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AUTH.NAME AUTHOR AFFILIATION
RUEGER,G.M. Pacific Gas & Electric Co.
RECIP.NAME RECIPIENT AFFILIATION
Document Control Branch (Document Control Desk)

See Proposed Change To Tech Specs

SUBJECT: Forwards amends to licenses & TS,modifying SG tube plugging criteria in TS 3.4.5 & allowable leakage limit in TS 3.4.6.2.

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Pacific Gas and Electric Company

245 Market Street, Room 937-N9B
San Francisco, CA 94105
*Mailing Address*
Mail Code N9B
P.O. Box 770000
San Francisco, CA 94177
415/973-4684 Fax 415/973-2313

Gregory M. Rueger
Senior Vice President and
General Manager
Nuclear Power Generation

February 26, 1997

PG&E Letter DCL-97-034

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

Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyon Units 1 and 2
License Amendment Request 97-03
Voltage-Based Alternate Steam Generator Tube Repair Limit for Outside Diameter Stress Corrosion Cracking at Tube Support Plate Intersections

Dear Commissioners and Staff:

Enclosed is an application for amendment to Facility Operating License Nos. DPR-80 and DPR-82 for Units 1 and 2 of the Diablo Canyon Power Plant (DCPP). This License Amendment Request (LAR) will modify the steam generator (SG) tube plugging criteria in Technical Specification (TS) 3.4.5 and the allowable leakage limit in TS 3.4.6.2. These changes will allow implementation of voltage-based alternate SG tube plugging criteria for outside diameter stress corrosion cracking (ODSCC) at tube support plate (TSP) intersections.

The LAR complies with the guidance in Generic Letter (GL) 95-05, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking," August 3, 1995. Implementation of some of the GL recommendations requires supplemental clarification, and some of the GL recommendations are implemented using alternatives that require NRC review and approval. All clarifications and proposed alternate methodology are described and technically justified in Attachment D.

PG&E will implement voltage-based plugging criteria using the methodology described in WCAP-14277, Revision 1, "SLB Leak Rate and Tube Burst Probability Analysis Methods for ODSCC at TSP Intersections," January 1997. This document was submitted to the NRC on December 20, 1996, in support of voltage-based plugging criteria for the Donald C. Cook Nuclear Plant Unit 1. PG&E will use the burst data for 7/8-inch diameter tubing contained in the latest revision of the industry database approved by the NRC. The latest revision submitted to the NRC for approval is EPRI Topical Report NP-7480-L, Addendum 1, "Steam Generator Tubing Outside Diameter Stress Corrosion Cracking at Tube Support Plates Database for Alternate Repair Limits, 1996 Data Update," Final Report, November 1996.

060065

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This LAR is composed of one enclosure with four attachments. Attachment A provides a listing of the affected TS, background information, the safety evaluation, the no significant hazards evaluation and determination, and the environmental evaluation. Attachment B provides marked-up TS pages in accordance with Attachment 2 to GL 95-05. Attachment C provides proposed new TS pages. Attachment D provides PG&E's technical support document, which discusses compliance with the guidance contained in GL 95-05, along with clarifications and proposed alternate methodology.

PG&E plans to implement voltage-based alternate plugging criteria during the first refueling outage for either Unit 1 or Unit 2 following issuance of a license amendment by the NRC. The Unit 1 eighth refueling outage (1R8) is scheduled to begin on April 19, 1997, and the Unit 2 eighth refueling outage (2R8) is scheduled to begin in January 1998. PG&E does not believe that issuance of this license amendment will be necessary for Unit 1 startup after 1R8. However, PG&E notes that this license amendment, if approved, will prevent unnecessary steam generator tube plugging during 1R8. PG&E requests that NRC review the subject LAR on a medium priority and issue a license amendment as soon as is reasonably practical.

PG&E requests that the TS changes requested in this LAR be effective upon issuance of the license amendment, with the provision that PG&E implement the changes within 30 days.

Sincerely,

Gregory M. Rueger

cc: Edgar Bailey, DHS
Steven D. Bloom
James E. Dyer
Kenneth E. Perkins
Michael D. Tschiltz
Diablo Distribution

Enclosure

RLJ/2057

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# LICENSE AMENDMENT REQUEST

# VOLTAGE-BASED ALTERNATE STEAM GENERATOR TUBE REPAIR LIMIT FOR OUTSIDE DIAMETER STRESS CORROSION CRACKING AT TUBE SUPPORT PLATE INTERSECTIONS

## A. DESCRIPTION OF AMENDMENT REQUEST

The proposed amendment would revise Technical Specification (TS) 3/4.4.5 and 3.4.6.2 including associated Bases 3/4.4.5 and 3/4.4.6.2 to allow the implementation of steam generator tube voltage based repair criteria for outside diameter stress corrosion cracking (ODSCC) indications at tube to tube support plate (TSP) intersections. The allowed primary-to-secondary operational leakage from any one steam generator (SG) would be reduced from 500 gpd to 150 gpd.

This proposed amendment applies to DCPP Units 1 and 2.

The LAR incorporates the guidance in Generic Letter (GL) 95-05, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking," August 3, 1995. Implementation of some of the GL recommendations requires supplemental clarification, and some of the GL recommendations are implemented using alternatives which require NRC review and approval. All clarifications and proposed alternate methodology are described and technically justified in Attachment D.

Attachment A provides a listing of the affected TS, background information, the safety evaluation, the no significant hazards evaluation and determination, and the environmental evaluation. Attachment B provides marked-up TS pages in accordance with Attachment 2 to GL 95-05. Attachment C provides proposed new TS pages. Attachment D provides PG&E's technical support document which discusses compliance with the guidance contained in GL 95-05, along with clarifications and proposed alternate methodology.

The table below summarizes the TS revisions.

Table of Technical Specification Revisions

| Proposed TS | Summary Description of TS Change |
|---|---|
| 4.4.5.2b.4) | Added TS to require bobbin coil inspection of non-repaired indications subject to voltage-based repair criteria |
| 4.4.5.2d | Added TS to require 100 percent bobbin coil inspection of applicable tube support plate intersections |
| 4.4.5.4a.6) | Revised TS to exclude intersections subject to voltage-based repair criteria from the 40 percent plugging criterion. |
| 4.4.5.4a.10)a through 4.4.5.4a.10)e | Added TS to provide plugging limit acceptance criteria for intersections subject to voltage-based repair criteria. |
| 4.4.5.4b | Revised TS to be consistent with plugging limit acceptance criterion. |
| 4.4.5.5d.1) through 4.4.5.5d.5) | Added TS to provide reporting requirements for voltage-based repair criteria. |
| 3.4.6.2c | Revised TS to reduce primary-to-secondary operational leak limit from any one SG from 500 gpd to 150 gpd. Added notation regarding compliance in Modes 3 and 4. |
| 4.4.6.2.1f | Added TS surveillance requirement for determining primary-to-secondary leakage. |
| Bases 3/4.4.5 | Revised Bases to add basis for voltage-based repair limits. |
| Bases 3/4.4.6.2 | Revised Bases to add basis for reduced SG tube operational leakage limits. |

## B. BACKGROUND

The tubing of the steam generator constitutes more than one-half of the reactor coolant pressure boundary (RCPB). Design of the RCPB for purposes of structural and leakage integrity is a requirement under Title 10 of the Code of Federal Regulations Part 50 (10 CFR 50), Appendix A. Specific requirements governing the maintenance of steam generator tube integrity are in DCPP TS, Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (ASME Code), and Regulatory Guide 1.83. These include requirements for periodic inservice inspection of the tubing, flaw acceptance criteria (i.e., repair limits for plugging), and primary-to-secondary leakage limits. These requirements, coupled with the broad scope of plant

operational and maintenance programs, have formed the basis for ensuring adequate steam generator tube integrity.

SG tube plugging limits are specified in the Diablo Canyon Power Plant (DCPP) TS. The current DCPP TS require that flawed tubes be removed from service by plugging if the depths of the flaws are greater than or equal to 40 percent through-wall. The TS repair limits ensure that tubes accepted for continued service will retain adequate structural and leakage integrity during normal operating, transient, and postulated accident conditions, consistent with General Design Criteria (GDCs) 14, 15, 30, 31, and 32 of 10 CFR 50, Appendix A. Structural integrity refers to maintaining adequate margins against gross failure, rupture, and collapse of the steam generator tubing. Leakage integrity refers to limiting primary-to-secondary leakage to within acceptable limits.

The traditional strategy for achieving the objectives of the GDCs related to steam generator tube integrity has been to establish a minimum wall thickness requirement in accordance with the structural criteria of Regulatory Guide (RG) 1.121, "Bases for Plugging Degraded PWR Steam Generator Tubes." Development of minimum wall thickness requirements to satisfy RG 1.121 was governed by analyses for uniform thinning of the tube wall in the axial and circumferential directions. The assumption of uniform thinning results in development of a repair limit that is conservative for all flaw types occurring in the field. The resultant 40 percent depth-based repair limit incorporated into the DCPP TS is conservative for highly localized flaws such as pits, short cracks, and in particular ODSCC that occurs at TSPs.

NRC GL 95-05 was issued by the NRC on August 3, 1995. The GL provides guidance on the implementation of an alternate repair criterion to be applied to predominantly axially oriented ODSCC at TSP locations. This criterion does not set limits on the depth of ODSCC indications to ensure tube integrity margins; instead, it relies on correlating the eddy current voltage amplitude from a bobbin coil probe with the more specific measurement of burst pressure and leak rate to ensure structural and leakage integrity for all postulated design basis events. Since the voltage-based repair criteria do not incorporate minimum wall thickness requirements, there is a possibility that tubes with up to 100 percent through-wall cracks can remain in service. Because of the increased potential for through-wall cracks, the voltage-based repair criteria include provisions for augmented steam generator tube inspections and more restrictive operational leakage limits.

C. JUSTIFICATION

Existing DCPP TS 4.4.5.4a.6), Plugging Limit, requires that tubes with imperfections greater than or equal to 40 percent of the tube wall thickness be

removed from service. Over the operating life of the SGs, this criterion would result in unnecessarily plugging significant numbers of SG tubes affected with ODSCC at TSP intersections. Unnecessarily plugged tubes reduce SG heat removal capability in both accident conditions and normal operations. The proposed amendment would preserve the reactor coolant flow margin and reduce the occupational radiation exposure that would otherwise be incurred by plant workers involved in tube plugging operations. Other benefits of not plugging ODSCC indications that meet the voltage-based repair criteria would be a reduction in man-hours required for tube plugging, potential impact to critical path time, and time the SG is open to the containment environment during refueling outages.

PG&E's goal is to prolong SG life over the remaining plant life. The goal is best achieved by proactive measures that defer or eliminate the need to replace SGs. SG replacement results from the loss of reactor coolant system flow margin due to tube plugging. Accordingly, the proposed amendment to implement voltage-based repair criteria would prolong SG life and reduce personnel exposure while maintaining the SG plugging margin.

D. SAFETY EVALUATION

PG&E's proposed voltage-based repair program incorporates the guidance in GL 95-05. Detailed discussion of PG&E's compliance to GL 95-05 is provided in Attachment D of this LAR. Implementation of some of the GL recommendations require supplemental clarification, and some of the GL recommendations are implemented using alternatives which require NRC review and approval. All clarifications and alternate methodology are described and technically justified in Attachment D.

PG&E's proposed voltage-based repair program implements the requirements specified in GL 95-05. The specific voltage-based repair criteria implementation requirements are listed below.

1. PG&E will implement the applicability requirements specified in GL 95-05. The GL 95-05 voltage-based repair criteria are applicable to DCPP Units 1 and 2 because the Westinghouse-designed steam generators have 7/8-inch diameter alloy 600 tubes and drilled-hole TSPs. The repair criteria will only be applied to predominantly axially oriented ODSCC confined within the tube-to-TSP intersection.

   Certain intersections located near the wedges of the SGs will be excluded from application of the voltage-based repair criteria. In addressing the combined effects of a loss of coolant accident (LOCA) and safe shutdown earthquake (SSE) on the SGs, as required by GDC 2, it has been

determined that tube collapse may occur in the SG at some plants. This is the case at DCPP Units 1 and 2 based on analysis for a large break LOCA plus SSE documented in Westinghouse letter to PG&E dated September 3, 1992, "Deformation of Steam Generator Tubes Following a Postulated LOCA and SSE Event." The TSP may become deformed as a result of lateral loads at the wedge supports at the periphery of the TSPs due to the combined effects of the LOCA rarefaction wave and SSE loadings. The resulting primary-to-secondary pressure differential on the deformed tubes may cause some of the tubes to collapse. The Westinghouse analysis identifies a maximum of 7.5 percent of tubes per SG that are subject to potential collapse during combined LOCA and SSE. These tubes are located adjacent to the SG wedge regions.

There are two concerns associated with SG tube collapse. First, the collapse of SG tubing reduces the RCS flow area through the tubes. The reduction in flow area increases the resistance to flow of steam from the core during a LOCA which, in turn, may potentially increase peak cladding temperature (PCT). A PCT penalty of 30 degrees has been applied to the DCPP Units 1 and 2 large break LOCA analysis to compensate for 7.5 percent tube collapse and RCS flow reduction. LOCA analyses support 15 percent steam generator tube plugging, in addition to the 7.5 percent potential tube collapse for the LOCA plus SSE event. No additional tube plugging margin is required to compensate for potential tube collapse.

Second, there is the potential that through-wall degradation in tubes could sufficiently enlarge during tube deformation or collapse, causing in-leakage of secondary water back to the core which dilutes the poisoning effect of boron injection from the emergency cooling system.

To reduce the likelihood that cracked tubes in the wedge region would be subjected to collapse loads, enhanced eddy current inspection requirements have been established at DCPP Units 1 and 2 at these locations. Tubes in the wedge region exclusion zone are inspected by bobbin coil every outage. If degradation is identified at the wedge region support plate intersection by the bobbin coil, then the intersection is inspected by rotating pancake coil (RPC) and the tube would be plugged upon confirmation of any crack-like indication.

2. PG&E will implement eddy current inspection criteria in accordance with GL 95-05, with clarifications described in Appendix D to this LAR. The inspection criteria ensures that the techniques used to inspect the steam generator tubes are consistent with the techniques used to develop the voltage-based repair criteria. PG&E's clarifications to the GL guidance are summarized as follows. Because of the very large population of greater

than or equal to 5 volt dented intersections in Unit 1, PG&E will focus on inspecting those dents at the lower hot leg TSP intersections where primary water stress corrosion cracking (PWSCC) indications have been previously detected. In addition, for both units, PG&E will RPC inspect all less than 5 volt dented intersections having bobbin indications that could remain in service under voltage-based repair criteria. The purpose of this RPC inspection is to verify that voltage-based repair criteria will not be applied to tubes containing either PWSCC or circumferential cracks at TSP intersections because the repair criteria in GL 95-05 apply only to predominately axially oriented cracks caused by ODSCC. Finally, because PWSCC (axial and circumferential) indications at dented TSP intersections have been previously detected in the DCPP Units 1 and 2 SGs, PG&E has an augmented inspection program in place to detect PWSCC at less than 5 volt dented TSP intersections.

3. PG&E will implement the voltage-based repair limits in accordance with GL 95-05. The voltage-based repair limits in GL 95-05 were determined considering the entire range of design basis events that could challenge tube integrity. The voltage-based repair criteria ensure structural and leakage integrity for all postulated design basis events.

   PG&E will use the latest NRC-approved database for application of the voltage-based repair limits. The voltage repair limits for axial ODSCC indications are defined as follows:

   - Indications less than or equal to 2.0 volts, the lower voltage repair limit, as measured by bobbin coil, will remain in service, independent of RPC confirmation. This lower voltage repair limit should preclude end of cycle (EOC) indications from growing in excess of the structural limit. The structural limit for 7/8-inch diameter tubing is 8.7 volts based on the current industry database (EPRI Topical Report NP-7480-L, Addendum 1). This 2.0 volt repair limit is very conservative because it contains a large safety margin of 5.25 volts, deterministically calculated as follows:

     The NDE uncertainty to be applied is 20 percent in accordance with GL 95-05. Because of the low number of ODSCC indications at DCPP, the average growth rate allowance to be applied is 30 percent per effective full power year (EFPY) in accordance with GL 95-05. It is reasonable to assume that 30 percent growth bounds DCPP Units 1 and 2 because it envelopes all domestic plants with 7/8-inch tubing. Near term operating cycles at DCPP are expected to be 21 months, or 1.75 EFPY. Therefore, a 52.5 percent growth component is appropriate.

Adding these allowances to the 2.0 volt repair limit results in a projected EOC indication of 3.45 volts. Therefore, a 5.25 volt safety margin exists, which is the difference between the 8.7 volt structural limit and the 3.45 volt projected EOC indication.

- Indications greater than 2.0 volts and less than or equal to the upper voltage repair limit (URL), as measured by bobbin coil, will remain in service if RPC inspections do not confirm the indications. The methodology for calculating the URL is specified in GL 95-05. An URL of 5.0 volts is calculated by subtracting the NDE uncertainty and growth rate allowances from the structural limit. 5.0 volts is the appropriate repair limit for bobbin indications that are not confirmed by RPC. Tubes with bobbin indications greater than or equal to 5.0 volts will be repaired. The URL value will be updated as appropriate to apply the structural limit from the latest NRC-approved database.

- Indications greater than 2.0 volts and less than or equal to the URL, as measured by bobbin coil, that are confirmed by RPC, and indications greater than the URL, as measured by bobbin coil, will be repaired.

4. Following each inspection, PG&E will calculate the primary-to-secondary leakage for degradation subjected to the voltage repair criteria under worst-case postulated main steam line break (MSLB) conditions using (a) Monte Carlo analysis techniques according to GL 95-05 guidance and WCAP-14277 Revision 1 methodology and (b) the latest NRC-approved database. This leakage will be added to leakage from any other tube degradation left in service under separate alternate repair criteria. The total calculated leak rate will be compared to the maximum allowable leak rate limit to ensure that a postulated MSLB occurring at EOC would not result in radiological consequences that are in excess of the applicable offsite and control room dose guidelines of 10 CFR 100 and GDC 19, respectively.

   PG&E has performed a radiological dose analysis, using currently accepted licensing basis assumptions, to establish the limiting maximum primary to secondary MSLB leak rate in a DCPP steam generator faulted loop. This bounding leak rate has been calculated to be 12.8 gpm, based on the DCPP TS allowable RCS iodine activity level of 1.0 microcuries per gram dose equivalent I-131 and the recommended Iodine-131 transient spiking values consistent with NUREG-0800 (NRC Standard Review Plan 15.1.5).

5. Following each inspection, PG&E will calculate the conditional burst probability for degradation subjected to the voltage repair criteria under worst-case postulated MSLB conditions using (a) Monte Carlo analysis techniques according to GL 95-05 guidance and WCAP-14277, Revision 1 methodology and (b) the latest NRC-approved database. This calculation will assess the voltage distribution for the next cycle of operation and the results will be compared against a threshold value of $1 \times 10^{-2}$ to provide assurance of acceptable structural integrity.

6. PG&E will implement reduced operational leakage limits as recommended in GL 95-05. PG&E will revise the TS to implement a maximum leakage rate of 150 gpd for any one SG to help preclude the potential for excessive leakage during power operation in Modes 1 and 2. Also, a TS surveillance requirement will be added to specify that SG primary-to-secondary leakage will be determined at least once per 72 hours, except when source term and mass flowrates are changing. For changing conditions, an evaluation of primary-to-secondary leakage will be performed within 48 hours after stable conditions are established, which is the approximate time it takes for the radionuclides to stabilize. The TS has also been changed to specify that the 150 gpd leak limit is not a limiting condition for operation in Modes 3 and 4. As noted in EPRI TR-104788, "the 150 gpd leak rate per steam generator has been established for normal operation." This leakage rate provides added assurance against tube rupture at normal and faulted conditions. During power operation (Modes 1 and 2), the source term is relatively high and leakage can be accurately determined. In Modes 3 and 4, there is less differential pressure across the tube and the potential source term from a tube failure is much less than in Modes 1 and 2. Because the source term is much lower, the leakage determination is more uncertain. However, because the source term is low in Modes 3 and 4, the accuracy with which the leakage can be measured is of lesser importance than in Modes 1 and 2.

   The primary-to-secondary operational leakage limit of 150 gpd for any one SG is more restrictive than the current TS limits, which are 1 gpm for all SGs and 500 gpd for any one SG. The operational leak rate monitoring program is a defense-in-depth measure that provides a means for identifying leaks during power operation to allow for repair before such leaks can result in tube failure.

   The RG 1.121 criterion for establishing operational leakage rate limits that require plant shutdown is based on leak-before-break considerations to detect a free-span crack before potential tube rupture during faulted plant conditions. It is conservatively assumed that the entire crevice region is uncovered during the secondary side blowdown following a MSLB. In

reality, the proximity of the TSP will prevent excessive tube leakage. The 150 gpd limit is intended to provide for leakage detection during power operation and plant shutdown in the event of an unexpected crack propagation resulting in excessive leakage. The 150 gpd limit provides increased confidence that plant shutdown will occur prior to a crack reaching critical degradation lengths.

PG&E's primary-to-secondary leakage monitoring program is in compliance with the current industry guidelines contained in EPRI topical report TR-104788, "PWR Primary-to-Secondary Leak Guidelines," May 1995. Plant shutdown limits are in compliance with the Action Level 2 plant shutdown limits in the EPRI guidelines (i.e., leakage greater than or equal to 150 gpd or leak rate increasing at greater than 60 gpd per hour). PG&E's measures ensure that should a significant leak occur during power operation, it will be detected and the plant will be shutdown in a timely manner to reduce the likelihood of a potential tube rupture. The measures also ensure the timely detection, trending, and response to rapidly increasing leaks.

The 150 gpd leak rate limit, together with limiting the number of tubes that may remain in service under voltage-based repair criteria, helps to ensure that the dose contribution from tube leakage will be limited to less than the dose guideline values of 10 CFR 100 and GDC 19 for postulated faulted events.

7. PG&E will pull tubes in accordance with GL 95-05, with an alternative for DCPP Unit 1 as described in Attachment D of this LAR. Specifically, based on tube pulls performed in 1R7, it is concluded that the DCPP Unit 1 OD crack morphology is typical of the industry database. It is PG&E's intent to use the 1R7 removed tubes and morphology verification to postpone further tube intersection removals until 1R9, scheduled for January 1999, on the basis that the expected indications in 1R8 will be small and would not contribute significantly to the industry database. However, if bobbin indications greater than 3 volts in pullable tube locations are found during the 1R8 inspection and confirmed by RPC, then the largest indication, along with at least one other intersection, will be removed to support the industry database.

8. PG&E will implement the reporting requirements specified in GL 95-05. Because GL 95-05 allows PG&E to implement voltage-based repair criteria on a continuing basis after the NRC Staff has approved this LAR, PG&E will provide notifications to the NRC Staff to enable assessment of PG&E's implementation of voltage-based repair criteria.

In summary, PG&E will perform an enhanced inspection of tubes at the TSP intersections; use NDE data acquisition and analysis procedures that are consistent with the methodology used to develop the voltage-based repair criteria; repair tubes that exceed the voltage limits; determine the beginning-of-cycle (BOC) voltage distribution; project the end-of-cycle (EOC) voltage distribution; calculate both the primary-to secondary leakage and conditional burst probability under postulated accident conditions using the projected EOC voltage distribution; reduce operational leakage limits; pull tubes to verify degradation morphology; and implement reporting requirements.

Based on the implementation of these practices, in conjunction with preserving reactor coolant flow margin and reducing occupational radiation exposure by not unnecessarily plugging tubes, the proposed TS change to allow application of voltage-based repair criteria will not adversely affect the health and safety of the public.

E. NO SIGNIFICANT HAZARDS EVALUATION

PG&E has evaluated the no significant hazards considerations involved with the proposed amendment, focusing on the three standards set forth in 10 CFR 50.92(c):

> *"The commission may make a final determination, pursuant to the procedures in paragraph 50.91, that a proposed amendment to an operating license for a facility licensed under paragraph 50.21(b) or paragraph 50.22 or for a testing facility involves no significant hazards considerations, if operation of the facility in accordance with the proposed amendment would not:*
>
> *(1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or*
>
> *(2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or*
>
> *(3) Involve a significant reduction in a margin of safety."*

The following evaluation is provided for the no significant hazards considerations.

1. *Does the change involve a significant increase in the probability or consequences of an accident previously evaluated?*

Structural Integrity Considerations

The structural criteria ensure that all indications subjected to voltage-based repair limits will be able to withstand pressure loading consistent with the criteria of NRC Regulatory Guide (RG) 1.121.
Tube burst criteria are inherently satisfied during normal operating conditions because of the proximity of the tube support plate (TSP). It is conservatively assumed that the entire crevice region is uncovered during the secondary side blowdown of a main steam line break (MSLB). Therefore, during a postulated MSLB accident, tube burst capability must exceed the RG 1.121 criterion requiring a margin of 1.43 times the steam line break pressure differential on tube burst.

Based on the latest industry database, the RG 1.121 criterion is satisfied by bobbin coil indications of outside diameter stress corrosion cracking (ODSCC) with signal amplitudes less than 8.7 volts. The latest NRC-approved database will be used for repair and analysis applications.

Industry testing of model boiler and operating plant tube specimens for free-span tubing (no tube support plate (TSP) restraint) at room temperature conditions show typical burst pressures in excess of 5,000 psi for ODSCC indications with voltage measurements at or below 8.7 volts. This tube burst capability exceeds the RG 1.121 criterion.

The lower voltage repair limit is conservatively defined to be 2.0 volts in accordance with NRC Generic Letter (GL) 95-05, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking," August 3, 1995. This 2.0 volt repair limit is very conservative because it contains a large safety margin, based on a structural limit of 8.7 volts. A maximum allowable upper repair limit (URL) is also established using the guidance of GL 95-05. The URL is calculated before each inspection by subtracting the NDE uncertainty and growth rate allowances from the current structural limit. The URL for near term inspections at DCPP Units 1 and 2 is expected to be about 5.0 volts. Bobbin indications greater than 2.0 volts and less than or equal to 5.0 volts that are confirmed by RPC will be repaired. Bobbin indications greater than 5.0 volts will be repaired.

Following each inspection, burst probability analyses are performed for the end of cycle (EOC) distribution. In accordance with GL 95-05, the projected MSLB burst probability must be less than the threshold value of $1 \times 10^{-2}$.

Based on the relatively small number and voltages of ODSCC indications identified to date at DCPP Units 1 and 2, it is expected that the near term EOC conditional burst probability for a faulted SG will be much less than this threshold value, providing further assurance of acceptable structural integrity.

Leakage Considerations

PG&E will implement reduced operational leakage limits as recommended in GL 95-05. PG&E will revise the TS to implement a maximum leakage rate of 150 gpd for any one SG to help preclude the potential for excessive leakage during power operation in Modes 1 and 2. The TS has also been changed to specify that the 150 gpd leak limit is not necessarily a limiting condition for operation in Modes 3 and 4. The 150 gpd leak rate per steam generator has been established for normal operation. This leakage rate provides added assurance against tube rupture at normal and faulted conditions. In Modes 3 and 4, there is less differential pressure across the tube and the potential source term from a tube failure is much less than in Modes 1 and 2. The operational leak rate monitoring program is a defense-in-depth measure that provides a means for identifying leaks during power operation to allow for repair before such leaks can result in tube failure. The leakage criteria ensure that for indications subjected to voltage-based repair criteria, induced leakage under worst-case MSLB conditions will not result in offsite and control room dose releases that exceed the applicable guideline values of 10 CFR 100 and GDC 19.

Relative to the expected leakage during accident condition loadings, a postulated MSLB outside of containment, but upstream of the main steam isolation valve (MSIV), represents the most limiting radiological condition for implementation of voltage-based repair criteria. The steam generator tubes are subjected to an increase in differential pressure following a MSLB, resulting in a postulated increase in leakage and associated offsite doses. Leakage following a MSLB bypasses containment.

PG&E will calculate the primary-to-secondary leakage for degradation subjected to the voltage repair criteria under worst-case postulated MSLB conditions. The leak rate will be compared to the maximum allowable leak rate limit of 12.8 gpm to ensure that a postulated MSLB occurring at EOC would not result in radiological consequences that are in excess of the applicable offsite and control room dose guidelines of 10 CFR 100 and GDC 19. Based on the relatively small number of ODSCC indications identified to date at DCPP Units 1 and 2, it is expected that the near term EOC predicted leak rates for a faulted SG will be much less than the maximum allowable leak rate limit.

Therefore, based on the structural integrity and leakage considerations discussed above, the proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. *Does the change create the possibility of a new or different kind of accident from any accident previously evaluated?*

Implementation of the proposed voltage-based repair criteria for ODSCC at TSP intersections does not introduce any significant change to the plant design basis. Use of the criteria does not create a mechanism which could result in an accident in the free span because the repair criteria do not apply to tubes containing ODSCC located outside the thickness of the TSPs. Based on the burst probability acceptance limit of $1 \times 10^{-2}$, it is expected that for all plant conditions, neither a single nor multiple tube rupture event would likely occur in a steam generator where voltage-based repair criteria have been applied.

Steam generator tube integrity is continually maintained through inservice inspection and primary-to-secondary leakage monitoring. Any tubes with ODSCC degradation in excess of the URL are repaired.

Therefore, the proposed changes do not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. *Does the change involve a significant reduction in a margin of safety?*

The use of the bobbin probe to disposition ODSCC degraded tubes within TSP intersections by voltage-based repair criteria is demonstrated to maintain SG tube integrity in accordance with the requirements of RG 1.121. RG 1.121 describes a method acceptable to the NRC Staff for meeting GDCs 14, 15, 31, and 32 by reducing the probability or the consequences of SG tube rupture. This is accomplished by determining the limiting conditions of degradation of SG tubing, as established by inservice inspection, for which tubes with unacceptable degradation are removed from service. Upon implementation of the voltage-based repair criteria, even under the worst case conditions, the occurrence of ODSCC at TSP intersections is not expected to lead to a SG tube rupture during normal or faulted plant conditions, nor is it expected to lead to unacceptable primary-to-secondary leakage.

In addressing the combined effects of a loss of coolant accident (LOCA) and safe shutdown earthquake (SSE) on the SGs, as required by GDC 2, it has been determined that tube collapse may occur based on analysis for a large break LOCA plus SSE. The analysis identifies a maximum of 7.5 percent of

tubes per SG located adjacent to wedge regions that are subject to potential collapse during combined LOCA and SSE. Tubes located in the wedge region exclusion zone will be excluded from application of voltage-based repair criteria. Thus, existing tube integrity requirements apply to these tubes and the margin of safety is not reduced.

Implementation practices using voltage-based repair criteria bounds RG 1.83 considerations. Specifically, GL 95-05 requires the following: (1) enhanced eddy current inspection guidelines are implemented to provide consistency in voltage normalization; (2) 100 percent bobbin coil inspections are performed each cycle for all hot leg TSP intersections and all cold leg TSP intersections down to the lowest cold leg TSP with known ODSCC indications; and (3) rotating pancake coil (RPC) inspection of indications greater than 2 volts are performed to characterize the principal degradation as ODSCC. DCPP's proposed voltage-based repair criteria implementation practices meet the above requirements, and in some areas exceed them (for example, 100 percent bobbin coil inspections are routinely performed each cycle on every TSP intersection).

Implementation of voltage-based repair criteria at TSP intersections will decrease the number of tubes which must be repaired. Since the installation of tube plugs to remove ODSCC degraded tubes from service reduces RCS flow margin, voltage-based repair criteria implementation will help preserve the margin of RCS flow.

Therefore, the proposed changes do not involve a significant reduction in a margin of safety.

F. NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

Based on the above safety evaluation, PG&E concludes that the changes proposed by this LAR satisfy the no significant hazards consideration standards of 10 CFR 50.92(c), and accordingly a no significant hazards finding is justified.

G. ENVIRONMENTAL EVALUATION

PG&E has evaluated the proposed changes and determined the changes do not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed changes meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), an environmental assessment of the proposed change is not required.