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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 129 TO FACILITY OPERATING LICENSE NO. NPF-10

AND AMENDMENT NO. 118 TO FACILITY OPERATING LICENSE NO. NPF-15

SOUTHERN CALIFORNIA EDISON COMPANY

SAN DIEGO GAS AND ELECTRIC COMPANY

THE CITY OF RIVERSIDE, CALIFORNIA

THE CITY OF ANAHEIM, CALIFORNIA

SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 AND 3

DOCKET NOS. 50-361 AND 50-362

1.0 INTRODUCTION

By letter dated December 30, 1992, as supplemented by letters dated September 7, 1993, August 17, 1994, and March 7, 1996, Southern California Edison Company, et al. (SCE or the licensee) submitted a request for changes to the Technical Specifications (TS) for San Onofre Nuclear Generating Station (SONGS), Unit Nos. 2 and 3. The proposed changes would add a new TS 3/4.7.3.1, "Component Cooling Water (CCW) Safety Related Makeup System," and its associated Bases. The new TS will ensure that sufficient CCW capacity is available for continued operation of safety-related equipment during normal conditions and design-basis events.

The September 7, 1993, August 17, 1994, and March 7, 1996, letters provided clarifying information and did not change the initial no significant hazards consideration determination published in the Federal Register on March 3, 1993 (58 FR 12268).

2.0 BACKGROUND

Makeup to the CCW system at SONGS is normally supplied by the non-safety-related nuclear service water system. In the event of a safe-shutdown earthquake (SSE), normal nuclear service water makeup is assumed to be unavailable. The current SONGS accident analysis credits being able to provide Seismic Category I makeup water from Seismic Category I fire tankers via hose connections to the CCW surge tanks. In 1988, a Safety System Functional Inspection (SSFI) at SONGS assessed the operational readiness of the CCW system and salt water cooling system under normal and analyzed accident conditions. As a result of NRC concerns regarding the operability of the CCW system, the licensee conducted an assessment of the system. The licensee identified a number of concerns with the fire truck makeup water supply regarding flow and pressure controls, potential radiation exposure during hookup, and an alternate hookup location. The licensee committed to provide a dedicated safety-related Seismic Category I source of emergency makeup water for the CCW system. In accordance with this commitment, the licensee upgraded the existing primary plant makeup storage (PPMU) tanks to Seismic Category I, Quality Class II tanks during the Units 2 and 3 Cycle 7 refueling outages. The PPMU tanks will become a part of the CCW safety-related makeup system.

The CCW safety-related makeup system for each unit will consist of one PPMU tank and two redundant flow paths. Each flow path incorporates one 100-percent capacity pump. The tanks receive demineralized makeup water from the nuclear service water system. The CCW safety-related makeup system is designed to provide each critical loop of CCW with adequate makeup for seven days under design-basis events.

By application dated December 30, 1992, the licensee proposed the addition of TS 3/4.7.3.1, "Component Cooling Water Safety Related Makeup System." By letters dated September 7, 1993, August 17, 1994, and March 7, 1996, the licensee provided the analysis summary of the PPMU tank upgrade to support the NRC review of the proposed TS change.

3.0 EVALUATION

3.1 Evaluation of Proposed Technical Specifications Changes

The licensee has proposed to include a new TS 3/4.7.3.1, "Component Cooling Water Safety Related Makeup System," and its associated Bases in the TS for SONGS Units 2 and 3. The purpose of this TS is to ensure that sufficient inventory is maintained in the PPMU tanks during plant operation. The required level will be based on CCW system leak rate, unrecoverable volume in the tanks, and total loop uncertainty in the tank level instrumentation.

The proposed new Limiting Condition for Operation (LCO) will read:

> Two trains of Component Cooling Water (CCW) Safety Related Makeup System shall be OPERABLE with a contained volume in the Primary Plant Makeup Storage Tank at or above the level specified in Figure 3.7-2.

Figure 3.7-2, "Total Allowable CCW Leakage Versus the PPMU Tank Level" represents a 7-day supply of makeup water at a specific allowable leakage rate from the CCW system. The required water level shown in Figure 3.7-2 is based on the associated leak rate from the CCW system, an unrecoverable volume and a level instrumentation total loop uncertainty. The NRC Standard Review Plan (SRP), Section 9.2.2, specifies that a Seismic Category I source provide makeup water for at least 7 days of potential CCW leakage. The proposed TS is in accordance with SRP Section 9.2.2 and is acceptable. The LCO will apply to Modes 1, 2, 3, and 4. Since this is a support system to the CCW system, it must be operable during all modes that CCW is required to be operable.

TS 3/4.7.3 requires the CCW to be operable during Modes 1, 2, 3, and 4. Therefore, the applicability statement is acceptable.

The proposed Action a. for TS 3/4.7.3.1 will read:

> With one CCW Safety Related Makeup flow path inoperable, restore the flow path to OPERABLE status within 7 days.

The seven day allowed outage time (AOT) is acceptable based on the redundant capability of the operable CCW safety-related makeup flow path, and because it is consistent with the AOTs of other systems of equal safety significance.

The proposed Action b. for TS 3/4.7.3.1 will read:

> With the Primary Plant Makeup Storage Tank level less than that required by Figure 3.7-2 and/or both CCW Safety Related Makeup flow paths inoperable, restore the Primary Plant Makeup Storage Tank level and one CCW Safety Related Makeup flow path to OPERABLE status within 8 hours.

If the level in the tank decreases below that in Figure 3.7-2, then insufficient water will be available in the tank to support operation of two CCW critical loops for seven days. This condition is similar to the loss of both CCW safety-related makeup system flow paths. The allowed time of eight hours to either restore the PPMU tank level or restore one CCW safety-related makeup flow path is acceptable based on operating experience and because it is consistent with the AOTs of other systems of equal safety significance.

The proposed Action c. for TS 3/4.7.3.1 will read:

> With Actions a or b, above, not completed in the specified action times, be in HOT STANDBY within the next 6 hours, and be in COLD SHUTDOWN within the following 24 hours.

If Actions a or b cannot be completed in the allowed outage time, then the system must be placed in a mode for which the LCO does not apply. To achieve this status, the unit must be in at least hot standby within 6 hours and in cold shutdown within 24 hours. These times are consistent with the LCOs of other systems of equal safety significance, and are acceptable.

The proposed Action d. for TS 3/4.7.3.1 will read:

> The provisions of Specification 3.0.4 are not applicable.

TS 3.0.4 requires that mode changes may not be made unless the conditions of the LCO are met without relying on provisions contained in the action statements. The exception from TS 3.0.4 gives the licensee more flexibility to change modes while performing the required actions. It should be noted that the CCW safety-related makeup system is only required to support the CCW system in the event of a design-basis earthquake. Changing modes has no effect on the probability of an event occurring which would require the use of the CCW safety-related makeup system. Therefore, the exception is acceptable.

The proposed Surveillance Requirement 4.7.3.1.1 will read:

> The Primary Plant Makeup Storage Tank shall be demonstrated OPERABLE at least once per 7 days by verifying the contained water volume is within its limits.

The seven day frequency is identical to similar surveillance requirement frequencies and is acceptable. In addition, other indications in the control room, including alarms, would alert the operators to abnormal PPMU tank level deviations.

The proposed Surveillance Requirement 4.7.3.1.2 will read:

> Each CCW Safety Related Makeup flow path shall be demonstrated OPERABLE at least once per 92 days by testing the CCW makeup pumps pursuant to Specification 4.0.5.

This surveillance requires that the pumps be tested in accordance with the inservice testing program based on the ASME Code, Section XI and is acceptable. The licensee has included these pumps in the ASME Code Section XI testing program.

The proposed Surveillance Requirement 4.7.3.1.3 will read:

> Measure CCW leakage at least once per refueling interval.

This surveillance requirement measures CCW leakage to ensure that the PPMU tank level is in accordance with Figure 3.7-2. Because this measurement can only be performed when one loop of CCW is removed from service, it must be performed during refueling outages. Figure 3.7-2 provides the minimum required PPMU tank level as a function of CCW system leakage from 0 to 18 gpm. In 1984, the licensee reassessed the maximum design basis leakage from the CCW system and concluded that six gpm was the maximum expected leakage. In its CCW system operability assessment dated December 1988, the licensee concluded that its existing method of monitoring surge tank levels was adequate to detect significant system leakage. In addition, a surge tank low-level alarm would notify operators to a low surge tank level which may indicate CCW system leakage. Therefore, verifying the leakage rate on a refueling outage frequency is acceptable.

The licensee's March 7, 1996, submittal provided the proposed TS changes in the new improved TS format that will be implemented by August 9, 1996. The staff has reviewed these changes to the improved TS, and finds them consistent with the proposed changes to the current TS. Therefore the proposed changes to the improved TS are acceptable.

3.2 Evaluation of Upgrades to the Primary Plant Make-up Storage Tanks

The PPMU storage tanks are designated as T-056 for Unit 2 and T-055 for Unit 3. Each tank is located inside an enclosed room in their respective unit's auxiliary building. The PPMU tanks have an inside diameter of 40 feet and are

34 feet high with a capacity of 303,500 gallons. The tanks are constructed of stainless steel SA 240-304 plates and are anchored to the foundation by 36 equally spaced anchor bolts (34 additional anchor bolts were added as part of the Seismic Category I modification). The anchor bolt chair material is A-36. The tank wall plate thickness is 3/16-inch at the top of the tank and 5/16-inch near the base. The roof and bottom plate are both 1/4-inch thick. The concrete base is reinforced by #18 size reinforcing bars (rebars). The rebars are 2.257 inches in diameter and are separated by a 16-inch center-to-center distance. The combined weight of the tank roof and the cylindrical shell is 53,077 pounds.

The PPMU tanks were originally designed to American Petroleum Institute (API) 620 Standard, 5th edition, constructed and tested to API-650 Standard, 5th edition, and classified as Seismic Category II and Quality Class III components. These tanks were upgraded with physical modifications to meet the requirements of Seismic Category I, Quality Class II, and American Society of Mechanical Engineers (ASME) Section III Class 3 Code with the exception of the N-stamp and Code inspection.

By letters dated September 7, 1993, August 17, 1994, and March 7, 1996, the licensee provided its analysis of the PPMU tank upgrade for both units. The analysis has three main sections; an ASME code reconciliation, a seismic modification/analysis to Seismic Category 1, and, because of the weld flaws observed during the tank modification process, a fracture mechanics analysis to evaluate the impact of these weld flaws. Each of these areas are discussed more fully below.

3.2.1 ASME Section III Code Reconciliation

The licensee reconciled the requirements for the materials, design, fabrication, installation, examination, testing, inservice inspection (ISI), overpressure protection, and welding of the API 650 Standard, 5th Edition with those of the ASME Boiler and Pressure Vessel Code, Section III, 1989 Edition, no Addenda. The major areas of the code reconciliation are summarized below:

<u>Materials Requirements</u>

Article ND 2000 of Section III to the ASME Code and API-650, Section 2 discuss the requirements for materials used in the PPMU tanks. The licensee states that the requirements are very similar except that the ASME Code requires certified material test reports (CMTRs). The licensee stated the following regarding the CMTRs:

> Not all the CMTRs for the tank material were retrieved, with heat numbers for both tanks missing from a total of 35 heat numbers. A non-destructive examination was performed at 16 locations in addition to 2 reference locations in each tank.

The licensee checked hardnesses and chemical compositions. The licensee stated:

Results showed that the material properties to be equivalent to the materials specified in the tank drawings. The available CMTRs and the NDE demonstrated that this requirement is met.

The licensee built the tanks with ASME Code-approved materials except for the anchor bolt chairs which it replaced with new chairs of an ASME Code-approved material. The licensee considers the ASME Code requirements on materials satisfied. The staff finds the licensee satisfied this Code requirement by having CMTRs for most of the material and by verifying the acceptability of that material without CMTRs. The tank material (SA-240) is, therefore, Code acceptable.

Design Requirements

Article ND-3000 of the ASME Code and API-650 Section 3 discuss the requirements for design. The licensee states that except for tank shell buckling and water sloshing height, the existing tank design meets all ND-3000 requirements. The tank thickness ranges from 5/16-inch near the base to 3/16-inch at the top. This satisfies the minimum tank shell thickness requirements of ND-3324.3 at all elevations. The licensee reinforced the tank manway by a 0.25-inch thick plate to meet the requirements of ND-3332 and added reinforcing pads to 3 nozzles to reduce local stresses in the tank shell.

Subarticle ND-3800, "Design of Atmospheric Storage Tanks," applies to the PPMU tanks. The licensee states that the bottom plate size and foundation meet the requirements of ND-3831, the roof design meets the requirements of ND-3856, and the stresses in the tank shell meet the requirements of ND-3821.5, "Limits of Calculated Stresses for Design and Service Loadings," under operating basis earthquake and design-basis earthquake (DBE) conditions. The staff's evaluation of the ability of the tanks to withstand DBE conditions is contained in Section 3.2.2.

Fabrication and Installation Requirements

The ASME Code, Article ND-4000 discusses the requirements for fabrication and installation. Since API-650, Sections 4 and 5 are similar to ASME Code, Article ND-4000, the fabrication and installation is generally in compliance with ASME Code requirements. The codes differ in the requirement for roundness (specified in ND-4224 of the ASME Code). The licensee surveyed the tanks for roundness at two elevations (7 feet above the bottom and 6 feet below the roof-to-shell weld) and concluded that the tanks were within the out-of-roundness requirements of the ASME Code (.22 feet measured versus 0.4 feet maximum allowed per paragraph ND-4224). The staff agrees that the licensee has demonstrated the requirement for roundness.

Examination Requirements

ASME Code, Article ND-5000 discusses the requirements for nondestructive examination of welds in ASME Code Class 3 components. Examination of tank shell welding by spot radiography is acceptable by both the 1989 ASME Code, Section III, Subsection ND and API Standard 650, 5th Edition. The licensee compared the requirements of the ASME Code and the API Standard, showing the areas of agreement and differences. The differences pertain to the number of spots for examination and the acceptability criteria for crowns and undercuts.

As part of the upgrade of the Unit 2 tank, SCE surveyed the original shell plate seam welds to satisfy the ASME Code requirement for the extent of spot radiographic examinations. The results showed welding defects exceeding the code allowables. Excessive weld reinforcement and undercuts and slag inclusions were observed. To demonstrate the acceptability of the tank shell welds, SCE used statistics along with a fracture mechanics analysis. Section 3.2.3 contains the staff's evaluation of the fracture mechanics analysis.

Testing Requirements

Testing requirements are specified in the ASME Code, Article ND-6000 and API-650, Section 5.0. The testing requirements of API-650 and ND-6000 are similar (hydrostatic testing) and therefore, the ASME Code requirements are considered satisfied by the staff. Moreover, after modifying the tanks, the licensee satisfactorily tested them according to Article ND-6000 requirements by filling them to the maximum possible water level.

Inservice Inspection Requirements

Surveillance, maintenance, repair, and replacement will be performed in accordance with the ASME Code, Section XI requirements. The staff finds these requirements meet the applicable regulations and are thus acceptable.

Overpressure Protection Requirements

ASME Code Article ND-7000 discusses the requirements for overpressure protection. The API-650 Standard does not have any overpressure requirements. However, because the tanks are atmospheric tanks, the ASME Code does not require overpressure protection other than vents. The existing vents are adequate for maintaining the tanks at atmospheric pressure. Thus, the tanks are in compliance with the ASME Code.

Welding Requirements

According to Section 7.0 of the API-650 Standard, all welding must be done in accordance with ASME Code Section IX. Thus, the tanks comply with this section of the ASME Code. Although the welding procedure and implementation satisfy the ASME Code requirements, the design of the welds does not. The licensee stated:

> The tank shell is welded to the bottom by a double 1/4" fillet weld in accordance with API-650, Section 3, but ND-4746.2 calls for a full penetration weld. To address this deviation, the weld was evaluated for both shear and moment loads using ND-3852.6 shear allowable. The analysis results show that the existing fillet weld meets the ASME Code allowable stresses under DBE loading.

Based on the staff's evaluation of the ability of the tanks to withstand DBE conditions contained in Section 3.2.2, the staff finds this reconciliation to be acceptable.

<u>Overall Evaluation of Code Reconciliation Effort</u>

The staff reviewed the licensee's actions, modifications, and analysis and concludes that the materials, design, fabrication, installation, examination, testing, ISI requirements, overpressure protection and welding of the PPMU tanks satisfy the requirements of the ASME Code or provide a level of quality and safety equivalent to the ASME Code for Class 3 tanks, and are therefore acceptable. The staff further finds that the lack of an N-stamp does not affect the operability of the CCW system.

3.2.2 Seismic Category I Upgrade Evaluation

The PPMU tanks were originally designed and qualified as Seismic Category II components and have been upgraded by the licensee to Seismic Category I. This section evaluates the adequacy of the seismic upgrade.

Among the key modifications implemented by the licensee as a result of the seismic upgrade evaluation were: bottom plate extension by a continuous ring; reinforcement of the tank bottom section by two continuous rings and 36 vertical stringers; addition of 34 new anchor bolts; and reinforcement pads for the main manhole and three connecting nozzles.

The seismic spectra used for determining the seismic loads for the tanks had already accounted for the tank/foundation interaction effects. Key assumptions used by the licensee in the seismic upgrade evaluation were: the pre-existing anchor bolts and the anchor bolts added as part of the tank upgrade effort share the applied loads proportional to their stiffness; piping lines attached to the PPMU tanks are considered as de-coupled from the tanks when performing their flexibility analysis; and the effective wall thickness to tank radius ratio was conservatively assumed in the analysis.

For the seismic analysis of the tanks, the licensee used a method similar to that presented by M. A. Haroun and G. W. Housner in a paper titled, "Seismic Design of Liquid Storage Tanks," Journal of the Technical Councils of ASCE, April 1981. The method uses a three-lumped-mass model to represent the tank-fluid system and takes into account the deformability of the tank wall. The three effective masses m_r, m_f, and m_s correspond to the forces associated with the seismic ground motion, wall deformation relative to the ground, and liquid sloshing, respectively. The validity of the method was verified by the results of a finite element analysis of the tank-liquid system by the authors. The staff performed a detailed review of the analysis method, which included evaluating the extent of modeling and the rigor of the analytical techniques contained in this method. The staff concludes that the use of this methodology is acceptable for the seismic upgrade analysis for the PPMU tanks. Floor response spectra applicable to the PPMU tanks were generated to determine their seismic loads. The analysis assumed that the tanks will be subject to seismic accelerations of 0.75 g (Operating Basis Earthquake (OBE) and 1.15 g (Design Basis Earthquake (DBE)), and calculated a base shear load of 2.05 x 10^6 lb and a base overturning moment of 3.82 x 10^8 in-lb. The staff reviewed the assumptions, the modeling of the tanks and the detail of seismic analysis performed to obtain these seismic loads, and concludes they meet the criteria developed using the M. A. Haroun methodology, and are acceptable.

The tanks were evaluated against the above listed loads and shown to have safety factors against base shear and overturning of 1.17 and 1.16, respectively. These factors exceed the minimum safety factors provided in SRP 3.8.5, and are acceptable. The adequacy of the stiffeners used for the anchor chairs and their welds were evaluated and compared to the allowable stresses contained in the AISC Manual of Steel Construction, 9th Edition. This comparison showed a 40 percent margin in the allowable stresses, which is acceptable to the staff.

The tank shell buckling potential was evaluated based on the M. A. Haroun method discussed above, and a similar one presented in a National Aeronautics and Space Administration (NASA) Technical Publication, "Buckling of Thin-Walled Circular Cylinders," NASA SP-8007, August 1968. Both the elephant foot and diamond buckling modes were considered in the evaluation and the results were found satisfactory. The roof sloshing effects due to seismic excitation was also evaluated. The stresses of the roof plate resulting from the sloshing and at the roof plate-to-tank shell junction welds were determined to be lower than the code allowable stresses stipulated in Subarticle ND-3821.5 of the ASME Code, and therefore are satisfactory.

In addition to the use of the M. A. Haroun methodology discussed previously, the licensee used the ASME Code Case N-284 approach in checking the adequacy of various stiffened tank shell sections subjected to seismic and other applicable loads. The analysis showed meridional stresses at key shell sections ranging from 13.4 ksi to 28.5 ksi with acceptable safety factors with respect to their allowable stresses. It also indicated that the shell sections have met pertinent code case requirements.

The licensee also evaluated anchor bolts shear load distribution, shell-to-bottom fillet weld stresses, shear stresses of anchor bolt chair bottom plate, local stresses due to external loads at nozzle-to-tank connections and out-of-roundness distortion of the tank. The results of these evaluations showed full compliance with applicable ASME and AISC acceptance criteria with adequate safety margins, and are acceptable.

The licensee's evaluation of anchorage included concrete shear stresses, shear cone capacity, bolt edge distance, bolt spacing, concrete compressive stresses and the affected part of the radwaste building base mat stress analysis. The anchor bolt loads were calculated based on the tank overturning moment and slosh uplift forces. The safety factors against tension and shear for the A-307 bolts (existing bolts) under the design basis earthquake loads were determined as 1.25 and 2.34, respectively. The corresponding safety factors for the spin-lock bolts (newly installed bolts) were computed as 2.14 and 2.88. These safety factors are conservative when compared to the allowable stresses specified in ACI 318-71, "Building Code Requirements for Reinforced

Concrete." Therefore, the staff finds the anchor bolts acceptable as designed and installed.

In summary, with respect to the structural and seismic aspects considerations, the SONGS Units 2 and 3 PPMU tanks were analyzed, modified and installed conservatively to fully comply with the applicable Codes and NRC acceptance criteria. The staff concludes that the tanks will maintain their structural integrity and perform their safety functions under the combined design basis loads including the design basis earthquake.

The staff noted that the March 7, 1996, licensee submittal made references to information discussed in the "Generic Implementation Procedure (GIP) for Seismic Verification of Nuclear Plant Equipment," Revision 8 (Corrected February 14, 1992). However, the staff acceptance of the licensee's PPMS tank evaluation as discussed above is based on technical merits derived from the licensee's successful application of the M. A. Haroun's analysis method as well as the ASME Code, Code Case N-284 and the demonstration of compliance with applicable staff acceptance criteria. Such acceptance should not be construed as staff endorsement of the use of part of the GIP methodology by non-USI A-46 plants in their future evaluation of seismic category I structures, systems and components.

3.2.3 Evaluation of Fracture Mechanics Analysis

As part of the effort of upgrading the PPMU tanks, the licensee conducted a survey of the original radiographic examination results of the tanks. The survey revealed that there were welding defects on the PPMU tank shells exceeding the code allowables. As a result, the licensee performed fracture mechanics analysis to demonstrate that these welds, with their flaws characterized, would still be capable of withstanding a design basis earthquake plus other simultaneous loads.

The licensee's examination of the spot radiography results showed 283 welding flaws ranging in length from 1/32-inches to 4-7/8 inches for the Unit 2 PPMU tank and 126 welding flaws ranging from 1/16-inch to 4-1/2 inches for the Unit 3 PPMU tank. The licensee used a bounding flaw size of five inches, and assumed this bounding flaw to be located at the most vulnerable location. This conservative assumption is acceptable to the staff.

In the evaluation of the critical axial crack, the licensee used the maximum hoop stress of 15.9 ksi due to hydrostatic pressure and the water sloshing load from a design base earthquake (DBE) event in its applied K_I calculation. Two crack geometries, a half-through crack of infinite length and a through-wall crack of 5 inches in length were then selected to bound all flaws. The resulting K_I values were 35.72 ksi$(in)^{1/2}$ and 50.80 ksi$(in)^{1/2}$ for these two crack geometries. As to the toughness, the licensee used a K_{Ic} value of 157.32 ksi$(in)^{1/2}$, which was derived from the J_{Ic} value of 990 in-lb/in^2 from the SMAW weld at 550°F. Based on these K_I and K_{Ic} values, the licensee reported margins of 4.4 for the half-through crack of infinite length and 3.13 for the postulated through crack of 5 inches in length. The licensee stated that the crack will be stable. This analysis was performed for the faulted load condition.

The staff considered the through-wall crack geometry to be the more conservative representation, since the radiographic results lacked the characterization of the crack depths. Therefore, the calculated applied K_I of 50.80 ksi(in)$^{1/2}$ for the through-wall crack of 5 inches in length was used in the staff's evaluation. The toughness used by the licensee was for the SMAW weld at 550°F. This value might not be applicable to the weld at the tank temperature of 104°F. The staff used a more conservative K_{Ic} value of 135 ksi(in)$^{1/2}$ from Generic Letter (GL) 90-05 for its evaluation. If this lower toughness value was used, the margin would be reduced from 3.13 to 2.66. This is still larger than the code required margin of 1.414 for emergency and faulted conditions, and is therefore acceptable.

Since it was not obvious that the faulted condition was limiting, the licensee, at the staff's request, expanded the evaluation to include normal and upset conditions. The licensee's analysis showed that the margin for the worst axial flaw under the normal and upset condition was 3.09. The calculation was based on the faulted load and a K_{Ia} value of 125.86 ksi(in)$^{1/2}$ derived from applying a factor of 0.8 to the K_{Ic} value of 157.32 ksi(in)$^{1/2}$. The staff performed an independent verification for the normal load case by deducting the DBE water sloshing load of 3.29 psi from the faulted load and using a K_{Ia} value of 108.0 ksi(in)$^{1/2}$ derived from applying a factor of 0.8 to a conservative K_{Ic} value of 135 ksi(in)$^{1/2}$. The resulting margin was still above 3 because the effect due to lower K_{Ia} value was offset by the effect due to lower applied load. In this evaluation, the staff used acceptance criteria of IWB and IWC of Section XI of the ASME Code. The staff concludes that the faulted condition is limiting.

The licensee used the curve for water environment in Figure A-4300-1 of the ASME Code in its fatigue analysis. Using a ΔK of 50 ksi(in)$^{1/2}$ based on the 5 inch axial crack, the crack growth is only 0.08 inch after the tank has undergone 400 cycles of filling and refilling. The margin of more than 3 calculated above is large enough to cover the fatigue crack growth if a revised applied K_I calculation incorporating fatigue crack growth was performed. The staff concludes that fatigue crack growth is not a concern for these tanks.

In summary, the staff has determined that the evaluation methodology used by the licensee is appropriate and the criteria are in accordance with the ASME Code for both normal/upset and faulted/emergency conditions. The current applied K_I values for the bounding case are less than the fracture toughness of the shell weld by adequate margins.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the California State official was notified of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendments change a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and change surveillance requirements. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (58 FR 12268). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributors: D. Jeng
S. Sheng
M. Banic

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