB environment is less severe than for HPI cooling function (Reference 100)	Valve can be opened using console key switch	W	Current Class	Tech Specs control unavailability
RC-TE-952C	Incore T/C penetration temperature sensor for incore T/C compensation	RCS Temperature Control	RC-TI-958A	ALL	ALL	This equipment is located in Tornado, Seismic & Flood Protected structure	Qualified for post ELAP RB environment (Reference 76)	NA	W	Current Class	Tech Specs control unavailability
RC-TI-952	Incore Temperature	RCS Temperature Control	RC-TI-958A	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
RC-TI-958A	"A" Loop T-HOT Temperature Indicator	RCS Temperature Control	RC-TI-952	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
RC-TI-959A	"A" Loop T-COLD Temperature Indicator	DID - Monitor Natural Circ conditions	No redundancy	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
RC-TI-960A	"B" Loop T-HOT Element	DID Monitor Natural Circ conditions and provide RCS temperature after boiling with incores removed.	RC-TI-952	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability
RC-TI-961A	"B" Loop T-COLD Temperature Indicator	DID -Monitor Natural Circ conditions	No redundancy	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 104F) ECR 13-00310	NA	W	Current Class	Tech Specs control unavailability

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
RC-V-28	PZR Vent Valve	DID - Vent Path for RCS pressure reduction	RC-RV-2	ALL	A,C	This equipment is located in Tornado, Seismic & Flood Protected structure	Electrical components are qualified for post LOCA environment (i.e. EQ)	FAI-CLOSED	W	Current Class	Tech Specs control unavailability
RC-V-40A	Hot Leg A Vent Valve	DID - remove non-condensable gases AND optimize fill rate	No redundancy	ALL	A,B,C	This equipment is located in Tornado, Seismic & Flood Protected structure	Electrical components are qualified for post LOCA environment (i.e. EQ)	FAIL CLOSED	W	Current Class	Tech Specs control unavailability
RC-V-40B	Hot Leg B Vent Valve	DID - remove non-condensable gases AND optimize fill rate	No redundancy	ALL	A,B,C	This equipment is located in Tornado, Seismic & Flood Protected structure	Electrical components are qualified for post LOCA environment (i.e. EQ)	FAIL CLOSED	W	Current Class	Tech Specs control unavailability
RC-V-41A	Hot Leg A Vent Valve	DID - remove non-condensable gases AND optimize fill rate	No redundancy	ALL	A,B,C	This equipment is located in Tornado, Seismic & Flood Protected structure	Electrical components are qualified for post LOCA environment (i.e. EQ)	FAIL CLOSED	W	Current Class	Tech Specs control unavailability
RC-V-41B	Hot Leg B Vent Valve	DID - remove non-condensable gases AND optimize fill rate	No redundancy	ALL	A,B,C	This equipment is located in Tornado, Seismic & Flood Protected structure	Electrical components are qualified for post LOCA environment (i.e. EQ)	FAIL CLOSED	W	Current Class	Tech Specs control unavailability
RC-V-44	PZR Vent Valve	DID - Vent Path for RCS pressure reduction	RC-RV-2	ALL	A,C	This equipment is located in Tornado, Seismic & Flood Protected structure	Electrical components are qualified for post LOCA environment (i.e. EQ)	FAIL CLOSED	W	Current Class	Tech Specs control unavailability
RM-G-22	Reactor Building Radiation Monitor	DID	RM-G-23	ALL	ALL	This equipment is located in Tornado, Seismic & Flood Protected structure	Electrical components are qualified for post LOCA environment (i.e. EQ)	NA	W	Current Class	Tech Specs control unavailability
RM-G-23	Reactor Building Radiation Monitor	DID	RM-G-22	ALL	ALL	This equipment is located in Tornado, Seismic & Flood Protected structure	Electrical components are qualified for post LOCA environment (i.e. EQ)	NA	W	Current Class	Tech Specs control unavailability
RM-G-9	Spent Fuel Pool Area Radiation Monitor	DID	No redundancy	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX Function not evaluated.	NA	W	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
SF-LI-1219A	Spent Fuel Pool A Level Indicator (ZERO is above TAF at 319.33' elevation)	Control spent fuel pool water level	SF-LI-1219B	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 122F) ECR 13-00310	Battery backup for 72 hours	W	C-1101-251-E410-011	If one channel of SF level indication is NON-functional, and the other channel is functional, then restore the NON-functional channel within 90 days. If both channels are NON-functional, then restore one channel or provide alternate capability within 72 hours.(Refer to CC-AA-118 for additional detail). NOTE: If the GATE is installed between the A & B SF Pools, the channel redundancy is lost, and a 90 day clock applies.

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
SF-LI-1219B	Spent Fuel Pool B Level Indicator (ZERO is above TAF at 319.33' elevation)	Control spent fuel pool water level	SF-LI-1219A	ALL	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	FLEX temporary ventilation will maintain ambient temperature with design (< 122F) ECR 13-00310	Battery backup for 72 hours	W	C-1101-251-E410-011	See SF-LI-1292A
SF-V-19	BWST isolation from SF system	RCS Makeup-HP	SF-T-2A/B	ALL EXC WIND	A,B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	NA	W	Current Class	If valve cannot be opened, then restore capability within 90 days.
SF-V-20	SF SYST TO BWST ISOLATION VALVE	RCS Makeup-HP	SF-T-2A/B	ALL EXC WIND	A,B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	NA	W	Current Class	If valve cannot be opened, then restore capability within 90 days.
SF-V-36	SF-P-2 Suction from BWST	RCS Makeup-HP	SF-T-2A/B	ALL EXC WIND	A,B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	NA	W	Current Class	If valve cannot be opened, then restore capability within 90 days.
SF-V-37	SF-P2 SUCT VLV FROM FUEL POOL A & B	RCS Makeup	BWST	WIND	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	NA	W	Current Class	If valve cannot be opened, then restore capability within 90 days.
SF-V-38	A SF POOL DRAIN ISOL VALVE	RCS Makeup	BWST	WIND	ALL	This equipment is located above 320' elevation in a Tornado & Seismic qualified structure, with missile protection .	NA - mechanical eqpt.	NA	W	Current Class	If valve cannot be opened, then restore capability within 90 days.
SF-V-40	SF-P2 DISCH ISOL VLV TO LWDS SYSTEM	RCS Makeup-LP	Redundancy is not available (See reference 23 section 2.12.2)	ALL EXC WIND	D	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	NA	W	Current Class	If valve cannot be opened, then restore capability within 72 hours.
SF-V-41	SF-P2 DISCH ISOL VLV TO A SF POOL	SFP Makeup	Contingency method per section 4.11.6	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	NA	W	Current Class	If valve cannot be opened and contingency method per section 4.11.6 is available, then restore capability within 90 days.

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
SF-V-87	FX-P-1A/B SUCTION ISOLATION VALVE	RCS Makeup-HP	Redundancy is not available (See reference 23 section 2.12.2)	ALL	A,B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	NA	W	SQ-T1-FX-VALVES	If valve cannot be opened and WDL-T-1C contingency is available (WDL-T-1C contains greater than 40,000 gallons above 2200 ppmb), then restore capability within 90 days.
SF-V-88	FLEX FW ISOLATION VALVE	RCS Makeup-LP or SFP Makeup	Redundancy is not available (See reference 23 section 2.12.2)	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will be reconfigured prior to potential loss of access due to flood.	NA - mechanical eqpt.	NA	W	SQ-T1-FX-VALVES	In MODE A if valve cannot be opened and contingency method per section 4.11.6 is available, then restore capability within 90 days. In other MODES, if valve cannot be opened then restore valve or alternate capability within 72 hours.
TMI-BLG-131	FLEX Storage Facility	Protect FLEX equipment & provide access	PASSIVE	ALL	ALL	This is a Tornado & Seismic qualified structure (ECR 13-00074).	NA -structure	NA	U	13-00074 Att #8	No active function
TMI-BLG-2	Turbine Building	Protect FLEX equipment & provide access	PASSIVE	ALL	ALL	This is a Tornado & Seismic qualified structure (ECR 14-00501).	NA -structure	NA	U	C-1101-919-E410-011	No active function
TMI-DR-RW103A	Roll up door - Vehicle Entrance to FSF	Protect FLEX equipment & provide access	Redundancy is not available (See reference 23 section 2.12.4)	ALL	ALL	This is a Tornado & Seismic qualified structure (ECR 13-00074).	NA - mechanical eqpt.	NA	U	C-1101-919-E410-012	If door cannot be opened, then restore capability within 90 days.
TMI-DR-RW103B	Missile Barrier Door - Vehicle Entrance to FSF	Protect FLEX equipment & provide access	Redundancy is not available (See reference 23 section 2.12.4)	ALL	ALL	This is a Tornado & Seismic qualified structure (ECR 13-00074).	NA - mechanical eqpt.	NA	U	C-1101-919-E410-012	If door cannot be opened, then restore capability within 72 hours. If door cannot be closed, then restore capability within 45 days.
VA-V-8	Main Condenser Vacuum Breaker	DID - break vacuum quickly to minimize risk of H2 fire while supporting DC load shedding requirement	No Redundancy	ALL	A	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	NA - mechanical eqpt.	FAI - CLOSED	Z	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
WDG-V-4	RCDT to Waste gas System - CIV	Containment isolation	WDG-V-3	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	Function is complete within the first hour. Loss of IA keeps valve closed.	Fails closed on loss of air or power	W	Current Class	Tech Specs control unavailability
WDL-P-6C	WDL-T-1C Waste Transfer Pump	DID - additional borated water source	No Redundancy	WIND	A,B,C	The equipment is located in a Tornado qualified structure.	FLEX Function not evaluated.	Radwaste control panel is powered from 1B Radwaste MCC. Energize Radwaste panel AND jumper start interlock	V	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
WDL-T-1C	Reactor Coolant Bleed Tank	DID - additional borated water source	Passive	WIND	A,B,C	The equipment is located in a Tornado qualified structure and protected from tornado missiles.	NA - mechanical eqpt.	NA	W	Current Class	No active function

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
WDL-V-022	RCBT C recirculation inlet	DID - additional borated water source	No Redundancy	WIND	A,B,C	The equipment is located in a Tornado qualified structure and protected from tornado missiles.	NA - mechanical eqpt.	Fails closed on loss of air. TCCP required to block open the valve	V	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
WDL-V-031	RCBT C OUTLET TO WDL-P-6C	DID - additional borated water source	No Redundancy	WIND	A,B,C	The equipment is located in a Tornado qualified structure and protected from tornado missiles.	NA - mechanical eqpt.	Fails closed on loss of air. TCCP required to block open the valve	V	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
WDL-V-034	WDL-P-6C OUTLET to WASTE PROCESSING Isol Valve	DID - additional borated water source	No Redundancy	WIND	A,B,C	The equipment is located in a Tornado qualified structure and protected from tornado missiles.	NA - mechanical eqpt.	Fails closed on loss of air. TCCP required to block open the valve	V	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
WDL-V-037	WDL-P-6C recirculation isolation valve	DID - additional borated water source	No Redundancy	WIND	A,B,C	The equipment is located in a Tornado qualified structure and protected from tornado missiles.	NA - mechanical eqpt.	Fails closed on loss of air. TCCP required to block open the valve	V	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
WDL-V-038	Waste Process Control Valve	DID - additional borated water source	No Redundancy	WIND	A,B,C	The equipment is located in a Tornado qualified structure and protected from tornado missiles.	NA - mechanical eqpt.	Fails open on loss of air.	V	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
WDL-V-063	A Precoat Filter Inlet	NO - loss of SFP, BWST or DH inventory addressed by Tech Eval 15-00252	NA	NA	NA	NA	NA	NA	U	TECH EVAL 15-00252	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
WDL-V-064	B Precoat Filter Inlet	NO - loss of SFP, BWST or DH inventory addressed by Tech Eval 15-00252	NA	NA	NA	NA	NA	NA	U	TECH EVAL 15-00252	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
WDL-V-304	RCDT to WDL system - CIV	Containment isolation	WDL-V-303	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	Function is complete within the first hour. Loss of IA keeps valve closed.	Fails closed on loss of air or power	W	Current Class	Tech Specs control unavailability
WDL-V-421	Temporary hose connection isolation valve	DID - additional borated water source	No Redundancy	WIND	A,B,C	This equipment is located in Tornado & Seismic qualified structure, with missile protection and is protected from external flooding due to river water up to 313.5' elevation.	NA - mechanical eqpt.		V	Current Class	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
WDL-V-534	RB sump to AB SUMP - CIV	Containment isolation	WDL-V-535	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	Function is complete within the first hour. Loss of IA keeps valve closed.	Fails closed on loss of air or power	W	Current Class	Tech Specs control unavailability

Component ID	Function	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Environmental Availability	Effect of ELAP (on motive power or control logic)	Seismic Class (NOTE 1)	SQ Basis	Unavailability Response
WDL-V-535	RB sump to AB SUMP - CIV	Containment isolation	WDL-V-534	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	Function is complete within the first hour. Loss of IA keeps valve closed.	Fails closed on loss of air or power	W	Current Class	Tech Specs control unavailability
WELD-A-2-BK	Power to Welding Receptacle A2 & A3	Isolate CBO Flow	Redundancy is not available (See reference 23 section 2.12.3)	WIND	A,B	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	Jumper design qualified for 122F per ECR 13-00070.	NA	W	Current Class	If weld receptacle or breaker is not functional, then restore functionality within 72 hours.
WELD-A-3	Connect temporary power cable 1A ES valves MCC to 1A Radwaste MCC	Isolate CBO Flow	Redundancy is not available (See reference 23 section 2.12.3)	WIND	A,B	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	Jumper design qualified for 122F per ECR 13-00070.	NA	Z	Current Class	If weld receptacle or breaker is not functional, then restore functionality within 72 hours.
WELD-A-9	Connect temporary power cable 1A ES valves MCC to 1A Radwaste MCC	Isolate CBO Flow	Redundancy is not available (See reference 23 section 2.12.3)	WIND	A,B	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	Jumper design qualified for 122F per ECR 13-00070.	NA	Z	Current Class	If weld receptacle or breaker is not functional, then restore functionality within 72 hours.
WELD-A-9-BK	Power to Welding Receptacle	Isolate CBO Flow	Redundancy is not available (See reference 23 section 2.12.3)	WIND	A,B	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	Jumper design qualified for 122F per ECR 13-00070.	NA	Z	Current Class	If weld receptacle or breaker is not functional, then restore functionality within 72 hours.
WELD-T-26	Welding Receptacle on EE-MCC-FX	BACKUP to EE-PNL-FX-1 or EE-PNL-ATC, ATC1	EE-PNL-FX-1-BK, EE-PNL-ATC-BK	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	FLEX temporary ventilation will maintain ambient temperature less than design 122F. ECR 13-00310	NA	Z	13-00070	If weld receptacle or breaker is not functional, then restore functionality within 90 days.
WELD-T-26-BK	Welding Receptacle on EE-MCC-FX	BACKUP to EE-PNL-FX-1 or EE-PNL-ATC, ATC1	EE-PNL-FX-1-BK, EE-PNL-ATC-BK	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	FLEX temporary ventilation will maintain ambient temperature less than design 122F. ECR 13-00310	NA	U	SQ-T1-EE-PNL-FX	If weld receptacle or breaker is not functional, then restore functionality within 90 days.

NOTE 1: Seismic CLASS: W = Seismic Class I (DB SSE) ; V = Seismic Class II (DB OBE); U = Seismic Class SIf (BDB SSE) ; Y = Seismic Anti-Fall down (SSE) ; Z = No Seismic Design

NOTE 2: BDBEE External Hazards are abbreviated as follows: WIND = High Winds / Tornado ; QUAKE = Earthquake : EXC = 'except' ; COLD = Extreme Cold Snow & Ice; HOT = Extreme Heat

Component ID	Description	Function	Bldg.	ELEV (floor)	LOCATION (Room Area)	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Associated ECR	Unavailability Response
EG-P-20A & B	120VAC Portable Air Compressor, 5.2 CFM @ 90 psi, 1.6HP, 200 psi, 4.5 gal tank	Portable compressed air supply	FSF	312		Air supply for A-116 door seals	EG-P-20B,A	FLOOD	ALL	This equipment is stored in Tornado & Seismic qualified structure, relocated in preparation for a flood.	15-00155	If one compressor is functional, then restore the affected unit with 90 days.
EPB-D-10	Power Buggy Input: 480 VAC MALE 100 Amp Weld Plug Output : 70 Amp 120/240 Distribution Panel & Receptacles	Provides 120 VAC Power for ISPH area lighting	ISPH	308	"A" screen/rake area	DID - portable lighting can be used	Substitute 480V power buggy	QUAKE, COLD	ALL	This equipment is stored in Tornado & Seismic qualified structure.	14-00134	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
EPB-FX-1	Power Buggy Input: 480 VAC MALE 100 Amp Weld Plug Output : 70 Amp 120/240 Distribution Panel & Receptacles	Provides 120 VAC Power	TB	322	Electrical Swgr Room w. of 1A 6900V SWGR	BACKUP for 120VAC at FLEX platform or 120VAC in Control Bldg 322.	Substitute 480V power buggy	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure. This component is shielded by TB east wall to 325' elev. and 1A 6900V swgr.	13-00070	If power buggy is not functional, then provide a functional unit with 90 days.
EPB-FX-2	Power Buggy Input: 480 VAC MALE 100 Amp Weld Plug Output : 70 Amp 120/240 Distribution Panel & Receptacles	Provides 120 VAC Power	IB	305	Under stairway to 322	Power for ventilation or RB vent radiation monitor	Substitute 480V power buggy	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure. [ESDS (#2016-010).]	13-00310, 14-00033	If power buggy is not functional, then provide a functional unit with 90 days.
FX-CABLE-A	50 foot length of #2 / 4 conductor SO cable with 100A Weld connectors (MALE on one end, FEMALE on other).	Connect WELD-A3 to WELD-A9 (94 feet) (two FX-CABLE-A and one FX-CABLE-A1 required)	FHB	305	AOP Box 2	Isolate CBO Flow	SPARE CABLE in FSF	WIND	A,B	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	13-00070	If cable staged for event mitigation is found to be NON-functional, then replace the cable with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-CABLE-A	50 foot length of #2 / 4 conductor SO cable with 100A Weld connectors (MALE on one end, FEMALE on other).	Connect WELD-T-26-BK to power buggy (145 ft Actual length) (Three(3) FX-CABLE-A are REQUIRED)	TB	322	AOP Box 8	BACKUP to EE-PNL-ATC or ATC1	SPARE CABLE in FSF	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	13-00070	If cable staged for event mitigation is found to be NON-functional, then replace the cable with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-CABLE-A	50 foot length of #2 / 4 conductor SO cable with 100A Weld connectors (MALE on one end, FEMALE on other).	Connect WELD-T-26BK to power buggy in FLEX platform area (25 ft actual length) (One FX-CABLE-A is REQUIRED)	TB	322	AOP Box 8	Backup to EE-PNL-FX-1-BK	SPARE CABLE in FSF	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	13-00070	If cable staged for event mitigation is found to be NON-functional, then replace the cable with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-CABLE-A	50 foot length of #2 / 4 conductor SO cable with 100A Weld connectors (MALE on one end, FEMALE on other).	Power supply to FX-P-2A or FX-P-2B from WELD-T-26-BK (260 ft) (Six (6) FX-CABLE-A are required), FX-P-2A/B-EX4 has MALE connector.	TB	322	AOP Box 8	Backup to FX-P-2A/B-BK	SPARE CABLE in FSF	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	13-00070	If cable staged for event mitigation is found to be NON-functional, then replace the cable with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.

Component ID	Description	Function	Bldg.	ELEV (floor)	LOCATION (Room Area)	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Associated ECR	Unavailability Response
FX-CABLE-A	50 foot length of #2 / 4 conductor SO cable with 100A Weld connectors (MALE on one end, FEMALE on other).	Power supply to FX-P-2A or FX-P-2B from FX-P-2A/B-BK (260 ft) (Six (6) FX-CABLE-A are required), FX-P-2A/B-EX4 has MALE connector.	TB	322	AOP Box 8	Feedwater to OTSG, and RCS or SF Pool Makeup	SPARE CABLE in FSF	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	13-00070	If cable staged for event mitigation is found to be NON-functional, then replace the cable with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-CABLE-A1	4 foot length of #2 size SO cable with MALE 100A Weld connectors on each end.	See FX-CABLE-A	FHB	305	AOP Box 2	Isolate CBO Flow	SPARE CABLE in FSF	WIND	A,B	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will perform its function prior to potential flood damage.	13-00070	If cable staged for event mitigation is found to be NON-functional, then replace the cable with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-CABLE-B	30 foot length of 4/0 Type W cable with PA22 series connectors (MALE on one end, FEMALE on other end) (brown, orange, yellow or white)	Connect EE-PNL-FX-2 to EE-MCC-ES-1A-BK1 (24 ft actual length) (Eight (8) FX-CABLE-B (2 per phase and 2 per neutral), and eight FX-CABLE B1 are REQUIRED)	CB	322	AOP Box 9 (in 1P 480V swgr room)	BACKUP to EE-1P-12-BK2	SPARE CABLE in FSF	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation.	13-00070	If cable staged for event mitigation is found to be NON-functional, then replace the cable with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-CABLE-B	30 foot length of 4/0 Type W cable with PA22 series connectors (MALE on one end, FEMALE on other end) (brown, orange, yellow or white)	Connect EE-PNL-FX-4 to EE-PNL-FX-3A or 3B (< 30 ft Actual length) (1 conductors per phase and 1 per neutral: 4 FX-CABLE-B and 4 FX-CABLE-D2 are REQUIRED)	CB	322	AOP Box 9 (in 1P 480V swgr room)	Backup to EE-PNL-FX-BK1 or DID for failure of cable from EE-PNL-FX-XFR to EE-PNL-FX-2	SPARE CABLE in FSF	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation.	13-00070	If cable staged for event mitigation is found to be NON-functional, then replace the cable with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-CABLE-B1	5 foot length of 4/0 Type W cable with MALE PA22 series connector on one end and FEMALE PA18 connector on other (brown, orange, yellow or white)	See FX-CABLE-B	CB	322	AOP Box 9 (in 1P 480V swgr room)	BACKUP to EE-1P-12-BK2	SPARE CABLE in FSF	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation.	13-00070	If cable staged for event mitigation is found to be NON-functional, then replace the cable with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-CABLE-D	300 ft length of 4/0 type W cable on a cable reel (K cart). One MALE and one FEMALE PA22 series connector on each end. (brown, orange, yellow or white)	Connect NSRC diesel to EE-PNL-FX-3A or 3B (540 ft Actual length) (3 conductors per phase and 2 per neutral: 22 FX-CABLE-D and 11 FX-CABLE-D2 are REQUIRED)	FSF	312		DID- Additional phase 3 power source	SPARE CABLE in FSF	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	13-00070	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.

Component ID	Description	Function	Bldg.	ELEV (floor)	LOCATION (Room Area)	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Associated ECR	Unavailability Response
FX-CABLE-D	300 ft length of 4/0 type W cable on a cable reel (K cart). One MALE and one FEMALE PA22 series connector on each end. (brown, orange, yellow or white)	Connect EE-PNL-FX-4 to EE-MCC-RBH-1A-BK1 (270 ft Actual length) (1 conductors per phase and 1 per neutral: 4 FX-CABLE-D and 4 FX-CABLE-D3 are REQUIRED)	FSF	312		DID for RB Pressure Control	SPARE CABLE in FSF	FLOOD	D	This equipment is stored in Tornado & Seismic qualified structure, relocated in preparation for a flood.	13-00070	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-CABLE-D	300 ft length of 4/0 type W cable on a cable reel. One MALE and one FEMALE PA22 series connector on each end. (brown, orange, yellow or white)	Connect EE-PNL-FX-3A or 3B to EE-MCC-ES-1A-BK1 (250 ft Actual length) (2 conductors per phase and 2 per neutral: 8 FX-CABLE-C and 8 FX-CABLE-B1 are REQUIRED)	TB	322	West of pedestal, north of mezzanine	DID for failure of cable from EE-PNL-FX-XFR to EE-PNL-FX-2	SPARE CABLE in FSF	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation.	13-00070	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-CABLE-D2	5 foot length of 4/0 type W cable with MALE PA22 series connectors on each end. (brown, orange, yellow or white)	See FX-CABLE-B and FX-CABLE-D	CB	322	AOP Box 9 & FSF	Backup to EE-PNL-FX-BK1	SPARE CABLE in FSF	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation.	13-00070	If cable staged for event mitigation is found to be NON-functional, then replace the cable with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-CABLE-D3	5 foot length of 4/0 type W cable with MALE PA22 series connector on one end and Shoo-pin adapter on other. (brown, orange, yellow or white)	See FX-CABLE-D	FSF	312		DID for RB Pressure Control	No redundancy	FLOOD	D	This equipment is stored in Tornado & Seismic qualified structure, relocated in preparation for a flood.	13-00070	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-CABLE-D3X	4/0 cable adapters with barrel lugs on end	Connect FX-Cable D3 to EE-MCC-RBH-1A-BK1	FSF	312		DID for RB Pressure Control	No redundancy	FLOOD	D	This equipment is stored in Tornado & Seismic qualified structure, relocated in preparation for a flood.	13-00070	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-CABLE-F	100 foot length of #12 / 3 conductor 120VAC Extension cord with standard parallel blade plug	2 FANS fed from ATC CB 355 2 FANS fed from ATC1 CB 322 5 FANS fed from FX1 CB338 & TB 355 1 FAN fed from Power Buggy IB 322 (Ten (10) Required)	CB	322	AOP Box 10	Power for temporary ventilation	SPARE CABLE in FSF	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	13-00310	If cable staged for event mitigation is found to be NON-functional, then replace the cable with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-CABLE-F	100 foot length of #12 / 3 conductor 120VAC Extension cord with standard parallel blade plug	Connect power from EE-PNL-ATC1 to SF-LI-1219A & SF-LI-1219B (Two required)	CB	322	AOP Box 10	Power to SF-LI-1219A & SF-LI-1219B	SPARE CABLE in FSF	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	13-00310	If cable staged for event mitigation is found to be NON-functional, then replace the cable with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-CABLE-F	100 foot length of #12 / 3 conductor 120VAC Extension cord with standard parallel blade plug	Connect power from Evaporator Control Panel receptacles to EG-P-20A and EG-P-20B (Two required)	FHB	305	AOP Box 2	Air supply for A-116 & FH-208 door seals	SPARE CABLE in FSF	FLOOD	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	13-00310	If cable staged for event mitigation is found to be NON-functional, then replace the cable with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.

Component ID	Description	Function	Bldg.	ELEV (floor)	LOCATION (Room Area)	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Associated ECR	Unavailability Response
FX-CABLE-F	100 foot length of #12 / 3 conductor 120VAC Extension cord with standard parallel blade plug	Connect power from receptacle FX-P-5A/B at EE-PNL-FX-1 to FX-P-5A or B control box (One required)	TB	322	AOP BOX 8	Fuel oil supply to FLEX DG	SPARE CABLE in FSF	FLOOD	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	13-00070	If cable staged for event mitigation is found to be NON-functional, then replace the cable with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-CABLE-G1	45 foot length of #4 / 4 conductor with one MALE and one FEMALE 100 Amp Weld connector on ends	Connect FX-Y-3-BK to FX-CABLE-G2 (or FX-CABLE-G3) (for FX-P-6A or FX-P-6B) (2 required)	FSF	312		Long term condensate supply	SPARE CABLE in FSF	QUAKE, COLD	ALL	This equipment is stored in Tornado & Seismic qualified structure.	14-00134	If cable staged for event mitigation is found to be NON-functional, then replace the cable with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-CABLE-G2	"Y" Cable Splitter Assembly #4 / 4 conductor cable 100 amp MALE weld input and two 100 amp FEMALE weld connector outputs)	Splits power feed from generator FX-Y-3 (via FX-CABLE-G1) to FX-P-6A & B and power buggy for lighting.	FSF	312		DID - portable lighting can be used	No redundancy	QUAKE, COLD	ALL	This equipment is stored in Tornado & Seismic qualified structure.	14-00134	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-CABLE-G3	"Y" Cable Splitter Assembly #6 / 4 conductor cable 100 amp MALE weld input and two 60 amp FEMALE weld connector outputs)	Distribute power from FX-CABLE-G2 to FX-P-6A-BK and FX-P-6B-BK	FSF	312		Long term condensate supply	SPARE CABLE in FSF	QUAKE, COLD	ALL	This equipment is stored in Tornado & Seismic qualified structure.	14-00134	If cable staged for event mitigation is found to be NON-functional, then replace the cable with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-CABLE-G4	30 foot length of #6 / 4 conductor with one MALE and one FEMALE 30 Amp Weld connector on ends	Extension cord between FX-P-6A and FX-P-6A-BK (or B) (Two Required)	FSF	312		DID	No redundancy	QUAKE, COLD	ALL	This equipment is stored in Tornado & Seismic qualified structure.	14-00134	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-CABLE-S1	100' Sound powered phone extension cable	Provide for sound powered phones if all other communications fail.	CB	322	AOP Box 10	DID	No redundancy	QUAKE, WIND	ALL	This equipment is stored in Tornado & Seismic qualified structure.	15-00044	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-CABLE-S2	400' Sound powered phone extension cable	Provide for sound powered phones if all other communications fail.	CB	322	AOP Box 10	DID	No redundancy	QUAKE, WIND	ALL	This equipment is stored in Tornado & Seismic qualified structure.	15-00044	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-CABLE-S3	50' Sound powered phone extension cable	Provide for sound powered phones if all other communications fail.	CB	322	AOP Box 10	DID	No redundancy	QUAKE, WIND	ALL	This equipment is stored in Tornado & Seismic qualified structure.	15-00044	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-CABLE-S4	5' Sound powered phone extension cable with male plug on both ends	Provide for sound powered phones if all other communications fail.	CB	322	AOP Box 10	DID	No redundancy	QUAKE, WIND	ALL	This equipment is stored in Tornado & Seismic qualified structure.	15-00044	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-CABLE-S5	"Y" adapter for Sound powered phones. One male to 2 female connectors	Provide for sound powered phones if all other communications fail.	CB	322	AOP Box 10	DID	No redundancy	QUAKE, WIND	ALL	This equipment is stored in Tornado & Seismic qualified structure.	15-00044	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.

Component ID	Description	Function	Bldg.	ELEV (floor)	LOCATION (Room Area)	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Associated ECR	Unavailability Response
FX-FAN-A	Portable 42" diameter 13300 CFM fan with 120 VAC 3/4 HP motor	Drive air flow from A(B) inverter room into A (B) battery room (TWO REQD)	CB	322	Patio	Cooling, and hydrogen gas concentration control in CB 322 & 338 elevations.	SPARE : One FX-FAN-A stored in FSF	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation.	13-00310	If FAN staged for event mitigation is found to be NON-functional, then replace the FAN with SPARE stored in FSF within 72 hours, and RESTORE SPARE within 90 days.
FX-FAN-A	Portable 42" diameter 13300 CFM fan with 120 VAC 3/4 HP motor	Drive air flow from TB 322 to above TB 355 floor near CIV-6	TB	355	Behind the elevator	Cooling and ventilation of Turbine Bldg and CB exhaust	SPARE : One FX-FAN-A stored in FSF	ALL	ALL	The fan is stored in the Turbine Bldg away from the exposed walls. If the building envelope is damaged, then portable ventilation will not be required.	13-00310	If FAN staged for event mitigation is found to be NON-functional, then replace the FAN with SPARE stored in FSF within 72 hours, and RESTORE SPARE within 90 days.
FX-FAN-B	48" diameter 19500 CFM fan with 120 VAC 1.5 HP motor	Drive air flow from TB 322 to above TB 355 floor at southwest stairwell (Two FANS required)	TB	355	southwest corner - against CB wall	Cooling and ventilation of TB south (FX-Y-1A or FX-Y-1B)	SPARE : One FX-FAN-B stored in FSF	ALL	ALL	The fan is stored in the Turbine Bldg away from the exposed walls. If the building envelope is damaged, then portable ventilation will not be required.	13-00310	If FAN staged for event mitigation is found to be NON-functional, then replace the FAN with SPARE stored in FSF within 72 hours, and RESTORE SPARE within 90 days.
FX-FAN-C	Portable 20" diameter 9500 CFM fan with 120 VAC 1 HP motor	Drive air flow from CB 355 office area into the control room	CB	355	patio /IC shop - under south stairwell	Cooling and ventilation of control room	SPARE : FX-FAN-C stored in FSF	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation.	13-00310	If FAN staged for event mitigation is found to be NON-functional, then replace the FAN with SPARE stored in FSF within 72 hours, and RESTORE SPARE within 90 days.
FX-FAN-C	Portable 20" diameter 9500 CFM fan with 120 VAC 1 HP motor	Drive air flow from CB 355 control room area up the stairwell to CB 380	CB	355	patio /IC shop - under south stairwell	Cooling and ventilation of control room	SPARE : FX-FAN-C stored in FSF	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation.	13-00310	If FAN staged for event mitigation is found to be NON-functional, then replace the FAN with SPARE stored in FSF within 72 hours, and RESTORE SPARE within 90 days.
FX-FAN-C	Portable 20" diameter 9500 CFM fan with 120 VAC 1 HP motor	Drive air flow from IB 322 outside through RB purge supply duct.	IB	322	purge air intake - north end	Cooling and ventilation of Intermediate Bldg 295 elev.	SPARE : FX-FAN-C stored in FSF	ALL	A	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation.	13-00310	If FAN staged for event mitigation is found to be NON-functional, then replace the FAN with SPARE stored in FSF within 72 hours, and RESTORE SPARE within 90 days.
FX-FAN-C	Portable 20" diameter 9500 CFM fan with 120 VAC 1 HP motor	Drive air flow from CB 338 into Turbine Bldg (Two FANS required)	TB	338	north end of landing in front of elevator	Cooling, and hydrogen gas concentration control in CB 322 & 338 elevations.	SPARE : FX-FAN-C stored in FSF	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	13-00310	If FAN staged for event mitigation is found to be NON-functional, then replace the FAN with SPARE stored in FSF within 72 hours, and RESTORE SPARE within 90 days.
FX-HOSE-A	50 ft length of 4 inch hose with min pressure rating 250 psig @ 150F with 4 inch STORZ connectors	Connect FX-V-203 to FX-V-205 (125 feet) (Three (3) sections of FX-HOSE-A required)	TB	305	AOP Box 6	Feedwater to OTSG, and RCS or SF Pool Makeup	SPARE FX-HOSE-A stored in FSF.	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure. This location is shielded from tornado missiles. The component will be reconfigured prior to potential loss of access due to flood.	14-00031	If HOSE staged for event mitigation is found to be NON-functional, then replace the HOSE with SPARE stored in FSF within 72 hours, and RESTORE SPARE within 90 days.
FX-HOSE-B1	1.5 inch SS braided hose, rated above 2200 psig, ~ 80 ft length, with 1500# RF flange on south end, and MNPT on north end	(1) Connect FX-HOSE-B-X1 to FX-HOSE-B-X2 or (2) Connect FX-HOSE-Z-X2 to FX-HOSE-B-X2	CB	322	patio : connected to FX-HOSE-B-X2 not connected on north end	DID - Alternate path for failure of HP piping between CB and FHB	No redundancy	ALL EXCEPT FLOOD	A,B,C	This equipment is stored in Tornado & Seismic qualified structure.	15-00345	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.

Component ID	Description	Function	Bldg	ELEV (floor)	LOCATION (Room Area)	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Associated ECR	Unavailability Response
FX-HOSE-B2	1.5 inch SS braided hose, rated above 2200 psig, 85 ft length, with threaded 1500# RF flanges on each end	Connect FX-HOSE-B-X2 to FX-HOSE-B-X3 (3 required)	FHB	305	AOP BOX 11A & 11B	DID - Alternate path for failure of HP piping between CB and FHB	No redundancy	ALL EXCEPT FLOOD	A,B,C	This equipment is stored in Tornado & Seismic qualified structure.	15-00345	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-HOSE-B2.1	1.5 inch SS braided hose, rated above 2200 psig, 85 ft length, with 1500# RF flanges on one end and FNPT on other	Connect FX-HOSE-B-X2 to FX-HOSE-B-X3 (3 required)	FHB	305	AOP BOX 11C	DID - Alternate path for failure of HP piping between CB and FHB	No redundancy	ALL EXCEPT FLOOD	A,B,C	This equipment is stored in Tornado & Seismic qualified structure.	15-00345	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-HOSE-B3	0.75 inch SS braided hose, rated above 2200 psig, 25 to 30ft length, MNPT and FNPT connections on each end	Connect FX-HOSE-B-X3 to MU-V-143C & MU-V-143D (2 required)	FHB	305	AOP Box 2	DID - Alternate path for failure of FXP1 discharge piping	No redundancy	ALL EXCEPT FLOOD	A,B,C	This equipment is stored in Tornado & Seismic qualified structure.	15-00345	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-HOSE-B-X3	304 SS pipe adaptor (rated > 2500 psig at 150F) with a 1.5 inch FNPT inlet and two 0.75 inch FNPT outlets	Connect FX-HOSE-B2 to two FX-HOSE-B3	FHB	305	AOP Box 2	DID - Alternate path for failure of HP piping between CB and FHB	No redundancy	ALL EXCEPT FLOOD	A,B,C	This equipment is stored in Tornado & Seismic qualified structure.	15-00345	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-HOSE-C-1	3/8' SS Ball Valve,3/8" Female Universal SS Air Couplings, 1/2" ODTx3/8" SS Male Branch Tee, 100' 3/8" Flexible Air Hose	Air supply hose from EG-P-20A or B to FH-208 missile door flood seals	FSF	312		Required for flood protection	SPARE HOSE in FSF	FLOOD	ALL	This equipment is located in Tornado & Seismic qualified structure, and will be reconfigured prior to potential loss of access due to flood.	15-00155	If HOSE staged for event mitigation is found to be NON-functional, then replace the HOSE with SPARE stored in FSF within 72 hours, and RESTORE SPARE within 90 days.
FX-HOSE-C-2	3/8' SS Ball Valve,3/8" Female Universal SS Air Couplings, 1/2" ODTx3/8" SS Male Branch Tee, 12' 3/8" Flexible Air Hose	Air supply hose from EG-P-20A or B to A-116 missile door flood seals	FSF	312		Required for flood protection	SPARE HOSE in FSF	FLOOD	ALL	This equipment is located in Tornado & Seismic qualified structure, and will be reconfigured prior to potential loss of access due to flood.	15-00155	If HOSE staged for event mitigation is found to be NON-functional, then replace the HOSE with SPARE stored in FSF within 72 hours, and RESTORE SPARE within 90 days.
FX-HOSE-E	10 foot length of 6 inch hose rated for 20 ft of water vacuum to 10 psig @ 150F with 6 inch STORZ on each end	River supply to FX-P-3A or 3B (need 4 lengths of FX-HOSE-E)	FSF	312		Long term condensate supply	SPARE FX-HOSE-E stored in FSF.	ALL EXC QUAKE	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	07-00695	If HOSE staged for event mitigation is found to be NON-functional, then replace the HOSE with SPARE stored in FSF within 72 hours, and RESTORE SPARE within 90 days.
FX-HOSE-E-X1	6 inch elbow and strainer basket	Minimize debris intake to FXP3 suction	FSF	312		Long term condensate supply	SPARE in FSF	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	07-00695	If equipment is not available, then replace the damaged or missing component within 90 days.
FX-HOSE-E-X2	suction hose floats	Keep FXP3 suction strainer submerged but not in the mud	FSF	312		Long term condensate supply	SPARE in FSF	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	07-00695	If equipment is not available, then replace the damaged or missing component within 90 days.
FX-HOSE-F	3 inch X 50 ft length canvas fire hose rated 250 psig with 2.5 inch M & F FST ends	Connect FX-P-6A discharge to FX-HOSE-F-X1	ISPH	308	AOP box 7 or nearby	Long term condensate supply	SPARE FX-HOSE-X stored in FSF.	QUAKE, COLD	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	14-00031	If HOSE staged for event mitigation is found to be NON-functional, then replace the HOSE with SPARE stored in FSF within 72 hours, and RESTORE SPARE within 90 days.

Component ID	Description	Function	Bldg.	ELEV (floor)	LOCATION (Room Area)	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Associated ECR	Unavailability Response
FX-HOSE-F	3 inch X 50 ft length canvas fire hose rated 250 psig with 2.5 inch M & F FST ends	Connect FX-P-6B discharge to FX-HOSE-F-X1	ISPH	308	AOP box 7 or nearby	Long term condensate supply	SPARE FX-HOSE-X stored in FSF.	QUAKE, COLD	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	14-00031	If HOSE staged for event mitigation is found to be NON-functional, then replace the HOSE with SPARE stored in FSF within 72 hours, and RESTORE SPARE within 90 days.
FX-HOSE-F-X1	3 inch pipe manifold with two 2.5 inch FEMALE FST connections and one 3 inch STORZ coupling	Connect FX-P-6A & B discharge HOSES to FX-HOSE-X	ISPH	308	AOP box 7 or nearby	Long term condensate supply	No redundancy	QUAKE, COLD	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	13-00502	If equipment is not available, then replace the damaged or missing component within 72 hours.
FX-HOSE-F-X2	Four inch pipe manifold with three valves (FX-V-301, 302 & 303) and 3 inch STORZ couplings	Control river water flow to water treatment or borated water skid, and route output to CO-T-1B or hotwell (connected to FX-HOSE-X)	FSF	312		Long term condensate supply	No redundancy	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	14-00031	If equipment is not available, then replace the damaged or missing component within 72 hours.
FX-HOSE-F-X3	Adaptor: Four inch (150# class) flange to three inch STORZ connector	Connect FX-HOSE-X to CO-T-1B 4 inch chem add flange	FSF	312		Long term condensate supply	No redundancy	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	07-00695	If equipment is not available, then replace the damaged or missing component within 72 hours.
FX-HOSE-F-X4	Three inch pipe tee with 3 inch STORZ couplings	Return Water Treatment Skid Outlet to condensate supply hoses AND to Mobile Boration Skid inlet (connected to FX-HOSE-X)	FSF	312		Long term borated water supply	No redundancy	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	14-00031	If equipment is not available, then replace the damaged or missing component within 72 hours.
FX-HOSE-F-X5	5 inch STORZ , Y pipe splitter, 2.5" ball valves and 2.5" MALE NST ends	Connect FX-P-3A or B to FX-HOSE-X	FSF	312		Long term borated water supply	No redundancy	ALL	A,B,C	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	07-00695	If equipment is not available, then replace the damaged or missing component within 72 hours.
FX-HOSE-F-X6	Adaptor: Four inch (900# class) flange to three inch STORZ connector	Connect FX-HOSE-X to MFW 4 inch chem cleaning flange	TB	322	AOP Box 8	DID - alternate strategy to feed OTSG	No redundancy	ALL EXCEPT FLOOD	A,B,C	This equipment is stored in Tornado & Seismic qualified structure.	15-00345	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-HOSE-F-X7	Adaptor: 3 inch STORZ to 5 inch STORZ	Connect FX-HOSE-X to SFP Standpipe (at 305 elev)	FSF	312		DID - alternate strategy for SFP makeup	No redundancy	ALL EXCEPT FLOOD	ALL	This equipment is stored in Tornado & Seismic qualified structure.	15-00345	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-HOSE-G	150 ft length of 1 inch rated for 250 psig @ 450F with 1 inch MALE and FEMALE NPT ends (3 x 50 ft sections connected together). AND adaptors to 1/2" NPT (MS-V) to connect	Connect Main Steam Drain (MS-V-44 or 52) to EFW Pump Recirc drain (EF-V-17) (132' or less actual length)	IB	295	AOP Box 4	Maintain CO-T-1B above 40F	SPARE FX-HOSE-G stored in FSF.	COLD	A	This equipment is stored in Tornado & Seismic qualified structure, N481+N487	13-00502	If a hose section staged for event mitigation is found to be NON-functional, then replace the hose with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.

Component ID	Description	Function	Bldg.	ELEV (floor)	LOCATION (Room Area)	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Associated ECR	Unavailability Response
FX-HOSE-X	3 inch X 50 ft length canvas fire hose rated 250 psig with 2.5 inch M & F FST ends, and 3 INCH STORZ adaptors on each end	Connect FX-HOSE-F-X4 to the mobile boration skid, and connect boration skid outlet to FX-P-4 (2 sections of FX-HOSE-X)	FSF	312		Long term borated water supply	SPARE sections of FX-HOSE-X are stored in FSF.	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	14-00218	If a hose section staged for event mitigation is found to be NON-functional, then replace the hose with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-HOSE-X	3 inch X 50 ft length canvas fire hose rated 250 psig with 2.5 inch M & F FST ends, and 3 INCH STORZ adaptors on each end	Connect Mobile Boration Skid Outlet to AB west wall penetration (FX-V-304) (475 feet) (Ten (10) sections of FX-HOSE-X)	FSF	312		Long term borated water supply	SPARE sections of FX-HOSE-X are stored in FSF.	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	14-00218	If a hose section staged for event mitigation is found to be NON-functional, then replace the hose with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-HOSE-X	3 inch X 50 ft length canvas fire hose rated 250 psig with 2.5 inch M & F FST ends, and 3 INCH STORZ adaptors on each end	Connect Water Treatment skid to river water supply (FX-HOSE-F-X2) and outlet to FX-HOSE-F-X4 (2 sections of FX-HOSE-X)	FSF	312		Long term condensate supply	SPARE sections of FX-HOSE-X are stored in FSF.	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	14-00031	If a hose section staged for event mitigation is found to be NON-functional, then replace the hose with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-HOSE-X	3 inch X 50 ft length canvas fire hose rated 250 psig with 2.5 inch M & F FST ends, and 3 INCH STORZ adaptors on each end	Long term water supply to Hotwell (FX-HOSE-F-X2 to EX-T-1) (650 feet) (13 lengths of FX-HOSE-X)	FSF	312		Long term condensate supply	SPARE sections of FX-HOSE-X are stored in FSF.	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	14-00031	If a hose section staged for event mitigation is found to be NON-functional, then replace the hose with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-HOSE-X	3 inch X 50 ft length canvas fire hose rated 250 psig with 2.5 inch M & F FST ends, and 3 INCH STORZ adaptors on each end	Connect FX-HOSE-F-X1 (from FX-P-6A or B) to FX-HOSE-F-X2 (1250 feet) (25 sections of FX-HOSE-X)	FSF	312		Long term condensate supply	SPARE sections of FX-HOSE-X are stored in FSF.	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	14-00031	If a hose section staged for event mitigation is found to be NON-functional, then replace the hose with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-HOSE-X	3 inch X 50 ft length canvas fire hose rated 250 psig with 2.5 inch M & F FST ends, and 3 INCH STORZ adaptors on each end	Connect FX-HOSE-F-X5 (FX-P-3A/B) to FX-HOSE-F-X2 (690 feet) (14 sections of FX-HOSE-X)	FSF	312		Long term condensate supply	SPARE sections of FX-HOSE-X are stored in FSF.	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	14-00031	If a hose section staged for event mitigation is found to be NON-functional, then replace the hose with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-HOSE-X	3 inch X 50 ft length canvas fire hose rated 250 psig with 2.5 inch M & F FST ends, and 3 INCH STORZ adaptors on each end	Long term water supply to CO-T-1B (from FX-HOSE-F-X2) (250 ft) (5 lengths of FX-HOSE-X)	FSF	312		Long term condensate supply	SPARE sections of FX-HOSE-X are stored in FSF.	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	14-00031	If a hose section staged for event mitigation is found to be NON-functional, then replace the hose with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-HOSE-X	3 inch X 50 ft length canvas fire hose rated 250 psig with 2.5 inch M & F FST ends, and 3 INCH STORZ adaptors on each end	Connect FX-V-208 to FX-V-113 (175 feet) (Four (4) FX-HOSE-X required)	TB	322	AOP BOX 8	Feedwater to RCS or SF Pool Makeup	SPARE sections of FX-HOSE-X are stored in FSF.	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	14-00031	If a hose section staged for event mitigation is found to be NON-functional, then replace the hose with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.

Component ID	Description	Function	Bldg.	ELEV (floor)	LOCATION (Room Area)	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Associated ECR	Unavailability Response
FX-HOSE-Y	1.5 inch X 100 ft length FUEL OIL HOSE rated above 50 psig with 1.5 inch Male QUICK DISCONNECTS on each end	Connect DF-V-41 to FX-V-1 (90 feet) (one section of FX-HOSE-Y)	DGB	305	AOP Box 5	Fuel oil supply to FLEX DG	SPARE FX-HOSE-Y is stored in FSF.	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, and will be reconfigured prior to potential loss of access due to flood.	13-00164	If a hose section staged for event mitigation is found to be NON-functional, then replace the hose with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-HOSE-Y	1.5 inch X 100 ft length FUEL OIL HOSE rated above 50 psig with 1.5 inch Male QUICK DISCONNECTS on each end	Connect FX-P-5A or B discharge to FX-Y-1A or FX-Y-1B (100 feet) (1 section of FX-HOSE-Y)	TB	322	AOP Box 3	Fuel oil supply to FLEX DG	SPARE FX-HOSE-Y is stored in FSF.	FLOOD	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	13-00164	If a hose section staged for event mitigation is found to be NON-functional, then replace the hose with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-HOSE-Y	1.5 inch X 100 ft length FUEL OIL HOSE rated above 50 psig with 1.5 inch Male QUICK DISCONNECTS on each end	Connect FX-V-2 to FX-T-2, FX-T-3 or FX-T-4) (FXV2 to FXT3 is 340 ft) (4 sections of FX-HOSE-Y)	TB	322	AOP Box 3	Fuel oil supply to FLEX DG	SPARE FX-HOSE-Y is stored in FSF.	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	13-00164	If a hose section staged for event mitigation is found to be NON-functional, then replace the hose with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-HOSE-Y-X2	1.5 inch pipe nipple with FEMALE QUICK DISCONNNECTS on each end	Used to connect lengths of FX-HOSE-Y	TB	322	AOP Box 3	Fuel oil supply to FLEX DG	SPARE FX-HOSE-Y-X2 is stored with FX-HOSE-Y in FSF.	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	13-00164	If a hose coupling staged for event mitigation is found to be NON-functional, then replace the section with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-HOSE-Y-X4	1.5 inch pipe tee with FEMALE QUICK DISCONNNECTS on each end, and MALE QD on the tee	Connect at FX-V-2 to permit use of parallel hoses to FX-T-3 and FX-T-4	TB	322	AOP Box 3	DID - simplifies process to fill FX-T-4 but hose used for FX-T-3 can be temporarily rerouted to fill FX-T-4	No redundancy	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, above 320' elevation. This location is shielded from tornado missiles.	13-00164	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-HOSE-Z	50 foot length of 1.5" ID hose rated at 270 psig with 2 inch STORZ connections	WDL-V-421 (AB west wall) to FX-V-111 (FX-P-1 suction) (approx. 200') (Four FX-HOSE-Z required)	FHB	305	AOP Box 2	DID - additional borated water source	SPARE Hose section is stored in FSF	WIND	A,B,C	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	14-00218	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-HOSE-Z	50 foot length of 1.5" ID hose rated at 270 psig with 2 inch STORZ connections	Connect FX-HOSE-Z-X3 (from BWST or SFP) to FX-HOSE-X-X4 (at CB standpipe) (Three FX-HOSE-Z required)	FHB	305	AOP Box 2	DID - Alternate path for failure of FX-P-1 suction piping	SPARE Hose section is stored in FSF	ALL	A,B,C	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	15-00345	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-HOSE-Z	50 foot length of 1.5" ID hose rated at 270 psig with 2 inch STORZ connections	Connect FX-V-304 (AB west wall) to FX-V-111 (FX-P-1 suction) (actual length 280 Ft) (SIX sections FX-HOSE-Z)	FHB	305	AOP Box 2	Long term borated water supply	SPARE Hose section is stored in FSF	ALL	ALL	This equipment is located in Tornado & Seismic qualified structure, with missile protection and will be reconfigured prior to potential loss of access due to flood.	14-00218	If a hose section staged for event mitigation is found to be NON-functional, then replace the hose with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-HOSE-Z-X1	Adaptor to connect 1.5" 150# flange to 2 inch STORZ. Including an elbow for accessibility.	Connect FX-HOSE-Z to fitting at WDL-V-421	FHB	305	AOP Box 2	DID - additional borated water source	No redundancy	WIND	A,B,C	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	14-00218	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.

Component ID	Description	Function	Bldg.	ELEV (floor)	LOCATION (Room Area)	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Associated ECR	Unavailability Response
FX-HOSE-Z-X2	Short section of 1.5 inch hose with a 1.5 FNPT connector on one end, rated for 150 psig	Connect FX-HOSE-B1 to 1.5 pipe nipple on FX-P-1A or FX-P-1B suction	CB	322	AOP BOX 10	DID - Alternate path for failure of FX-P-1 suction piping		ALL EXCEPT FLOOD	A,B,C	This equipment is stored in Tornado & Seismic qualified structure.	15-00345	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-HOSE-Z-X3	Adaptor 4 inch 150# flange to a 2 inch STORZ connector, rated for 150 psig	Connect FX-HOSE-Z to 4 inch flange at SF-V-36 or SF-V-37	FHB	305	AOP Box 2	DID - Alternate path for failure of FX-P-1 suction piping		ALL EXCEPT FLOOD	A,B,C	This equipment is stored in Tornado & Seismic qualified structure.	15-00345	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-HOSE-Z-X4	Adaptor 1.5 inch 1500# flange to a 2 inch STORZ connector, rated for 150 psig	Connect FX-HOSE-Z to 2 inch flange at FX-HOSE-B-X2 (at 305)	FHB	305	AOP Box 2	DID - Alternate path for failure of FX-P-1 suction piping	SPARE Hose section is stored in FSF	ALL EXCEPT FLOOD	A,B,C	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	15-00345	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-HTR-1	200,000 BTU/HR Portable Propane Space Heater	Hotwell area space heater (4 UNITS REQUIRED)	FSF	312		Maintain hotwell above 40F	One SPARE is stored in the FSF	COLD	C,D	No protection required. Only required for Extreme Cold Event.	13-00502	If a heater is found to be NON-functional, then replace the heater with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-HTR-2	200,000 BTU/HR Portable Propane Space Heater	ISPH Space Heater	FSF	312		Prevent FLEX equipment in ISPH from freezing	One SPARE is stored in the FSF	COLD	ALL	No protection required. Only required for Extreme Cold Event.	13-00502	If a heater is found to be NON-functional, then replace the heater with SPARE stored in FSF within 72 hours, and procure new SPARE within 90 days.
FX-LIGHT-01	SmithLights IN120LB-R	Provide temporary flood lighting	CB	322	Next to AOP BOX 10	DID - Provide temporary flood lighting	Alternative capabilities are described in Reference 62.	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure.	2494447-02	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-LIGHT-01	SmithLights IN120LB-R	Provide temporary flood lighting	FSF	312		DID - Provide temporary flood lighting	Alternative capabilities are described in Reference 62.	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure.	2494447-02	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-LIGHT-02	Flashlights	Provide Backup lighting	CB	322	AOP Box 10	DID - Backup portable lighting	Alternative capabilities are described in Reference 62.	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure.	2494447-02	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-LIGHT-02	Flashlights	Provide Backup lighting	FSF	312		DID - Backup portable lighting	Alternative capabilities are described in Reference 62.	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure.	2494447-02	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-LIGHT-03	Headlamps for Hard Hats	Provide Backup lighting	CB	322	AOP Box 10	DID - Backup portable lighting	Alternative capabilities are described in Reference 62.	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure.	2494447-02	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.

TMI1 – Final Integrated Plan - ATTACHMENT 2B "PORTABLE FLEX EQUIPMENT LIST"

Component ID	Description	Function	Bldg.	ELEV (floor)	LOCATION (Room Area)	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Associated ECR	Unavailability Response
FX-LIGHT-03	Headlamps for Hard Hats	Provide Backup lighting	FSF	312		DID -Backup portable lighting	Alternative capabilities are described in Reference 62.	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure.	2494447-02	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-MISC-01	Evaporative Cooling Vest	Personnel Comfort for Hot Environments	CB	322	AOP Box 10	DID - Personnel Comfort for Hot Environments	No redundancy	HOT	ALL	This equipment is stored in Tornado & Seismic qualified structure.	NA	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-MISC-01	Evaporative Cooling Vest	Personnel Comfort for Hot Environments	FSF	312		DID - Personnel Comfort for Hot Environments	No redundancy	HOT	ALL	This equipment is stored in Tornado & Seismic qualified structure.	NA	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-MISC-02	Door Chocks	Means to prop open Doors	CB	322	AOP Box 10	Prop open Doors	SPARES are STORED in FSF	HOT	ALL	This equipment is stored in Tornado & Seismic qualified structure.	13-00310	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-P-3A	Portable Diesel Driven Pump (420 GPM@ 525 TDH) on trailer	Pump river water to CO-T-1B or hotwell	FSF	312		Long term condensate supply	FX-P-3B	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, relocated in preparation for a flood.	14-00031	NOTE: The following address FLEX requirements but NOT B.5.b requirements. If FX-P-3A cannot provide 150 GPM at 165 ft. TDH at 2200 RPM and FX-P-3B is functional, then restore FX-P-3A within 90 days. If FX-P-3A and FX-P-3B are NON-functional, then initiate action to restore one pump to an functional condition (or develop an equivalent capability) within 72 hours.
FX-P-3B	Portable Diesel Driven Pump (420 GPM@ 525 TDH) on trailer	Pump river water to CO-T-1B or hotwell	FSF	312		Long term condensate supply	FX-P-3A	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, relocated in preparation for a flood.	14-00031	see FX-P-3A
FX-P-4	Portable Diesel driven pump (60 GPM@ 90FT TDH)	Transfer borated water from NSRC tank to FX-P-1A or B suction	FSF	312		Long term borated water supply	SPARE PUMP in FSF	ALL	A,B,C	This equipment is stored in Tornado & Seismic qualified structure, relocated in preparation for a flood.	14-00218	There are 3 FX-P-4 UNIT stored in FSF. If no functional units are available in FSF, then initiate action within 24 hrs to provide an equivalent capability within 72 hours.
FX-P-6A	Submersible centrifugal pump (150 GPM@ 200 ft. TDH) driven by 15 HP 480VAC motor	Pump River Water to CO-T-1B or Hotwell	ISPH	308	Near AOP box 7	Long term condensate supply	FX-P-6B	QUAKE, COLD	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	14-00031	If FX-P-6A or FX-P-6B cannot provide 120 GPM at 180 ft. TDH and the other pump is functional, then restore the functional pump within 90 days. If FX-P-6A and FX-P-6B are NON-functional, then initiate action to restore one pump to an functional condition (or develop an equivalent capability) within 72 hours. NOTE: If a seismic event causes a failure of York Haven Dam, river water will not be accessible at ramp west of the NOB (where FX-P-3 is used).

Component ID	Description	Function	Bldg.	ELEV (floor)	LOCATION (Room Area)	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Associated ECR	Unavailability Response
FX-P-6A-BK	30 amp fused disconnect Fuses: 30 Amp (Time Delay) NEMA Class: 3R (Rainproof) Input/Output: 4/C#2 AWG with 100 Amp Weld Connectors	Start or stop FX-P-6A	FSF	312		Long term condensate supply	FX-P-6B	QUAKE, COLD	ALL	This equipment is stored in Tornado & Seismic qualified structure.	14-00134	See FX-P-6A
FX-P-6B	Submersible centrifugal pump (150 GPM@ 200 ft TDH) driven by 15 HP 480VAC motor	Pump River Water to CO-T-1B or Hotwell	ISPH	308	Near AOP box 7	Long term condensate supply	FX-P-6A	QUAKE, COLD	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	14-00031	See FX-P-6A
FX-P-6B-BK	30 amp fused disconnect Fuses: 30 Amp (Time Delay) NEMA Class: 3R (Rainproof) Input/Output: 4/C#2 AWG with 100 Amp Weld Connectors	Start or stop FX-P-6B	FSF	312		Long term condensate supply	FX-P-6A	QUAKE, COLD	ALL	This equipment is stored in Tornado & Seismic qualified structure.	14-00134	See FX-P-6A
FX-P-8	25 GPM@ 17 PSIG diesel fuel pump driven by 3/4 HP 12VDC motor	FX-T-4 fuel transfer pump	FSF	312	FX-TRUCK	Portable equipment fuel supply	No redundancy	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, relocated in preparation for a flood.	NA	If FX-P-8 cannot transfer at least 10 GPM, then develop equivalent capability within 72 hours.
FX-T-4	200 gallon tank	Transport Diesel Fuel Oil to Portable FLEX components	FSF	312	FX-TRUCK	Portable equipment fuel supply	Passive	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, relocated in preparation for a flood.	13-00074	No active function
FX-TOOL-01	Electric Saws-all	Debris Removal	FSF	312		DID Debris Removal (Misc)	No redundancy	WIND	ALL	This equipment is stored in Tornado & Seismic qualified structure.	2494447-03	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-TOOL-02	Battery operated electric Chainsaw	Debris Removal	FSF	312		DID Debris Removal (Trees)	No redundancy	WIND	ALL	This equipment is stored in Tornado & Seismic qualified structure.	2494447-03	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-TOOL-MISC	MISC HAND TOOLS (e.g., shovel, come-along, levers, Skiff Thongs, Axes, bolt cutters)	Debris Removal	FSF	312		DID Debris Removal	No redundancy	WIND	ALL	This equipment is stored in Tornado & Seismic qualified structure.	2494447-02	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-TRUCK	Ford F750 with hitch, plow & 200 gallon auxiliary diesel fuel oil tank (FX-T-4)	Move FX-P-3A or B into position, deliver equipment & distribute diesel fuel to FX-P-3A & B	FSF	312		Transport FLEX portable equipment and distribute fuel oil	No redundancy	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, relocated in preparation for a flood.	13-00074	If truck cannot perform its hauling or fuel distribution functions, then implement alternate plans for those functions within 72 hours. Multiple alternate vehicles can be used but those vehicles need to be protected.

Component ID	Description	Function	Bldg.	ELEV (floor)	LOCATION (Room Area)	FLEX Function	Redundancy	External Hazard (NOTE 2)	Plant Mode	External Hazard Protection	Associated ECR	Unavailability Response
FX-V-0301	4 inch GATE valve, 300# Class, CS, Flanged ends	River water makeup hose - cleanup diversion valve for NSRC water treatment eqpt	FSF	312		Long term condensate supply	Redundancy is not available (See reference 23 section 2.12.2)	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	14-00031	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability, within 72 hours.
FX-V-0302	4 inch GATE valve, 300# Class, CS, Flanged ends	River water makeup hose - cleanup inlet valve for NSRC water treatment eqpt	FSF	312		Long term condensate supply	Redundancy is not available (See reference 23 section 2.12.2)	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	14-00031	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability, within 72 hours
FX-V-0303	4 inch GATE valve, 300# Class, CS, Flanged ends	River water makeup hose - cleanup return valve for NSRC water treatment eqpt	FSF	312		Long term condensate supply	Redundancy is not available (See reference 23 section 2.12.2)	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	14-00031	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability, within 72 hours
FX-V-0304	2 inch ball valve, 150#, CS, NPT	Aux Bldg. west wall penetration isolation valve - long term borated water supply	AB	305	Vent Equip room - West wall at 307' elev. north of AH-F-2	Long term borated water supply	Use alternate route from YARD to AUX BLDG.	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	14-00218	If valve cannot be opened, then initiate action to restore this function or provide equivalent capability (describe a different route and provide connectors) , within 72 hours.
FX-V-0305A & B	3 inch check valve, 150#, CS, NPT (TWO)	Prevent backflow through FX-P-6A & 6B	ISPH	308	Near AOP box 7	Long term condensate supply	FX-V-305B & A	QUAKE, COLD	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	13-00502	If valve is not functional, then initiate action consistent with an NON-functional FX-P-6A.
FX-V-0306	3 inch ball or gate valve, 150#, CS, with 3 inch STORZ ends	Control SFP Makeup and maintain pressure for feedwater	FSF	312		DID - alternate strategy for SFP makeup	No redundancy	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, and is not vulnerable to flood damage.	15-00345	Equipment is utilized but not essential to the FLEX strategy. There are no specific regulatory required limits on unavailability.
FX-Y-3	Portable 350kW 480VAC diesel generator	Provide power for FX-P-6A or B	FSF	312		Long term condensate supply	Alternate method using FX-P-3A & FX-P-3B	QUAKE, COLD	ALL	This equipment is stored in Tornado & Seismic qualified structure.	14-00134	If FX-Y-3 and associated equipment cannot provide power to operate FX-P-6, then initiate action to restore this function within 90 days.
FX-Y-4	Yanmar 5.5 kW diesel generator	Provide 120 VAC power	FSF	312		Power for FXP3 & FXY3 block heaters,	SPARE FX-Y-4 is stored in FSF	COLD	ALL	This equipment is stored in Tornado & Seismic qualified structure, relocated in preparation for a flood.	13-00070	There are several FX-Y-4 stored in FSF, if at least one is not functional, then restore at least one with 72 hours. NOTE: Requirements for use for FX-Y-4 for EP Communications must also be addressed.
FX-Y-4	Yanmar 5.5 kW diesel generator	Provide 120 VAC power	FSF	312		DID - Alternate power to IB fan, power for portable radiation monitors at SFP or RB exhaust	SPARE FX-Y-4 is stored in FSF	ALL	ALL	This equipment is stored in Tornado & Seismic qualified structure, relocated in preparation for a flood.	13-00070	See row above

NOTE 2: BDBEE External Hazards are abbreviated as follows: WIND = High Winds / Tornado ; QUAKE = Earthquake : EXC = 'except' ; COLD = Extreme Cold Snow & Ice; HOT = Extreme Heat

Comp ID	Description	Implementing notes	Period
FX-P-1A & FX-P-1B	75 HP 460VAC TEFC Motor and Triplex Plunger Style Positive Displacement Pump (design capacity: 40 gpm @ 2600 psig)		
	Performance Test – Verify min flow at pressure ; Verify associated component operation	PM223811 OP-TM-919-202 (FX-P-1A) PM223812 OP-TM-919-209 (FX-P-1B)	1 year
	Grease motor bearings	PM223813	5 year
	Replace pump oil, seal kit, valve kit	PM223815	5 year
	Pump bump to lubricate gear box	PM223750 OP-TM-919-202 (FX-P-1A) PM223752 OP-TM-919-209 (FX-P-1B)	6 mo.
FX-P-2A & FX-P-2B	Submersible six stage centrifugal pump (design capacity: 175 gpm @ 460 ft. TDH) driven by 40 HP 480VAC electric motor		
	Performance Test – Verify head flow relationship at 3 points ; Verify associated component operation ; Measure Motor Vibration	PM223817 OP-TM-919-203	1 year
	Pump operation recirculating the tank	PM223821 OP-TM-919-203	6 mo.
FX-P-3A& FX-P-3B	Variable Speed Diesel Driven Centrifugal Pump (design capacity: 420 GPM @ 525 TDH) (portable pump on trailer)		
	Performance Test (Operate unit for min of 2 hours) ; Verify pump can achieve min flow requirements ; Verify associated component operation ; Add stabilizer to the fuel tank ; Includes Lube Oil and Fluid Filter Replacement	PM222177 OP-TM-919-204	1 year
	Ten Minute Dry run	PM222175 OP-TM-919-207	6 mo.
	Standby Inspection	Operator Rounds (ESOMS)	7 days
	Battery Checks	PM22173	31 days
	Air Compressor and Pump Checks Coolant and fuel replacement	PM222179	3 year
	Pump Battery replacement	PM217680	3 year
FX-P-5A & FX-P-5B	4.5 GPM positive displacement pump driven by 0.5 HP 120VAC motor		
	Performance Test Verify pump flow capacity	PM223823 OP-TM-919-205	5 year

Comp ID	Description	Implementing notes	Period
FX-P-6A & FX-P-6B	Submersible centrifugal pump (design capacity: 150 GPM@ 200 ft. TDH) driven by 15 HP 480VAC motor		
	Performance Test Verify pump meets minimum head flow requirements	PM223825 OP-TM-919-206	5 year
FX-Y-1A & FX-Y-1B	500kW 480VAC air cooled diesel generator		
	Performance Test (100% load for 2 hrs) Cycle output breaker ; Inspection	PM223829 OP-TM-919-201	1 year
	Battery replacement ; Generator offline Testing	PM223831	3 year
	No load run for <15 mins	PM223758 PM223760	6 mo.
	Flush and replace coolant and lube oil. Replace fluid filters (lube, coolant, fuel)	PM223834	2 year
	Standby Inspection	Operator Rounds (ESOMS)	7 days
FX-Y-3	Portable 350kW 480VAC air cooled diesel generator		
	Performance Test (100% load for 2 hrs) Cycle output breaker ; Inspection ; Replace diesel fuel ; Battery replacement	PM223840 OP-TM-919-208	3 years
	>30% load for 2 hrs and cycle output breaker ; Stabilizer added to fuel tank	PM223842	1 year
	No load run for <15 mins	PM223844	6 mo.
	Flush and replace coolant and lube oil. Replace fluid filters (lube, coolant, fuel)	PM223846	2 year
	Generator offline Testing	PM223841	3 year
	Standby Inspection	Operator Rounds (ESOMS)	7 days
FX-HOSE-E	Hydrostatic test (FX-P-3A/B suction hoses)	PM213928	3 year
HOSE (NOTE 3)	Replace hose	PM223850	10 year
CABLE (NOTE 3)	Test continuity and resistance (Megger) and visual inspection	PM223852	10 year
VALVES (NOTE 1)	Cycle valve to confirm freedom of movement over full stroke	Implementing details are in Reference 114	2 year
480V BREAKERS (NOTE 2)	Trip test and MCC compartment inspection	Implementing details are in Reference 114	10 year
480V BREAKERS (NOTE 2)	Cycle breakers to confirm function	Implementing details are in Reference 114	1 year

NOTES

1. All manual or remote operated valves with a required FLEX function as listed on Attachment 2A or 2B will be fully stroked periodically. Where valve testing is included within the Technical Specification required surveillance program, the testing and frequency is determined by Tech Specs.

2. All 480V breakers with a required FLEX function as listed on Attachment 2A or 2B will be tested. Where breaker testing is included within the Technical Specification required surveillance program, the testing and frequency is determined by Tech Specs.

3. This includes hose or cable with a required FLEX function as listed on Attachment 2A or 2B

REVISIONS		
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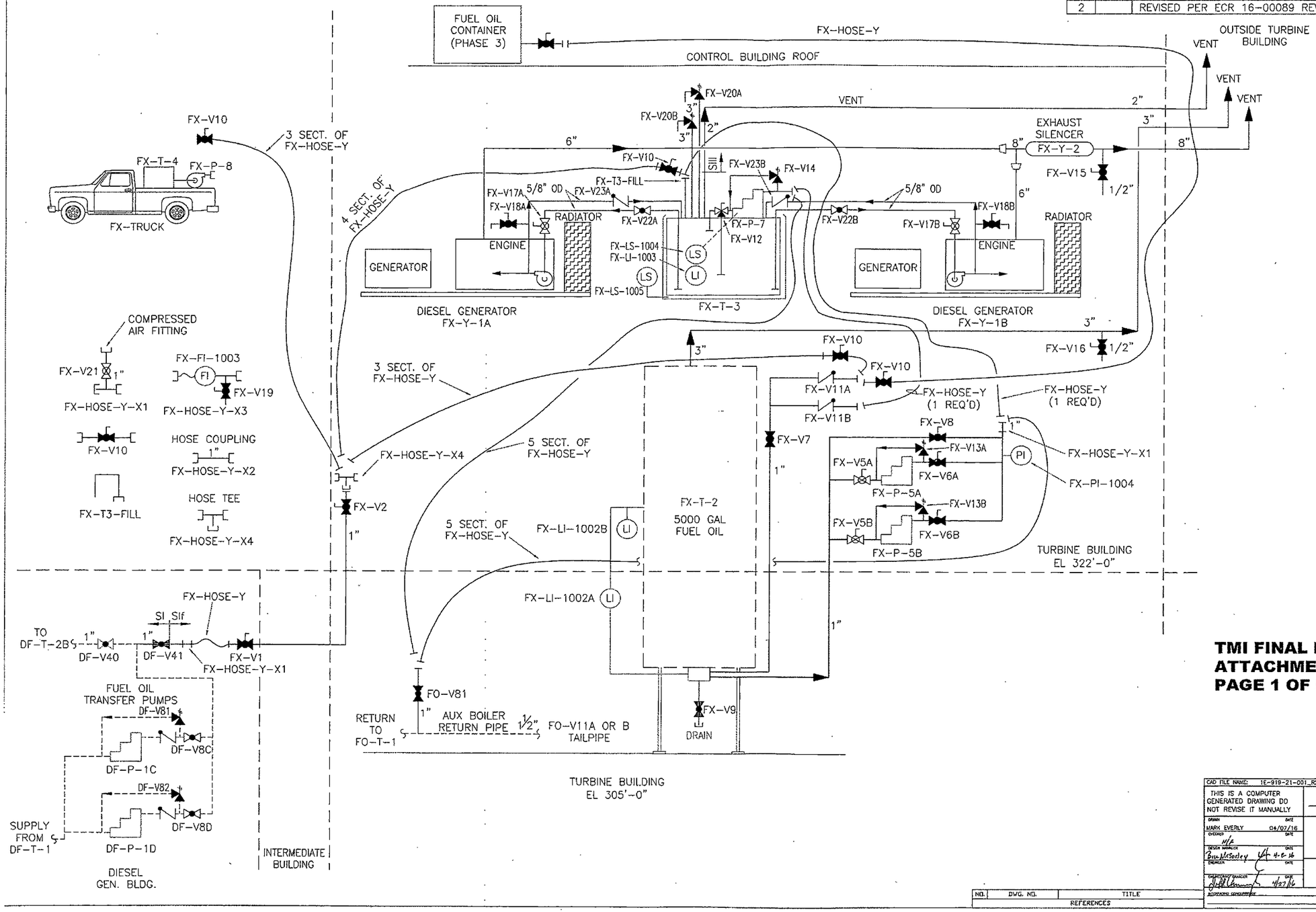


TMI FINAL INTEGRATED PLAN
ATTACHMENT 4
PAGE 1 OF 5

NO.	DWG. NO.	TITLE
REFERENCES		

CAD FILE NAME: 1E-919-21-001_R2.DWG

THIS IS A COMPUTER GENERATED DRAWING DO NOT REVISE IT MANUALLY

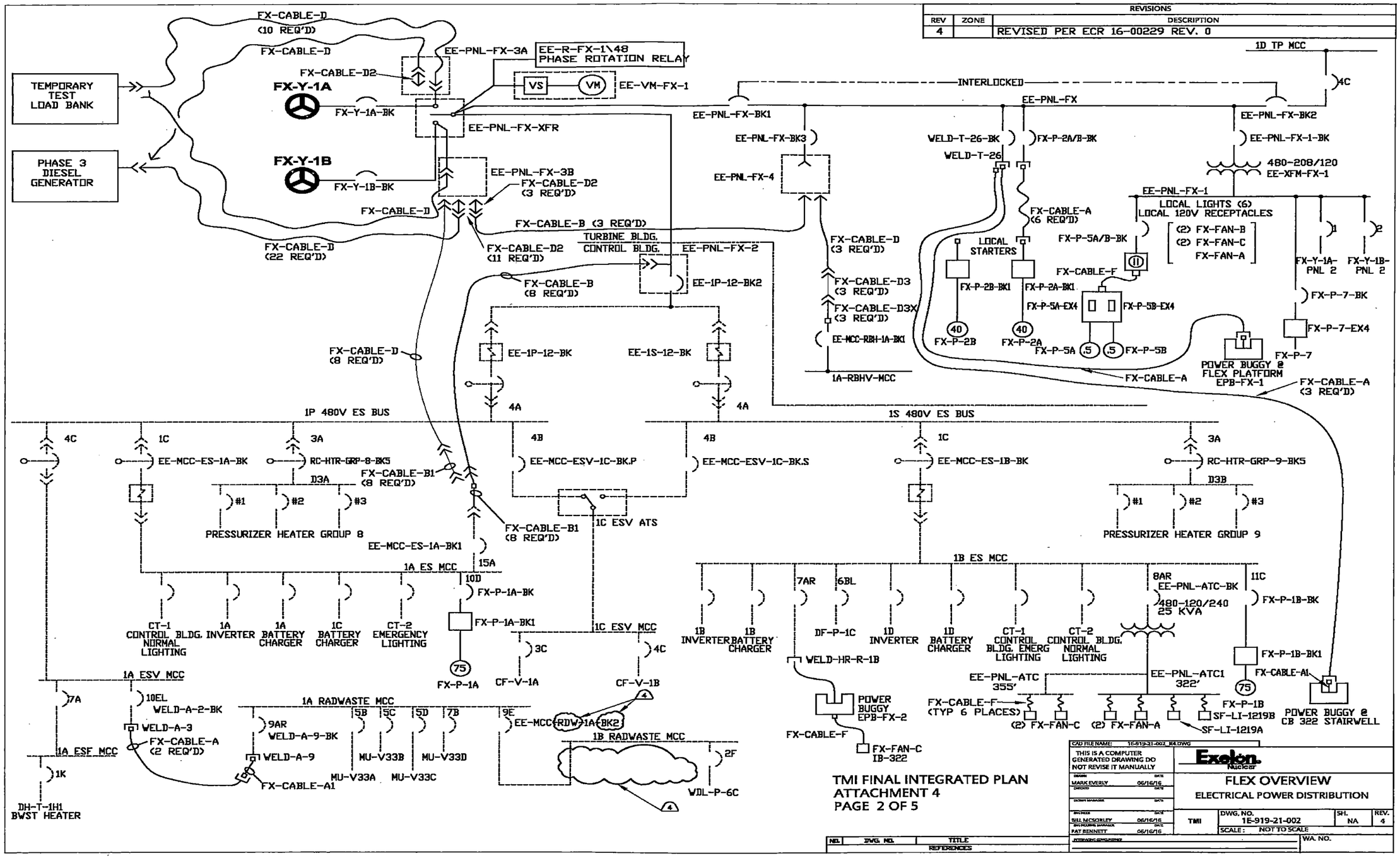
Exelon Nuclear

DRAWN	MARK EVERLY	04/07/16
CHECKED	n/a	
DESIGN MANAGER	Bruce Mosley	4-8-16
ENGINEER		
CERTIFICATION MANAGER		4/27/16

FLEX OVERVIEW
DIESEL GENERATOR & FUEL OIL

TMI | DWG. NO. 1E-919-21-001 | SH. NA | REV 2
SCALE : NOT TO SCALE
WA. NO.

REVISIONS		
REV	ZONE	DESCRIPTION
4		REVISED PER ECR 16-00229 REV. 0



REVISIONS		
REV	ZONE	DESCRIPTION
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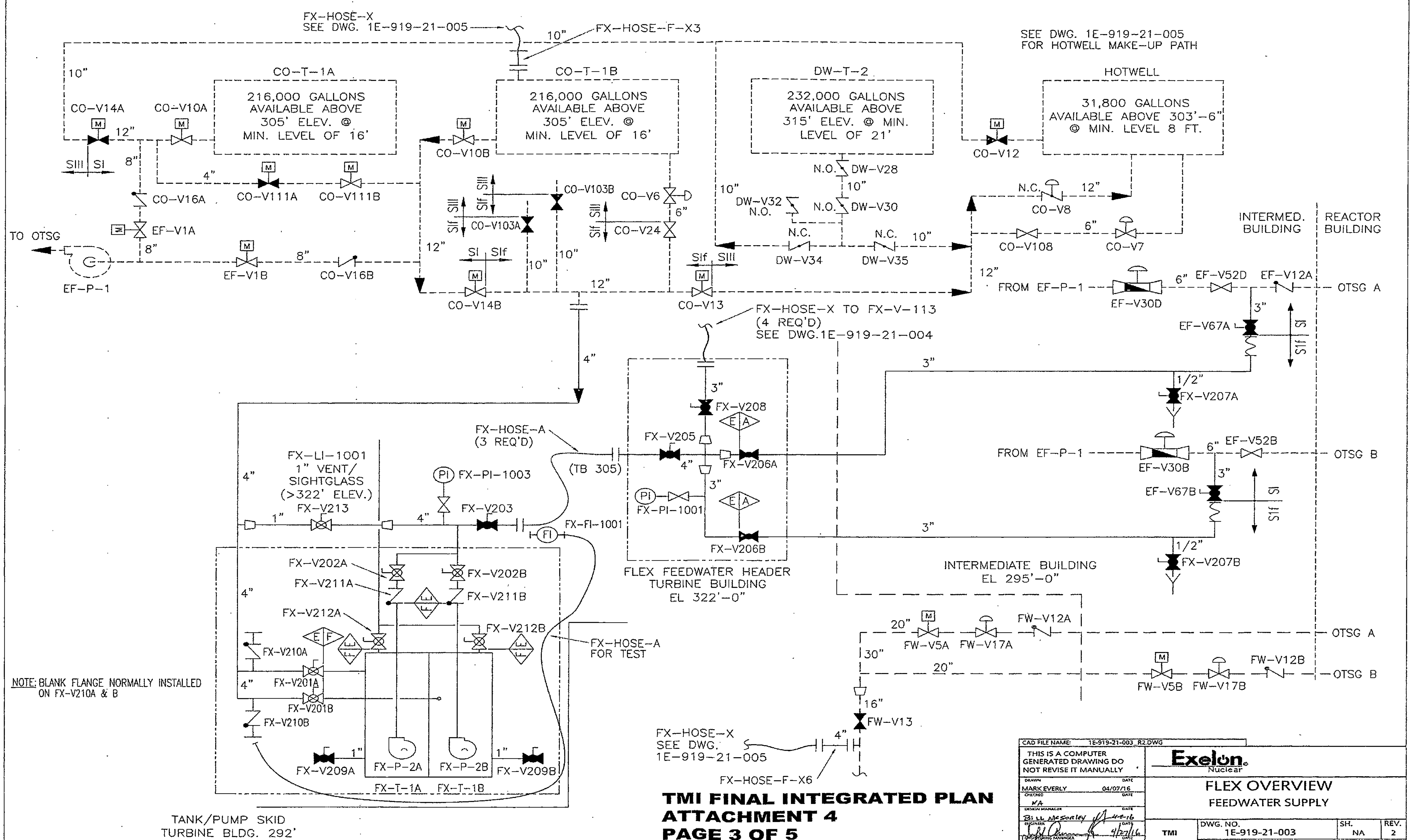

TMI FINAL INTEGRATED PLAN
ATTACHMENT 4
PAGE 3 OF 5

NO.	DWG. NO.	TITLE
REFERENCES		

CAD FILE NAME: 1E-919-21-003_R2.DWG

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Exelon Nuclear

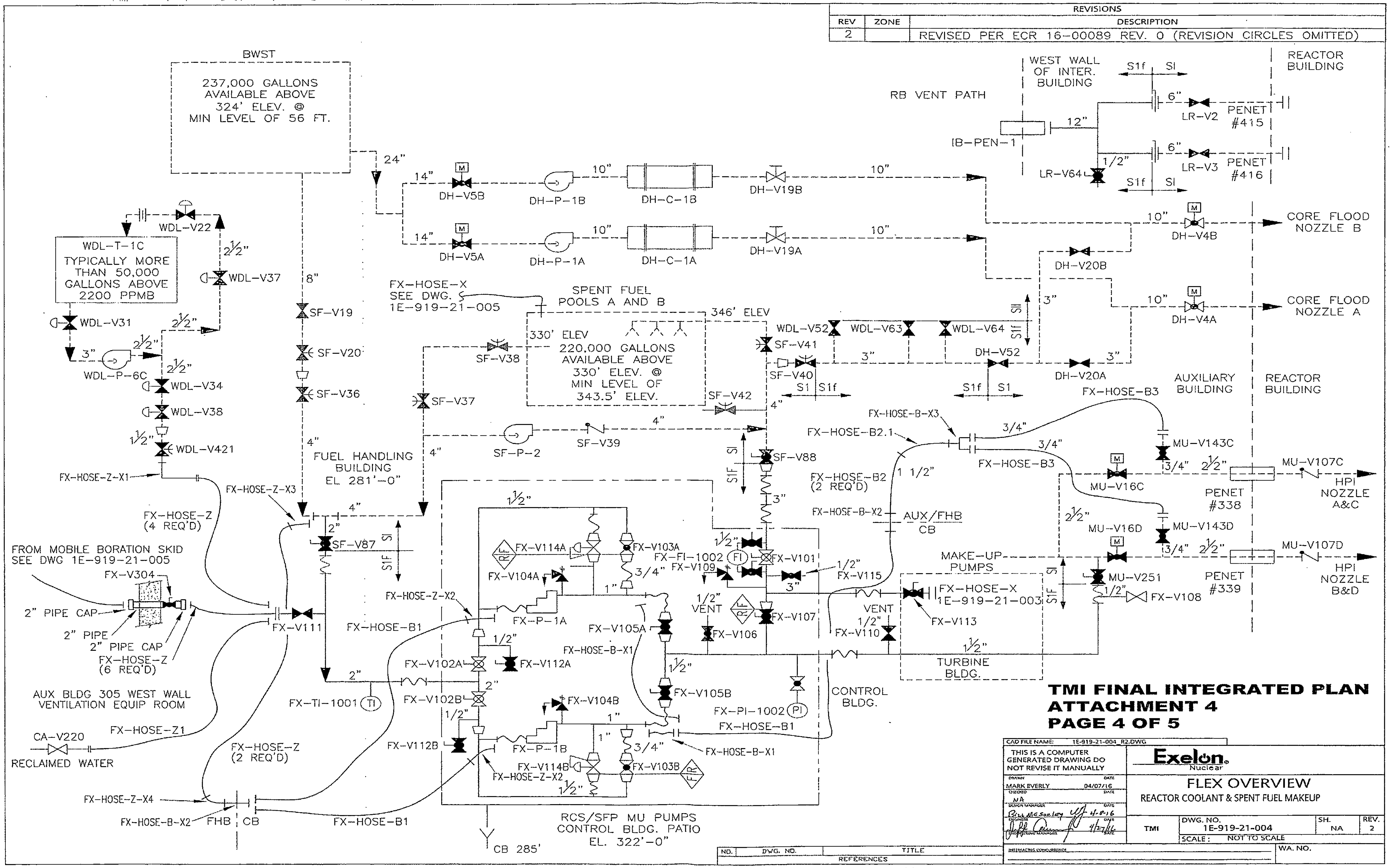
DRAWN: MARK EVERLY 04/07/16
CHECKED: KA
DESIGN MANAGER: BILL McSORLEY 4-8-16
4/27/16

FLEX OVERVIEW
FEEDWATER SUPPLY

TMI

DWG. NO.	SH.	REV.
1E-919-21-003	NA	2

SCALE: NOT TO SCALE
WA. NO.


REVISIONS
REV | ZONE | DESCRIPTION
2 | | REVISED PER ECR 16-00089 REV. 0 (REVISION CIRCLES OMITTED)
BWST
237,000 GALLONS AVAILABLE ABOVE 324' ELEV. @ MIN LEVEL OF 56 FT.
24"
14"
DH-V5B
DH-P-1B
DH-C-1B
DH-V19B
10"
14"
DH-V5A
DH-P-1A
DH-C-1A
DH-V19A
RB VENT PATH
WEST WALL OF INTER. BUILDING
IB-PEN-1
12"
S1f SI
6"
LR-V2
PENET #415
1/2"
LR-V3
PENET #416
LR-V64
REACTOR BUILDING
DH-V4B
CORE FLOOD NOZZLE B
DH-V20B
DH-V4A
CORE FLOOD NOZZLE A
WDL-V22
WDL-T-1C
TYPICALLY MORE THAN 50,000 GALLONS ABOVE 2200 PPMB
2½"
WDL-V37
WDL-V31
3"
WDL-P-6C
WDL-V34
WDL-V38
WDL-V421
FX-HOSE-Z-X1
8"
SF-V19
SF-V20
SF-V36
FX-HOSE-X SEE DWG. 1E-919-21-005
SPENT FUEL POOLS A AND B
346' ELEV
330' ELEV
220,000 GALLONS AVAILABLE ABOVE 330' ELEV. @ MIN LEVEL OF 343.5' ELEV.
SF-V38
SF-V37
SF-V42
WDL-V52
WDL-V63
WDL-V64
SF-V41
SF-V40
DH-V52
DH-V20A
S1 S1f
AUXILIARY BUILDING
REACTOR BUILDING
FX-HOSE-B3
FX-HOSE-B-X3
FX-HOSE-B2.1
3/4"
MU-V143C
SF-P-2
SF-V39
4"
SF-V88
FUEL HANDLING BUILDING EL 281'-0"
FX-HOSE-Z-X3
FX-HOSE-Z (4 REQ'D)
FX-HOSE-B2 (2 REQ'D)
1 1/2"
FX-HOSE-B-X2
AUX/FHB
CB
MU-V16C
MU-V107C
PENET #338
HPI NOZZLE A&C
MU-V16D
MU-V143D
MAKE-UP PUMPS
MU-V107D
MU-V251
FX-V108
PENET #339
HPI NOZZLE B&D
SF-V87
FROM MOBILE BORATION SKID SEE DWG 1E-919-21-005
FX-V304
2" PIPE CAP
2" PIPE
2" PIPE CAP
FX-HOSE-Z (6 REQ'D)
FX-V111
FX-HOSE-Z-X2
FX-HOSE-B1
FX-V114A
FX-V103A
FX-V104A
FX-P-1A
FX-FI-1002
FX-V109
FX-V101
FX-V115
FX-HOSE-X 1E-919-21-003
FX-V113
1/2" VENT
FX-V107
FX-V106
VENT 1/2"
FX-V110
FX-V105A
FX-HOSE-B-X1
FX-V102A
FX-V112A
TURBINE BLDG.
CONTROL BLDG.
AUX BLDG 305 WEST WALL VENTILATION EQUIP ROOM
FX-TI-1001
FX-V102B
FX-V105B
FX-V104B
FX-PI-1002
FX-HOSE-B1
CA-V220
FX-HOSE-Z1
RECLAIMED WATER
FX-HOSE-Z (2 REQ'D)
FX-V112B
FX-P-1B
FX-V114B
FX-HOSE-Z-X2
FX-V103B
FX-HOSE-B-X1
FX-HOSE-Z-X4
FX-HOSE-B-X2
FHB
CB
FX-HOSE-B1
CB 285'
RCS/SFP MU PUMPS CONTROL BLDG. PATIO EL. 322'-0"
TMI FINAL INTEGRATED PLAN
ATTACHMENT 4
PAGE 4 OF 5
CAD FILE NAME: 1E-919-21-004_R2.DWG
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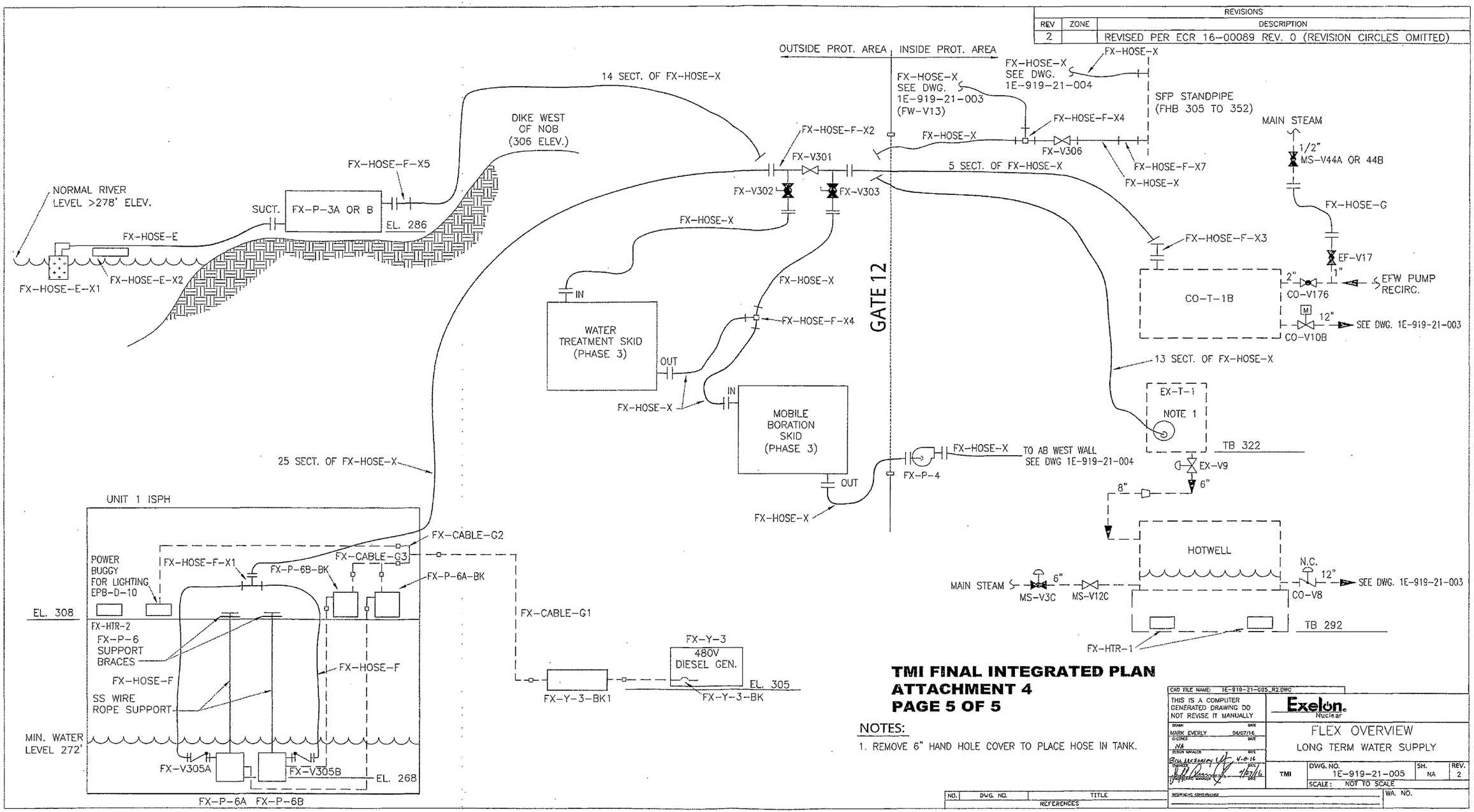
DRAWN MARK EVERLY 04/07/16
Exelon Nuclear
FLEX OVERVIEW
REACTOR COOLANT & SPENT FUEL MAKEUP
TMI
DWG. NO. 1E-919-21-004
SH. NA
REV. 2
SCALE: NOT TO SCALE
WA. NO.
NO. DWG. NO. TITLE
REFERENCES

REVISIONS		
REV	ZONE	DESCRIPTION
2		REVISED PER ECR 16-00089 REV. 0 (REVISION CIRCLES OMITTED)



TMI FINAL INTEGRATED PLAN
ATTACHMENT 4
PAGE 5 OF 5

NOTES:

1. REMOVE 6" HAND HOLE COVER TO PLACE HOSE IN TANK.

NO.	DWG. NO.	TITLE
		REFERENCES

CAD FILE NAME: 1E-919-21-005_R2.DWG

THIS IS A COMPUTER GENERATED DRAWING DO NOT REVISE IT MANUALLY

DESIGN	DATE
MARK EVERLY	04/07/16
CHECKED	DATE
NA	
DESIGN MANAGER	DATE
Bill McSeeley	4-8-16
OWNER	DATE
Mark Everly	4/7/16
MECHANICAL CONSULTANT	DATE

Exelon Nuclear

FLEX OVERVIEW
LONG TERM WATER SUPPLY

TMI	DWG. NO. 1E-919-21-005	SH. NA	REV. 2
	SCALE: NOT TO SCALE		

WA. NO.

Attachment 5A

MODE A Sequence of Events Timeline (Reference Section 4)

The "time" is the expected event or action completion time after the LOOP. The timeline is the expected sequence. Limiting performance times are identified in the "basis for ACTION" column. The contingencies in Section 4.11 are not included in this sequence of events. This sequence is a composite of each MODE "A" event sequence except for flood.

Time (hr.)	**Description of ACTION**	**TSA (Y/N)**	**Basis for ACTION**
Minus 0.5	If a tornado "warning" is issued, then CLOSE MS-V-36A,B,C & D	Y	Required prior to event to ensure OTSG pressure boundary integrity
0	Loss Of Offsite Power (LOOP).	N	Event assumed
0	All control rods are inserted and the reactor is shutdown.	N	Automatic plant response
0.01	Emergency Diesel Generators fail to energize ES buses.	N	Failure assumed per NEI 12-06
0.01	EFW is actuated: Steam driven pump (EF-P-1) and EFW Control valves (EF-V-30A & B) supply feedwater. MSSV & ADV control OTSG pressure.	N	Automatic plant response
0.05	RCS Letdown isolation valve (MU-V-3) is CLOSED.	N	Automatic plant response to high letdown temperature. Minimizes RCS inventory loss and establishes containment boundary.
0.08	Operator throttles MS-V-4A and MS-V-4B as needed to maximize RCS temperature without lifting MSSV	N	Minimize RCS cooldown and establish stable RCS natural circulation with heat removal through the OTSG.
0.08	Operator attempts to start and load SBO Diesel Generator.	N	Response to LOOP with failure of EDG

MODE A Sequence of Events Timeline (Reference Section 4)

Time (hr.)	Description of ACTION	TSA (Y/N)	Basis for ACTION
0.10	Operator closes RCP Controlled Bleed Off Isolation Valve (MU-V-26).	N	Ensure containment boundary is isolated.
0.10	Confirm containment valve closure on at least one valve following "Reactor Trip Isolation"	N	Ensure containment boundary is isolated.
0.20	SBO Diesel generator is not functional. START of ELAP	Y	TSA is to energize a 4160V Bus within 10 minutes after a SBO event. Failure assumed per NEI 12-06
0.25	E-plan initiated. Satellite phones are available for offsite notifications & communication.	N	
0.25	Operator throttles open the main condenser vacuum breaker (VA-V-8).	N	VA-V-8 is at least 10% open within 30 min. to support LO-P-6 shutdown at 60 minutes and ensure station battery function (Reference 7).
0.25	Operator secures DC powered FW pump turbine lube oil pumps (LO-P-9A & B).	Y	LO-P-9A & B are shutdown within 35 minutes to ensure station battery function (Reference 7).
0.35	Operator opens HG-V-G0003 (Main Generator H2 vent to atmosphere).	N	Vent is open within 60 minutes to support GN-P-2 shutdown at 120 minutes and ensure station battery function (Reference 7).
0.5	Operator opens doors to inverter and battery rooms.	N	Establish passive ventilation of inverter and battery rooms prior to energizing battery chargers (Reference 13).
0.5	If CO-T-1B is damaged (tornado missiles), then CLOSE CO-V-176	N	This is required to maximize the condensate supply (Reference 35).
0.75	Operator locally isolates the Turbine Gland steam supply from Main Steam (CLOSE MS-V-7 or GS-V-4)	Y	GS must be isolated within 90 minutes to prevent loss of RCS temperature control (Reference 59).

MODE A Sequence of Events Timeline (Reference Section 4)

Time (hr.)	Description of ACTION	TSA (Y/N)	Basis for ACTION
0.85	Operator transfers ICS AUTO power from ATA to ATB and strips unnecessary load from VBA (including ESAS CH 1)	Y	Required between 45 and 60 minutes to ensure station battery function (Reference 7).
0.9	If earthquake cause loss of FS integrity, then operators isolate affected buildings (CLOSE FS-V-43, FS-V-51 or FS-V-233).	N	Eliminates threat of any adverse impact of spray or flooding affecting FLEX strategy (Reference 71).
0.97	Control room operator secures Main Turbine Lube Oil Pump LO-P-6.	Y	Required within 60 minutes to ensure station battery function (Reference 7).
1.1	Operator shuts down 1C Inverter and de-energizes VBC	Y	Required within 75 minutes to ensure station battery function (Reference 7).
1.1	After generator H2 pressure is < 2 psig, operator lines up CO2 tank to main generator (without vaporizer) and closes HG-V-G0003.	N	CO2 is lined up and the atmospheric vent closed to minimize the possibility of an explosive hydrogen concentration in the generator (Reference 125).
1.5	Operator lines up FLEX Diesel Generator.	N	This action is required to initiate RCS makeup within 4 hours.
1.75	Operator strips all unnecessary loads on ATB (NOTE 1).	Y	Required within 120 minutes to ensure station battery function (Reference 7).
1.97	Control room operator secures Main Generator Seal Oil Pump (GN-P-2) (NOTE 1)	Y	Operation up to 2 hours is desired, but DC motor must be shut down within 2 hours to ensure station battery function (Reference 7).
2.0	Operator props open doors for initial intermediate building ventilation.	N	Ventilation is established to improve conditions for local control of EFW & ADVs is required (Reference 13).
2.0	Operator lines up FLEX RCS Makeup Pump from BWST or Spent Fuel Pool to RCS.	N	This action is required to initiate RCS makeup within 4 hours.

MODE A Sequence of Events Timeline (Reference Section 4)

Time (hr.)	Description of ACTION	TSA (Y/N)	Basis for ACTION
2.0	Operator takes local control of MS-V-6 (EF-P-1 steam supply), EF-V-30A & EF-V-30B (EFW Flow Control Valves) and MS-V-4A & MS-V-4B (Atmospheric Dump Valves).	Y	Local control is established within 3 hours i.e. before the 2HR air system pressure is less than 60 psig.
2.25	Operator strips loads from 1P & 1S 480V Buses, and 1A & 1B ES MCC to prepare to load FLEX diesel generator.	N	This action is required to initiate RCS makeup within 4 hours.
2.5	Operator starts FLEX Diesel Generator, energizes FLEX MCC and closes breakers to energize 1P-1S 480V cross tie bus.	N	This action is required to initiate RCS makeup within 4 hours.
2.5	Operator with security support opens service bldg. and turbine bldg. machine shop roll up doors, aux boiler roll up door and doors in IB.	N	Provide outside air to FX-Y-1A or FX-Y-1B, EFW area, and Control Bldg. (Reference 13).
2.58	Operator closes breakers to energize 1P 480V Bus, 1S 480V Bus, 1A ES MCC and 1B ES MCC.	N	This action is required to initiate RCS makeup within 4 hours.
2.75	Operator closes breakers for selected loads on 1A and 1B ES MCC: ➢ Battery Chargers & Inverters for vital Instruments ➢ FLEX RCS Makeup Pumps ➢ Emergency Lighting	N	This action is required to initiate RCS makeup within 4 hours.
3.0	If battery chargers are not energized, then VBB Load Shed including ESAS CH 2 (NOTE 1).	N	Required within 240 minutes to ensure station battery function (Reference 7).

MODE A Sequence of Events Timeline (Reference Section 4)

Time (hr.)	Description of ACTION	TSA (Y/N)	Basis for ACTION
3.0	Operator starts FLEX RCS Makeup Pump (A or B) to restore RCS inventory and increase RCS boron concentration.	Y	This action is required within 4 hours (Reference 10 and 73).
3.2	If earthquake cause loss of integrity of the hotwell or associated piping, then operator locally closes CO-V-13 & CO-V-24	N	Minimizes the loss of inventory from CO-T-1B (Reference 35).
4.0	Operator connects hose from DF-V-41 to FX-V-1, connects hose from FX-V-2 to Fuel Oil Tank (FX-T-3), and routes hose from FX-P-7 to FX-T-2.	N N	The flow path to FX-T-3 is required to support fuel oil transfer within 3 hours after FX-Y-1A or B is started. The flow path to FX-T-2 is required before transferring fuel to FX-T-3.
4.0	Operator strips loads on 1A ESV MCC & 1A Radwaste MCC and installs jumper between 1A ESV MCC and 1A Radwaste MCC.	N	Required to support CBO isolation within six hours.
4.0	Operator starts DF-P-1C or DF-P-1D to maintain level in FX-T-3.	Y	Fuel oil makeup to FX-T-3 is required within 3 hours after FX-Y-1A or B is started (Reference 21).
4.0	When pressurizer level reaches 100 inches, operator throttles open MS-V-4A & B to initiate a cooldown to control pressurizer level at 100 inches.	N	Action maximizes cooldown rate. This minimizes the challenge to RCP seals and maximizes the rate of borated water injection (Reference 66).
4.5	Operator energizes1A ESV MCC and 1A Radwaste MCC, and Closes CBO Isolation Valves MU-V-33A, MU-V-33B, MU-V-33C and MU-V-33D.	N	Required within 6 hours (except after earthquake) to reduce RCS inventory loss (Reference 39 and 10)
4.5	Operator sets up and starts portable ventilation for CB 2nd & 3rd floors (including battery rooms) and for the control room.	N	This action is required to minimize the hydrogen concentration in the battery rooms, and fresh air & cooling throughout the CB (Reference 13).

MODE A Sequence of Events Timeline (Reference Section 4)

Time (hr.)	Description of ACTION	TSA (Y/N)	Basis for ACTION
5.5	If ambient temperature is below 40°F, then drain DW-T-2 & CO-T-1A into the hotwell, and crack open MS-V-3C as needed to maintain hotwell temperature above 40°F.	N	Required to prevent condensate supply from freezing (Reference 35).
5.6	If ambient temperature is less than 40°F, then energize BWST immersion heater as needed to maintain BWST temperature above 40°F.	N	Reference 39
6.0	Operator sets up and starts portable fans for TB and IB ventilation.	N	This action is required to optimize the environment for personnel and FLEX equipment (Reference 13).
6.0	Operator transfers Group 8 or 9 pressurizer heaters to the emergency power supply and energize heaters.	N	Maintain or restore a pressurizer steam bubble for RCS pressure control.
6.5	If the rate of RCS pressure reduction is not adequate, then control room operator opens RC-V-28 and RC-V-44 to maintain SCM < 250°F.	N	This contingency ensures RCS temperature can be reduced as planned and maximize the reliability of the RCP seals.
7.0	Operator strips loads on 1C ESV MCC, energizes 1C ESV MCC, and closes breakers for CF-V-1A and CF-V-1B.	N	Required to support action to close MSIV & CFT Isolation Valves
7.5	Control Room Operator closes MS-V-1A, MS-V-1B, MS-V-1C and MS-V-1D.	N	Minimizes the OTSG pressure boundary and optimizes control of OTSG pressure.
7.7	When a reliable Pressurizer steam bubble is established, then operator closes CF-V-1A & CF-V-1B.	N	Isolating CF eliminates the potential to inject N2 into RCS and block primary to secondary heat transfer

MODE A Sequence of Events Timeline (Reference Section 4)

Time (hr.)	Description of ACTION	TSA (Y/N)	Basis for ACTION
8.0	Operator connects hose from FX-P-2A & B pump discharge to FLEX feedwater header, connects power cable to FX-P-2A or B starter, and opens FX-V-203, FX-V-205, EF-V-67A and EF-V-67B.	N	This action supports backup FW capability and Spent Fuel pool makeup capability
10.0	OTSG Pressure is now less than 200 psig. Backup feedwater capability is enabled. If backup feedwater is required, operator starts FX-P-2A or B and throttles opens FX-V-206A and FX-V-206B to control OTSG level.	N	FX-P-2A or B can provide sufficient feedwater to OTSG at 200 psig to match core decay heat at 10 hours after reactor shutdown (Reference 23 and 15).
10.5	RCS cooldown is complete. • OTSG A & B Pressure 150 psig • Incore temperature 400F • RCS Pressure 400 psig Operator begins raising pressurizer level to > 300 inches.	N	T_{COLD} is reduced to less than 375°F within 12 hours to ensure the reliability of the Reactor Coolant Pump seals (Reference 48 – Response to ISE item 3.2.1.1.B)
10.7	If ambient temperature is less than 40°F, then add steam as needed to maintain CO-T-1B temperature above 40°F.	N	Reference 35
11	Transfer portable diesel-driven pump (FX-P-3A or FX-P-3B) from FLEX storage facility (FSF) to road next to the river, route suction hose into river, and route discharge hose to CO-T-1B or hotwell.	N	Establish the capability to resupply condensate (Reference 35).

MODE A Sequence of Events Timeline (Reference Section 4)

Time (hr.)	Description of ACTION	TSA (Y/N)	Basis for ACTION
12	If BWST is not available, then operator connects hose, uses temporary air bottle to open valves, and lines up WDL-P-6C (from RCBT "C") to FX-V-111 (FX-P-1A/B suction)	N	The RCBT borated water source provides defense in depth until offsite equipment is available to provide borated water (Reference 39).
12.5	If BWST is available, then Pressurizer level is stabilized between 300 and 320 inches.	N	Additional pressurizer level provides margin if RCS makeup capability is interrupted (Reference 39).
13.5	If BWST is not available, the Pressurizer level is stabilized between 360 and 380 inches.	N	Additional pressurizer level is required to provide time for NSRC borated water supply to be established after SFP is no longer available (Reference 39).
15.0	Operator creates spent fuel pool vent path (by opening doors from U2 fuel pool area to U2 FHB roof).	N	This action is required to prevent pressurizing the FHB when SFP boils.
18.0	Operator opens SF-V-88 and SF-V-41, connects hose FX-V-208 to FX-V-113, and opens FX-V-113.	N	Spent fuel pool does not reach boiling until more than 36 hours after the LOOP
20.0	If river level is inadequate or inaccessible to use FX-P-3A or B, then FX-P-6 is configured to supply CO-T-1B (using FX-Y-3 for power).	N	Establish the capability to resupply condensate (Reference 35).
22.0	If ambient temperature is less than 40°F and FX-P-6 is required, then set up portable propane heaters to maintain ISPH temperature above 40°F.	N	

MODE A Sequence of Events Timeline (Reference Section 4)

Time (hr.)	Description of ACTION	TSA (Y/N)	Basis for ACTION
>24.0	NSRC resources begin arriving on site. NSRC equipment will be used to maintain a reliable condensate supply and to address longer term needs for fuel oil or borated water.	N	If the BWST is not available, water treatment equipment and equipment for mixing borated water to supply FX-P-1A/B is a priority (Reference 39).
>24	Operator monitors Spent Fuel pool level, throttles open FX-V-208 and FX-V-101 as needed to maintain SFP level.	N	Spent fuel pool does not reach boiling until more than 36 hours after the LOOP.

NOTE 1: Action is NOT required if battery chargers have been energized.

Three Mile Island Unit 1 - Final Integrated Plan

Attachment 5B

MODE B Sequence of Events Timeline (Reference Section 6)

The plant initial condition is MODE "B". The DH system is in service AND the RCS Filled (RCS Pressure > 20 psig). The "time" is the event or completion time for an action, after the LOOP. This time shows an expected sequence. Limiting performance times are identified in the "basis for ACTION". This sequence is a subset (not including spent fuel pool cooling or containment which are the same as MODE "A") of the actions of each event sequence except for flood. The flood event preparations are described in Section 4.6.

Time (hr.)	**MODE "B" SOE** **Description of ACTION**	**TSA (Y/N)**	**Basis for ACTION**
0	Loss Of Offsite Power (LOOP).	N	Event assumed
< .01	Emergency Diesel Generators fail to energize ES buses.	N	Failure assumed
< .02	EOP-030 initiated.	N	
< 0.08	Operator attempts to start and load SBO Diesel Generator.	N	Response to LOOP with failure of EDG
< 0.17	Ensure MS-V-4A and MS-V-4B are OPEN	N	
< 0.17	SBO Diesel generator is not functional. START of ELAP	N	Failure assumed
0.25	E-plan initiated. Satellite phones are available for offsite notifications & communication.	N	
0.5	Operator opens doors to inverter and battery rooms.	N	

MODE B Sequence of Events Timeline (Reference Section 6)

Time (hr.)	MODE "B" SOE Description of ACTION	TSA (Y/N)	Basis for ACTION
0.9	If earthquake cause loss of FS integrity, then operators isolate affected buildings (CLOSE FS-V-43, FS-V-51 or FS-V-233).	N	Eliminates threat of any adverse impact of spray or flooding affecting FLEX strategy (Reference 71).
1.0	Operator lines up FLEX Diesel Generator.	Y	This action is required to restore feedwater within 160 minutes.
1.0	Operator closes DH-V-12A and DH-V-12B	N	This action maintains the RCS pressure boundary
1.25	Operator strips loads from 1P & 1S 480V Buses, and 1A & 1B ES MCC to prepare to load FLEX diesel generator.	N	This action is required within 2 hours to ensure feedwater can be maintained.
1.5	Operator starts FLEX Diesel Generator, energizes FLEX MCC and closes breakers to energize 1P-1S 480V cross tie bus.	N	This action is required within 2 hours to ensure feedwater can be maintained.
1.75	Operator connects hose from FX-P-2A & B pump discharge to FLEX feedwater header, connects power cable to FX-P-2A or B starter, opens FX-V-203, FX-V-205, EF-V-67A, and EF-V-67B.	N	This action is required to feed OTSG.
1.75	If earthquake cause loss of hotwell integrity or associated piping, then operator closes CO-V-13 & CO-V-24	N	Minimizes the loss of inventory from CO-T-1B
1.9	Operator closes breakers to energize 1P 480V Bus, 1S 480V Bus, 1A ES MCC and 1B ES MCC.	N	This action is required within 6 hours to ensure station battery function.

MODE B Sequence of Events Timeline (Reference Section 6)

Time (hr.)	MODE "B" SOE Description of ACTION	TSA (Y/N)	Basis for ACTION
2.0	Operator closes breakers for selected loads on 1A and 1B ES MCC: • Battery Chargers & Inverters (Vital Instruments) • Emergency Lighting	N	This action is required within 6 hours to ensure station battery function.
2.0	Operator starts FX-P-2A (or B) and throttles open FX-V-206A and FX-V-206B to maintain OTSG Level above 75% operating range.	Y	OTSG feedwater must be restored with 160 minutes to ensure natural circulation is not interrupted.
2.1	If outside ambient is below 40°F, then drain available condensate (DW-T-2, CO-T-1A, CO-T-1B) to the hotwell.	N	
2.25	If earthquake cause loss of hotwell integrity or associated piping, then operator closes CO-V-13 & CO-V-24	N	Minimizes the loss of inventory from CO-T-1B
2.5	Transfer Grp 8 or 9 heaters to the emergency power supply and emergency pressurizer heaters	N	A pressurizer steam bubble is required to maintain RCS SCM
2.5	If ambient temperature is below 40°F, then drain DW-T-2 & CO-T-1A into the hotwell, and open MS-V-3C as needed to maintain hotwell temperature above 40°F.	N	
2.75	Operator lines up FLEX RCS Makeup Pump from BWST or Spent Fuel Pool to RCS.	N	
3.0	Operator shuts down 1C Inverter and de-energizes VBC (NOTE 1)	N	Required within 180 minutes to ensure station battery function

MODE B Sequence of Events Timeline (Reference Section 6)

Time (hr.)	MODE "B" SOE Description of ACTION	TSA (Y/N)	Basis for ACTION
3.0	Operator connects hose from DF-V-41 to FX-V-1, connects hose at FX-V-2, routes hose to Fuel Oil Tank (FX-T-3), and routes hose from FX-P-7 to FX-T-2.	Y N	The flow path to FX-T-3 is required for fuel oil transfer to FX-T-3 within 3 hours after FX-Y-1A or B is started. The flow path to FX-T-2 is required before transferring fuel to FX-T-3.
3.0	Operator opens service bldg. and turbine bldg. machine shop roll up doors and aux boiler roll up door.	N	Provide ventilation for FX-Y-1A or FX-Y-1B
3.25	Operator starts DF-P-1C or DF-P-1D, as needed, to maintain level in FX-T-3.	Y	Fuel oil makeup to FX-T-3 is required within 3 hours after FX-Y-1A or B is started.
3.5	Start FX-P-1A or B as needed to maintain pressurizer level between 200 and 220 inches	N	
3.5	Operator sets up and starts portable ventilation for CB 322 & 338 elevations and the control room	N	This action is required to minimize the hydrogen concentration in the battery rooms.
4.0	Operator sets up and starts additional temporary ventilation in Turbine Bldg.	N	This action is required to optimize conditions for personnel and FLEX equipment.
6.0	Operator strips loads on 1A ESV MCC & 1A Radwaste MCC and installs jumper between 1A ESV MCC and 1A Radwaste MCC.	N	
6.5	Operator energizes1A ESV MCC and 1A Radwaste MCC, and ensures all CBO Isolation Valves (MU-V-33A/D) are CLOSED.	N	Minimize RCS loss rate.

MODE B Sequence of Events Timeline (Reference Section 6)

Time (hr.)	MODE "B" SOE Description of ACTION	TSA (Y/N)	Basis for ACTION
7.0	Transfer portable diesel-driven pump (FX-P-3A or FX-P-3B) from FLEX storage facility (FSF) to road next to the river, route suction hose into river, and route discharge hose to CO-T-1B or hotwell.	N	
8.0	If ambient temperature is less than 40°F, then energize BWST immersion heater as needed to maintain BWST temperature above 40°F.	N	
9.0	If river level is inadequate or inaccessible to use FX-P-3A or B, then FX-P-6 is configured to supply CO-T-1B (using FX-Y-3 for power).	N	
9.5	If ambient temperature is less than 40°F and FX-P-6 is required, then set up portable propane to maintain ISPH temperature above 40°F.	N	
>24.0	NSRC resources begin arriving on site. NSRC equipment will be used to maintain a reliable condensate supply and to address longer term needs for fuel oil.	N	

NOTES
(1) This action is NOT required if the station battery chargers have been energized

Attach 5C-1 "Boiler Condenser Cooling" (Reference Section 7.1)
MODE "C" Sequence of Events Timeline

The plant initial condition is MODE "C" during initial RCS draining. RCS NOT Filled (RCS Pressure < 20 psig) AND RCS vent area is less than the minimum. The "time" is the event or completion time for an action, after the LOOP. This time shows an expected sequence. Limiting performance times are identified in the "basis for ACTION". This sequence is a subset (not including spent fuel pool cooling or containment (which are the same as MODE "D")) of the actions of each event sequence except for flood. The flood event preparations are described in Section 5.6.

Time (hr.)	**MODE "C" SOE (BCC)** **Description of ACTION**	**TSA (Y/N)**	**Basis for ACTION**
0	Loss Of Offsite Power (LOOP).	N	Event assumed
< .01	Emergency Diesel Generators fail to energize ES buses.	N	Failure assumed
< .02	EOP-030 initiated.	N	
< 0.08	Operator attempts to start and load SBO Diesel Generator.	N	Response to LOOP with failure of EDG
0.15	Operator opens both atmospheric dump valves (MS-V-4A & B)	N	
< 0.17	SBO Diesel generator is not functional. START of ELAP	N	Failure assumed
0.25	E-plan initiated. Satellite phones are available for offsite notifications & communication.	N	
0.40	Open DH-V-5A (or B)	N	Maximize RCS water level to provide the maximum time to establish feedwater

Time (hr.)	MODE "C" SOE (BCC) Description of ACTION	TSA (Y/N)	Basis for ACTION
0.5	Open RC-V-40A and RC-V-41A Open RC-V-40B and RC-V-41B	N	Remove non-condensable gases from RCS
0.5	Operator opens doors to inverter and battery rooms.	N	
0.75	Operator lines up FLEX RCS Makeup Pump from BWST or Spent Fuel Pool to RCS.	N	
0.9	If earthquake cause loss of FS integrity, then operators isolate affected buildings (CLOSE FS-V-43, FS-V-51 or FS-V-233).	N	Eliminates threat of any adverse impact of spray or flooding affecting FLEX strategy (Reference 71).
1.0	Operator lines up FLEX Diesel Generator.	Y	This action is required to restore feedwater and RCS makeup within 150 minutes.
1.2	Operator strips loads from 1P & 1S 480V Buses, and 1A & 1B ES MCC to prepare to load FLEX diesel generator.	N	This action is required to restore feedwater and RCS makeup within 150 minutes.
1.25	Operator connects hose from FX-P-2A & B pump discharge to FLEX feedwater header, connects power cable to FX-P-2A or B starter, opens FX-V-203, FX-V-205, EF-V-67A, and EF-V-67B.	N	This action is required to restore feedwater within 150 minutes.
1.3	Operator starts FLEX Diesel Generator, energizes FLEX MCC and closes breakers to energize 1P-1S 480V cross tie bus.	N	This action is required to restore feedwater and RCS makeup within 150 minutes.
1.4	Operator closes breakers to energize 1P 480V Bus, 1S 480V Bus, 1A ES MCC and 1B ES MCC.	N	This action is required to restore feedwater and RCS makeup within 150 minutes.

Time (hr.)	MODE "C" SOE (BCC) Description of ACTION	TSA (Y/N)	Basis for ACTION
1.5	Operator closes breakers for selected loads on 1A and 1B ES MCC: • FLEX RCS Makeup Pumps • Battery Chargers & Inverters (Vital Instruments) • Emergency Lighting	N	This action is required within 6 hours to ensure station battery function.
1.6	Operator initiates RCS makeup using FX-P-1A or B. RCS makeup flow is throttled to maintain pressurizer level between 200 and 220".	Y	RCS makeup is restored within 150 minutes to ensure RCS inventory remains sufficient for core cooling.
1.7	Operator connects hose from DF-V-41 to FX-V-1, connects hose at FX-V-2, routes hose to Fuel Oil Tank (FX-T-3), and routes hose from FX-P-7 to FX-T-2.	N N	The flow path to FX-T-3 is required for fuel oil transfer to FX-T-3 within 3 hours after FX-Y-1A or B is started. The flow path to FX-T-2 is required before transferring fuel to FX-T-3.
1.75	Operator closes DH-V-12A and DH-V-12B	N	This action maintains the RCS pressure boundary
1.75	If earthquake cause loss of hotwell integrity or associated piping, then operator closes CO-V-13 & CO-V-24	N	Minimizes the loss of inventory from CO-T-1B
2.0	Operator starts FX-P-2A (or B) and throttles open FX-V-206A and FX-V-206B to maintain OTSG Level above 75% operating range.	Y	OTSG feedwater must be restored with 150 minutes to ensure natural circulation is not interrupted.
2.0	Operator starts DF-P-1C or DF-P-1D, as needed, to maintain level in FX-T-3.	Y	Fuel oil makeup to FX-T-3 is required within 3 hours after FX-Y-1A or B is started.
2.1	If outside ambient is below 40°F, then drain available condensate (DW-T-2, CO-T-1A, CO-T-1B) to the hotwell.	N	

Time (hr.)	MODE "C" SOE (BCC) Description of ACTION	TSA (Y/N)	Basis for ACTION
2.1	Operator opens service bldg. and turbine bldg. machine shop roll up doors and aux boiler roll up door.	N	Provide ventilation for FX-Y-1A or FX-Y-1B
3.0	Operator sets up and starts portable ventilation for Control Building 322 & 338 elevations, and the control room.	N	This action is required to minimize the hydrogen concentration in the battery rooms.
4.0	Operator sets up and starts additional temporary ventilation in Turbine Bldg.	N	This action is required to optimize conditions for personnel and FLEX equipment.
7.0	Transfer portable diesel-driven pump (FX-P-3A or FX-P-3B) from FLEX storage facility (FSF) to road next to the river, route suction hose into river, and route discharge hose to CO-T-1B or hotwell.	N	
8.0	If ambient temperature is less than 40°F, then energize BWST immersion heater as needed to maintain BWST temperature above 40°F.	N	
9.0	If river level is inadequate or inaccessible to use FX-P-3A or B, then FX-P-6 is configured to supply CO-T-1B (using FX-Y-3 for power).	N	
9.5	If ambient temperature is less than 40°F and FX-P-6 is required, then set up portable propane to maintain ISPH temperature above 40°F.	N	
>24.0	NSRC resources begin arriving on site. NSRC equipment will be used to maintain a reliable condensate supply and to address longer term needs for fuel oil.	N	

Attach 5C-2 "FLEX PORV Cooling" (Reference Section 7.2)
MODE "C" Sequence of Events Timeline

The plant initial condition is MODE "C" during preparation for filling the RCS. RCS NOT Filled (RCS Pressure < 20 psig) AND RCS vent area is less than the minimum. The "time" is the event or completion time for an action, after the LOOP. This time shows an expected sequence. Limiting performance times are identified in the "basis for ACTION". This sequence is a subset (not including spent fuel pool cooling or containment (which are the same as MODE "D")) of the actions of each event sequence except for flood. The flood event preparations are described in Section 5.6.

Time (hr.)	**MODE "C" SOE (FLEX PORV COOLING)** **Description of ACTION**	**TSA (Y/N)**	**Basis for ACTION**
0	Loss Of Offsite Power (LOOP).	N	Event assumed
< .01	Emergency Diesel Generators fail to energize ES buses.	N	Failure assumed
< .02	EOP-030 initiated.	N	
< 0.08	Operator attempts to start and load SBO Diesel Generator.	N	Response to LOOP with failure of EDG
< 0.17	SBO Diesel generator is not functional. START of ELAP	N	Failure assumed
0.25	E-plan initiated. Satellite phones are available for offsite notifications & communication.	N	
0.40	Open DH-V-5A (or B)	N	Maximize RCS water level
0.5	Operator opens doors to inverter and battery rooms.	N	

Time (hr.)	MODE "C" SOE (FLEX PORV COOLING) Description of ACTION	TSA (Y/N)	Basis for ACTION
0.75	Operator lines up FLEX RCS Makeup Pump from BWST or Spent Fuel Pool to RCS.	N	
0.9	If earthquake cause loss of FS integrity, then operators isolate affected buildings (CLOSE FS-V-43, FS-V-51 or FS-V-233).	N	Eliminates threat of any adverse impact of spray or flooding affecting FLEX strategy (Reference 71).
1.0	Operator lines up FLEX Diesel Generator.	N	This action is required to restore feedwater and RCS makeup within 150 minutes.
1.2	Operator strips loads from 1P & 1S 480V Buses, and 1A & 1B ES MCC to prepare to load FLEX diesel generator.	N	This action is required to restore feedwater and RCS makeup within 150 minutes.
1.3	Operator starts FLEX Diesel Generator, energizes FLEX MCC and closes breakers to energize 1P-1S 480V cross tie bus.	N	This action is required to restore feedwater and RCS makeup within 150 minutes.
1.4	Operator closes breakers to energize 1P 480V Bus, 1S 480V Bus, 1A ES MCC and 1B ES MCC.	N	This action is required to restore feedwater and RCS makeup within 150 minutes.
1.5	Operator closes breakers for selected loads on 1A and 1B ES MCC: • FLEX RCS Makeup Pumps • Battery Chargers & Inverters (Vital Instruments) • Emergency Lighting	N	This action is required within 6 hours to ensure station battery function.
1.6	Operator initiates RCS makeup using FX-P-1A or B (flow is NOT throttled).	Y	RCS makeup is restored within 150 minutes to maximize the lowest RCS water level.
1.61	OPEN PORV (RC-RV-2)	N	The PORV is opened to remove core decay heat.

Time (hr.)	MODE "C" SOE (FLEX PORV COOLING) Description of ACTION	TSA (Y/N)	Basis for ACTION
1.7	Operator connects hose from DF-V-41 to FX-V-1, connects hose at FX-V-2, routes hose to Fuel Oil Tank (FX-T-3), and routes hose from FX-P-7 to FX-T-2.	N N	The flow path to FX-T-3 is required for fuel oil transfer to FX-T-3 within 3 hours after FX-Y-1A or B is started. The flow path to FX-T-2 is required before transferring fuel to FX-T-3.
1.75	Operator closes DH-V-12A and DH-V-12B	N	This action maintains the RCS pressure boundary
1.75	If earthquake cause loss of hotwell integrity or associated piping, then operator closes CO-V-13 & CO-V-24	N	Minimizes the loss of inventory from CO-T-1B
2.0	Operator starts DF-P-1C or DF-P-1D, as needed, to maintain level in FX-T-3.	Y	Fuel oil makeup to FX-T-3 is required within 3 hours after FX-Y-1A or B is started.
2.1	If outside ambient is below 40°F, then drain available condensate (DW-T-2, CO-T-1A, CO-T-1B) to the hotwell.	N	
2.1	Operator opens service bldg. and turbine bldg. machine shop roll up doors and aux boiler roll up door.	N	Provide ventilation for FX-Y-1A or FX-Y-1B
3.0	Operator sets up and starts portable ventilation for Control Building 322 & 338 elevations, and the control room.	N	This action is required to minimize the hydrogen concentration in the battery rooms.
4.0	Operator sets up and starts additional temporary ventilation in Turbine Bldg.	N	This action is required to optimize conditions for personnel and FLEX equipment.
7.0	Transfer portable diesel-driven pump (FX-P-3A or FX-P-3B) from FLEX storage facility (FSF) to road next to the river, route suction hose into river, and route discharge hose to CO-T-1B or hotwell.	N	

Time (hr.)	MODE "C" SOE (FLEX PORV COOLING) Description of ACTION	TSA (Y/N)	Basis for ACTION
8.0	If ambient temperature is less than 40°F, then energize BWST immersion heater as needed to maintain BWST temperature above 40°F.	N	
9.0	If river level is inadequate or inaccessible to use FX-P-3A or B, then FX-P-6 is configured to supply CO-T-1B (using FX-Y-3 for power).	N	
9.5	If ambient temperature is less than 40°F and FX-P-6 is required, then set up portable propane to maintain ISPH temperature above 40°F.	N	
>24.0	NSRC resources begin arriving on site. NSRC equipment will be used water treatment and long term needs for fuel oil.	N	

MODE D Sequence of Events Timeline (Reference Section 5)

The plant initial condition is MODE "D". The "time" is the event time or the action completion time, after the LOOP. This time shows an expected sequence. Limiting performance times are identified in the "basis for ACTION". Bounding conditions for initial RCS water level (24" above cold leg centerline) and time since reactor shutdown (72 hours) are used. This sequence is a composite of each event sequence except for flood. The flood event action sequence is described in Section 5.6.

Time (hr.)	MODE "D" SOE Description of ACTION	TSA (Y/N)	Basis for ACTION
0	Loss Of Offsite Power (LOOP).	N	Event assumed
< .01	Emergency Diesel Generators fail to energize ES buses.	N	Failure assumed per NEI 12-06
< .02	EOP-030 initiated.	N	
< 0.08	Operator attempts to start and load SBO Diesel Generator.	N	Response to LOOP with failure of EDG
0.08	If BWST is not available, operator lines up SFP to RCS (open SF-V-38, SF-V-37, and DH-V-20A or B)	Y	This action supports capability to gravity drain from SFP within 15 minutes.
< 0.17	SBO Diesel generator is not functional. START of ELAP	N	Failure assumed per NEI 12-06
0.25	E-plan initiated. Satellite phones are available for offsite notifications & communication.	N	
0.27	RCS temperature reaches boiling (212F)	N	Assumes minimum RCS water level and reactor shutdown for 72 hours.

MODE D Sequence of Events Timeline (Reference Section 5)

Time (hr.)	MODE "D" SOE Description of ACTION	TSA (Y/N)	Basis for ACTION
0.30	If the BWST is available, then operator locally throttles open DH-V-19A (or B) to maintain RCS water level.	Y	Gravity drain core cooling flow can be initiated within 15 minutes if required.
0.30	If the BWST is NOT available, then operator throttles open DH-V-52 to maintain RCS water level.	Y	Gravity drain core cooling flow can be initiated within 15 minutes if required.
0.5	Operator opens doors to inverter and battery rooms.	N	
0.75	Maintenance team closes containment equipment hatch missile shield door	N	Establish containment boundary prior to boiling (NOTE 2)
0.9	If earthquake cause loss of FS integrity, then operators isolate affected buildings (CLOSE FS-V-43, FS-V-51 or FS-V-233).	N	Eliminates threat of any adverse impact of spray or flooding affecting FLEX strategy
1.0	Operator lines up FLEX Diesel Generator.	Y	This action is required within 6 hours to ensure station battery function (Reference 7).
1.0	Operator closes DH-V-12A and DH-V-12B	N	Establish RCS and containment boundary
1.0	Containment closure (i.e. one boundary on any open penetration) is complete.	N	Establish containment boundary
1.25	Operator strips loads from 1P & 1S 480V Buses, and 1A & 1B ES MCC to prepare to load FLEX diesel generator.	N	This action is required within 6 hours to station battery function (Reference 7).
1.5	Operator starts FLEX Diesel Generator, energizes FLEX MCC and closes breakers to energize 1P-1S 480V cross tie bus.	N	This action is required within 6 hours to ensure station battery function.

MODE D Sequence of Events Timeline (Reference Section 5)

Time (hr.)	MODE "D" SOE Description of ACTION	TSA (Y/N)	Basis for ACTION
1.75	Operator closes breakers to energize 1P 480V Bus, 1S 480V Bus, 1A ES MCC and 1B ES MCC.	N	This action is required within 6 hours to ensure station battery function.
2.0	Operator opens LR-V-3 to vent the RB	Y	This action is required within 3 hours after RCS boiling begins to ensure effective gravity drain cooling and maintain RB pressure below the rating of any temporary containment barriers.
2.0	Operator closes breakers for selected loads on 1A and 1B ES MCC: • Battery Chargers & Inverters (Vital Instruments) • Emergency Lighting	Y	This action is required within 6 hours to ensure station battery function.
2.0	If outside ambient is below 40°F, then drain available condensate (DW-T-2, CO-T-1A, CO-T-1B) to the hotwell.	N	
2.25	If earthquake cause loss of hotwell integrity or associated piping, then operator closes CO-V-13 & CO-V-24	N	Minimizes the loss of inventory from CO-T-1B
2.5	Operator opens service bldg. and turbine bldg. machine shop roll up doors and aux boiler roll up door.	N	Provide outside air for FX-Y-1A or FX-Y-1B and control building ventilation
3.0	Operator shuts down 1C Inverter and de-energizes VBC (NOTE 1)	N	Required within 180 minutes to ensure station battery function
3.25	Operator connects hose from DF-V-41 to FX-V-1, connects hose at FX-V-2, routes hose to Fuel Oil Tank (FX-T-3), and routes hose from FX-P-7 to FX-T-2.	N N	The flow path to FX-T-3 is required for fuel oil transfer to FX-T-3 within 3 hours after FX-Y-1A or B is started. The flow path to FX-T-2 is required before transferring fuel to FX-T-3.

MODE D Sequence of Events Timeline (Reference Section 5)

Time (hr.)	MODE "D" SOE Description of ACTION	TSA (Y/N)	Basis for ACTION
3.5	Operator sets up and starts portable ventilation in control building 322 & 338 elevations and control room.	N	This action is required to minimize the hydrogen concentration in the battery rooms.
3.5	Operator starts DF-P-1C or DF-P-1D, as needed, to maintain level in FX-T-3.	Y	Fuel oil makeup to FX-T-3 is required within 3 hours after FX-Y-1A or B is started.
4.0	Operator connects hose from FX-P-2A & B pump discharge to FLEX feedwater header, connects power cable to FX-P-2A or B starter, connects hose from FX-V-208 to FX-V-113, opens FX-V-203, FX-V-205, FX-V-208, FX-V-113 and SF-V-88.	Y	This action is required to ensure RCS makeup is maintained as RB pressure rises and is ready for use when non-borated water is preferred.
4.0	Operator creates spent fuel pool vent path (by opening doors through U2 fuel pool to U2 FHB roof atmosphere).	N	
4.0	Operator sets up and starts temporary ventilation in Turbine Bldg.	N	This action is required to optimize conditions for personnel and FLEX equipment.
5.0	If outside ambient is below 40°F, then set up portable propane heaters in the condenser pit to maintain hotwell & FX-P-2 area above 40°F.	N	
7.0	Transfer portable diesel-driven pump (FX-P-3A or FX-P-3B) from FLEX storage facility (FSF) to road next to the river, route suction hose into river, and route discharge hose to CO-T-1B or hotwell.	Y	A condensate source is required within 12 hours to support transition from a borated water source.
8.0	If ambient temperature is less than 40°F, then energize BWST immersion heater as needed to maintain BWST temperature above 40°F.	N	

MODE D Sequence of Events Timeline (Reference Section 5)

Time (hr.)	MODE "D" SOE Description of ACTION	TSA (Y/N)	Basis for ACTION
9.0	If river level is inadequate or inaccessible to use FX-P-3A or B, then FX-P-6 is configured to supply CO-T-1B (using FX-Y-3 for power).	Y	A condensate source is required within 12 hours to support transition from a borated water source.
9.5	If ambient temperature is less than 40°F and FX-P-6 is required, then set up portable propane to maintain ISPH temperature above 40°F.	N	
10.0	Operators continue maintaining RCS water level using condensate via FX-P-2A or FX-P-2B, and stop making up from borated water source (BWST or SFP).	N	Transition to forced flow with non-borated water is required if RB pressure limits gravity flow or to avoid excessive RV boron concentration, boron precipitation and the potential adverse effects on core cooling.
10.2	Operator monitors SF pool level and throttles SF-V-41 open as needed to maintain SFP level.	N	
>24.0	NSRC resources begin arriving on site. NSRC equipment will be used to maintain a reliable condensate supply and to address longer term needs for fuel oil.	N	

NOTES
(1) This action is NOT required if the station battery chargers have been energized.
(2) The RB equipment hatch is only allowed to be removed if the RV "time to boil" is greater than 1 hour. The action is listed because it is a significant action for events with time to boil of one hour or more.
(3) The time to boil in the spent fuel (~ 10 hours) is very conservative assumption and is not consistent with the other assumed conditions in this SOE (e.g. RV boils in 15 minutes after loss of DH)