ENCLOSURE 2

PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 1 AND 2

Prairie Island Mitigating Strategies
Flood Hazard Assessment

(REDACTED VERSION)

(32 pages to follow)

Xcel Energy

Contract No. 00047588

Prairie Island Mitigating Strategies
Flood Hazard Assessment

CLIENT APP.: N/A

BLACK & VEATCH

Overland Park, KS

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Table of Contents

List of Acronyms, Abbreviations, and Definitions

Acronyms

- AC – Alternating Current
- AFW – Auxiliary Feedwater
- BDB – Beyond Design Basis
- CDB – Current Design Basis
- cfs – cubic feet per second
- CST – Condensate Storage Tank
- CL – Cooling Water
- DC – Direct Current
- DDCLP – Diesel Driven Cooling Water Pump
- ECA – Emergency Contingency Action
- ELAP – Extended Loss of all AC Power
- FFE – Finished Floor Elevation
- FHRR – Flood Hazard Reevaluation Report
- FLEX DB – FLEX Design Basis (flood hazard)
- LIP – Local Intense Precipitation
- LUHS – Loss of Ultimate Heat Sink
- MCC – Motor Control Center
- MSA – Mitigating Strategies Flood Hazard Assessment
- MSFHI – Mitigating Strategies Flood Hazard Information (from the FHRR and MSFHI letter)
- MSL – Mean Sea Level
- NB – not bounded
- NGVD29 - National Geodetic Vertical Datum of 1929
- NEI – Nuclear Energy Institute
- NRC – Nuclear Regulatory Commission
- NSPM – Northern States Power Company, a Minnesota corporation
- NSRC – National SAFER Response Center
- NTTF – Near Term Task Force
- PINGP – Prairie Island Nuclear Generating Plant
- PMF – Probable Maximum Flood
- psf – pounds per square foot
- RCS – Reactor Coolant System
- SBO – Station Blackout
- SFP – Spent Fuel Pool
- SI – Safety Injection
- SSC – Structure, System, Component
- SGs – Steam Generators
- TDAFW – Turbine Driven Auxiliary Feedwater
- USACE – United States Army Corps of Engineers
- USAR - Updated Safety Analysis Report
- VAC – Volts AC
- VDC – Volts DC
- WO – Work Order

- WSE – Water Surface Elevation

Definitions

FLEX Design Basis Flood Hazard: the controlling flood parameters used to develop the FLEX strategies for a flood.

1. Executive Summary

FLEX strategies were developed to mitigate an extended loss of all AC power (ELAP) and a loss of normal access to the ultimate heat sink resulting from beyond design bases external events; including design bases flooding events. New flooding analyses were performed in support of developing the Flood Hazard Reevaluation Report (FHRR) for the Prairie Island Nuclear Generating Plant (PINGP). For all postulated flooding scenarios, except the Local Intense Precipitation (LIP), the new flooding analyses were bounded by the plant design basis flood. The Mitigating Strategies Assessment (MSA) evaluates FLEX strategies to ensure the strategies can successfully be implemented for the Local Intense Precipitation flooding event or to determine if changes are required to the strategies. Based on the evaluation herein, the FLEX strategies can be implemented without change for the Local Intense Precipitation event.

2. Background

2.1 Purpose

On March 12, 2012, the NRC issued Reference 1 to request information associated with Near-Term Task Force (NTTF) Recommendation 2.1 for Flooding. One of the Required Responses in Reference 1 directed licensees to submit a Flood Hazard Reevaluation Report (FHRR). The NRC determined that the reevaluated flood hazard is "beyond the current design/licensing basis of operating plants." Reference 2, as supplemented by Reference 29, was submitted in response to the request in Reference 1 for the PINGP.

Concurrent to the flood hazard reevaluation, the PINGP developed and implemented mitigating strategies in accordance with NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," (earlier revision of Reference 4).

In Reference 3, the Commission affirmed that licensees need to address the reevaluated flooding hazards within their mitigating strategies for beyond-design-basis (BDB) external events, including the reevaluated flood hazards. This position was confirmed in Reference 5.

Guidance for performing mitigating strategies flood hazard assessments (MSAs) is provided in Appendix G of NEI 12-06 (Reference 4). For the purpose of the MSA, the NRC determined that the flood hazard information provided in the FHRR is the "Mitigating Strategies Flood Hazard Information" (MSFHI). Appendix G of NEI 12-06, describes the MSA for flooding as containing the following elements:

- Section G.2 – Characterization of the MSFHI
- Section G.3 – Basis for Mitigating Strategies Assessment (MSFHI-FLEX DB Comparison)
- Section G.4.1 – Assessment of Current FLEX Strategies (if necessary)
- Section G.4.2 – Assessment for Modifying FLEX Strategies (if necessary)
- Section G.4.3 – Assessment of Alternative Mitigating Strategies (if necessary)
- Section G.4.4 – Assessment of Targeted Hazard Mitigating Strategies (if necessary)

If a Section G.3 assessment shows that the FLEX Design Basis flood hazard (FLEX DB) completely bounds the reevaluated flood (in the MSFHI), only documentation for Sections G.2 and G.3 are required; assessments and documentation for the remaining sections (G.4.1 through G.4.4) are not necessary. If a

Section G.3 assessment shows that the FLEX DB does not completely bound the MSFHI, then Sections G.4.1 through G.4.4 need to be performed. Sections G.4.1 through G.4.4 are performed sequentially until an acceptable result is received. For example, if the evaluation for Section G.4.1 demonstrates that the existing FLEX strategies can be implemented as designed, then the MSA is considered complete and the results documented.

2.2 Site Description

The PINGP site is located within the city limits of the City of Red Wing, Minnesota, on the right (West) bank of the Mississippi River. Topography near the PINGP site is fairly level to slightly rolling ground ranging in elevation from 675 ft to 706 ft. The site surface slopes gradually toward the Mississippi River on the northeast and to the Vermillion River on the southwest. Normal river pool elevation is at 674.5 ft and the maximum reported flood elevation was recorded in 1965 at 687.7 ft. Steep bluffs parallel this stretch of the Mississippi River and rise to above a 1,000-ft elevation approximately one and a half miles northeast and southwest of the site. Northeast and southwest of these bluffs, the ground elevation ranges from 1,000 ft to 1,200 ft and is marked by many deeply eroded coulees. The plant grade surrounding the Power Block and Screenhouse varies between elevation 694.5 ft and 695 ft (Reference 6).

The principal surface waters in the vicinity of the site are the Mississippi River, Sturgeon Lake, the Vermillion River, and the Cannon River. The water level of the Mississippi River and Sturgeon Lake are controlled by Lock and Dam No. 3, which is located approximately one and a half miles downstream from the plant. The Vermillion River enters the main stream of the Mississippi River below the dam. The flow in the Mississippi River is for the most part unregulated (i.e., natural river flow is passed through the dam so as to maintain an unvarying upper pool level). The normal upper pool is at elevation 674.5 ft. This level may be lowered to elevation 672.5 ft at the dam to control pool elevation at Prescott to elevation 674.5 ft for a river flow of approximately 17,000 cfs. According to the U.S. Army Corps of Engineers (USACE), the 1965 flood, which is the highest on record, has a recurrence interval of 150 years. The peak elevation at Lock and Dam No. 3 during this flood was elevation 687.7 ft. It is estimated by the USACE that a flood having a 1,000-year recurrence interval would have a peak elevation of 691.8 ft. at Lock and Dam No. 3, and a discharge of about 335,000 cfs (Reference 6).

The main powerhouse structures consist of the Reactor Buildings, the Auxiliary and Fuel Handling Building, the Turbine Building, the D5/D6 Diesel Generator Building, and the Screenhouse. Plant grade for these structures is elevation 695 ft (Reference 6).

The probable maximum flood for the PINGP site is a flood from the Mississippi River with a peak stage of 703.6 ft. The flood would result from meteorological conditions which could occur in the spring and could reach maximum river level in about 12 days. It was estimated that the flood stage would remain above 695 ft. for approximately 13 days. (Reference 6)

Elevations used in this evaluation are in the NGVD29 datum.

3. Overview of FLEX Strategies

FLEX capability is designed to mitigate the consequences of a postulated beyond-design-basis external event coincident with an extended loss of all AC power (ELAP) and a loss of normal access to the ultimate heat sink. NEI 12-06 (Reference 4) outlines an approach for adding diverse and flexible mitigation strategies, or FLEX, that will increase defense-in-depth for beyond-design-basis scenarios to address an ELAP and loss of normal access to the ultimate heat sink occurring simultaneously at all units on a site.

Plant coping capability during a FLEX scenario is divided into three phases:

- Phase 1 (short term phase) – During Phase 1, the plant is coping using installed plant equipment.
- Phase 2 (transition phase) – During Phase 2, coping is extended using portable equipment that is stored on-site.
- Phase 3 (long term phase) – During Phase 3, coping is extended indefinitely using portable equipment that is stored off-site and is deployed to the site.

Time durations for the short term and transition phase are defined based on plant specific or generic analyses, capabilities of the portable on-site equipment, and capabilities for accessing the site to deploy off-site portable equipment following a beyond design bases external event.

FLEX strategies were previously designed for the design bases flood external event (i.e., FLEX Design Basis Flood Hazard), which for the PINGP is the probable maximum flood (PMF) on the Mississippi River. The PMF is a relatively slow developing event that allows for several days to prepare for the event. The FLEX strategy for the PMF is to prestage selected Phase 2 and Phase 3 FLEX equipment within the flood-protected buildings before the design basis flood level is reached.

The timeline for implementation of FLEX strategies for external events, except the PMF, is shown in Table 3.3-1. For the LIP no credit is taken for warning time. Thus, the evaluation of the ability to implement the FLEX strategies for the LIP is based on the FLEX strategies in Table 3.3-1 in lieu of the FLEX strategies for the PMF. The information in Table 3.3-1 is from the Prairie Island FLEX Program Document (Reference 7).

Table 3.3-1 – Timeline for Implementation of FLEX Strategies

Action Item	Projected Start	Projected Completion	Action	Time Constraint (Y/N)	Remarks
0	0	0	Event Starts	N/A	Both units initially at 100% power
1	0	60 sec	TDAFW pumps start suppling AFW to all SGs	N	Design bases for SBO event requires AFW to SGs within 60 secs
2	-	3 min	Determination Made that AC Power is Lost and Cannot be Recovered - ELAP Declared	Y (20 min)	ELAP declared within 20 minutes
3	10 min	40 min	Align Cooling Water to TDAW Pump	Y (74 min)	With the assumed loss of the CSTs at event initiation analyses demonstrate that at least 74 minutes are available to restore AFW flow to the SG.

Table 3.3-1 – Timeline for Implementation of FLEX Strategies

Action Item	Projected Start	Projected Completion	Action	Time Constraint (Y/N)	Remarks
4	20 min	40 min	Reduce speed on running DDCLP	Y (2 hr)	To ensure sufficient fuel oil in Day Tank, DDCLP speed must be reduced within 2 hrs.
5	20 min	2 hr	Reduce Cooling Water flow	Y (3.3 hr)	To ensure that flow demand does not exceed capacity of Emergency Intake Line, flow must be reduced within 3.3 hrs.
6	30 min	50 min	DC Load Shed from the Battery Rooms	Y (60 min)	Battery Depletion calculation assumes initial DC loads are shed within 60 min.
7	50 min	90 min	DC Load Shed from Relay Room, D5/D6 Bldg & Aux Bldg	Y (90 min)	Battery Depletion calculation assumes remaining DC loads are shed within 90 min.
8	1 hr	1 hr 10 min	Open doors to Control room to establish cooling	Y (11.7 hr)	Alternate room cooling established by blocking doors open.
9	1 hr	1 hr 10 min	Open doors to Battery Room to establish cooling	Y (18 hr)	Alternate room cooling established by blocking doors open.
10	1 hr	3 hr	Cool RCS/SG down to a SG pressure of 350 psig	N	Assumed cooldown rate of 70°F/hr.
11	40 min	2 hr 10 min	Open Disconnects and disengage 345 kv overhead power lines in Switchyard	N	Assumed high voltage power lines need to be cleared out the way to deploy equipment.
12	40 min	2 hr 10 min	Move debris within Screenhouse to allow deployment of cables to Screenhouse MCC	N	Resources and time (.15 hr) are allocated to clearing debris within Screenhouse.
13	40 min	2 hr 40 min	Move external debris and establish external access routes	N	Time to clear debris to allow deployment is assumed to be 2 hrs.
14	3 hr	4 hr	Stage 480 VAC portable diesel generator and Cables for Screenhouse MCC	N	This action stages the equipment but does not connect the generator to the MCC.
15	4 hr	4 hr 45 min	Connect cables to 480 VAC portable diesel generator and Screenhouse MCC	N	Power source for the DDCLP Fuel Oil Transfer Pump.
16	4.75 hr	5 hr	Start 480 VAC portable diesel generator and energize selected Screenhouse loads	Y (8 hr)	Fuel oil consumption calculation shows that the DDCLP Fuel Oil Transfer Pump must be repowered within 8 hrs to support continued operation of the DDCLP.
17	4 hr	6 hr	Move debris within Turbine Building to allow deployment of cables to Battery Room MCCs	N	Resources and time (2 hr) are allocated to clearing debris within the Turbine Building.

Table 3.3-1 – Timeline for Implementation of FLEX Strategies

Action Item	Projected Start	Projected Completion	Action	Time Constraint (Y/N)	Remarks
18	4 hr	4 hr 10 min	Open doors to AFW pump room to establish cooling	N	Alternate room cooling established by blocking doors open.
19	6 hr	7 hr	Stage cables for Battery Room MCCs	N	This action stages the equipment but does not connect to the generator to the MCC. Note that the portable diesel generator has previously been staged in Action 14.
20	7 hr	8 hr	Connect cables to 480 VAC portable diesel generator and Battery Room MCCs	N	Power source for Battery Chargers
21	8 hr	9 hr	Restart associated Battery Chargers and Inverters	Y (11.5 hr)	Battery depletion calculation shows that power to the Battery Chargers/Inverters must be restored within 11.5 hrs to maintain instrumentation power.
22	6 hr	8 hr	Move debris within Turbine/Aux Buildings to allow deployment of cables to Charging Pump MCCs	N	Resources and time (2 hr) are allocated to clearing debris within the Turbine and Auxiliary Buildings.
23	8 hr	10 hr	Stage 480 VAC portable diesel generator and cables for Charging Pump MCCs	N	This action stages the equipment but does not connect to the generator to the MCC.
24	10 hr	11 hr	Connect cables to 480 VAC portable diesel generator and Charging Pump MCCs	N	Power source for the Charging Pumps.
25	11 hr	11 hr 30 min	Start 480 VAC portable diesel generator and energize Charging Pump MCCs	N	Power source for the Charging Pumps.
26	11.5 hr	As Needed	Establish Charging Pump flow and maintain RCS inventory	Y 32 hr)	Calculations show that RCS makeup should be established within 32 hrs to prevent the onset of Reflux cooling.
27	After 12 hr	Before 24 hr	Deploy submersible pump, SG/SFP makeup pump, and hoses to the FLEX AFW connections	N	As a backup to the TDAFW Pump, the FLEX strategies call for a portable diesel driven pump to be connected to the AFW system piping.
28	After 12 hr	Before 24 hr	Deploy hoses to provide SFP makeup	Y (33 hr)	To avoid concerns related to habitability during installation, SFP makeup hose will be deployed prior to pool boiling, which is expected to be greater than 33 hrs.

Table 3.3-1 – Timeline for Implementation of FLEX Strategies

Action Item	Projected Start	Projected Completion	Action	Time Constraint (Y/N)	Remarks
29	24 hr	72 hr	Deploy SAFER 4kV Turbine Generators	N	Repowers a 4kV safeguard bus on each Unit.
30	72 hr	-	Restore Safeguards load as desired/needed	N	Normal SFP and containment cooling may be reestablished.

4. Characterization of the MSFHI (NEI 12-06, Revision 2, Appendix G, Section G.2)

The NRC has completed the "Interim Staff Response to Reevaluated Flood Hazards" to the flood hazards information submitted in the PINGP FHRR (Reference 8). The NRC staff has concluded that the licensee's reevaluated flood hazard information is suitable for the assessment of mitigating strategies developed in response to Order EA-12-049. The summary of the reevaluated flood hazard (i.e., MSFHI) parameters was provided in Reference 8. The following flood-causing mechanisms were considered as part of the FHRR:

- Local Intense Precipitation
- Streams and Rivers
- Failure of Dams and Onsite Water Control/Storage Structures
- Storm Surge
- Seiche
- Tsunami
- Ice-Induced Flooding
- Channel Migrations/Diversions

Table 2 in the Enclosure to Reference 8 indicates that the following are the flood hazards for use in the MSA.

Mechanism	Stillwater Elevation	Waves/Runup	Reevaluated Flood Hazard
Local Intense Precipitation	695.4 ft NGVD29	Minimal	695.4 ft NGVD29

Note 1 to Table 2 in the Enclosure to Reference 8 states that: "the licensee is expected to develop flood event duration parameters and applicable flood associated effects to conduct the MSA. The staff will evaluate the flood event duration parameters (including warning time and period of inundation) and flood associated effects during its review of the MSA."

5. Basis for Mitigating Strategies Assessment (NEI 12-06, Revision 2, Appendix G, Section G.3)

FLEX strategies were developed to mitigate an extended loss of all AC power resulting from an external event; including design bases flooding events. As described in the FHRR (Reference 2), Section 3, "Comparison of Current Design Basis and Reevaluated Flood Hazard," the only non-bounded flood mechanism is the LIP. The LIP is considered non-bounded because it is not included in the PINGP CDB. Table 5-1 summarizes the results of the flood hazard reevaluation for the LIP. A discussion of the assumptions, inputs, methods, and results for the LIP analyses is provided in Section 2.1 of Reference 2.

Table 5-1 – Local Intense Precipitation

<table>
<tr><th colspan="2">Flood Scenario Parameter</th><th>Plant Design Basis Flood</th><th>FLEX DB Flood Hazard</th><th>MSFHI</th><th>MSFHI Bounded (B) or Not Bounded (NB) by FLEX DB</th></tr>
<tr><td rowspan="6">Flood Level and Associated Effects</td><td>1. Maximum Stillwater Elevation (ft MSL)</td><td rowspan="12">LIP was not specifically addressed in the USAR.</td><td rowspan="12">FLEX strategies did not include LIP as it is not within the PINGP design basis</td><td>695.35</td><td>NB</td></tr>
<tr><td>2. Maximum Wave Run-up Elevation (ft MSL)</td><td>See Note 2</td><td>N/A</td></tr>
<tr><td>3. Maximum Hydrodynamic/Debris Loading (psf)</td><td>See Note 3</td><td>N/A</td></tr>
<tr><td>4. Effects of Sediment Deposition/Erosion</td><td>See Note 4</td><td>N/A</td></tr>
<tr><td>5. Concurrent Site Conditions</td><td>See Note 5</td><td>N/A</td></tr>
<tr><td>6. Effects on Groundwater</td><td>See Note 6</td><td>N/A</td></tr>
<tr><td rowspan="4">Flood Event Duration</td><td>7. Warning Time (hours)</td><td>See Note 7</td><td>N/A</td></tr>
<tr><td>8. Period of Site Preparation (hours)</td><td>See Note 8</td><td>N/A</td></tr>
<tr><td>9. Period of Inundation (hours)</td><td>~1.1 (see Note 9)</td><td>NB</td></tr>
<tr><td>10. Period of Recession (hours)</td><td>~5.4 (see Note 10)</td><td>NB</td></tr>
<tr><td rowspan="2">Other</td><td>11. Plant Mode of Operations</td><td>See Note 11</td><td>N/A</td></tr>
<tr><td>12. Other Factors</td><td>See Note 12</td><td>N/A</td></tr>
</table>

Additional notes, "N/A" justifications (why a particular parameter is judged not to affect the site), and explanations regarding the bounded/non-bounded determination.

1. None.
2. Consideration of wind-generated wave action for the LIP event is not explicitly required in NUREG/CR-7046, ANS-2.8 or the 50.54(f) letter. Furthermore, wave runup is considered negligible due to limited flood depths and fetch.
3. Hydrodynamic loading was not considered plausible as surface water flow direction is not towards the buildings. Debris impact loading was not considered plausible due to limited velocities and flood depths (Reference 9).
4. Due to limited velocities, and short duration of flooding (Reference 9), sediment deposition and erosion is not considered to have an effect on the LIP flood levels.
5. High winds and hail could coincide with the LIP event. In general, no manual actions are required to be performed outside. Personnel may be, however, exposed to the elements while moving between locations. Environmental conditions would be considered prior to personnel being directed to move between locations. Section 6.5 addresses FLEX required activities.
6. Due to relatively short duration of the LIP event (Reference 9), surcharge to groundwater is not considered. In addition, the PINGP is a wet site where the structures are designed for a flooded condition (Reference 6). Thus, an increase in groundwater elevation would not impact the site.
7. Warning time is not credited in the flood protection strategy for LIP flood (since only permanent/passive measures are used for the LIP flood) and, therefore, was not considered as part of the analysis.
8. SSCs important to safety are protected by means of permanent/passive measures and, therefore, site preparation was not considered as part of the analysis.
9. The period of inundation varies throughout the site; however, at the location with the highest flood depth, it was estimated that water level would remain above FFE for 66 minutes (Reference 9).
10. Once the flood waters recede below FFE, it would take approximately 5.4 hours for flood waters to completely recede from areas near the critical doors, which is approximately within 30 minutes after the end of the 6-hr storm LIP event (Reference 9).
11. There are no limitations on plant modes of operation prior to, or during, the LIP event.
12. There are no other factors applicable to this flood causing mechanism.

6. Assessment of Current FLEX Strategy (NEI 12-06, Revision 2, Appendix G, Section G.4.1)

The assessment of the ability to implement the FLEX strategies during a LIP focuses on the following:

- Robustness of Plant Equipment (Section 6.2).
  The robustness of plant equipment is evaluated to confirm that SSCs are capable of withstanding the LIP.
- Actions performed by plant personnel (Section 6.3).
  Potential impacts to timing of operator actions are evaluated as well as actions associated with operation of portable equipment during the LIP.
- Connection Points (Section 6.4).
  The locations of connection points for the FLEX portable equipment are evaluated for potential impact from the LIP.
- Deployment of Portable Equipment (Section 6.5).
  The deployment of FLEX portable equipment during and following the LIP event is evaluated. Considerations in the evaluation include FLEX equipment storage; deployment of the FLEX equipment from the storage building to the staging location; deployment of cables and hoses; and qualifications of the portable equipment.

6.1 LIP Timeline

Section 6.1 identifies the assumption with bases for the timing of the ELAP concurrent with the LIP per Reference 4, Appendix G. In addition, Section 6.1 describes the impacts from the LIP that will be used for evaluation of the FLEX strategies.

As described above, FLEX strategies were initially designed for the design bases flood external event, which for the PINGP is the probable maximum flood (PMF) on the Mississippi River. The PMF is a relatively slow developing event that allows for several days to prepare for the event. For the LIP, warning time is not credited. Thus, the assessment of FLEX strategy implementation for the LIP needs to account for an absence of warning time.

The LIP event is not expected to cause an ELAP. For the LIP, similar to other external events, it is assumed that the ELAP occurs at time = 0. As shown in Table 6.1-1 this time period also corresponds with the time period of highest precipitation. It is reasonable to assume that the loss of offsite power occurs during the most severe time of the LIP event. In addition, as the LIP event is a 6 hour event, assuming that the ELAP occurs at time = 0 places the maximum subsequent FLEX strategy implementation time coincident with the LIP event.

The LIP calculation for the PINGP is provided in Reference 9; which describes the inputs, assumptions, methodology, and results. The timelines for the cumulative precipitation and precipitation rates during the LIP are shown in Table 6.1-1. The precipitation rate is determined by dividing the change in cumulative precipitation by the change in time duration.

Table 6.1-1, Precipitation Cumulative Precipitation and Rates

Time Duration	Cumulative Precipitation (inches)	Precipitation Rate (inches/hour)
5 min	4.6	55.2
15 min	7.3	16.2
30 min	10.4	12.4
1 hr	13.4	6.0
6 hr	21.0	1.5

Figures 6.1-1, 6.1-2, and 6.1-3 show water depths at various times during the LIP event. Water levels shown in Figures 6.1-1 through 6.1-3 are extracted from the Reference 9 analysis results. Figure 6.1-1 shows the maximum water depths which occur during the first hour, Figure 6.1-2 shows the water depths at one hour into the event, and Figure 6.1-3 shows the water depths at 2 hours into the event. It is noted that the FLEX storage building is not included in the southwest section of Figures 6.1-1, 6.1-2, and Figure 6.1-3 as Reference 9 was developed before the FLEX building was constructed. The FLEX storage building is addressed separately in Section 6.5, below.

Figure 6.1-1, Maximum Water Surface Elevations During First Hour of LIP

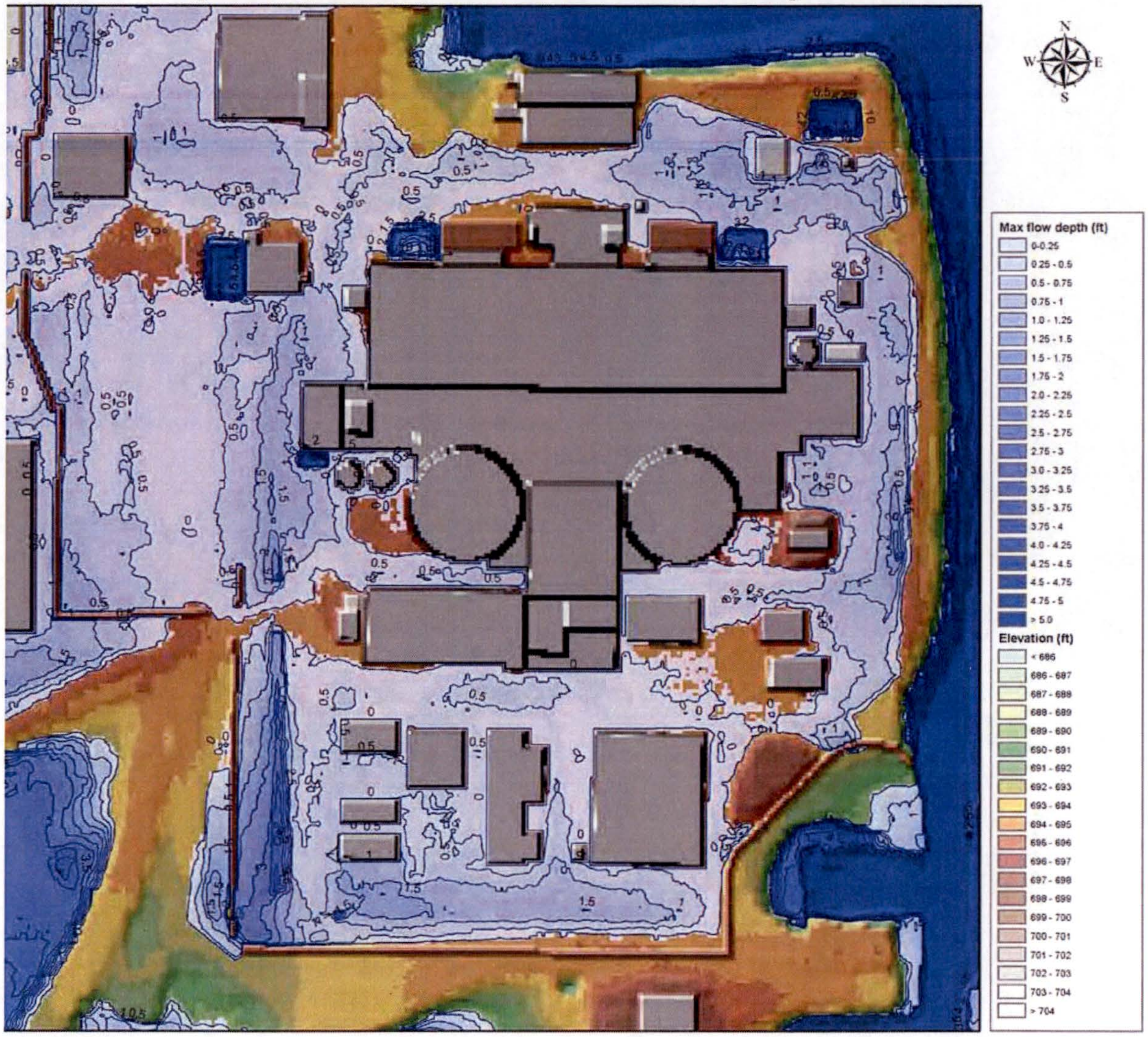


Figure 6.1-2, Water Surface Elevations During LIP at One Hour

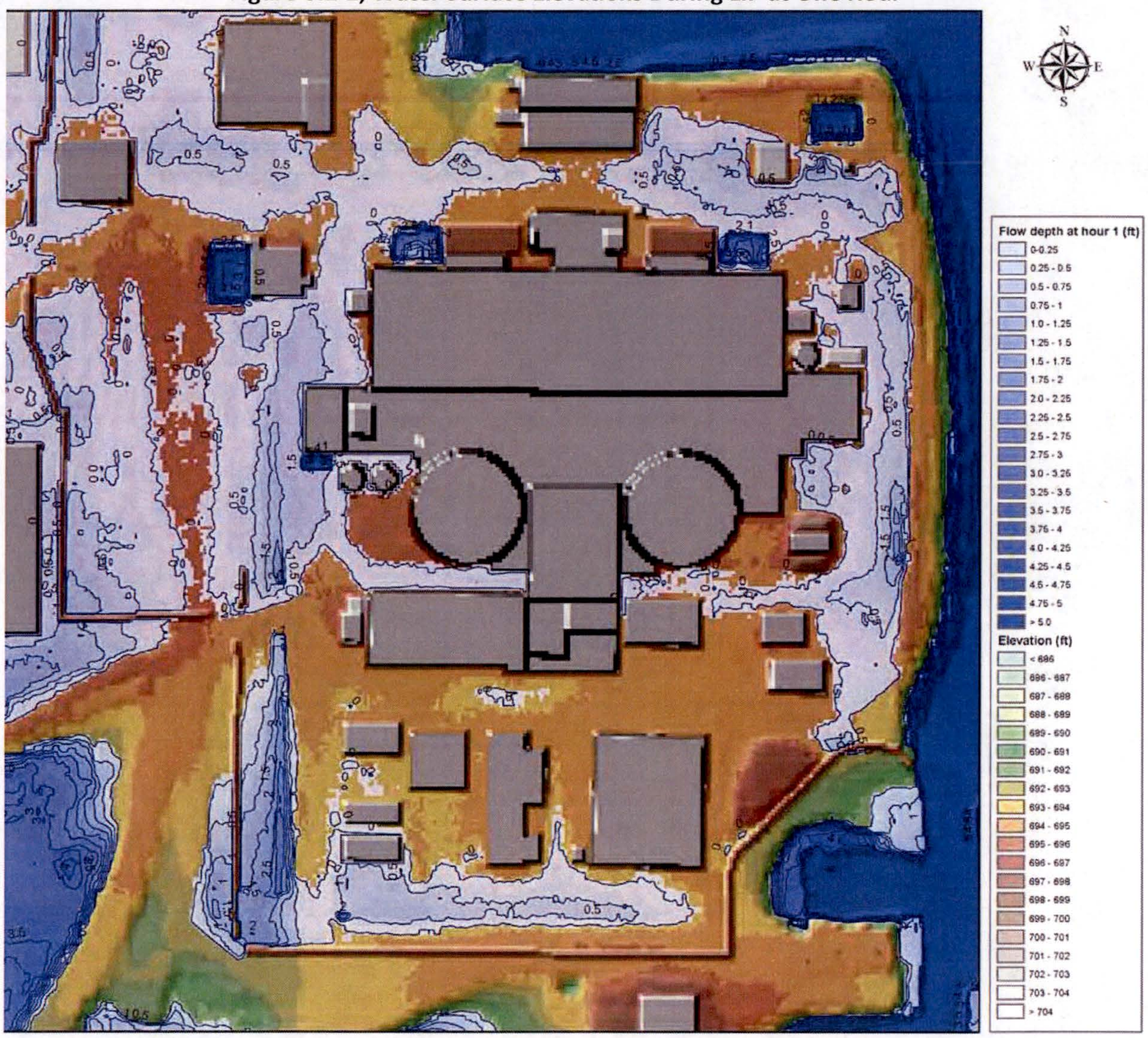
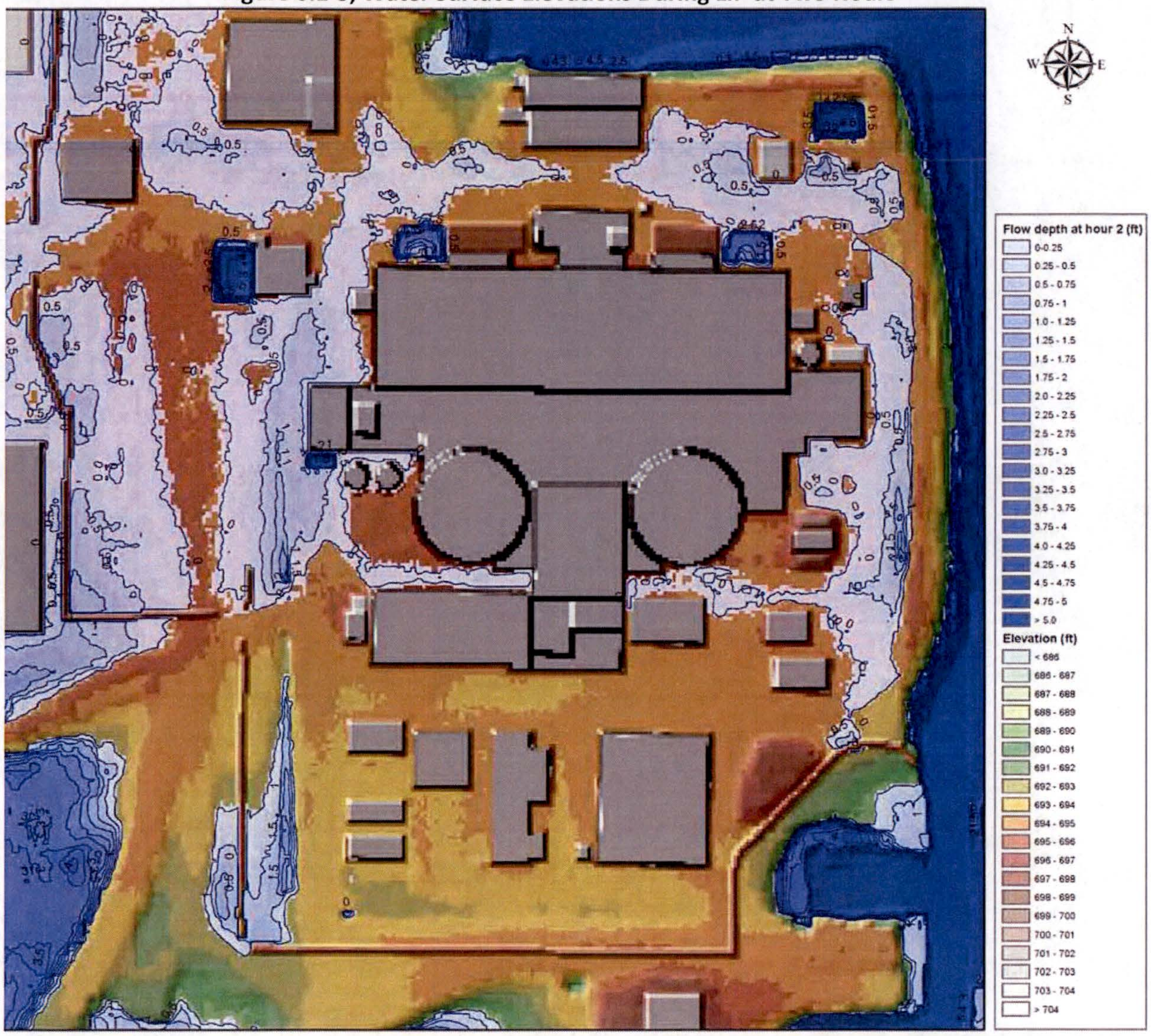


Figure 6.1-3, Water Surface Elevations During LIP at Two Hours



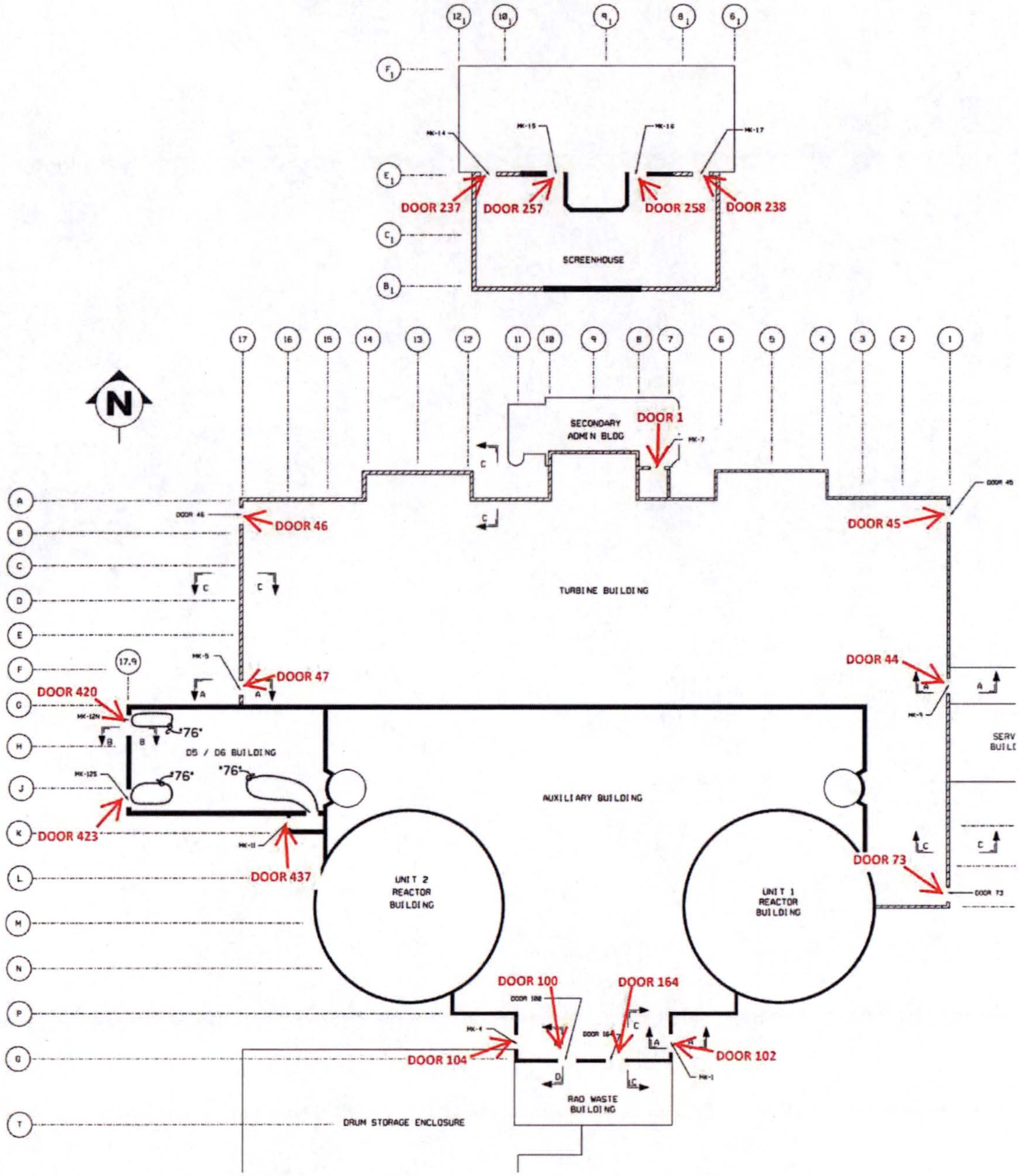
An additional consideration is the potential for water ingress to the plant structures. As shown in Table 6.1-2, the maximum water surface elevations around the plant structures can be up to 0.45 ft above the FFE elevation for some of the plant access doors. The locations of the plant access doors are shown in Figure 6.1-4.

Table 6.1-2, Maximum Water Surface Elevations (WSE) at Plant Access Doors

Door Number	Description	Max WSE (ft)	Survey FFE (ft)	Maximum Depth Above FFE (ft)
237	Screenhouse	694.82	694.90	Below FFE
257	Screenhouse	694.82	694.90	Below FFE
258	Screenhouse	694.82	694.90	Below FFE
238	Screenhouse	694.82	694.90	Below FFE
1	Old Admin Building	694.82	694.90	Below FFE
47	Turbine Building	695.17	694.90	0.27
46	Turbine Building	694.74	694.90	Below FFE
45	Turbine Building	694.82	694.90	Below FFE
44	Turbine Building/Service Building	694.77	694.90	Below FFE
73	Turbine Building	694.76	694.90	Below FFE
104	Auxiliary Building/Rad Waste Building	695.35	694.90*	0.45
100	Auxiliary Building/Rad Waste Building	695.35	694.90*	0.45
164	Auxiliary Building/Rad Waste Building	695.24	694.90	0.34
102	Auxiliary Building/Rad Waste Building	695.24	694.90	0.34
420	D5/D6 Building	695.17	694.90	0.27
423	D5/D6 Building	695.17	694.90	0.27
437	D5/D6 Building	695.19	694.90	0.29

* No survey FFE point available at door, closest FFE survey point was used.

Figure 6.1-4, Plant Access Door Locations



6.2 Robustness of Plant Equipment

Section 6.2 evaluates the robustness of plant equipment per Reference 4, Appendix G, in order to demonstrate that the existing FLEX strategies can be implemented for the LIP. The PINGP is designed for a PMF from the Mississippi River with a flood water elevation up to 703.6 ft (Reference 6). The majority of the plant structures are capable of withstanding the PMF without protection measures being implemented; i.e., permanent passive protection. Selected actions are implemented in anticipation of a PMF to provide full protection. The water surface elevation during a PMF is much greater than during a LIP; thus, the permanent passive protection features are capable of withstanding a LIP. For the LIP, warning time is not credited. Thus, the evaluation for the LIP focuses on the protection features that would not be in place given that no actions are taken to prepare for the LIP.

Flood preparation measures for a PMF are implemented per procedure AB-4 (Reference 10). Specific measures are taken as part of Reference 10 for preparation for a flood from the Mississippi River. Due to absence of warning time the following actions would not be implemented for a LIP flood.

- Installation of flood bulkheads and sealing flood doors. As part of preparation for a PMF, flood waters entering the plant through doors are precluded by installing bulkheads over some of the plant access doors or sealing of other plant access doors.

- Installation of blind flanges on the D5/D6 fuel oil tank overflow lines. The tank overflow line is routed to the associated tank vault. This action precludes water from entering the fuel oil tanks for Emergency Diesel Generators D5 and D6 through the tank overflow line in the event that inleakage to the vault occurred during the PMF.

The evaluation of the robustness of plant flood protection features considers these differences; specifically, the impact of water intrusion at doors that would be protected during a PMF, the structural impacts of the hydraulic loads to doors that would be protected by the bulkheads, and the potential for water intrusion into the D5/D6 Fuel Oil Tank Vaults.

6.2.1 Plant Access Doors – Evaluation of Potential Water Intrusion

As shown in Table 6.1-2, the LIP flood levels exceed the FFE elevation at several doors. The potential impact from the flood levels exceeding the door FFE elevation is addressed below.

<u>Turbine Building</u>

The predicted maximum water surface elevation at Door 47 is 0.27 ft above the FFE. Door 47 is [redacted] redacted per 10 CFR 2.390. To determine the impact that the LIP event can have in terms of potential internal flooding to the Turbine Building, the amount of water that could enter through Door 47 was calculated (Reference 9). The flow rate into the building through Door 47 is determined using the standard weir equation and the depth of water in the vicinity of the door as a function of time. Using this approach, it was determined that 3700 ft^3 could enter the Unit 2 Turbine Building. The water would collect in the Condenser Pit and Sump. The floor space of the Unit 2 Condenser Pit is 8,993 ft^2. Therefore, the 3700 ft^3 of water will result in less than six inches of water on the pit floor, which will have no impact to SSCs important to safety.

<u>Auxiliary Building</u>

The predicted maximum water surface elevation at Doors 100 and 104 is 0.45 ft above the FFE. The predicted maximum water surface elevation at Doors 102 and 164 is 0.34 ft above the FFE. Doors 102 and 104 are roll up doors from the exterior to the Fuel Receipt Area of the Auxiliary Building. Doors 100 and 164 provide access between the Fuel Receipt Area of the Auxiliary Building and the Rad Waste Building. Door 164 is surrounded by a block wall on the exterior side that would not allow water into the Auxiliary Building. Doors 100, 102, and 104 are normally maintained closed and will limit the volume of water that is able to enter the Auxiliary Building during a LIP event. If water inleakage occurs past Doors 100, 102, and/or 104 it will first accumulate in the Fuel Receipt area. There are additional interior doors that are normally maintained closed between the Fuel Receipt area and the locations of SSCs important to safety in the Auxiliary Building. Inleakage would need to traverse a relatively long torturous path to reach SSCs important to safety. Furthermore, the water would need to fill the large interior surface area of the Auxiliary Building to a level of 695.75 ft before any SSCs important to safety are affected (Reference 11). To fill that surface area in the Auxiliary Building to 695.75 ft would require approximately 23,959 ft^3 of water (Reference 12). LIP events are of limited duration that preclude accumulating significant water through the closed doors. Furthermore, even if it is assumed that Doors 100, 102, and 104 were open and the water level in the Auxiliary Building equalized with the maximum water surface elevation outside the doors, the maximum water level in the Auxiliary Building would be 695.35 ft. This is below the water level of 695.75 ft where SSCs important to safety could be affected.

<u>D5/D6 Building</u>

The predicted maximum water surface elevation at Doors 420 and 423 is 0.27 ft above the FFE. Doors 420 and 423 are exterior access doors to the D5 and D6 diesel generator rooms from the west side of the building. Doors 420 and 423 are maintained closed. Figure 6.1-4 also shows that Door 437 could provide access to the building. However, flood protection bulkhead MK-11 is installed at Door 437 as controlled by station configuration documents. Predicted flood elevations for a PMF are much greater than for a LIP. Thus, leakage past Door 437 is not considered for a LIP.

The maximum water surface elevation and stage hydrograph at Doors 420 and 423 is redacted per 10 CFR 2.390 [redacted], the total water ingress through each door is 1069 ft^3 [3700 ft^3 * (4 ft 4 in. / 15 ft)].

The maximum allowable inleakage during an external flood is 16,760 gallons (2240 ft^3) into the D5 room and 17,627 gallons (2356 ft^3) into the D6 room (Reference 11). This is greater than the maximum volume of water that could enter either room with the door open. As discussed above, Doors 420 and 423 are maintained closed. Thus, the leakage past the doors would be much less than that that determined with the doors being open. Therefore, inleakage past Doors 420 and 423 will not impact SSCs important to safety.

6.2.2 Plant Access Doors – Structural Evaluation for LIP Loads

Consideration was also given to hydrodynamic and debris impacts during the LIP event. The maximum flood level predicted during the LIP event is 695.35 ft. The LIP event will not include any debris impact or any appreciable hydrodynamic effects due to the direction of all flow being away from the building. Furthermore, the flood levels are bounded by the PMF. Therefore, the existing flood walls will not be impacted by the LIP flood levels. There are several doors that will be subjected to hydrostatic loading that would be protected by flood bulkheads during a PMF. These doors and associated supporting structures have been evaluated (Reference 14) and determined to be capable of withstanding the loads from the LIP water level.

6.2.3 D5/D6 Fuel Oil Tank Vaults

The D5/D6 Fuel Oil Tank Vaults are located below grade to the west side of the D5/D6 Building. The tank vaults are accessed through covers located at grade elevation. The tank vault covers are a heavy duty watertight design (Reference 15). The actions in AB-4 (Reference 10) to install the blank flanges on the tank overflow lines are an additional protective measure (i.e., defense-in-depth) due to the duration and water surface elevation above the tank covers during the design basis PMF. The tank overflow is located near the top of the tank. Thus, a significant volume of water would need to leak into the vault to enter the tank through the overflow line. Given the heavy duty watertight design of the vault covers, the relatively short time period of the LIP, and the relatively small head of water above the vault covers, it is reasonable to conclude that potential inleakage would be small and not enter the fuel oil tanks.

6.3 Operator Actions Outside of the Plant Structures

Section 6.3 evaluates the ability to perform any necessary operator actions outside of plant structures during the LIP per Reference 4, Appendix G, to assure that the sequence of events for the FLEX strategies are not affected. Actions associated with deployment of portable equipment are addressed in Section 6.6.

During the initial time period following an ELAP an operator would be dispatched to the Screenhouse to reduce the speed of one of the Diesel Driven Cooling Water Pumps (DDCLP) per procedure FSG-20 (Reference 16). This action requires the operator to traverse outside approximately 150 to 200 feet from the Turbine Building to the Screenhouse (Reference 17) and then back to the Turbine Building after completing the actions in the Screenhouse.

During an ELAP the purpose of reducing the Cooling Water (CL) system flow rate is to increase the available time that the DDCLP can draw fuel oil from the Fuel Oil Day Tank before the Day Tank needs to be refilled. In order to refill the Day Tank, a portable generator is installed to repower the Motor Control Center (MCC) that energizes the Fuel Oil Transfer Pump. As shown in Table 3.3-1 there is a two hour time constraint for reducing the DDCLP speed. Time validation for operator actions to reduce DDCLP pump speed were performed per Work Order (WO) 00518025 Task 08 (Reference 18). The validation shows that the longest measured time to perform the actions in the Screenhouse was 18 minutes 30 seconds.

Precipitation rates as a function of time are shown in Table 6.1-1, above. During the first hour the precipitation rates are very high and may make it difficult for the operator to go between the Turbine Building and the Screenhouse. After the first hour, the precipitation rate has decreased to 1.5 inches per hour and the operator can more easily make the transit to perform the actions in the Screenhouse. Figure 6.1-2 shows water depths in the area between the Turbine Building and the Screenhouse at one hour into the event. As shown the water depth is no more than 3 inches and an operator would be able to traverse between the two buildings to perform the actions in the Screenhouse. Assuming the operator does not start the actions until one hour and using the longest validated time to perform the actions, the DDCLP pump speed would be reduced well within the two hour time constraint.

The operator could exit that Turbine Building through Door 1 to traverse from the Turbine Building to the Screenhouse; Door 1 location is shown on Figure 6.1-4. As shown in Table 6.1-2, the maximum water surface elevation is below the FFE at Door 1, thus, there is no concern with water intrusion into the Turbine Building when this door is open nor will the water level interfere with the ability to open the door.

Table 3.3-1 shows a projected start at 20 minutes and projected completion at 40 minutes for reducing the speed of the running DDCLP. The Staffing Assessment Report (Reference 19) indicates these actions would be performed by the Out-Plant Operator 3 (AO3). The AO3's next action is to open disconnects and disengage overhead lines in the switchyard (Reference 19). Table 3.3-1 shows that the projected start and completion times for this action are 40 minutes and 2 hours 10 minutes, respectively. The action to open the disconnects and disengage overhead lines is only necessary if the ELAP event has brought down the power lines between the switchyard and the plant. This is a potential concern for a seismic event or a tornado, but not during a LIP. For the LIP these actions are not required and the AO3 has sufficient time to complete the actions in the Screenhouse without affecting his ability to perform other required subsequent actions.

Therefore, there is reasonable assurance that the LIP will not preclude performance of actions in the Screenhouse and other credited actions consistent with the existing FLEX strategies.

6.4 FLEX Portable Equipment Connection Points

Section 6.4 evaluates the location of FLEX connection points relative to the LIP per Reference 4, Appendix G, in order to demonstrate that the existing FLEX strategies can be implemented. The connection points for the FLEX portable equipment are in the Screenhouse, Battery Rooms, Auxiliary Feedwater Pump Rooms and the Auxiliary Building.

- The connections in the Screenhouse are to repower 480 VAC MCCs to enable operating the DDCLP Fuel Oil Transfer Pumps. As shown in Table 6.1-2 the maximum water surface elevation is below the Screenhouse FFE; thus, these connection points are unaffected.

- The connections in the Battery Rooms are to repower 480 VAC MCCs to repower the Battery Chargers to recharge the 125 VDC Batteries. The connections in the Auxiliary Feedwater Pump Rooms are to provide an alternative means to supply water to the Steam Generators. The Battery Rooms and Auxiliary Feedwater Pump Rooms are located inside the Turbine Building. As discussed in Section 6.2.1, water intrusion into the Turbine Building during the LIP will collect in the Condenser Pit. In this case the water will not reach the Battery Rooms or the Auxiliary Feedwater Pump Rooms. Thus, these connection points are unaffected.

- The connections in the Auxiliary Building are to repower 480 VAC MCCs to restore the capability to provide makeup to the Reactor Coolant System using the Charging Pumps. As discussed in Section 6.2.1, significant water intrusion into the Auxiliary Building is not expected due to closed doors and a long path to reach the areas where SSCs important to safety are located, including the connection points. A relatively large free volume in the Auxiliary Building is available to accept any water intrusion. Even in the most conservative case where the water level in the Auxiliary Building is assumed to be equivalent to the maximum water surface elevation outside the Auxiliary Building doors, the connection points would remain unaffected. As shown in Table 3.1-1, makeup to the Reactor Coolant System is not required until 32 hours into the event. The LIP event is well over by this time and the water levels have receded.

In conclusion, there is no impact to FLEX connection points from a LIP flood.

6.5 Deployment of Portable Equipment

Section 6.5 evaluates FLEX equipment storage, deployment, and the validation performed of deployment activities per Reference 4, Appendix G, in order to demonstrate that the existing FLEX strategies can be implemented for the LIP.

6.5.1 Portable Equipment Stored in the FLEX Building

The FLEX Building elevation and grading is shown on drawing C-11634309-03 (Reference 20). Calculation 180461.51.1015 (Reference 21) determines the potential impact to the FLEX Building from the LIP. The drainage areas around the FLEX Building are shown on Figure 6.5-1.

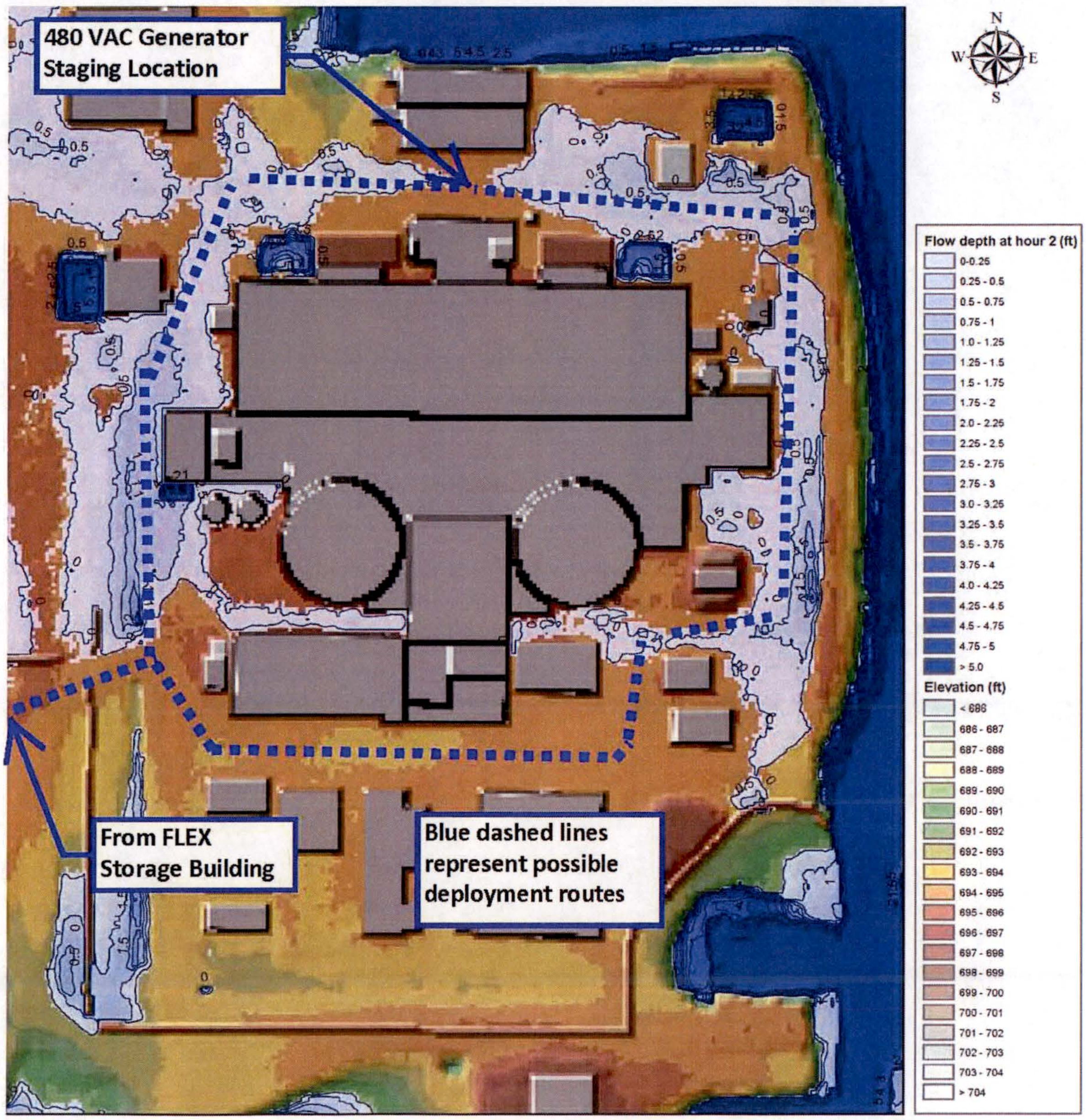
Figure 6.5-1, FLEX Building Drainage Areas

The maximum water surface elevation in the vicinity of the FLEX Building is predicted to be 692.46 ft in Storage Area 5A and 692.54 ft in Storage Area 5B. Reference 20 shows that the FFE of the FLEX Building is 695 ft and that the deployment pathway from the northeast side of the FLEX Building to the plant is between elevations 694 ft and 695 ft. Therefore, the LIP will not impact the equipment in the FLEX Building.

6.5.2 Deployment of Portable Equipment

Figure 6.5-2 shows that there are several different optional deployment routes between the FLEX storage building and the staging location for the 480 VAC generator to provide flexibility to account for uncertainties related to the event and the conditions. As shown in Table 3.3-1, the initial piece of portable equipment (480 VAC generator) used is to repower MCCs 1AB1 or 1AB2 to maintain fuel oil supply to the Diesel Driven Cooling Water Pumps. This same generator is then used to repower MCCs 1AC1 and 2AC2 or 1AC2 and 2AC1 to maintain DC power. The staging location for deployment of this generator is shown on Figure 6.5-2. For any ELAP scenario it is reasonably expected that the deployment route selected will use the least impeded path available.

Figure 6.5-2, Deployment Routes



As shown in Figure 6.5-2, depicted by the blue dashed line, the deployment route for the 480 VAC generator could be either around the west side or the east side of the Power Block to the staging location at the north side of the Power Block between the Turbine Building and the Screenhouse. This deployment route is asphalt roadway with the exception of the route between the FLEX storage building and the Protected Area; which is hard-packed gravel. Given that the surfaces around the plant are asphalt, these will not be subject to erosion. As shown in Reference 21, the maximum water surface in the vicinity of the FLEX storage building is 692.54 ft in Storage Area 5B. The elevation of the roadway between the FLEX storage building and the plant is between elevations 694 ft and 695 ft (Reference 20). Thus, the maximum water surface elevation during the LIP is below the elevation of the gravel road surface from the FLEX storage building. Therefore, this surface will only experience precipitation run-off and not significant erosion during a LIP event.

In support of implementation of FLEX strategies, debris removal is assessed in Evaluation 178599.50.2200-04 (Reference 22). The plant maintains equipment for debris removal stored in the FLEX storage building. Regarding timing of debris removal (for any external event), Reference 22 states:

> "Based on the type of debris expected it is reasonable to consider that a deployment path can be cleared within two hours. Minor debris such as building materials, tree limbs, and fencing can be removed within a 2 hour period by use of the debris removal equipment."

The two hours estimated in Reference 22 encompasses external events such as a tornado which would potentially generate much more debris than from a LIP. For the LIP event significant debris is not expected due to limited velocities and flood depths during the LIP. Any debris and minor erosion repair are well within the capability of the debris removal equipment. The FLEX strategy timeline depicted in Table 3.3-1 includes actions to clear debris internal to structures. These actions could be needed for a seismic event or a tornado but not for a LIP.

Similar to the discussion in Section 6.3, due to precipitation rates it is assumed that no actions occur outside the plant structures for the first hour. There are several possible access routes to the FLEX storage building from the Power Block that can be selected based on conditions. One such route is exiting the power block out Door 73 (location shown on Figure 6.1-4), then going south and west to the FLEX storage building. Figure 6.1-2 shows that there is not significant ponding along this route and that water surfaces would not impede getting to the building. It is noted that the FLEX storage building is not included in the southwest section of this figure. The FLEX storage building is addressed in Section 6.5.1, above. Assuming that personnel do not go the FLEX storage building during the first hour, any necessary debris removal can be completed no later than the third hour following the initiation of the LIP/ELAP event.

6.5.3 Timing vs. Weather Conditions

The following actions are performed to repower the MCCs from the portable generator:

(1) Deploy portable equipment (generator trailer and cable trailer from the FLEX storage building to the staging location),
(2) Route cables, and
(3) Make electrical connections at the generator and at the MCCs.

Time validation for these actions were performed per Work Order (WO) 00518025 and documented in the Master Validation Document. The time validations were performed in accordance with Reference 4. The time validations were previously performed for the FLEX strategies. Specific differences for the LIP that could affect the implementation of the strategies are accounted for below. The limiting time for each action is identified in Table 6.5-1.

Table 6.5-1, Validated Times for Repowering Screenhouse MCCs

Action	Time	WO 00518025 Task #	Remarks
Move Generator Trailer from FLEX Storage Bldg to Staged Location near Screenhouse	45 min, 24 sec	21 or 22 (Refs. 23, 24)	Validation used a conservative deployment route that maximized the time to perform this action.
Move Cable Trailer from FLEX Storage Bldg to Staged Location and Run Cable to Screenhouse MCC	59 min, 10 sec	24 (Ref. 25)	Validation used a conservative deployment route that maximized the time to move the cable trailer from the FLEX Storage Bldg.
Connect Cables and Power Up MCC 1AB1 or 1AB2	1 hr, 15 min, 21 sec	09 (Ref. 26)	
Total Time	**~ 3 hrs**		

As shown in Table 6.5-1 the maximum time to deploy and connect the portable generator to the MCC to energize MCC 1AB1 or 1AB2 to restore a DDCLP Fuel Oil Transfer Pump is approximately 3 hours. Conservatively assuming that these action do not start until the debris removal is complete at 3 hours after event initiation (which assumes that no actions are taken during the first hour due to the heavy precipitation), the Fuel Oil Transfer Pump will be available 6 hours after event initiation. This provides 2 hours margin to the 8 hour time constraint shown in Table 3.3-1. The two hour margin is adequate as it is an additional 67% above the 3 hours identified in Table 6.5-1 to deploy and connect the portable generator.

In addition to precipitation rates, deployment could possibly be affected by water depths. As shown on Figure 6.1-3, at 2 hours, the water depths at the staging area between the Screenhouse and the Turbine Building is shallow; i.e., less than 3 inches with no ponding in areas. The water depth at the deployment routes around the east side of the Power Block between the FLEX storage building and the staging area for the 480 VAC generator could be up to 3 inches for most of the route along the east side of the Turbine Building with some deeper ponding in specific locations. The water depths are somewhat greater on the west side of the Power Block. These water depths would not preclude deployment. The possible deployment routes for the cables between the 480 VAC generator and the Screenhouse MCC would be selected to be in the shallowest water. As shown in Figure 6.1-3 areas with no ponding could be used for the cable routes. These water depths will continue to decrease for time periods past two hours. Therefore, there is reasonable assurance that water depths will not impede deployment of the 480 VAC generator.

The next time constraint that requires going outside is to restart the Battery Chargers and Inverters from the same 480 VAC generator to two MCCs in the Battery Rooms. Table 3.3-1 shows that this action needs to be done within 11.5 hours. With the connections made to the MCCs in the Screenhouse within 8 hours, this leaves 3.5 hours to repower the MCCs in the Battery Rooms. Per Table 6.1-1, at 6 hours, the LIP event is essentially over and water is receding from the site. The access to the Battery Rooms from the generator is through the north side of the Turbine Building. Reference 25 validated that these cables can be pulled in less than 30 minutes. Reference 27 validated that the cable connections to the two MCCs could be made in approximately 20 minutes each. Therefore, the total time to run cables and connect to the MCCs is approximately 70 minutes; i.e., 30 minutes + 2 * 20 minutes. Therefore, if not already done, the cables can be routed and connected to the MCCs in the Battery Rooms within the available time.

As shown in Table 3.3-1, the next time constraint that requires deployment of portable equipment not until 32 hours into the event. By this time the LIP event is over and water has receded from the site.

Refueling of portable equipment is not included as part of this evaluation. Refueling of portable equipment is required no earlier than 12 hours; which is well after the LIP event is over.

6.5.4 Operation of Portable Equipment

The evaluation of the operation of portable equipment considers the equipment qualifications and the conditions for the personnel operating the equipment. Per Section 6.5.3, above, the portable 480 VAC generator is expected to be available at 6 hours. Per Table 6.1-1, at 6 hours, the LIP event is essentially over. The heaviest precipitation has passed; however, there could be some lingering relatively light precipitation. In the event the 480 VAC generator is staged and available prior to 6 hours, then the LIP is still in process. As shown in Table 6.1-1 the precipitation rate between 1 and 6 hours is approximately 1.5 inches/hour.

The procurement specification (Reference 28, Section 4.4, Item 2) for the 480 VAC generator includes the following requirement for the equipment:

> "The engine and generator shall also be capable of starting and continuous operation regardless of external weather conditions (e.g., rain, snow, sleet, ice, wind, high solar radiation, high humidity, etc.). Support system enclosures shall provide protection from these elements and shall be permanently affixed to the unit (e.g., NEMA 4X cabinet for controls)."

To check on the operating portable equipment, personnel would use protective clothing as necessary.

6.6 Conclusions and Summary

The above evaluation demonstrates that the current FLEX strategies can be implemented during a LIP without changes. Therefore, consistent with NEI 12-06 (Reference 4), Section G.4.1, the existing FLEX strategies can be implemented for the LIP as designed and no further actions are necessary.

7. References

1. U.S. Nuclear Regulatory Commission Letter, "Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident;" dated March 12, 2012.

2. NSPM Letter L-PI-16-039 to the U.S. Nuclear Regulatory Commission, "Prairie Island Nuclear Generating Plant, Units 1 and 2, Response to March 12, 2012 Request for Information Enclosure 2, Recommendation 2.1, Flooding, Required Response 2, Flooding Hazard Reevaluation Report," dated May 9, 2016, (ADAMS Accession No. ML16133A041).

3. U.S. Nuclear Regulatory Commission Letter, "Coordination of Requests for Information Regarding Flooding Hazard Reevaluations and Mitigating Strategies for Beyond-Design-Basis External Events," dated September 1, 2015.

4. Nuclear Energy Institute (NEI), Report NEI 12-06, Rev 2, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," dated December 2015.

5. U.S. Nuclear Regulatory Commission, Revision to JLD-ISG-2012-01, Revision 1, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigating Strategies for Beyond-Design-Basis External Events," dated January 22, 2016, (ADAMS Accession No. ML15357A163).

6. NSPM, "Prairie Island Updated Safety Analysis Report," Revision 34P.

7. NSPM, BDB-FLEX, "Diverse and Flexible Coping Strategies Coping Strategies (FLEX) Program Document," Revision 1.

8. U.S. Nuclear Regulatory Commission, Letter to Scott D. Northard, Northern States Power Company – Minnesota, "Subject: Prairie Island Nuclear Generator Plant, Units 1 and 2 – Correction to Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10 CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (CAC Nos. MF7710 and MF7711)," Dated October 17, 2016, (ADAMS Accession No. ML16286A161).

9. Black & Veatch, "Local Intense PMP & Hydrology," Calculation 180461.51.1005, Revision 1.

10. NSPM, Procedure AB-4, "Flood," Revision 50.

11. NSPM, Calculation ENG-ME-529, "Flood Barrier Leakage Criteria," Revision 0.

12. NSPM, Calculation ENG-ME-448, "Auxiliary Building Flooding Analysis," Revision 1, including minor revisions 1A and 1B.

13. NSPM, Drawing NF-117023, "D5/D6 Bldg. – Architectural Door Schedule & Door Details," Revision B.

14. Black & Veatch, "Evaluation of Structural Elements – Flood," Calculation 180461.51.1008, Revision 1.

15. NSPM, Drawing NF-117027, "Fuel Oil Storage Vault Plans," Revision A.

16. NSPM, FLEX Implementing Procedure FSG-20, "Cooling Water Management Following a Loss of AC Power," Revision 0.

17. NSPM, Drawing NF-38204-1, "Yard Plan, Gen. Arrangement of Structures – North, Units 1 & 2," Revision 83.

18. NSPM, Work Order Package 00518025 Task 08, "Reduce Clg Wtr Flow < 12,800 gpm."

19. NSPM Letter L-PI-15-044 to the U.S. Nuclear Regulatory Commission, "Prairie Island Nuclear Generating Plant Phase 2 Staffing Assessment Report in Response to March 12, 2012, Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, Enclosure 5, Recommendation 9.3, Emergency Preparedness- Staffing, Requested Information Items 1, 2, and 6," dated May 28, 2015 (ADAMS Accession No. ML 15154A564).

20. NSPM, Drawing C-11634309-03, Sheet No. EC1, "Preliminary and Intermediate Erosion Control Plan & Grating Plan," dated July 8, 2015.

21. Black & Veatch, "PINGP – FLEX Building Hydrology and Hydraulics," Calculation 180461.51.1015, Revision 0.

22. Black & Veatch, "Prairie Island Debris Removal Assessment," Evaluation 178599.50.2200-04, Revision 2.

23. NSPM, Work Order Package 00518025 Task 21, "Retrieve Scrnhouse / Battery Charger Dsl Gen from FLEX Bldg."

24. NSPM, Work Order Package 00518025 Task 22, "Retrieve Scrnhse/Battery Charge Dsl Gen & Place at Alt Loc."

25. NSPM, Work Order Package 00518025 Task 24, "Place Cable Trailer and Run Cable to Scrnhouse & 11 Batt Rm."

26. NPSM, Work Order Package 00518025 Task 09, "Connect Cables and Power Up 1AB1 or 1AB2: Primary."

27. NSPM, Work Order Package 00518025 Task 13, "Connect Cables and Power Up 1AC1 or 1AC2."

28. NSPM, Specification E201-0001-0002, "480 VAC FLEX Portable Diesel Generator for Battery and Screen House MCC's," Revision 0.

29. NSPM Letter L-PI-16-076 to the U.S. Nuclear Regulatory Commission, "Prairie Island Nuclear Generating Plant, Units 1 and 2 - Supplement to the Response to March 12, 2012, Request for Information Enclosure 2, Recommendation 2.1, Flooding, Required Response 2, Flood Hazard Reevaluation Report," dated September 29, 2016, (ADAMS Accession No. ML16273A556).