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

Gentlemen:

Subject: **Docket No. 50-206**
Intake Structure Surveillance
San Onofre Nuclear Generating Station Unit 1 (SONGS 1)

References:
1. Letter, M. O. Medford, SCE to W. A. Paulson, NRC, "Intake Structure Degradation and Repair," October 18, 1984
2. Letter, M. O. Medford, SCE to J. A. Zwolinski, NRC, "Intake Structure Surveillance Guidelines," October 4, 1985
3. Letter, George Kalman, NRC to Harold B. Ray, SCE, "San Onofre Unit 1 Intake Structure Degradation (TAC No. M74168)," November 24, 1991

The purpose of this letter is to inform the NRC of our plans with regard to surveillance of the SONGS 1 Intake Structure. An evaluation was performed to determine the applicability of the current surveillance program requirements for future surveillance of the Intake Structure in light of permanent cessation of operation at SONGS 1 on November 30, 1992 (at the end of fuel Cycle 11). Based on the results of the evaluation, we have concluded that a final visual inspection of the Intake Structure is sufficient to ensure the structure's capability to perform its safety function, and that the current surveillance provisions for core drilling and half-cell measurements are no longer needed.

1.0 BACKGROUND

The SONGS 1 Intake Structure provides the structural transition from the pipes used to collect and discharge seawater for safety-related salt water cooling to the ocean. The salt water cooling pumps are located on the top slab of the structure. The structure performs a safety function by allowing adequate flow of seawater for the salt water cooling pumps. Accordingly, the structure has been analyzed to withstand a Design Basis Earthquake horizontal ground

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acceleration of 0.67g and a vertical ground acceleration of 0.44g using the modified Housner Spectra.

Corrosion of the Intake Structure rebar was discovered during the plant shutdown associated with the Seismic Reevaluation Program in 1984. Further inspections revealed corrosion of the reinforcing steel on the inside surface (seawater side) of the walls in the pump and screen wells that were in contact with seawater. Core samples taken through the walls showed no signs of corrosion of the outside rebar (soil side). A repair program was subsequently implemented to ensure that the structure would continue to perform its safety function following a Design Basis Earthquake. A detailed description of the rebar corrosion and the subsequent repair program was provided to the NRC in a letter dated October 18, 1984 (Reference 1). In that letter, we also committed to develop a surveillance program to monitor any further corrosion of the Intake Structure.

A surveillance program was subsequently developed and submitted to the NRC by letter dated October 4, 1985 (Reference 2). The program included certain inspection provisions recommended by the NRC in their safety evaluation of our October 18, 1984 letter. In accordance with commitments made in the program, surveillances of the Intake Structure were performed during the Cycle 9, 10, and 11 refueling outages in 1986, 1988, and 1990, respectively. Based on the results of these surveillances, and in conjunction with repairs made in 1984 and 1988, we concluded that the Intake Structure would continue to perform its safety function under the postulated loadings until the next surveillance scheduled to be performed during the Cycle 12 outage.

Based on their review of the surveillance program and the results of the three surveillances, the NRC concurred with our conclusion with regard to the capability of the Intake Structure to meet its safety function. The results of the staff review were contained in a letter dated November 24, 1991 (Reference 3). In that letter, the staff also made six recommendations to be incorporated in future surveillances.

2.0 CURRENT SURVEILLANCE REQUIREMENTS

The Intake Structure surveillance program submitted in October 1985 required that the surveillance of the structure be performed at each future refueling outage (approximately 18 month intervals). In addition to the frequency at which the surveillances are to be conducted, the program described methods by which the Intake Structure inspection data must be collected. These included visual inspections, half-cell potential measurements, and core drilling. Visual inspections and half-cell measurements are to be conducted during each refueling outage, whereas core drilling is to be performed at every fourth refueling outage.

The surveillance program requirements for the scope and frequency of the surveillances were based on the assumption that SONGS 1 would continue to

operate through future fuel cycles. However, SONGS 1 was permanently shutdown on November 30, 1992 at the end of Cycle 11, and consequently, there will be no Cycle 12 refueling outage. In light of the permanent cessation of operation at SONGS 1, we have re-evaluated the existing surveillance program to determine the applicability of the requirements contained therein. This re-evaluation indicates that the scope of the existing surveillance requirements can be significantly reduced.

3.0 JUSTIFICATION FOR REDUCED SURVEILLANCE

As part of establishing post-shutdown technical specification requirements for SONGS 1, we have evaluated the impact of losing all spent fuel pool (SFP) cooling during the permanently defueled mode. This evaluation focused in part on two areas: (1) the time for the SFP to heat up to 150°F (existing licensing basis for the SFP cooling system) after a loss of cooling, and (2) SFP equilibrium conditions (temperature and evaporation rate) assuming no SFP cooling was in operation. The results of the evaluation demonstrate that the SFP cooling function is not essential for the safe storage of spent fuel in the SFP. Therefore, the SFP cooling system will not be required to perform a safety-related function once the Permanently Defueled Technical Specifications (PDTS) become effective. The requirements for the SFP cooling system will be addressed in the proposed PDTS currently being prepared for submittal to the NRC.

The reduced SFP cooling requirements, after the PDTS become effective, result in reduced operability requirements for the Salt Water Cooling System (SWCS) and the Intake Structure. The structure will no longer be performing a safety-related function during the defueled condition. Evaluation of the existing Intake Structure surveillance program in terms of these reduced operability requirements has led to the conclusion that:

- a visual inspection of the Intake Structure would be the only surveillance method necessary to ensure adequate flow to the SWCS;

- surveillance by the other methods required by the current surveillance program, namely, core drilling, and half-cell measurements would no longer be necessary; and

- the six recommendations made in the NRC's November 24, 1991 letter (Reference 2) would not be required to be incorporated in future surveillances.

Accordingly, we plan to perform only a visual surveillance of the SONGS 1 Intake Structure as the final surveillance of the structure. Justification for not performing the other currently required (core drilling and half-cell measurements) or recommended (six NRC recommendations) surveillances is discussed below.

3.1 CORE DRILLING

Current Requirements

The current surveillance program requires that core drilled samples be taken at every fourth refueling outage, and the samples be visually examined for delamination and tested for chloride content. The core drill requirements are relevant only to the outside rebar since any significant corrosion of the inside rebar can be visually detected without the need for core sampling.

Projection of Corrosion at the Intake Structure

Core samples were last taken in 1984. All the samples indicated that the outside reinforcing steel was in good condition with no signs of corrosion or delamination of the concrete on the outside face. This represented approximately 20 years of exposure to the ground water. The good condition of the outside reinforcing steel in 1984 was consistent with the low chloride concentrations of 300 ppm measured in the ground water immediately adjacent to the walls and floor. The ground water chloride concentration was well below the 19,000 ppm generally accepted as the chloride content of seawater.

In addition to high chloride concentrations, the availability of oxygen is essential for the corrosion process to proceed. Chapter 3 of American Concrete Institute (ACI) 222 states: "In concrete which is continuously submerged, the rate of corrosion is controlled by the rate of oxygen diffusion which is not significantly affected by the concrete quality or the thickness of cover. However, as noted in Chapter 2, corrosion of embedded steel is a rare occurrence in continuously submerged concrete structures." Since the outside surface of the SONGS 1 Intake Structure is continuously submerged under the minimum ground water table of approximate elevation (+)2 feet, the amount of oxygen readily available to contribute to the corrosion process is very limited. As such, the environment is not conducive to corrosion.

Although no core data have been obtained since 1984, the amount of chloride available to contribute to the corrosion process in the subsequent years can be predicted. Based on chloride concentration profiles taken in 1984, chloride ion concentration at the outside reinforcing bars in the year 1991 has been estimated (Reference 3) to be 0.16% (percentage of chloride content by weight of cement). The chloride concentration for the year 1994 (two years following SONGS 1 shutdown and core off-load) is expected to be only slightly higher than the predicted value for 1991 (0.16%). This value is higher than the threshold value of 0.15% established by ACI 349. However, the threshold value of 0.15% is based on the assumption that oxygen is readily available to contribute to the corrosion process. As discussed above, the amount of oxygen available to the submerged surface of the SONGS 1 Intake Structure is limited. Consequently, the expected chloride concentration in 1994 represents a conservative value, and its increment over the threshold value is considered to be insignificant.

Future Requirements for Core Drilling

The low levels of chloride in the concrete and in the ground water, the lack of availability of oxygen, and the good condition of the concrete in 1984 support the conclusion that the outside reinforcing steel and exterior surfaces of the walls have been unaffected by corrosion, and will continue to be unaffected in the future. This conclusion is consistent with our position in our earlier submittals to the NRC. Consequently, we believe that eliminating the current core drilling requirements from the surveillance program will not inhibit our ability to determine the Intake Structure's capability to perform its design function.

3.2 HALF-CELL MEASUREMENTS

The current surveillance program also requires that half-cell measurements of the Intake Structure be taken at every refueling outage to identify the potential for rebar corrosion. Initial readings were obtained in 1986, 1988, and 1990. The readings showed an increased negative bias toward the seawall and toward the bottom of the structure. However, this pattern of half-cell readings did not correlate with the areas where an increase in the number of corrosion indications was observed during visual inspections. The half-cell readings were taken to determine the areas of highest potential for rebar corrosion and to establish a correlation between the half-cell readings and rebar corrosion. However, reviews of the data have failed to produce any trends for corrosion, or to detect any localized areas of corrosion.

We have concluded that the underwater half-cell readings at the SONGS 1 Intake Structure are not a reliable tool for indicating areas with a high probability for corrosion. The pattern of readings does not correlate with observations during visual inspections. Therefore, the data have not been used to evaluate the Intake Structure. This subject was discussed with the NRC during a meeting at the SONGS site in July 1990, and the staff concurred with our conclusion that the underwater half-cell readings do not yield useful data. Accordingly, the deletion of this surveillance requirement will not adversely affect our ability to determine the Intake Structure's capability to meet its design basis.

3.3 NRC RECOMMENDATIONS

The NRC's safety evaluation of the Intake Structure degradation and corrective actions was forwarded by letter dated November 24, 1991. In that letter, the NRC summarized six recommendations to be incorporated in future surveillances of the structure. The recommendations included tests to determine quantities of dissolved oxygen and pH in the ground water in the vicinity of the outside reinforcing bars. The purpose of these tests was to investigate the factors which could affect the rate of corrosion of the outside reinforcing bars.

The staff recommendations were intended to make future surveillances more

effective in establishing the serviceability of the Intake Structure, and were made on the assumption that SONGS 1 would continue to operate through its useful life. However, as discussed earlier, the SWCS is no longer required to be operational as a heat sink for the SFPCS beyond the time when the PDTS becomes effective. Accordingly, the long-term operability and serviceability of the Intake Structure are no longer a concern. Therefore, the six NRC recommendations are no longer necessary to be incorporated in future surveillances. The preceding sections demonstrate that a visual surveillance of the Intake Structure will be sufficient to ensure that the structure will perform its intended safety function until the PDTS becomes effective.

4.0 SUMMARY

The existing surveillance program for the SONGS 1 Intake Structure has been re-evaluated for applicability in light of the permanent cessation of operation at the unit. Based on this evaluation, we have determined that the structure is not required for safety-related operation after the PDTS becomes effective, and that only a final visual inspection is necessary to ensure that the structure will perform its intended safety function until that time. Other surveillance methods included in the current surveillance program, and the NRC recommendations with regard to the long-term serviceability of the structure are no longer necessary. We will notify the NRC if there are any changes in these conclusions.

The changes to the existing SONGS 1 Intake Structure surveillance program described in this letter do not involve an unreviewed safety question, and will be implemented as appropriate.

Should you have any questions regarding this matter, or desire additional information, please contact me.

Very truly yours,

RM Rosenblum

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