



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

December 18, 2017

Mr. Edward D. Halpin
Senior Vice President, Generation
and Chief Nuclear Officer
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SUBJECT: DIABLO CANYON POWER PLANT, UNIT NOS. 1 AND 2 – STAFF
ASSESSMENT OF FLOODING FOCUSED EVALUATION (CAC NOS. MF9969
AND MF9970; EPID L-2017-JLD-0025 AND EPID L-2017-JLD-0026)

Dear Mr. Halpin:

By letter dated March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340), the U.S. Nuclear Regulatory Commission (NRC) issued a request for information to all power reactor licensees and holders of construction permits in active or deferred status, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(f), "Conditions of Licenses" (hereafter referred to as the "50.54(f) letter"). The request was issued in connection with implementing lessons learned from the 2011 accident at the Fukushima Dai-ichi nuclear power plant, as documented in the NRC's Near-Term Task Force (NTTF) report (ADAMS Accession No. ML111861807). Enclosure 2 to the 50.54(f) letter requested that licensees reevaluate flood hazards for their sites using present-day methods and regulatory guidance used by the NRC staff when reviewing applications for early site permits and combined licenses (ADAMS Accession No. ML12056A046). By letter dated March 11, 2015 (ADAMS Accession No. ML15071A045), as supplemented by letter dated February 8, 2016 (ADAMS Accession No. ML16040A009), Pacific Gas and Electric Company (the licensee) responded to this request for Diablo Canyon Power Plant, Unit Nos. 1 and 2 (DCPP).

After its review of the licensee's response, the NRC issued an interim staff response (ISR) letter for DCPP, dated March 30, 2016 (ADAMS Accession No. ML16083A551). The ISR letter provided the reevaluated flood hazard mechanisms that exceeded the current design basis (CDB) for DCPP and parameters that are a suitable input for the mitigating strategies assessment (MSA). As stated in the letter, because the local intense precipitation is not fully bounded by the plant's CDB, additional assessments of that flood hazard mechanism are necessary.

By letter dated July 19, 2017 (ADAMS Accession No. ML17200D161), the licensee submitted the focused evaluation (FE) for DCPP. The FEs are intended to confirm that licensees have adequately demonstrated, for the unbounded mechanism identified in the ISR letter, that: 1) a flood mechanism is bounded based on further reevaluation of flood mechanism parameters; 2) effective flood protection is provided for the unbounded mechanism; or 3) a feasible response

is provided if the unbounded mechanism is local intense precipitation. The purpose of this letter is to provide the NRC's assessment of the DCPD FE.

As set forth in the attached staff assessment, the NRC staff has concluded that the DCPD FE was performed consistent with the guidance described in Nuclear Energy Institute (NEI) 16-05, Revision 1, "External Flooding Assessment Guidelines" (ADAMS Accession No. ML16165A178). Guidance document NEI 16-05, Revision 1, has been endorsed by Japan Lessons-Learned Division (JLD) interim staff guidance (ISG) JLD-ISG-2016-01, "Guidance for Activities Related to Near-Term Task Force Recommendation 2.1, Flood Hazard Reevaluation" (ADAMS Accession No. ML16162A301). The NRC staff has further concluded that the licensee has demonstrated that effective flood protection, if appropriately implemented, exists for the unbounded flooding mechanism during a beyond-design-basis external flooding event at DCPD. This closes out the licensee's response for DCPD for the reevaluated flooding hazard portion of the 50.54(f) letter and the NRC's efforts associated with CAC Nos. MF9969 and MF9970.

If you have any questions, please contact me at 301-415-2864 or via e-mail at Milton.Valentin@nrc.gov.

Sincerely,



Milton O. Valentin, Project Manager
Beyond-Design-Basis Management Branch
Division of Licensing Projects
Office of Nuclear Reactor Regulation

Enclosure:
Staff Assessment Related to the
Flooding Focused Evaluation for DCPD

Docket Nos. 50-275 and 50-323

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STAFF ASSESSMENT BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO THE FOCUSED EVALUATION FOR
DIABLO CANYON POWER PLANT, UNIT NOS. 1 AND 2
AS A RESULT OF THE REEVALUATED FLOODING HAZARD NEAR-TERM TASK FORCE
RECOMMENDATION 2.1 - FLOODING

1.0 INTRODUCTION

By letter dated March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340), the U.S. Nuclear Regulatory Commission (NRC) issued a request for information to all power reactor licensees and holders of construction permits in active or deferred status, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(f) (hereafter referred to as the “50.54(f) letter”). The request was issued in connection with implementing lessons learned from the 2011 accident at the Fukushima Dai-ichi nuclear power plant, as documented in the NRC’s Near-Term Task Force (NTTF) report (ADAMS Accession No. ML111861807).

Enclosure 2 of the 50.54(f) letter requested that licensees reevaluate flood hazards for their respective sites using present-day methods and regulatory guidance used by the NRC staff when reviewing applications for early site permits and combined licenses (ADAMS Accession No. ML12056A046). If the reevaluated hazard for any flood-causing mechanism is not bounded by the plant’s current design basis (CDB) flood hazard, an additional assessment of plant response would be necessary. Specifically, the 50.54(f) letter stated that an integrated assessment should be submitted, and described the information that the integrated assessment should contain. By letter dated November 30, 2012 (ADAMS Accession No. ML12311A214), the NRC staff issued Japan Lessons-Learned Division (JLD) interim staff guidance (ISG) JLD-ISG-2012-05, “Guidance for Performing the Integrated Assessment for External Flooding.”

On June 30, 2015 (ADAMS Accession No. ML15153A104), the NRC staff issued COMSECY-15-0019, describing the closure plan for the reevaluation of flooding hazards for operating nuclear power plants. The Commission approved the closure plan on July 28, 2015 (ADAMS Accession No. ML15209A682). COMSECY-15-0019 outlines a revised process for addressing cases in which the reevaluated flood hazard is not bounded by the plant’s CDB. The revised process describes a graded approach in which licensees with hazards exceeding their CDB flood will not be required to complete an integrated assessment, but instead will perform a focused evaluation (FE). As part of the FE, licensees will assess the impact of the hazard(s) on their site and then evaluate and implement any necessary programmatic, procedural, or plant modifications to address the hazard exceedance.

Nuclear Energy Institute (NEI) 16-05, Revision 1, “External Flooding Assessment Guidelines” (ADAMS Accession No. ML16165A178), has been endorsed by the NRC as an appropriate methodology for licensees to perform the FE in response to the 50.54(f) letter. The NRC’s endorsement of NEI 16-05, including exceptions, clarifications, and additions, is described in NRC JLD-ISG-2016-01, “Guidance for Activities Related to Near-Term Task Force Recommendation 2.1, Flood Hazard Reevaluation” (ADAMS Accession No. ML16162A301). Therefore, NEI 16-05, Revision 1, describes acceptable methods for demonstrating that Pacific

Gas and Electric Company (PG&E, the licensee) has effective flood protection for the Diablo Canyon Power Plant, Unit Nos. 1 and 2 (DCPP).

2.0 BACKGROUND

This background section describes the reevaluated flood information provided by the licensee and the associated assessments performed by the NRC staff. The reevaluated flood information includes the flood hazard reevaluation report (FHRR), the mitigation strategies assessment (MSA), and the FE.

Flood Hazard Reevaluation Report

By letter dated March 11, 2015 (ADAMS Accession No. ML15071A045), the licensee submitted the FHRR for DCPP. In this letter, the licensee made a regulatory commitment to implement interim actions to mitigate the potential effects of the local intense precipitation (LIP), which was found not fully bounded by the CDB. The regulatory commitment consisted of utilizing existing weather forecasting technologies combined with deployment of temporary barriers (sandbags or equivalent) at affected doors of safety and non-safety-related structures until the integrated assessment report (or FE) was completed. By letter dated February 8, 2016 (ADAMS Accession No. ML16040A009), PG&E submitted a revised response that contained a reevaluated LIP and associated site drainage analysis, not revising or introducing new regulatory commitments. After reviewing the licensee's response, by letter dated March 30, 2016 (ADAMS Accession No. ML16083A551), the NRC issued an interim staff response (ISR) letter for DCPP. The ISR letter discussed the reevaluated flood hazard mechanism that exceeded the CDB for DCPP and the parameters that are a suitable input for other assessments associated with NTTF Recommendation 2.1 "Flooding." As stated in the ISR letter, because the LIP was not fully bounded by the plant's CDB, additional assessments are necessary. The NRC staff issued a final staff assessment of the FHRR by letter dated December 18, 2017 (ADAMS Accession No. ML17024A207). The NRC staff's conclusions regarding flooding-mechanisms exceeding the DCPP CDB remained unchanged from the information provided in the ISR letter.

Mitigation Strategies Assessment

By letter dated April 6, 2017 (ADAMS Accession No. ML17096A766), PG&E submitted the DCPP MSA for NRC review. The MSAs are intended to confirm that licensees have adequately addressed the reevaluated flooding hazards within their mitigation strategies for beyond design basis external events. The licensee stated that no credit was taken for the interim actions proposed in the FHRR to mitigate the potential effects of the unbounded LIP event. The April 6, 2017, letter included a revision to the LIP model. By letter dated December 18, 2017 (ADAMS Accession No. ML17310A265), the NRC issued its assessment of the DCPP MSA. The NRC staff concluded that the DCPP MSA was performed consistent with the guidance described in Appendix G of Nuclear Energy Institute 12-06, Revision 2, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide" (ADAMS Accession No. ML16005A625). The NRC's endorsement of NEI 12-06, Revision 2, is described in JLD-ISG-2012-01, Revision 1, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" (ADAMS Accession No. ML15357A163). The NRC staff further concluded that the licensee has demonstrated that the mitigation strategies with a minor modification; if appropriately implemented, are reasonably protected from reevaluated flood hazards conditions for beyond-design-basis external events.

In addition, the staff concluded that the revised LIP model and associated values were acceptable for use in the MSA and forthcoming flooding FE.

Focused Evaluation

By letter dated July 19, 2017 (ADAMS Accession No. ML17200D161), the licensee submitted the FE for DCPD. The FEs are intended to confirm that licensees have adequately demonstrated, for unbounded mechanisms identified in the ISR letter, that: 1) a flood mechanism is bounded based on further reevaluation of flood mechanism parameters; 2) effective flood protection is provided for the unbounded mechanism; or 3) a feasible response is provided if the unbounded mechanism is LIP. These 3 options associated with performing an FE are referred to as Path 1, 2, or 3, as described in NEI 16-05, Revision 1. The purpose of this staff assessment is to provide the results of the NRC's evaluation of the DCPD FE.

3.0 TECHNICAL EVALUATION

As described in the ISR letter, the LIP was found to exceed the plant's CDB. The licensee stated that the FE for DCPD followed Path 2 of NEI 16-05, Revision 1 and followed guidance in Appendix B to evaluate the site's strategy. This technical evaluation characterizes flood parameters and evaluates the following flood impact assessment topics for each unbounded flood-causing mechanisms: description of impact of unbounded hazard; evaluation of available physical margin and reliability of flood protection features; and overall site response.

3.1 Characterization of Flood Parameters

The licensee assessed flood-causing mechanisms as documented in its FHRR (ADAMS Accession No. ML15071A045) and revised responses dated February 8, 2016 (ADAMS Accession No. ML16040A009) and April 6, 2017 (ADAMS Accession No. ML17096A766). The NRC staff found the reevaluated hazard parameters suitable for assessments associated with NTFP Recommendation 2.1 "Flooding" in letters dated March 30, 2016 (ADAMS Accession No. ML16083A551) and December 18, 2017 (ADAMS Accession No. ML17321B040). The licensee used the FHRR information as input for its FE and concluded that key safety functions (KSFs) are protected from the non-bounded reevaluated flood-causing mechanism (LIP) by plant grade or permanent/passive features with adequate margin. The licensee also stated that the site does not require human actions to protect key structures, systems, and components (SSCs); therefore, an evaluation of the overall site response was not necessary.

The licensee stated in its FE, that the elevation data is based on the North American Vertical Datum of 1988 (NAVD88). The licensee also stated that flood heights from a LIP event vary at different DCPD locations due to the site-specific terrain and watershed pathways. For the same reason, the licensee performed plant walkdowns and software modeling to understand the potential effects of the LIP event. Consequently, the licensee completed two studies where water surface elevations at points of interests, water pathways and water intrusion volumes were estimated. The first study, PG&E calculation No. 9000042281-000-00, "Study Calculation: Diablo Canyon Power Plant Local Intense Precipitation Analysis 2D Modeling," dated March 22, 2017, was also used to support the licensee's April 6, 2017, flooding MSA submittal. This study provided a more detailed LIP analysis for the DCPD site. The staff found this analysis acceptable for use in the flooding MSA and for use in the FE as documented in the staff's assessment of the licensee's flooding MSA dated December 18, 2017 (ADAMS Accession No. ML17321B040). The second study, PG&E calculation No. 9000042232-001-00, "Study Calculation: Diablo Canyon Local Intense Precipitation (LIP) Effect on Building Internals," dated

June 14, 2017, was used to determine the flow path and volume of water entering plant structures and potential impact on SSCs.

Based on these studies, the licensee stated that SSCs potentially impacted by flood waters from the postulated LIP are located in the auxiliary building (AB) and the turbine building (TB). The licensee also identified the SSCs important to safety located close to points of interest where water might accumulate. In its FE, the licensee described that the potential water intrusion in these structures does not compromise KSFs at DCP.

3.2 Evaluation of Flood Impact Assessment for LIP

3.2.1 Description of Impact of Unbounded Hazard

Tables 1, 2, and 3 of the licensee's FE provide a summary of the LIP flood impact at DCP. Table 1 shows water depths above door thresholds and flood durations. Tables 2 and 3 show pathways and volume estimates of water that could potentially enter the AB and TB. The licensee explained that water intrusion could be expected at these pathways. The volume of water potentially entering the AB and TB was estimated to be around 388,566 gallons and 25,475 gallons, respectively. Given that possibility, the licensee assessed the equipment around the identified pathways and determined that no KSFs would be affected by water intrusion. The licensee also stated that this analysis demonstrated that the interim actions proposed in the FHR to mitigate the potential effects of the LIP event at DCP are not required to respond to LIP flooding.

The licensee's FE described inputs used to estimate the water elevations and intrusion volumes as conservative. Among the arguments provided, PG&E explained that the analysis took no credit for site drainage systems, ground infiltration, or water runoff losses. The licensee's March 11, 2015, and February 8, 2016 LIP event calculations provided in response to the March 12, 2012, 50.54(f) letter were evaluated by the staff as documented in the staff's assessment of the FHR dated December 18, 2017 (ADAMS Accession No. ML17024A207).

3.2.2 Evaluation of Available Physical Margin and Reliability of Flood Protection Features

The licensee stated in its FE that potential water intrusion into the AB from the LIP event should drain into the AB sump cavity and Pipe Tunnels. Potential water intrusion into the TB should convey at lower levels of the TB. The licensee's FE states that the sump cavity and pipe tunnel have enough capacity to retain the water intrusion without compromising KSF equipment.

Using the audit process, performed in accordance with a generic audit plant dated July 18, 2017 (ADAMS Accession No. ML17192A452), the NRC staff reviewed the evaluation of LIP effects on building internals (PG&E calculation 9000042232-001-01). Inputs for the calculation used flood parameters provided in the FHR. Configuration of SSCs was consistent with the DCP Updated Final Safety Analysis Report (UFSAR). Based on the review, the staff concluded that the calculation followed the guidance in NEI 16-05 for evaluating and describing flood impacts.

PG&E calculation 9000042232-001-01 assumed no deployment of sandbags prior to the LIP event. As described in the licensee's July 19, 2017 letter, gaps under various doors were physically measured, taken from plant drawings, or conservatively estimated. The licensee stated that building internal flood drains were generally considered non-functional. However, for the purpose of calculating water levels on the exterior of the structures at the points of interest, the exterior drainage system between the Unit 1 and Unit 2 containment structures, fuel

handling building and the AB were considered functional for draining water to the surrounding ground surface elevation by means of several existing piped conveyance systems. These drains are included in a preventative maintenance program. Additional drains in the adjacent outage access control area are modeled to convey water externally through the existing drain system. The licensee stated that although these drains were not in a preventative maintenance program at the time of the FE submittal, the licensee planned to add these drains to the preventative maintenance program by August 30, 2017. Using the audit process, the NRC staff confirmed that PG&E has added these drains to the licensee's preventative maintenance program. The subject drains have been added to work instructions in PG&E Maintenance Plan 35459, "AUX / FHB ROOF DRAINS; CLEAN & INSP." This addition was documented as part of Notification 50926905.

Because increased focus has been placed on flood protection since the accident at Fukushima, licensees and NRC inspectors have identified deficiencies with equipment, procedures, and analyses relied on to either prevent or mitigate the effects of external flooding at a number of licensed facilities. Recent examples include those found in Information Notice 2015-01, "Degraded Ability to Mitigate Flooding Events" (ADAMS Accession No. ML14279A268). In addition, the NRC is cooperatively performing research with the Electric Power Research Institute to develop flood protection systems guidance that focuses on flood protection feature descriptions, design criteria, inspections, and available testing methods in accordance with a memorandum of understanding dated September 28, 2016 (ADAMS Accession No. ML16223A495). The NRC staff expects that licensees will continue to maintain flood protection features in accordance with their current licensing basis. The staff also expects that licensees will use the site corrective action program to disposition flood-related maintenance, operations, and design issues, consistent with the provisions of NEI 16-05 and NEI 12-07, "Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features," as endorsed by the NRC, where appropriate. Continued research involving flood protection systems will be performed and shared with licensees in accordance with the guidance provided in Management Directive 8.7, "Reactor Operating Experience Program" (ADAMS Accession No. ML122750292), as appropriate.

The NRC staff confirmed that Section 9.2.3.3 of the UFSAR (Revision 20, November 2011), that the AB sump and pipe tunnel can receive about 345,000 gallons of water. This available space can accommodate the estimated 338,566 gallons of water intrusion from the LIP event. The NRC staff also confirmed that the licensee has controls in place to monitor and address internal flooding at the AB. The DCPD UFSAR states that the AB sump and pipe tunnel has alarms and sump pumps to monitor and control internal flooding. If available, these features should provide additional protection to the KSFs in the AB.

To assess the potential water intrusion at the TB, the NRC staff also considered information in the DCPD UFSAR. Similarly, the NRC staff confirmed that UFSAR Section 10.4.5.4 states that the TB lower levels (below 85 feet) can accommodate the potential water intrusion estimated by the licensee, with sufficient margin. In addition, the UFSAR explains that the TB sump also has alarms and pumps to mitigate internal flooding. As stated for the AB, the TB sump pumps and alarms should provide additional protection to the KSFs in the TB.

Accordingly, the NRC staff agrees with the licensee's statement that interim actions are no longer required to mitigate the potential effects of the LIP event at the DCPD site.

Based on the above evaluation, the NRC staff concludes that existing margins and protective features provide adequate protection to maintain KSFs as defined in Appendix B of NEI 16-05, Revision 1.

3.2.3 Overall Site Response

The licensee does not rely on any personnel actions or new modifications to the plant in order to respond to the LIP event. As described above, the licensee's evaluation relied on passive existing flood protection features to demonstrate adequate flood protection; therefore, there is no need to review overall site response.

4.0 AUDIT REPORT

The July 18, 2017, generic audit plan describes the NRC staff's intention to issue an audit report that summarizes and documents the NRC's regulatory audit of the licensee's FE. The NRC staff's DCPD audit was limited to the review of the calculations and procedures described above. Because this staff assessment appropriately summarizes the results of the audit, the NRC staff concludes a separate audit report is not necessary, and that this document serves as the audit report described in the staff's July 18, 2017, letter.

5.0 CONCLUSION

The NRC staff concludes that PG&E performed the DCPD FE in accordance with the guidance described in NEI 16-05, Revision 1, as endorsed by JLD-ISG-2016-01, and that the licensee has demonstrated that effective flood protection exists against the reevaluated flood hazards. Furthermore, the NRC staff concludes that DCPD screens out of performing an integrated assessment based on the guidance found in JLD-ISG-2016-01. As such, in accordance with Phase 2 of the process outlined in the 50.54(f) letter, additional regulatory actions associated with the reevaluated flood hazard, beyond those associated with mitigation strategies assessment, are not warranted. The licensee has satisfactorily completed providing responses to the 50.54(f) activities associated with the reevaluated flood hazard.

SUBJECT: DIABLO CANYON POWER STATION, UNITS 1 AND 2 – STAFF ASSESSMENT OF FLOODING FOCUSED EVALUATION (CAC NOS. MF9969 AND MF9970; EPID L-2017-JLD-0025 AND EPID L-2017-JLD-0026) DATED December 18, 2017

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