



Order No. EA-12-049

RS-15-216  
TMI-15-083

August 28, 2015

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: 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)

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)

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. 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

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. References 6, 7, 8, and 9 provided the first, second, third, and fourth six-month status reports, respectively, 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 fifth 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 10.

It is noted that open issues were identified by the NRC during the NRC on-site audit review conducted on August 10-13, 2015 that require additional follow-up with the NRC staff and could affect the final strategies.

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 28<sup>th</sup> day of August 2015.

Respectfully submitted,



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

Enclosure:

1. Three Mile Island Nuclear Station, Unit 1 Fifth 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  
NRC Senior Resident Inspector – Three Mile Island Nuclear Station, Unit 1  
NRC Project Manager, NRR – Three Mile Island Nuclear Station, Unit 1  
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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**

**Three Mile Island Nuclear Station, Unit 1**

**Fifth 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**

(23 pages)

## Three Mile Island Station, Unit 1

### Fifth 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 (February 2015), 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 February 27, 2015 and are current as of August 28, 2015:

- Engineering for
  - FLEX Electrical Power Supply
  - FLEX RCS & SFP Makeup
  - FLEX Feedwater System
  - FLEX Storage Facility
  - FLEX fuel oil supply
  - Spent Fuel Pool Level
  - On Site Communications modification
- Installation of the FLEX Platform modification is complete

## 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 SNRC	Complete

Three Mile Island Nuclear Station, Unit 1 Fifth Six Month Status Report  
for the Implementation of FLEX, August 28, 2015

Original Target Completion Date	Activity	Status
	6 Month Updates	
Aug., 2013	Update 1	Complete
Feb., 2014	Update 2	Complete
Aug., 2014	Update 3	Complete
Feb., 2015	Update 4	Complete
Aug., 2015	Update 5	Complete with this submittal
	Modification Development	
Oct 2014	Phase 1 modifications (1) RCP Seal Upgrade	(1) Complete
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 Structure (6) Turbine Bldg FLEX platform (7) FLEX fuel oil supply (8) Spent Fuel Pool Level (9) On Site Communications modification (10) Reactor Building Vent (11) Satellite phone storage	(1) Complete (2) Complete (3) Complete (4) Complete (5) Started (6) Complete (7) Complete (8) Complete (9) Complete (10) Complete (11) Complete
Oct 2014	Phase 3 modifications	None
	Modification Implementation	
Nov 2015	Phase 1 modifications (1) RCP Seal Upgrade	Not Started

Three Mile Island Nuclear Station, Unit 1 Fifth Six Month Status Report  
for the Implementation of FLEX, August 28, 2015

Original Target Completion Date	Activity	Status
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) Turbine Bldg. FLEX platform (7) FLEX fuel oil supply (8) Spent Fuel Pool Level (9) On Site Communications modification (10) Reactor Building Vent (11) Satellite phone storage	Started Started Started Started Started Complete Started Started Started Started Complete
Nov 2015	Phase 3 modifications	None

Original Target Completion Date	Activity	Status
	Procedure development	
Jun 2015	<ul style="list-style-type: none"> <li>• Create Site-Specific Procedures</li> </ul>	Started - to be completed prior to Nov 2015
Jul 2015	<ul style="list-style-type: none"> <li>• Validate Procedures (NEI 12-06, Sect. 11.4.3)</li> </ul>	Started - to be completed prior to Nov 2015
Jun 2015	<ul style="list-style-type: none"> <li>• Create Maintenance Procedures</li> </ul>	Started - to be completed prior to Nov 2015
Jul 2015	Staffing analysis	Complete
Nov 2015	Storage Plan	Complete
Nov 2015	FLEX equipment acquisition	Started
Nov 2015	Training	Started
Jun 2015	Regional Response Center Operational	Complete
Nov 2015	Unit 1 Implementation date	

#### 4 Changes to Compliance Method

The following changes are the most significant changes made to the FLEX implementation strategy since the last update (February 2015):

- Access to CO-V-8 or DW-V-35 could be impeded by internal flooding. Therefore, condensate valve CO-V-13 will be used to isolate the hotwell if the Earthquake adversely affects hotwell integrity and DW-V-30 will be used to control flow from DW-T-2 in the event of a tornado.

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

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

It is noted that open issues were identified by the NRC during the NRC on-site audit review conducted on August 10-13, 2015 that require additional follow-up with the NRC staff and could affect the final strategies.

#### 6 Open Items from Overall Integrated Plan and Interim Staff Evaluation

<b>Section Reference</b> (Refer to OIP Update from Aug 2013)	<b>Overall Integrated Plan Open Item</b> (Refer to OIP Update from Feb 2014)	<b>Status</b> (As of August 28, 2015)
None		



**Interim Staff Evaluation Open Item or Confirmatory Items**

<b>Item #</b>	<b>NRC ref no.</b>	<b>Description</b>	<b>Status</b> <b>AUG 2015 UPDATE</b>
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.	<p>(1) The potential for earthquake induced liquefaction has been evaluated. Deployment of TMI1 FLEX equipment will not be adversely impacted. (Reference 5).</p> <p>(2) 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 (References 6 and 7)</p> <p>(3) A vehicle stored in the FLEX storage facility will be used to deploy or move FLEX equipment. No additional power is required.</p> <p>This response will be completed in the compliance letter.</p>
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.	<p>A procedure (Reference 8) has been prepared which provides operators with the direction on how to obtain parameters critical to implementing the FLEX mitigation strategy without reliance on functional electrical equipment outside the reactor building after a seismic event.</p> <p>[COMPLETE]</p>
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 SNRC playbook will be made available when approved to address this.	<p>The local assembly area (Staging area "C") is the Lancaster Airport. The site staging area is the south parking lot (staging area "B"). The primary delivery method will be by truck, but airlift capability via helicopter will be available to address delivery after any hazard. The TMI SNRC playbook has been approved. (Reference 9)</p> <p>[COMPLETE]</p>

Three Mile Island Nuclear Station, Unit 1 Fifth Six Month Status Report  
for the Implementation of FLEX, August 28, 2015

Item #	NRC ref no.	Description	Status  AUG 2015 UPDATE
22	3.2.1.6.A	<p>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.</p>	<p>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.</p> <p>This response will be completed in the compliance letter.</p>
39	3.2.4.5.A	<p>The licensee provided no information in the Integrated Plan regarding local access to the protected areas under ELAP.</p>	<p>A response plan which coordinates Operations and Security response has been developed (Reference 10), which ensures the security staff can support access to the protected area within the time frame required for successful implementation. [COMPLETE]</p>
45	3.3.3.A	<p>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.</p>	<p>This response will be completed in the compliance letter.</p>

## 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. TMI Station's Fourth Six Month Status Report for the Implementation of FLEX, dated February 27, 2015
5. 990-2179 "Assessment of earthquake-induced liquefaction potential and associated ground failure hazards for Three Mile Island Unit 1", Geomatrix Consultants
6. Technical Evaluation 14-00126, FLEX Impact evaluation – Turbine Building
7. Technical Evaluation 15-00142, FLEX Impact evaluation – Non Seismic Eqpt Failures in Class I Buildings
8. OP-TM-919-907 "ALTERNATE MONITORING OF ESSENTIAL INSTRUMENTATION
9. 38-5237994-000, TMI Station SAFER Response Plan
10. SY-TM-101-102-1001, "Security system component degradation compensatory measures"

Three Mile Island Nuclear Station, Unit 1 Fifth Six Month Status Report  
for the Implementation of FLEX, August 28, 2015

## **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, Rev. 1 draft, FLEX Diesel Generator and Fuel Oil System
- 2B** 1E-919-21-002, Rev. 1 draft, FLEX Electrical Distribution
- 2C** 1E-919-21-003, Rev. 1 draft, FLEX Feedwater System
- 2D** 1E-919-21-004, Rev. 1 draft, FLEX RCS & SFP Makeup System
- 2E** 1E-919-21-005, Rev. 1 draft, Long Term water Supply

## 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 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.	N	This is a pre-condition to reduce DC loads.
12	0.5	Control Room operator secures DC powered FW pump turbine lube oil pumps (LO-P-9A & B).	N	DC Load shedding
13	0.5	Operator opens doors to inverter and battery rooms.	Y	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.	N	DC Load shedding.
15	< 0.75	Operator lines up CO2 purge for main generator.	N	Minimize risk of main generator fire.
16a	< 0.75	If earthquake occurs, then operator closes CO-V-13 and CO-V-24.	N	
16b	< 0.75	If tornado damages both CO-T-1A and CO-T-1B, then operator throttles open DW-V-30 to supply EF-P-1 from DW-T-2 until CO-V-10B is closed.	Y	Maintain EFW and minimize loss of condensate
17	< 1.0	Operators isolate fire service to IB, CB, AB or FHB, if required. (CLOSE FS-V-43, 233 or 51)	N	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.	N	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	If battery chargers have not been re-energized, then Control room operator secures Main Generator Seal Oil Pump (GN-P-2).	Y	DC load shedding is complete.
21	2.0	Actions for passive Intermediate Building ventilation are completed.	N	
22	2.0	Operator lines up FLEX RCS Makeup Pump from BWST or Spent Fuel Pool to RCS.	N	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.	N	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.	N	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, routes hose to FLEX DG Fuel Oil Tank (FX-T-3), and routes hose from FX-P-7 discharge to FX-T-2.	N	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-3.	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 energizes 1A 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 approximately 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 initiates temporary ventilation in Control Bldg, IB and Turbine Bldg.	N	
36	6.0	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.
37	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 Pressurizer steam bubble is established or If RCS pressure drops below 300 psig, then CLOSE CF-V-1A & CF-V-1B.	N	Contingency action.
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-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	Minimum condensate supply would last greater than 24 hours.
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 within 12 hours.
41	10.0	RCS cooldown is complete.  <ul style="list-style-type: none"> <li>• Incore temperature 400F</li> <li>• OTSG A &amp; B Pressure 150 psig</li> <li>• RCS Pressure 400 psig</li> </ul> Operator begins raising pressurizer level to > 300 inches	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.	N	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 props open doors from Unit 2 fuel pool area to the roof to provide a U1 spent fuel pool vent path.	N	Spent fuel pool boiling occurs after 40 hours.
44	24.0	NSRC resources begin arriving on site.  NSRC Equipment will be used to provide a quality condensate supply and to address longer term needs for fuel oil or borated water.	N	If BWST is damaged by tornado, then a borated water supply will be required.  On site fuel supply is sufficient for greater than 2 weeks.

## 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	River level exceeds 284.2 or flow exceeds 200,000 cfs. Emergency procedure OP-TM-AOP-002 "Flood" is 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 - 16	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. 14 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 cool-down 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 <ul style="list-style-type: none"> <li>- RCS temperature at 375F</li> <li>- RCS pressure 400 psig</li> <li>- Pressurizer level 200 to 220 inches</li> <li>- CF-V-1A &amp; B closed</li> <li>- MU-V-33C &amp; D closed</li> <li>- OTSG pressure A &amp; B at 165 psig</li> <li>- OTSG Level A &amp; B at 97 to 99 % op range</li> </ul>	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	FLEX truck, FX-P-3A or B, FX-P-4 and FX-Y-4 are relocated to the training center.	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	-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	
16	-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	
17	-3	Operator connects power cable to FX-P-5A or B, hose from FX-P-5A & B discharge to FX-T-3 and FX-P-7 discharge to FX-T-2.	Note 1	
18	-2	Operator opens breakers for BWST tunnel sump pumps and closes WDL-V-612	Note 1	
19	-1	Operator strips unprotected DC circuits from DC system (OP-TM-734-903 & 904).	Note 1	Prevents loss of battery capacity.
20	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.
21	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.
22	< .02	EOP initiated.	NA	
23	< 0.05	Letdown isolates (MU-V-3) automatically on high temperature.	NA	Automatic plant response.
24	< 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: <ul style="list-style-type: none"> <li>- RCS temperature at 400F</li> <li>- RCS pressure 425 psig</li> <li>- Pressurizer level 200 to 220 inches</li> <li>- OTSG pressure A &amp; B at 150 psig</li> <li>- OTSG Level A &amp; B is maintained 75 to 85 % operating range.</li> </ul>	N	

## 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
25	< 0.08	Control Room operators attempt to start and load SBO Diesel Generator.	N	
26	< 0.10	Control Room operator closes RCP Controlled Bleed Off Isolation Valve (MU-V-26).	N	Contain RCS losses within Reactor Bldg.
27	< 0.17	Control room operators recognize SBO Diesel generator is not functional.	N	Failure per NEI 12-06.
28	0.25	Operator performs E-plan offsite notifications & communication using satellite phones.	N	
29	< 0.25	Operator close FS-V-256 & FS-V-257 to terminate IA-P-1A & B cooling water flow into IB sump.	N	
30	< 0.5	Operator lines up FLEX Diesel Generator.	Y	Pre-condition to maintain vital AC power and restore RCS makeup.
31	0.5	Operator opens doors to inverter and battery rooms for ventilation.	Y	Maintain acceptable FLEX equipment cooling.
32	.75	Operator strips loads from 1P & 1S 480V Buses, and 1A & 1B ES MCC to prepare to load FLEX diesel generator.	N	Pre-condition to maintain vital AC power and restore RCS makeup.
33	< 1.0	Operator starts FLEX Diesel Generator, energizes FLEX Distribution Panel and closes breakers to energize 1P-1S 480V cross tie bus.	N	Pre-condition to maintain vital AC power and restore RCS makeup.
34	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.
35	1.25	Operator closes breakers for selected loads on A and B 480V ES Bus: <ul style="list-style-type: none"> <li>- Battery Chargers</li> <li>- AC Power to Inverters &amp; Vital Instruments</li> <li>- FLEX RCS Makeup Pumps</li> <li>- Emergency Lighting</li> <li>- Pressurizer heater group</li> </ul>	Y	Pre-condition to maintain vital AC power and restore RCS makeup.
36	1.5	Operator starts FLEX RCS Makeup Pump (A or B) and slowly raises pressurizer level above 300 inches.	N	
37	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	

## 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	2.0	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.
39	2.5	Operator strips loads on 1A ESV MCC and installs jumper between 1A ESV MCC and 1A Radwaste MCC.	N	
40	3.0	Operator energizes 1A ESV MCC and 1A Radwaste MCC, and Closes CBO Isolation Valves MU-V-33A and MU-V-33B.	N	
41	3.5	Operator use FX-V-8 to gravity drain fuel oil from FX-T-2 to maintain level in FX-T-3.	Y	Required for continued operation of FX-Y-1A or B. Pre-staged fuel supply will last 3 hours at full load.
42	4.0	Operator sets up and starts temporary ventilation in CB, IB and TB.	N	
43	15.0	Operator lines up spent fuel pool vent path (opening doors through U2 fuel pool to atmosphere).	N	Spent fuel pool boiling occurs after 40 hours.
44	24.0	NSRC resources are available. No equipment is required until after water level recedes from the site.	N	
45	> 24	Operator throttles open FX-V-101 as needed to maintain SFP level.	N	Spent fuel pool boiling occurs after 40 hours.
46	> 96	Transfer portable diesel-driven pump (FX-P-3A or FX-P-3B) from temporary offsite storage to road next to the river, route suction hose into river, and route discharge hose to CO-T-1B.	N	Minimum condensate supply would last greater than 48 hours after water recedes.

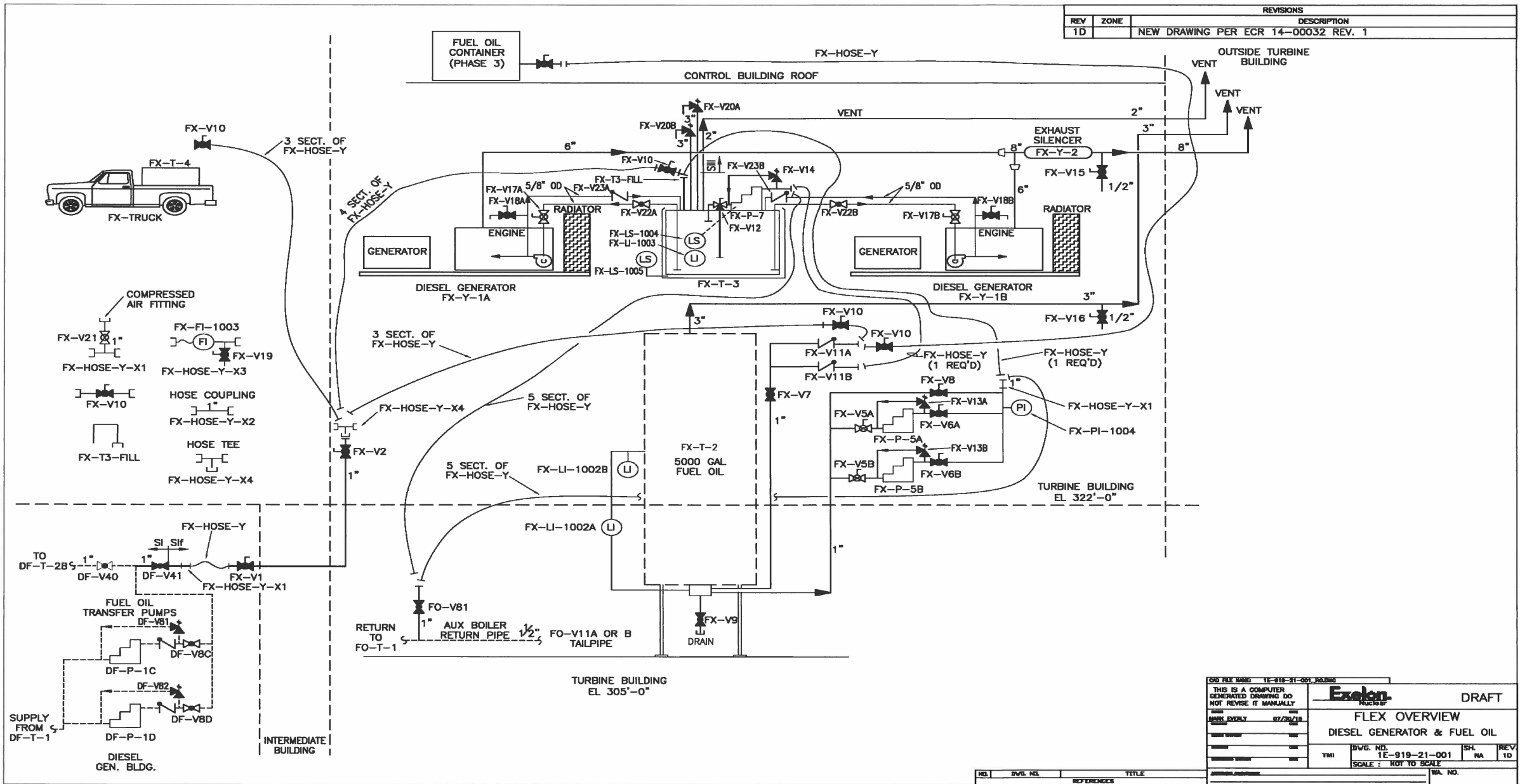
NOTE 1: In the event of a flood, additional resources are applied to ensure the proactive actions can be completed within the described timeline.

## 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	
		<b>See Attachment 1A items 2 through 41.</b>		
42	12.0	Operator connects a hose from main steam drain line to piping connected to condensate tank B and initiates tank heating.	N	
43	12.0	BWST immersion heater 1A is energized from 1A ESF MCC.	N	
44/ 45		<b>See Attachment 1A items 42 and 43.</b>		
46	48	Establish condensate resupply using (1) Portable diesel-driven pump (FX-P-3A or FX-P-3B) placed on ramp with suction hose into river, and route discharge hose to CO-T-1B or (2) Portable submersible (FX-P-6A & B) dropped into ISPH pump bay and discharge routed to CO-T-1B.	N	Minimum condensate supply would last greater than 72 hours.

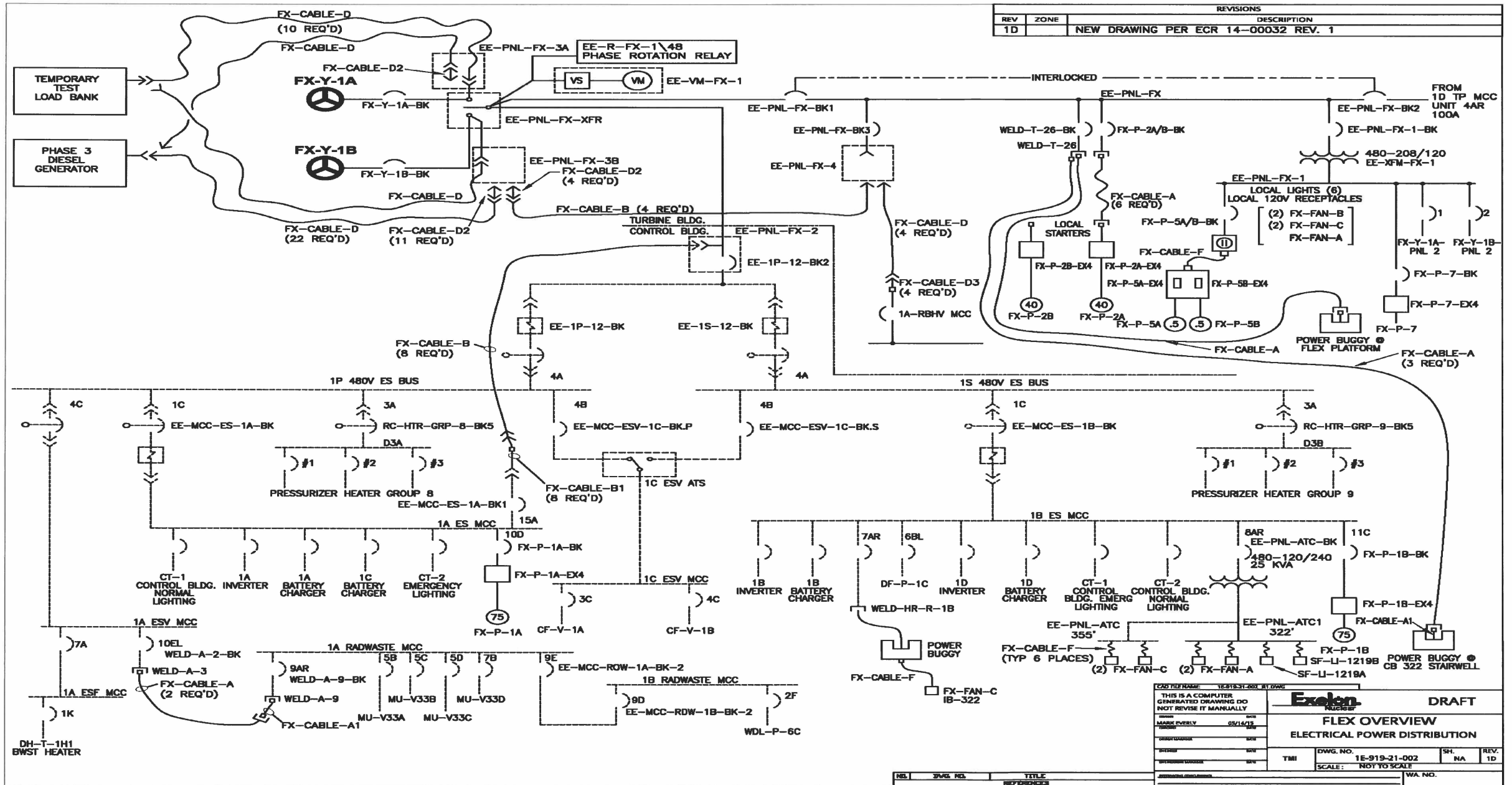
# Attachment 2A

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



# Attachment 2B

## 1E-919-21-002, draft, FLEX Electrical Distribution

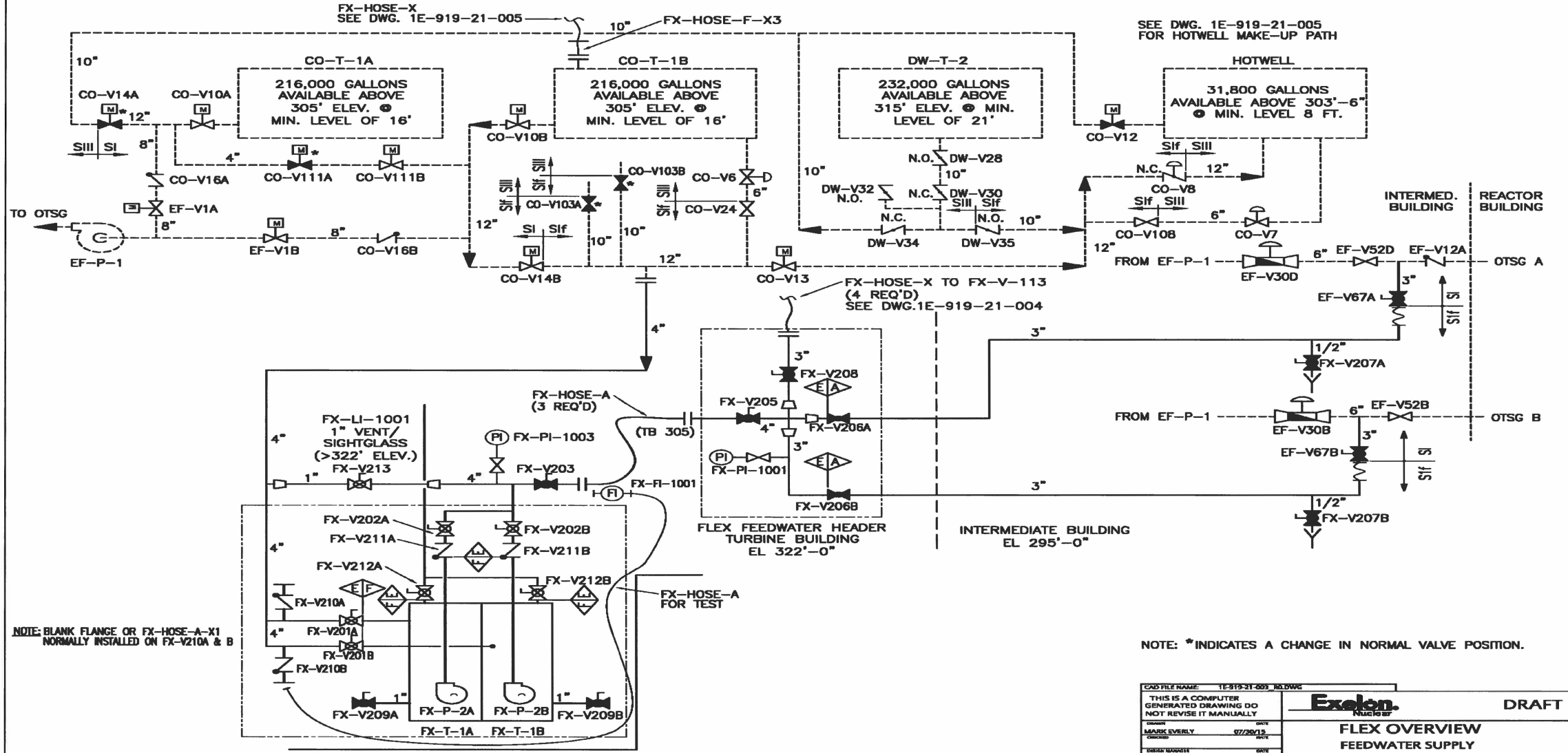




# Attachment 2C

## 1E-919-21-003, draft, FLEX Feedwater System

REVISIONS		
REV	ZONE	DESCRIPTION
1D		NEW DRAWING PER ECR 14-00032 REV. 1



NOTE: \*INDICATES A CHANGE IN NORMAL VALVE POSITION.

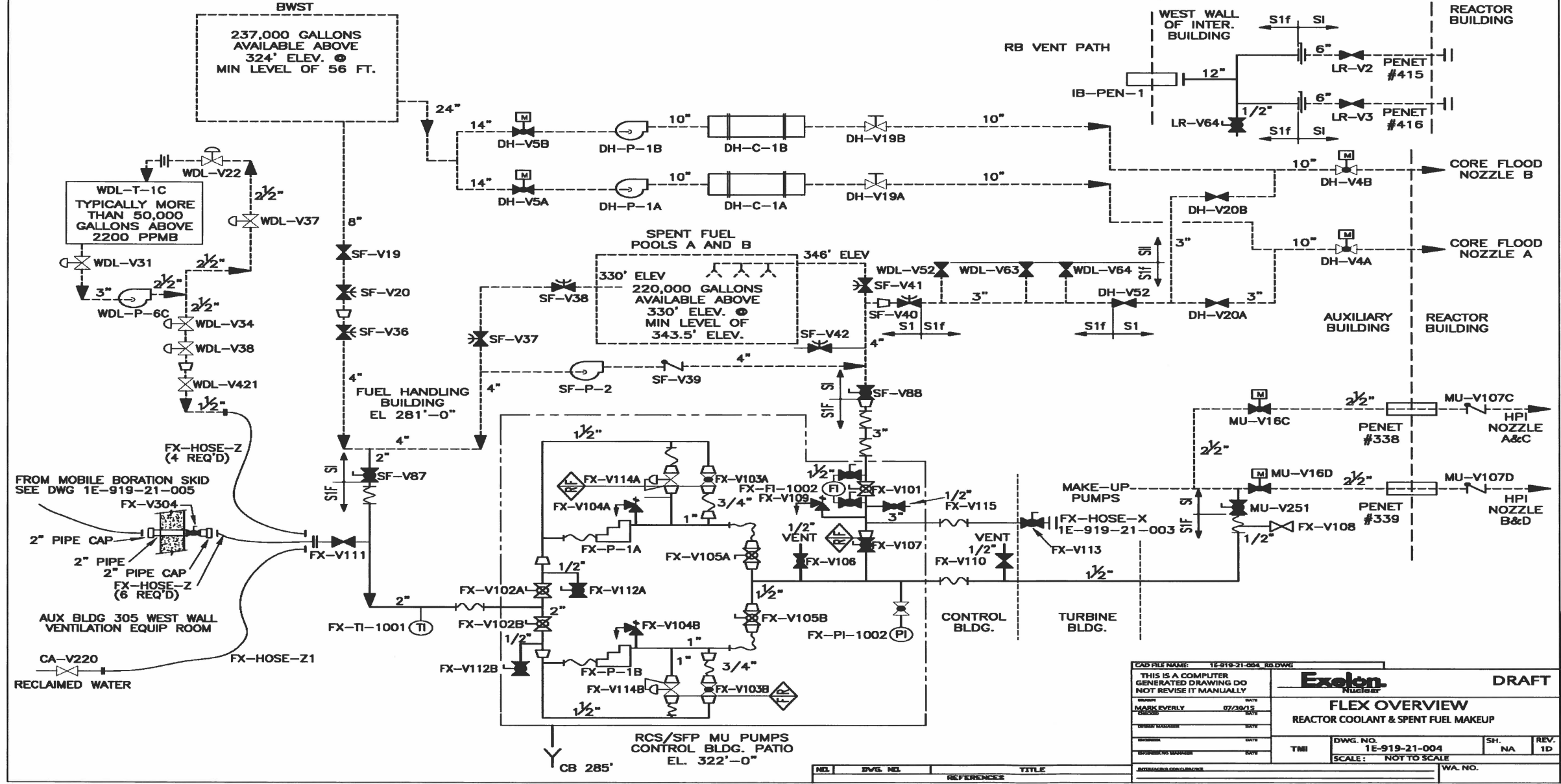
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THIS IS A COMPUTER GENERATED DRAWING DO NOT REVISE IT MANUALLY				
DRAWN	DATE	<b>FLEX OVERVIEW</b> <b>FEEDWATER SUPPLY</b>		
MARK EVERLY	07/20/15			
CHECKED	DATE			
DESIGNED	DATE			
TMI	DWG. NO.	SH.	NA	REV.
	1E-919-21-003			1D
SCALE: NOT TO SCALE		WA. NO.		

NO.	SYMBOL	REFERENCE	TITLE

# Attachment 2D

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

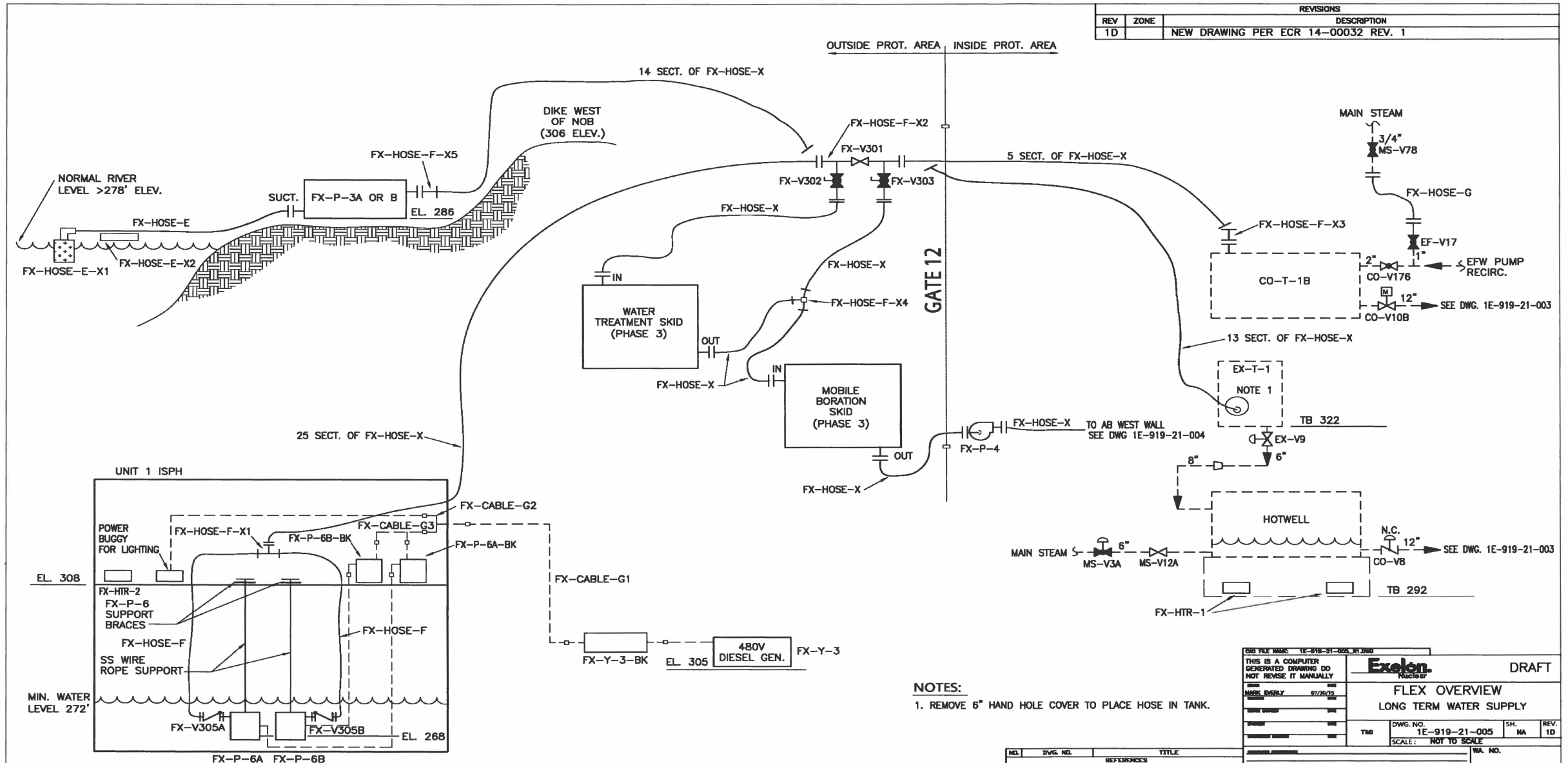
REVISIONS		
REV	ZONE	DESCRIPTION
1D		NEW DRAWING PER ECR 14-00032 REV. 1



CAD FILE NAME: 1E-919-21-004_R0.DWG		<b>Exelon</b> NUCLEAR		<b>DRAFT</b>
THIS IS A COMPUTER GENERATED DRAWING DO NOT REVISE IT MANUALLY				
MARK EVERLY	07/28/15	<b>FLEX OVERVIEW</b>		
SUBMIT NUMBER: 0000		REACTOR COOLANT & SPENT FUEL MAKEUP		
ISSUE NO.	DATE	TMI	DWG. NO.	REV. ID
			1E-919-21-004	
SUPERVISING ENGINEER		SCALE: NOT TO SCALE		
APPROVALS AND SIGNATURES				WA. NO.

# Attachment 2E

## 1E-919-21-005, draft, Long Term water supply



**NOTES:**  
 1. REMOVE 6" HAND HOLE COVER TO PLACE HOSE IN TANK.

END FILE NAME: 1E-919-21-005_H.DWG		<b>Exelon</b> DRAFT	
THIS IS A COMPUTER GENERATED DRAWING DO NOT REVISE IT MANUALLY			
<b>FLEX OVERVIEW</b>			
LONG TERM WATER SUPPLY			
DATE: 07/20/15	DWG. NO. 1E-919-21-005	SH. NA	REV. 1D
SCALE: NOT TO SCALE		WA. NO.	