



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

June 24, 2014

Mr. Louis P. Cortopassi
Site Vice President and Chief Nuclear Officer
Omaha Public Power District
Fort Calhoun Station
9610 Power Lane, Mail Stop FC-2-4
Omaha, NE 68008

SUBJECT: FORT CALHOUN STATION, UNIT NO. 1 – 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. MF0230)

Dear Mr. Cortopassi:

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 tsunamis. 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 27, 2012, Omaha Public Power District (OPPD, the licensee) submitted a Flooding Walkdown Report as requested in Enclosure 4 of the 50.54(f) letter for Fort Calhoun Station (FCS), Unit No. 1, as supplemented by letters dated March 29, 2013, and August 15, 2013. By letter dated January 31, 2014, OPPD provided a response to the NRC staff's request for additional information dated December 23, 2013, for the staff to complete its assessments. In addition, the licensee submitted a letter dated December 13, 2013, clarifying the available physical margin discussion presented in the walkdown submittal, as supplemented.

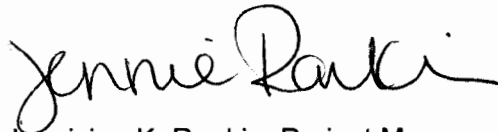
The NRC staff reviewed the information provided and, as documented in the enclosed staff assessment, determined sufficient information was provided to be responsive to Enclosure 4 of the 50.54(f) letter.

L. Cortopassi

- 2 -

If you have any questions, please contact me at (301) 415-1530 or by e-mail at Jennivine.Rankin@nrc.gov.

Sincerely,

A handwritten signature in black ink that reads "Jennivine Rankin". The signature is written in a cursive, flowing style.

Jennivine K. Rankin, Project Manager
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-285

Enclosure:
Staff Assessment of Flooding
Walkdown Report

cc w/encl: Distribution via Listserv

STAFF ASSESSMENT OF FLOODING WALKDOWN REPORT
NEAR-TERM TASK FORCE RECOMMENDATION 2.3 RELATED TO
THE FUKUSHIMA DAI-ICHI NUCLEAR POWER PLANT ACCIDENT
OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION, UNIT NO. 1
DOCKET NO. 50-285

1.0 INTRODUCTION

On March 12, 2012,¹ the U.S. Nuclear Regulatory Commission (NRC) issued a request for information per Title 10 of the *Code of Federal Regulations*, 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,"² 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.

Enclosure 4 of 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 SSCs [structures, systems, and components] 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.

¹ Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340.

² 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, 2012,³ 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, 2012,⁴ the NRC staff endorsed the walkdown guidance.

By letter dated November 27, 2012,⁵ as supplemented by letters dated March 29, 2013,⁶ August 15, 2013,⁷ Omaha Public Power District (OPPD, the licensee), provided a response to Enclosure 4 of the 50.54(f) letter Required Response Item 2, for Fort Calhoun Station (FCS), Unit No. 1. The NRC staff issued a request for additional information (RAI) to the licensee regarding the available physical margin (APM) dated December 23, 2013.⁸ The licensee responded by letter dated January 31, 2014.⁹ In addition, the licensee issued a letter dated December 13, 2013,¹⁰ clarifying the APM discussion presented in the walkdown submittal as supplemented.

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.

³ ADAMS Package Accession No. ML121440522.

⁴ ADAMS Accession No. ML12144A142.

⁵ ADAMS Accession No. ML12334A449.

⁶ ADAMS Accession No. ML13091A059

⁷ ADAMS Accession No. ML13228A098.

⁸ ADAMS Accession No. ML13325A891.

⁹ ADAMS Accession No. ML14031A344.

¹⁰ ADAMS Accession No. ML13351A426.

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 for Nuclear Power Plants," Criterion 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, tsunami, and seiches without loss of capability to perform their safety functions.

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), as defined in 10 CFR 54.3(a), 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 bases that are in effect.

3.0 TECHNICAL EVALUATION

3.1 Design Basis Flooding Hazard Fort Calhoun Station

The licensee reported that the design basis flood hazard for the site is a probable maximum flood on the Missouri River considering maximum rainfall (not probable maximum precipitation) over the watershed coincident with upstream dam failure of the Oahe or Fort Randall dam. The licensee stated that the CLB requires protection from external flooding levels less than or equal to 1014 feet (ft) Mean Sea Level (MSL), and that site grade is nominally set at 1004.5 ft MSL. The licensee also stated that flood time duration is not discussed in the CLB; however, the licensee assumed 7 days of onsite supply requirements and cited information provided by the U.S. Army Corps of Engineers (USACE) of a time period of 2 days for a dam failure flood crest to travel from the point of failure to the FCS site. The licensee stated that FCS is designed to be protected from the effects of river flooding and local rainwater.

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

3.2 Flood Protection and Mitigation

3.2.1 Flood Protection and Mitigation Description

The licensee stated that CLB flood protection is to an elevation of 1014 ft MSL. The licensee also stated that flood protection and mitigation features were designed using the following assumptions and inputs:

- The Emergency Response plan is activated if FCS is notified by the USACE or county/state/federal authorities that an upstream dams or dams have failed or are anticipated to fail with flooding expected to exceed 1004 ft MSL in the FCS area.
- Approximately 2 days would elapse after a dam failure before the resulting flood crest would reach the FCS site which is sufficient warning time to shut down the plant and implement adequate emergency procedures.
- Safety-related equipment susceptible to flooding is located in the Containment, Auxiliary Building, and Intake Structure.

The licensee stated that the Containment Structure (personnel access and equipment hatch) penetrations have a lower elevation of 1011.5 ft MSL. Flood barriers installed in the Auxiliary Building provide protection to 1014 ft MSL. Openings at the Auxiliary Building and Intake Structure were constructed to 1007 ft MSL. The licensee reported that throttling of the traveling screen sluice gates is performed to prevent a flood water pathway between the Intake Structure and the Circulation Water Pump cells, and that the operating strategy for floods greater than site grade (1004.5 ft MSL) is to place the plant on shutdown cooling.

3.2.2 Incorporated and Exterior Barriers

The licensee reported that incorporated and exterior barriers that are permanently in-place, requiring no operator manual actions. These barriers include watertight floors and exterior walls, and penetration seals for conduits, cable vaults and manholes that have a path for flood waters into safety-related buildings.

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 barriers include temporary and active features that require implementation of a procedure for performance of manual operator actions in order for the feature to perform its intended flood protection function. These features include flood doors, removable metal barriers for protection of the Auxiliary Building and Intake Structure, and the associated tools required to install these barriers.

3.2.4 Reasonable Simulation and Results

The licensee did not conduct reasonable simulations of the manual actions. In place of simulations, the licensee noted verifications completed as part of the installation process for

installation of new flood barriers during March 2011 and the procedures for installation of the barriers during summer 2011 flooding at FCS were used to demonstrate that that FCS procedures covering implementation of the flood protection strategy can be executed as written.

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 consistent with the walkdown guidance.

3.3 Warning Systems

The licensee stated that the CLB does not include warning systems in rooms important to safety credited to protect against flooding from external sources. During routine operations, FCS monitors the Missouri River for conditions that would initiate flood response actions. When one or more of the following events occur, flood response actions and entry conditions are initiated:

- The National Weather Service or the USACE forecasts the possibility of Missouri River level exceeding 1004 ft.
- Missouri River level reaches the 1000 ft level.
- Notification by the USACE that an upstream dam or dams have failed with flooding expected in the FCS area.

As stated by the licensee, if notified by USACE or other government authorities (local, state or federal) that an upstream dam or dams have failed or are anticipated to fail with flooding expected to exceed 1004 ft MSL in the FCS area, the Emergency Response Plan will be activated immediately. Immediate notification is intended to allow for the longest lead times to safely shutdown the plant and maintain it in a safe shutdown condition. Details regarding how the USACE or other authorities notify site personnel were not discussed by the licensee.

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 its flooding walkdown consisted of three primary segments: (1) checking credited flood protection features in the Intake Structure, Auxiliary Building and Containment; (2) reviewing outdoor features to ensure no topography changes, added structures or security barriers affect site drainage as described in the CLB; and (3) inspecting below-grade structures (i.e., basement walls, slabs and associated penetrations) in the Intake Structure, Auxiliary Building and Containment. Features in these areas are credited in the CLB to keep groundwater and rainfall runoff out of the safety-related buildings.

The licensee determined that sluice gates in the Intake Structure should be included in the walkdowns as a follow up to questions resulting from NRC inspection activities. Valves intended to prevent flooding in the switchgear room and other locations were found not to be in a preventative maintenance program. Cracks in exterior walls subject to exterior flooding, stains and rust around a flood penetration, and cracking around a plugged penetration were found in the Auxiliary Building. A vent flange in the Auxiliary Building was found to be undocumented as to water tightness. Stains and signs of leakage were found around a drain line that could provide a potential flood water pathway into a safety-related room. Cracking was found on a wall in the Intake Structure. Some flood protection penetrations were found to not be included in a periodic test, monitoring, or inspection program to ensure their functionality is adequately maintained. Additional cracks in floor slabs were evaluated that were at or below site grade.

The licensee confirmed that no topography changes, added structures or security barriers affected site drainage as described in the CLB. Evidence of groundwater/rainwater leakage through conduits into safety-related buildings at FCS was not identified during the walkdowns.

For each of the non-conforming items, the licensee stated that a condition report was generated and entered into the CAP for evaluation. The licensee stated that the inspections of walls, floors and penetrations confirmed that credited flood barriers are in place and no deficiencies were identified in the CAP that render these features incapable of performing their intended function.

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 8, 2012,¹¹ 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."¹² The licensee's walkdown submittal dated November 27, 2012, as supplemented, 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 presented information related to the implementation of the walkdown process as requested in the 50.54(f) letter and consistent with the walkdown guidance.

3.6 Walkdown Results

3.6.1 Walkdown Scope

The licensee performed walkdowns of 425 flood protection features, consisting primarily of visual inspections of flood protection systems and exterior, incorporated, and temporary flood

¹¹ ADAMS Accession No. ML12163A249.

¹² ADAMS Accession No. ML12173A215.

barriers. An outdoor walkdown was also conducted to confirm surface drainage provisions have not been impacted by changes to topography, resulting from such changes as installation of new security barriers. In lieu of reasonable simulations, the licensee cited the process for installation of new flood barriers in March 2011 and the procedures used for installation of the barriers during the summer 2011 flood to demonstrate that FCS procedures covering flood protection strategy implementation can be executed as written. Degraded, non-conforming or unanalyzed conditions were identified, the findings documented and entered into the FCS CAP.

The licensee stated that flood protection features at FCS are not dependent on weather, and that flood protection features are designed to function during any plant mode of operation.

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

3.6.3 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. The licensee determined that flood protection barriers are functional primarily by visual inspection of flood protection systems and exterior, incorporated, and temporary flood barriers. The licensee conducted an outdoor walkdown to confirm that surface drainage systems have not been impacted by changes to topography or new security barriers. The licensee stated that none of the issues identified during the walkdowns and documented in the condition reports resulted in an operability concern. The licensee cited procedures evaluated for temporary barrier installation in March 2011 and the installation during the summer 2011 flooding event as demonstration that the applicable FCS flood protection procedure can be performed successfully.

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 did not identify any deficiencies during the course of the flood walkdowns. The licensee stated that visual inspections of walls, floors and penetrations through the walls and floors were conducted to verify there are no observable structural deficiencies that may impact the structure's ability to remain watertight, and that all condition reports related to procedures were entered into the CAP have been addressed and are not deficiencies.

3.6.3 Flood Protection and Mitigation Enhancements

The licensee implemented or planned the following enhancements that improve or increase flood protection or mitigation: covering flood protection penetrations with periodic surveillance/maintenance programs for those penetrations not already covered by a program; installation of wireless water level measurement devices in manholes containing safety equipment; and revisions to Raw Water Pump intake cell level control during flooding conditions.

3.6.4 Planned or Newly Installed Features

The licensee determined that changes were not necessary by the flood walkdowns.

3.6.5 Deficiencies Noted and Actions Taken or Planned to Address

The licensee stated that inspections of flood protection features identified no deficiencies that would render these features incapable of performing their intended function. The licensee stated that all condition reports entered into the CAP have been evaluated with no deficiencies.

3.6.6 Staff Analysis of Walkdowns

The NRC staff reviewed the licensee's walkdown report dated November 27, 2012, as supplemented. The licensee evaluated the station's flood protection capability and stated that flood protection features are designed to function during any plant mode of operation and are not dependent on weather, and that there are no time-dependent actions required. The licensee wrote a condition report to develop and implement a procedure for surveillance/maintenance of flood protection penetrations that are not already covered in such a program. The licensee did not perform reasonable simulations but instead used operating experience from actual flood barrier installation during the summer 2011 flooding event, and the licensee revised existing procedures. The licensee stated that notification of a corresponding flooding event from the USACE or county/State/federal authorities will activate the Emergency Response Plan. The licensee stated that all potential deficiencies were evaluated in the FCS CAP and no deficiencies resulted.

Based on the NRC staff's review, the licensee appears to have provided results of the walkdown and described any other planned or newly installed flood protection systems or flood mitigation measures as requested in the 50.54(f) letter and consistent with 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.

3.7 Available Physical Margin

NRC staff issued an RAI to the licensee regarding the APM dated December 23, 2013. The licensee responded with a letter dated January 31, 2014. In addition, the licensee issued a letter dated December 13, 2013, clarifying the APM discussion presented in the walkdown submittal as supplemented. The licensee has reviewed its APM determination process, and entered any unknown APMs into the CAP. The NRC 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 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

On June 27, 2012, the NRC issued Temporary Instruction (TI) 2515/187, "Inspection of Near-Term Task Force Recommendation 2.3 Flooding Walkdowns."¹³ In accordance with the TI, NRC inspectors independently verified that the 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 December 31, 2012,¹⁴ documents the results of this inspection. The NRC resident inspector determined that the licensee failed to properly scope all the pertinent external flood protection features consistent with industry guidance NEI 12-07. The licensee entered the issue into its CAP and revised the scope of its flood protection measures accordingly. The licensee, as a corrective action, will also implement a preventative maintenance plan for the corresponding flood protection features (valves), as discussed in Section 3.4. The NRC inspector will provide regulatory oversight for this finding including monitoring of the corrective actions taken.

4.0 SSCS NOT WALKED DOWN

The licensee identified restricted access and inaccessible features.

4.1 Restricted Access

The licensee identified restricted access to 64 penetrations and wall features due to ongoing construction activities, or because access to these penetrations requires additional maintenance support. Approximately 38 of these penetrations (associated with Manhole 31) had upgraded conduit supports and new seals installed to protect equipment from water intrusion. Inspections for the remaining penetrations and walls which are in the Intake Structure and Auxiliary Building were completed by June 1, 2013. The licensee provided a supplemental response dated August 15, 2013, documenting the results.

4.2 Inaccessible Features

The licensee identified two inaccessible features in the Auxiliary Building. The licensee could not inspect an exterior wall of the Auxiliary Building due to a metal plate covering the wall and could not inspect another wall due to no physical access to the wall. The licensee provided information to assure that inaccessible features are available and will perform credited flood protection functions. The licensee performed inspections of spaces during the flooding of summer 2011, including the Auxiliary Building. During this extended flood condition, the licensee did not note water leakage at or from these two inaccessible areas, and therefore the licensee concludes that the features perform their flood protection function.

¹³ ADAMS Accession No. ML12129A108.

¹⁴ ADAMS Accession No. ML12366A158

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 licensee's walkdown results, which were verified by the staff's inspection, identified no immediate safety concerns. 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.

L. Cortopassi

- 2 -

If you have any questions, please contact me at (301) 415-1530 or by e-mail at Jennivine.Rankin@nrc.gov.

Sincerely,

/RA/

Jennivine K. Rankin, Project Manager
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-285

Enclosure:
Staff Assessment of Flooding
Walkdown Report

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ADAMS Accession No.: ML14157A079

*email dated May 21, 2014

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