DiabloCanyonNPEm Resource

From: Doutt, Clifford
Sent: Thursday, March 03, 2011 9:03 AM
To: Wong, Albert
Subject: SER Input 3.0.3.2.14 Event Driven RAI Reposne Inaccessible Cable.doc
Attachments: RAI Response Event Driven ML1101004302.pdf; RAI Response November 24 2010ML1033000500.pdf; SER Input 3.0.3.2.14 Event Driven RAI Reposne Inaccessible Cable.doc

Hi Albert,

Attached is a revision to the Diablo Canyon SER input for inaccessible cables that incorporates recent industry operating experience. Also attached are the associated RAI responses (for background).

Thanks,

Cliff

Hearing Identifier: DiabloCanyon_LicenseRenewal_NonPublic
Email Number: 2670

Mail Envelope Properties (Clifford.Doutt@nrc.gov20110303090300)

Subject: SER Input 3.0.3.2.14 Event Driven RAI Reposne Inaccessible Cable.doc
Sent Date: 3/3/2011 9:03:11 AM
Received Date: 3/3/2011 9:03:00 AM
From: Doutt, Clifford

Created By: Clifford.Doutt@nrc.gov

Recipients:
"Wong, Albert" <Albert.Wong@nrc.gov>
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Files	**Size**	**Date & Time**
MESSAGE	250	3/3/2011 9:03:00 AM
RAI Response Event Driven ML1101004302.pdf	1318519	
RAI Response November 24 2010ML1033000500.pdf	1300221	
SER Input 3.0.3.2.14 Event Driven RAI Reposne Inaccessible Cable.doc	68722	

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Expiration Date:
Recipients Received:

Pacific Gas and Electric Company®

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January 7, 2011

PG&E Letter DCL-10-166

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

Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyon Units 1 and 2
Response to Telephone Conference Call Held on December 8, 2010, Between the U.S. Nuclear Regulatory Commission and Pacific Gas and Electric Company Concerning Responses to Requests for Additional Information Related to the Diablo Canyon Nuclear Power Plant, Units 1 and 2, License Renewal Application

Dear Commissioners and Staff:

By letter dated November 23, 2009, Pacific Gas and Electric Company (PG&E) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) for the renewal of Facility Operating Licenses DPR-80 and DPR-82, for Diablo Canyon Power Plant (DCPP) Units 1 and 2, respectively. The application included the license renewal application (LRA), and Applicant's Environmental Report – Operating License Renewal Stage.

On December 8, 2010, a telephone conference call between the NRC and representatives of PG&E was held to obtain clarification on PG&E's response to a request for additional information (RAI), which was submitted to the NRC in PG&E Letter DCL-10-148, dated November 24, 2010, regarding RAI D-RAI B2.1.26-3.

PG&E's supplemental information to the RAI response for which the staff requested information is provided in Enclosure 1. PG&E revises its response in PG&E Letter DCL-10-148 to perform testing of the in-scope 480V and higher power cables at a frequency of at least every 6 years. See amended LRA Table A4-1, License Renewal Commitments, provided in Enclosure 2. LRA Amendment 33 is included in Enclosure 2.

If you have any questions regarding this response, please contact Mr. Terence L. Grebel, License Renewal Project Manager, at (805) 545-4160.

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

Executed on January 7, 2011.

Sincerely,

James R. Becker
Site Vice President

TLG/5454160
Enclosures
cc: Diablo Distribution
cc/enc: Elmo E. Collins, NRC Region IV Regional Administrator
Nathanial B. Ferrer, NRC Project Manager, License Renewal
Kimberly J. Green, NRC Project Manager, License Renewal
Michael S. Peck, NRC Senior Resident Inspector
Alan B. Wang, NRR Project Manager

Pacific Gas and Electric (PG&E) Supplement to Telephone Conference Call Held on December 8, 2010, Concerning Response to Request for Additional Information (RAI) Submitted to the NRC in a Letter Dated November 24, 2010, Regarding RAI D-RAI B2.1.26-3

The Diablo Canyon Power Plant does not have any in-scope circuits whose power supply voltage is in the range from 400V to 480V. All in-scope 480V and higher power circuits routed through underground conduit are included in the pull box inspection program and will be included in the cable testing program. PG&E Letter DCL-10-148, dated November 24, 2010, indicated that insulation testing of in scope 480V and higher cables would be tested at least once every 10 years. In-scope 480V and higher power cables will be tested at a frequency of at least every 6 years with the first test completed prior to entering the period of extended operation. See amended LRA Table A4-1 in Enclosure 2.

The in-scope electrical pull boxes between the intake structure and turbine building are designed with drain conduits that drain to pull boxes at the intake and turbine building. The end pull boxes drain to a building sump or to an in-ground drain sump, which is separate from the pull boxes. The in-ground drain sump has an automatic sump pump and high level alarm, which provides indication of pump failure before the sump backs up into pull boxes. The sump pump and alarm features are tested annually in accordance with the plant maintenance work orders. The remaining in-scope electrical pull boxes are located in doors and are not subject to weather related water intrusion. Some of the indoor pull boxes are also equipped with drain conduits that drain to a building sump.

As indicated in PG&E Letter DCL-10-148, the pull box inspection program has been effective in preventing pull box flooding and cable submergence in all in-scope pull boxes. The pull box sump pump and alarm features are tested annually in accordance with the plant maintenance work orders. Pull box inspections are currently being performed bi-monthly in accordance with plant maintenance work orders. The inspections monitor water accumulation during rainy periods. The inspections can be deferred if no rain has fallen since the last inspection. These inspections have demonstrated that event-driven water accumulation from natural sources has not been occurring. Therefore, event-driven inspections are not required. Recent structural pull box inspections have not identified any visible indication of significant cable or cable support degradation. The pull box inspection frequency is subject to change based on inspection results. However, the program will require that in-scope cable pull boxes will be inspected for water accumulation at least once every year.

LRA Section B2.1.26 indicates that as an enhancement, procedures will be implemented for cable testing and periodic inspections of the pull boxes for in-scope medium voltage cables. PG&E revises this procedural commitment as follows. Procedures will be implemented for cable testing and periodic inspections of the pull

boxes for in-scope 480V and higher power cables. These procedures will also include pull box sump pump box and alarm features testing on an annual basis. See amended LRA Table A4-1 in Enclosure 2.

LRA Amendment 33

LRA Section
Table A4-1

Table A4-1License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
56	*Procedures will be implemented for:* *A. Cable testing and periodic water accumulation inspections of the pull boxes for in-scope 480V and higher power cables.* *B. Pull box sump pump box and alarm features testing on an annual basis.*	*B2.1.26*	*Prior to the period of extended operation*
57	*In-scope 480V and higher power cables will be tested at a frequency of at least every 6 years with the first test completed prior to entering the period of extended operation.*	*B2.1.26*	*Prior to the period of extended operation*

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November 24, 2010

PG&E Letter DCL-10-148

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20852

Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyon Units 1 and 2
Response to NRC Letter dated November 03, 2010, Request for Additional Information (Set 29) for the Diablo Canyon License Renewal Application

Dear Commissioners and Staff:

By letter dated November 23, 2009, Pacific Gas and Electric Company (PG&E) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) for the renewal of Facility Operating Licenses DPR-80 and DPR-82, for Diablo Canyon Power Plant (DCPP) Units 1 and 2, respectively. The application included the license renewal application (LRA), and Applicant's Environmental Report - Operating License Renewal Stage.

By letter dated November 03, 2010, the NRC staff requested additional information needed to continue their review of the DCPP LRA.

PG&E's response to the request for additional information is included in Enclosure 1. LRA Amendment 25 resulting from the responses is included in Enclosure 2 showing the changed pages with line-in/line-out annotations.

PG&E makes new commitments in revised LRA Table A4-1, License Renewal Commitments, shown in Enclosure 2.

If you have any questions regarding this response, please contact Mr. Terence L. Grebel, License Renewal Project Manager, at (805) 545-4160.

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

Executed on November 24, 2010.

Sincerely,

James R. Becker

tlg/50358666
Enclosure
cc: Diablo Distribution
cc/enc: Elmo E. Collins, NRC Region IV Regional Administrator
Nathanial Ferrer, NRC Project Manager, License Renewal
Kimberly J. Green, NRC Project Manager, License Renewal
Michael S. Peck, NRC Senior Resident Inspector
Fred Lyon, NRC Project Manager, Office of Nuclear Reactor Regulation
Alan B. Wang, NRC Project Manager, License Renewal

PG&E Response to NRC Letter dated November 03, 2010
Request for Additional Information (Set 29) for the
Diablo Canyon License Renewal Application

RAI B2.1.18-2 (Follow-up)

Background:
Given that there have been a number of recent industry events involving leakage from buried or underground piping, the staff requested further information to evaluate the impact that these recent industry events might have on the applicant's Buried Piping and Tanks Inspection Program. By letter dated August 3, 2010, the staff issued RAI B.2.1.18-2 requesting that the applicant provide information regarding how Diablo Canyon will incorporate the recent industry operating experience into its aging management reviews and programs. The applicant responded on August 30, 2010. In reviewing the response, the staff noted the following.

Issue:

1) *The applicant's response stated that, "Evaluation and appropriate changes to applicable programs as a result of recent operating experience are still ongoing both within PG&E and the industry. PG&E is committed to follow the EPRI 1016456, Recommendations for an Effective Program to Control the Degradation of Buried Pipe. The EPRI initiative addresses recent industry operating experience. PG&E programs, which will be modeled after the EPRI initiative, will also consider plant-specific operating experience. The EPRI initiative will set an inspection schedule for buried piping segments based on, among other things, pipe materials and locations. PG&E will develop an inspection plan for buried piping in accordance with NRC staff accepted industry guidelines that will provide the number of excavations, the minimum length of piping that will be exposed, and the percentage of the total length of piping that will be inspected."*

   The staff believes that in order to provide a reasonable assurance that in-scope buried piping will be capable of performing its intended function(s) and not release hazardous materials (i.e., material which, if released, could be detrimental to the environment such as diesel fuel and radioisotopes that exceed EPA drinking water standards) to the environment, each material, safety/Code class, and potential to contain hazardous material during normal operation category of in-scope buried pipe should be inspected. The staff also believes that there is a minimum set of excavated and visual inspections of buried piping segments that should be conducted. The LRA and supplemental material did not contain enough specifics on the planned inspections for the staff to determine if the inspections would be adequate to manage the aging effect for all material, safety/Code class, and potential to contain hazardous material categories of in-scope buried pipes.

2) *The applicant's response stated that, "At this time, PG&E does not plan to use any examination method other than excavation or visual inspection of buried piping. If PG&E decides to use methods of examination other than excavation and direct visual inspection, these methods will be submitted for NRC staff approval in accordance with NRC staff accepted buried piping and underground piping guidelines."*

   The staff acknowledges that examining buried pipe from the exterior surface may sometimes not be possible due to plant configuration (e.g., the piping is located underneath foundations); nevertheless, it is important to expose a large enough length of the piping in order to establish reasonable assurance of the condition of the piping system. The staff believes that in instances where it is not possible to expose the program designated length of piping during each inspection, an alternative examination should be proposed. The staff notes that it is reasonable to substitute an ultrasonic volumetric examination from the interior of the pipe provided the surface is properly prepared. Although the applicant stated that they will submit alternative examination methodologies for NRC staff approval, there is no specific requirement for a licensee to submit such changes for approval in the license renewal guidelines. Therefore the RAI response lacks sufficient specificity for the staff to find the applicant's proposal acceptable.

3) *The applicant stated that, "The remaining DFO system piping runs in air either in a conduit between the DFO tank and DFO transfer pump or in a concrete lined trench from the DFO transfer pumps to each diesel generator with no CP since the piping is not buried." The staff believes that this statement is in conflict with LRA Table 3.3.2-13 which indicates that there is buried piping in the diesel generator fuel oil system. The staff also believes that there is a minimum set of excavated and visual inspections of buried piping segments that contain hazardous materials that should be conducted to establish a reasonable basis of assurance that aging effects are not adversely impacting buried pipe and resulting in the system or component not meeting its intended function. Additionally, the staff does not have enough information to determine what percent of total linear feet of the Diesel Generator Fuel Oil System piping will be inspected by the External Surfaces Monitoring Program during each ten year period starting ten years prior to the period of extended operation.*

4) *The applicant stated that,*

   > *CP is used in portions of the auxiliary saltwater (ASW) piping and for the intake structure traveling screens, gates and guides, ASW pumps and screen wash pumps. PG&E procedures perform monthly monitoring of the rectifier output voltage and current for the CP system. An annual survey of the ASW pipe CP system includes monitoring rectifier output voltage and current, "ON/OFF" pipe to soil potentials, and individual anode currents. The recent annual*

survey results show that the ASW piping meet at least one of the specified CP criteria for CP, as established by the National Association of Corrosion Engineers International in their Standard SP0169-07, "Control of External Corrosion on Underground or Submerged Metallic Piping Systems.

The staff believes that cathodic protection is an important preventive measure for steel piping. The LRA and supplemental documents lack sufficient detail for the staff to understand (a) which portions of the ASW piping systems that contain steel piping are not cathodically protected, (b) the availability of the cathodic protection system, and (c) given that NACE SP0169-07, paragraph 6.2.2, allows "other criteria" than demonstrating a negative potential of at least 850mv or a minimum of 100 mv of cathodic polarization between the piping and a stable reference electrode contacting the electrolyte, what CP criteria is being used for buried in-scope steel piping.

5) *The LRA does not describe the quality of the backfill in the vicinity of buried in-scope piping. The staff understands that the presence of rocks and sharp objects in the backfill around buried pipes is a leading precursor of degradation of buried piping when over time ground movement causes these materials to come in contact with the buried pipe resulting in damage to the pipe's coating or external surfaces.*

6) *Based on a review of LRA Section 2.3.3.5 and the License Renewal Boundary Drawings, it is not clear to the staff if the in-scope buried make-up water system piping has a safety related function.*

<u>Request:</u>

1) *For buried piping within the scope of license renewal, respond to the following:*

    a) *Understanding that the total number of inspections performed will be dictated by plant-specific and industry operating experience, clarify the minimum number of inspections of buried in-scope piping are planned during the 30 – 40, 40 – 50, and 50 – 60 year operating period. When describing the minimum number of planned inspections, differentiate between material, code/safety-related piping, and potential to contain hazardous material category piping inspection quantities of buried in-scope piping.*
    b) *For the minimum number of planned inspections, indicate what length of piping will be excavated and have a direct visual inspection conducted.*

2) *For buried piping within the scope of license renewal, respond to the following:*

a) *Describe what alternative inspection methods will be utilized when excavated direct visual examinations are not possible due to plant.*
b) *If alternative volumetric examination methods, beyond ultrasonic examinations, will be utilized for conducting an interior wall thickness measurement when not excavating and visually inspecting a buried piping segment, justify why they will be effective at providing a reasonable assurance that the buried in-scope piping systems will meet their current licensing basis function.*
c) *If a volumetric examination method is used in lieu of direct visual examination, indicate what percentage of interior axial length of the pipe will be inspected.*

3) *For buried steel piping within the scope of license renewal, respond to the following:*

a) *LRA Table 3.3.2-13, page 3.3-200, Diesel Generator Fuel Oil System, lists an AMR line item, piping constructed of buried carbon steel and being managed for loss of material by the Buried Piping and Tanks Inspection Program. Reconcile this line item with the statement in Issue 3 above, that there is no in-scope buried carbon steel piping in the Diesel Generator Fuel Oil System.*
b) *If portions of the piping are buried, state what percent of total linear feet of the Diesel Generator Fuel Oil System piping will be inspected by the Buried Piping and Tanks Inspection Program during each ten year period starting ten years prior to the period of extended operation.*
c) *If the piping is not buried, state what percent of total linear feet of the Diesel Generator Fuel Oil System piping will be inspected by the External Surfaces Monitoring Program during each ten year period starting ten years prior to the period of extended operation.*
d) *If there are no planned inspections for this piping, justify why it is acceptable to not inspect in-scope pipe containing hazardous materials.*

4) *For buried steel piping within the scope of license renewal, respond to the following:*

a) *State which portions of the ASW system that contain steel piping are not cathodically protected.*
b) *If portions of the in-scope ASW system piping are not cathodically protected:*
    i. *Justify how the piping will meet or exceed the minimum design wall thickness throughout the period of extended operation.*
    ii. *State what augmented inspections of these portions of the ASW system will be conducted, and if no augmented inspections are planned, justify how a reasonable assurance will be established*

that the piping will meet its Current Licensing Basis intended functions throughout the period of extended operation.

c) *State the availability of the cathodic protection system, and if portions of the system are not available 90% of the time or will be allowed to be out of service for greater than 90 days in any given year, justify how the piping will meet or exceed the minimum design wall thickness throughout the period of extended operation.*

d) *State whether the acceptance criteria for the annual survey of the CP system is either a negative potential of at least 850mv or a minimum of 100 mv of cathodic polarization between the piping and a stable reference electrode contacting the electrolyte, or if alternative criteria are utilized justify how it achieves corrosion control comparable to the above criteria.*

5) *For buried piping within the scope of license renewal, respond to the following:*

   a) *Provide details on the quality of the backfill in the vicinity of in-scope buried pipes.*

   b) *If there is no information on the condition of the quality of backfill beyond initial installation specifications (i.e., no documented observations of the quality of the backfill), justify why the planned inspections are adequate to detect potential degradation as a result of coating damage or holidays, or damage to the exterior surface of non-coated piping.*

6) *Clarify whether any of the buried make-up water system piping within the scope of license renewal has a safety related function.*

PG&E Response to RAI 2.1.18-2

1) The Buried Piping and Tanks Inspection Program will include a risk assessment of in-scope buried piping and tanks that includes consideration of the consequences of buried piping or tank leakage and of conditions affecting the risk for corrosion. The piping segments and tanks will be classified as having a high, medium or low impact of leakage based on items such as the safety class, the hazard posed by fluid contained in the piping, and the impact of leakage on plant operation. The corrosion risk will be determined through consideration of items such as piping or tank material, soil resistivity, drainage, the presence of cathodic protection, and the type of coating.

   Pacific Gas and Electric (PG&E) backfill requirements include placement of all yard piping and electrical conduit runs, not encased in concrete, in an envelope. This envelope shall extend 6 inches below and above pipe or conduit and for the entire width of the trench. Care is taken to prevent damage to exterior coatings of pipe. Backfill material consists of clean sand, slurry, or selected stone sieved to exclude all particles larger than ¼ inch. Backfill shall be clean and free of expansive material.

Inspections will be conducted during each 10-year period beginning 10 years prior to the entry in the period of extended operation. Examinations of buried piping and tanks will consist of visual inspections as well as non-destructive examination (e.g. ultrasonic) to perform an overall assessment of the condition of buried piping and tanks.

The Buried Piping and Tanks Inspection Program manages the following safety related systems: auxiliary saltwater (ASW), make-up water, and diesel fuel oil (DFO). The firewater system is included for fire protection per 10CFR54.4(a)(3).

The following is a summary of materials associated with the in scope systems:

Auxiliary Saltwater

The in-scope ASW system piping includes the original and the bypass piping. The original piping is 24-inch ASTM A53, Type S seamless carbon steel. The original piping is externally coated with two coats of coal tar epoxy with an embedded layer of 6 ounce treated square woven fiberglass cloth. The interior liner is an abrasion resistant Paraline AR brand seamless polyvinyl chloride (PVC). The ASW piping bypass is 24-inch ASME SA-106, Grade B carbon steel. The piping is externally coated with two coats of Devoe Coatings' Devguard 238 and a fiberglass lining. The interior liner is Paraliner.

As indicated in PG&E letter DCL-97-010 dated January 27, 1997, a portion of the ASW piping was bypassed due to a concern that localized corrosion was occurring in the portion of the piping buried below sea level in the tidal zone outside the intake structure.

The piping buried in soil from the intake structure to the turbine building wall has cathodic protection (CP) designed and installed at the whole length.

The ASW discharge piping is carbon steel and mostly encased in concrete, except near the turbine building. The piping exiting the turbine building is epoxy coated and buried in soil for less than 40 feet with approximately 5 feet of cover. There is currently no CP on this segment of pipe.

Make-up Water

The in scope buried piping of the make-up water system consists of Asbestos Cement Pipe (ACP). There is also a short segment of in scope, non-cathodically protected carbon steel piping contained inside a valve pit in contact with soil.

Diesel Fuel Oil

The DFO piping is not in direct contact with soil or concrete and therefore not buried. The DFO piping is contained within a trench, vault, or pipeway such that it is in contact with air and is located where access for inspection is restricted. The DFO piping is carbon steel. The branch lines are 2 inch and the main header piping is

2 ½ inch. The DFO piping is externally coated with a Rayclad 120 (thickness type B) heat-shrinkable pipeline coating system. No DFO piping is buried, therefore, license renewal application (LRA) Table 3.3.2-13 has been corrected.

The DFO storage tanks are buried in soil. The tanks are designed with three layers, two steel shells and an outer fiberglass shell. The primary corrosion protection for the DFO tanks is the 300 mil. fiberglass reinforced plastic outer shell. A zinc coating on the outer surface of the secondary steel shell provides backup corrosion protection in the event of the failure of the outer shell.

Firewater

The Plant Yard Loop is 12-inch ACP, with cast iron fittings. Carbon steel piping runs are also present in the Plant Yard Loop in branch lines to the turbine and auxiliary buildings (Units 1 & 2). After the start of plant operation, PVC pipe with ductile iron fittings was used to extend the firewater system to new non-power block buildings.

a) Inspections of Buried Piping Based on Material and Environment Combinations

Fire mains are installed in accordance with NFPA 24. Preventive actions for fire mains beyond those in NFPA 24 need not be provided if the system undergoes a periodic flow test in accordance with NFPA 25 section 7.3 at a frequency of at least one test in each 1-year period. Fire mains will be subject to a periodic flow test in accordance with NFPA 25 section 7.3 at a frequency of at least one test in each one year period. These flow tests will be performed in lieu of excavating buried portions of firewater pipe for visual inspections.

For cathodically-protected metallic piping, at least one excavation and visual inspection of steel piping will be conducted each 10-year period beginning 10 years prior to the entry in the period of extended operation. Cathodically-protected steel piping within the scope of license renewal exists in the ASW system intake lines.

For non cathodically-protected buried metallic piping, at least four excavations and visual inspections of steel piping will be conducted each 10-year period beginning 10 years prior to the entry in the period of extended operation. Non Cathodically-protected steel piping within the scope of license renewal exists in the ASW system discharge lines, makeup water system and firewater system. PG&E will install CP for the ASW discharge piping in contact with soil during the first 10 year interval period excavation and inspection prior to the period of extended operation. Following the installation of the CP on ASW discharge piping, one excavation and visual inspection will be conducted per 10 year interval. The makeup water system piping in the valve pit and in contact with soil will be visually inspected four times per 10-year period. If the configuration of the piping in the valve pit is altered so that the piping is no longer in contact with soil the inspection frequency will be revised to two visual inspections per 10-year period.

For non metallic piping, at least one excavation and visual inspection each of PVC and ACP will be conducted each 10-year period beginning 10 years prior to the entry in the period of extended operation. PVC piping within the scope of license renewal exists in the firewater system. Asbestos cement piping within the scope of license renewal exists in the firewater system and make-up water system.

b) Each inspection will examine either the entire length of a run of pipe or a minimum of 10 feet. If the number of inspections times the minimum inspection length (10 feet) exceeds 10 percent of the length of the piping under consideration, only 10 percent will need to be inspected. If the total length of the in-scope pipe constructed of a given material times the percentage to be inspected is less than 10 feet, either 10 feet or the total length of pipe present, whichever is less will be inspected.

2) At this time, PG&E does not plan to use any examination method other than excavation or visual inspection of buried piping. If the instance were to arise where it is not possible to expose the program designated length of piping during each inspection, prior NRC approval would be obtained for use of alternative ultrasonic volumetric examination techniques from the interior of the pipe.

3)

a) All fuel oil piping is contained in either a pipe trench with a leak chase or vault. The trenches are equipped with leak detection. Therefore, the LRA has been revised to show no buried DFO pipe. See revised LRA Section 2.4.7 and Tables 2.4-7, 3.3.2-13, and 3.5.2-7 in Enclosure 2.

b) As discussed above there are no buried portions of piping containing hazardous materials.

c) One hundred percent of the below grade diesel generator fuel oil system piping is visually inspected by an existing plant procedure on a 10 year interval. The External Surfaces Monitoring Program will be revised to describe this inspection and the associated 10 year frequency. See revised LRA Appendix B2.1.20 in Enclosure 2.

d) As discussed above, inspections of below grade piping containing hazardous materials will be conducted.

4)

a) The ASW intake piping has no CP system between the turbine building wall and the ASW heat exchangers. The piping in this section is encased in the concrete floor of the turbine building. The ASW intake piping buried in soil from the intake structure to the turbine building has CP installed for the whole length. The ASW discharge piping is in contact with soil when it leaves the turbine building for approximately 40 feet at which point the pipe is encased in concrete for the

remainder of the run to the discharge structure. This portion of the ASW discharge piping is not cathodically protected. As discussed above, CP will be installed on this portion of the discharge piping.

b) The ASW system piping that is not cathodically protected is encased in concrete. The concrete provides a non corrosive environment for the steel piping such that CP is not necessary and there are no aging effects. Diablo Canyon Power Plant (DCPP) operating experience confirms effectiveness of this design.

c) CP systems of the ASW piping have been and will be available more than 90 percent of the time.

d) The NACE SP0169-07, paragraph 6.2.2, “negative potential of at least 850mV or a minimum of 100 mV of cathodic polarization” is the only criteria used at DCPP. At the ASW pipe test locations where static (native) pipe-to-soil potential data is not available, the 850mV criteria are used. At ASW pipe test locations where static (native) pipe-to-soil potential data is available, the 100mV criteria are used. There have been no corrosion leaks on the ASW piping since the CP systems have been installed.

5)

a) PG&E backfill requirements include placement of all yard piping and electrical conduit runs, not encased in concrete, in an envelope. This envelope shall extend 6 inches below and above pipe or conduit and for the entire width of the trench. Care is taken to prevent damage to exterior coatings of pipe. Backfill material consists of clean sand, slurry, or selected stone sieved to exclude all particles larger than ¼". Backfill shall be clean and free of expansive material.

b) A comprehensive search of DCPP records provided a single event of foreign objects found in backfill during an excavation. In 1992, an excavation of the ASW carbon steel annubar line found wood blocks and debris around the buried pipe. This finding was entered in the corrective action program. An investigative action was also taken to further excavate around all four of the main 24" diameter ASW pipes to inspect the flanges and bottom side of the pipe.

6) None of the buried make-up water system piping has a safety related function. The reservoir gravity feed asbestos cement piping supplying water to the fire system yard loop is buried piping and is in-scope for fire protection (10 CFR 54.4(a)(3)) and long term cooling(10 CFR 54.4(a)(2)). The piping is shown on boundary drawing LR-DCPP-16-106716-11.

D-RAI B2.1.26-3

Background:
NUREG-1801, Rev. 1, "Generic Aging Lessons Learned," (the GALL Report) addresses inaccessible medium voltage cables in Aging Management Program (AMP) XI.E3, "Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." The purpose of this program is to provide reasonable assurance that the intended functions of inaccessible medium voltage cables (2 kV to 35 kV), that are not subject to environmental qualification requirements of 10 CFR 50.49 and are exposed to adverse localized environments caused by moisture while energized, will be maintained consistent with the current licensing basis. The scope of the program applies to inaccessible (in conduits, cable trenches, cable troughs, duct banks, underground vaults or direct buried installations) medium-voltage cables within the scope of license renewal that are subject to significant moisture simultaneously with significant voltage.

The application of AMP XI.E3 to medium voltage cables was based on the operating experience available at the time Revision 1 of the GALL Report was developed. However, recently identified industry operating experience indicates that the presence of water or moisture can be a contributing factor in inaccessible power cables failures at lower service voltages (480V to 2kV). Applicable operating experience (OE) was identified in licensee responses to Generic Letter (GL) 2007-01, "Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients," which included failures of power cable operating at service voltages of less than 2kV where water was considered a contributing factor.

Recently identified industry operating, provided by the NRC licensees in response to GL 2007-01, has shown that there is an increasing trend of cable failures with length in service beginning in the 6th through 10th years of operation and also that moisture intrusion is the predominant factor contributing to cable failure. The staff has determined, based on the review of the cable failure distribution, that annual inspection of manholes and cable testing frequency of at least every 6 years is a conservative approach to ensuring the operability of power cables and, therefore, should be considered.

In addition, recently identified industry operating experience has shown that some NRC licensees may experience events, such as flooding or heavy rain, that subjects cables within the scope of program for GALL Report XI.E3 to significant moisture. The staff has determined that event driven inspections, in addition to a 1 year periodic inspection frequency, is a conservative approach and, therefore, should be considered.

Issue:
The staff has concluded, based on recently identified industry operating experience concerning the failure of inaccessible low voltage power cables (480v to 2kV) in the presence of significant moisture, that these cables can potentially experience age

related degradation. The staff noted that the applicant's Inaccessible Medium-Voltage Cables Program does not address inaccessible low voltage power cables (400V (Nominally 480V) to 2kV inclusive). In addition, increased cable test and inspection frequencies (6 and 1 years respectively) should be evaluated to ensure that the Inaccessible Medium Voltage Program test and inspection frequencies reflect industry and plant-specific operating experience and that test and inspection frequencies may be increased based on future industry and plant-specific operating experience.

Request:

1. *Provide a summary of your evaluation of recently identified industry operating experience and any plant-specific operating experience concerning inaccessible low voltage power cable failures within the scope of license renewal (not subject to 10 CFR 50.49 environmental qualification requirements), and how this operating experience applies to the need for additional aging management activities at your plant for such cables.*

2. *Provide a discussion of how Diablo Canyon Nuclear Power Plant, Units 1 and 2, will manage the effects of aging on inaccessible low voltage power cables within the scope of license renewal and subject to aging management review; with consideration of recently identified industry operating experience and any plant-specific operating experience. The discussion should include assessment of your aging management program description, program elements (i.e., Scope of Program, Parameters Monitored/Inspected, Detection of Aging Effects, and Corrective Actions), and FSAR summary description to demonstrate reasonable assurance that the intended functions of inaccessible low voltage power cables subject to adverse localized environments will be maintained consistent with the current licensing basis through the period of extended operation.*

3. *Provide an evaluation showing that the Inaccessible Medium Voltage Program test and inspection frequencies, including event driven inspections, incorporate recent industry and plant-specific operating experience for both inaccessible low and medium voltage cable. Discuss how the Inaccessible Medium Voltage Program will ensure that future industry and plant-specific operating experience will be incorporated into the program such that inspection and test frequencies may be increased based on test and inspection results.*

PG&E Response to D-RAI B2.1.26-3

1) In response to Diablo Canyon Power Plant (DCPP) operation experience associated with underground cable degradation, all of the in-scope inaccessible underground medium voltage cables at DCPP have been replaced. As discussed, in the License Renewal Application section B2.1.26, DCPP has experienced water accumulation in the pull boxes and underground conduits. Actions taken to address

this water accumulation include implementation of an inspection program of pull boxes for water accumulation, removal of water from pull boxes as required, maintenance of sump pumps and removal of conduit seals.

DCPP operation experience has shown there have been no in scope 480 V power circuit cable failures at DCPP.

2) DCPP's medium voltage cable aging management program is consistent with the guidance in NUREG 1801 section XI.E3. The program will be revised to include in scope inaccessible underground 480 V power cables. The program will be revised such that all underground in scope 480 V or higher power cables is being included in the program, regardless of the percentage of time the loads are energized.

   As previously noted, all in scope medium voltage cable at DCPP has been recently replaced. DCPP 480 V buses are equipped with continuous ground detection. DCPP ground detection operating experience has not identified 480 V grounds that were a result of power conductor insulation failures.

   The DCPP pull box inspection program has been effective in preventing pull box flooding and cable submergence in all in scope medium and low voltage pull boxes. Bi-monthly pull box inspections are currently being performed. The inspections monitor water accumulation during rainy periods. The inspections can be deferred if no rain has fallen since the last inspection. These inspections have demonstrated that event driven water accumulation from natural sources is not occurring. Event driven inspections are thus not required. Recent structural pull box inspections have not produced any visible indication of significant cable or cable support degradation. The pull box inspection frequency is subject to change based on inspection results. However the program will require that in scope cable pull boxes will be inspected for water accumulation at least once every year.

   Based on current DCPP operating experience insulation testing of in scope 480 V and higher power cables at least once every 10 years is sufficient. This includes medium voltage power cables. The first tests will be completed prior to entering the period of extended operation. The test will be a proven test with acceptance criteria determined prior to conducting the tests.

   Detailed internal pull box inspections of cables and cable supports will be included in the structural monitoring program. Inspection criteria will be included in plant procedures. These are opportunistic inspections conducted when the pull boxes are opened for maintenance or other reasons. More frequent tests and inspections will be required when the current program identifies adverse trends indicating that in scope power cables insulation resistance is being reduced or the cables are being subjected to submergence or visible indications of cable aging or cable support degradation are observed. A corrective action document is required to be written

when test or inspection requirements do not meet acceptance requirements or when adverse trends are noted when evaluating results over time.

3) The DCPP site is not prone to flooding events from natural sources. The design and layout of the in scope cable pull boxes limit the likelihood that any significant water will accumulate in the pull boxes. The boxes are designed to drain down-hill toward plant structures/sumps, to automatic pump equipped sumps which pump to structure sumps, or they are designed or located such that significant water ingress or retention is not likely. Since completion of corrective action which include implementation of a pull box inspection program to inspect and remove water accumulation. A review of the past five years of operation experience demonstrates that this program has been effective in preventing pull box flooding and cable submergence in pull boxes. As stated above, water accumulation is not occurring and recent structural pull box inspections have not identified any visible indication of significant cable or cable support degradation. Based on DCPP operating experience, event driven pull box inspections are not required.

   As previously noted, all in scope medium voltage cable at DCPP has been recently replaced. DCPP operating experience has not identified any indication that failures of inaccessible 480 V or higher power conductors located underground are a concern. Based on this and reviews of industry operating experience reported as a result of responses to NRC Generic letter 2007-01 and recent cable replacements at DCPP compliance with NUREG 1801 section XI.E3 inspection and testing guidance, with previously noted program enhancements, ensures that in scope underground low and medium voltage power cables will continue to perform their intended functions through the period of extended operation.

   Any necessary changes to inspection or test frequencies will be evaluated as part of the DCPP corrective action program. Industry operating experience is evaluated by the plant staff through the corrective action program. A corrective action document is required to be written when test or inspection requirements do not meet acceptance requirements or when adverse trends are noted when evaluating test or inspection results over time.

   In summary based on the above, the DCPP Inaccessible Medium Voltage Program incorporates recent industry and plant-specific operating experience for both inaccessible low and medium voltage cable and adjusts testing and inspection frequency based on test and inspection results. DCPP operation experience shows that in scope pull boxes are not accumulating water and pull box cable and support degradation is not occurring.

   See revised license renewal application (LRA) Table A4-1 for medium and low voltage commitments.

LRA Amendment 25

LRA Section	RAI
Section 2.4.7	B2.1.18-2
Table 2.4-7	B2.1.18-2
Table 3.3.2-13	B2.1.18-2
Table 3.5.2-7	B2.1.18-2
Table A4-1	B2.1.18-2 B2.1.26-3
Appendix B2.1.20	B2.1.18-2

2.4.7 Diesel Fuel Oil Pump Vaults and Structures

Structure Description

The diesel fuel oil pump vaults and structures include the pump vaults, pipe trenches (also referred to as the DFO pipeway structure), and the diesel fuel oil *storage* tank foundations. Also included are the vaults at the suction and discharge lines, manway and level monitors, fill line, and vent line, and the traffic box at the vacuum gage. These reinforced concrete structures are below grade west of the turbine building. The vaults and trenches have reinforced concrete covers and steel hatches flush at ground level. Concrete curbing prevents water intrusion into the vaults. *A 30 inch diameter steel pipeway provides a conduit for the diesel fuel oil piping between the fuel oil storage tank and the transfer pump vault. A reinforced concrete slab above the pipeway protects it from heavy equipment loads and any potential missiles.* The tanks are supported on granular bedding over a reinforced concrete foundation. The vaults and trenches are supported either on compacted backfill or by reinforced concrete grade beams and drilled concrete piles, which extend down to bedrock. These structures support the underground fuel oil storage tanks, transfer pumps, piping, valves, and instrumentation for the emergency diesel generators. To provide for seismic separation between the underground tanks and diesel fuel pump vaults, there are ~~conduits with~~ flex*ible* piping connections *inside the 30 inch pipeway* between the two structures. The pump vaults are Design Class I. The Design Class II trench bottom slab and walls are qualified for the Hosgri earthquake to protect the Design Class I piping

Table 2.4-7 Diesel Fuel Oil Pump Vaults and Structures

Component Type	Intended Function
Structural Steel	*Shelter, Protection* Structural Support

Table 3.3.2-13 Auxiliary Systems – Summary of Aging Management Evaluation – Diesel Generator Fuel Oil System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
~~Closure Bolting~~	~~PB~~	~~Carbon Steel~~	~~Buried (Ext)~~	~~Loss of material~~	~~Buried Piping and Tanks Inspection (B2.1.18)~~	~~VII.H1-9~~	~~3.3.1.19~~	~~D~~
~~Piping~~	~~PB~~	~~Carbon Steel~~	~~Buried (Ext)~~	~~Loss of material~~	~~Buried Piping and Tanks Inspection (B2.1.18)~~	~~VII.H1-9~~	~~3.3.1.19~~	~~B~~

Table 3.5.2-7 Containments, Structures, and Component Supports – Summary of Aging Management Evaluation – Diesel Fuel Oil Pump Vaults and Structures

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Structural Steel	*SH, SS*	*Carbon Steel*	*Plant Indoor Air (Structural) (Ext)*	*Loss of material*	*Structures Monitoring Program (B2.1.32)*	*III.A3-12*	*3.5.1.25*	*A, 1*

Plant Specific Notes:

1 The 30 inch diameter steel pipeway provides a conduit for the diesel fuel oil piping between the fuel oil storage tank and the transfer pump vault. A reinforced concrete slab above the pipeway protects it from heavy equipment loads and any potential missiles. The outside surface of the pipeway is inaccessible due to the protective slab, but the structures monitoring inspections examine the inside surfaces of the pipeway to ensure that any degradation will be identified and managed prior to a loss of intended function.

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
52	*The Buried Piping and Tanks Inspection Program will be revised to include the following inspections that will be conducted during each 10-year period beginning 10 years prior to the entry in the period of extended operation. Examinations of buried piping and tanks will consist of visual inspections as well as non-destructive examination (e.g. ultrasonic) to perform an overall assessment of the condition of buried piping and tanks.* *Each inspection will examine either the entire length of a run of pipe or a minimum of 10 feet. If the number of inspections times the minimum inspection length (10 feet) exceeds 10 percent of the length of the piping under consideration, only 10 percent will need to be inspected. If the total length of the in-scope pipe constructed of a given material times the percentage to be inspected is less than 10 feet, either 10 feet or the total length of pipe present, whichever is less will be inspected.* *<u>Inspections of Buried Piping Based on Material and Environment Combinations</u>* *Fire mains will be subject to a periodic flow test in accordance with NFPA 25 section 7.3 at a frequency of at least one test in each one year period. These flow tests will be performed in lieu of excavating buried portions of Fire Water pipe for visual inspections.* *For cathodically-protected metallic piping, at least one excavation and visual inspection of steel piping will be conducted. Cathodically-protected steel piping within the scope of license renewal exists in the Auxiliary Salt Water (ASW) system intake lines.* *For non cathodically-protected buried metallic piping, at least four*	*B2.1.18*	*Prior to the period of extended operation*

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	excavations and visual inspections of steel piping will be conducted. Non Cathodically-protected steel piping within the scope of license renewal exists in the ASW system discharge lines and Makeup Water system. *For non metallic piping, at least one excavation and visual inspection each of polyvinyl chloride (PVC) and Asbestos Cement Pipe (ACP) will be conducted. PVC piping within the scope of license renewal exists in the Fire Water system. Asbestos cement piping within the scope of license renewal exists in the Fire Water system and Make-up Water system.*		
53	*PG&E will install cathodic protection for the ASW discharge piping in contact with soil during the first 10 year interval period excavation and inspection prior to the period of extended operation.*	*B2.1.18*	*Prior to the period of extended operation*
54	*The DCPP XI.E3 program will be revised to include in scope inaccessible underground 480 V power cables or higher power cables, regardless of the percentage of time the loads are energized. The program will require that in scope cable pull boxes will be inspected for water accumulation at least once every year. Detailed internal pull box inspections of cables and cable supports will be included in the structural monitoring program. Inspection criteria will be included in plant procedures. These are opportunistic inspections conducted when the pull boxes are opened for maintenance or other reasons. More frequent tests and inspections will be required when the current program identifies adverse trends indicating that in scope power cables insulation resistance is being reduced or the cables are being subjected to submergence or visible indications of cable aging or cable support degradation are observed. The DCPP corrective action program will drive any necessary changes. A corrective action document is required to be written when test or inspection requirements do not meet acceptance requirements or when adverse trends are noted when evaluating results over time.*	*B2.1.26*	*Prior to the period of extended operation*

B2.1.20 External Surfaces Monitoring Program

Program Description

The External Surfaces Monitoring Program manages loss of material for external surfaces of steel, stainless steel, aluminum, copper alloy components and elastomers, and hardening and loss of strength for elastomers. The program is a visual monitoring program that includes those systems and components within the scope of license renewal. *The below grade Diesel Generator Fuel Oil System piping is visually inspected by an existing plant procedure on a ten year interval.*

Surfaces that are inaccessible or not readily visible during plant operations are inspected during refueling outages. Surfaces that are inaccessible or not readily visible during both plant operations and refueling will be evaluated by the DCPP Corrective Action Program to evaluate applicable industry and plant-specific aging operating experience for the material and environmental combination. The evaluation will determine if there is a representative location, based on the material, environment, and applicable aging effect that has been or can be inspected in place of the inaccessible components. When appropriate for the component configuration and material, physical manipulation of elastomers is used to augment visual inspections to confirm the absence of hardening or loss of strength.

The External Surfaces Monitoring program may be credited with managing loss of material from internal surfaces for situations in which material and environment combinations are the same for internal and external surfaces such that external surface condition is representative of internal surface condition.

The External Surfaces Monitoring program is a monitoring program that provides measures for detecting the aging effects prior to loss of intended function, but does not prevent degradation due to aging effects.

The External Surfaces Monitoring Program manages aging for external surfaces that are not within the scope of the following programs:

1.) Boric Acid Corrosion program (B2.1.4) for components in a system with treated borated water or reactor coolant environment in which boric acid corrosion may occur

2.) Buried Piping and Tanks Inspection program (B2.1.18) for buried components

3.) Structures Monitoring Program (B2.1.32) for civil structures, and other structural items which support and contain mechanical and electrical components

4.) Fire Protection program (B2.1.12) for the CO_2 fire suppression system components.

Personnel performing external surfaces monitoring inspection will be qualified in accordance with DCPP-controlled procedures and processes.

The External Surfaces Monitoring Program will be implemented within the context of the System Engineering Program. Routine system walkdowns are required by the System Engineering Program to perform inspection on components. External surface inspections will be performed on passive components in scope for license renewal at intervals no longer than once per refueling cycle except for those inspections pertaining to the fire protection CO_2 system. The inspection interval for the passive fire protection CO_2 system components in scope for license renewal will be no longer than once every six months as discussed in the Fire Protection program (B2.1.12) for the CO_2 fire suppression system components. The program will include periodic visual inspections for loss of material, leakage, and conditions indicating elastomer hardening and loss of strength. Visual inspection parameters for metals and non-metals will be specified in walkdown procedures.

The External Surfaces Monitoring program will require that completed inspection documentation be reviewed by an engineer and retained for historical information and trending. Trending of inspection results will be performed to the extent reasonably practicable.

The External Surfaces Monitoring program will include inspection criteria for metals and non-metals that list general conditions that should be identified as discrepancies in the DCPP corrective action program. This listing will serve as acceptance criteria.

3.0.3.2.14 Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Summary of Technical Information in the Application. LRA Section B2.1.26 describes the existing Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program as consistent, with enhancement, with GALL AMP XI.E3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." The applicant stated that the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program manages the aging effects of inaccessible medium-voltage cables located in conduit, duct banks, and pull boxes exposed to adverse localized environments caused by significant moisture simultaneously with significant voltage to ensure that inaccessible medium-voltage cables, not subject to EQ requirements of 10 CFR 50.49 and within scope of license renewal, are capable of performing their intended function.

The applicant also stated that it inspects cable pull boxes, with the potential for water intrusion that contain in-scope, non-EQ inaccessible medium voltage cables, for water collection. The inspection frequency will be based on plant experience with an inspection frequency of at least once every 2 years. Further, the applicant stated that it will test in-scope, non-EQ inaccessible medium voltage cables routed through pull boxes to provide an indication of the conductor insulation condition. The applicant stated that it will perform either a polarization index test or other testing that is state-of-the-art at the time of the testing at least once every 10 years, with the first test completed prior to the period of extended operation.

Staff Evaluation. During its audit, the staff reviewed the applicant's claim of consistency with the GALL Report. The staff also reviewed the plant conditions to determine if they are bounded by the conditions for which the GALL Report was evaluated.

The staff compared elements one through six of the applicant's program to the corresponding elements of GALL AMP XI.E3. As discussed in the Audit Report, the staff confirmed that the elements for which the applicant claimed consistency with the GALL Report, are indeed consistent with the corresponding elements of GALL AMP XI.E3.

The staff also reviewed the portions of the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements associated with the enhancement to determine if the program will be adequate to manage the aging effects for which it is credited. The staff's evaluation of this enhancement follows.

Enhancement 1. The Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program states an enhancement to the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements. The applicant stated that procedures will carry out the AMP for testing of the medium voltage cable not subject to 10 CFR 50.49 EQ requirements and enhance the periodic inspections and removal of water from the cable pull boxes containing in-scope medium voltage cables not subject to 10 CFR 50.49 EQ requirements. The applicant's enhancement incorporates GALL AMP XI.E3 program elements into existing program inspections to make them consistent with the GALL AMP XI.E3 program "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "acceptance criteria" program elements. The enhancement includes new procedures that incorporate inspections and testing consistent with the guidance of GALL AMP XI.E3. Based on its review, the staff

finds this enhancement acceptable because, when it is implemented prior to the period of extended operation, it will be make the applicant's existing program consistent with the recommendations in GALL AMP XI.E3.

Based on its audit, the staff finds that elements one through six of the applicant's Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program, with an acceptable enhancement, are consistent with the corresponding program elements of GALL AMP XI.E3 and, therefore, are acceptable.

Operating Experience. LRA Section B2.1.26 summarizes operating experience related to the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program. The applicant stated that plant-specific operating experience indicates that DCPP has experienced seven in-service power cable single phase grounds that required removing components from service to replace conductors. The applicant also stated that cable testing found four additional cables that did not pass insulation acceptance criteria. The applicant further stated that all 11 cables have been replaced. The applicant's failure analysis on one of the failed cables determined that contamination in the cable insulation led to the failure, with the failure likely influenced by water diffusion into the cable insulation. The applicant concluded that contamination may be present in additional cables supplied from the same cable manufacturer and may be subject to the same degradation. Based on this, the applicant initiated a cable replacement project. The applicant stated that all medium voltage cables within the scope of license renewal have subsequently been replaced. The applicant also noted corrective actions that include periodic inspection of pull boxes for water accumulation, removal of water as required, periodic maintenance of sump pumps, inspection of duct bank conduits for water accumulation, and removal of conduit seals.

The staff reviewed operating experience information, in the application and during the audit, to determine if the applicable aging effects and industry and plant-specific operating experience were reviewed by the applicant. As discussed in the Audit Report, the staff conducted an independent search of the plant-specific operating experience information to determine if the applicant had adequately incorporated and evaluated operating experience related to this program. Further, the staff performed a search of operating experience for at least 10 years back. The staff searched databases using various key word searches, the results of which were then reviewed by technical staff. The staff also confirmed that the applicant addressed operating experience noted after issuance of the GALL Report.

During its review, the staff identified operating experience that could show that the applicant's program may not be effective in adequately managing aging effects during the period of extended operation. The staff determined the need for additional clarification, which resulted in the issuance of RAIs.

SRP-LR Appendix A.1, Section A.1.2.3.10, "operating experience," states, in part, that "the operating experience of aging management programs, including past corrective actions resulting in program enhancement or additional programs, should be considered." Given the operating experience relating to inaccessible medium voltage cable at DCPP, the proposed testing frequency of at least every 10 years and inspection of at least every 2 years may not be adequate to ensure that inaccessible medium voltage cables will perform their intended functions during the period of extended operation. By letter dated June 29, 2010, the staff issued RAI B2.1.26-2 asking the applicant to describe how LRA Section B2.1.26-2 meets GALL AMP XI.E3 for in-scope, inaccessible medium voltage cables based on plant-specific operating experience that shows in-scope inaccessible medium voltage cable failures and

inaccessible medium voltage cables exposed to significant moisture. Specifically, the staff asked the applicant to supply the following information:

- describe how plant-specific operating experience has been or will be assessed and applicable changes incorporated into the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program to minimize exposure of in-scope inaccessible medium voltage cables and cable splices to significant moisture and minimize cable support degradation during the period of extended operation
- discuss AMP pull box (manhole and vault) inspection procedures for in-scope cable testing and inspection including periodic and event-driven inspections as applicable (such as rain or flood) to minimize inaccessible medium voltage cables exposure to significant moisture (should also include accommodations for future adjustment or modifications to inspection methods and frequency based on operating experience (industry and plant-specific))
- describe corrective actions taken or planned to minimize medium voltage cable submergence and cable support structure degradation
- discuss inspections and tests performed that demonstrate in-scope medium voltage cable will continue to perform its intended function during the period of extended operation having previously been exposed to significant moisture (cable submergence)

The applicant responded by letter, dated July 15, 2010, and stated that LRA Section B2.1.26 summarizes plant operating experience, including water accumulation in pull boxes and conduits, and corrective actions taken. The evaluation of plant operating experience during the period of extended operation is performed as part of the CAP described in LRA Section B2.1.26. The CAP will evaluate exposure and cable support structure degradation and ensure appropriate corrective actions are taken. The applicant committed (Commitment No. 33) to revise the plant procedure on work control to require that when an in-scope pull box is opened, a determination is made whether an opportunistic structural inspection of the pull box should be ~~perofrmed~~performed. The applicant stated that LRA Section B2.1.26 shows that cable~~s~~ pull boxes, with a potential for water intrusion that contain inaccessible medium voltage cables, are inspected for water collection, and the inspection frequency is at least once every 2 years. The inspection frequency will be adjusted based on plant operating experience. The applicant also stated that DCPP is currently performing these inspections more frequently than every 2 years. The applicant further stated that based on the corrective actions taken for previous water accumulation in the cable pull boxes and recent inspections, these inspections have been effective in minimizing inaccessible medium voltage cable exposure to significant moisture. These inspections are being done using work orders as part of the plant maintenance program with the applicant stating that these inspections will be formalized in a plant procedure prior to the period of extended operation.

The application of AMP XI.E3 to medium voltage cables was based on the operating experience available at the time Revision 1 of the GALL Report was developed. However, recently-identified industry operating experience shows that the presence of water or moisture can be a contributing factor in inaccessible power cables failures at lower service voltages (480V–2kV). Applicable operating experience was found in licensee responses to GL 2007-01, "Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients," which included failures of power cable operating at service voltages of less than 2kV, where water was considered a contributing factor. The staff has concluded, based on recently-identified industry operating experience concerning the failure of inaccessible low voltage power cables (480V–2kV) in the presence of significant moisture, that these cables

should be addressed in an AMP. The staff noted that the applicant's AMP does not address these inaccessible low voltage power cables.

By letter dated September 30, 2010, the staff issued RAI B2.1.26-3 asking the applicant to supply the following information:

(1) a summary of its evaluation of recently-identified industry operating experience and any plant-specific operating experience concerning inaccessible low voltage power cable failures within the scope of license renewal (not subject to 10 CFR 50.49 EQ requirements) and an explanation of how this operating experience applies to the need for additional aging management activities for such cables

(2) a discussion of how it will manage the effects of aging on inaccessible low voltage power cables within the scope of license renewal and subject to AMR; with consideration of recently-identified industry operating experience and any plant-specific operating experience (should include assessment of AMP description, program elements (i.e., scope of program, parameters monitored or inspected, detection of aging effects, and corrective actions), and FSAR summary description to demonstrate reasonable assurance that the intended functions of inaccessible low voltage power cables subject to adverse localized environments will be maintained consistent with the CLB through the period of extended operation)

(3) an evaluation showing that the Inaccessible Medium Voltage Program test and inspection frequencies, including event-driven inspections, incorporate recent industry and plant-specific operating experience for both inaccessible low and medium voltage cable and an explanation of how the Inaccessible Medium Voltage Program will ensure that future industry and plant-specific operating experience will be incorporated into the program such that inspection and test frequencies may be increased based on test and inspection results

The applicant responded by letter dated November 24, 2010, and in addressing request (1) stated:

> In response to Diablo Canyon Power Plant (DCPP) operation experience associated with underground cable degradation, all of the in-scope inaccessible underground medium voltage cables at DCPP have been replaced. As discussed, in the License Renewal Application section B2.1.26, DCPP has experienced water accumulation in the pull boxes and underground conduits. Actions taken to address this water accumulation include implementation of an inspection program of pull boxes for water accumulation, removal of water from pull boxes as required, maintenance of sump pumps and removal of conduit seals. DCPP operation experience has shown there have been no in scope (400V–2kV) power circuit cable failures at DCPP.

In response to request (2), the applicant stated:

> DCPP's medium voltage cable aging management program is consistent with the guidance in NUREG 1801 section XI.E3. The program will be revised to include in scope inaccessible underground 480 V power cables. The program will be revised such that all underground in scope 480 V or higher power cables is being included in the program, regardless of the percentage of time the loads are energized.

As previously noted, all in scope medium voltage cable at DCPP has been recently replaced. DCPP 480 V buses are equipped with continuous ground detection. DCPP ground detection operating experience has not identified 480 V grounds that were a result of power conductor insulation failures.

The DCPP pull box inspection program has been effective in preventing pull box flooding and cable submergence in all in scope medium and low voltage pull boxes. Bi-monthly pull box inspections are currently being performed. The inspections monitor water accumulation during rainy periods. The inspections can be deferred if no rain has fallen since the last inspection. These inspections have demonstrated that event driven water accumulation from natural sources is not occurring. Event driven inspections are thus not required. Recent structural pull box inspections have not produced any visible indication of significant cable or cable support degradation. The pull box inspection frequency is subject to change based on inspection results. However the program will require that in scope cable pull boxes will be inspected for water accumulation at least once every year.

Based on current DCPP operating experience insulation testing of in scope 480 V and higher power cables at least once every 10 years is sufficient. This includes medium voltage power cables. The first tests will be completed prior to entering the period of extended operation. The test will be a proven test with acceptance criteria determined prior to conducting the tests.

Detailed internal pull box inspections of cables and cable supports will be included in the structural monitoring program. Inspection criteria will be included in plant procedures. These are opportunistic inspections conducted when the pull boxes are opened for maintenance or other reasons. More frequent tests and inspections will be required when the current program identifies adverse trends indicating that in scope power cables insulation resistance is being reduced or the cables are being subjected to submergence or visible indications of cable aging or cable support degradation are observed. A corrective action document is required to be written when test or inspection requirements do not meet acceptance requirements or when adverse trends are noted when evaluating results over time.

In response to request (3), the applicant stated:

The DCPP site is not prone to flooding events from natural sources. The design and layout of the in scope cable pull boxes limit the likelihood that any significant water will accumulate in the pull boxes. The boxes are designed to drain down-hill toward plant structures/sumps, to automatic pump equipped sumps which pump to structure sumps, or they are designed or located such that significant water ingress or retention is not likely. Since completion of corrective action which include implementation of a pull box inspection program to inspect and remove water accumulation. A review of the past five years of operation experience demonstrates that this program has been effective in preventing pull box flooding and cable submergence in pull boxes. As stated above, water accumulation is not occurring and recent structural pull box inspections have not identified any visible indication of significant cable or cable support degradation.

Based on DCPP operating experience, event driven pull box inspections are not required.

As previously noted, all in scope medium voltage cable at DCPP has been recently replaced. DCPP operating experience has not identified any indication that failures of inaccessible 480 V or higher power conductors located underground are a concern. Based on this and reviews of industry operating experience reported as a result of responses to NRC Generic letter 2007-01 and recent cable replacements at DCPP compliance with NUREG 1801 section XI.E3 inspection and testing guidance, with previously noted program enhancements, ensures that in scope underground low and medium voltage power cables will continue to perform their intended functions through the period of extended operation.

Any necessary changes to inspection or test frequencies will be evaluated as part of the DCPP corrective action program. Industry operating experience is evaluated by the plant staff through the corrective action program. A corrective action document is required to be written when test or inspection requirements do not meet acceptance requirements or when adverse trends are noted when evaluating test or inspection results over time.

In summary based on the above, the DCPP Inaccessible Medium Voltage Program incorporates recent industry and plant-specific operating experience for both inaccessible low and medium voltage cable and adjusts testing and inspection frequency based on test and inspection results. DCPP operation experience shows that in scope pull boxes are not accumulating water and pull box cable and support degradation is not occurring.

With the information provided by the applicant's RAI responses, the staff finds the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program unacceptable ~~with respect to inaccessible low voltage power cable~~ because the applicant failed to provide an adequate ~~explanation on the~~ basis for not incorporating ~~to maintain~~ in-scope inaccessible power cables testing at a frequency of least once every ~~10~~6 years or not performing inspection of pull boxes after event driven occurrences that may subject inaccessible power cables to significant moisture.

~~The applicant has included inaccessible low voltage power cables into LRA B2.1.26-3 consistent with industry and plant-specific operating experience such that there is reasonable assurance that inaccessible low voltage power cable subject to significant moisture will be adequately managed during the period of extended operation.~~ The applicant in its RAI response did included 480V and higher inaccessible power cables, the deletion of the significant voltage criterion, and revision of pull box inspections for water accumulation to at least once every year consistent with industry operating experience and staff recommendations for the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program. The applicant identified these changes as License Renewal Commitment No. 54. ~~The staff noted that the applicant will not perform inspection of pull boxes after events which can cause elevated level of water, because the applicant stated that the pull boxes are designed to drain down-hill toward plan structures that contain sumps.~~

During a conference call held on December 8, 2010, the applicant stated that it will change the cable testing frequency to at least once every 6 years and will confirm to the staff that all of the pull boxes, within the scope of license renewal, have a sump pump installed or have a drainage

path to a sump pump such that event driven inspections for in-scope pull boxes are not required. The applicant agreed to supplement its response to RAIs B2.1.26-3 to address the staff's concerns. The staff identified the resolution of RAI B2.1.26-3 as Confirmatory Item 3.0.3.2.14-1.

By letter dated January 7, 2011, the applicant provided additional clarification on the applicant's response to RAI B2.1.26-3. The applicants stated that in-scope inaccessible low voltage power cables 480V and above are included in the pull box inspection program, and will be included in the cable testing program. The applicant also stated that in-scope 480V and higher power cables will be tested at a frequency of at least every 6 years. The applicant identified the development of procedures for cable testing, periodic inspection of pull boxes (for in-scope 480V and higher power cables), and the testing of sump pumps and associated alarms as License Renewal Commitment No. 56. The applicant also identified the testing of in-scope 480V and higher power cables at a frequency of at least every 6 years with the first test completed prior to entering the period of extended operation as License Renewal Commitment No. 57.

The applicant stated that, (a) in-scope electrical pull boxes between the intake structure and turbine building are designed with drain conduits that drain to pull boxes at the intake and turbine building, (b) the end pull boxes drain to a building sump or to an in-ground drain sump separate from the pull boxes, (c) the in-ground drain sump has an automatic sump pump with alarm with testing of the sump pump and alarm performed annually, (d) the remaining in-scope pull boxes are located indoors and are not subject to weather related water intrusion.

The applicant stated that the pull box inspection program has been effective in preventing pull box flooding and cable submergence in all in-scope pull boxes. The applicant also stated that pull box inspections are currently being performed bi-monthly and have demonstrated that water accumulation from natural sources are not occurring. The applicant further stated that the frequency of inspection is subject to change based on inspection results. The applicant therefore concluded that event driven inspections are not required.

The staff finds the applicants RAI response acceptable because the applicant has shown that in-scope pull boxes are located such that (a) the pull box is not to be subject event driven water accumulation, or (b) the pull box drains to a building sump or an in-ground drain sump pump that is tested annually and (c) the in-scope inaccessible power cable test frequency is revised to at least every 6 years consistent with industry operating experience and staff recommendations. Therefore, that staff finds that the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program will adequately manage the aging effects of inaccessible power cables, consistent with industry operating experience, such that there is reasonable assurance that in-scope inaccessible power cables (subject to significant moisture) will be adequately managed during the period of extended operation. Based on the above, the staff considers Confirmatory Item 3.0.3.2.14-1 resolved.

~~The staff finds this acceptable upon confirmation of cable testing frequency revision from at least once every 10 years to at least once every 6 years and description of pull box drainage path configurations. The resolution of RAIs B2.1.26-2 and B2.1.26-3 is tracked as Confirmatory Item 3.0.3.2.14-1.~~

Based on its audit and review of the application, and review of the applicant's response to RAI B2.1.26-2 and 3, ~~pending resolution of Confirmatory Item 3.0.3.2.14-1,~~ the staff finds that operating experience related to the applicant's program demonstrates that it can adequately manage the detrimental effects of aging on SSCs within the scope of the program and implementation of the existing program has resulted in the applicant taking corrective action. The staff confirmed that the "operating experience" program element satisfies the criteria in SRP-LR Section A.1.2.3.10 and, therefore, the staff finds it acceptable.

FSAR Supplement. LRA Section A1.26 supplies the FSAR supplement for the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program. The staff noted that the applicant committed (Commitment No. 13) to enhance the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program prior to entering the period of extended operation. Specifically, the applicant committed to implement the AMP for testing of medium voltage cables not subject to 10 CFR 50.49 EQ requirements and enhance the periodic inspections and removal of water from cable pull boxes that contain in-scope medium voltage cables not subject to 10 CFR 50.49 EQ requirements.

The staff reviewed this FSAR supplement description of the program against the recommended description for this type of program as described in SRP-LR Table 3.6-2. By letter dated June 29, 2010, the staff issued RAI B2.1.26-1, asking that the applicant discuss why the LRA Appendix A, Section A1.26 FSAR summary description does not include definitions of significant moisture and significant voltage consistent with SRP-LR Table 3.6-2 and GALL AMP XI.E3. In its response, dated July 15, 2010, the applicant stated that the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program manages localized damage and breakdown of insulation leading to electrical failure in inaccessible medium voltage cables exposed to adverse localized environment caused by significant voltage (energized greater 25 percent of the time) to ensure that inaccessible medium voltage cables, not subject to the EQ requirements of 10 CFR 50.49 and within the scope of license renewal, are capable of performing their intended function. The applicant also stated that LRA Sections A1.26 and B2.1.26 have been revised to include the definition of significant voltage and moisture. The applicant further stated that SRP-LR~~GALL Report~~, Table 3.6-2 states that the specific type of test performed will be determined before the initial test and is to be a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, or polarization index, as described in EPRI TR-103834-P1-2, or other testing that is state-of-the art at the time the test is performed. The applicant revised LRA Section A1.26 and B2.1.26 to show conformance with SRP-LR ~~GALL Report~~, Table 3.6-2 guidance regarding cable testing.

With the information supplied by the applicant's RAI responses, the staff finds the FSAR supplement acceptable because the applicant revised LRA Sections A1.26 and B2.1.26 to be consistent with the definitions provided in SRP-LR Table 3.6-2 and GALL AMP XI.E3. The staff's concern described in RAI B2.1.26-1 is resolved.

The applicant's responses to RAIs B2.1.26-2 and B2.1.26-3 added license renewal commitment Nos. 54, 56 and 57. These commitments enhance the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program to include inaccessible 480V cable and above, remove the significant voltage criterion, revise the pull box inspection frequency to at least once every year, revise the cable test frequency to at least once every 6 years, and add pull box structural monitoring consistent with industry operating experience and staff recommendations.

The staff determines that the information in the FSAR supplement is an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review of the applicant's Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements Program, the staff determines that those program elements for which the applicant claimed consistency with the GALL Report are consistent. The staff also determines that the incorporation of inaccessible 480V to 2kV power cables with implementation of associated Commitment Nos. 54, 56, and 57 is consistent with industry operating experience and staff recomendations. Also, the staff reviewed the enhancement and confirmed that its implementation of Commitment No.13 prior to the period of extended operation would make the existing AMP consistent with the GALL Report AMP to which it was compared. The staff ~~concludes, with the exception of Confirmatory Item 3.0.3.2.14-1, that~~concludes that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the FSAR supplement for this AMP and concludes that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).