



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

May 30, 2014

Mr. Adam C. Heflin
President, Chief Executive Officer,
and Chief Nuclear Officer
Wolf Creek Nuclear Operating Corporation
P.O. Box 411
Burlington, KS 66839

SUBJECT: WOLF CREEK GENERATING STATION – 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. MF0298)

Dear Mr. Heflin:

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) (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 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, the Wolf Creek Nuclear Operating Corporation (WCNOC, the licensee) submitted a Flooding Walkdown Report as requested in Enclosure 4 of the 50.54(f) letter for the Wolf Creek Generating Station. By letter dated January 28, 2014, WCNOC provided a response to the NRC request for additional information dated December 23, 2013, for the staff to complete its assessments.

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.

A. Heflin

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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, appearing to read "CF Lyon".

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

Docket No. 50-482

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
WOLF CREEK NUCLEAR OPERATING CORPORATION
WOLF CREEK GENERATING STATION
DOCKET NO. 50-482

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," 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 Wolf Creek Nuclear Operating Corporation (WCNOC, the licensee), provided a response to Enclosure 4 of the 50.54(f) letter Required Response Item 2, for the Wolf Creek Generating Station (WCGS). The NRC staff issued a request for additional information (RAI) to the licensee regarding the available physical margin (APM) dated December 23, 2013.⁶ The licensee responded by letter dated January 28, 2014.⁷

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. ML12144A142.

⁵ ADAMS Package Accession No. ML123400472.

⁶ ADAMS Accession No. ML13325A891.

⁷ ADAMS Accession No. ML14035A225.

of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunamis, 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 WCGS Site

The design basis flood hazard for the WCGS site is a probable maximum precipitation (PMP) event (28 inches in 6 hours with a maximum of 10.6 inches in 1 hour) with coincident wave runup attributed to the Wolf Creek lake, as described in the Final Safety Analysis Report for the site. Based on the drainage characteristics of the site, the licensee reports that the WCGS site was divided into two zones for the purposes of the Near-Term Task Force Recommendation 2.3 (NTTF 2.3) Walkdown Report. They are designated Zone A and Zone B. The maximum calculated combined flooding elevations for Zones A and B are 1099.86 feet (ft) and 1099.68 ft, respectively, above mean sea level (MSL). The licensee also reported that safety-related facilities at the WCGS site are not affected by the local flooding event as the elevation of those facilities is 1100 ft MSL.

The WCGS site is located on a relatively low peninsula overlooking a man-made lake created by impoundment of Wolf Creek, a tributary of the Neosho River. The site grade and floor elevation of the WCGS power block are, respectively, 1099.5 ft and 1100 ft MSL.

The licensee noted that the WCGS site is not considered to be susceptible to flooding by rivers, streams, dam failures, ice flooding, or channel migration. The site is also not adjacent to any coastal area and, therefore, not vulnerable to flooding by tsunamis, tidal surge, or seiche. As a consequence, these flooding scenarios were not considered as part of the original licensing basis.

The site is underlain by a shallow aquifer whose depth to the water table closely mirrors surface topography. Safety-related plant structures at the WCGS are conservatively designed to an elevation of 1100 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 for the WCGS site is a combined flooding event to elevations of 1099.86 ft MSL and 1099.68 ft MSL, respectively, for WCGS Zones A and B.

For the purposes of flood protection, the licensee reported that the reactor's flood protection and mitigation features were designed so that all safety-related systems and components occur at an elevation of 1100 ft MSL. The topography there is defined by relatively low relief. A yard drainage system is reported to be in-place to manage surface flow due to flooding. The maximum calculated water level due to PMP near safety-related plant buildings is less than the 1100 ft elevation level. A shallow water table is reported to occupy the site. As a consequence, safety-related SSCs have also been designed to withstand hydrostatic loads equivalent to an elevation of 1100 ft.

3.2.2 Incorporated and Exterior Barriers

In general, any flood protection measures intended to protect safety-related systems and equipment are both passive and active features that were incorporated into the original WCGS site design or later added and are now credited in the CLB. The licensee noted that the passive features include interior and exterior walls of structures, floors, walls, penetrations, vaults, and forebay. The licensee also mentioned existing site topography (both natural and modified) as well as the drainage system integrated into the original site design (i.e., culverts, drainage basins, and/or drainage ditches). Active features include doors, sump pumps, and sump pump motor doors.

The licensee reports 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 WCGS 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 protection

function. Hence, no 'Reasonable Simulation' of manual actions was reported to have been performed.

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 WCGS 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 WCGS site is a combined PMP event.

All flood protection features at the WCGS site are intended to protect safety-related equipment are either passive or active design features. These features include reliance on the existing topography or grading of the existing ground surface, below-grade waterproofing, and a below-grade 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, 2012,⁸ 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."⁹ 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.

⁸ ADAMS Accession No. ML12165A244.

⁹ 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 WCGS site; however, the exact number and types of as-built features visually inspected was not reported. The walkdown scope was developed to confirm that flood protection features credited in the CLB were acceptable and capable of performing their credited flood protection functions. The licensee noted that flood protection features at the WCGS 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 reported to have been performed.

The licensee did not discuss modes of operation and concurrent environmental conditions that were considered for the walkdowns.

The licensee used acceptance criteria in consistent with the intent of 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.

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 WCGS's flood protection features. By virtue of its walkdown inspections, the licensee verified that permanent safety-related SSCs at the WCGS site were acceptable, not degraded, and capable of performing their intended design function as credited in the CLB. No WCGS 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 stated that some of the features evaluated did not meet the acceptance criteria, but none of the observations were determined to be a deficiency as defined in NEI 12-07. Features that did not meet the NEI 12-07 were entered into the CAP and evaluated. The licensee concluded, based on its operability determinations, that these features could perform their intended flood protection functions when subjected to the design basis flooding hazard.

NEI 12-07 requires licensees to identify observations in the CAP that were not yet dispositioned at the time the walkdown report was submitted. The licensee did not identify any observations that had been entered into the CAP as the result of the walkdowns that had been dispositioned at the time the report was created.

3.6.3 Flood Protection and Mitigation Enhancements

The licensee reported that there is one planned enhancement to the WCGS physical plant that is intended to improve or increase flood protection and/or mitigation. A CAP plan was identified that was in progress to implement a design modification that will relieve groundwater pressure to power block structures. Penetrations with a history of leakage within that structure will then be reworked or repaired.

The licensee also reported that there is another CAP plan in progress to update existing external flood calculations for the WCGS site. The licensee expressed the view that the results of the reanalysis would increase design margins to CLB limits.

3.6.4 Planned or Newly Installed Features

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

3.6.5 Deficiencies Noted and Actions Taken or Planned to Address

No deficiencies were noted by the licensee that call for actions to be taken or planned to further enhance flood protection at the WCGS site.

The NRC staff reviewed the licensee's walkdown report submitted November 27, 2012. Based on the above assessment, the staff concludes that the licensee performed the walkdowns consistent with the intent of the guidance provided in NEI 12-07.

3.6.6 Staff Assessment of Walkdowns

The NRC staff reviewed the licensee's walkdown report submitted November 27, 2012.

As part of the walkdown effort, the licensee evaluated the capability of flood protection features by conducting visual inspections. Visual inspections included credited flood protection features such as: seals on through-wall penetrations; floor barrier walls and floors; designated flood protection doors; and sump pumps and motors. The licensee reported that the inspection of seals on through-wall penetrations indicated that they were generally in good condition and did not show signs of degradation or leakage. The licensee noted that flood protection features at the WCGS 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 was performed. The licensee-reported inspections confirmed with reasonable assurance that credited design features were in-place, available, and capable of performing their intended flood protection or mitigation functions. No deficiencies were identified. Two changes to flood protection or mitigation features were identified as a result of the walkdowns and were referred to the site's CAP. Based on the above assessment, the NRC staff concludes that the licensee performed the walkdowns consistent with the intent of NEI 12-07.

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 issued an RAI to the licensee regarding the APM dated December 23, 2013. The licensee responded by letter dated January 28, 2014. The licensee has reviewed its APM determination process, and entered any unknown APMs into the CAP. The NRC staff reviewed the response, and concludes 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."¹⁰ In accordance with the TI, NRC inspectors independently verified that the WCGS 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 13, 2013,¹¹ documents the results of this inspection. No findings of significance were identified.

4.0 SSCs NOT WALKED DOWN

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

4.1 Restricted Access

There were two classes of features that were determined to be restricted access as defined by NEI 12-07. They included certain hydraulic engineering features associated with the operation of the power plant as well as specific essential service water (ESW) manholes:

- *The Ultimate Heat Sink Dam and Associated Lake, and the ESW Pumphouse Forebay and Discharge Structure.* The licensee reported that these features are normally submerged under water, and are inspected by divers as part of the site's preventive maintenance (PM) program.

¹⁰ ADAMS Accession No. ML12129A108.

¹¹ ADAMS Accession No. ML13045A251.

- *Ten ESW Electrical Manholes.* The licensee reported that certain specific manholes were not inspected because doing so would require two actions: both the removal of a 6200 pound concrete cover that restricts access to each manhole as well as de-energization of exposed medium voltage ESW train cables for personnel safety. Consequently, the licensee reported that it intended to take credit for past inspections of these features for the purposes of the required walkdowns.

4.2 Inaccessible Features

The licensee reported that certain features of the WCGS physical plant were not inspected. They included:

- *Room 1319. Demineralizer Compartments South Wall.* It was noted that Room 1319 is entombed by the concrete wall and a Concrete Masonry Unit shielding preventing personnel access. This room has remote cameras in it to support health physics monitoring. The licensee reported that no evidence of external flood leakage has been seen from these cameras. The room also shares a common wall with the Hot Machine Shop. The licensee reported that there is no evidence of damage to the walls made of similar construction in rooms adjacent to Room 1319. As a result, the licensee reported that it had reasonable assurance that the wall in question is available and would perform the external flood protection function for the full duration of the flood condition.
- *Waterstops.* The licensee noted that waterstops and waterproofing materials were within the scope of the flooding walkdown review even though they have no credited safety function. 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 locations where these features occur. Therefore, the licensee expressed the view that that these features were available and functioning, as intended.
- *Sump Pumps.* The licensee noted that credited sump pumps were inspected in accordance with the acceptance criteria. Disassembly of the motor and cover plate over the sump would have been required to visually inspect the pumps. Low rating requirements were determined using documentation and name plate rating. The licensee noted that its PM program records were reviewed to ensure that the pumps in question were being maintained, and thus available and functioning, as intended.

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.

A. Heflin

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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,

/RA/

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

Docket No. 50-482

Enclosure
Staff Assessment of Flooding
Walkdown Report

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