Exelon Generation®

Order No. EA-12-049

RS-14-016
TMI-14-006

February 28, 2014

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: 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)

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. 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 Nos. MF0803), dated December 17, 2013

On March 12, 2012, the Nuclear Regulatory Commission ("NRC" or "Commission") issued an order (Reference 1) to Exelon Generation Company, LLC (EGC). Reference 1 was immediately effective and directs 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.

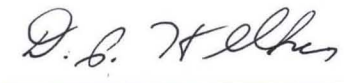
Reference 1 required submission of an initial status report 60 days following issuance of the final interim staff guidance (Reference 2) and an overall integrated plan pursuant to Section IV, Condition C. Reference 2 endorses industry guidance document NEI 12-06, Revision 0 (Reference 3) with clarifications 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 overall integrated plan.

Reference 1 requires submission of a status report at six-month intervals following submittal of the overall integrated plan. Reference 3 provides direction regarding the content of the status reports. Reference 6 provides the first six-month status report pursuant to Section IV, Condition C.2, of Reference 1 for Three Mile Island Nuclear Station, Unit 1. The purpose of this letter is to provide the second six-month status report pursuant to Section IV, Condition C.2, of Reference 1, that delineates progress made in implementing the requirements of Reference 1. The enclosed report provides an update of milestone accomplishments since the last status report, including any changes to the compliance method, schedule, or need for relief and the basis, if any. The enclosed report also addresses the NRC Interim Staff Evaluation Open and Confirmatory Items contained in Reference 7.

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 28th day of February 2014.

Respectfully submitted,



David P. Helker
Manager - Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Enclosure:

1. Three Mile Island Nuclear Station, Unit 1 Second Six-Month Status Report for the Implementation of Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events

cc: Director, Office of Nuclear Reactor Regulation
NRC Regional Administrator - Region I
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R. R. Janati, Chief, Division of Nuclear Safety, Pennsylvania Department of Environmental Protection, Bureau of Radiation Protection

Enclosure

Three Mile Island Nuclear Station, Unit 1

Second Six-Month Status Report for the Implementation of Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events

(46 pages)

Three Mile Island Station, Unit 1

Second Six-Month Status Report for the Implementation of Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events

1 Introduction

Three Mile Island Nuclear Station, Unit 1 (TMI) developed an Overall Integrated Plan (Reference 1 in Section 8), documenting the diverse and flexible strategies (FLEX), in response to Reference 2. This enclosure provides an update of milestone accomplishments since submittal of the last status report (August 2013), including any changes to the compliance method, schedule, or need for relief/relaxation and the basis, if any.

2 Milestone Accomplishments

The following milestone(s) have been completed since July 30, 2013 and are current as of February 1, 2014.

None

3 Milestone Schedule Status

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

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

Original Target Completion Date	Activity	Status
	Submit 60 Day Status Report	Complete
	Submit Overall Integrated Implementation Plan	Complete
	Contract with RRC	Complete
	6 Month Updates	
Update 1	Aug., 2013	Complete
Update 2	Feb., 2014	Complete with this submittal
Update 3	Aug., 2014	Not Started
Update 4	Feb., 2015	Not Started

Original Target Completion Date	Activity	Status
Update 5	Aug., 2015	Not Started
Update 6	Feb., 2016	Not Started
	Modification Development	
Oct 2014	Phase 1 modifications (1) RCP Seal Upgrade (2) Condensate piping supports	 (1) Started (2) Started
Oct 2014	Phase 2 modifications (1) FLEX Electrical Power Supply (2) FLEX RCS & SFP Makeup (3) FLEX Feedwater System (4) FLEX Storage Facility (5) Turbine Bldg Structural (6) FLEX fuel oil supply (7) Spent Fuel Pool Level (8) Communications modification (9) Main Generator Purge (10) Reactor Building Vent (11) Satellite phone storage	 (1) Started (2) Started (3) Started (4) Started (5) Started (6) Started (7) Started (8) Not Started (9) Not Started (10) Not Started (11) Complete
Oct 2014	Phase 3 modifications	Not Started
	Modification Implementation	
Nov 2015	Phase 1 modifications (1) RCP Seal Upgrade (2) Condensate piping supports	Not Started
Nov 2015	Phase 2 modifications (1) FLEX Electrical Power Supply (2) FLEX RCS & SFP Makeup (3) FLEX Feedwater System (4) FLEX Storage Facility (5) Turbine Bldg Structural (6) FLEX fuel oil supply (7) Spent Fuel Pool Level (8) Communications modification (9) Main Generator Purge (10) Reactor Building Vent (11) Satellite phone storage	Not Started
Nov 2015	Phase 3 modifications	Not Started

Original Target Completion Date	Activity	Status
	Procedure development	
Jun 2015	• Create Site-Specific Procedures	Started
Jul 2015	• Validate Procedures (NEI 12-06, Sect. 11.4.3)	Started
Jun 2015	• Create Maintenance Procedures	Started
Jul 2015	Staffing analysis	Started
Nov 2015	Storage Plan	Started
Nov 2015	FLEX equipment acquisition	Started
Nov 2015	Training	Started
Jul 2015	Regional Response Center Operational	Started
Nov 2015	Unit 1 Implementation date	

4 Changes to Compliance Method

The following significant changes have been made to the FLEX conceptual design:

(1) FLEX Diesel Generator and Fuel Oil Supply (Reference Attachment 2A)
- FLEX Diesel Generators FX-Y-1A & B and FX-T-2 will be located at the south end of the Turbine Bldg
- Skid mounted fuel tanks will be used for the initial supply. FX-T-2 will normally be empty and only used for floods. Fuel Supply from DF-T-1 will directly fill FX-T-2, or FX-Y-1A or B skid mounted tanks. New pumps (FX-P-5A & B) will be used to transfer fuel from FX-T-2 to the skid mounted fuel tanks.

(2) FLEX Electrical Distribution (Reference Attachment 2B)
- A 480V distribution panel and a transfer switch replace the FLEX 480V MCC
- Temporary cable will be used for power to FX-P-2A & B
- The temporary power feed to RB H&V MCC is no longer required
- 120VAC regulated panel ATC will be modified to provide power to FLEX temporary ventilation

(3) FLEX Feedwater System (Reference Attachment 2C)
- Capacity of FX-P-2A & B was increased, and series operation with a portable diesel driven pump (FX-P-3 or 4) was eliminated.

(4) FLEX RCS and SFP Makeup System (Reference Attachment 2D)
- Added flow path for core cooling via Spent Fuel Pool gravity drain
- Added RB vent path

The following significant changes have been made to the FLEX Sequence of Events and Timelines (Reference Attachment 1A (Earthquake or Tornado Event Timeline), Attachment 1B (External Flood Event Timeline) and Attachment 1C (Extreme Cold, Snow & Ice event timeline).
- Previously only the earthquake/tornado event SOE was described. The SOE for flood or extreme cold, snow & ice events in Attachment 1B & 1C are new.
- Description of operator interaction with SBO diesel was split into two items to show action being initiated and the recognition that the SBO diesel as unavailable as two separate events. (Confirmatory Item 3.2.1.6.D)
- Actions (item 14 in AUG 13 update) to move a diesel driven pump into the Turbine Bldg have been removed
- New actions (Attachment 1A 16 & 17) describe contingencies to deal with condensate inventory loss or internal flooding hazard
- Attachment 1A items 40 & 41, describe when backup feedwater is available (< 12 hours) and final RCS & OTSG conditions.

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

TMI Unit 1 expects to comply with the Order implementation date and no relief/relaxation is required at this time.

6 Open Items from Overall Integrated Plan and Interim Staff Evaluation

Section Reference (Refer to OIP Update from Aug 2013)	Overall Integrated Plan Open Item (Refer to OIP Update from Aug 2013)	Status (As of February 1, 2014)
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.
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.	SOE Timelines are included in Attachment 1A, 1B and 1C. Closed to "ISE Open & Confirmatory Item" No. 22.
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.	Complete
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.	Closed to "Milestone Schedule" tracking in Section 3
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.	Closed to "Milestone Schedule" tracking in Section 3
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.	Closed to "Milestone Schedule" tracking in Section 3
New ECR, no reference.	ECR 13-00078 Turbine Building Structural Modifications is not finalized. Changes will be provided in a six (6) month update.	Closed to "Milestone Schedule" tracking in Section 3
New ECR, no reference.	ECR 13-00164 FLEX Fuel Oil and Fire Protection is not finalized. Changes will be provided in a six (6) month update.	Closed to "Milestone Schedule" tracking in Section 3

Section Reference (Refer to OIP Update from Aug 2013)	**Overall Integrated Plan Open Item** (Refer to OIP Update from Aug 2013)	**Status** (As of February 1, 2014)
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.	Closed to "ISE Open & Confirmatory Item" No. 29.
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
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.	Closed to "Milestone Schedule" tracking in Section 3
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.	Closed to "Milestone Schedule" tracking in Section 3
Maintain RCS Inventory (pg 22)	A plan will be developed to re-supply borated water to the BWST or SF pool.	Complete On site storage will provide borated water for greater than 24 hours in the limiting case. RRC will provide capability to prepare and deliver borated water if needed.
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.	Complete
Maintain Containment (pg 26)	TM-FLEX-002, *RB Pressure Analysis*, Rev 0 (Reference 4), results show that Reactor Building pressure will remain below design pressure without any active means of RB cooling for any event where the OTSG is available to remove core heat.	Complete

Section Reference (Refer to OIP Update from Aug 2013)	**Overall Integrated Plan Open Item** (Refer to OIP Update from Aug 2013)	**Status** (As of February 1, 2014)
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.	Closed to "Milestone Schedule" tracking in Section 3
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.	Closed to "ISE Open & Confirmatory Item" No. 34.

Interim Staff Evaluation Open Item or Confirmatory Items

Item #	NRC ref no.	Description	Status FEB 2014 UPDATE
1	3.2.1.1.B	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.	WCAP 17792-P has been issued by PWROG. TMI Plan is described in Attachment 3 of this update. COMPLETE
2	3.2.1.1.C	As applicable, provide additional analyses for core cooling, RCS makeup, and shutdown margin that are relied upon, but not included in WCAP-17792-P.	TMI Plan is described in Attachment 3 of this update. COMPLETE
3	3.2.4.7.A	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.	TMI Plan is described in Attachment 3 of this update. COMPLETE
4	3.2.4.8.B	On page 37 of the Integrated Plan, the licensee states that two (2) diesel generators along with Fuel Tanks will be pre-staged in a protected enclosure on the 322' elevation of the Turbine Building. Provide justification addressing the flexibility of this alternate approach to mitigate BDBEEs.	TMI Plan is described in Attachment 3 of this update. COMPLETE
5	3.1.1.1.A	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.	The Unit 2 screen house will be modified to be used as the FLEX equipment storage facility. The U2 screen house is a tornado hardened seismic Class I structure with the floor at 312' elevation. The structure will be modified to provide a new access for the FLEX truck and equipment trailers. The new access will provide tornado protection and remain functional after a tornado event. The equipment stored in the building will be evaluated and secured as needed to ensure FLEX equipment is not damaged during a seismic event. The elevation is sufficient to prevent equipment damage during an external flood event. COMPLETE

Item #	NRC ref no.	Description	Status FEB 2014 UPDATE
6	3.1.1.2.A	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.	(1) The potential for earthquake induced liquefaction has been evaluated. Deployment of TMI1 FLEX equipment will not be adversely impacted. (Reference 990-2179 "Assessment of earthquake-induced liquefaction potential and associated ground failure hazards for Three Mile Island Unit 1", Geomatrix Consultants. (2) The evaluation of access paths through non-seismic structures is in progress. (AUG 2014 Update) (3) A vehicle stored in the FLEX storage facility will be used to deploy or move FLEX equipment. No additional power is required.
7	3.1.1.3.A	The licensee did not address the determination of necessary instrument local readings per consideration 1 of NEI 12-06 Section 5.3.2, to support the implementation of the mitigating strategies in the event that seismically qualified electrical equipment is affected by a BDBEE.	AUG 2014 Update
8	3.1.1.4.A	The licensee did not identify the local assembly area or describe the methods to be used to deliver the equipment to the site for all hazards. In the audit process the licensee stated that the TMI RRC playbook will be made available when approved to address this.	FEB 2015 Update

Item #	NRC ref no.	Description	Status FEB 2014 UPDATE
9	3.1.2.2.A	The licensee did (not) specifically address considerations 2, 3, 4, 5, 8, and 9 of NEI 12-06 Section 6.2.3.2 regarding deployment of FLEX equipment.	All FLEX actions for an external flood event (1) are performed prior to the ELAP event based on flood warning time, (2) are performed at elevations above the PMF peak water level or (3) were evaluated as follows to address access and deployment concerns. After the water recedes below site grade, a portable diesel driven pump (FX-P-3 or 4) will be moved from the FLEX Storage Facility to the ramp next to the river located west of the NOB. The pump and RRC 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 a minimum of five days to reliably accomplish this task with RRC support. COMPLETE
10	3.1.3.2.A	The licensee did not address considerations 2-5 of NEI 12-06 Section 7.3.2 regarding loss of access to the ultimate heat sink, the need to remove debris, a means to move equipment that is protected, and the ability to restock supplies.	(2) If the capability to utilize the ultimate heat sink (Susquehanna River) is affected by hurricane or tornado, an alternate means to obtain river water has been developed. A portable diesel driven pump (FX-P-3 or 4) will be moved from the Flex Storage Facility (FSF) to the ramp next to the river located west of the NOB. The pump (RRC supplied water filtration equipment will be used after 24 hours) will be used to provide a continuous condensate supply to CO-T1B or the hotwell. (3 & 4) Debris removal may be required on the road or the river ramp. The equipment used to move the FLEX equipment and for debris removal will be stored in the FSF for protection during the event. (5) No event specific proactive action is necessary for mitigation of tornado or high wind events. COMPLETE

Item #	NRC ref no.	Description	Status FEB 2014 UPDATE
11	3.1.5.3.A	The licensee provided no information regarding the heat up of various rooms and enclosures in the Integrated Plan, and there was no discussion of the potential effects of high temperatures at the location where portable (or permanently installed FLEX) equipment would actually operate in the event of high temperatures in these plant locations.	A plan to provide portable ventilation for areas where natural circulation may be insufficient and key FLEX equipment performance may be adversely affected by abnormally high ambient temperature is being prepared. AUG 2014 UPDATE
12	3.2.1.A	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.	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.

Item #	NRC ref no.	Description	Status FEB 2014 UPDATE
13	3.2.1.B	The licensee needs to provide adequate technical basis for concluding that nitrogen injection will not occur from the core flood tanks.	Prior analysis to determine the RCS pressure when CFT N2 injection could occur established that pressure at 202 psig (Reference: C-1101-213-5450-002). If a very conservative approach to temperature is taken, and the CFT is assumed to immediately rise to the RB temperature 24 hours into the event (i.e. 230 F), the RCS pressure where N2 injection could occur rise to 256 psig. The TMI strategy includes a slow RCS cooldown and depressurization to the point where RCS pressure is stabilized at 400 psig. Therefore, there is large margin to the point where CF N2 injection could occur In addition, power will be restored to the CF isolation valves early in the event (within 8 hours) such that the control room would have the capability to remotely close the valves if needed. Once a pressurizer steam bubble is established, the core flood isolation valves will be closed. COMPLETE.
14	3.2.1.1.A	The licensee needs to confirm that analysis and conclusions based on simulations with the MAAP4 code are not relied upon for demonstrating adequate core cooling, RCS makeup, or shutdown margin for TMI-1.	See Attachment 3 of this document COMPLETE.
15	3.2.1.1.D	The licensee did not provide information confirming that reliance on the RELAP5/MOD2-B&W code in the ELAP analysis for Babcock and Wilcox plants is limited to the flow conditions before boiler-condenser cooling initiates.	The TMI strategy and supporting technical analysis do not rely upon operation in or recovery from boiler condenser cooling. Single phase sub-cooled conditions are maintained at all times. COMPLETE.

Item #	NRC ref no.	Description	Status FEB 2014 UPDATE
16	3.2.1.2.A	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.	See Attachment 3 of this document. COMPLETE
17	3.2.1.2.B	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.	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 and manual control will maintain OTSG pressure at approximately 1000 psig. Therefore, OTSG temperature will be approx. 547F and cold leg temperature will be approximately 550F. The RCP seal temperature will remain below 560F throughout the event. The initial RCS loss rate due to seal leakage and controlled bleed off flow will be less 2.6 GPM/ RCP. This value is based on an RCS pressure at 2150 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. As described in Attachment 3, a total RCS loss rate of 20 GPM was used in the MAAP analysis, and a rate of 11 GPM was used to apply the WCAP 17792 analysis product. OPEN – Pending delivery of supporting Flowserve documentation to NRC by PWROG
18	3.2.1.2.C	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.	See item #17 COMPLETE.

Item #	NRC ref no.	Description	Status FEB 2014 UPDATE
19	3.2.1.2.D	Address the acceptability of using the Flowserve N-9000 RCP [Reactor coolant Pump] seals with the abeyance seal in the Westinghouse RCPs. The RCP seal leakages rates for use in the ELAP analysis should be provided with acceptable justification.	See item #17 COMPLETE.
20	3.2.1.4.A	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, 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 ER-TM-TSC-0016.	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 6 hours for the initial conditions where OTSG steam pressure is insufficient to drive the EFW pump, or (3) the reactor has been shutdown at least 72 hours before the OTSG is unavailable, and gravity drain core cooling methods are required. 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 one third of core 20 days after reactor shutdown. (2) At any other time, the design basis (Reference UFSAR section 9.4.1) spent fuel pool heat load is assumed (i.e., a full core offload plus one third of a core 36 days after reactor shutdown plus the long term heat load). COMPLETE.

Item #	NRC ref no.	Description	Status FEB 2014 UPDATE
21	3.2.1.5.A	The licensee's evaluation of the FLEX strategy may identify additional parameters that are needed to support key actions identified in the plant procedures/guidance or to indicate imminent or actual core damage. Differences will be provided in a future 6-month update and, as appropriate, the acceptability will need to be confirmed.	The instruments required to support key actions for FLEX are: RCS Pressure RCS water level (pressurizer level or "RCS drain down" level as applicable) Incore Temperature OTSG water Level (A & B) OTSG Pressure A & B Spent Fuel Pool water level Other instruments will be maintained to confirm expected response, but are not required for plant control. Source Range Nuclear Instrument Reactor Building Pressure COMPLETE.
22	3.2.1.6.A	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 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.	A SOE timeline for flooding is provided as Attachment 1B The capability to perform the actions within the period identified in analysis will be validated when the procedures are written through table top, simulator and field simulation exercises. Update FEB 2015

Item #	NRC ref no.	Description	Status FEB 2014 UPDATE
23	3.2.1.6.B	The licensee will establish FLEX RCS makeup capability within approximately 4 hours to maintain sufficient RCS inventory to support core heat removal. This judgment is based on expected leakage reduction from the installation of low-leakage RCP seals. Conceptual design for low leakage RCP seal design and analysis to confirm the time requirement to establish RCS makeup capability are not yet complete.	The analysis which provides the technical basis to conclude that at 4 hours action time has sufficient conservative margin has been completed. See Attachment 3. The ability to meet this time will be validated as described in response to item 22.
24	3.2.1.6.C	In the sequence of events timeline, the licensee identifies a task to attempt to start the Station Blackout (SBO) diesel generator located in Unit 2 within 5 minutes. The licensee did not explain the extent of operator actions to perform this task to determine the feasibility of accomplishing this task in such a short period of time.	The operations necessary to start the SBO diesel generator are performed inside the Unit 1 control room. The timeline for the SBO response described in Attachment 1A is the same as described in current licensing basis documents (UFSAR 8.5.2). COMPLETE.
25	3.2.1.6.D	The licensee will revise the SOE Attachment 1A in the February 2014 6-month update and will distinguish the time when action to start SBO is initiated from the time when the decision is made to initiate ELAP actions.	Attachment 1A has been revised. COMPLETE.

Item #	NRC ref no.	Description	Status FEB 2014 UPDATE
26	3.2.1.9.A	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.	The location for the FLEX diesel generators (FX-Y-1A & FX-Y-1B) has been moved to a new platform supported by and shielded by the main generator pedestals at the south end of the Turbine Building. This location provides significantly improved seismic structural support and shielding from high winds or missiles. The FLEX MCC has been replaced by a distribution panel, which will be located in the vicinity of the diesels. The fuel supply concept was modified. The 5000 gallon storage tank will only be used for flooding events. Otherwise, the fuel will be supplied directly from the underground storage tank (DF-T-1) to skid mounted fuel tanks at FX-Y-1A & B. COMPLETE.
27	3.2.1.9.B	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. 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.	These tables list equipment which is available but it may not have a defined FLEX function. The only pumps listed in these tables which have a required FLEX function are the two diesel driven pumps (Godwin HL110M and HL130M). These pumps are used to maintain a continuous condensate supply by transferring water from the river or other on site sources to the condensate tank or the hotwell. The performance requirement for this function is satisfied with a flow of 150 GPM. Considering the elevation and head loss in these configurations, either of these pumps can easily meet the flow requirement. COMPLETE.

Item #	NRC ref no.	Description	Status FEB 2014 UPDATE
28	3.2.1.9.C	The licensee noted the availability of a FLEX portable diesel driven pump, 600 gpm at 245 pounds per square inch differential. This pump is used to pump river water to resupply the condensate source and to provide river water flow through a Reactor Building (RB) emergency cooler when the OTSG is not available. Condensate resupply is needed within 18 hours. RB cooling is required within 3 hours after time to boil. These times are being refined. The RB cooling requirement only applies during outage conditions when additional resources will be made available. Hydraulic analysis is being completed to confirm the pump capacity is adequate for the required FLEX function.	The strategy for limiting RB pressure during events when the OTSG is not available has been revised. A passive RB vent path will be used in lieu of an active RB cooling method. The only remaining function for the portable diesel driven pumps is described in item 27. COMPLETE.
29	3.2.1.9.D	The license stated that, for Phase 3, a portable refueling vehicle with a large diesel oil bladder will be available on site to support refilling the portable equipment diesel tanks. An additional means (river makeup is available) of delivering condensate may also be developed.	The RRC will provide the capability to airlift diesel fuel from the offsite staging area to TMI utilizing a large diesel fuel bladder. On site fuel distribution will be accomplished with transfer pumps (RRC), hoses and the on-site FLEX vehicle which has a 200 gallon supplemental fuel tank. COMPLETE.
30	3.2.2.A	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	Cooling of the spent fuel is accomplished by providing makeup water to maintain the pool level after boiling begins. The bounding values for the spent fuel pool heat load in operating or outage conditions are described in the response to item 20. The time for the spent fuel pool to reach boiling was evaluated using a pre-established process for that purpose (i.e., ER-TM-TSC-0016). The vent path has no interfaces with equipment relied upon for the FLEX strategy. Therefore, potential water damage to equipment along the steam vent path to atmosphere will not adversely affect the ability to maintain core cooling, spent fuel cooling or containment. COMPLETE.

Item #	NRC ref no.	Description	Status FEB 2014 UPDATE
31	3.2.4.1.A	The licensee did not specify if the FLEX diesel generators on the Turbine Building were of sufficient capacity to supply any additional cooling need such as the system that provides for the steam driven emergency feedwater (EFW) pump bearing cooling, or any other plant components or cooling systems needed to support the FLEX strategies. Additional formal analysis is required to determine the acceptability of the licensee's plans to provide supplemental cooling to the subject areas, e.g., Main Control Room (MCR), EFW room, Atmospheric Dump Valve (ADV) room, battery rooms.	A plan to provide portable ventilation for areas where natural circulation may be insufficient and key FLEX equipment performance may be adversely affected by abnormally high ambient temperature is being prepared. Power for portable ventilation will be included to establish the FLEX diesel generator capacity. (AUG 2014 UPDATE).
32	3.2.4.2.A	Habitability conditions in the MCR will be evaluated and a strategy will be developed to maintain MCR habitability. The strategy and associated support analyses will be provided in a future 6-month update.	Portable ventilation will be utilized to improve CR habitability and provide cooling for key FLEX equipment. The complete plan will be provided in the AUG 2014 UPDATE.
33	3.2.4.2.B	The analysis of battery room conditions was not complete, and the licensee noted that additional formal analysis to determine the acceptability of their actions regarding the battery room's accessibility is needed. Also additional discussion on the hydrogen gas exhaust path for each strategy is needed, and a discussion of the accumulation of hydrogen to ensure that the hydrogen gas level is below combustible level when the batteries are being recharged during Phase 2 and 3.	Portable ventilation will be utilized to prevent an excessive hydrogen concentration in the battery rooms. The complete plan will be provided in the AUG 2014 UPDATE.

Item #	NRC ref no.	Description	Status FEB 2014 UPDATE
34	3.2.4.2.C	The licensee did not provide any information regarding temporary cooling/ventilation for areas such as the steam driven emergency feedwater pump room, ADV rooms or cable spreading rooms. The licensee's current strategies are based on preliminary analysis. The current strategy for providing cooling or ventilation for these areas is to connect a permanently staged 480V AC diesel generator and fuel tanks to be located in the Turbine Building elevation 322. The strategy is to repower 1A and 1B ES MCCs in four hours and hence supply power for cooling these areas. The licensee did not provide any details regarding what ventilation systems would be repowered for these areas of the plant, or the capacity of the FLEX emergency diesel generators to meet these needs, or how this would be accomplished.	Portable ventilation will be utilized to provide cooling for key FLEX equipment. The complete plan will be documented in Technical Evaluation ECR 13-00310 which will be available for review in AUG 2014.
35	3.2.4.2.D	Provide a discussion on extreme high/low temperature effects on the battery capability to perform its function for the duration of ELAP event.	A colder ambient assumption was used to provide a conservative result in the battery life analysis (Reference 6). An ambient temperature of 70F was assumed throughout the period of battery discharge. COMPLETE.
36	3.2.4.3.A	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.	A sequence of events timeline for an extreme cold, snow & ice is provided in Attachment 1C. This plan has two actions which are unique for this event: (1) provide power to the BWST heat trace circuits AND (2) connect a hose to route steam into the condensate tank. Other actions are common for other events. COMPLETE.

Item #	NRC ref no.	Description	Status FEB 2014 UPDATE
37	3.2.4.4.A	The licensee plans and strategies include providing power to installed emergency lighting via the permanently installed FLEX emergency generators. The licensee has not completed the final analysis for the time constraints noted in the SOE therefore the timing of the need for use of the emergency generators to supply emergency lighting cannot be determined.	For actions required in the first eight hours, lighting will be provided by battery supplied lighting, either installed or portable. COMPLETE.
38	3.2.4.4.B	The NRC staff reviewed the licensee communications assessment and has determined that the assessment for communications is reasonable, and the analyzed existing systems, proposed enhancements, and interim measures will help to ensure that communications are maintained. Therefore, there is reasonable assurance that the guidance and strategies developed by Exelon will conform to the guidance of NEI 12-06 Section 3.2.2 (8) regarding communications capabilities during an ELAP. Confirmation that upgrades to the site's communications systems have been completed will be accomplished.	FEB 2015 UPDATE
39	3.2.4.5.A	The licensee provided no information in the Integrated Plan regarding local access to the protected areas under ELAP.	FEB 2015 UPDATE

Item #	NRC ref no.	Description	Status FEB 2014 UPDATE
40	3.2.4.6.A	The licensee's analysis regarding access to the MCR, and battery rooms, is preliminary and additional formal analysis is required. In the audit process the licensee specified that temporary ventilation (fans and flexible ducts) will be used to maintain control room habitability, to control the ambient temperature in control building areas with credited FLEX electrical equipment and to limit the accumulation of hydrogen during battery charging. This approach uses a "once through" air flow path. The licensee stated that the technical basis to demonstrate that this temporary capability is sufficient and that supporting documentation, ECR [engineering change Request] 13-00310, will be made available to NRC when it is completed.	AUG 2014 UPDATE
41	3.2.4.8.A	In the audit process the licensee specified that the FLEX electrical power system (480V ac diesel generators and new MCC) will be designed to handle the appropriate loads. The load sizing calculations will be reviewed when provided by the licensee.	The maximum required electrical load for the FLEX power supply is summarized in Attachment 4. COIMPLETE
42	3.2.4.10.A	The licensee stated that their load shedding analysis was based on a preliminary calculation, and the final calculation results could differ from initial assumptions and could therefore provide different outcomes regarding DC load shedding strategies. No supporting information was provided regarding the analysis in calculation C-1101-734-E420-009.	C-1101-734-E420-009 "Extending Battery Life to 6 hours during an ELAP" is available for review.
43	3.2.4.10.B	Provide basis for the minimum dc voltage at the dc bus that will be required to ensure proper operation of all the electrical equipment.	In the battery life analysis (Reference 6) a minimum acceptable voltage of 105VDC at the battery was used to ensure proper operation of all the electrical equipment. This is the minimum voltage used in the station design basis battery life analysis. COMPLETE.

Item #	NRC ref no.	Description	Status FEB 2014 UPDATE
44	3.3.2.A	The licensee provided insufficient information to conclude that configuration control of equipment and connections will be in conformance with the guidance of NEI 12-06, Section 11.8, Items 1, 2 and 3.	The TMI FLEX strategy and the engineering basis are documented in a site program document which will be issued to support implementation. The modification design review process will be modified to recognize the FLEX program documents to ensure the strategy is maintained through future modification.
45	3.3.3.A	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.	FEB 2015 UPDATE
46	3.4.A	The licensee's plans for the use of off-site resources conform to the minimum capabilities specified in NEI 12-06 Section 12.2, with regard to the capability to obtain equipment and commodities to sustain and backup the site's coping strategies, item 1. The licensee did not address the remaining items, 2 through 10 of Section 12.2.	FEB 2015 UPDATE

7 Potential Draft Safety Evaluation Impacts

No potential impact to the Draft Safety Evaluation was identified.

8 References

The following references support the updates to the Overall Integrated Plan described in this 6-month update.

1. Three Mile Island Nuclear Station, Unit 1, 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.
2. NRC Order Number EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events, dated March 12, 2012.
3. NEI 12-06, Rev. 0, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, dated August 2012.
4. TM-FLEX-002, *Reactor Building Pressure Analysis for FLEX,* Rev. 0
5. TMI Station's First Six Month Status Report for the Implementation of FLEX, dated August 28, 2013.
6. C-1101-734-E420-009 "Extending Battery Life to 6 hours during an ELAP"

9 Attachments

1A Sequence of Events Timeline Earthquake or Tornado @ 100% power

1B Sequence of Events Timeline External Flood @ 100% power

1C Sequence of Events Timeline Extreme Cold, Snow and Ice @ 100% power

2A 1E-919-21-001, draft, FLEX Diesel Generator and Fuel Oil System

2B 1E-919-21-002, draft, FLEX Electrical Distribution

2C 1E-919-21-003, draft, FLEX Feedwater System

2D 1E-919-21-004, draft, FLEX RCS and SFP Makeup System

3 ISE Open Item Response

4 FLEX Power Supply - Electrical Load Summary

Attachment 1A - Sequence of Events Timeline
Earthquake or Tornado @ 100% power

#	ELAP Time (HR)	Action	Time Constraint Y/N	Remarks / Applicability
1	0	Earthquake or tornado Causes LOOP and damages unprotected equipment All control rods are inserted and the reactor is shutdown.	NA	
2	0	Emergency Diesel Generators fail to energize ES buses.	NA	Failures per NEI 12-06
3	< .01	EFW 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
4	< .02	EOP initiated	NA	
5	< 0.05	RCS Letdown is automatically isolated on high temperature (MU-V-3 closes).	N	Automatic plant response
6	< 0.08	Control Room operators throttle ADV to stabilize OTSG pressure and RCS temperature. Adequate core cooling is provided through RCS natural circulation and heat removal through the OTSG.	N	
7	< 0.08	Control Room operators attempt to start and load SBO Diesel Generator	N	
8	< 0.10	Control Room operator closes RCP Controlled Bleed Off Isolation Valve (MU-V-26)	N	Contains RCS losses within the Reactor Bldg.
9	< 0.17	SBO Diesel generator is not functional	N	Failure per NEI 12-06.
10	0.25	Operator initiates Eplan. If needed, satellite phones are used for offsite notifications & communication	N	
11	0.25	Operators open main condenser vacuum breaker (VA-V-8) and valves to vent Main Generator H2 to atmosphere	Y	This is a pre-condition to reduce DC loads.
12	0.25	Control Room operator secures DC powered FW pump turbine lube oil pumps (LO-P-9A & B)	Y	DC Load shedding
13	0.5	Operator opens doors to inverter and battery rooms.	N	Maintain acceptable temperature for FLEX equipment

Attachment 1A - Sequence of Events Timeline
Earthquake or Tornado @ 100% power

#	ELAP Time (HR)	Action	Time Constraint Y/N	Remarks / Applicability
14	0.5	Operator de-energizes instrument systems not required for FLEX.	Y	DC Load shedding
15	< 0.75	Operator lines up CO2 purge for main generator	N	Minimize risk of main generator fire
16	< 0.75	If condensate is lost due to damaged hotwell or piping, then operator closes CO-V-8, CO-V-108 and CO-V-24 If both CO-T-1A and CO-T-1B are damaged, then operator closes CO-V-10B and opens DW-V-35 to line up DW-T-2 to EF-P-1	Y	Minimize loss of condensate
17	< 1.0	If necessary, operators secures fire service pumps (FS-P-1 and FS-P-3)	Y	Mitigates the effects of non seismic piping failures in Class I buildings.
18	1.0	Control room operator secures Main Turbine Lube Oil Pump LO-P-6	Y	DC load shedding
19	1.5	Operator lines up FLEX Diesel Generator	Y	Pre-condition to maintain vital AC power and restore RCS makeup
20	< 2.0	Control room operator secures Main Generator Seal Oil Pump (GN-P-2).	Y	DC load shedding
21	2.0	Operator props open doors for initial intermediate building ventilation	N	
22	2.0	Operator lines up FLEX RCS Makeup Pump from BWST or Spent Fuel Pool to RCS	Y	Pre-condition to maintain vital AC power and restore RCS makeup
23	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	Bottled air system will last at least 3 hours, and then local manual control is required.
24	2.25	Operator strips loads from 1P & 1S 480V Buses, and 1A & 1B ES MCC to prepare to load FLEX diesel generator	Y	Pre-condition to maintain vital AC power and restore RCS makeup
25	2.5	Operator starts FLEX Diesel Generator, energizes FLEX MCC and closes breakers to energize 1P-1S 480V cross tie bus	Y	Pre-condition to maintain vital AC power and restore RCS makeup

Attachment 1A - Sequence of Events Timeline
Earthquake or Tornado @ 100% power

#	ELAP Time (HR)	Action	Time Constraint Y/N	Remarks / Applicability
26	2.58	Operator closes breakers to energize 1P 480V Bus, 1S 480V Bus, 1A ES MCC and 1B ES MCC	Y	Pre-condition to maintain vital AC power and restore RCS makeup
27	2.75	Operator closes breakers for selected loads on 1A and 1B ES MCC Battery Chargers AC Power to Inverters & Vital Instruments FLEX RCS Makeup Pumps Emergency Lighting	Y	Pre-condition to maintain vital AC power and restore RCS makeup
28	3.0	Operator starts FLEX RCS Makeup Pump (A or B) to restore RCS inventory and increase RCS boron concentration.	Y	Restore makeup within 4 hours to prevent interruption of core cooling.
29	3.5	Operator opens service bldg and turbine bldg machine shop roll up doors and aux boiler roll up door.	N	
30	4.0	Operator connects hose from DF-V-41 to pipe in DGB, connects hose to fuel oil pipe in TB, and routes hose to FLEX DG Fuel Oil Tank (FX-T-3A or B)	Y	Required for continued operation of FX-Y-1A or B
31	4.0	Operator strips loads on 1A ESV MCC & 1A Radwaste MCC and installs jumper between 1A ESV MCC and 1A Radwaste MCC	N	Pre-condition to isolate RCP controlled bleed off flow.
32	4.0	Operator starts DF-P-1C or DF-P-1D, as needed, to maintain level in FX-T-3A and B.	Y	Required for continued operation of FX-Y-1A or B. Pre-staged fuel supply will last 3 hours at full load.
33	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	Isolate RCP controlled bleed off flow to minimize RCS loss rate.
34	5.0	When pressurizer level reaches 100 inches, operator throttles open MS-V-4A & B to initiate a cooldown and controls pressurizer level at 100 inches. Cooldown rate will be less than 30 F/HR.	N	

Attachment 1A - Sequence of Events Timeline
Earthquake or Tornado @ 100% power

#	ELAP Time (HR)	Action	Time Constraint Y/N	Remarks / Applicability
35	5.0	Operator sets up and starts temporary ventilation in Control Bldg, IB and Turbine Bldg	N	
36	7.0	Operator strips loads on 1C ESV MCC, energizes 1C ESV MCC, and closes breakers for CF-V-1A and CF-V-1B. When a reliable Pzr steam bubble is established or If RCS pressure drops below 300 psig, then CLOSE CF-V-1A & CF-V-1B .	N	Contingency action
37	7 to 8	Operator transfers a pressurizer heater group (RC-HTR-GRP- 8 or 9) to the emergency power supply and energizes heaters	N	Hydraulic control of RCS pressure can be used if required
38	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, opens FX-V-203, FX-V-205, EF-V-67A and EF-V-67B.	N	This is a pre-condition to use backup feedwater capability.
39	8 to 11	Transfer portable diesel-driven pump (FX-P-3 or 4) from FLEX storage facility (FSF) to road next to the river or circ water flume, route suction hose into river/flume, and route discharge hose to CO-T-1B or hotwell.	Y	For a tornado, minimum condensate supply would last greater than 24 hours. The minimum supply is greater for an earthquake.
40	< 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 (all action TB 322 north).	N	Design objective is to be able to establish a backup with 12 hours.
41	10.0	RCS cooldown is complete. • Incore temperature 400F • OTSG A & B Pressure 150 psig • RCS Pressure 400 psig	N	
42	12.0	Operator opens SF-V-88, connects hose from FLEX feedwater header to the FLEX primary low pressure header, monitors SF pool level and throttles FX-V-101 open as needed to maintain SFP level.	Y	Spent fuel pool boiling occurs after 40 hours.

Attachment 1A - Sequence of Events Timeline
Earthquake or Tornado @ 100% power

#	ELAP Time (HR)	Action	Time Constraint Y/N	Remarks / Applicability
43	15.0	Operator lines up spent fuel pool vent path (opening doors through U2 fuel pool to atmosphere)	Y	Spent fuel pool boiling occurs after 40 hours.
44	24.0	RRC (Regional Response Center) resources begin arriving on site. RRC Equipment will be used to maintain a reliable condensate supply and to address longer term needs for fuel oil or borated water.	N	On site fuel supply is sufficient for greater than 2 weeks. If BWST is damaged by tornado, then a borated water supply will be required.

Attachment 1B - Sequence of Events Timeline
External Flood @ 100% power

#	ELAP Time (HR)	Action (only selected actions in AOP-002 listed)	Time Constraint Y/N	Remarks / Applicability
1	-36	Forecast indicates river level could exceed the height of the dike within the next 36 hours. Emergency procedure OP-TM-AOP-002 "Flood" initiated.	NA	Plant @100% power
2	-35 to -12	Operators maximize condensate tank (CO-T-1A & CO-T-1B) and demineralized water tank (DW-T-2) inventory.	Note 1	
3	-30	Operators install drain plugs, close drain valves and inflate seals for AB & FHB Missile shield doors	Note 1	
4	- 30 to - 18	Operator connects hose from DF-V-41 to pipe in DGB, connects hose to fuel oil pipe in TB, and routes hose to FLEX DG Fuel Oil Tank (FX-T-2). Operator starts DF-P-1C and initiates fill of FX-T-2	Note 1	DF-P-1C can fill FX-T-2 in approx 10 hours
5	- 30 to - 12	Maintenance installs flood barriers and stages, consumables within the flood protected area	Note 1	
6	- 22 to - 2	Maintenance installs U2 flood barriers and stages, consumables within the flood protected area	Note 1	
7	- 20	Plant shutdown and cooldown initiated	Y	
8	- 19 to - 12	Vent the main generator hydrogen and purge with CO2	N	
9	-18	Reactor is shutdown	Y	
10	-16	RC-P-1C and RC-P-1D shutdown and cooldown initiated	N	
11	-13	RCS cooldown terminated - RCS temperature at 390F - RCS pressure 425 psig - Pressurizer level 200 to 220 inches - CF-V-1A & B closed - MU-V-33C & D closed - OTSG pressure A & B at 175 psig - OTSG Level A & B at 97 to 99 % op rg	N	
12	-10	RCS boron concentration exceeds cold shutdown boron concentration requirement	N	
13	-9 to -8	Operator transfers a pressurizer heater group (RC-HTR-GRP- 8 or 9) to the ES power supply	Note 1	
14	-6	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.	Note 1	

Attachment 1B - Sequence of Events Timeline
External Flood @ 100% power

#	ELAP Time (HR)	Action (only selected actions in AOP-002 listed)	Time Constraint Y/N	Remarks / Applicability
15	-4	Operator lines up FX-P-1A & B path from BWST to RCS Operator connects hose from FLEX feedwater header to the FLEX primary low pressure header, and lines up FLEX makeup to the SF pool.	Note 1	
16	-3	Operator connects power cable to FX-P-5A or B and hose from FX-P-5A & B discharge to FX-T-3A or B.	Note 1	
17	-2	Operator opens breakers for BWST tunnel sump pumps and closes WDL-V-612	Note 1	
18	-1	Operator strips unprotected DC circuits from DC system (OP-TM-734-903 & 904)	Note 1	Prevents loss of battery capacity
19	0	River level exceeds the height of the dike. LOOP occurs and Emergency Diesel Generators fail to energize ES buses.	NA	Failures per NEI 12-06
20	0	EFW actuated: Steam driven pump (EF-P-1) starts and EFW Control valves (EF-V-30A & B) are available to supply feedwater. RCS hot leg and cold leg temperatures diverge. OTSG pressure is dropping slowly.	NA	Automatic plant response
21	< .02	EOP initiated	NA	
22	< 0.05	Letdown isolates (MU-V-3) automatically on high temperature.	NA	Automatic plant response
23	< 0.08	Control Room operators throttle ADV to reduce OTSG pressure, maintain OTSG level with EFW control valves, and stabilize RCS temperature. Adequate core cooling is provided through RCS natural circulation and heat removal through the OTSG. RCS conditions follow: - RCS temperature at 400F - RCS pressure 425 psig - Pressurizer level 200 to 220 inches - OTSG pressure A & B at 150 psig - OTSG Level A & B is at "flooded nozzle" (97 to 99 % operating range)	N	
24	< 0.08	Control Room operators attempt to start and load SBO Diesel Generator	N	
25	< 0.10	Control Room operator closes RCP Controlled Bleed Off Isolation Valve (MU-V-26)	N	Contain RCS losses within Reactor Bldg.

Attachment 1B - Sequence of Events Timeline
External Flood @ 100% power

#	ELAP Time (HR)	Action (only selected actions in AOP-002 listed)	Time Constraint Y/N	Remarks / Applicability
26	< 0.17	Control room operators recognize SBO Diesel generator is not functional	N	Failure per NEI 12-06. .
27	0.25	Operator performs E-plan offsite notifications & communication using satellite phones	N	
28	< 0.25	Operator close FS-V-256 & FS-V-257 to terminate IA-P-1A & B cooling water flow into IB sump	N	
29	< 0.5	Operator lines up FLEX Diesel Generator	Y	Pre-condition to maintain vital AC power and restore RCS makeup
30	0.5	Operator opens doors to inverter and battery rooms for ventilation.	N	Maintain acceptable FLEX equipment cooling
31	.75	Operator strips loads from 1P & 1S 480V Buses, and 1A & 1B ES MCC to prepare to load FLEX diesel generator	Y	Pre-condition to maintain vital AC power and restore RCS makeup
32	< 1.0	Operator starts FLEX Diesel Generator, energizes FLEX Distribution Panel and closes breakers to energize 1P-1S 480V cross tie bus	Y	Pre-condition to maintain vital AC power and restore RCS makeup
33	1.0	Operator closes breakers to energize 1P 480V Bus, 1S 480V Bus, 1A ES MCC and 1B ES MCC	Y	Pre-condition to maintain vital AC power and restore RCS makeup
34	1.25	Operator closes breakers for selected loads on 1A and 1B ES MCC - Battery Chargers - AC Power to Inverters & Vital Instruments - FLEX RCS Makeup Pumps - Emergency Lighting - Pressurizer heater group	Y	Pre-condition to maintain vital AC power and restore RCS makeup
35	1.5	Operator starts FLEX RCS Makeup Pump (A or B) and throttles FX-V-103A (B) to maintain pressurizer level above 200 inches	Y	Objective to restore makeup with 4 hours is conservative
36	2.0	If backup feedwater is required, then operator starts FX-P-2A or B and throttles open FX-V-206A and FX-V-206B to control OTSG level.	N	
37	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	Bottled air system will last at least 3 hours, and then manual control is required.

Attachment 1B - Sequence of Events Timeline
External Flood @ 100% power

#	ELAP Time (HR)	Action (only selected actions in AOP-002 listed)	Time Constraint Y/N	Remarks / Applicability
38	2.5	Operator strips loads on 1A ESV MCC and installs jumper between 1A ESV MCC and 1A Radwaste MCC	N	
39	3.0	Operator energizes1A ESV MCC and 1A Radwaste MCC, and Closes CBO Isolation Valves MU-V-33A and MU-V-33B	N	
40	3.5	Operator starts FX-P-5A or B, as needed, to maintain level in FX-T-3A and B.	Y	Required for continued operation of FX-Y-1A or B. Pre-staged fuel supply will last 3 hours at full load.
41	4.0	Operator sets up and starts temporary ventilation in CB, IB and TB.	N	
42	15.0	Operator lines up spent fuel pool vent path (opening doors through U2 fuel pool to atmosphere)	Y	Spent fuel pool boiling occurs after 40 hours.
43	24.0	RRC (Regional Response Center) resources available …limited capability to transport any resources until 72 hours due to water level on site	N	
44	> 24	Operator throttles open FX-V-101 as needed to maintain SFP level.	Y	Spent fuel pool boiling occurs after 40 hours.
45	96	Transfer portable diesel-driven pump (FX-P-3 or 4) from FLEX storage facility (FSF) to road next to the river, route suction hose into river, and route discharge hose to CO-T-1B.	Y	Minimum condensate supply would last greater than 48 hours after water recedes (at 72 hrs).

NOTE 1: In the event of a flood, additional resources are applied to ensure the proactive actions can be completed within the described timeline.

Attachment 1C - Sequence of Events Timeline
Extreme Cold, Snow and Ice @ 100% power

#	ELAP Time (HR)	Action	Time Constraint Y/N	Remarks / Applicability
	-8	Weather predicts extreme cold conditions Staff augmentation is initiated	NA	
	-4	Staff augmentation is complete	NA	
1	0	Extreme cold, snow or ice causes LOOP All control rods are inserted and the reactor is shutdown.	NA	
2	0	Emergency Diesel Generators fail to energize ES buses.	NA	Failures per NEI 12-06
3	< .01	EFW 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
4	< .02	EOP initiated	NA	
5	< 0.05	RCS Letdown is automatically isolated on high temperature (MU-V-3 closes).	N	Automatic plant response
6	< 0.08	Control Room operators throttle ADV to stabilize OTSG pressure and RCS temperature. Adequate core cooling is provided through RCS natural circulation and heat removal through the OTSG.	N	
7	< 0.08	Control Room operators attempt to start and load SBO Diesel Generator	N	
8	< 0.10	Control Room operator closes RCP Controlled Bleed Off Isolation Valve (MU-V-26)	N	Contains RCS losses within the Reactor Bldg.
9	< 0.17	SBO Diesel generator is not functional	N	Failure per NEI 12-06.
10	0.25	Operator initiates E-plan. If needed, satellite phones are used for offsite notifications & communication	N	
11	0.25	Operators open main condenser vacuum breaker (VA-V-8) and valves to vent Main Generator H2 to atmosphere	Y	This is a pre-condition to reduce DC loads.
12	0.25	Control Room operator secures DC powered FW pump lube oil pumps (LO-P-9A and LO-P-9B)	Y	DC Load shedding

Attachment 1C - Sequence of Events Timeline
Extreme Cold, Snow and Ice @ 100% power

#	ELAP Time (HR)	Action	Time Constraint Y/N	Remarks / Applicability
13	0.5	Operator opens doors to inverter and battery rooms.	N	
14	0.5	Operator de-energizes instrument systems not required for FLEX.	Y	DC Load shedding
15	< 0.75	Operator lines up CO2 purge for main generator	N	Minimize risk of main generator fire
16	1.0	Control room operator secures Main Turbine Lube Oil Pump LO-P-6	Y	DC load shedding
17	1.5	Operator lines up FLEX Diesel Generator	Y	Pre-condition to maintain vital AC power and restore RCS makeup.
18	< 2.0	Control room operator secures Main Generator Seal Oil Pump (GN-P-2).	Y	DC load shedding
19	2.0	Operator lines up FLEX RCS Makeup Pump from BWST to RCS	Y	Pre-condition to restore RCS makeup.
20	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	Bottled air system will last at least 3 hours, and then manual control is required.
21	2.25	Operator strips loads from 1P & 1S 480V Buses, and 1A & 1B ES MCC to prepare to load FLEX diesel generator	Y	Pre-condition to maintain vital AC power and restore RCS makeup.
22	2.5	Operator starts FLEX Diesel Generator, energizes FLEX MCC and closes breakers to energize 1P-1S 480V cross tie bus	Y	Pre-condition to maintain vital AC power and restore RCS makeup.
23	2.58	Operator closes breakers to energize 1P 480V Bus, 1S 480V Bus, 1A ES MCC and 1B ES MCC	Y	Pre-condition to maintain vital AC power and restore RCS makeup.
24	2.75	Operator closes breakers for selected loads on 1A and 1B ES MCC Battery Chargers AC Power to Inverters & Vital Instruments FLEX RCS Makeup Pumps Emergency Lighting	Y	Pre-condition to maintain vital AC power and restore RCS makeup.

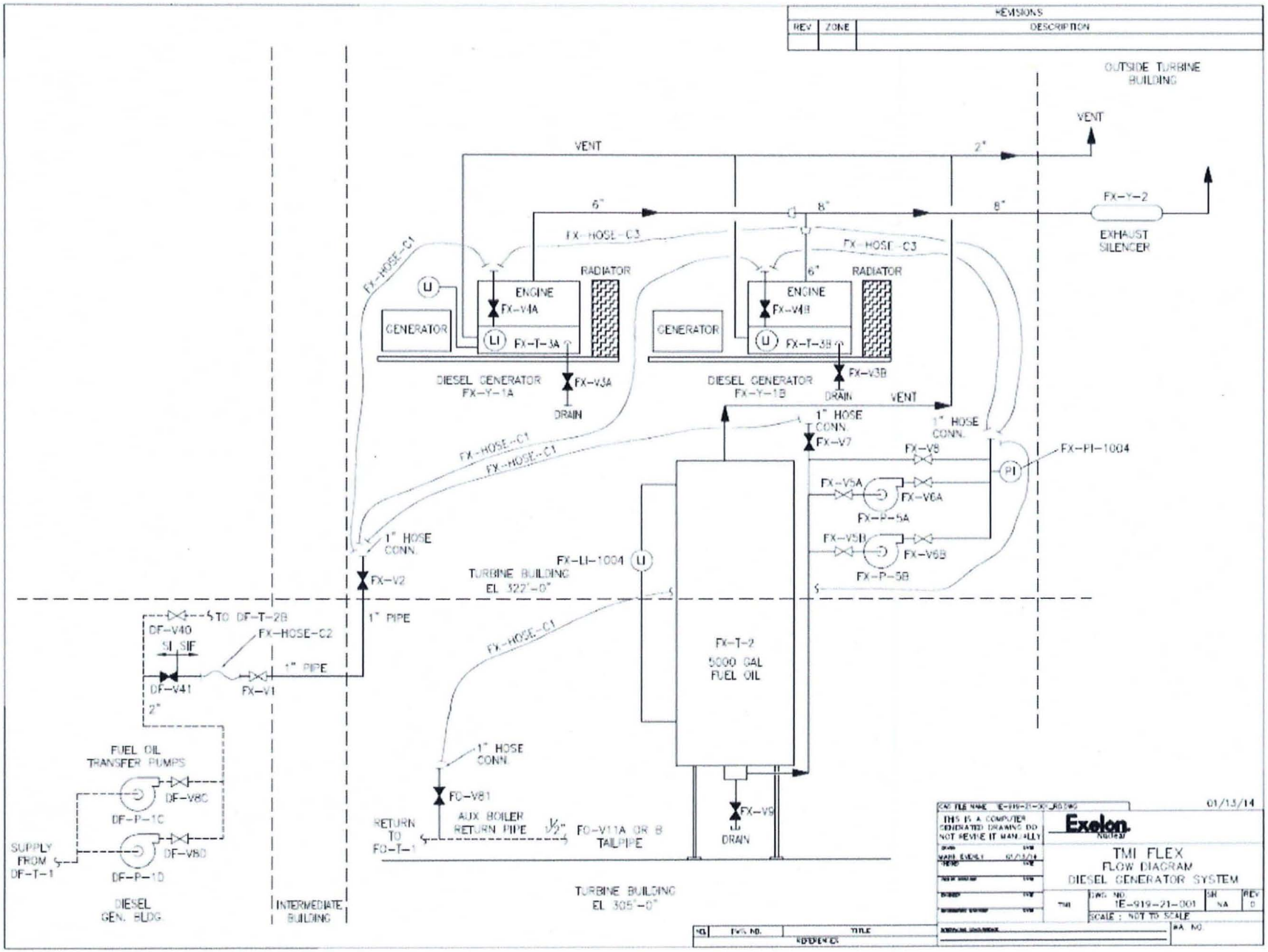
Attachment 1C - Sequence of Events Timeline
Extreme Cold, Snow and Ice @ 100% power

#	ELAP Time (HR)	Action	Time Constraint Y/N	Remarks / Applicability
25	3.0	Operator starts FLEX RCS Makeup Pump (A or B) to restore RCS inventory and increase RCS boron concentration.	Y	Restore makeup within 4 hours to prevent interruption of core cooling.
26	4.0	Operator connects hose from DF-V-41 to pipe in DGB, connects hose to fuel oil pipe in TB, and routes hose to FLEX DG Fuel Oil Tank (FX-T-3A or B)	Y	Pre-condition to maintain fuel supply to FX-Y-1A or B
27	4.0	Operator strips loads on 1A ESV MCC & 1A Radwaste MCC and installs jumper between 1A ESV MCC and 1A Radwaste MCC. Operator ensures BWST heat trace is energized.	N	
28	4.0	Operator starts DF-P-1C or DF-P-1D, as needed, to maintain level in FX-T-3A and B.	Y	Required for continued operation of FX-Y-1A or B. Pre-staged fuel supply will last 3 hours at full load.
29	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	Isolate RCP controlled bleed off flow to minimize RCS loss rate.
30	5.0	When pressurizer level reaches 100 inches, then operator throttles open MS-V-4A & B to initiate a cooldown and controls pressurizer level at 100 inches. Cooldown rate will be less than 30 F/HR	N	Pre-condition to enable back-op feedwater capability.
31	7.0	Operator strips loads on 1C ESV MCC, energizes 1C ESV MCC, and closes breakers for CF-V-1A and CF-V-1B. When a reliable steam bubble is established or if RCS pressure drops below 300 psig, then CLOSE CF-V-1A & CF-V-1B .	N	Contingency actions
32	7 to 8	Operator transfers a pressurizer heater group (RC-HTR-GRP- 8 or 9) to the emergency power supply and energizes heaters	N	Hydraulic control of RCS pressure can be used if required.
33	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, opens FX-V-203, FX-V-205, EF-V-67A and EF-V-67B.	N	Pre-condition to enable back-op feedwater capability.

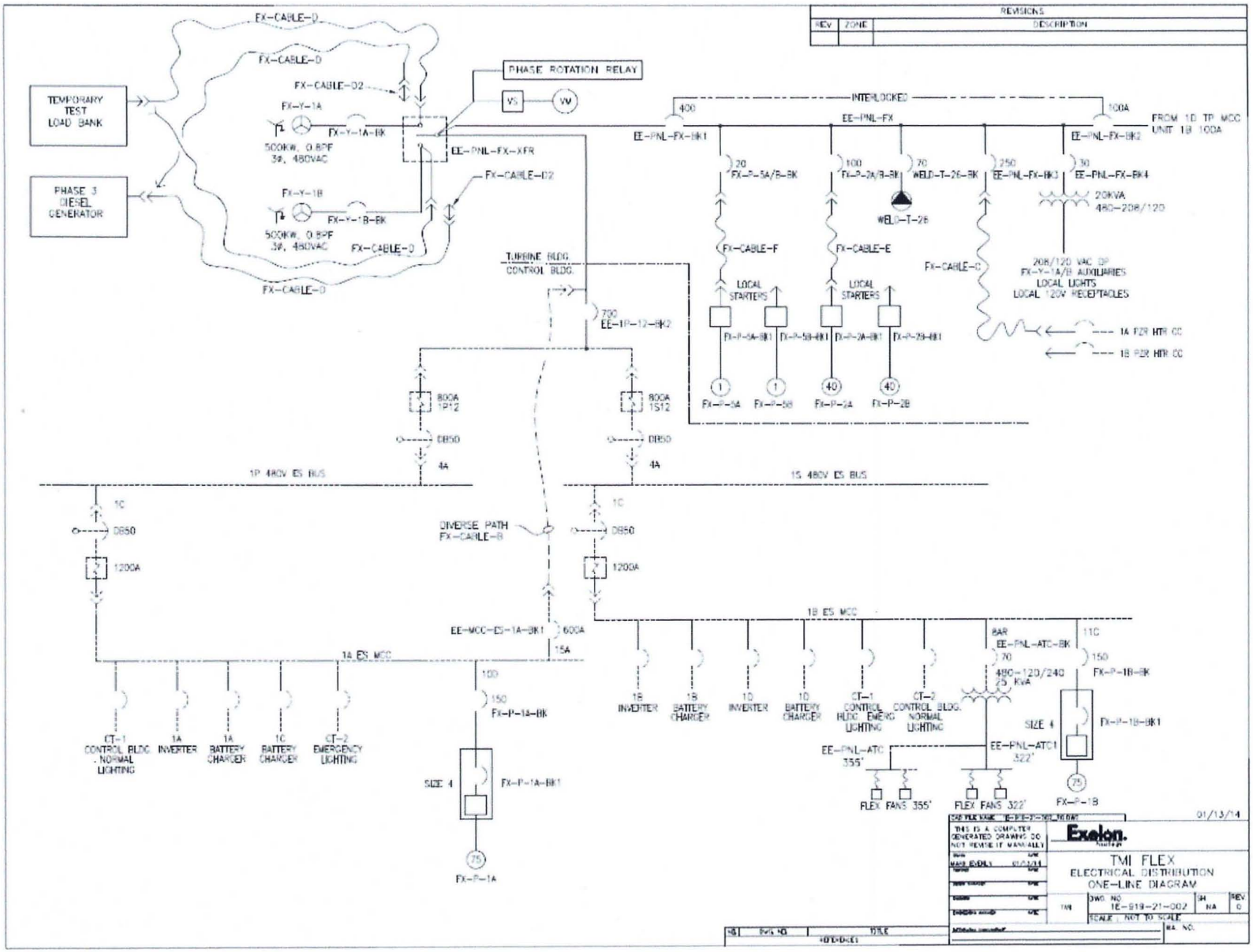
Attachment 1C - Sequence of Events Timeline
Extreme Cold, Snow and Ice @ 100% power

#	ELAP Time (HR)	Action	Time Constraint Y/N	Remarks / Applicability
34	< 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 (all action TB 322 north).	N	The design objective is to enable back-op feedwater capability within 12 hours.
35	10.0	RCS cooldown is complete. • Incore temperature 400F • OTSG A & B Pressure 150 psig • RCS Pressure 400 psig	N	
36	12.0	Operator connects a hose from main steam drain line to piping connected to condensate tank B and initiates tank heating.	N	
37	12.0	Operator opens SF-V-88, connects hose from FLEX feedwater header to the FLEX primary low pressure header, monitors SF pool level and throttles FX-V-101 open as needed to maintain SFP level.	Y	Spent fuel pool boiling occurs after 40 hours.
38	15.0	Operator lines up spent fuel pool vent path (opening doors through U2 fuel pool to atmosphere)	Y	Spent fuel pool boiling occurs after 40 hours.
39	24.0	RRC (Regional Response Center) resources begin arriving on site. RRC Equipment will be used to maintain a reliable condensate supply and to address longer term needs for fuel oil or borated water.	N	
40	48	Transfer hose and portable diesel-driven pump (FX-P-3 or 4) from FLEX storage facility (FSF) to road next to the river, route suction hose into river, and route discharge hose to CO-T-1B.	Y	Minimum condensate supply would last greater than 72 hours.

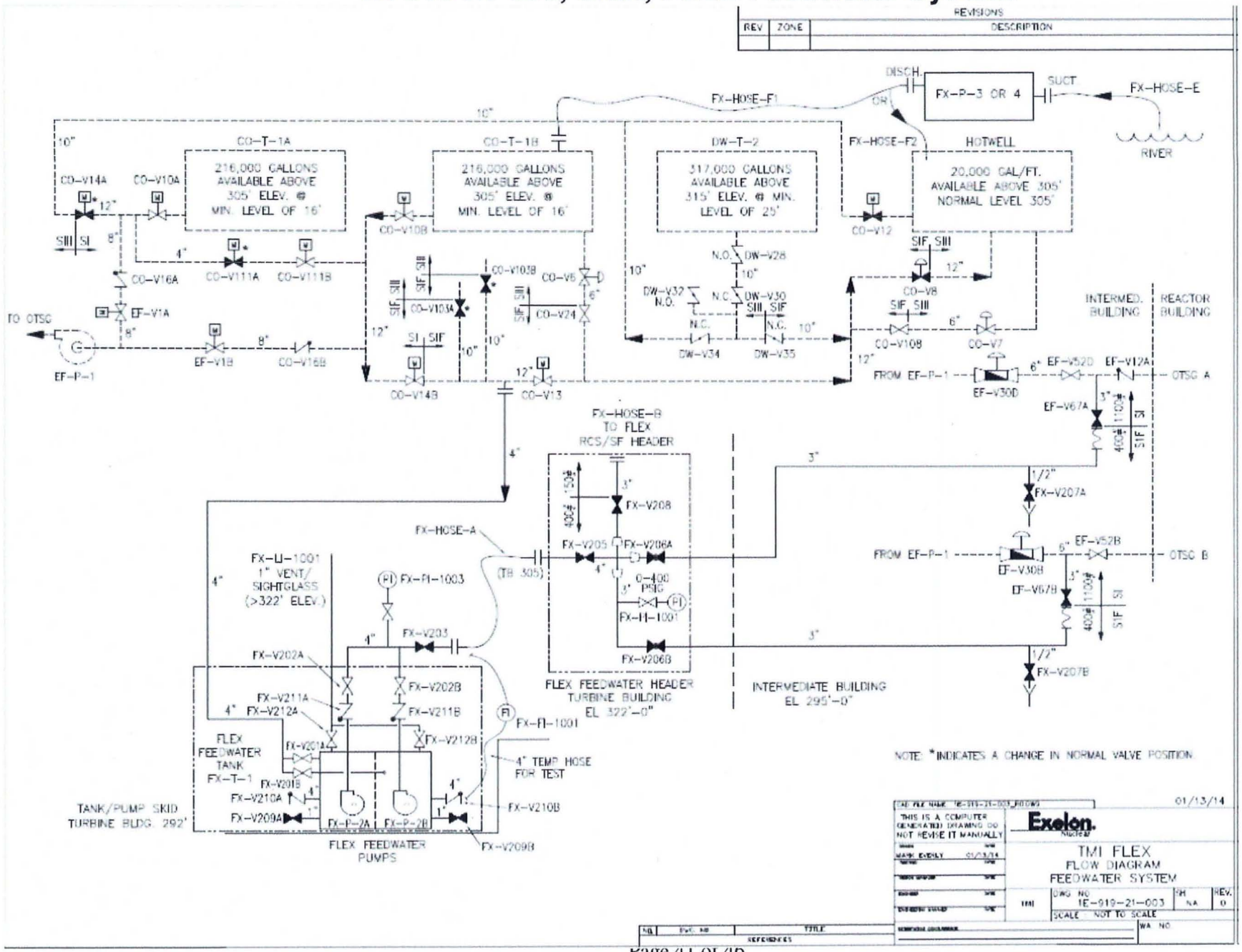
Attachment 2A
1E-919-21-001, draft, FLEX Diesel Generator and Fuel Oil System



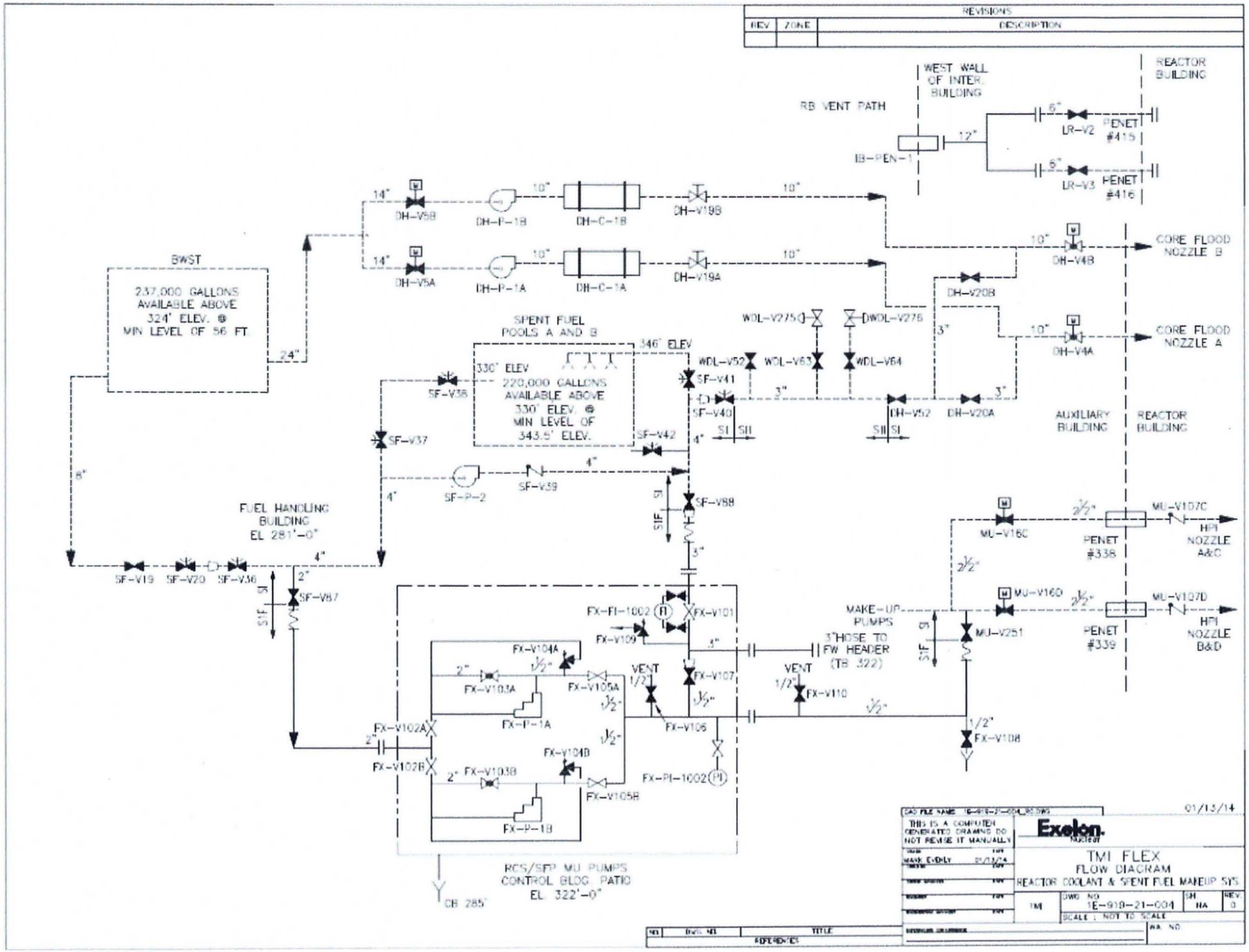
Attachment 2B
1E-919-21-002, draft, FLEX Electrical Distribution



Attachment 2C
1E-919-21-003, draft, FLEX Feedwater System



Attachment 2D
1E-919-21-004, draft, FLEX RCS and SFP Makeup System



Attachment 3

Interim Staff Evaluation Open Items

NRC issued their Interim Staff Evaluation for the TMI-1 Plan for compliance with Order EA 12-049 on December 17, 2013. The Interim Staff Evaluation (ISE) identified four open items. This document provides specific details of the TMI plan in response to those items. (1 &2) Describe the basis that RCS inventory will remain adequate for core cooling based on WCAP 17792 (3) An alternate method for evaluation of available condensate sources and (4) An alternate approach using pre-staged diesel generators.

OPEN ITEMS #1 & 2

The ISE items 3.2.1.1.B and 3.2.1.1.C requested the following: "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." and "As applicable, provide additional analyses for core cooling, RCS makeup, and shutdown margin that are relied upon, but not included in WCAP-17792-P."

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 MAAP analysis and PWROG analysis described in WCAP 17792P.

The time from the ELAP occurrence until the point at which the loss of RCS inventory could interrupt natural circulation was conservatively estimated using MAAP. For this analysis, RCS leakage was assumed to be 20 GPM (with RCS at normal operating pressure of 2155 psig). Design and testing of the Flowserve N-9000 seal indicate that the total loss rate through the seal package (controlled bleed off flow and seal leakage) would be less than 11 GPM @ 2155 psig. The MAAP analysis showed there is greater than 6.5 hrs before water level in either hot leg reaches 3 inches above the bottom of the hot leg.

WCAP 17792P, Figure C.5-2 "ELAP Estimated Time to LOHT for 400" Pressurizer Scale Plants" provides a method to estimate the time until loss of heat transfer following an ELAP. The WCAP method used generic bounding plant design parameters, and conservatively ignores the water inventory in the pressurizer below 0" indication. Of the two B&W designs, TMI-1 has a pressurizer with a 400 inch measurement scale. To use the WCAP Figure the RCS loss rate (11 GPM) is converted to a "Pressurizer Level Rate of Change" of 0.46 inches/min based on a pressurizer inside diameter of 84 inches, and an initial post reactor trip pressurizer level of 100 inches. 100" is a conservative estimate of pressurizer level following an ELAP or LOOP where T_{AVG} is significantly higher due to the lack of forced RCS flow. Using WCAP 17792P, Figure C.5-2, the "Time to Loss of Heat Transfer" is approx. 5.5 hours.

The TMI FLEX strategy is to 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 remains shutdown. Cycle specific reactivity analysis has been completed 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 Xenon. The TMI strategy injects additional boron to compensate for RCS losses. This adds shutdown margin beyond that credited in the analysis completed.

Attachment 3

Interim Staff Evaluation Open Items

References:

TM-FLEX-001 "Core Cooling Analysis for FLEX"

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

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

OPEN ITEM #3

The ISE described item 3.2.4.7.A as "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."

NEI 12-06 3.2.1.3.3 "Cooling and makeup water inventories contained in systems or structures with designs that are robust with respect to seismic events, floods, and high winds, and associated missiles are available." All of the condensate source relied upon for the TMI BDBEE Mitigation strategy were not protected by design from high wind conditions but as described below there is reasonable assurance that one or more of these three sources would be available after a high wind event. This is an alternate strategy which complies with Order EA 12-049.

The applicable high wind hazard based on the TMI-1 geographical location and Regulatory Guide 1.76 is a tornado wind speed of 200 mph. 95% of the tornadoes recorded by NOAA in the last 60 years within a 50 miles radius of TMI had a maximum estimated wind speed of 157 mph or less. The condensate storage tanks (CO-T-1A and CO-T-1B) are designed to withstand design basis tornado wind loads of 300 mph. Both condensate storage tanks will maintain their integrity when subjected to wind load from a tornado. The demineralized water storage tank (DW-T-2) is capable of withstanding a tornado wind speed of 185 mph. In the event of high winds (either from hurricane or tornado), both condensate storage tanks will be available and it is very likely that DW-T-2 will remain available.

The condensate storage tanks and DW-T-2 were not protected by design against tornado-generated missiles. However, there is reasonable assurance that one or more of these three tanks would not be damaged by wind generated missiles. This conclusion is based similar considerations as described for protecting FLEX equipment in NEI 12-06 (i.e., the equipment is located "in diverse locations" and is "adjacent to existing robust structures", and "separation" is considered based on the "predominant path of tornados in the geographical location").

The three potential condensate source tanks are located as follows: 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. TMI Class 1 structures are designed for aircraft impact per plant's design basis. These structures limit the generated missile pathways and thereby minimize the probability of missile impact. In addition to the Class I structures separating the tanks east and west, DW-T-2 is further shielded by adjacent robust structures: the Chemical Cleaning Building at the east side, the Unit 2 Auxiliary building at the west side and the Unit 2 BWST and Unit 2 Control Building from the south side.

Based on a review of historical records, the predominant tornado pathway for TMI is from southwest toward northeast. CO-T-1B & CO-T-1A tanks are separated by 392 feet, CO-T-1A and DW-T-2 are separated by 430 feet, and CO-T-1B and DW-T-2 are separated by 542 feet. The separation between CO-T-1B and DW-T-2 is approximately perpendicular to the expected travel pathway of the tornado.

Within the last 60 years, 85% of the tornados within a 50 mile radius from TMI-1 were less than 450 feet wide. Given the historical tornado width and the separation between CO-T-1B and DW-T-2, only one of those tanks would be within the tornado path.

Therefore, based on the separation, adjacent robust structures and the predominant tornado pathway there is reasonable assurance that if a tornado was to strike TMI, one or more of these three tanks would not be damaged by wind generated missiles.

References:

(1) Technical Evaluation 13-00476 "FLEX Strategy Design Evaluation for CO-T-1A/1B and DW-T-2"
(2) Technical Evaluation 13-00477 "TMI-1 Tornado Study For FLEX Strategy"

OPEN ITEM #4

The ISE described item 3.2.4.8.B as "On page 37 of the Integrated Plan, the licensee states that two (2) diesel generators along with Fuel Tanks will be pre-staged in a protected enclosure on the 322' elevation of the Turbine Building. Provide justification addressing the flexibility of this alternate approach to mitigate BDBEEs."

The TMI FLEX strategy complies with EA-12-049, but is an alternate approach to NEI-12-06 in that it relies upon two new installed RCS makeup pumps and two new installed diesel generators.

The new RCS makeup pumps will be installed in the tornado protected seismic Class I control bldg at 322' elevation (above the TMI site flood elevation of 313.3'). The two new diesel generators will be installed on a new platform at 322' elevation in the Turbine Building. The structure supporting the diesel generators will provide adequate support during a flood, seismic or tornado event. The diesel generators will be shielded to ensure their function is satisfied with regard to tornado winds and missiles.

The B&W RCS and Steam Generator configuration results in a challenging timeline for response to an ELAP event at TMI. Conserving RCS inventory and promptly restoring RCS makeup are key elements in the TMI FLEX strategy. RCS makeup capability (greater than RCS loss rate) will be established within four hours in order to maintain continuous core cooling. The TMI FLEX strategy is dependent on a more timely response than can be reliably implemented using portable equipment. Additionally, portable equipment and associated connections could not be staged at grade as they would be impacted by the flood event (flood level is approx. 8 feet above grade around the main plant structures).

Even though the new diverse RCS makeup and electrical power supply capabilities are installed, this approach has significant flexibility to mitigate Beyond Design Basis events. The RCS makeup pumps can utilize the safety related electrical power supply or the FLEX power supply. These pumps can use multiple water sources to inject water into the RCS. The FLEX feedwater pumps can be used to supply water to the Steam Generators, the Spent Fuel Pool or directly to the RCS in low pressure conditions. The FLEX electrical power supply can provide power to either ES power train or the FLEX power distribution panel. These new capabilities provide significant mitigation value and flexibility for events not described in NEI 12-06 or NRC Order EA 12-049.

Attachment 4

FLEX Power Supply – Electrical Load Summary

DESCRIPTION of LOAD (see NOTE 1)	Max. Load (Amps @ 480V)
Inverter 1A (NOTE 3) (NOTE 4)	25
Inverter 1B (NOTE 3)	21
Inverter 1D	16
Battery Charger 1A (NOTE 2)	45
Battery Charger 1C (NOTE 2)	45
Battery Charger 1B (NOTE 2)	45
Battery Charger 1D (NOTE 2)	45
Emergency Lighting (CB, TB, AB & IB)	50
DF-P-1C	0.4
FX-P-1A (or FX-P-1B)	87
FX-P-2A (or FX-P-2B)	52
BWST Heater (65 kW)	78
Pressurizer Heater Group 8 (84kW)	101
Portable Fans (4@ 1 kW and 3@ 1.5kW)	12
one of MU-V-33A,B,C,D or CF-V-1A or CF-V-1B	5
Maximum required load (480v Amps)	**617**
FLEX Diesel capacity 500KW @ 0.9 pf (Amps)	**668**
Maximum required load as % of FLEX DG Capacity	**92%**

NOTE 1: This list describes the loads for the maximum required electrical load condition which occurs during an extreme cold scenario when BWST heating is required and when the OTSG is available (and Pressurizer heaters and High Pressure RCS makeup are required).

NOTE 2: This is load while the batteries are being recharged. Once battery voltage is restored, the load is approximately 10 amps per charger.

NOTE 3: This is a conservative load which does not reflect planned load shed actions.

NOTE 4: ICS AUTO load is included with 1A Inverter. This load remains but is is transferred to the 1E Inverter during the event as part of DC load shed actions.