



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

June 17, 2014

Mr. Kevin K. Davison  
Site Vice President  
Northern States Power Company - Minnesota  
Prairie Island Nuclear Generating Plant  
1717 Wakonade Drive East  
Welch, MN 55089

SUBJECT: PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 1 & 2 – STAFF ASSESSMENT OF THE FLOODING WALKDOWN REPORT SUPPORTING IMPLEMENTATION OF NEAR-TERM TASK FORCE RECOMMENDATION 2.3 RELATED TO THE FUKUSHIMA DAI-ICHI NUCLEAR POWER PLANT ACCIDENT (TAC NO. MF0268 & MF0269)

Dear Mr. Davison:

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued a request for information letter per Title 10 of the *Code of Federal Regulations*, Section 50.54(f) (50.54(f) letter). The 50.54(f) letter was issued to power reactor licensees and holders of construction permits requesting addressees to provide further information to support the NRC staff's evaluation of regulatory actions that may be taken in response to lessons learned from Japan's March 11, 2011, Great Tōhoku Earthquake and subsequent tsunami. The request addressed the methods and procedures for nuclear power plant licensees to conduct flooding hazard walkdowns to identify and address degraded, nonconforming, or unanalyzed conditions through the corrective action program, and to verify the adequacy of the monitoring and maintenance procedures.

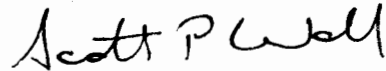
By letter dated November 26, 2012, Northern States Power Company – Minnesota (NSPM, the licensee) submitted a Flooding Walkdown Report as requested in Enclosure 4 of the 50.54(f) letter for the Prairie Island Nuclear Generating Plant, Units 1 and 2. In a letter dated January 31, 2014, NSPM provided a response to the NRC request for additional information for the staff to complete its assessments.

The NRC staff acknowledges that the licensee committed to complete the delayed walkdown items by November 29, 2013, consistent with the regulatory commitment. The NRC staff reviewed the information provided and, as documented in the enclosed staff assessment, determined sufficient information was provided to be responsive to Enclosure 4 of the 50.54(f) letter.

- 2 -

If you have any questions, please contact me at 301-415-2855 or by e-mail at Scott.Wall@nrc.gov.

Sincerely,

A handwritten signature in black ink that reads "Scott P Wall". The signature is written in a cursive style with a large initial "S" and a distinct "P" and "W".

Scott Wall, Senior Project Manager  
Plant Licensing Branch III-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-282 and 50-306

Enclosure:  
Staff Assessment of Flooding Walkdown Report

cc w/encl: Distribution via Listserv

STAFF ASSESSMENT OF SEISMIC WALKDOWN REPORT  
NEAR-TERM TASK FORCE RECOMMENDATION 2.3 RELATED TO  
THE FUKUSHIMA DAI-ICHI NUCLEAR POWER PLANT ACCIDENT  
NORTHERN STATES POWER COMPANY - MINNESOTA  
PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 1 & 2  
DOCKET NOS. 50-282 AND 50-306

1.0 INTRODUCTION

On March 12, 2012,<sup>1</sup> the U.S. Nuclear Regulatory Commission (NRC) issued a request for information per Title 10 of the *Code of Federal Regulations*, (10 CFR) Section 50.54(f) (50.54(f) letter) to all power reactor licensees and holders of construction permits in active or deferred status. The request was part of the implementation of lessons learned from the accident at the Fukushima Dai-ichi nuclear power plant. Enclosure 4, "Recommendation 2.3: Flooding,"<sup>2</sup> to the 50.54(f) letter requested licensees to conduct flooding walkdowns to identify and address degraded, nonconforming, or unanalyzed conditions using the corrective action program (CAP), verify the adequacy of monitoring and maintenance procedures, and report the results to the NRC.

The 50.54(f) letter requested licensees to include the following:

- a. Describe the design basis flood hazard level(s) for all flood-causing mechanisms, including groundwater ingress.
- b. Describe protection and migration features that are considered in the licensing basis evaluation to protect against external ingress of water into structures, systems, and components (SSCs) important to safety.
- c. Describe any warning systems to detect the presence of water in rooms important to safety.
- d. Discuss the effectiveness of flood protection systems and exterior, incorporated, and temporary flood barriers. Discuss how these systems and barriers were evaluated using the acceptance criteria developed as part of Requested Information item 1.h.
- e. Present information related to the implementation of the walkdown process (e.g., details of selection of the walkdown team and procedures) using the documentation template discussed in Requested Information item 1.j, including actions taken in response to the peer review.

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<sup>1</sup> Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340

<sup>2</sup> ADAMS Accession No. ML12056A050

- f. Results of the walkdown including key findings and identified degraded, nonconforming, or unanalyzed conditions. Include a detailed description of the actions taken or planned to address these conditions using guidance in Regulatory Issues Summary 2005-20, Revision 1, Revision to the NRC Inspection Manual Part 9900 Technical Guidance, "Operability Conditions Adverse to Quality or Safety," including entering the condition in the corrective action program.
- g. Document any cliff-edge effects identified and the associated basis. Indicate those that were entered into the corrective action program. Also include a detailed description of the actions taken or planned to address these effects.
- h. Describe any other planned or newly installed flood protection systems or flood mitigation measures including flood barriers that further enhance the flood protection. Identify results and any subsequent actions taken in response to the peer review.

In accordance with the 50.54(f) letter, Enclosure 4, Required Response Item 2, licensees were required to submit a response within 180 days of the NRC's endorsement of the flooding walkdown guidance. By letter dated May 21, 2012<sup>3</sup>, the Nuclear Energy Institute (NEI) staff submitted NEI 12-07, Revision 0, "Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features" to the NRC staff to consider for endorsement. By letter dated May 31, 2012<sup>4</sup>, the NRC staff endorsed the walkdown guidance.

By letter dated November 26, 2012<sup>5</sup>, Northern States Power Company – Minnesota (NSPM, the licensee), provided a response to Enclosure 4 of the 50.54(f) letter Required Response Item 2, for the Prairie Island Nuclear Generating Plant, Units 1 and 2 (PINGP). The NRC staff issued a request for additional information (RAI) to the licensee regarding the available physical margin (APM) dated December 23, 2013<sup>6</sup>. The licensee responded by letter dated January 31, 2014<sup>7</sup>.

The NRC staff evaluated the licensee's submittals to determine if the information provided in the walkdown report met the intent of the walkdown guidance and if the licensee responded appropriately to Enclosure 4 of the 50.54(f) letter.

## 2.0 REGULATORY EVALUATION

The SSCs important to safety in operating nuclear power plants are designed either in accordance with, or meet the intent of Appendix A to 10 CFR Part 50, General Design Criteria (GDC) 2: "Design Bases for Protection Against Natural Phenomena;" and Appendix A "Seismic and Geological Criteria for Nuclear Plants," to 10 CFR Part 100, Criterion 2 states that SSCs important to safety at nuclear power plants shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunamis, and seiches without loss of capability to perform their safety functions.

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<sup>3</sup> ADAMS Package Accession No. ML121440522

<sup>4</sup> ADAMS Accession No. ML12144A142

<sup>5</sup> ADAMS Accession No. ML12332A302

<sup>6</sup> ADAMS Accession No. ML13325A891

<sup>7</sup> ADAMS Accession No. ML14031A348

For initial licensing, each licensee was required to develop and maintain design bases that, as defined by 10 CFR 50.2, identify the specific functions to be performed by an SSC and the specific values or ranges of values chosen for controlling parameters as reference bounds for the design.

The design bases for the SSCs reflect appropriate consideration of the most severe natural phenomena that have been historically reported for the site and surrounding area. The design bases also reflect sufficient margin to account for the limited accuracy, quantity, and period of time in which the historical data have been accumulated.

The current licensing basis (CLB) is the set of NRC requirements applicable to a specific plant, and a licensee's written commitments for ensuring compliance with, and operation within, applicable NRC requirements and the plant-specific design basis that are in effect.

### 3.0 TECHNICAL EVALUATION

#### 3.1 Design Basis Flooding Hazard for Prairie Island Nuclear Generating Plant, Units 1 and 2

The design basis flood hazard for the PINGP site is a probable maximum flood (PMF) of the Mississippi River due to rapid runoff over frozen (impermeable) ground caused by heavy precipitation during a probable maximum spring storm melting the snowpack. The licensee stated that the probable maximum discharge for the PMF is 910,200 cubic feet per second with a corresponding peak stage of 703.6 feet mean sea level (MSL). The licensee stated that the maximum river level would be reached in about 12 days and remain above 695 feet MSL (site grade) for approximately 13 days.

The licensee also considered a number of other events including a summer storm over the project area, flooding due to backwater caused by ice jams, and failure of Lock and Dam Number 2 located 17 miles upstream of the PINGP site. The licensee determined that the spring storm event would produce the more critical flood.

Based on the NRC staff's review, the licensee appears to have described the design basis flood hazard level requested in the 50.54(f) letter and is consistent with the walkdown guidance.

#### 3.2 Flood Protection and Mitigation

##### 3.2.1 Flood Protection and Mitigation Description

The licensee stated that the CLB occurs at 703.6 feet MSL and it would be reached at approximately 12 days from the start of the event. The licensee stated that the flood protection features at PINGP are both incorporated and temporary active and passive barriers. Maximum wave runup (3.1 feet) was determined to result in an elevation of 706.7 feet MSL; however, the licensee stated that 703.6 feet MSL is the PMF level for the PINGP site. The licensee stated that the PINGP site is designed such that all areas critical to nuclear safety are protected against the effects of probable maximum flood and associated wave runup.

Plant operating procedures state flood stage elevation values at which plant protective measures must be taken. Implementation of flood procedures are based on three day forecasts of flood

stage and the actual flood stage at the PINGP site with specific actions in the flood procedure implemented based on water elevations for the flood forecasts. PINGP Procedure AB-4, "Flood," outlines actions to be taken when the three-day flood forecast exceeds elevation 678 feet. Action levels progress based on additional three-day flood forecasts at elevations 680 feet, 683 feet, 685 feet, 688 feet, 690 feet, and 692 feet. For the design basis flood, the total time available between the initial three-day forecast of water elevation of 678 ft and when the water elevation reaches the site grade (695 feet) is approximately six (6) days.

Flood protection procedures require placing the units in Mode 3, (Hot Standby), when flood stage elevation three-day projections exceed 693 ft MSL at the PINGP site. The licensee noted that procedures also require the plant to be placed in Mode 4 based on the High Energy Line Break analysis before flood bulkheads are installed. The licensee stated that a critical action during this timeframe is the installation of the flood doors and bulkheads. Other than a general statement that site preparation and response for the licensing basis flood event were adequate and could be completed with acceptable time, the licensee does not discuss the installation time for flood doors and bulkheads or for other specific flood protection features.

The licensee stated that the CLB does not describe adverse weather conditions that are assumed concurrent with flood protection features and associated actions.

### 3.2.2 Incorporated and Exterior Barriers

The licensee reported that the site has incorporated and exterior barriers that are permanently in-place, requiring no operator manual actions. These barriers include: structural walls, floors, roofs, and penetration seals. The licensee stated that the Reactor, Auxiliary, Fuel Handling, Turbine, and D5/D6 Diesel Generator buildings are all capable of withstanding the PMF of 703.6 feet MSL. The licensee stated that the slabs and flood protection walls for these structures are designed to resist the hydrostatic forces associated with the probable maximum flood and maximum wave runup. In addition, the licensee stated that all construction joints are keyed and provided with waterstops; penetrations through the basemat were held to a minimum and safeguard related equipment located outside of the structures are buried and designed to resist hydrostatic forces related to the PMF. The licensee noted that some leakage would occur for wave runup greater than 705 feet MSL between the top of the concrete wall and the bottom of metal siding; however, this small amount of leakage would be accommodated by sump pumps and would not contact safety related equipment. Diesel fuel tanks and fuel storage vaults, pipes and control cables are buried and designed to resist hydrostatic forces in addition to other effects associated with the probable maximum flood.

### 3.2.3 Temporary Barriers and Other Manual Actions

The licensee stated that the site has temporary barriers and other manual actions that require operator action. The actions and/or associated barriers include: flood doors and bulkheads, portable pumps and enactment of plant flood operating procedures.

The licensee stated that advance planning and preliminary arrangements during floods are based on the advisory reports of flood potential. When three-day forecasts project crests higher than the minimum access roads elevations, plant emergency fuel oil storage tanks will be maintained in a "keep-full" status until the road becomes impassable or the flood crest subsides below the

road level. Back up provisions for plant personnel transportation will be instituted. For three-day forecasts projecting water elevation in excess of 692 feet MSL, bulkheads stored onsite will be installed to close all openings in flood protection walls.

PINGP Procedure AB-4, "Flood" outlines actions to be taken in the event of a three-day river level forecast exceeding 678 ft MSL. Action levels progress based on additional three-day forecasts at elevations 680 feet, 683 feet, 688 feet, 690 feet, and 692 feet MSL. Implementation of the flood procedures are based on the three-day forecasts available from the U.S. Army Corp of Engineers (USACE) at Lock & Dam #3. The licensee stated that when flooding is predicted at the site, the plant staffs a full time flood response team with a team leader to monitoring flood conditions at the plant and at the USACE, coordinate preparation activities, and ensure tasks are completed by responsible groups.

#### 3.2.4 Reasonable Simulation and Results

The licensee evaluated the Flood Procedure AB-4 "Flood" using the reasonable simulation methodology as described in the walkdown guidance. The simulation consisted of:

- Review of the total time lapse between the initial three-day forecast of river water elevations of 678 feet and the water level reaching the site grade elevation of 695 feet MSL (approximately 6 days);
- Review of the total time lapse between the initial three-day forecast of river water elevation of 678 feet and water level elevation reaching 692 feet. At this point both units are shut down and flood doors and bulkhead closures are installed (approximately 4 days).
- Review of the time required to complete actions necessary to mitigate any impacts due to adverse conditions caused by the event or simultaneous with the event. Personnel interviews and field walkdowns of flood protection features and procedure steps as well as operator training reviews were conducted.

The licensee stated that simulations consisted of reviewing the time required to complete the actions, personnel requirements and availability, resource requirements and availability, and any impacts due to adverse conditions either from the event it is intended to mitigate or other adverse conditions that could reasonably be expected to simultaneously occur. The licensee did not discuss the length of time required for completion of the specific flood protection feature implementation actions; however, all actions were noted as being completed in the required time.

As a result of this simulation, the licensee suggested several enhancements to improve clarity, preparedness and streamline actions which were entered into the CAP. In addition, the licensee determined, after a review of lesson plans and training periodicity, that operator training for Flood Procedure AB-4 is adequate.

#### 3.2.5 Conclusion

Based on the NRC staff's review, the licensee appears to have described protection and mitigation features as requested in the 50.54(f) letter and the walkdown guidance.

### 3.3 Warning Systems

The licensee reported that, in general, awareness on emergency floods will come from the National Weather Service either through news releases or notices from the Xcel Energy Corporate Office. In addition, the licensee stated that Control Room indicators will show increasing water levels. The licensee added that water level warning systems exist in the Diesel Generator Building where leak detection sumps located in the storage vaults will trigger operator alarms if they fill with water and/or fuel oil.

Based on the NRC staff's review, the licensee appears to have provided information to describe any warning systems, as requested in the 50.54(f) letter and consistent with the walkdown guidance.

### 3.4 Effectiveness of Flood Protection Features

The licensee stated that the purpose of the flooding walkdowns was to review the acceptability of external flood features within the CLB; and to ensure that credited features were properly validated in preventative or surveillance programs for continued conformance within the CLB. The licensee found that the majority of flood protection features at PINGP were effective in meeting their intended credited function. One deficiency was identified concerning providing power to portable sump pumps in the event of a loss of offsite power. The deficiency was entered into the PINGP CAP for evaluation and disposition. The licensee added that potential observation issues found in the field that were questionable or did not meet the acceptance criteria, were captured in the PINGP CAP for resolution.

Based on the NRC staff's review, the licensee appears to have discussed the effectiveness of flood protection features as requested in the 50.54(f) letter and consistent with the walkdown guidance.

### 3.5 Walkdown Methodology

By letter dated June 11, 2012,<sup>8</sup> the licensee responded to the 50.54(f) letter that it intended to utilize the NRC endorsed walkdown guidelines contained in NEI 12-07, "Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features."<sup>9</sup> The licensee's walkdown submittal dated November 26, 2012, indicated that the licensee implemented the walkdowns consistent with the intent of the guidance provided in NEI 12-07. The licensee did not identify any exceptions from NEI 12-07.

Based on the NRC staff's review, the licensee appears to have discussed the effectiveness of flood protection features as requested in the 50.54(f) letter and consistent with the walkdown guidance.

### 3.6 Walkdown Results

#### 3.6.1 Walkdown Scope

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<sup>8</sup> ADAMS Accession No. ML12053A340

<sup>9</sup> ADAMS Accession No. ML12173A215



The licensee performed walkdowns of 52 flood protection features including walls, floors, roofs, and penetration seals. In addition, the licensee performed reasonable simulation of specific aspects of Flood Procedure AB-4 "Flood" related to protection of SSCs important to safety. The simulations involved review of available times and time required for implementation of flood protection features, interviews and field walkdowns of selected flood protection features and procedure steps with responsible workgroups.

The licensee stated that plant protective measures during flood stage elevations require placing the unit in Mode 3, Hot Standby, when flood stage elevation three-day projections exceed 692 ft. at the plant site. It is noted that operating procedures also require the plant be placed in Mode 4 based on the High Energy Line Break analysis, which is more restrictive than the actions for the external flooding event, before the flood bulkheads are installed. The licensee state that the CLB does not describe adverse weather conditions that are assumed concurrent with flood protection features and associated actions.

The licensee developed acceptance criteria consistent with the intent of NEI 12-07.

### 3.6.2 Licensee evaluation of flood protection effectiveness, key findings, and identified deficiencies

The licensee performed an evaluation of the overall effectiveness of the plant's flood protection features. Based on past experience, the plant staffs a full time flood protection response team when flooding is predicted. The team coordinates preparation activities to ensure that required tasks are completed by the responsible groups and that look-ahead activities are planned. The licensee reported that the majority of flood protection features at PINGP were found to be as described in the CLB (available, functional and maintained) and in conformance with the CLB.

NEI 12-07 defines a deficiency as follows: "a deficiency exists when a flood protection feature is unable to perform its intended function when subject to a design basis flooding hazard." The licensee identified one deficiency during the course of the flood walkdowns related to the power supply for portable sump pumps. The licensee stated that Flood Procedure AB-4 does not provide specifics regarding power supply to ensure their functionality during a loss of offsite power event. The licensee committed to develop a plan to resolve this by February 28, 2013.

NEI 12-07 specifies that licensees identify observations/potential deficiencies in the CAP that were not yet dispositioned at the time the walkdown report was submitted. PINGP identified eight items to be added to the plant's CAP for disposition. The licensee stated that those features were added to the CAP for material or design evaluation and were determined not to be deficiencies.

### 3.6.3 Flood Protection and Mitigation Enhancements

As a result of the reasonable simulation of Flood Procedure AB-4, the licensee identified several enhancements to improve the clarity of the procedure, streamline actions, and increase the overall preparedness of operators implementing the procedure.

#### 3.6.4 Planned or newly installed features

The licensee determined that no changes to flood protection features were necessary.

#### 3.6.5 Deficiencies Noted and Actions Taken or Planned to Address

The licensee noted one potential deficiency at the PINGP site which was entered into the PINGP CAP for review and disposition. The licensee committed to resolve this deficiency by February 28, 2013.

#### 3.6.6 Staff Analysis of Walkdowns

Staff reviewed the licensee walkdown report dated November 26, 2013. The staff noted that the licensee followed the intent of the recommended walkdown guidance. The licensee has summarized all findings including deficiencies, restricted access features, and inaccessible features in its walkdown report. In addition, the staff noted that features that were questionable or did not meet the acceptance criteria, were captured in the PINGP CAP for resolution. The staff noted that a reasonable simulation was performed for flood procedures and its results were adequately discussed by the licensee.

Based on the NRC staff's review, the staff concludes that the licensee has provided results of the walkdown and described any other planned or newly installed flood protection systems or flood mitigation measures as indicated in Requested Information items 2.f and 2.h of the 50.54(f) letter consistent with Appendix D, Walkdown Report, of the walkdown guidance. Based on the information provided in the licensee's submittals, the NRC staff concludes that the licensee's implementation of the walkdown process meets the intent of the walkdown guidance.

#### 3.6.7 Available Physical Margin

NRC staff issued a RAI to the licensee regarding the APM dated December 23, 2013<sup>10</sup>. The licensee responded with a letter dated January 31, 2014<sup>11</sup>. The licensee has reviewed their APM determination process, and entered any unknown APMs into their CAP. Staff reviewed the response, and concluded that the licensee met the intent of the APM determination per NEI 12-07.

Based on the NRC staff's review, the licensee appears to have documented the information requested for any cliff-edge effects, as requested in the 50.54(f) letter and consistent with the walkdown guidance. Further, the NRC staff reviewed the response, and concludes that the licensee met the intent of the APM determination per NEI 12-07.

### 3.7 NRC Oversight

#### 3.7.1 Independent Verification by Resident Inspectors

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<sup>10</sup> ADAMS Accession No. ML13325A891

<sup>11</sup> ADAMS Accession No. ML14031A348

On June 27, 2012, the NRC issued Temporary Instruction (TI) 2515/187 "Inspection of Near-Term Task Force Recommendation 2.3 Flooding Walkdowns." In accordance with the TI, NRC inspectors independently verified that the PINGP licensee implemented the flooding walkdowns consistent with the intent of the walkdown guidance. Additionally, the inspectors independently performed walkdowns of a sample of flood protection features. The inspection report dated February 7, 2013<sup>12</sup> documents the results of this inspection. No findings of significance were identified.

#### 4.0 SSCs NOT WALKED DOWN

The licensee Identified restricted access and inaccessible features.

##### 4.1 Restricted Access

The licensee identified 16 restricted access features which included: oil sumps, walls, electrical conduits and floor areas. The licensee provided justification for the delay in walkdowns of restricted access features in the walkdown report. Justifications vary from disassembly of equipment, confined spaces, entry into high radiation areas, among others. The licensee added that access to these features require additional plant support not available during normal plant operations. The licensee entered these features into the CAP for disposition and committed to inspect them by November 29, 2013.

##### 4.2 Inaccessible Features

The licensee identified the concrete basemats in the Auxiliary and Turbine Buildings as inaccessible features. Their function is to prevent or limit water intrusion to protect safety-related equipment from flood-related impacts. The licensee provided basis for reasonable assurance that inaccessible access features are available and will perform credited functions. Based on an evaluation of potential in-leakage relative to the maximum allowable rate of groundwater ingress into each of these buildings, the licensee determined that significant in-leakage is not expected. In addition, the licensee added that inspections of the topping concrete in these buildings found no evidence of degradation.

#### 5.0 CONCLUSION

The NRC staff concludes that the licensee's implementation of flooding walkdown methodology meets the intent of the walkdown guidance. The staff concludes that the licensee, through the implementation of the walkdown guidance activities and, in accordance with plant processes and procedures, verified the plant configuration with the current flooding licensing basis; addressed degraded, nonconforming, or unanalyzed flooding conditions; and verified the adequacy of monitoring and maintenance programs for protective features. Furthermore, the staff notes that no immediate safety concerns were identified. The NRC staff acknowledges that the licensee was to complete all delayed walkdown items before November 29, 2013, consistent with the regulatory commitment. The NRC staff reviewed the information provided and determined that sufficient information was provided to be responsive to Enclosure 4 of the 50.54(f) letter.

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<sup>12</sup> ADAMS Accession No. ML13038A671

If you have any questions, please contact me at 301-415-2855 or by e-mail at Scott.Wall@nrc.gov.

Sincerely,

/RA/

Scott Wall, Senior Project Manager  
Plant Licensing Branch III-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-282 and 50-306

Enclosure:  
Staff Assessment of Flooding Walkdown Report

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