



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

June 23, 2014

Mr. Edward D. Halpin
Senior Vice President and Chief Nuclear Officer
Pacific Gas and Electric Company
Diablo Canyon Power Plant
P.O. Box 56, Mail Code 104/6
Avila Beach, CA 93424

SUBJECT: DIABLO CANYON POWER PLANT – 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 NOS. MF0221 AND MF0222)

Dear Mr. Halpin:

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 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, Pacific Gas and Electric Company (PG&E, the licensee) submitted a Flooding Walkdown Report as requested in Enclosure 4 of the 50.54(f) letter for the Diablo Canyon Power Plant, Units 1 and 2. By letter dated January 29, 2014, PG&E 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 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.

E. Halpin

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If you have any questions, please contact me at 301-415-2833 or via e-mail at Peter.Bamford@nrc.gov.

Sincerely,

A handwritten signature in black ink that reads "Peter Bamford". The signature is written in a cursive style with a large, looping initial "P".

Peter J. Bamford, Project Manager
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-275 and 50-323

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
PACIFIC GAS & ELECTRIC COMPANY
DIABLO CANYON POWER PLANT, UNITS 1 AND 2
DOCKET NOS. 50-275 AND 50-323

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 Pacific Gas and Electric Company (PG&E, the licensee), provided a response to Enclosure 4 of the 50.54(f) letter Required Response Item 2, for the Diablo Canyon Power Plant (DCPP), Units 1 and 2. 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 29, 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 "Seismic and Geological Criteria for Nuclear Plants," to 10 CFR

³ ADAMS Package Accession No. ML121440522.

⁴ ADAMS Accession No. ML12144A142.

⁵ ADAMS Accession No. ML12333A145.

⁶ ADAMS Accession No. ML13325A891.

⁷ ADAMS Accession No. ML14029A702.

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) 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 the Diablo Canyon Power Plant Site

The licensee stated that based on the location and topography of the DCPD site, that DCPD has limited susceptibility to external flooding. The grade elevation of DCPD is 85 feet (ft) above mean sea level (MSL) and the site generally slopes away from major plant buildings toward the ocean or Diablo Creek. The licensee reported that the auxiliary salt water (ASW) pump rooms location is subject to the potential effects of surge and seiche and tsunami and is the controlling flood hazard at the site.

The licensee reported that that the probable maximum flood (PMF) was obtained by deriving the estimated probable maximum precipitation (PMP) with duration of 24 hours over Diablo Creek's drainage area. The PMP for the 24-hour duration was determined to be 16.6 inches. The PMF also assumed that all culverts are plugged, and water is impounded to the crest of the lowest depression of the switchyard's fill. The DCPD Updated Final Safety Analysis Report (UFSAR) concluded the artificial reservoir formed by the PMF would not affect the plant and the canyon that forms Diablo Creek would pass floods without hazard to site SSCs.

The licensee reported that the ASW main deck elevation is 20 ft above mean lower low water level (MLLW). The combined wave runup elevation for distantly-generated tsunami is 30 ft MLLW, and the combined wave run-up for near-shore tsunamis is 34.6 ft MLLW. The CLB did not evaluate any specific flood duration for this event.

Based on the NRC staff's review, the licensee appears to have described the design basis flood hazard level(s) as 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 the CLB for flood protection at the DCPD site is the combined effects of tsunami, wind-generated storm waves, storm surge, and tides at the ASW pump room location. As discussed in its walkdown report and the UFSAR, the licensee performed scale-model testing to evaluate the effects of splash and spray of the sea waves on safety-related equipment. The licensee observed potential splash and spray of sea water up to and above elevation 52 ft MLLW (the top of the ventilation shaft for the ASW pump rooms) during its scale-model testing. ASW ventilation shaft extensions are subject to splash and spray events and are a potential source of water entry into the ASW pumps rooms. The licensee concluded that the orientation and positioning of the shaft extensions mitigates any potential for flooding of the ASW pump rooms from tsunami, storm waves, and high tides.

3.2.2 Incorporated and Exterior Barriers

The licensee reported that the site has incorporated and/or exterior barriers that are permanently in-place, requiring no operator manual actions. The ASW pump motors are housed in watertight compartments designed for a combination tsunami-storm wave activity to elevation 48 ft MLLW. Floor drain systems in each of the ASW pump rooms include backflow check valves to maintain the pump rooms dry. ASW piping is buried and protected from erosion with gabion mattresses, reinforced concrete pavement above the buried piping, and armored embankments.

The intake structures at DCPD are protected from wave action by two breakwaters. These structures are constructed of precast concrete with interlocking tri-bars and reinforced concrete cap slab.

The ventilation shafts of the ASW are set back away from the seaward edge of the ASW structure and openings face away from the sea. Thus, the ASW ventilation shafts remain free of upward splashing of sea waves. Modeling results presented in the UFSAR concluded that not enough water would enter the ventilation shafts from spray events to render the ASW pumps inoperable.

The diesel fuel oil system (DFO) contains two buried DFO storage tanks and DFO transfer system. These systems consist of pumps and piping in underground rooms and trenches. Below-ground storage tanks are sealed and the vent lines extend 2 feet above ground. Access to the room is through steel hatch covers with concrete curbing to prevent water intrusion. The DFO transfer system pumps are separated in underground reinforced concrete rooms. They are protected from water intrusion by solid steel covers and concrete curbing. Drainage from these rooms are directed towards the turbine building sump and protected with backwater rooms.

The roof drain systems for buildings at DCPD are designed to handle a maximum rate of 4 inches of rain an hour. This capacity exceeds the PMP rate for the site. The topography around safety-related structures is graded to provide slope away from buildings and storm water

runoff is overland and unobstructed. The licensee reported that ponding around safety-related structures is not possible.

3.2.3 Temporary Barriers and Other Manual Actions

The licensee reported that the site has no temporary barriers. The only manual actions associated with protection features involve having an individual available to close any water-tight doors and having someone function as an active participant in conjunction with the tsunami warning procedure.

3.2.4 Reasonable Simulation and Results

The licensee reported that a reasonable simulation was performed for the tsunami procedure. The licensee reported that a team of engineering and operations personnel performed a procedure walkthrough that verified the procedure 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 reported that there are no alarms or warning systems used to detect water from external flooding. The tsunami warning procedure is entered when a tsunami, distant or near shore, warning is received from the appropriate federal agency.

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 visually inspected flood protection features during the walkdowns and used the CAP process to determine functionality, deficiencies, required actions, and whether immediate action was necessary to protect the plant. The licensee also evaluated the maintenance procedures and identified enhancements that were entered into the CAP. Additionally, the licensee reported that walkdowns of recent design modifications were performed to ensure that they did not adversely affect flood protection features. The report suggests there are no issues with the effectiveness of the flood protection/mitigation features. The licensee has met the intent of the walkdown guidance by reviewing and confirming the effectiveness of the flood protection features.

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 7, 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. 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 the NRC staff's review, the licensee appears to have presented information related to the implementation of the walkdown process as requested in 50.54(f) letter and consistent with the walkdown guidance.

3.6 Walkdown Results

3.6.1 Walkdown Scope

The licensee performed walkdowns of features categorized in five groups: ASW water-tight pump rooms, tsunami warning response procedure, breakwater system, DFO system, and roof drains and yard slope.

The licensee reported that the water-tight ASW pump rooms help protect pump motors for the intake structure from the design basis tsunami and storm wave event. The tsunami warning response procedure indicates activities required at the intake structure. The breakwater system protects the intake structure from waves. The DFO system (storage tanks and transfer system) consists of underground pipes and pumping designed to prevent flooding water or groundwater from entering the DFO storage tanks, concrete rooms, and pipe trenches. The roof drain system is designed to handle a rainfall rate of that exceeding the site probable maximum precipitation. The grounds around the safety-related buildings are sloped away from the buildings.

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 plant's flood protection features. The licensee reported that no deficiencies were noted that would prevent the flood protection features from performing their intended function.

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 deficiencies because of the flood walkdowns.

⁸ ADAMS Accession No. ML12159A582.

NEI 12-07 requires that licensees identify observations in the CAP that were not yet dispositioned at the time the walkdown report was submitted. The licensee's report stated that observations made during the walkdown process were evaluated and entered into the CAP.

3.6.3 Flood Protection and Mitigation Enhancements

The licensee identified enhancements to existing maintenance procedures and entered them into the CAP. The licensee did not identify the details regarding these enhancements. However, these enhancements are not required to be reported in response to 50.54(f) letter. The NRC staff concludes that the licensee has met the intent of the walkdown guidance.

3.6.4 Planned or Newly Installed Features

The licensee did not identify any necessary changes in the walkdown report.

3.6.5 Deficiencies Noted and Actions Taken or Planned to Address

The licensee noted no deficiencies resulting from the walkdown. The report stated that the "walkdown process also evaluated the existing maintenance procedures and identifies enhancements that were entered in the CAP." The licensee did not identify the details regarding these enhancements in the submitted report. However, as described above, the NRC staff concludes that these enhancements are not required to be reported in response to 50.54(f) letter.

3.6.6 Staff Analysis of Walkdowns

The NRC staff reviewed the licensee's walkdown report dated November 27, 2012. The walkdown revealed no deficiencies that would prevent flood protection features from performing their intended function and the licensee stated that observations were entered into the CAP. The report did not specifically identify what items, if any, were entered into the CAP. The licensee did not identify any deficiencies and likewise, does not require any planned actions. The licensee stated that existing maintenance procedures were evaluated and enhancements were entered into the CAP.

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.

3.6.7 Available Physical Margin

The NRC staff issued a request for additional information (RAI) to the licensee regarding the available physical margin (APM) dated December 23, 2013. The licensee responded with a letter dated January 29, 2014. The licensee has reviewed its APM determination process, and entered any unknown APMs into the CAP. The staff reviewed the response, and concludes 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."⁹ In accordance with the TI, NRC inspectors independently verified that the DCPD 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 12, 2013¹⁰, documents the results of this inspection. No findings of significance were identified.

4.0 SSCs NOT WALKED DOWN

The licensee identified inaccessible features but no restricted access features.

4.1 Restricted Access

There were no items identified in the walkdown that were considered "restricted."

4.2 Inaccessible Features

The licensee identified the following inaccessible features during the walkdowns: the Gabion Mattress, the ASW room internal conduit seals, and the DFO pump room internal conduit seals.

The licensee provided a basis for reasonable assurance that these inaccessible access features are available and will perform credited functions. The Gabion Mattress is inaccessible due to being buried over the ASW bypass piping and is unable to be walked down. Construction records indicate that the feature was correctly installed and inspected. No major settlement or erosion has occurred since installation. The ASW room internal conduit seals are inaccessible without significant disassembly. The conduit seals were replaced in the late 1990s and construction records indicate that they were properly installed and inspected. The DFO pump room internal conduit seals are inaccessible without significant disassembly.

The licensee evaluated the aggregate effect of potential loss of more than one inaccessible feature. The potential impact of losing the DFO pump room internal conduit seals was evaluated and since these are located at an elevation above where water could enter (above 85 ft) or are at a location where it is protected from flooding by another feature, the licensee

⁹ ADAMS Accession No. ML12129A108.

¹⁰ ADAMS Accession No. ML13043A160.

concluded that the DFO transfer system will not be impacted by flooding. Based on the information provided, the NRC staff concludes that there is reasonable assurance that the inaccessible features are either available, or have been evaluated, such that SSCs important to safety maintain the ability to perform their specified function under postulated flooding conditions.

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.

E. Halpin

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If you have any questions, please contact me at 301-415-2833 or via e-mail at Peter.Bamford@nrc.gov.

Sincerely,

/RA/

Peter J. Bamford, Project Manager
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-275 and 50-323

Enclosure:
Staff Assessment of Flooding
Walkdown Report

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*email dated April 28, 2014

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