



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

May 16, 2014

Mr. Fadi Diya
Senior Vice President and
Chief Nuclear Officer
Union Electric Company
P.O. Box 620
Fulton, MO 65251

SUBJECT: CALLAWAY PLANT, UNIT 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. MF0207)

Dear Mr. Diya:

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*, Subpart 50.54(f) (the 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 to 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 seismic and 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, Union Electric Company (the licensee) submitted a Flooding Walkdown Report as requested in Enclosure 4 of the 50.54(f) letter for Callaway Plant, Unit 1. By letter dated January 31, 2014, Union Electric Company provided a response to the NRC staff's request for additional information dated December 23, 2013, for the staff to complete its assessments.

The NRC staff acknowledges that the licensee will complete the delayed walkdown items during refueling outage 20, currently scheduled to begin October 4, 2014, consistent with the regulatory commitment provided in its letter dated November 27, 2012. The 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.

F. Diya

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If you have any questions, please contact me at 301-415-2296 or via e-mail at fred.lyon@nrc.gov.

Sincerely,

A handwritten signature in black ink that reads "CFlyon". The letters are cursive and somewhat stylized.

Carl F. Lyon, Project Manager
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-483

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
UNION ELECTRIC COMPANY
CALLAWAY PLANT, UNIT 1
DOCKET NO. 50-483

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*, Subpart 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-A, "Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features,"⁴ to the NRC staff to consider for endorsement. By letter dated May 31, 2012,⁵ the NRC staff endorsed the walkdown guidance.

By letter dated November 27, 2012,⁶ Union Electric Company (the licensee), provided a response to Enclosure 4 of the 50.54(f) letter Required Response Item 2, for the Callaway Plant, Unit 1 (Callaway). The NRC staff issued a request for additional information (RAI) to the licensee regarding the available physical margin (APM) dated December 23, 2013.⁷ The licensee responded by letter dated January 31, 2014.⁸ 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 for Nuclear Power Plants," Criterion 2, "Design bases for protection against natural phenomena," and Appendix A to 10 CFR Part 100, "Reactor Site Criteria." Criterion 2 states that SSCs important to safety at nuclear power plants shall be designed to withstand the effects

³ ADAMS Package Accession No. ML121440522.

⁴ ADAMS Accession no. ML14123A215.

⁵ ADAMS Accession No. ML12144A142.

⁶ ADAMS Accession No. ML12333A165.

⁷ ADAMS Accession No. ML13325A891.

⁸ ADAMS Accession No. ML14031A319.

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 that an SSC of a facility must perform, 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, including the licensee's docketed commitments for ensuring compliance with, and operation within, applicable NRC requirements and the plant-specific design basis, including all modifications and additions to such commitments over the life of the facility operating license.

3.0 TECHNICAL EVALUATION

3.1 Design Basis Flooding Hazard for the Callaway Plant

The design basis flood hazard for the Callaway site is a probable maximum precipitation (PMP) event. It was obtained from an analysis previously contained in the site's Final Safety Analysis Report (FSAR). In the Callaway FSAR, the greatest precipitation rate for the PMP event was 25.4 inches rainfall in 6 hours over a 75-acre tract defining the plant site thereby yielding a conservative ponding level of 6 inches above the existing site grade of 840 feet (ft) above mean sea level (MSL). [The site elevation reported corresponds to a Standardized Nuclear Unit Power Plant System (SNUPPS) Standard Elevation of 1999.5 ft, the preferred convention for reporting elevations in this walkdown report.]

The Callaway site is located on a topographic plateau, at an elevation of 840 ft approximately 5 miles inland from, and 300 ft above, the Missouri River. The licensee notes that the Callaway site is not considered to be susceptible to flooding by rivers, streams, dam failures, or channel migration. By virtue of its elevation, the site is higher than the calculated elevations associated with a probable maximum flood (PMF) event; the PMF elevation reported in the Near-Term Task Force Recommendation 2.3 (NTTF 2.3) Walkdown is 548 ft MSL. The site is not adjacent to any coastal area and, therefore, is not vulnerable to tsunami flooding and/or tidal surge or seiche. Because there is no design basis flood hazard assumed for the site, it may be considered to be a "dry site" ft MSL.

A groundwater-driven flood intrusion scenario was evaluated for the Callaway site. The analysis resulted in an estimated flood elevation of 840.00 ft MSL (or SNUPPS elevation 1999.50 ft) corresponding to the current Callaway site grade. The licensee reports that safety-related plant structures are conservatively designed for groundwater-related hydrostatic loads to a SNUPPS elevation of 2000.0 ft.

Based on its review, the NRC staff concludes that the licensee has described the design basis flood hazard level(s) as indicated in Requested Information item 2.a of the 50.54(f) letter, consistent with Appendix D, Walkdown Report, of the walkdown guidance.

3.2 Flood Protection and Mitigation

3.2.1 Flood Protection and Mitigation Description

The CLB for flood protection at the Callaway site is a PMP event. The earlier Individual Plant Examination of External Events (IPEEE)⁹ conducted for the Callaway site notes that the topography of the site serves as an important flood protection function. The site's natural drainage characteristics generally slope downgrade and radially away from the plant site, and thus help to passively divert any surface flow that might be attributed to storms to any stream networks adjacent to the site. A site storm drainage system has also been installed to drain surface runoff away from plant buildings. The system is comprised of catchment basins, artificial contour grading, drainage ditches, and storm drain pipes. Collectively, this man-made system that conveys surface flow to existing natural water courses ultimately feeds into the Missouri River.

3.2.2 Incorporated and Exterior Barriers

In general, any flood protection measures intended to protect safety-related systems and equipment are passive features that were incorporated into the original Callaway site design or later added and are now credited in the CLB. The NTTF 2.3 Walkdown Report (at page 7) notes that these features are described in the FSAR and include building ceilings, interior and exterior walls, floors, doors, penetrations, roofs, and sump pumps. Also cited are earthen (man-made) features and the existing topography of the site.

The licensee reported that no safety-related systems or equipment are affected by flooding. Lastly, the licensee did not identify any exterior flood prevention barriers permanently in-place requiring operator manual actions.

3.2.3 Temporary Barriers and Other Manual Actions

The site has no temporary barriers that require manual operator actions in the event of a flood threat.

3.2.4 Reasonable Simulation and Results

The purpose of performing reasonable simulations is to verify that the required flood protection procedures or activities can be executed as-specified/as-written. The licensee noted that flood protection features at the Callaway site do not include any temporary or active features that would require the implementation of a procedure for the performance of those manual/operator actions necessary for the flood protection feature in question to perform its intended flood

⁹ ADAMS Accession No. ML063550238.

protection function. Hence, there was a reference to “Reasonable Simulation” that might have been conducted by the licensee at the Callaway site in its NTTF 2.3 Walkdown Report.

3.2.5 Conclusion

Based on its review, the NRC staff concludes that the licensee has described protection and mitigation features as indicated in Requested Information item 2.b of the 50.54(f) letter consistent with Appendix D, Walkdown Report, of the walkdown guidance.

3.3 Warning Systems

There are no credited external flooding warning systems installed at the Callaway site.

Based on its review, the NRC staff concludes that the licensee has provided information to describe any warning systems as indicated in Requested Information item 2.c of the 50.54(f) letter, consistent with Appendix D, Walkdown Report, of the walkdown guidance.

3.4 Effectiveness of Flood Protection Features

The licensing basis flood event at the Callaway site is a PMP event. All flood protection features at the Callaway site are intended to protect safety-related equipment are passive design features. These features include reliance on the existing topography, grading of the existing ground surface, and a below-grade (gravity-driven) storm drainage system.

Based on its review, the NRC staff concludes that the licensee has discussed the effectiveness of flood protection features as indicated in Requested Information item 2.d of the 50.54(f) letter consistent with Appendix D, Walkdown Report, of the walkdown guidance.

3.5 Walkdown Methodology

By letter dated June 5, 2012,¹⁰ 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.”¹¹ The licensee’s walkdown submittal dated November 27, 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 its review, the NRC staff concludes that the licensee has presented information related to the implementation of the walkdown process as indicated in Requested Information item 2.e of the 50.54(f) letter, consistent with Appendix D, Walkdown Report, of the walkdown guidance.

¹⁰ ADAMS Accession No. ML12159A520.

¹¹ ADAMS Accession No. ML12173A215.

3.6 Walkdown Results

3.6.1 Walkdown Scope

The licensee performed walkdowns of currently-credited flood protection features at the Callaway site; however, the exact number of as-built features visually inspected was not reported. The walkdown scope was developed by the licensee to confirm that flood protection features credited in the CLB were acceptable and capable of performing their credited flood protection functions. Those passive features generally reported to have been inspected included: exterior and interior walls, floors, roofs, penetrations; and sumps, and elements of the onsite drainage system (both natural and man-made). The active features inspected included doors and manhole covers.

The licensee noted that flood protection features at the Callaway site do not include any temporary or active features that would require the implementation of a procedure for the performance of those manual/operator actions; hence, no "Reasonable Simulation" of manual actions was performed. The licensee used 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 Callaway's flood protection features. By virtue of its walkdown inspections, the licensee verified that permanent safety-related SSCs at the Callaway site were acceptable, not degraded, and capable of performing their intended design function as credited in the CLB. No Callaway operator actions are credited for external flood protection.

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 per Section 8 of NEI 12-07 because of the flooding walkdowns. However, there were 13 conditions observed during the walkdowns that warranted entry into the CAP via a Condition Report. These were documented as external flooding mitigation deficiencies. 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. There are no observations relating to the flooding walkdown awaiting disposition at the time the Walkdown Report was prepared.

3.6.3 Flood Protection and Mitigation Enhancements

There are no recently implemented or planned enhancements to the Callaway site identified by the licensee that are intended to improve or increase flood protection and/or mitigation.

3.6.4 Planned or Newly Installed Features

The licensee did not determine that changes were necessary by the flooding walkdowns.

3.6.5 Deficiencies Noted and Actions Taken or Planned to Address

Several external flooding mitigation deficiencies were noted by the licensee that called for actions to be taken or planned to further enhance flood protection at the Callaway site; none of these deficiencies required an operability determination. The deficiencies identified (Table 1 of the Callaway NTTF 2.3 Walkdown Report) have been documented as Corrective Actions.

3.6.6 NRC Staff Analysis of Walkdowns

The NRC staff reviewed the licensee's walkdown report dated November 27, 2012. The staff reviewed this additional information in conjunction with the submitted walkdown report.

Based on its review, the NRC 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

The NRC staff submitted a request for additional information (RAI) to the licensee regarding the available physical margin (APM) dated December 23, 2013.¹² The licensee responded by letter dated January 31, 2014. The licensee has reviewed its APM determination process, and entered any unknown APMs into its CAP. The staff reviewed the response, and concluded that the licensee met the intent of the APM determination per NEI 12-07.

Based on its review, the NRC staff concludes that the licensee has documented the information requested for any cliff-edge effects, as indicated in Requested Information item 2.g of the 50.54(f) letter consistent with Appendix D, Walkdown Report, of 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 Callaway 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 May 3, 2013,¹⁴ documents the results of this inspection. No findings of significance were identified.

¹² ADAMS Accession No. ML13325A891.

¹³ ADAMS Accession No. ML12129A108.

¹⁴ ADAMS Accession No. ML13123A252.

4.0 SSCs NOT WALKED DOWN

The licensee identified both restricted access as well as inaccessible features.

4.1 Restricted Access

There were two areas that were determined to be restricted access as defined by NEI 12-07. They were the sump rooms in both the Control Building and the Fuel Building. Sumps in these areas were not inspected as they were deemed inaccessible at the time the walkdown was conducted owing to the presence of installed covers. Attachment I to the licensee's letter dated November 27, 2012, contains a regulatory commitment associated with the schedule for completing walkdowns of areas that were unable to be inspected due to inaccessibility. The licensee committed to inspect these areas during refueling outage 20 currently scheduled to begin October 4, 2014.

4.2 Inaccessible Features

The licensee reported that certain features of the Callaway physical plant were not inspected. They included waterproof membranes, waterstops, and waterproof expansion joints. These features were not inspected as they are buried or embedded in concrete and therefore not physically accessible. However, the licensee stated there were no indications of in-leakage of water at those locations. Therefore, the licensee provided the NRC staff assurance that the as-designed and built structures in question are available, functioning, and are capable of performing their credited flood protection functions.

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 acknowledges that the licensee will complete the delayed walkdown items during refueling outage 20, currently scheduled to begin October 4, 2014, in accordance with the licensee's regulatory commitment provided in its letter dated November 27, 2012. 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.

F. Diya

- 2 -

If you have any questions, please contact me at 301-415-2296 or via e-mail at fred.lyon@nrc.gov.

Sincerely,

/RA/

Carl F. Lyon, Project Manager
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-483

Enclosure:
Staff Assessment of Flooding
Walkdown Report

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