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PG&E Letter DCL-10-073

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 Request for Additional Information 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 June 14, 2010, the NRC staff requested additional information needed to continue their review of the Diablo Canyon License Renewal Application.

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

PG&E makes no regulatory commitments (as defined in NEI 99-04) in this letter.

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

Sincerely,

James R. Becker

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NRR

pns/50321512
Enclosure
cc: Diablo Distribution
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PG&E Response to Request for Additional Information For the Diablo Canyon License Renewal Application

RAI B2.1.1-1

Generic Aging Lessons Learned (GALL) Report aging management program (AMP) XI.M1 "scope of program" element contains a broad class of components for inservice inspection (ISI) with respective standards for flaw acceptance and flaw evaluation. Also, the "detection of aging effects" program element covers the inspections of Class 1 small-bore piping and socket welds.

In its description of the ISI program under license renewal application (LRA) Section B2.1.1, the applicant stated that Diablo Canyon Nuclear Power Plant (DCPP) evaluates every indication. However, the acceptance standards IWD-3400 and IWD-3500 and the flaw evaluation standard IWD-3600, for Class 3 components, are not included in the "program description" of LRA AMP B2.1.1. Also, Class 1 small-bore piping and socket welds for the AMP are covered under different AMPs for DCPP.

Explain how the "program description" includes the use of acceptance and evaluation standards for Class 3 components. Also, indicate in which AMP the inspection of Class 1 small-bore piping and socket welds are covered or supplemented, including a justification for using this program.

PG&E Response to RAI B2.1.1-1

LRA Section B2.1.1 has been revised to discuss the acceptance standards IWD-3400 and IWD-3500 and the flaw evaluation standard IWD-3600, for Class 3 components. See revised LRA Section B2.1.1 in Enclosure 2.

Detection of aging effects for Class 1 small-bore piping and socket welds is described in LRA Section B2.1.19, "One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program." This program is implemented as part of the fourth interval of the DCPP Inservice Inspection (ISI) program. Further information on the basis for using the One-Time Inspection of ASME Code Class 1 Small-Bore Piping program is in the response to RAI B2.1.19-2.

RAI B2.1.1-2

In its "operating experience" summary the applicant noted an instance of intergranular stress corrosion cracking in an accumulator nozzle, identified in 1987, stating that all nozzles were inspected and those with unacceptable indications were subsequently weld-repaired or replaced with nozzles made of a new material. Also, in its evaluation of operating experience the applicant indicated that a long-term inspection plan is followed with visual examination of all nozzles and underskirt piping at normal operating pressure, and ultrasonic testing (UT) of those nozzles and underskirt piping which were not replaced.

The nozzle cracking was not identified as part of the inspections performed under the ASME Section XI ISI program. It is not clear why the UT is not performed on the replacement nozzles as part of the long-term plan, while it is performed on the non-replaced nozzles.

Provide justification for why only a visual inspection is performed on the replaced nozzles and underskirt piping, and not UT, as part of the long-term inspection plan for aging management.

PG&E Response to RAI B2.1.1-2

DCPP accumulators and their nozzles are categorized under IWC-1221(c): "Vessels ... and component connections of any size in statically pressurized (i.e., no pumps) safety injection systems of pressurized water reactor plants," and thus are exempted from volumetric and surface examination by Code. Thus the Code requirement for inspection of the accumulators and nozzles is VT-2 during pressure test once each inspection period (40 months).

Beginning in 1986, two of the original nozzles in Unit 2 were observed to have evidence of leakage due to intergranular stress corrosion cracking (IGSCC). These two nozzles were replaced. The analysis performed in 1987 determined that sulfur and chlorine were present at the failure locations. These contaminants apparently originated during the construction hydrostatic tests at the vessel fabricator. All of the original nozzles were 304 grade stainless steel and apparently were installed with partial penetration welds to the shell before the vessels were heat treated, thus potentially being subject to sensitization during both the welding and heat treatment processes.

Ultrasonic and eddy current techniques were developed to detect incipient cracking and together with penetrant tests, all nozzles were inspected in the 4th refueling outage in Unit 2 (2R4), the 5th refueling outage in Unit 1 (1R5), and the 5th refueling outage in Unit 2 (2R5). Twenty-seven nozzles in Unit 2 and 5 in Unit 1 were ultimately found to have indications ranging from obvious cracks to small rounded penetrant indications that would normally be deemed acceptable. Twenty-four of the nozzles were replaced. Some nozzles having minor indications were weld repaired or buffed out.

Replacement nozzles were fabricated from 304L grade stainless steel to reduce susceptibility to IGSCC, and were fillet welded to the vessel shell instead of the original partial penetration welds to the shell. The new nozzles were installed under environmentally controlled conditions to assure absence of sulfur and chlorides. The redesigned weld configuration and lack of contaminants reduces sensitization and susceptibility to ICSCC, thus the new nozzles have been determined not to require ultrasonic monitoring.

PG&E has continued to ultrasonically inspect the original nozzles. No indications have been found since the major repair efforts in 1R5/2R5. The new nozzles are subject to the Code-required periodic pressure test and VT-2 examination once each period (40 months). Additionally, boric acid walkdowns every refueling outage and operator rounds in the containment would detect any leakage at an early stage. No such leakage has occurred.

A visual inspection is adequate to manage the replaced nozzles and underskirt piping since the degradation environment (contaminants, susceptible materials) that caused the original flaws is not present in the new nozzles.

RAI B2.1.3-1

In LRA Section B2.1.3 and a program exception to the GALL Report, the applicant stated, "[t]he future 120-month inspection interval for DCPP will incorporate the then-current requirements specified in the version of the ASME Code incorporated into 10 CFR 50.55a twelve months before the start of the inspection interval." Also, LRA Appendix A, Section A1.3 states, "DCPP is required to update its Section XI ISI program and use the ASME Code Edition consistent with the provisions of 10 CFR 50.55a during the period of extended operation."

The staff determines the acceptability of the newly proposed ASME Code Section XI editions for license renewal in the Statements of Consideration (SOC). The SOC are issued on the update of the 10 CFR 50.55a rule and published in the Federal Register. It is not evident to the staff whether the applicant's statement refers to the SOC associated with the update of 10 CFR 50.55a in order to justify the applicant's use of a more recent edition of the ASME Code Section XI when the plant enters the period of extended operation.

Clarify whether the statement quoted above means that for the future 120-month ISI intervals, which will be implemented during the period of extended operation, the applicant will incorporate the editions and addenda of the ASME Code that will be endorsed for use in 10 CFR 50.55a (as modified and subject to any limitations in rule) and be acceptable for the license renewal as referenced in the SOC on the update of 10 CFR 50.55a and published in the Federal Register.

PG&E Response to RAI B2.1.3-1

LRA Sections A1.3 and B2.1.3 indicate that DCPP is required to update its Section XI ISI program and use the ASME Code Edition consistent with the provisions of 10 CFR 50.55a during the period of extended operation. This means that for the future 120-month ISI intervals, which will be implemented during the period of extended operation, PG&E will incorporate the editions and addenda of the ASME Code that will be endorsed for use in 10 CFR 50.55a (as modified and subject to any limitations in rule) and be acceptable for the license renewal as referenced in the Statements of Consideration on the update of 10 CFR 50.55a and published in the *Federal Register.*

RAI B2.1.3-2

During the audit of the Reactor Head Closure Studs Program (LRA Section B2.1.3), the applicant identified an exception to the "scope of program" program element. The applicant stated that the tensile strength of four heats of the material used in fabricating the studs exceeded the maximum tensile strength limit of 1172 MPa (170 ksi) specified in Regulatory Guide (RG) 1.65, "Material and Inspection for Reactor Vessel Closure Studs," October 1973. The applicant also stated that only heat and charge numbers are marked on the studs, and because there is a significant variation in tensile properties within a Heat and Charge of the material, it is unlikely that DCPP will be able to identify which stud from a given heat has tensile strength greater than 1172 MPa (170 ksi).

In addition to the tensile strength exceeding 1172 MPa, the yield strength of these heats of material exceeded 1034 MPa (150 ksi). For some materials, the yield strength was as high as 1138 MPa (165 ksi). When tempered to a tensile strength level above 1172 MPa, the high strength low-alloy steel for the studs becomes increasingly susceptible to stress corrosion cracking. In NUREG-1339, "Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants," June, 1990, the U.S. Nuclear Regulatory Commission established a position that the yield strength of high-strength bolts should not exceed 1034 MPa (150 ksi).

(a) Revise the LRA to include the newly identified exception to GALL "scope of program" program element that identifies that the tensile strength of four of the heats used in fabricating the studs exceeded the maximum tensile strength limit of 1172 MPa (170 ksi) specified in Regulatory Guide (RG) 1.65, "Material and Inspection for Reactor Vessel Closure Studs," October 1973.

(b) In view of the greater susceptibility of some of the studs to SCC, describe any preventive actions taken or planned to avoid the exposure of the studs to the environmental conditions that can lead to SCC, and describe possible changes/modifications in the program for managing cracking due to stress corrosion cracking for reactor head closure studs.

PG&E Response to RAI B2.1.3-2

After submittal of the LRA, Certified Material Test Reports were found to indicate that DCPP has 4 heats that have an average ultimate tensile strength of 170.8 ksi, with a range of 160 ksi to 175.5 ksi. This constitutes an exception to the "scope of program" program element of NUREG-1801, Rev. 1, Section XI.M3. See revised LRA Section B2.1.3 in Enclosure 2.

The DCPP reactor vessel closure studs were fabricated prior to issuance of Regulatory Guide 1.65 and were built in accordance with the required design specifications, SA-540 Grade B-23 and B-24. As described in LRA Section B2.1.3, DCPP manages the reactor head closure studs and bolts for cracking and loss of material through visual and volumetric examinations in accordance with ASME Section XI Subsection IWB requirements and as recommended in Regulatory Guide 1.65.

DCPP reactor vessel closure studs are not metal-plated. DCPP uses "Neolube" and "FelPro N-5000" as lubricant on reactor head closure studs after reactor head closure stud cleaning and examinations are complete. Neolube and FelPro are compatible with the reactor vessel flange, stud, nut, and washer materials at operating temperature.

Reactor vessel flange holes are plugged with water tight plugs during cavity flooding. When the plugs are removed, the threaded holes in the vessel flange are inspected and cleaned if necessary to ensure the bolt holes remain dry. These methods assure the holes, studs, nuts, and washers are protected from borated water during cavity flooding and draining.

If reactor vessel stud, nut, and washer cracking, loss of material, or reactor coolant leakage from the reactor vessel flange is identified, these are evaluated through the DCPP corrective actions program. Corrective actions can include evaluation of adjustment to the stud inspection frequency.

Based on the above information the current program is adequate for managing cracking due to stress corrosion cracking for reactor head closure studs.

RAI B2.1.8-1

In LRA Section B2.1.8, the applicant stated that the "tubing and secondary internals in the replacement steam generators are not susceptible to corrosion due to advanced material design."

Thermally treated Alloy 690 may be susceptible to corrosion as demonstrated in laboratory tests, but are more resistant than Alloy 600 mill annealed which was previously used in the DCPP steam generators. Please clarify the statement in the LRA regarding the corrosion susceptibility of the Alloy 690 material in the replacement steam generators.

PG&E Response to RAI B2.1.8-1

LRA Section B2.1.8, Operating Experience section, has been revised to indicate the tubing and secondary internals in the replacement steam generators are more resistant to corrosion due to advanced material design. See revised LRA Section B2.1.8 in Enclosure 2.

RAI B2.1.10-1

10 CFR Part 54.4(a) provides the regulations for which plant systems, structures, and components are within the scope of the license renewal. These include items under 10 CFR 54.4(a)(2), which are all nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in safety-related systems. The "parameters monitored or inspected" program element of the Closed-Cycle Cooling Water AMP in the GALL Report, Section XI.M21, indicates that the program includes monitoring the effects of corrosion and stress corrosion cracking by testing and inspection in accordance with the guidance in the EPRI report closed cooling water chemistry guideline as well as performance testing for pumps and heat exchangers.

LRA, Appendix B, Section B2.1.10 indicates that the applicant's Closed-Cycle Cooling Water Program will be consistent with the GALL Report Section XI.M21 with various exceptions. In both the LRA B2.1.10 program description and the applicant's basis document, the applicant indicated that the program will not conduct inspections or performance testing for components in scope of license renewal under criterion of 10 CFR 54.4(a)(2). It is not clear to the staff what the technical basis is for limiting the prescribed guidance in the GALL Report based on how a component was scoped into the license renewal process.

Provide justification for not performing the program's inspections and performance testing on components within the scope of license renewal under criterion 10 CFR 54.4(a)(2).

PG&E Response to RAI B2.1.10-1

PG&E will monitor the corrosion of closed cooling water components by inspecting the condition of corrosion coupons installed in the system and perform internal inspections of select components within the systems. These methods will verify that wetted material exposed to the chemistry of the closed cooling water systems are not experiencing corrosion. The corrosion coupons are strips of metal (i.e. copper, carbon steel, stainless steel, etc) that are installed in the closed cooling water systems in a manner such that they are exposed to the cooling water. Periodically these coupons are removed and their condition can be evaluated. This inspection will provide DCPP indication if significant corrosion is occurring in the system. The material of these corrosion coupons is representative of most of the materials that are used in the system. For those components that do not have material represented by the corrosion coupons, internal inspections will be performed on those components, or other component with similar material, in order to monitor for corrosion. See revised LRA Section B2.1.10 and Table A4-1 in Enclosure 2.

RAI B2.1.10-2

The Closed-Cycle Cooling Water System AMP in the GALL Report, Section XI.M21, includes non-chemistry monitoring parameters, including pump and heat exchanger performance monitoring.

LRA, Appendix A, Section A1.10 indicates that the Closed-Cycle Cooling Water System Program will include maintenance of system chemistry parameters, but does not mention any non-chemistry monitoring parameters.

Update the Final Safety Analysis Report (FSAR) supplement to be consistent with LRA Section B2.1.10 program description, including monitoring of non-chemistry parameters or provide justification for not including the monitoring of these parameters.

PG&E Response to RAI B2.1.10-2

LRA Appendix A, Section A1.10 has been revised to address monitoring of non-chemistry parameters. See revised LRA Section A1.10 in Enclosure 2.

RAI B2.1.16-1

GALL Report AMP XI.M32, "One-Time Inspection," "detection of aging effects" program element states that "the inspection includes a representative sample of the system population, and, where practical, focuses on the bounding or lead components most susceptible to aging...." The applicant's One-Time Inspection program description states, in part, that sampling will be conducted "using an engineered sampling technique for each material-environment group based on criteria such as the longest service period, most severe operating conditions, lowest design margins, lowest or stagnant flow conditions, high flow conditions, and highest temperature."

Provide additional details of the sampling procedure to be used. Indicate whether the One-Time Inspection program utilizes a risk-informed inservice inspection or similar methodology, or an alternative form of probabilistic or statistical sampling to select the number, types, and locations of the components to be inspected under this program. If not, provide additional details of the sampling procedure to be used.

PG&E Response to RAI B2.1.16-1

The DCPP One-time Inspection (OTI) Program uses a risk-informed methodology by identifying the material/environment combination most susceptible to the aging mechanisms of concern. Inspection sample sizes will be determined based on an assessment of materials of fabrication, environment, plausible aging effects and mechanisms, and operating experience. The OTI program determines NDE sample size for each material-environment group using an engineered sampling technique for each material-environment group based on criteria such as the longest service period, most severe operating conditions, lowest design margins, lowest or stagnant flow conditions, high flow conditions, and highest temperature. Component selection will be performed by the system engineer or other knowledgeable personnel. A representative sample is selected at locations in the system that has stagnant or low flow conditions where the full benefit of a water chemistry program may not be realized.

Loss of Material -
System components containing carbon steel managed by Water Chemistry Programs were selected over other material types as carbon steel has the lowest corrosion resistance. In the case where carbon steel is not present, such as stainless steel primary systems exposed to borated water, no OTI inspections were identified for material loss. However, volumetric examinations for the detection of stress corrosion cracking as required by OTI Program and the OTI of Class-1 Small Bore Program provide additional opportunities to inspect for loss of material for stainless steel in borated water.

Total Sample = 15

System components containing carbon steel managed by the Fuel Oil Chemistry Program were selected over other material types as carbon steel has the lowest corrosion resistance than other material types. Locations of low flow or stagnant conditions were selected where water / contaminants may collect over time.

Total Sample = 8

System components containing carbon steel and copper alloys managed by the Lubrication Oil Chemistry Program were selected over other material types as carbon steel and copper alloys have lower corrosion resistance than other material types in this environment. Locations of low flow or stagnant conditions were selected where water / contaminants may collect over time.

Total Sample = 5

Cracking -
System components containing stainless steel greater than 140°F managed by the Water Chemistry Program in stagnant or low flow locations were selected for examination. Examinations performed as part of OTI of Class-1 Small Bore Program may supplement these inspections if the service temperature is greater than 140°F.

Total Sample = 2

Fouling-
System components containing heat exchangers managed by the Water Chemistry Program were selected based on environment (Borated Water and Auxiliary Feed Water).

Total = 2

System components containing heat exchangers managed by the Lubricating Chemistry Program were selected to provide a representative sample. Heat exchangers selected have oil flow only when the associated pump runs which is infrequent.

Total = 3

RAI B2.1.16-2

LRA Table 3.3.1, Item 3.3.1.07 refers to the aging evaluation of stainless steel non-regenerative heat exchanger components exposed to treated borated water in the auxiliary systems. The aging effect identified is cracking due to stress corrosion cracking, and the GALL Report recommends the use of the Water Chemistry Program to manage this effect. The GALL Report also states that further evaluation is recommended and that an acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of the tubes. The applicant proposes to manage this aging effect using its Water Chemistry Program, with its One-Time Inspection Program to be used for verification of program effectiveness.

In its further evaluation of this aging effect, the applicant states that temperature and radioactivity of the shell-side water of the letdown (non-regenerative) heat exchanger is monitored continuously by installed plant instrumentation. The applicant also states that its One-Time Inspection Program will be used in lieu of eddy-current testing of the tubes to provide confirmation that cracking is not occurring. However, the applicant does not identify the testing technique to be used to perform the proposed inspections.

Describe the details of the inspection technique to be used to perform the one-time inspection of these components in lieu of eddy-current testing and provide relevant plant or industry experience to demonstrate the effectiveness and reliability of this technique.

PG&E Response to RAI B2.1.16-2

The Water Chemistry Program manages crack initiation and growth of SCC in the non-regenerative heat exchangers and seal water heat exchangers. The One-Time Inspection (OTI) Program verifies the effectiveness of the Water Chemistry Program in preventing cracking due to SCC for in-scope components. If selected as part of the inspection sample, the OTI program will perform eddy current testing on the heat exchangers.

RAI B2.1.17-1

Program element "parameters monitored or inspected" of GALL Report Program XI.M33, "Selective Leaching of Materials" states:

> *The visual inspection and hardness measurement is to be a one-time inspection. Because selective leaching is a slow acting corrosion process, this measurement is performed just before the beginning of the license renewal period. Follow-up of unacceptable inspection findings includes expansion of the inspection sample size and location.*

In the LRA, the applicant describes its Selective Leaching of Materials Program in Appendix B2.1.17 as consistent with the GALL Report, with no exceptions or enhancements. The program descriptions provided in the LRA and the FSAR Supplement (A.1.17) state that the detection of selective leaching will result in the performance of an engineering evaluation, which will then determine the need for an expansion of inspection sample sizes and locations. It is unclear if an engineering evaluation will result in an expansion of inspection sample sizes and locations, consistent with the GALL Report.

Clarify if the Selective Leaching of Materials Program will expand the inspection sample size and location if selective leaching is detected. Provide justification if no expansion of sample size and location is to occur if selective leaching is detected.

PG&E Response to RAI B2.1.17-1

LRA Sections A1.17 and B2.1.17 have been revised to clarify that if evidence of selective leaching is discovered in the implementation of the program, an engineering evaluation will determine the extent of expansion of the sample size and locations for additional inspections and evaluations. See revised LRA Sections A1.17 and B2.1.17 in Enclosure 2.

<u>RAI B2.1.19-1</u>

GALL AMP XI.M35, "One-Time Inspection of ASME Code Class 1 Small-Bore Piping," states that a volumetric inspection should be used to detect cracking in small-bore piping. However, the applicant's One-Time Inspection of ASME Code Class 1 Small-Bore Program in LRA Section B2.1.19 states that a reliable and effective volumetric inspection technique to detect cracking in socket welds is currently not available. The applicant instead proposes to use the visual examination technique (VT-2) for the examination of small-bore socket welds.

The applicant's proposed usage of the VT-2 technique for the examination of these welds conflicts with the guidance in the GALL Report.

Justify the proposed deviation from the GALL Report recommendation to perform volumetric examinations of socket welds in ASME Code Class 1 small-bore piping.

<u>PG&E Response to RAI B2.1.19-1</u>

DCPP has 47 small-bore piping socket welds identified as high risk (both units); high risk Category-2. Category-2 as defined in EPRI report TR-112657, Rev B-A, "Revised Risk-Informed Inservice Inspection Evaluation Report" are those components that have a high consequence and medium failure potential. Out of this population 13 small-bore piping socket welds are selected for surface examination during the interval. ASME Code Edition 2001 with 2003 Addenda, Section XI, Table IWB requires a surface examination of the selected socket welds.

LRA Section B2.1.19 has been revised to address volumetric examination and sample size and to clarify plant operating experience. See revised LRA Section B2.1.19 in Enclosure 2.

RAI B2.1.19-2

GALL AMP XI.M35 states that the One-Time Inspection of ASME Class 1 Small-Bore Piping Program is applicable only to plants that have not experienced cracking of ASME Class 1 small-bore piping. It further states that "[s]hould evidence of significant aging be revealed by a one-time inspection or previous operating experience, periodic inspection will be proposed, as managed by a plant specific program."

During a review of the applicant's operating experience, the staff noted that there have been failures of Class 1 small bore piping at DCPP.

In view of the above-cited GALL Report guidance and plant-specific operating experience, justify the proposed application of the applicant's proposed One-Time Inspection of ASME Code Class 1 Small-Bore Piping Program, or provide a plant-specific AMP for managing aging during the period of extended operation.

PG&E Response to RAI B2.1.19-2

NUREG-1801, Revision 1, Volume 2, states within the Program Description of XI.M35 that OTIs provide "...additional assurance that either aging of small-bore ASME Code Class 1 piping is not occurring or the aging is insignificant, such that an aging management program (AMP) is not warranted." DCPP has had one occurrence of stress corrosion cracking in Class-1 small bore piping during plant operation and one occurrence of stress corrosion cracking in Class-2 small bore piping. The Class-1 event occurred on a segment of piping configured in a manner that increased the base metals to SCC compared to the remaining population of Class-1 small bore piping. The close proximity of the two weld toes, 0.125 inches apart, allowed the pipe material to become overly sensitized during the welding process. The corrective action replaced the piping material with a stabilized grade of stainless steel to address the material sensitization and reduce the susceptibility of the heat affected zones to stress corrosion cracking. The occurrence of SCC in Class-2 small bore piping with a configuration that allowed it to become overly sensitized during the welding process. The corrective actions for the Class-2 piping involved a design change to increase the spacing between the welds.

Based on the unique piping configuration and the limited frequency of cracking (one Class-1 occurrence in 50 plant-operating years), the aging that has occurred is considered insignificant and does not warrant periodic inspection beyond inspections already specified by ASME Section XI. If OTIs of Class-1 small bore piping identify additional SCCs, then a new periodic plant specific AMP would be implemented.

<u>RAI B2.1.22-1</u>

GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," states that the program includes visual inspections of internal surfaces of steel piping, piping components, ducting, and components in an internal environment (such as indoor uncontrolled air, condensation, and steam) for degradation from various corrosion mechanisms. In the two exceptions to the GALL Report stated in LRA Section B2.1.22, the program is expanded to include additional materials (aluminum, asbestos cement, copper alloy, elastomers, nickel alloys, stainless steel, and cast austenitic stainless steel) and to include additional examination techniques (volumetric testing and physical manipulation).

In the actual application of this AMP as summarized in the applicant's LRA, the scope of the program is significantly expanded beyond both GALL XI.M38 and the applicant's description of the program in LRA Appendix B, Section B2.1.22. This expanded application of the program in the LRA appears to encompass a substantial number of additional component types, materials, and environments beyond those in the GALL Report and the applicant's AMP description.

Clarify that the program description for Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program in Appendix B of the LRA encompasses the actual application of the program as described in the LRA.

<u>PG&E Response to RAI B2.1.22-1</u>

LRA Section B2.1.22 states that the "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" aging management program (AMP) will manage the aging of the internal surfaces of piping, piping components, ducting and other components that are not within the scope of other aging management programs consistent with NUREG-1801, Chapter XI.M38, Element 1. Component types, materials, and environments managed by this program are as follows.

Component:

Type	Explanation of Component Type
Abandoned-in-place components	Note 1
Flexible hoses	Note 2
Bellows	Note 4
Compressor	Note 4
Fan	Note 3
Filter	Note 4
Lubricator	Note 4
Regulators	Note 4
Silencer	Note 4
Turbine	Note 4
Sensor element	Note 4
Sight gauge	Note 2
Strainer	Note 2
Demineralizer	Note 2
Pumps	Note 2
Vessel	Note 4
Switch	Note 2

Note 1: The aging of internal surfaces of abandoned-in-place components is not managed by other programs of sampling and verification of other special-environment programs and therefore are among the "internal surfaces ... that are not included in other aging management programs for loss of material" as stated in NUREG-1801, Chapter XI.M38, Element 1.

Note 2: With respect to component types of flexible hoses, sight gauge, strainer, demineralizer pump (casing – bowl) and switch (the component can be also characterized as a multi-port valve), these components are included in the definition of the term "piping and piping components" in NUREG-1801, Chapter IX.B.

Note 3: With respect to the component type fan, this component is included in the definition of the term "ducting and components" in NUREG-1801, Chapter IX.

Note 4: With respect to component types bellows, compressor, fan, filter, lubricator, regulators, silencer, turbine, sensor element and vessel, these component types are considered as among the "other components" having internal surfaces whose aging is not managed by other aging management programs as stated in NUREG-1801, Chapter XI.M38, Element 1.

Materials:

NUREG-1801, Chapter IX.C defines as "steel" a list of materials that it characterizes as "vulnerable to general, pitting and crevice corrosion, even though the rates of aging may vary" and states that these "metal types are generally grouped for AMRs under the broad term 'steel' ." Included in the definition of NUREG-1801, Chapter IX.C for steel is galvanized steel and malleable iron, which is an alternative name for ductile iron. NUREG-1801 Chapter IX.C states that the broad purpose of the definition of copper alloy (greater than 15 percent zinc) is "to collect those copper alloys whose critical alloying elements are above certain thresholds that make the alloy susceptible to stress corrosion cracking, selective leaching (except for inhibited brass), and pitting and crevice corrosion." Included explicitly is aluminum bronze greater than eight percent aluminum. The XI.M38 aging management program includes galvanized steel, ductile iron and copper alloy (greater than 8 percent aluminum) consistent with NUREG-1801, Chapter IX.C.

Environments:

Treated Borated Water - Although treated borated water is an environment addressed in NUREG-1801, Chapters VII and IX; NUREG-1801, Chapter XI does not provide a specific aging management program to address elastomers exposed to the treated borated water environment. Elastomers exposed to the treated borated water are among the "internal surfaces ... that are not included in other aging management programs for loss of material" as stated in NUREG-1801, Chapter XI.M38, Element 1. LRA Table 3.3.1, Item Number 3.3.1.12 describes the application of the "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" aging management program in this environment.

Raw Water – The definition of "raw water" in NUREG-1801, Chapter IX.D includes raw, untreated fresh, salt and ground water. Floor drains and reactor buildings and auxiliary building sumps may be exposed to a variety of untreated water that is thus classified as raw water, for the determination of aging effects. Raw water may contain contaminants, including oil and boric acid, depending on the location, as well as originally treated that is not monitored by a chemistry program. The contents of floor drains, sumps and waste streams are among the "internal surfaces ... that are not included in other aging management programs for loss of material" as stated in NUREG-1801, Chapter XI.M38, Element 1. LRA Table 3.3.1, Item Numbers 3.3.1.76, 3.3.1.78, 3.3.1.79, and 3.3.1.81, and Table 3.4.1, Item Numbers 3.4.1.16 and 3.4.1.32 further describe the application of the "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" aging management program in this environment.

Potable Water – Potable water is an internal environment for in-scope components of the Makeup Water System 16 and the HVAC System 23. The potable water environment is further described in LRA Table 3.0-1. NUREG-1801 does not address the potable water environment and therefore these surfaces are among the "internal surfaces ... that are not included in other aging management programs for loss of material" as stated in NUREG-1801, Chapter XI.M38, Element 1.

Sulfuric Acid – Sulfuric acid is an internal environment for in-scope components of the Turbine Steam Supply System 04 and the Makeup Water System 16. The sulfuric acid environment is further described in LRA Table 3.0-1. NUREG-1801 does not address the sulfuric acid environment and therefore these surfaces are among the "internal surfaces ... that are not included in other aging management programs for loss of material" as stated in NUREG-1801, Chapter XI.M38 Element 1.

Diesel Exhaust – Although diesel exhaust is an environment addressed in NUREG-1801, Chapters VII and IX; NUREG-1801, Chapter XI does not provide a specific aging management program to address the diesel exhaust environment and therefore these surfaces are among the "internal surfaces ... that are not included in other aging management programs for loss of material" as stated in NUREG-1801, Chapter XI.M38, Element 1. LRA Table 3.3.1, Item Numbers 3.3.1.06 and 3.3.1.18 further describe the application of the "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" aging management program in this environment.

Lubricating Oil – The Lubricating Oil Analysis aging management program B2.1.23 is credited for managing the internal surfaces of in-service components exposed to lubricating oil with the exception of the surfaces of abandoned-in-place components. The aging of internal surfaces of abandoned-in-place components is among the "internal surfaces ... that are not included in other aging management programs for loss of material" as stated in NUREG-1801, Chapter XI.M38, Element 1. LRA Table 3.4.1, Item Numbers 3.4.1.07 and 3.4.1.18 further describe the application of the "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" aging management program in this environment.

Fuel Oil – The Fuel Oil Chemistry aging management program B2.1.14 is credited for managing the internal surfaces of in-scope components exposed to fuel oil. The internal surfaces of abandoned-in-place components are among the "internal surfaces ... that are not included in other aging management programs for loss of material" as stated in NUREG-1801, Chapter XI.M38, Element 1. LRA Table 3.3.1, Item Numbers 3.3.1.20 and 3.3.1.32 further describe the application of the "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" aging management program in this environment.

RAI B2.1.22-2

In LRA Appendix B, Section B2.1.22, the applicant states that this program "will use the work control process for preventive maintenance and surveillance to conduct and document inspections."

The term "work control process" appears nowhere else in the applicant's LRA except in the Appendix A FSAR supplement for this AMP, nor does it appear anywhere in either the GALL Report or NUREG-1800, Revision 1, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants." Consequently, the staff is unable to determine precisely what is meant by this term in the context of the applicant's program description.

Define what is meant by the term "work control process" as it is used in the description of the program, particularly with respect to what program elements in the GALL Report it impacts and how it impacts these elements.

PG&E Response to RAI B2.1.22-2

NUREG 1801, Rev-1, XI.M38 (B2.1.22) "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components", Element-3 states "Visual inspections of internal surfaces of plant components are performed during maintenance or surveillance activities". Appendix B states that the work control process will be utilized to identify those preventative maintenance activities and surveillance to conduct and document inspections. The DCPP work control process generates the corrective maintenance, preventative maintenance, and surveillance work orders (SAP Order/Operations) which direct the maintenance department during the performance of maintenance activities. The SAP system provides a recurring task scheduler to track completion and future due dates for all preventive maintenance and surveillance test activities. During the generation of maintenance work orders for in-scope components requiring aging management the DCPP work control process will be used to identify those maintenance activities that would provide opportunistic visual inspection of accessible internal surfaces.

RAI B2.1.24-1

The GALL Report AMP XI.E1 program description states that cables and connections from accessible areas (the inspection sample) are inspected and represent, with reasonable assurance, all cables and connections in the adverse localized environments. The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program in the LRA states "At least once every 10 years, accessible cables/cable jackets, connections, and terminal blocks within the scope of license renewal located in an adverse localized environment are inspected."

It is unclear if the applicant will use sampling or include all cables (within the scope of license renewal) in its inspection.

Please clarify if all accessible cables and connections within adverse localized environments will be inspected consistent with the GALL Report.

PG&E Response to RAI B2.1.24-1

The GALL Report AMP XI.E1 program requires that a representative sample of accessible in scope electrical cables and connections installed in adverse localized environments be visually inspected for cable jacket and connection surface anomalies.

Rather than performing an inspection of a representative sample of in-scope cables and connections PG&E will inspect all accessible cables, connections and terminal blocks that are identified within adverse localized environments.

RAI B2.1.25-1

In order for NRC staff to review an AMP with enhancement(s), the impact of the enhancement(s) for each element of the AMP must be clearly stated.

The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program (LRA Appendix B, Section B2.1.25) states "the following enhancement will be implemented in the following program elements: Scope of Program - Element 1, Parameters Monitored/Inspected - Element 3, Detection of Aging Effects - Element 4, Acceptance Criteria - Element 6, and Corrective Actions - Element 7." The LRA lacks detailed information on how the enhancement impacts each element. This information is also incomplete in the basis document.

Explain how each element will be impacted by enhancement such that it will be consistent with the GALL Report.

PG&E Response to RAI B2.1.25-1

Prior to the period of extended operation, plant procedures will be developed or revised in the following program elements as discussed below:

Scope of Program - Element 1

Plant procedures will be developed or revised to specify the cables and connections used in circuits with sensitive, high voltage, low-level signal instrumentation circuits within the scope of this program.

Parameters Monitored/Inspected - Element 3

Calibration surveillance tests are used to manage the aging of the cable insulation and connections for in scope radiation monitors so that circuits perform their intended functions. Cable testing is used to manage the aging of the cable insulation for the Nuclear Instrumentation System. Cable tests such as insulation resistance testing or other tests are performed for detecting deterioration of the cable insulation system. Procedures associated with calibration and testing will be developed or revised to note the parameters that require monitoring for indications of age related degradation.

Detection of Aging Effects - Element 4

The cables and connections for in-scope high voltage, low level signal circuits are subjected to calibration or cable testing. These calibrations or cable tests provide reasonable assurance that severe aging degradation will be detected prior to loss of the cable and connector intended function. Calibration and test procedures will be developed or revised to ensure that all calibration and surveillance results that fail to meet acceptance criteria will be reviewed, including consideration of cable aging effects, as appropriate, and that corrective actions are taken. Additionally procedures will be in place to ensure that a review of the calibration and test results will be completed prior to the period of extended operation and every 10 years thereafter.

Acceptance Criteria - Element 6

Plant procedures will be developed or revised to establish cable testing acceptance criteria based on the type of cable and type of test performed.

Corrective Actions - Element 7

Plant procedures will be developed or revised to ensure that when test or calibration acceptance criteria are not met, a corrective action document is initiated and an engineering evaluation is performed. The evaluation will consider the significance of the test results, the operability of the component, the reportability of the event, the extent of the concern, the potential root causes for not meeting the acceptance criteria, the corrective actions required, and likelihood of recurrence to ensure that the intended functions of the electrical cable system can be maintained consistent with the current licensing basis.

RAI B2.1.36-1

The applicant proposed to credit the Metal Enclosed Bus program for inspecting the in-scope iso-phase bus. The iso-phase bus provides the station blackout delay access offsite power source through back feeding the unit transformers and is included in the scope of the Metal Enclosed Bus Program. However, the inspection aspects of the iso-phase bus are different from those of the non-segregated bus. For example, the iso-phase bus does not have bus insulation, but has a bare conductor tube with no insulation material. Therefore, the bus insulation inspection as describe in the Metal Enclosed Bus Program is not applicable.

The GALL Report XI.E4 program is written specifically for managing non-segregated buses. The program attributes including parameters monitored or inspected, detection of aging effects, and acceptance criteria for non-segregated buses may not be appropriate for the iso-phase bus.

Explain how the inspections of non-segregated bus as described in the Metal Enclosed Bus Program are appropriate for the iso-phase bus.

PG&E Response to RAI B2.1.36-1

The scope of metal enclosed bus program includes both non-segregated phase bus sections and isolated phase bus sections that are included within the scope of license renewal due to being part of the station blackout recovery path.

The basic design of the non-segregated and Isophase busses is similar. Both designs include conducting bus bar on rigid insulated supports routed in a metal enclosure.

Some inspection parameters described in GALL for Metal Enclosed Bus would not be applicable to Isophase bus. The bus segments are not wrapped with insulation, as is the non-segregated bus. Therefore, inspection of insulation is not applicable. Most of the Isophase bus sections are welded together. There are three locations of bolted connections within the Isophase bus. These connections are inspected as part of Metal Enclosed Bus program, LRA Section B2.1.36. PG&E manages bolted connections at the ends of the isolated phase bus under the maintenance programs of the motor operated disconnect, the main unit transformers, and the auxiliary transformers. The bolted connections that are part of active components are not within the scope of this aging management program.

LRA Sections 2.5, 2.5.1.6, A1.36, B2.1.36, and Table 3.6.2-1 have been revised to account for the differences between the isolated phase and non-segregated phase bus designs. Section B2.1.36, the Metal Enclosed bus aging management program, is revised to take an exception that the isolated phase bus inspections do not require inspection or testing of bolted connections between bus segments or the inspection of insulating materials on the bus. See revised LRA Sections 2.5, 2.5.1.6, A1.36, and B2.1.36, and Table 3.6.2-1 in Enclosure 2.

LRA Amendment 2

LRA Section	RAI
Section 2.5	B2.1.36-1
Section 2.5.1.6	B2.1.36-1
Section A1.10	B2.1.10-2
Section A1.17	B2.1.17-1
Section A1.36	B2.1.36-1
Section B2.1.1	B2.1.1-1
Section B2.1.3	B2.1.3-2
Section B2.1.8	B2.1.8-1
Section B2.1.10	B2.1.10-1
Section B2.1.17	B2.1.17-1
Section B2.1.19	B2.1.19-1
Section B2.1.36	B2.1.36-1
Table 3.6.2-1	B2.1.36-1
Table A4-1	B2.1.10-1

2.5 SCOPING AND SCREENING RESULTS: ELECTRICAL AND INSTRUMENTATION AND CONTROL SYSTEMS

The scoping and screening results for electrical and instrument and control system components consist of a list (Table 2.5-1, Electrical and I&C Component Groups Requiring Aging Management Review) of component types that require AMR.

Using the plant "spaces" approach, all electrical and instrument and control components were reviewed as a group regardless of the system assigned to each component. Bounding environmental conditions were used to evaluate the identified aging effect(s) with respect to component function(s) to determine the passive component groups that require AMR. This methodology is discussed in Section 2.1.3.3 and is consistent with the guidance in NEI 95-10.

The interface of electrical and instrument and control components with other types of components and the assessments of these interfacing components are provided in the appropriate mechanical or structural sections. The evaluation of electrical racks, panels, frames, cabinets, cable trays, conduit, manhole, duct banks, transmission towers and their supports is provided in the structural assessment documented in Section 2.4.

The following electrical component groups were evaluated to determine the groups that require AMR:

- Cable Connections (metallic parts)
- Connectors (exposed to borated water)
- Fuse Holders (not part of a larger assembly)
- High Voltage Insulators
- Insulated Cable and Connections (includes the following):
    - Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements
    - Electrical cables and connections used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance
    - Inaccessible Medium-Voltage Electrical Cables not subject to 10 CFR 50.49 EQ requirements

- Metal Enclosed Bus (includes the following):
    - *Non-segregated Phase Bus*
        - Bus bar and connections
        - Bus enclosure
        - Bus Insulation and insulators
    - *Isolated Phase Bus*
        - *Bus bar*
        - *Bus enclosure*
        - *Bus insulators*
- Switchyard Bus and Connections
- Terminal Blocks (not part of a larger assembly)
- Transmission Conductors and Connections
- Lightning Rods
- Electrical equipment subject to 10 CFR 50.49 environmental qualification (EQ) requirements
- Penetrations, Electrical
- Grounding conductors
- Cable Tie Wraps

A license renewal boundary drawing (LR-DCPP-ELEC-502110) was created from the plant one-line diagram. The plant one-line diagram schematically shows the portions of the plant AC electrical distribution system, including the SBO recovery path, that are included within the scope of license renewal.

2.5.1.6 Metal Enclosed Bus

Metal Enclosed Bus is bus that is enclosed and not part of an active component such as switchgear, load centers or motor control centers. There are typically three types of metal enclosed bus:

- Isolated Phase Bus
- Non-Segregated Phase Bus
- Segregated Phase Bus

The in-scope non-segregated phase bus ~~and isolated phase bus~~ supports the restoration of offsite power to meet the SBO requirements is in the scope of license renewal. The ~~following component types are part of the~~ non-segregated phase bus *consists of the following component types:* ~~and isolated phase bus~~.

- Bus bar and connections
- Bus enclosure
- Bus Insulation and insulators

The in-scope isolated phase bus supports the restoration of offsite power to meet the SBO requirements is in the scope of license renewal. The isolated phase bus consists of the following component types:

- *Bus bar and connections*
- *Bus enclosure*
- *Bus insulators*

The function of the non-segregated phase bus, the isolated phase bus and bus bar and connections is to maintain electrical continuity between specified sections of an electrical circuit to deliver voltage and current.

The function of the bus enclosure is to provide for expansion *(non-segregated and isolated phase bus)* and separation of the bus *(non-segregated)* as well as structural support *(non-segregated and isolated phase bus)*. The function of the bus insulation *serves* ~~and insulators is~~ to electrically insulate the *non-segregated phase* bus bars from *each other and* the enclosure ~~and supports~~. *The function of the bus insulators is to support and electrically insulate the non-segregated and isolated phase bus bars from the enclosure.*

DCPP does not use segregated phase bus.

A1.10 CLOSED-CYCLE COOLING WATER SYSTEM

The Closed-Cycle Cooling Water System program manages loss of material, cracking, and reduction in heat transfer for components within the scope of license renewal in closed-cycle cooling water systems. The program includes maintenance of system chemistry parameters following the guidance of EPRI TR 107396, Revision 1, *Closed Cooling Water Chemistry Guidelines (EPRI 1007820)* to minimize aging. *The program provides for: (1) preventive measures to minimize corrosion including maintenance of corrosion inhibitor, pH buffering agent, and biocide concentrations, and (2) periodic system and component performance testing and inspection. Periodic inspection and testing to confirm function and monitor corrosion is performed in accordance with EPRI TR 107396, Revision 1 (EPRI 1007820), and industry and plant operating experience.*

A1.17 Selective Leaching of Materials

The Selective Leaching of Materials program manages the loss of material due to selective leaching for brass (copper alloy >15 percent zinc), aluminum-bronze (copper alloy >8 percent aluminum), and gray cast iron components within the scope of license renewal that are exposed to raw water, including condensation, and treated water.

The Selective Leaching of Materials program includes a one-time visual inspection and hardness measurement (where feasible based on form and configuration) or other industry-accepted mechanical inspection techniques of selected components that may be susceptible to selective leaching to determine whether loss of material due to selective leaching is occurring, and whether the process will affect the ability of the components to perform their intended functions for the period of extended operation. *If evidence of selective leaching is discovered in the implementation of the program, an engineering evaluation will determine the extent of expansion of the sample size and locations for additional inspections and evaluations.* Follow up examinations or evaluations will be performed as required to ensure component functionality during the period of extended operation.

The Selective Leaching of Materials program is a new program and the inspections will be completed within the 10-year period prior to the period of extended operation.

A1.36 Metal enclosed Bus

The Diablo Canyon metal enclosed bus program manages aging of in-scope non-segregated phase and isolated phase bus.

The ~~Metal Enclosed Bus~~*non-segregated phase portion of the* program manages the effects of loose connections, embrittlement, cracking, melting, swelling, or discoloration of insulation, loss of material of bus enclosure assemblies, hardening of boots and gaskets, and cracking of internal bus supports to ensure that *non-segregated phase* metal enclosed buses within the scope of license renewal *are capable of performing their intended function*.

Prior to the period of extended operation and every 10 years thereafter, internal portions of the *in-scope non-segregated phase* MEBs are visually inspected for cracks, corrosion, foreign debris, excessive dust buildup, and evidence of water intrusion~~,~~. *The* bus insulation is inspected for signs of embrittlement, cracking, melting, swelling, hardening or discoloration, *which may indicate over heating or aging degradation. T*~~t~~he internal bus supports are inspected for structural integrity and signs of cracks. ~~, and~~ ~~t~~*T*he bus enclosure assemblies are inspected for loss of material due to corrosion and hardening of boots and gaskets.

Prior to the period of extended operation and every 10 years thereafter, a sample of the accessible bolted connections ~~on the~~*of non-segregated phase* internal bus work is checked for loose connections by measuring connection resistance or thermography. Where the alternative visual inspection is used to check bolted connections, the first inspection will be completed prior to the period of extended operation and every five years thereafter.

When contact resistance test or thermography is not performed *on non-segregated phase bus*, a visual inspection of connection insulation material to detect surface anomalies, such as discoloration, cracking, chipping or surface contamination will be performed. The first visual inspection for license renewal will be performed prior to the period of extended operation and once every five years thereafter.

The isolated phase portion of the program manages the effects of cracking and loss of material of bus enclosure assemblies, hardening of gaskets, and cracking of internal bus supports to ensure that isolated phase metal enclosed buses within the scope of license renewal are capable of performing their intended function.

Prior to the period of extended operation and every 10 years thereafter, internal portions of the in scope isolated phase MEBs are visually inspected for cracks, corrosion, foreign debris, excessive dust buildup, and evidence of water intrusion. The internal bus supports are inspected for structural integrity and signs of cracks. The bus enclosure assemblies are inspected for loss of material due to corrosion and hardening of boots and gaskets.

B2.1.1 ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD

Program Description

ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program inspections are performed to manage cracking, loss of fracture toughness, and loss of material in Class 1, 2, and 3 piping and components within the scope of license renewal. The program includes periodic visual, surface, volumetric examinations and leakage tests of Class 1, 2, and 3 pressure-retaining components, including welds, pump casings, valve bodies, integral attachments, and pressure-retaining bolting. These components are identified in ASME Section XI Tables IWB-2500-1, IWC-2500-1, and IWD-2500-1 for Class 1, 2 and 3 components, respectively. DCPP inspections meet ASME Section XI requirements. The DCPP ISI Program is in accordance with 10 CFR 50.55a and ASME Section XI, 2001 edition through 2003 addenda. In conformance with 10 CFR 50.55a(g)(4)(ii), the DCPP ISI Program is updated each successive 120-month inspection interval to comply with the requirements of the latest edition of the ASME Code specified 12 months before the start of the inspection interval.

The ASME Section XI, IWB, IWC, and IWD Inservice Inspection program is implemented by plant procedures. DCPP is in the third 10-year interval which will end on May 7, 2015 for Unit 1, and March 13, 2016 for Unit 2. DCPP is following Inspection Program B as allowed by the ASME Code. Requirements are included for scheduling of examinations and tests for Class 1, 2, and 3 components. The program requires periodic visual, surface, volumetric examinations and leakage tests of all Class 1, 2 and 3 pressure-retaining components. The DCPP ASME Section XI ISI program provides measures for monitoring to detect aging effects prior to loss of intended function and provides measures for repair and replacement of Class 1, 2, and 3 piping and components in accordance with the requirements of IWA-4000.

ISI of reactor vessel flange stud holes, closure studs, nuts, washers, and bushings are evaluated in the Reactor Head Closure Studs program (B2.1.3).

ISI of Class 1, 2, and 3 component supports are evaluated in the ASME Section XI, Subsection IWF program (B2.1.29).

The DCPP ASME Class 1, 2, and 3 components described in Subsections IWB-1220, IWC-1220, and IWD-1220 are exempt from the volumetric and surface examination requirements of Subsections IWB-2500, IWC-2500, and IWD-2500.

The ISI 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 ISI Program uses visual, surface and volumetric examinations conducted in accordance with approved DCPP procedures that meet ASME Section XI requirements. Examinations are conducted by personnel qualified and certified in accordance with ASME Code requirements in Section XI IWA-2300. The NDE techniques used to inspect Class 1 (Table IWB-2500-1), Class 2 (Table IWC-2500-1), and Class 3 (Table IWD-2500-1) components are consistent with the ASME Section XI Code for the components.

The ISI Program, Subsections IWB, IWC, and IWD, is credited for detection of loss of fracture toughness aging effects in cast austenitic stainless steel piping, valves, and reactor coolant pump casings.

The ISI component examination schedules implemented in the DCPP ISI Program are consistent with the requirements of ASME Section XI, IWB-2412, IWC-2412, and IWD-2412 for Inspection Program B. Flaw indications and relevant conditions that have been evaluated and determined to be acceptable for continued service are re-examined during subsequent inspection periods. *Examinations that reveal f*~~F~~law indications and relevant conditions that have been evaluated and exceed the acceptance standards are extended to include additional examinations in accordance with IWB-2430, IWC-2430, or IWD-2430.

Indications, relevant conditions, and resolution of rejectable indications and relevant conditions are evaluated as required by ASME Section XI IWB-3000, IWC-3000, and IWD-3000. DCPP evaluates every indication. Examination results are evaluated in accordance with IWB-3100, ~~or~~ IWC-3100*, or IWD-3100* by comparing the results with acceptance standards of IWB-3400*,* ~~and~~ IWB-3500, ~~or~~ IWC-3400*,* and IWC-3500*, or IWD-3400 and IWD-3500* for Class 1, ~~or~~ Class 2*, or Class* ~~and~~ 3 components, respectively. Flaws exceeding the size of allowable flaws, as defined in IWB-3500, ~~or~~ IWC-3500*, or IWD-3500* ~~may be~~*are* evaluated using the analytical procedures of IWB-3600, ~~or~~ IWC-3600*, or IWD-3600, respectively*.

NUREG-1801 Consistency

The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program is an existing program that is consistent with NUREG-1801, Section XI.M1, ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

DCPP operating experience is evaluated and corrective actions are implemented to ensure that program operability is maintained. This is accomplished by promptly identifying and documenting any condition that indicates degradation of the systems that fall under the DCPP ISI Program, using the Corrective Action Program. Industry operating experience evaluations and ISI component inspections and testing results have proven that the effects of aging are adequately being managed so that the intended functions are maintained consistent with the current licensing basis for the period of extended operation

DCPP is now beginning the third 10-year interval of applying the requirements of ASME Section XI in its ISI Program to manage aging effects in Class 1, 2, and 3 components and their integral attachments in light-water cooled power plants. DCPP Inspections meet ASME Section XI requirements and can manage aging such as cracking, loss of material and loss of fracture toughness. The ASME Section XI ISI Program at DCPP has identified industry aging effects and has proven to maintain component structural integrity, and ensure that aging effects are discovered and repaired before the loss of component intended function.

Review of the second 10-year ISI Interval Summary Reports for 1R10, 1R11, 1R12, 1R13, 1R14, 1R15, 2R10, 2R11, 2R12, 2R13, and 2R14 indicates there were no aging related code repairs or code replacements required for continued service of ASME Tables IWB-2500-1, IWC-2500-1, and IWD-2500-1 Code components. The second 10-year ISI Interval Summary Reports reviewed did not indicate any program adequacy or implementation issues with the DCPP ASME Section XI Program for ASME IWB, IWC, and IWD code components.

An instance of accumulator nozzle cracking due to intergranular stress corrosion was identified in 1987. All nozzles were inspected and all nozzles that had unacceptable indications were weld-repaired or replaced with nozzles made of a new material.

Based on a review DCPP operating experience, relevant findings related to the ISI Program components have been identified and associated corrective actions have been taken.

The DCPP operating experience findings for this program identified no unique plant specific operating experience; therefore DCPP operating experience is consistent with NUREG-1801.

Conclusion

The continued implementation of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program provides reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B2.1.3 Reactor Head Closure Studs

Program Description

The Reactor Head Closure Studs program manages cracking and loss of material by providing periodic ASME Section XI inspections of reactor vessel flange stud hole threads, reactor head closure studs, nuts, and washers. The program includes periodic visual and volumetric examinations of reactor vessel flange stud hole threads, reactor head closure studs, nuts, and washers and performs visual inspection of the reactor vessel flange closure during primary system leakage tests. The current DCPP ISI Program implements ASME Code Section XI, Subsection IWB (2001 Edition including the 2002 and 2003 Addenda) Table IWB-2500-1 and manages reactor vessel stud, nut, and washer cracking, loss of material, and reactor coolant leakage from the reactor vessel flange. Reactor vessel flange stud hole threads, reactor head closure studs, nuts, and washers are identified in ASME Code Section XI , Subsection IWB Table IWB-2500-1 and are within the scope of license renewal.

Each of the reactor vessel flange stud hole threads, reactor head closure studs, nuts, and washers is inspected for potential cracking and loss of material through visual and volumetric examinations in accordance with ASME Section XI Subsection IWB requirements in DCPP procedures once every 10 years. These inspections are conducted during refueling outages. Reactor vessel studs are removed from the reactor vessel flange each refueling outage. Repair and replacement activities associated with reactor vessel flange closure head stud hole threads, reactor head closure studs, nuts, and washers are in accordance with the requirements of ASME Section XI, IWA-4000. Preventive measures include coating the studs, nuts, and washers after inspection and storing in protective racks after removal, as recommended in Regulatory Guide 1.65, *Material and Inspection for Reactor Vessel Closure Studs*. Reactor vessel flange holes are plugged with water tight plugs during cavity flooding. These methods assure the holes, studs, nuts, and washers are protected from borated water during cavity flooding. The reactor vessel flange is inspected for leakage prior to reactor startup during reactor coolant system pressure testing each refueling outage.

NUREG-1801 Consistency

The Reactor Head Closure Studs program is an existing program that is consistent with exception to NUREG-1801, Section XI.M3, Reactor Head Closure Studs.

Exceptions to NUREG-1801

<u>Program Elements Affected</u>

Scope of Program - Element 1

NUREG-1801 specifies that this program is applicable to closure studs and nuts constructed from materials with a maximum tensile strength limited to less than 1,172 MPa (170 ksi). DCPP Certified Material Test Reports indicate that DCPP has four heats *that have an average ultimate tensile strength of 170.8 ksi, with a range of 160 ksi to 175.5 ksi. DCPP credits inservice inspections that are within the scope of this AMP, which are implemented in accordance with the DCPP Inservice Inspection Program, Examination Category B-G-1 requirements as the basis for managing cracking in these components. This is in accordance with the "parameters monitored or inspected" and "detection of aging effects" program elements in GALL AMP XI.M3.*

Detection of Aging Effects - Element 4

NUREG-1801 specifies that surface examination uses magnetic particle, liquid penetration, or eddy current examinations to indicate the presence of surface discontinuities and flaws. The current DCPP ISI Program for the third interval implements ASME Code Section XI, Subsection IWB (2001 Edition including the 2002 and 2003 Addenda), which does not require surface examination. The current DCPP ISI Program requires visual and volumetric examinations in accordance with ASME Section XI Subsection IWA-2000 requirements. The future 120-month inspection interval for DCPP will incorporate the then-current requirements specified in the version of the ASME Code incorporated into 10 CFR 50.55a twelve months before the start of the inspection interval.

Enhancements

None

Operating Experience

A review of DCPP operating experience has not identified any SCC, IGSCC, galling or wear affecting the reactor vessel closure studs, nuts, washer, and flange thread holes. The Refueling Outage Inservice Inspection Summary Reports for Interval 2 (1996-2006) indicate there were no repair/replacement items identified involving reactor vessel closure studs, nuts, washers, or flange thread holes due to aging issues.

The DCPP operating experience findings for this program identified no unique plant specific operating experience; therefore DCPP operating experience is consistent with NUREG-1801. The Reactor Head Closure Studs program operating experience information provides objective evidence to support the conclusion that the effects of aging will be adequately managed so that the intended function of the reactor head closure stud bolting will be maintained during the period of extended operation.

The ISI Program at DCPP is updated to account for operating experience and code revisions as required by 10 CFR 50.55a(g)(4)(ii), at the end of each 120-month interval. ASME Section XI is also revised every three years and addenda issued in the interim, which allows the code to be updated to reflect industry experience. The requirement to update the ISI Program to reference more recent editions of ASME Section XI at the end of each inspection interval ensures the ISI Program reflects enhancements due to operating experience as well as changes incorporated into ASME Section XI.

Conclusion

The continued implementation of the Reactor Head Closure Studs program provides reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B2.1.8 Steam Generator Tube Integrity

Program Description

The Steam Generator Tube Integrity program manages the aging of steam generator tubes, plugs, and tube supports. The scope of the program includes the preventive measures, inspections, degradation assessment, condition monitoring, operational assessment, tube plugging, and leakage monitoring activities necessary to manage potential steam generator tube degradation, including mechanically induced phenomena, such as wear and impingement damage. The aging management measures employed includes nondestructive examinations, visual inspection, sludge removal, tube plugging, in-situ pressure testing and maintaining the chemistry environment by removal of impurities and addition of chemicals to control pH and oxygen. NDE inspection scope and frequency, and primary to secondary leak rate monitoring are conducted consistent with the requirements of DCPP Units 1 and 2 Technical Specifications and NEI 97-06, *Steam Generator Program Guidelines*. Tube structural integrity limits are applied consistent with Regulatory Guide 1.121, *Bases for Plugging Degraded PWR Steam Generator Tubes*, August 1976.

Guidance for steam generator management at DCPP is specified in plant procedures for steam generator tube integrity inspection and assessment, degradation assessment, maintenance, plugging or repair and primary to secondary leakage monitoring. Procedures also monitor and control secondary and primary side water chemistry. The DCPP steam generator tube inspection frequency is governed by the Technical Specifications and is evaluated as part of the Degradation Assessment performed prior to each refueling outage. Plugging criteria for removing tubes from service are consistent with the Technical Specifications.

The Steam Generator Tube Integrity program includes foreign material exclusion guidance, consistent with NEI 97-06. Plant procedural guidance includes measures to prevent the introduction of foreign material when access is provided to the primary and secondary sides of the steam generators. A secondary side foreign object search and retrieval effort is conducted when the hand hole covers are removed for maintenance to identify and remove loose parts and foreign material.

The Water Chemistry program (B2.1.2) mitigates the potentially corrosive effects of the primary and secondary water on the interior and exterior surfaces of the steam generator tubes and other steam generator internals.

Aging management activities for steam generator tubing integrity are controlled by plant procedures. DCPP procedural guidance includes performance criteria for tube structural integrity, operational leakage and accident induced leakage, and reporting criteria. The training and qualification standards for personnel engaged in non-destructive examination (NDE) activities are specified in a plant procedure. Inspection practices are consistent with the EPRI PWR Steam Generator Examination Guidelines.

DCPP programmatic guidance also requires that each inspection be based on a degradation assessment that considers DCPP historical data and industry operating experience from other similar steam generators.

The Degradation Assessment is performed to the guidelines of EPRI Steam Generator Integrity Assessment Guidelines, which covers degradation mechanisms, acceptable inspection techniques and sampling strategies. The Degradation Assessment assesses degradation of all components that affect steam generator tube integrity such as tubes, plugs and tube supports. Tube sleeves are not an approved method of repair at DCPP.

During each outage when the steam generator tubes are inspected or plugged, a Condition Monitoring and Operational Assessment is conducted to confirm that the structural and leakage integrity performance criteria have been satisfied. All degraded conditions identified during Steam Generator inspections are addressed in the DCPP corrective action program. All degraded steam generator tubes meeting the steam generator tube plugging criteria are removed from service by plugging.

NUREG-1801 Consistency

The Steam Generator Tube Integrity program is an existing program that is consistent with NUREG-1801, Section XI.M19, Steam Generator Tube Integrity.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The Steam Generator Tube Integrity program tube inspection requirements are consistent with NEI 97-06. The program benefits from the industry operating experience available when the initiative was issued as well as the EPRI guidelines it endorses.

NRC Information Notice 97-88, *Experiences During Recent Steam Generator Inspections* addressed the importance of recognizing the potential for degradation in areas that have not previously experienced tube degradation and the importance of licensees to assess the significance of indications with respect to the qualification of the inspection techniques and the manner in which the indications were detected. The DCPP steam generator Degradation Assessment evaluates industry experience as well as DCPP experience to identify active, relevant and potential tube damage mechanisms. Some of the important features of the Degradation Assessment include: choosing techniques to test for degradation based on the probability of detection and sizing capability, establishing the number of tubes to be inspected, establishing the structural limits, establishing the flaw growth rate or a plan to establish the flaw growth rate.

DCPP has replaced all four steam generators in each unit with Westinghouse Model Delta 54 steam generators, which contain Alloy 690 thermally treated tubes. The replacements took place during 2R14 in February 2008 for Unit 2 and 1R15 in February 2009 for Unit 1. A review of industry operating experience indicates that there have been no reported instances of cracking in thermally-treated Alloy 690 tubes at any U.S. plant. All degradation indications to date are from wear (fretting) due to loose parts, tube supports, anti-vibration bars, and manufacturing or handling anomalies. The tubing and secondary internals in these units are *more resistant* ~~not susceptible~~ to corrosion due to advanced material design.

The DCPP operating experience findings for this program identified no unique plant specific operating experience; therefore DCPP operating experience is consistent with NUREG-1801. As additional Industry and applicable plant-specific operating experience become available, the Operating Experience (OE) will be evaluated and appropriately incorporated into the program through the DCPP Corrective Action and Operating Experience Programs. This ongoing review of OE will continue throughout the period of extended operation, and the results will be maintained on site. This process will confirm the effectiveness of this license renewal aging management program by incorporating applicable OE and performing self assessments of the program.

Conclusion

The continued implementation of the Steam Generator Tube Integrity program provides reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B2.1.10 Closed-Cycle Cooling Water System

Program Description

The Closed-Cycle Cooling Water (CCCW) System program manages loss of material, cracking and reduction of heat transfer for components in the closed-cycle cooling water systems. The program provides for: (1) preventive measures to minimize corrosion including maintenance of corrosion inhibitor, pH buffering agent, and biocide concentrations, and (2) periodic system and component performance testing and inspection. Preventive measures include the monitoring and control of corrosion inhibitors and other chemical parameters, such as pH, in accordance with the guidelines of EPRI TR-107396, Revision 1 (EPRI 1007820). Periodic inspection and testing to confirm function and monitor corrosion is performed in accordance with EPRI TR-107396, Revision 1 (EPRI 1007820), and industry and plant operating experience.

DCPP has four systems within the scope of license renewal that meet the definition for CCCW systems in GL 89-13 and portions of additional systems (heat exchangers or coolers) that are serviced directly by these systems. These CCCW systems are not subject to significant sources of contamination. The water chemistry is controlled in these systems and heat is not directly rejected to a heat sink.

The CCCW systems in License Renewal scope are:

- component cooling water (CCW) system
- service cooling water (SCW) system
- diesel engine jacket cooling water (DECW) system, a subsystem of the diesel generator system
- auxiliary building HVAC system

The program maintains water chemistry within the parameter limits specified in plant procedures and consistent with those in EPRI TR-107396, Revision 1 (EPRI 1007820), in order to minimize corrosion and microbiological growth. The chemicals added to the CCW and SCW systems are potassium molybdate (iron and aluminum corrosion inhibitor), potassium nitrite (iron corrosion inhibitor), tolyltriazole (TTA - a copper corrosion inhibitor), potassium tetra borate (buffering), potassium hydroxide (pH control), glutaraldehyde (biocide) and isothiazoline (biocide). The chemicals added to the DECW system are potassium dichromate and potassium hydroxide (corrosion inhibitors). The cooling water system associated with the auxiliary building HVAC system is maintained as a sealed pure water system based on potable water, without additives.

The CCCW System program periodically monitors system chemistry to verify it is being maintained in accordance with the guidelines of EPRI TR-107396, Revision 1 (EPRI 1007820), with stated exceptions, to minimize corrosion and SCC. In addition, non-chemistry testing and inspection techniques consistent with EPRI TR-107396, Revision 1 (EPRI 1007820), are used to confirm the effectiveness of the program.

The CCW pumps are periodically tested to verify pump performance. Non-destructive examinations are used to verify that the pressure boundary intended function of the CCW heat exchangers is maintained. Periodic performance testing of the CCW heat exchangers is part of the Open-Cycle Cooling Water System program (B2.1.9). Diesel engine performance parameters are monitored through periodic surveillance tests. These tests are used to monitor the performance of the DECW System components. Inspections are performed periodically on the in-scope DECW components.

The SCW system and the auxiliary building HVAC system chilled water systems are within the scope of license renewal per 10 CFR 54.4(a)(2) for spatial interaction concerns only. Therefore, the only component intended function applicable to these systems is (a)(2) leakage boundary (spatial). The periodic sampling and maintenance of system chemistry within specified limits are adequate to manage aging before the loss of this intended function.

NUREG-1801 Consistency

The Closed-Cycle Cooling Water System program is an existing program that, following enhancement, will be consistent with exception to NUREG-1801, Section XI.M21, Closed-Cycle Cooling Water.

Exceptions to NUREG-1801

<u>Program Elements Affected</u>

Preventive Actions - Element 2, Parameters Monitored/Inspected - Element 3, and Acceptance Criteria - Element 6

EPRI TR-107396, *Closed Cooling Water Chemistry Guideline*, Revision 1, Table 5-4, establishes a normal chromate concentration operating range of 150 - 300 ppm. DCPP Unit 1 and Unit 2 operate in the chromate concentration range of 1580 - 3150 ppm for the DECW System. The EPRI limit is based on the National Association of Corrosion Engineers (NACE) Report #7G181, 1981. This report investigated the influence of water treatment chemicals on mechanical seals and concluded that the degradation rate of some seals increased with the concentration of chromate. DCPP has not observed seal failures that were attributed to the concentration of chromates in the DECW System. DCPP operating experience and recent industry research on the subject provide evidence that supports DCPP operating at chromate concentration levels greater than those established by the EPRI Closed Cooling Water Chemistry Guideline.

Preventive Actions - Element 2 and Parameters Monitored/Inspected - Element 3

EPRI TR-107396, *Closed Cooling Water Chemistry Guideline*, Revision 1, Table 5-4 establishes chloride and fluoride as control parameters to be monitored monthly. DCPP Unit 1 and Unit 2 do not monitor or analyze chloride and fluoride in the DECW system. The makeup water to the DECW system is demineralized and there are no known pathways for chloride or fluoride to enter the jacket cooling water. Also, chromates are anodic inhibitors and the concentration in the jacket cooling water is maintained above a level that prevents the onset of pitting corrosion due to chloride and fluoride.

Preventive Actions - Element 2, Parameters Monitored/Inspected - Element 3

EPRI TR-107396, *Closed Cooling Water Chemistry Guideline*, Revision 1, Table 5-4 establishes a monthly monitoring frequency for DECW control parameters under stable conditions. DCPP Unit 1 and Unit 2 currently perform a quarterly monitoring frequency for these DECW control parameters under stable conditions. The jacket cooling water chemistry has remained stable at DCPP for over 25 years. Increasing the sampling frequency would increase the amount of hazardous waste generated, and the amount of makeup required to replace the sample and purge volume. In addition, the jacket cooling water is an isolated system and contamination of the coolant is not expected. The high chromate concentration maintained at DCPP results in a very tenacious protective oxide corrosion layer that has a minimal corrosion rate.

Parameters Monitored or Inspected - Element 3, Detection of Aging Effects - Element 4, and Monitoring and Trending - Element 5

NUREG-1801, Section XI.M21, Element 3, states that the CCCW Program should monitor heat exchanger parameters including flow, inlet and outlet temperatures, and differential pressure. NUREG-1801, Section XI.M21, Element 4, states that performance and functional testing ensures acceptable functioning of the CCCW system or components serviced by the CCCW system. NUREG-1801, Section XI.M21, Element 5, states that internal visual inspections and performance/functional tests are to be performed periodically to confirm the effectiveness of the program. Exception is taken to performance testing and inspection of the heat exchangers served by the CCCW systems. At DCPP, performance/ functional testing and inspection of the heat exchangers served by the in-scope CCCW systems are not performed as part of the CCCW Program. EPRI TR-107396, Revision 1 (EPRI 1007820), Section 8.4.4, states that performance testing is typically part of an engineering program, as opposed to a CCCW program. Functional and performance testing verify that component active functions can be accomplished, and as such the testing is within the scope of the Maintenance Rule (10 CFR 50.65). The CCCW Program utilizes corrosion monitoring which includes component inspections to monitor program effectiveness in managing component degradation that could impact a passive function. Chemical analysis of iron and copper in the bulk water is performed to monitor the buildup of dissolved corrosion products. Higher than expected concentration levels of total iron and copper indicate possible corrosion within the closed-cycle cooling water systems. Measurement of accumulated corrosion products such as iron and copper provides an indirect indication of system corrosion.

DCPP employs non-chemistry testing and inspection techniques consistent with EPRI TR-107396, Revision 1 (EPRI 1007820), Section 8.4 (Non-Chemistry Monitoring), to evaluate system and component performance, determine the potential for loss of material or leakage caused by corrosion or SCC, and to monitor the potential for decreased flow capacity and heat transfer degradation caused by fouling. Plant procedures set forth testing and inspection requirements and frequency of performance. The techniques include thermal performance testing (performed on the CCW heat exchangers as part of the Open-Cycle Cooling Water Program), flow testing, operability testing and visual inspections. Visual inspections of the CCW supply isolation check valves to the reactor coolant pumps (valves CCW-1-585 and CCW-2-585) are used as a leading indicator of the condition of the interior of piping components otherwise inaccessible for visual inspection. This periodic internal inspection will detect loss of material and fouling.

Corrosion test loops using corrosion coupons are in place for Unit 1 and Unit 2 in the CCW and SCW Systems. These coupons have been visually examined with no detectible corrosion. Corrosion spool pieces with an orifice to create low flow are installed for the CCW System in Unit 1 and Unit 2. These are visually examined to detect bio-fouling. If bio-fouling is observed, potential surface corrosion will be evaluated to determine if a sample should be sent off for bacteria culture analysis to determine if there is MIC-type bacteria.

In lieu of performance testing and inspection of the heat exchangers served by the DECW system, diesel engine performance testing monitors various engine parameters monthly to validate the operability of the engines and to verify the performance of both the heat exchangers and pumps.

The diesel engine generator jacket cooling pumps, diesel engine generator jacket water after-coolers, diesel engine jacket water radiators and diesel engine lube oil heat exchangers are not individually monitored for flow, inlet and outlet temperatures and differential pressure and internal visual inspections are not performed on each component. At DCPP, diesel engine performance parameters are monitored through periodic Technical Specification surveillance tests and internal visual inspections of selected components that serve as leading indicators for the condition of surfaces exposed to closed-cycle cooling water. Diesel engine generator performance testing monitors various engine parameters to validate the operability of the engines and to verify the performance of both the heat exchangers and the pumps. Test data gathered includes DECW system cooling system levels, temperature and pressures from which the DECW heat exchanger performance and pump performance can be inferred. Trending of these parameters will detect component aging prior to loss of intended function. The jacket water after coolers are hydro tested. The jacket water radiators are visually inspected and cleaned. The diesel engine lube oil heat exchangers are internally inspected visually. The surveillance tests together with periodic hydro and internal visual inspections and the periodic sampling and control of system water chemistry are adequate to ensure the component intended functions are maintained within the DECW system.

EPRI TR-107396, Revision 1 (EPRI 1007820), Section 8.2, addresses fouling and indicates that fouling is unlikely to be significant for component surfaces exposed to closed cooling water. It states that control of both corrosion and microbiological growth will prevent fouling of CCCW systems and that visual examination is one of the most effective methods of determining the extent of fouling. For many heat exchangers, fouling of the closed cooling water side surfaces is insignificant compared with fouling on the opposite side of the heat exchanger and therefore reductions in the overall heat transfer coefficient may not be related to fouling of the closed cooling water side heat exchange surfaces. Raw water system heat exchangers are a primary example.

The DCPP position is consistent with the EPRI approach. Reductions in heat transfer are managed through a combination of chemistry controls and inspection activities. Chemistry controls are generally adequate to prevent buildup of significant fouling on heat exchanger surfaces. Periodic inspections are used to confirm the condition of component surfaces, including heat exchange surfaces.

The heat exchangers served by the CCCW systems that are in scope of license renewal per 10 CFR 54.4(a)(2) for spatial interaction concerns only, are not tested or inspected. The only intended function of these heat exchangers is (a)(2) leakage boundary (spatial). Periodic sampling and maintenance of system chemistry are adequate to manage aging for these components before the loss of intended function.

Preventive Actions - Element 2, Parameters Monitored/Inspected - Element 3, Detection of Aging Effects - Element 4, Monitoring and Trending - Element 5, Acceptance Criteria - Element 6, and Corrective Actions - Element 7

The program described in NUREG-1801, Section XI.M21, is based on the 1997 version of the EPRI Closed Cooling Water Chemistry Guideline, TR-107396, Revision 0. The DCPP CCCW System program currently uses the 2004 version of the EPRI Closed Cooling Water Chemistry Guideline, Revision 1. This exception is acceptable because the EPRI Closed Cooling Water Chemistry Guideline is a consensus document that is updated based on new operating experience, research data, and expert opinion. Incorporation of later versions of the guidance document ensures that the program addresses new information. DCPP has reviewed EPRI Closed Cooling Water Chemistry Guideline, Revision 1, and has determined that the most significant difference is that the new revision provides more prescriptive guidance and has a more conservative monitoring approach. The new revision meets the same requirements of EPRI TR-107396, Revision 0, for maintaining conditions to minimize corrosion and microbiological growth in closed cooling water systems for effectively mitigating many aging effects.

Enhancements

Prior to the period of extended operation, the following enhancements will be implemented in the following program element:

Monitoring and Trending - Element 5

DCPP will utilize inspections of the CCW supply isolation check valves to the reactor coolant pumps (valves CCW-1-585 and CCW-2-585) as a leading indicator of the condition of the interior of piping components otherwise inaccessible for visual inspection. This periodic internal inspection will detect loss of material and fouling. The inspections are scheduled to be performed for Unit 1 and for Unit 2 at least once every five years. Plant procedures will be enhanced to include the acceptance criteria.

Monitoring and Trending - Element 5

DCPP will monitor the corrosion of closed cooling water components by inspecting the condition of corrosion coupons installed in the system and perform internal inspections of select components within the systems. These methods will verify that wetted material exposed to the chemistry of the closed cooling water systems are not experiencing corrosion. The corrosion coupons are strips of metal (i.e. copper, carbon steel, stainless steel, etc) that are installed in the closed cooling water systems in a manner such that they are exposed to the cooling water. Periodically these coupons are removed and their condition can be evaluated. This inspection will provide DCPP indication if significant corrosion is occurring in the system. The material of these corrosion coupons is representative of most of the materials that are used in the system. For those components that do not have material represented by the corrosion coupons, internal inspections will be performed on those components, or other component with similar material, in order to monitor for corrosion.

Operating Experience

The CCCW System program is based on the guidance contained in EPRI TR-107396, Revision 1 (EPRI 1007820), which itself is based on industry-wide operating experience, research data, and expert opinion. The guideline is periodically updated and approved by the industry using a consensus process.

DCPP operating experience is evaluated and corrective actions are implemented for chemical concentrations, monitoring and testing, thereby minimizing aging effects to ensure adherence to EPRI TR-107396, Revision 1 (EPRI 1007820). This is accomplished by promptly identifying and documenting (using the Corrective Action Program) any conditions that indicates degradation of the DCPP CCCW systems. In addition, industry operating experience, self assessments and independent audits provide additional input to ensure that program operability is maintained at an optimum level.

In 1995, biofouling was discovered in the CCW system. CCW heat exchanger thermal performance testing demonstrated no downward trend of heat transfer since the discovery of biological activity in the CCW System.

In 2005, biofouling was observed in the SCW system. Corrective actions included chemical and mechanical cleaning of the heat exchangers. Chemicals such as glutaraldehyde and isothiazoline are added to the SCW system to control biological material. Measurement of bacteria is performed periodically to provide indications of biological activity averse to aging.

A review of CCCW heat exchanger performance testing results performed per plant procedures confirmed that the DCPP CCCW System program is capable of ensuring that the intended functions of the closed-cycle cooling water systems are not compromised by aging. Based on a review of DCPP operating experience, any chemistry parameters outside of established limits have been identified and the appropriate actions taken. Corrective actions have included increasing sampling frequencies, chemical addition, and feed and bleeds. The DCPP operating experience findings for this program identified no unique plant specific operating experience; therefore DCPP operating experience is consistent with NUREG-1801.

The CCCW System operating experience information provides objective evidence to support the conclusion that the effects of aging will be adequately managed so that the structure and component intended functions will be maintained during the period of extended operation.

Conclusion

The continued implementation of the Closed-Cycle Cooling Water program provides reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B2.1.17 Selective Leaching of Materials

Program Description

The Selective Leaching of Materials program manages loss of material due to selective leaching for brass (>15 percent zinc), gray cast iron, and aluminum-bronze (>8 percent aluminum) components within the scope of license renewal that are exposed to raw water, including condensation, and treated water. The program provides measures for detecting the aging effects prior to loss of intended function, but does not prevent degradation due to aging effects. There is no monitoring and trending for the one-time inspection activity.

The Selective Leaching of Materials program includes a one-time visual inspection and hardness measurement or other industry-accepted mechanical inspection techniques (where feasible based on form and configuration) of selected components that may be susceptible to selective leaching to determine whether loss of material due to selective leaching is occurring. Evidence of selective leaching discovered in the initial implementation of the program is submitted for engineering evaluation. The engineering evaluation will determine whether the potential loss of material affects the ability of the components to perform their intended function. The results of the engineering evaluation will also determine the ~~need to expand~~*extent of expansion of* the sample size and locations for additional inspections and evaluations. Follow-up examinations or evaluations are performed as required to ensure component functionality during the period of extended operation. Industry-accepted mechanical methods of testing for selective leaching may include scraping or chipping of the surfaces.

The Selective Leaching of Materials program is a new program and the inspections will be completed within the 10-year period prior to the period of extended operation.

NUREG-1801 Consistency

The Selective Leaching of Materials program is a new program that, when implemented, will be consistent with NUREG-1801, Section XI.M33, Selective Leaching of Materials.

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The Selective Leaching of Materials program is a new program at DCPP. Therefore, there is no plant-specific operating experience for program effectiveness. Industry operating experience that forms the basis for this program is included in the operating experience element of the corresponding NUREG-1801, aging management program description. The DCPP operating experience findings for this program identified no unique plant specific operating experience; therefore DCPP operating experience is consistent with NUREG-1801. The only plant operating experience identified in the review was the response to NRC Information Notice 94-59, *Accelerated Dealloying of Cast Aluminum-Bronze Valves Caused by Microbiologically Induced Corrosion,* which documented an evaluation that was completed for selective leaching. Upon completing the evaluation, DCPP concluded that biocide injection, periodic inspection and cleaning had been maintaining the affected components operable. In 1997, signs of selective leaching were noted on three valves in the auxiliary saltwater system. Polished counterweights and housings were installed to slow the rate of de-alloying. Subsequent visual inspections of the subject valves, performed every 18 months, have not identified any selective leaching issues since this implementation. Therefore, the existing plant maintenance practices have proven to be adequate for identification of selective leaching and periodic inspections of valves susceptible to selective leaching.

Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. As additional industry and applicable plant-specific operating experience become available, the operating experience will be evaluated and appropriately incorporated into the program through the DCPP Corrective Action Program and Operating Experience Program. This ongoing review of operating experience will continue throughout the period of extended operation, and the results will be maintained on site. This process will confirm the effectiveness of this new program by incorporating applicable operating experience and performing self assessments of the program.

Conclusion

The implementation of the Selective Leaching of Materials program will provide reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B2.1.19 One-Time Inspection of ASME Code Class 1 Small-Bore Piping

Program Description

The One-Time Inspection of ASME Code Class 1 Small-Bore Piping program manages cracking of ASME Code Class 1 piping less than or equal to four inches nominal pipe size (NPS 4). This program is implemented as part of the fourth interval of the DCPP Inservice Inspection (ISI) program.

For ASME Code Class 1 small-bore piping, the ISI program requires volumetric examinations on selected butt weld locations to detect cracking. Weld locations are selected based on the guidelines provided in EPRI TR-112657, *Revised Risk-Informed Inservice Inspection Evaluation Procedure*. Volumetric examinations are conducted in accordance with ASME Section XI with acceptance criteria from Paragraph IWB-3000 and IWB-2430. The fourth interval of the ISI program at DCPP, beginning in 2015 for Unit 1 and 2016 for Unit 2, will provide the results for the one-time inspection of ASME Code Class 1 small-bore piping. *A minimum of two socket weld locations per unit will be volumetrically inspected. For volumetric examinations of socket welds, DCPP will use a site developed and qualified procedure. DCPP will evaluate the need to enhance this procedure with the latest industry techniques at the time of the volumetric examination.* ~~Currently, a reliable and effective volumetric examination to detect cracking in socket welds and piping less than NPS 1 is not available. The DCPP ISI program performs periodic VT-2 visual examinations of ASME Class I piping socket welds and piping less than NPS 1 during each refueling outage.~~ DCPP has not experienced cracking of ASME Code Class 1 small bore pipe butt welds less than or equal to NPS 4.

In conformance with 10 CFR 50.55a(g)(4)(ii), the DCPP ISI Program is updated each successive 120 month inspection interval to comply with the requirements of the latest edition of the ASME Code specified twelve months before the start of the inspection interval.

DCPP inspects ASME Code Class 1 piping less than or equal to NPS 4 through the RI-ISI Program. To determine the selection of elements for examination, degradation mechanisms were assessed and a consequence evaluation was completed in order to perform a risk ranking of the piping segments within the scope of the RI-ISI program. A risk matrix was created with categories for high, medium and low risk. Elements for examination were selected such that 25 percent of the elements in the high risk category were selected, 10 percent of the elements in the medium risk region were selected, and no elements from the low risk region were selected.

The RI-ISI Program for pipe welds employs the EPRI methodology as described in EPRI Topical Report TR 112657, Revision. B. The selection for examination of specific elements within a segment is based on the degradation mechanism, as well as inspection cost, radiation exposure and accessibility. Other considerations that go into the element selection process are inspectability, distribution of inspections among systems and segments, plant specific inspection results, and repairs ~~to~~ *or* remedial measures which have been implemented.

NUREG-1801 Consistency

The One-Time Inspection of ASME Code Class 1 Small-Bore Piping program is an existing program that is consistent with exception to NUREG-1801, Section XI.M35, One-Time Inspection of ASME Code Class 1 Small-Bore Piping.

Exceptions to NUREG-1801

Program Elements Affected

Scope of Program - Element 1

NUREG-1801 recommends the use of EPRI Report 1000701, *Interim Thermal Fatigue Management Guideline* (MRP-24), January 2001, for identifying piping susceptible to potential effects of thermal stratification or turbulent penetration. The DCPP risk-informed process examination requirements are performed consistent with EPRI TR-112657, *Revised Risk-Informed Inservice Inspection Evaluation Procedure*, Revision B, instead of EPRI Report 1000701. Guidelines for identifying piping susceptible to potential effects of thermal stratification or turbulent penetration that are provided in EPRI Report 1000701 are also provided in EPRI TR-112657. The recommended inspection volumes for welds in EPRI Report 1000701 are identical to those for inspection of thermal fatigue in RI-ISI programs; thus, the DCPP risk-informed process examination requirements meet the recommendations of NUREG-1801. The NRC accepted DCPP's use of EPRI TR-112657 in a letter to PG&E dated November 8, 2001.

Enhancements

None

Operating Experience

Operating experience at DCPP is evaluated and implemented to ensure ASME Code Class 1 small-bore pipes are maintained within acceptable limits. This is accomplished by promptly identifying and documenting (using the corrective action program) any conditions that indicate degradation. In addition, industry operating experience, self assessments and independent audits provide additional input to ensure that program effectiveness is maintained.

A review of plant-specific operating experience *identified two examples of* ~~indicates no~~ cracking ~~has been observed for~~ *in* ASME Code Class 1 small-bore pipe ~~butt~~ welds less than or equal to NPS 4. ~~Although not within the scope of this program, the~~ *The* following two examples identify weld cracking at DCPP:

1) A cracked weld coupling on a pressurizer level instrument capillary fill line evaluation concluded that the crack was due to a lack of fusion to the tubing and previous metal removal *resulting in fatigue cracking*. New tubing was installed.

2) A *1*~~4~~-inch excess letdown piping reducer segment socket weld showed a crack indication. The evaluation concluded that the likely cause was due to inter-granular stress corrosion cracking caused by sensitization of the base metal as a result of the initial weld process. The piping was replaced and a fatigue resistant weld was used.

Follow-up inspections at these locations have not identified any further evidence of weld cracking. This demonstrates the effectiveness of the DCPP Corrective Action program.

Inservice Inspection Reports for the Second Interval were reviewed for Unit 1 Refueling Outages 10, 11, 12 and 13 and Unit 2 Refueling Outages 10, 11, 12 and 13. There were no reportable indications for small-bore piping observed.

The DCPP operating experience findings for this program identified no unique plant specific operating experience; therefore DCPP operating experience is consistent with NUREG-1801. Should evidence of significant aging be revealed by the one-time inspection, periodic inspections will be implemented.

Based on a review of operating experience, cracking of ASME Code Class 1 small-bore pipe butt welds less than or equal to NPS 4 has not been observed. This provides confidence that the One-Time Inspection of ASME Code Class 1 Small-Bore Piping program is adequate to assure that aging of ASME Code Class 1 piping is not occurring and component intended functions will be maintained during the period of extended operation.

Conclusion

The continued implementation of the One-Time Inspection of ASME Code Class 1 Small-Bore Piping program provides reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B2.1.36 Metal Enclosed Bus

Program Description

The Diablo Canyon metal enclosed bus program manages aging of in-scope non-segregated phase and isolated phase bus.

The Metal Enclosed Bus program manages the aging effects of loose connections, embrittlement, cracking, melting, swelling, or discoloration of insulation, loss of material of bus enclosure assemblies, hardening of boots and gaskets, and cracking of internal bus supports to ensure that metal enclosed buses within the scope of license renewal are capable of performing their intended function. The Metal Enclosed Buses (MEBs) within the scope of this program are the MEBs that are used during station blackout recovery. DCPP is currently performing metal enclosed bus work order inspection activities in response to DCPP plant-specific operating experience. The scope of metal enclosed bus sections in the existing DCPP maintenance inspections include *non-segregated phase* bus sections *and isolated phase bus sections* that are- specifically included within the scope of license renewal due to being part of the station blackout recovery path and conservatively includes other metal enclosed sections whose failure could effect the station blackout recovery buses.

Prior to the period of extended operation and every 10 years thereafter, internal portions of in-scope *non-segregated phase* MEBs are visually inspected for cracks, corrosion, foreign debris, excessive dust buildup, and evidence of water intrusion. The bus insulation *on the non-segregated phase bus* is inspected for signs of embrittlement, cracking, melting, swelling, hardening or discoloration, which may indicate overheating or aging degradation. The internal bus supports are inspected for structural integrity and signs of cracks. The bus enclosure assemblies are inspected for loss of material due to corrosion and hardening of boots and gaskets.

Prior to the period of extended operation and every 10 years thereafter a sample of the in--scope *non-segregated phase* MEB accessible bolted connections ~~is~~ *are* checked for evidence of overheating. Contact resistance test or thermography is performed on a sample of the accessible connections. As an alternative to thermography or measuring connection resistance of bolted connections, for the accessible bolted connections that are covered with insulating material DCPP may use visual inspection of insulation material to detect surface anomalies, such as discoloration, cracking, chipping or surface contamination. If this alternative visual inspection is used to check bolted connections, the first inspection will be completed prior to the period of extended operation and every five years thereafter.

The acceptance criteria for thermography testing will be based on the temperature rise above the reference temperature. The reference temperature will be ambient temperatures or the baseline temperature data from the same type of connections being tested. When contact resistance testing is used the accepted value shall be based on the type of test used and the configuration of the connection. The acceptance criterion for insulation material covering bolted connections is the absence of heat related anomalies.

The isolated phase portion of the program manages the effects of cracking and loss of material of bus enclosure assemblies, hardening of gaskets, and cracking of internal bus supports to ensure that isolated phase metal enclosed buses within the scope of license renewal are capable of performing their intended function. The isolated phase bus does not have bus insulation installed.

Prior to the period of extended operation and every 10 years thereafter, internal portions of the in-scope isolated phase MEBs are visually inspected for cracks, corrosion, foreign debris, excessive dust buildup, and evidence of water intrusion. The internal bus supports are inspected for structural integrity and signs of cracks. The bus enclosure assemblies are inspected for loss of material due to corrosion and hardening of gaskets. The isolated phase segments are welded and not bolted.

Additional investigation and evaluation will be performed when the acceptance criteria are not met. Corrective actions may include but are not limited to cleaning, drying, increased inspection frequency, replacement, or repair of the affected MEB components. When an unacceptable condition or situation is identified, a determination will be made as to whether the same condition or situation is applicable to other accessible or inaccessible MEBs.

The MEB program is an inspection program. No actions are taken as part of this program to prevent or mitigate aging degradation. Trending actions are not included as part of this program because the ability to trend inspection results is limited.

NUREG-1801 Consistency

The Metal Enclosed Bus program is an existing program that, following enhancement, will be consistent with *exception* to NUREG-1801, Section XI.E4, Metal Enclosed Bus.

Exceptions to NUREG-1801

~~None~~*The bus segments are not wrapped with insulation or have boots, as is the non-segregated bus. Therefore, inspection of insulation and boots is not applicable. Most of the Isophase bus sections are welded together. Resistance checks or infrared inspections area not required for welded connections. There are 3 locations of bolted connections within the Isophase bus. These connections are inspected as part of Metal Enclosed Bus program. PG&E manages bolted connections at the ends of the isolated phase bus under the maintenance programs of the motor operated disconnect, the main unit transformers, and the auxiliary transformers. The bolted connections that are part of active components are not within the scope of this aging management program.*

Enhancements

Prior to the period of extended operation, the following enhancement will be implemented in the following program elements:

Scope of Program - Element 1, Preventive Actions - Element 3, Detection of Aging Effects - Element 4, Acceptance Criteria - Element 6 and Corrective Actions - Element 7

The existing bus work order inspection activities for inspection and testing of the MEBs will be proceduralized to include specific inspection scope, frequencies and actions to be taken when acceptance criteria are not met.

Operating Experience

Industry experience has shown that failures have occurred on metal enclosed buses caused by cracked insulation and moisture or debris buildup internal to the metal enclosed bus. Experience has also shown that bus connections in the metal enclosed buses exposed to appreciable ohmic heating during operation may experience loosening due to repeated cycling of connected loads. NRC Information Notice 2000-14, *Non-Vital Bus Fault Leads to Fire and Loss of Offsite Power* and Information Notice 89-94, *Electrical Bus Bar Failures* are examples of non-segregated bus duct failures.

NRC Information Notice 2000-14 discusses a 12 kV Bus fault that occurred on DCPP Unit 1. The corrective actions, in response to the event included:

- Replaced aluminum bus with copper
- Added Belleville washers to bolted connections. The washers are non-electroplated to preclude hydrogen embrittlement.
- Bus cleaning, micro-ohm testing and bolting retorque

A review of plant operating experience identified four instances of cracked welds in the 25 kV ~~iso-phase~~*isolated* ~~bus~~*phase bus* neutral enclosures and three instances of cracked, corroded or loose 4 kV bus supports. In addition, instances of Noryl insulation aging were identified during MEB work order inspection activities in the 4 kV bus and the 12 kV aluminum bus ducts that were found to be corroded. All deficiencies were repaired. A periodic bus inspection has been implemented to assure bus availability.

The DCPP operating experience findings for this program identified no unique plant specific operating experience; therefore DCPP operating experience is consistent with NUREG-1801.

Conclusion

The continued implementation of Metal Enclosed Bus program will provide reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

Table 3.6.2-1 Electrical and Instrument and Controls – Summary of Aging Management Evaluation – Electrical Components

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Metal Enclosed Bus (Enclosure)	*SS*	*Aluminum*	*Atmosphere/ Weather (Ext)*	*Loss of material*	*Aging Management Program for Metal Enclosed Bus (B2.1.36)*	*None*	*None*	*F*
Metal Enclosed Bus (Enclosure)	*SS*	*Aluminum*	*Plant Indoor Air (Ext)*	*Loss of material*	*Aging Management Program for Metal Enclosed Bus (B2.1.36)*	*None*	*None*	*F*

F *Material not in NUREG-1801 for this component.*

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
30	DCPP will monitor the corrosion of closed cooling water components by inspecting the condition of corrosion coupons installed in the system and perform internal inspections of select components within the systems. These methods will verify that wetted material exposed to the chemistry of the closed cooling water systems are not experiencing corrosion. The corrosion coupons are strips of metal (i.e. copper, carbon steel, stainless steel, etc) that are installed in the closed cooling water systems in a manner such that they are exposed to the cooling water. Periodically these coupons are removed and their condition can be evaluated. This inspection will provide DCPP indication if significant corrosion is occurring in the system. The material of these corrosion coupons is representative of most of the materials that are used in the system. For those components that do not have material represented by the corrosion coupons, internal inspections will be performed on those components, or other component with similar material, in order to monitor for corrosion.	B2.1.10	Prior to the period of extended operation