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April 6, 2017

PG&E Letter DCL-17-024

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

EA-12-049
10 CFR 50.54(f)

Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyon Units 1 and 2
Submittal of the Diablo Canyon Power Plant Mitigating Strategies Assessment for Flooding Report

References:

1. NRC Order Number EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," dated March 12, 2012

2. NRC Letter, "Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," dated March 12, 2012 (ADAMS Accession No. ML12056A046)

3. PG&E Letter to NRC, DCL-15-034, "Final Response to Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 Flooding," March 11, 2015

4. PG&E Letter to NRC, DCL-16-016, "Updated Response to Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 Flooding," February 8, 2016

5. NRC Letter, "Diablo Canyon Power Plant, Unit Nos. 1 and 2 – Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10 CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (CAC Nos. MF6039 and MF6040)," March 30, 2016 (ADAMS Accession No. ML16083A551)

6. PG&E Letter to NRC, DCL-16-077, "Pacific Gas and Electric Company's Notification of Full Compliance with Commission Order Modifying Licenses with Regard to Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049) for Diablo Canyon Power Plant Units 1 and 2," July 28, 2016

Dear Commissioners and Staff:

On March 12, 2012, the NRC issued Reference 1 to Pacific Gas and Electric Company (PG&E) regarding mitigation strategies required for Beyond-Design-Basis External Events. Also on March 12, 2012, the NRC issued Reference 2 to request information associated with (among others) Near-Term Task Force (NTTF) Recommendation 2.1 for Flooding. One of the requests for information in Reference 2 directed licensees to submit a Flood Hazard Reevaluation Report (FHRR). PG&E submitted the FHRR in Reference 3 and updated it in Reference 4. Based on the updated FHRR, the NRC issued the interim staff response (Reference 5), which concluded that the FHRR was suitable for the assessment of mitigating strategies in response to Reference 1.

Table 2 of Reference 5 provided the Diablo Canyon Power Plant (DCPP) flood elevations to be considered in performing a mitigating strategies assessment (MSA) with respect to the local intense precipitation (LIP) reevaluated flood hazard, which is the sole reevaluated flood-causing mechanism that was not explicitly bounded by the DCPP current licensing basis. Note 1 of Table 2 stated that PG&E was expected to develop flood event duration (FED) parameters and applicable flood associated effects (AEs) to conduct the MSA.

The enclosure to this letter contains the PG&E MSA for flooding, which includes the requested FED parameters and applicable flood AEs that were used in the MSA. With two exceptions, the MSA concludes that the current FLEX strategies can be deployed as designed and submitted in the DCPP Final Integrated Plan (Enclosure 3 of Reference 6). The two exceptions are to provide instructions for placing water-activated flood barriers prior to blocking open one door if flood water is present, and to stage these barriers in the control room with other FLEX equipment.

This communication contains a regulatory commitment (as defined by NEI 99-04). The commitment is contained in Attachment 1 to the enclosure.

If you have any questions or require additional information, please contact Mr. Scott Maze at 805-542-9591.

I state under penalty of perjury that the foregoing is true and correct.

Executed on April 6, 2017.

Sincerely,

Jon A. Franke
Vice President, Generation Technical Services

mem6/4539/50465780
Enclosure
cc: Diablo Distribution
cc/enc: William M. Dean, NRC/NRR Director
Kriss M. Kennedy, NRC Region IV Administrator
Christopher W. Newport, NRC Senior Resident Inspector
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Diablo Canyon Power Plant
Mitigating Strategies Assessment for Flooding
NEI 12-06, Revision 2, Appendix G Submittal

Table of Contents

1. Executive Summary

The Diablo Canyon Power Plant (DCPP) Flood Hazards Reevaluation Report (FHRR) submitted in response to the NRC's March 2012 10 CFR 50.54(f) letter (Reference 1) determined that, for some locations, one potential external flood-causing mechanism, a Local Intense Precipitation (LIP) event, could result in flood water levels at DCPP that are not bounded by the design basis flood elevation. As required by the NRC, this Mitigating Strategies Assessment (MSA) was performed to evaluate the impact of the postulated LIP event on the DCPP FLEX strategies.

In support of the MSA, a more detailed LIP analysis was performed, "DCPP Local Intense Precipitation (LIP) Analysis 2D Modeling" (Reference 11). To determine flow path and volume of water entering plant structures and potential impact on structures, systems, and components (SSCs), an additional flooding analysis internal to buildings was conducted, "Study Calculation: Diablo Canyon Local Intense Precipitation (LIP) Effect on Building Internals" (Reference 10). These calculations determined that the water levels from a LIP event are bounded by the Current Licensing Basis values, and that no programmatic, procedural, or plant modifications are required. The MSA determined that the existing FLEX strategies can be implemented as designed, provided that the following actions are completed:

- Change plant procedures to provide instructions for placing water-activated flood barriers prior to blocking open door-355 if flood water is present.
- Stage water-activated flood barriers in the control room to support this activity.

These actions will be completed by the required compliance date for the forthcoming regulation 10 CFR 50.155, "Mitigation of Beyond-Design-Basis Events."

2. Background

On March 12, 2012, the NRC issued Reference 1 to request information associated with (among others) Near-Term Task Force (NTTF) Recommendation 2.1 for Flooding. On January 22, 2016, the NRC issued JLD-ISG-2012-01, Revision 1, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigating Strategies for Beyond-Design-Basis External Events" (Reference 5). One of the Required Responses specified in Reference 1 directed licensees to submit an FHRR. By letter dated March 11, 2015, PG&E provided the FHRR Revision 0, for the DCPP, Units 1 and 2 (Reference 2). By letter dated February 8, 2016, PG&E submitted a revised FHRR, Revision 1, which contained a new LIP and associated site drainage analysis (Reference 6). A description of interim actions implemented to address the potential effects of the unbounded flooding mechanism was required by the original 10 CFR 50.54(f) request, and these measures were described in both the original and revised FHRR submittals (References 2 and 6). These actions consisted of a warning time notification process and a procedure to deploy sandbags at all affected doors when heavy rainfall is forecast, and were inspected by the NRC as part of the TI-190 inspections. Based on Reference 6, on March 30, 2016, the NRC issued an interim staff response letter (Reference 3) to PG&E, also known as the "MSFHI Letter." Reference 3 transmitted a summary of the NRC staff's assessment of the reevaluated flood-causing mechanisms described in the DCPP FHRR, Revision 1 (Reference 6), and documented the NRC staff's conclusion that the reevaluated flood hazards information for DCPP was suitable for an assessment of mitigating strategies developed in response to Order EA-12-049.

The mitigating strategies for DCPP, termed FLEX strategies, developed in response to Order EA-12-049, were documented in the Final Integrated Plan (FIP) submitted by Reference 9 on July 28, 2016. As documented in Reference 13, the NRC staff concluded that the DCPP FLEX strategies, if implemented appropriately, would adequately address the requirements of Order EA-12-049. The FLEX Design Basis Flood Hazard is defined as the controlling flood parameters used to develop the FLEX flood strategies.

By Reference 7, the NRC affirmed that the licensees need to address the reevaluated flood hazards within their mitigating strategies for Beyond-Design-Basis External Events (BDBEEs). Guidance for performing MSAs is contained in Appendix G, "Mitigating Strategies Assessment for New Flood Hazard Information," of Reference 4, endorsed by the NRC (with conditions) in Reference 5. Appendix G of Reference 4 defines the reevaluated flood hazard information from the FHRR, Revision 1, as the mitigating strategies flood hazard information (MSFHI), and describes the MSA for flooding as containing the following elements:

- **Section G.2** – Characterization of the MSFHI
- **Section G.3** – Basis for Mitigating Strategy Assessment – Comparison of the MSFHI and FLEX Design Basis (DB) Flood to determine whether the MSFHI is bounded by the flood hazard that was used to develop the FLEX strategies
- **Section G.4.1** – Assessment of Current FLEX Strategies – If the MSFHI is not bounded in all aspects as described in Section G.3, this section provides guidance for evaluating the existing FLEX strategies against the impacts of the MSFHI to determine whether the FLEX strategies can still be implemented without change.
- **Section G.4.2** – Assessment for Modifying FLEX Strategies – If the FLEX strategies cannot be implemented without change, this section provides guidance to determine whether the FLEX strategies can be modified to address the identified impacts from the MSFHI.
- **Section G.4.3** – Assessment of Alternate Mitigating Strategies (if necessary)
- **Section G.4.4** – Assessment of Targeted Hazard Mitigating Strategies (if necessary)

The sections that are applicable to DCPP are G.2, G.3, G.4.1, and G.4.2. This MSA document provides the information requested by those sections. Elevation data in this document are based on the North American Vertical Datum of 1988 (NAVD88).

3. Site Description

The DCPP site consists of approximately 750 acres located in San Luis Obispo County, California, adjacent to the Pacific Ocean and roughly equidistant from San Francisco and Los Angeles. The DCPP site occupies a coastal terrace that ranges in elevation from 62.9 to 152.9 ft NAVD88 (60 to 150 ft mean sea level (MSL)) above sea level and is approximately 1,000 ft wide. The seaward edge of the terrace is a near-vertical cliff. With the exception of the intake and discharge facilities, plant grade is at elevation 87.9 ft NAVD88 (85 ft MSL) and entrance to major plant buildings is at or above this elevation. In addition, the plant site is generally sloped away from the major plant buildings and toward the ocean or Diablo Creek. Topography and plant site arrangement limit flood design considerations to local floods from Diablo Creek and sea wave action from the Pacific Ocean.

4. Characterization of the MSFHI (NEI 12-06, Revision 2, Section G.2)

The only unbounded external flood-causing mechanism from the FHRR (Reference 6) for the site is from LIP. All other flood-causing mechanisms were determined by the FHRR to be bounded by the existing licensing basis, and confirmed in the NRC interim staff response letter (Reference 3). Table 2 of the enclosure to the NRC interim staff response letter describes the reevaluated flood hazards that exceed the current design basis. This table lists the stillwater elevation/ reevaluated hazard elevation at 40 points of interest and notes that waves/runup is minimal at all doors. As described in the FHRR (Reference 6) the PMP for the DCPP area was calculated in accordance with NUREG/CR-7046 (November 2011). The probable maximum precipitation (PMP) was then used as input into a LIP and probable maximum flood (PMF) evaluation for the entire DCPP site. A LIP 2D evaluation (Reference 14) was conducted to determine the water surface elevation associated with the effects of the LIP inside the protected area where the power block and other safety-related structures and commodities are located. The calculation also determined the duration of flooding and associated hydrodynamic loading near the potential water entry points to the auxiliary building, fuel handling building, and turbine building (including the safety-related diesel generator room air inlet louvers locations and areas where important safety-related components for the diesel generator fuel oil transfer system are located).

As part of DCPP's effort to support the MSA, additional detailed modeling based on the LIP event was conducted. As a result, two new calculations were issued.

- Calculation titled, "DCPP Local Intense Precipitation (LIP) Analysis 2D Modeling" (Reference 11), included a more detailed LIP evaluation of water depth and potential entry points to safety-related structures on the rooftop of the Auxiliary Building, and determined new water depths above door thresholds and duration of inundation.
- Calculation titled, "Study Calculation: Diablo Canyon Local Intense Precipitation (LIP) Effect on Building Internals" (Reference 10), performed

analysis of doors and areas that experienced inundation, to determine flow path and volume of water entering buildings assuming no LIP interim actions (i.e., sandbags) were deployed, and to evaluate the impact on FLEX from LIP.

As documented in the Reference 11 calculation, the flood heights from a LIP event vary at different DCPP locations due to the site-specific terrain and watershed pathways. Based on the results of Reference 11, the water depth above the door thresholds in the power block area and surrounding structures varied between 0 ft and 1.01 ft. The duration of time-dependent water depths varied between 0.00 hours and 8.80 hours. Table 1 below, from Reference 11, provides the MSFHI parameters for the LIP event that are not bounded by the current design basis hazard. Note that inundation does not begin at any door until 2 hours after the start of the LIP event. The calculation in Reference 10 showed that without deployment of sandbags (i.e., the interim actions described in the FHRR Revision 1), water intrusion from flooding would not prevent any safety-related SSCs from performing their intended function, and that a total volume of 338,566 gallons of water would be conveyed to the Auxiliary Building sump and Pipe Tunnels. Since the DCPP Updated Final Safety Analysis Report (UFSAR), Section 9.2.3.3.7(2) - Internal Flooding Protection, states that, "[a] volume of 345,000 gallons in the auxiliary building pipe tunnel for sump overflow storage is available to receive water flooding," there is adequate volume to store water resulting from beyond-design-basis (BDB) flooding. Consequently, the interim actions implemented as described in the FHRR, Revision 1 (Reference 6), are not required to respond to LIP flooding since BDB flooding levels will not negatively impact safety-related SSCs within the plant.

The potential associated effects caused by a LIP flooding event are analyzed based on direction given in NEI 12-06, Revision 2. Guidance defines "flood height and associated effects" as the maximum stillwater surface elevation plus the following factors:

- hydrodynamic loading, including debris;
- wind waves and run-up effects;
- effects caused by sediment deposition and erosion;
- concurrent site conditions, including adverse weather conditions;
- groundwater ingress; and
- other "pertinent factors" including flood event duration and warning time.

Not all the associated effects indicated above are applicable to LIP flooding events. Only hydrostatic and hydrodynamic loading are considered in the LIP 2D calculation after screening out other associated effects (Reference 11). Hydrostatic and hydrodynamic loadings were calculated at each door, and the hydrodynamic loading was found to be insignificant. As stated in Reference 3, waves/runup is considered minimal, and no additional loads need be evaluated. As also stated and supported in Reference 11, the shallow flow depth (approximately 1 ft) and low velocity (approximately 1 ft/sec) due to LIP would not be expected to cause debris impact loading, sediment deposition or erosion at the DCPP site (Reference 11), and do not need additional consideration. As a result, the stillwater elevation and reevaluated hazard elevations are the same.

Table 1 – Reevaluated Flood Hazards for LIP External Flood Mechanism (Source: Reference 11)

Door/Unit No	Stillwater Elevation and Reevaluated Hazard Elevation (ft NAVD88)[3]	Max WD above grid surface (ft)	Maximum Water Depth Above Door Threshold (ft)[1]	Flood Duration (hours)
A1.1	87.48	0.21	-0.01	0
A1.2	86.77	0.21	-0.03	0
A2.1	86.64	0.16	0.14	1.90
BU101	86.58	0.10	0.08	0.45
BU102	86.66	0.19	0.16	0.95
BU103	86.63	0.18	0.13	0.45
A3.1	86.69	0.24	0.19	1.35
A3.2	86.70	0.23	0.20	1.55
A3.3	86.62	0.17	0.12	0.25
BU104	86.66	0.19	0.16	0.95
101-1	86.98	0.20	0.18	0.80
102-1	86.97	0.24	0.17	0.55
119-1	87.01	0.23	0.21	0.85
122-1	87.22	0.45	0.42	4.90
C1.1	86.91	0.14	0.11	0.95
129	86.90	0.12	0.10	0.95
130	86.89	0.12	0.09	0.60
C1.2	86.84	0.07	0.04	0.20
BU101-2	86.68	0.21	-0.02	0.00
BU102-2	86.65	0.07	0.00	0.00
BU103-2	86.43	0.07	-0.07	0.00
BU104-2	86.43	0.07	-0.07	0.00
BU108-2	86.62	0.15	0.12	0.95
BU105-2	86.60	0.12	0.10	0.50
BU106-2	86.90	0.26	0.20	2.85
B2.1	86.93	0.16	0.13	0.95
B1.1	86.87	0.11	0.07	0.25
B1.2	86.91	0.12	0.11	0.65
101-2	87.08	0.31	0.28	0.85
102-2	87.08	0.30	0.28	1.35

Door/Unit No	Stillwater Elevation and Reevaluated Hazard Elevation (ft NAVD88)[3]	Max WD above grid surface (ft)	Maximum Water Depth Above Door Threshold (ft)[1]	Flood Duration (hours)
119-2	87.10	0.32	0.30	1.35
122-2	87.10	0.32	0.30	1.35
192-1	87.21	0.43	0.41	6.20
191-1	87.04	0.25	0.24	2.70
194-1	87.02	0.25	0.22	0.75
192-2	87.19	0.40	0.39	8.80
191-2	87.11	0.33	0.31	2.40
194-2	87.10	0.37	0.30	0.80
363-1	116.87	0.09	0.07	0.45
361-1	117.14	0.36	0.34	1.90
360-1	117.14	0.35	0.34	4.10
355-1	117.19	0.43	0.39	5.45
354-1	117.19	0.40	0.39	6.30
360-2	117.20	0.45	0.40	8.55
361-2	117.20	0.44	0.40	8.55
363-2	116.83	0.05	0.03	0.20
520	140.51	0.50	-0.07	0.00
521	140.51	0.47	0.13	0.60
525	140.51	0.46	0.46	2.10
528	140.51	0.50	-0.07	0.00
530	140.21	0.21	-0.29	0.00
540	140.20	0.20	0.03	0.05
541	140.21	0.21	0.04	0.05
565	140.20	0.20	0.20	4.25
575	141.01	1.01	1.01	7.20
587	140.52	0.52	0.52	4.40
588	141.01	1.01	0.84	2.00
589	141.01	1.01	1.01	6.35
609	163.46	0.13	-0.54	0.00
610	163.46	0.13	-0.54	0.00
523-2	140.96	0.96	0.79	1.95
524-2	140.51	0.50	-0.07	0.00
529-2	140.51	0.49	-0.07	0.00
530-2	140.21	0.21	-0.29	0.00
540-2	140.19	0.19	0.02	0.05
541-2	140.18	0.18	0.01 [0.00][2]	0.00
565-2	140.18	0.18	0.18	4.20
575-2	140.97	0.97	0.97	6.25
584-2	140.62	0.62	0.62	4.25

Door/Unit No	Stillwater Elevation and Reevaluated Hazard Elevation (ft NAVD88)[3]	Max WD above grid surface (ft)	Maximum Water Depth Above Door Threshold (ft) [1]	Flood Duration (hours)
585-2	140.96	0.96	0.79	1.95
586-2	140.96	0.96	0.96	6.35
608-2	163.46	0.13	-0.54	0.00
611-2	163.47	0.14	-0.53	0.00
612-2	163.47	0.14	-0.53	0.00
LCRN	140.51	0.51	0.01 [0.00][2]	0.00
LCRS	140.52	0.52	0.02 [0.00][2]	0.00

Notes:

1. Maximum water depth above door threshold is calculated based on the difference between maximum stillwater elevation and door threshold elevation. A negative value indicates maximum stillwater elevation is below door threshold.
2. Inconsequential exceedance depth and duration less than the surface detention parameter result in no flooding time.
3. The values in this column are reported in the Reference 11 calculation in a local PG&E elevation datum. In order to convert these to NAVD88 elevation, 0.687 feet was added to the PG&E datum values (reference PG&E Drawing 522316, Sheet 1, Revision 1 (Reference 16)).

5. Basis for Mitigating Strategy Assessment (NEI 12-06, Revision 2, Section G.3)

The current licensing basis (CLB) for flood hazards found no ponding from local PMP events (UFSAR, Section 2.4.11). This is the flood hazard for which FLEX strategies were designed (i.e., the FLEX DB), except for the FLEX storage facilities, which were designed considering the reevaluated flooding hazard.

For the areas identified in the FHRR, Revision 1, that experienced inundation due to LIP, this MSA evaluates the impact on implementation of FLEX strategies at DCPP. Since the analysis of external flooding events on the inside of power block structures (Reference 10) determined that the interim actions of deploying sandbags for LIP is not required for the current design basis, FLEX strategies were assessed in this MSA report assuming these interim actions were not implemented.

Table 2 provides a comparison of MSFHI data from the BDB LIP event to the site's design basis/FLEX DB flood. Since the FLEX DB does not bound the Table 1 results (i.e., the MSFHI) a G.4.1 analysis is required.

Table 2 – Comparison of MSFHI LIP Flood Causing Mechanism to Plant and FLEX Design Basis Flood Hazard

Flood Scenario Parameter		Plant DB Flood	FLEX Design Basis Flood Hazard	MSFHI (NAVD88)	MSFHI Bounded (B) or Not Bounded (NB) by FLEX DB
Flood Level and Associated Effects	1. Max Stillwater Elevation (ft NAVD88)	Dry Site	Dry Site	Varies by location, Note 1	NB
	2. Max Wave Run-up Elevation (ft MSL)	Dry Site	Dry Site	Note 2	B
	3. Max Hydrodynamic/Debris Loading (psf)	Dry Site	Dry Site	Note 3	B
	4. Effects of Sediment Deposition/Erosion	Dry Site	Dry Site	Note 4	B
	5. Other Associated Effects (identify each effect)	Dry Site	Dry Site	Note 4	B
	6. Concurrent Site Conditions	Dry Site	Dry Site	None	B
	7. Effects on Groundwater	Dry Site	Dry Site	None Note 5	B
Flood Event Duration	8. Warning Time (hours)	Dry Site	Dry Site	N/A Note 6	B
	9. Period of Site Preparation (hours)	Dry Site	Dry Site	N/A Note 6	B
	10. Period of Inundation (hours)	Dry Site	Dry Site	9 hrs (Reference 11)	NB
	11. Period of Recession (hours)	Dry Site	Dry Site	Note 7	B
Other	12. Plant Mode of Operations	Dry Site	Dry Site	All modes Note 8	B
	13. Other Factors	Dry Site	Dry Site	None	B

Notes:

1. Table 6.3 in Reference 11 provides maximum stillwater elevation at the 76 doors that are impacted by LIP flooding. Conversion from the Local PG&E Datum to NAVD88 vertical datum requires raising the elevations by 0.687 feet.

	2. Based on the maximum water depths of less than or equal to one foot, waves/runup are minimal (Reference 3). 3. Debris flow is not a concern for water flow depth less than 1 foot and velocity less than 1 ft/sec. Maximum velocity values are less than 1 ft/sec for all commodities. Forces due to LIP flood event effects will not adversely impact the doors or power block and surrounding structures (Reference 2). 4. The shallow flow depth and low velocity due to LIP would not be expected to cause debris impact loading, sediment deposition and erosion, or other associated effects at the DCPP Site (Reference 11). 5. Groundwater at the site is limited to one Deep Well 0-2. No other significant groundwater has been encountered (UFSAR 2.4.14). The LIP event results in surface runoff and inundation that recedes to negligible levels within 9 hours. Due to short duration of surface runoff, groundwater recharge will be extremely limited and is not considered. 6. No actions are required to respond to a LIP event. 7. Due to the site being a free-flowing site with a small upstream watershed, no additional time is associated with recession of the flood waters beyond the period of inundation. 8. The plant can be in any mode of operation during the LIP flooding event.

6. Assessment of Current FLEX Strategies (NEI 12-06, Revision 2, Section G.4.1)

The overall FLEX planned response to an extended loss of AC power (ELAP) and loss of ultimate heat sink (LUHS) will be initiated through normal plant command and control procedures and practices. Site emergency operating procedures (EOPs) or abnormal operating procedures (AOPs) govern the operational response. The FLEX strategies will be deployed in support of the EOPs/AOPs using FLEX Support Guidelines (FSGs), which will provide direction for using FLEX equipment in maintaining or restoring key safety functions. Current FLEX Strategies assume a dry site based on the site design basis as required by NEI 12-06, Revision 2 (Reference 4). As described in the FHRR, site flooding occurs during the LIP event. The following discussion assesses the impacts of the MSFHI in place of the design basis on implementing FLEX strategies as required in NEI 12-06, Revision 2, and concludes that with the modification of placing water-activated flood barriers at one door, implementation of FLEX strategies is not affected by the impacts of the MSFHI.

Assessment of FLEX Strategies

- **The boundary conditions and assumptions of the initial FLEX design are maintained.**

The boundary conditions and assumptions for the initial FLEX design do not include any external flooding events at the site with the exception of the FLEX storage facilities. The current FLEX strategy assumes a dry site and all events are time zero events without warning time. The FHRR, Revision 1, LIP flooding scenario results in flood waters above site grade which causes ponding at several doors in the power block area (Reference 11).

In this evaluation, it is assumed that the ELAP/LUHS occurs approximately 6 hours after the beginning of the LIP rainfall event, corresponding to the peak LIP level. This is a conservative assumption because the end temporal distribution is the critical distribution for the DCPP site. For this distribution, rainfall amounts are approximately zero at the start of the event, and increase slowly until close to the time when peak rainfall occurs (Reference 11). Furthermore, Reference 10 shows that a LIP event will not cause an ELAP/LUHS, and this evaluation assumes that peak flooding from the LIP event results in an ELAP/LUHS.

As evaluated in Reference 10, without initiation of FLEX, the progression of inundation inside the affected buildings would not adversely impact installed plant equipment. As described below, the only impact on FLEX strategies occurs when blocking open Door 354 or Door 355 to control heat buildup in vital areas during an ELAP/LUHS event concurrent with a LIP event.

The reevaluated LIP hazard was considered in the design of the Primary and Secondary FLEX Equipment Storage Facilities and there are no adverse LIP flooding impacts to these facilities.

Deployment and staging of the first Phase 2 FLEX equipment is not expected to start until 10 hours after the ELAP/LUHS event, as documented in the DCPP BDB Validation of the FLEX Time Sensitive Actions report (Reference 12). Per Table 1, Reevaluated Flood Hazards for LIP External Flood Mechanism, the maximum water depth above grid surface in the vicinity of Phase 2 FLEX equipment deployment locations is 0.45 feet, with maximum inundation duration of 8.8 hours. Consequently, water will have receded prior to deployment and staging of Phase 2 FLEX equipment.

Predetermined, preferred staging routes and deployment paths have been identified and documented in the FSGs for the deployment of onsite FLEX equipment in Phase 2. These deployment paths have been evaluated for potential soil liquefaction, which determined that the FLEX staging routes and deployment paths are not subject to liquefaction hazards (Reference 15). Additionally the deployment paths minimize travel through areas with trees, power lines, narrow passages and other potential debris to the extent practical. Due to the DCPP site arrangement, the LIP event results in surface runoff that rapidly dissipates following the LIP event. Furthermore, debris removal equipment stored on-site is protected from BDBEE hazards such that the equipment remains functional and deployable to clear obstructions from the designated deployment paths between the FLEX storage facilities and associated staging locations. The stored

FLEX debris removal equipment includes front-end loaders equipped with buckets and lifting forks to move or remove debris from deployment paths.

Phase 3 of the FLEX strategies involves receipt of equipment from offsite sources including the National SAFER Response Center (NSRC) and various commodities such as fuel and supplies. Delivery of this equipment can be through airlift or via ground transportation. Debris removal for the pathway between the site and the NSRC receiving "Staging Areas" and from the various plant access routes may be required; however, in this scenario, plans have been created to airlift equipment from the various pre-identified staging areas to the site (Reference 9).

- **The sequence of events for the FLEX strategies is not affected by the impacts of the MSFHI (including impacts due to the environmental conditions created by the MSFHI) in such a way that the FLEX strategies cannot be implemented as currently developed.**

The FIP (Reference 9) presents a Sequence of Events (SOE) Timeline for an ELAP/LUHS event at DCPP. Validation of each of the FLEX time constraint actions has been completed in accordance with the FLEX validation process outlined in NEI 12-06, Revision 2, and documented in Reference 12. Table 3 below is a revised version of the FIP table that has been modified to describe the potential impacts of the LIP event on the sequence of events actions for which Time Constraints have been established. As documented in this table, the only FLEX Time Sensitive Action (TSA) that is impacted by the LIP event in such a way that FLEX strategies cannot be implemented as currently developed is TSA 14, "Doors to control room, cable spreading room, and battery charger/inverter rooms are blocked open."

Table 3 - Sequence of Events Timeline

Action Item	Action	Estimated Start Time	Duration	Time Constraint Finish (Hours)	LIP Impact
	Event Starts	0	N/A	N/A	Plant at 100% Power
1-10	These actions are normal operator control room actions that are not affected by LIP.				
11	Declare ELAP	34 mins	1 min	1	No impact – Local action occurring in the Control Room, an area that is not impacted by a LIP event
12	Control room portable lighting	N/A	5 hours	N/A	No impact – Installed emergency battery powered and personal lighting is available in the control room for 8 hours, after which portable battery powered lighting will be used.
13	Assistance requested from NSRC	53 mins	1 min	1.25	No impact – Phone call from Control Room, an area that is not impacted by a LIP event
14	Doors to control room, cable spreading room, and battery charger/inverter rooms are blocked open	53 mins	18 mins	1.5	Minimal impact – Local actions would be required inside the Turbine Building and Auxiliary Building, areas that are not impacted by a LIP event. Water-activated flood barriers would be deployed as needed prior to blocking open doors to mitigate impact from LIP

Action Item	Action	Estimated Start Time	Duration	Time Constraint Finish (Hours)	LIP Impact
15	Vital DC battery load stripping is completed	55 mins	14 mins	1.5	No impact – Local actions would be required inside Auxiliary Building and Turbine Building areas that are not impacted by a LIP event
16	Plant access assessment	3 hours	0.5 hours	6	No impact – LIP event results in surface runoff that rapidly dissipates following the LIP event.
17	Deploy hoses to SFP and open doors to FHB to ventilate SFP	6 hours	1.8 hours	13	No impact – Local actions to deploy hoses would be required in the Spent Fuel Pool area which is not impacted by a LIP event. Inundation levels would be minimal when doors are blocked open.
18	Transfer TDAFW pump suction to 0-1 FWST	16 hours	20 mins	17	No impact – LIP inundation levels at this time would be minimal
19	Align second vital battery and secure initial battery	18 hours	26 mins	19	No impact – LIP inundation levels at this time would be minimal

Action Item	Action	Estimated Start Time	Duration	Time Constraint Finish (Hours)	LIP Impact
20	Perform plant cooldown and depressurization	28 mins	2.3 hours	20	No impact – Local actions required inside buildings are in areas that are not impacted by a LIP event. Exterior actions are limited to manual operation of steam dump valves. Maximum inundation levels in this area would be less than 1.01 feet and would not impact accessibility or operation of the valves.
21	Align ERCS make-up pump from BASTs	10 hours	4.5 hours	20	No impact – LIP inundation levels at this time would be minimal
22	FLEX deployment damage assessment complete	1.5 hours	1.5 hours	24	No impact – Local actions would be required in areas around the Turbine Building and Auxiliary Building. Maximum inundation levels in these areas throughout the LIP event would be less than 1.01 feet and would not impact accessibility.
23	480 VAC generator repowers battery chargers	13 hours	4.3 hours	27	No impact – LIP inundation levels at this time would be minimal
24	Transfer TDAFW pump suction from 0-1 FWST to CST	28 hours	20 mins	29.5	No impact – LIP inundation levels at this time would be minimal
25	EAFW and RWR equipment in service	24 hours	6 hours	39.9	No impact – LIP inundation levels at this time would be minimal

Action Item	Action	Estimated Start Time	Duration	Time Constraint Finish (Hours)	LIP Impact
26	Align ERCS pump suction to RWST	> 24 hours	3.8 hours	43.7	No impact – LIP inundation levels at this time would be minimal
27	Align flexible hoses to RWR supply header for SFP cooling	> 24 hours	6 hours	67	No impact – LIP inundation levels at this time would be minimal
28	Establish alternate fuel supply[(b)]	> 24 hours	15 mins	<72	No impact – LIP inundation levels at this time would be minimal
29	Align large generators[(b)]	> 72 hours	28.3 hours	121	No impact – LIP inundation levels at this time would be minimal
30	Align EASW pump	> 72 hours	16.3 hours	121	No impact – LIP inundation levels at this time would be minimal

The first TSA that is executed in an exterior yard area where flooding may occur is Action Item 20, "Perform plant cooldown and depressurization." According to the DCPP BDB Validation of FLEX TSAs (Reference 12), the estimated start time is 28 minutes after the ELAP/LUHS. The time constraint for this action is completion by 20 hours. Required actions exterior to the building are limited to access through the 140 ft elevation "sundeck" area to manually operate steam dump valves. Access to this area likely would utilize Door 521. Ponding at this door would be below the door threshold when this TSA is started. Opening this door to pass through will not result in water entering the building. Ponding above the thresholds at other doors in this area when this TSA is started would be:

Door 575	0.5 feet
Door 588	0.3 feet
Door 589	0.4 feet
Door 523-2	0.3 feet
Door 575-2	0.5 feet
Door 585-2	0.4 feet
Door 586-2	0.5 feet

This level of flooding would not impact accessibility or operation of the steam dump valves.

Action Item 14, the next TSA executed in an exterior yard area where flooding may occur, involves blocking open doors to control heat buildup in vital areas. The time constraint for this action is completion by 1.5 hours. It is estimated to start at 53 minutes with an 18-minute duration determined for the current design basis. The DCPP LIP Effect on Building Internals calculation (Reference 10), which assumed that all doors remained closed, showed that water intrusion from external flooding would result in negligible water depths around safety-related SSCs, and that there is adequate available volume inside the Auxiliary Building to store water resulting from BDB flooding. The doors listed in Table 4 experience inundation from the MSFHI for LIP event and are directed to be open by plant procedures during an ELAP/LUHS event. At the time these doors would be required to be open (i.e., when this TSA is initiated), only doors 354 and 355 would still be inundated, and the water level at these doors would have decreased to approximately half of the maximum (see Table 4).

Table 4 - Doors That Experience Flooding due to MSFHI and are Blocked Open to Control Heat Build Up

Door Number	Maximum Water Depth Above Door Threshold (ft)	Water Depth Above Door Threshold at 6.75 hours (ft)
530	0.00	0.0
530-2	0.00	0.0
354 or 355 [1]	0.39	0.2
129	0.10	0.0
521	0.13	0.0
612-2	0.00	0.0

Note 1: Operations has the option to open either door based on conditions.

- **The validation performed for the deployment of the FLEX strategies is not affected by the impacts of the MSFHI.**

  The impacts of the MSFHI result in the need to require placement of water-activated flood barriers at one door, prior to blocking it open, as needed for flooding. The affected TSA will be required to be revised, and will be re-performed in accordance with NEI 12-06, Revision 2, requirements.

7. **Assessment for Modifying FLEX Strategies (NEI 12-06, Revision 2, Section G.4.2)**

- **If deployment locations of FLEX equipment are changed as a result of the evaluation per Section 6, the design considerations for the strategy should be reevaluated per Section 11.2.1.**

Water-activated flood barriers will be required to be stored in the control room and deployed to one door when blocking it open. The control room is a protected location so the water-activated flood barriers will not be impacted by inundation there.

- **New or modified actions required for the strategy or existing actions that are impacted by the environmental conditions created by the MSFHI should be validated in accordance with Appendix E.**

  The procedure will be modified for implementing Action Item 14, blocking open doors to control room, cable spreading room, and battery charger/inverter rooms. In the revised procedure, if flood waters are present, direction will be provided for sole use of Door 355 and to require placement of water-activated flood barriers prior to blocking open the door. This new action will be validated in accordance with NEI 12-06, Revision 2, Appendix E requirements.

- **The flood protection features that support the modified FLEX strategies should meet the performance criteria provided in Section G.5.**

  All performance criteria provided in Section G.5 will be met by the deployment of water-activated flood barriers that are designed to handle the maximum water depths for the duration of inundation. The water-activated flood barriers required to support the modified procedure will be stored in the control room with other staged FLEX equipment. The barriers will be added to the FLEX Preventative Maintenance (PM) Program. PG&E will complete the necessary changes to plant procedures, conduct required validation, stage water-activated flood barriers, and update the FLEX PM program by the required compliance date of the forthcoming regulation 10 CFR 50.155, "Mitigation of Beyond-Design-Basis Events."

8. List of Abbreviations and Acronyms

- AMS – Alternative Hazard Mitigating Strategies
- AOP – Abnormal Operating Procedures
- BAST – Boric Acid Storage Tank
- BDB – Beyond-Design-Basis
- BDBEE – Beyond Design Basis External Event
- CLB – Current Licensing Bases
- CST – Condensate Storage Tank
- DB – Design Basis
- EAFW – Emergency Auxiliary Feed Water
- EASW – Emergency Auxiliary Salt Water
- ELAP – Extended Loss of AC Power
- EOP – Emergency Operating Procedure
- ERCS – Emergency Reactor Coolant System
- FHRR – Flood Hazard Reevaluation Report

- FIP – Final Integrated Plan
- FLEX DB – FLEX Design Basis (flood hazard)
- FSG – FLEX Support Guidelines
- FWST – Fire Water Storage Tank
- LIP – Local Intense Precipitation
- LUHS – Loss of Ultimate Heat Sink
- MSA – Mitigating Strategies Assessment
- MSFHI – Mitigating Strategies Flood Hazard Information
- MSL – Mean Sea Level
- NAVD88 - North American Vertical Datum of 1988
- NSRC – National SAFER Response Center
- NTTF – Near-Term Task Force
- PM – Preventative Maintenance
- PMF – Probable Maximum Flood
- PMP – Probable Maximum Precipitation
- RWR – Raw Water Reservoir
- SFP – Spent Fuel Pool
- SOE – Sequence of Events
- SSCs – Structures, systems and components
- TDAFW – Turbine-Driven Auxiliary Feedwater
- THMS – Targeted Hazard Mitigating Strategies
- TSA – Time Sensitive Action
- UFSAR – Updated Final Safety Analysis Report
- WD – Water Depth

9. References

1. NRC Letter, “Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident,” dated March 12, 2012.

2. Pacific Gas and Electric Company (PG&E) Letter to NRC, “Final Response to Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 Flooding,” dated March 11, 2015.

3. NRC Letter, “Diablo Canyon Power Plant, Unit Nos. 1 and 2 – Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10 CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (CAC Nos. MF6039 and MF6040),” dated March 30, 2016.

4. Nuclear Energy Institute (NEI), Report NEI 12-06 [Rev 2], “Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,” dated December 2015.

5. U.S. Nuclear Regulatory Commission, 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, dated January 22, 2016.

6. Pacific Gas and Electric Company (PG&E) Letter to NRC, "Updated Response to Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1, Flooding," dated February 8, 2016.

7. NRC Memorandum, "Staff Requirements – COMSECY-14-0037 – Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards," dated March 30, 2015.

8. NRC Letter, "Supplemental Information Related to Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Flooding Hazard Reevaluations for Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," dated March 1, 2013.

9. PG&E Letter to NRC, "Pacific Gas and Electric Company's Notification of Full Compliance with Commission Order Modifying Licenses with Regard to Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049) for Diablo Canyon Power Plant Units 1 and 2," dated July 28, 2016.

10. PG&E Calculation No.: 9000042232-000-00 (Revision 0), "Study Calculation: Diablo Canyon Local Intense Precipitation (LIP) Effect on Building Internals," dated March 22, 2017.

11. PG&E Calculation No.: 9000042281-000-00 (Revision 0), "DCPP Local Intense Precipitation (LIP) Analysis 2D Modeling," dated March 22, 2017.

12. PG&E Report, "Diablo Canyon Power Plant Beyond-Design-Basis Validation of the FLEX Time Sensitive Actions, Units 1 & 2," Revision 4, dated July 28, 2016.

13. NRC Letter, "Diablo Canyon Power Plant, Unit Nos. 1 and 2 – Safety Evaluation Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Instrumentation Related to Orders EA-12-049 and EA-12-051," dated December 28, 2016.

14. PG&E Calculation No.: 9000041561-001-00 (Revision 1), "Study Calculation: Diablo Canyon Power Plant Local Intense Precipitation Analysis 2D Modeling," dated January 26, 2016.

15. PG&E Report, "Staging and Deployment Walkdown Report, Revision 2," dated October 30, 2015.

16. PG&E Drawing 522316, "Diablo Canyon Power Plant Hi-Resolution Topography Survey Power Block Area," Sheet 1, Revision 1, February 19, 2014.

Regulatory Commitments

Commitment # 1

PG&E will complete the necessary changes to plant procedures, conduct required validation, stage water-activated flood barriers, and update the FLEX Preventative Maintenance Program by the required compliance date of the forthcoming Regulation 10 CFR 50.155, “Mitigation of Beyond-Design-Basis Events.”