SOUTHERN CALIFORNIA
EDISON
An EDISON INTERNATIONAL Company

August 16, 1996

Mr. Louis Carson
U. S. Nuclear Regulatory Commission
Harris Tower, Suite 400
611 Ryan Plaza Drive
Arlington, Texas 76011-8064

Subject: Docket No. 50-206
Unit 1 Spent Fuel Pool Information
San Onofre Nuclear Generating Station, Unit 1

Via the INTERNET, Edison became aware of safety concerns raised in a letter to Mr. Jack W. Roe, Director, Division of Reactor Projects III/IV, dated May 16, 1996, regarding the Unit 1 spent fuel pool. As you requested during your June 12, 1996 exit interview (NRC Inspection Report No. 50-206/96-06), the enclosure to this letter provides our completed point-by-point evaluation associated with the safety concerns raised.

If you require any additional information, please call me.

Sincerely,

Gregory T. Gibson
Manager, Compliance

Enclosure:

cc: Document Control Desk
L. J. Callan, Regional Administrator, NRC Region IV
R. A. Scarano, Director, Division of Nuclear Materials, NRC Region IV
K. E. Perkins, Jr., Director Walnut Creek Field Office, NRC Region IV
M. K. Webb, NRC Project Manager, San Onofre Unit 1
J. A. Sloan, NRC Senior Resident Inspector, San Onofre Units 2 and 3

IE01

P. O. Box 128
San Clemente, CA 92674-0128

RESPONSE TO UNIT 1 SPENT FUEL POOL CONCERNS

August 6, 1996

This document provides the responses to concerns about the Unit 1 Spent Fuel Pool (SFP) raised in a letter to Mr. Jack Roe of the NRC dated May 16, 1996. The concern is first stated in bold font, and the response follows.

1. **Underground radioactive plume is moving toward the beach and local water supplies.**

   Environmental samples of marine life, ocean water, and sediments consistently demonstrate no significant introduction of radioactivity attributable to liquid releases from the site. The potential for an unmonitored release of radioactive material from the SFP to the environment was addressed in a problem review report (Reference 4). The beach is routinely surveyed and continues to show typical background radiation levels. The extent of the potential plume from an inadvertent release using the results of a simple solute transport model is shown in Reference 2. The evaluation from Reference 2 projects contamination in an area relatively inaccessible to both the public and workers, and also provides the basis for estimating the radiological dose to the public. The conclusion of Reference 2 is that there are no additional dose consequences to any members of the public. Ultimately, characterization of the actual contamination at SONGS Unit 1 will require empirical data obtained as part of the radiological site assessment that will be integral to decommissioning.

   There are no local water supplies in the immediate vicinity of the site. Water is imported from the Tri-Cities Water District and the Camp Pendleton groundwater supply is upstream from SONGS. Groundwater has a seaward gradient which indicates the water flow is toward the ocean (Reference 5, Section 2.4.13). Therefore, a radioactive plume from SONGS could not move towards any local water supplies.

2. **The sampling of soil around the Spent Fuel Pool should be performed to provide positive proof of the extent of radioactive contamination.**

   While the sampling of soils around and under the Fuel Storage Building could show if the soil is contaminated, there is presently no hazard to workers and the public from the buried, potentially-contaminated soils. The potentially contaminated soil is inaccessible because it is beneath asphalt paving and concrete foundations. Health Physics surveys of the area around the Fuel Storage Building do not indicate any abnormal radiation above background levels. Characterization of soil contamination and any necessary cleanup are planned at the time that SONGS Unit 1 is decommissioned. To undertake representative sampling of the site at this time is undesirable since utilities that are required for the safe storage of spent fuel would likely have to be disturbed or buildings may need to be partially demolished in order to access the area.

There is no evidence that contamination is spreading from the SFP. Actions have been implemented to prevent the possibility of leakage out to the environment by keeping the leak chase system drained below the lowest groundwater elevation. The water level in the leak detection well is kept below elevation +2.5 feet. Groundwater levels were monitored for a ten-year period between 1963 and 1974, and the groundwater table varied from +2.7 feet to +5.7 feet MLLW in the vicinity of the containment (Reference 5, Section 2.4.13). In this configuration, the water will flow into the leak chase system instead of out due to the relatively lower pressure in the leak chase system.

3. **Monitoring of the leak detection well is inadequate by Operations.**

Since the SFP leakage event in 1986 when water was found to be seeping through the SFP concrete walls, Operations has routinely monitored the leak detection well with manual methods and trended the leakage rate. In 1995, an evaluation of the SFP liner plate resulted in a procedural requirement for a weekly inspection and the need to pump out the well when the water level in the leak detection well is above elevation +2.5 feet. A level monitoring instrument and alarm were installed in the leak detection well in April 1996, to improve the accuracy and ease of taking level measurements. The new instrument provides continuous control room indication of the water level in the well, and the alarm will notify operators when the water level reaches the setpoint of Elevation +2.5 feet for draining the leak chase (Reference 3). The water level in the well is recorded weekly and the leakage rate is currently about 5 gal/week.

4. **Spent Fuel Pool is still leaking and leak locations are unknown.**

Whenever the leakage rate had changed by an order of magnitude in the past, the location of the leak has been in the upender area of the SFP and the leakage repaired. The leaks have been attributed to the combination of weld defects and the cyclic loading experienced by the upender area during refueling activities. There is still minor leakage into the leak chase system, but the leakage is being managed to prevent its release to the environment by keeping the water level in the leak detection well below the lowest groundwater table elevation.

The primary concerns about the integrity of the waterproof membrane are 1) the potential for an unmonitored contaminated water leakage into the environment, and 2) the chemical effect on the material condition of the SFP liner plate. Procedural actions are currently in place to preclude leak chase water seepage out into the environment by limiting the hydrostatic head in the leak chase detection well to below the lowest level of the groundwater table elevation. This is accomplished by checking the water level in the leak detection well at least once a week and draining the well when the water level exceeds Elevation +2.5 feet (Reference 3).

The liner plate was evaluated for the leak chase water chemistry. The evaluation concluded that the water quality is not conducive to adversely affecting the integrity of the stainless steel liner (Reference 1). Therefore, groundwater seepage into the leak chase system will not be detrimental to the function of the SFP liner plate and the concrete structure.

An evaluation (Reference 2) was also performed to determine the dose consequences to the public from a potential unmonitored release of contaminated water into the soil around the SFP. The results of the study conclude that although there may be contaminated soils, the levels and the spread of radioactive materials into the surrounding soil do not pose an additional dose consequence or hazard to the public or to workers on site. Thus, there is no safety significance and the site will be adequately characterized for radiological contamination during the decommissioning of SONGS Unit 1.

5. **There was a discovery of soil contamination between the Spent Fuel Pool and seawall in the mid 1980's.**

   There have been isolated incidents of soil contamination at SONGS Unit 1 in the 1980's, some of which were detected during excavations for seismic retrofits. In no instance was leakage from the SFP identified as the source of the contamination. All plans for isolation or disposal of the contaminated material were discussed with the NRC prior to implementation, in accordance with applicable regulations.

6. **Broken fuel pins, loose fuel pellets, plutonium assemblies, and fuel dust in the spent fuel pool probably means fuel particles and fleas are migrating to the environment.**

   Presently, there are a few known failed fuel pins located in the SONGS 1 SFP. However, routine analysis of the SFP water indicates that there has been no further degradation of the fuel cladding while it has been stored in the SFP. For instance, the long-lived and highly water-soluble fission product activity in the SFP is decreasing which indicates that there is no new fuel cladding leakage occurring.

   There are no known loose fuel pellets on the floor of the SFP. In the mid 1980's, a visual inspection of the SFP floor was performed which confirmed the absence of loose fuel pellets. Also the radiation surveys have indicated that there is no fuel dust on the accessible surfaces.

   There are four fuel assemblies located in the SFP which contain mixed oxide fuel. These mixed oxide fuel assemblies were slightly enriched with plutonium. There are no known fuel cladding failures associated with these fuel assemblies. Therefore, no fuel particles or fleas from the spent fuel assemblies could be migrating to the environment.

7. **Seawater plume is moving toward the Spent Fuel Pool and can cause the "rubber liner" and concrete to degrade.**

   The flow of ground water is toward the ocean and not inland. As stated in the SONGS Units 2&3 UFSAR, groundwater has a seaward gradient which indicates the water flow is toward the ocean (Reference 5, Section 2.4.13). The formation of a salt-wedge as far inland as the SFP is therefore highly unlikely. As an example, in 1984 when the Intake Structure was being evaluated for rebar corrosion, groundwater samples showed that the chloride content was a maximum of 300 ppm which is far below the 19,000 ppm that is common in seawater. The chemistry of the water in the leak detection well has also been very different from seawater, and an evaluation (Reference 1) concluded that the water in the leak detection well is not detrimental to the structural integrity of the SFP.

8. **Waterproof membrane has degraded due to age and existing condition is unknown. Also, the waterproof membrane has seams which may not be leaktight.**

The condition of the waterproof membrane is not empirically known, though engineering judgement considers it to be intact. It is unlikely that the membrane has deteriorated because of its underground conditions. Membranes do not generally deteriorate unless they are subjected to sunlight exposure and dry-wet cycles.

As noted above, the primary concerns about the integrity of the waterproof membrane are 1) the potential for an unmonitored leakage of contaminated water into the environment, and 2) the chemical effect on the material condition of the SFP liner plate. Procedural actions are currently in place to preclude leak chase water seepage out into the environment by limiting the hydrostatic head in the leak detection well below the lowest groundwater elevation. This is accomplished by checking the water level in the leak detection well at least once a week and pumping the well when the water level exceeds Elevation 2.5 feet (Reference 3).

The liner plate was evaluated for the leak chase water chemistry. The evaluation concluded that the water quality is not conducive to adversely affecting the integrity of the stainless steel liner (Reference 1). Therefore, groundwater seepage into the leak chase system will not be detrimental to the function of the SFP liner plate and the concrete structure.

Conclusive evidence is not available to verify the condition of the waterproof membrane and the seepage of groundwater into the SFP leak chase system. Analyses of water samples from the leak detection well have shown the tritium activity is about 50 percent of the tritium activity in the spent fuel pool water. The lower tritium activity in the sampled leak detection well water is the only indication that there may be groundwater in-leakage. Another explanation for the lower tritium activity is that there may be a plateout of the tritium as the water flows through the concrete leak chase system to the leak detection well. Positive verification can only be accomplished by excavating around and under the Fuel Storage Building. The excavation may adversely affect the stability and integrity of the building and thus is not recommended until the plant is decommissioned.

9. **The Spent Fuel Pool structure was built without a Quality Assurance Program and fails to meet the current seismic regulatory requirements for this site.**

The Fuel Storage Building was built before the advent of the current SONGS quality assurance program. The building was constructed to the recognized codes and standards in effect in the late 1960's. These include the American Concrete Institute Standard 318-63, Uniform Building Code (1961), and American Institute of Steel Construction "Steel Construction Manual," Sixth Edition (1963).

Subsequently in the 1980's, the Fuel Storage Building was reanalyzed for the Design Basis Earthquake of 0.67g and found to be able to maintain its structural integrity during a seismic event. The evaluation was performed as part of the Systematic Evaluation Program for SONGS Unit 1 (References 6 and 7). The evaluation also verified the building was constructed properly to perform as designed.

10. **Spent fuel cladding which is stainless steel could also be corroding and lead to failure of the fuel pin structure during a major seismic event.**

Stainless steel-clad fuel behavior in long-term storage was evaluated in Reference 9. Eight commercial nuclear power plants have used, or are using, stainless steel-clad uranium dioxide fuel. Those reactors include four boiling-water reactors and four pressurized-water reactors. Investigations of commercial spent fuel performance indicate that there was no evidence of stainless steel cladding degradation during fuel pool storage. SFP chemistry is closely tracked to ensure that water quality is maintained. As long as the strict chemical limits are maintained, degradation of the fuel cladding is not expected.

The spent fuel racks which hold the spent fuel are designed to withstand a seismic event (Reference 8, Section 9.1.2).

11. **Epoxy repairs are brittle and could fail during a seismic event.**

The epoxy coating of the SFP is "Duratough FL-100" which is manufactured by Palmer Services, Inc. The epoxy coating is elastic and the coating's initial failure behavior would result from loss of adhesion and not elasticity. Therefore, as long as the epoxy coating is adhering to the stainless steel liner, the coating will provide a leakproof barrier. The design of the stainless steel liner is to retain water within the SFP. The reinforced concrete structure provides the load bearing capability of the Fuel Storage Building. In order for the liner to stretch, the concrete would have to deform beyond its allowable limits in an earthquake. As evaluated during the Systematic Evaluation Program, the Fuel Storage Building is capable of withstanding the Design Basis Earthquake of 0.67g without loss of structural integrity (References 6 and 7).

12. **Units 2&3 spent fuel pool will eventually have the same problem and release radioactive particles to the environment because there is no containment.**

The Units 2&3 Fuel Handling Buildings (FHB) are designed for the safe storage of spent fuel as described in Section 9.1 of the Units 2&3 UFSAR (Reference 5). The FHB foundation is built above the groundwater elevation of +5 feet. The bottom of the FHB basemat varies from Elevation +7 to +10.5 feet. Therefore, groundwater in-leakage is not possible.

A series of pipes provide a leak chase system around the pools of the Units 2&3 FHBs and any leakage would follow the path of least resistance, flowing freely into a leak detection sump instead of through a minimum of 7 foot thick concrete and then into the ground. The SONGS Unit 1 leak chase system experienced the buildup of pressure due to a high hydrostatic head when the top of the leak detection well pipe was capped in 1986. The pressure was great enough to cause water seepage through the concrete construction joints of the Unit 1 Fuel Storage Building. A similar condition can not occur in the Units 2&3 FHBs because the leak chase pipes are open-ended and drain directly into the leak detection sump. So water leakage into the ground is unlikely. The leak detection pipes in Units 2&3 FHBs are inspected at least once a day by Operations.

Units 2&3 SFP water chemistry is monitored and maintained within strict limits that will not adversely affect the stainless steel liner and spent fuel assemblies. The HVAC system maintains a negative pressure inside the building to prevent gaseous release through unmonitored release points.

References

1. Letter from W. C. Marsh (SCE) to NRC, dated March 10, 1995, "NRC Inspection Report 50-206/94-23, San Onofre Nuclear Generating Station, Unit 1."

2. SCE memo, Kathleen Yhip to Dave Pilmer, dated April 4, 1995, "Evaluation of Potential Soil Contamination from Unit 1 Spent Fuel Pool Leakage."

3. Operations Procedure SO1-4-18, "Spent Fuel Pool System Operation."

4. Problem Review Report No. SO-201-88, "Unit 1 Spent Fuel Pool Leakage."

5. Updated Final Safety Analysis for San Onofre Nuclear Generating Station, Units 2&3.

6. Letter from K. Baskin (SCE) to D. Crutchfield (NRC), dated April 30, 1982, "SEP Topic III-6."

7. Letter from K. Baskin (SCE) to D. Crutchfield (NRC), dated September 30, 1982, Report, "Fuel Storage Building."

8. Updated Final Safety Analysis for San Onofre Nuclear Generating Station, Unit 1.

9. Electric Power Research Institute Report TR-106440, "Evaluation of Expected Behavior of LWR Stainless Steel-Clad Fuel in Long-Term Dry Storage," by Battelle, Pacific Northwest Laboratories, April 1996.