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November 7, 1996

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

Gentlemen:

Subject: **Docket Nos. 50-361 and 50-362**
Response to Generic Letter 96-04:
Boraflex Degradation in Spent Fuel Pool Storage Racks
San Onofre Nuclear Generating Station
Units 2 and 3

This letter provides the Southern California Edison (Edison) response to the request for information concerning Boraflex in spent fuel storage racks in Generic Letter (GL) 96-04.

BACKGROUND

During the time periods of May 1990 through December 1990, and November 1991 through June 1991, Edison installed high density spent fuel racks with Boraflex as a neutron absorber in the San Onofre Unit 2 spent fuel pool and the Unit 3 spent fuel pool, respectively. These new racks increased the capacity of each pool from 800 cells to 1542 cells.

Edison procured the high density racks with the specification that the neutron absorber material have a 40 year design life. The racks were licensed with a gamma radiation exposure limit of 1.03E11 rads, the radiation exposure previously demonstrated to cause no significant material deterioration. Edison performed initial calculations and continues to perform evaluations to ensure the gamma radiation exposure to the spent fuel racks will not exceed 1.03E11 rads during the 40 year period. A Unit 3 rack was used to hold fuel in the Unit 2 cask pool to support the Unit 2 reracking project. Therefore, the 40 year clock for both Units 2 and 3 began in May of 1990 and will end in May of 2030.

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RESPONSE TO THE REQUEST FOR INFORMATION

GL 96-04 requested an assessment of the physical condition of the Boraflex and a statement that the racks will maintain the subcritical margin for the life of the spent fuel racks.

Edison Response:

The Boraflex in the Unit 2 and Unit 3 racks is in an acceptable condition and minimal degradation has occurred. This assessment is based on results from the coupon surveillance program, silica monitoring, rack design, and fuel management. Extrapolating the minimal degradation observed to date while conservatively assuming 5.1% enriched fuel, and limiting the gamma radiation exposure of each rack to less than 1.03E11 rads, the subcritical margin of five percent is expected to be maintained in unborated water for the entire life of the spent fuel racks (May 2030).

GL 96-04 requested information concerning monitoring programs and calculational models.

Edison Response:

Coupon Surveillance

Edison has a coupon surveillance program based on EPRI report N-6159, Appendix C, December 1988 "Guidelines for a Standard Boraflex Coupon Surveillance Program." The spent fuel racks at San Onofre consist of two regions. Region I racks have been used during refueling outages to support full core offloads and to store new fuel. Therefore, Region I racks have received minimal exposure. The Region II rack cells opposite the coupons have been exposed to approximately 7 times the amount of gamma radiation as the remaining rack cells due to Edison's fuel management methods. With this accelerated coupon exposure, coupon shrinkage has been well within the acceptance criteria for each of the completed surveillance evaluations.

The Coupon surveillance program is as follows:

1) Physical dimensioning performed every refueling outage (N-6159,Section 6.4):

   Measurements of length and width are taken to determine that coupons have not decreased more than 3% from the original measurements. The thickness of the coupons is measured to ensure a minimum thickness of 0.089" for Region I coupons and 0.055" for Region II coupons.

2) Visual inspections and coupon weight are performed every refueling outage (N-6159, Section 6.3):

The visual inspections determine the general appearance of the coupons. Changes in color, surface irregularities, erosion, and cracks are observed. The weights are measured and recorded. This information is trended and used to make a general assessment of the condition of the coupons.

3) A Shore "A" hardness test and a Radioassay are performed every refueling outage (N-6159, Section 6.6):

Hardness measurements are intended to provide a rough estimate of the gamma exposure to detect any gross softening of the material. The radioassay provides an indication of the extent of water permeation into the coupons. This information is trended and used to make a general assessment of the condition of the coupons.

4) Specific gravity and a Boron determination are made every five years (N-6159, Section 6.8):

Specific gravity and volume by immersion are determined by a displacement method. The boron measurements are made via neutron attenuation measurements. These measurements are to verify the uniformity of B-10 loading in the coupons. This information is trended and used to make a general assessment of the condition of the coupons.

The Region I coupons have not been inspected because the gamma radiation exposure to Region I racks is significantly less than for Region II racks. Therefore, all data is from Region II coupons; and, as previously stated, these coupons have been exposed to gamma radiation at an accelerated rate. The latest results show that the length of Region II coupons has decreased 1.5% and the width has decreased 1.7%. The average thickness reduction is .0014" for the 10 coupons measured to date. The results of the remaining surveillances, items 2 through 4, are consistent with the measurements discussed above and support the assessment that the Boraflex is in an acceptable condition. As previously stated, extrapolating the minimal degradation observed to date with the conservative assumption of 5.1% enriched fuel and limiting the gamma radiation exposure of each rack to less than 1.03E11 rads, the subcritical margin of five percent is expected to be maintained in unborated water for the entire life of the spent fuel racks (May 2030).

Silica Mass Balance Calculation

A silica mass balance calculation has been performed to establish a gross approximation of Boraflex degradation. This is explained further below in direct response to the GL 96-04 inquiry about the relation of silica levels to Boraflex performance.

Radiation Exposure Tracking Program

Using in-house methods and gamma measurements, Edison has tracked gamma exposure from the time spent fuel was first placed in the storage racks which use boraflex as a neutron absorber. Additionally, Edison is evaluating a program, designed by EPRI, called "RACKLIFE." This is a computer program that computes irradiation and dissolution of Boraflex.

GL 96-04 requested information concerning any anticipated concerns based on rack design.

Edison Response:

Edison was aware of and considered the information provided to the Industry in the EPRI Report "An assessment of Boraflex Performance in Spent-Nuclear- Fuel Storage Racks," published in 1988, when reviewing the proposed rack designs for Units 2 and 3. As a result, the Boraflex sheets were not glued as in previous designs such that no tearing or gapping of the sheets would occur as the Boraflex shrinks over its irradiated life. As a result of the design of our racks, the Boraflex is contained in an envelope which reduces water ingress.

Edison has joined the EPRI Boraflex users group to keep up with current information as it is developed.

GL 96-04 requested information concerning future action to monitor degradation and potential actions to ensure subcritical margin.

Edison Response:

Edison is following activities of other utilities in such matters as using soluble boron credit and poison inserts.

Fuel storage is managed to limit the impact of high gamma doses to the Boraflex by placing the spent fuel into a storage rack and minimizing further movement. Average gamma exposure to the racks is estimated to be 2.8E+9 rads. This is representative of all areas except the rack cells near the surveillance coupons. Edison accelerated the gamma exposure to the surveillance coupons by placing recently irradiated fuel in the rack cells near the surveillance coupons to provide advance warning of any degradation.

As a result, these rack cells have received higher than the average rack exposure. The average gamma exposure to these rack cells near the surveillance coupons is estimated to be 2.0E+10 rads.

However, after three fuel cycles with limited effect on the surveillance coupons, Edison eliminated this practice of accelerating gamma exposure to surveillance coupons and is focusing on limiting the gamma exposure to all spent fuel racks.

Additionally, Edison intends on continuing the current surveillance programs and evaluating new programs, e.g., EPRI's RACKLIFE. Also, Edison intends to continue being an active member of the EPRI Boraflex Users Group to obtain industry experience and information for evaluating any corrective actions, should they become necessary.

Edison has not conducted any blackness testing. Blackness testing's primary function is to measure the gaps formed because of shrinkage. No blackness testing is currently being planned because our surveillance coupons are still within the acceptance criteria for length and width, and these coupons have received the highest radiation dose. Edison is following the research and development EPRI is conducting on their Boron-10 Areal Density Gage for Evaluating Racks (BADGER) system. The BADGER system will identify gaps in the Boraflex and determine average panel thickness.

GL 96-04 requested information concerning silica levels and the relation of silica levels to Boraflex performance.

Edison Response:

Enclosed are the graphs of the pool silica levels for Units 2 and 3. These curves show an increasing trend over six years, and have the significant events (i.e., refuelings and transshipments, as well as earthquakes) annotated on the graph. Also enclosed is a graph which compares the Edison spent fuel pool silica levels with the levels in plants discussed in GL 96-04.

Using this information, in addition to the concentration of the silica in each spent fuel pool and the total mass of silica in the Boraflex panels, Edison has made a gross approximation that the average thinning of Unit 2/3 panels is about 0.002".

CONCLUSION

The information provided in this letter responds to the NRC's request for information. Edison believes that minimal degradation of the Boraflex neutron absorber in the Unit 2 and Unit 3 spent fuel pool racks has occurred. Extrapolating the minimal degradation observed to date with the conservative assumption of 5.1% enriched fuel, and limiting the gamma radiation exposure of each rack to less than 1.03E11 rads, the subcritical margin of five percent is expected to be maintained in unborated water for the entire life of the spent fuel racks (May 2030). Finally, Edison is taking proactive measures to monitor this issue throughout the industry and at San Onofre Units 2 and 3.

If you have any questions concerning this information, please contact me.

Very truly yours,

J. L. Rainberry

State of California
County of San Diego
On 11/7/96 before me, Mariane Sanchez, personally appeared J. L. Rainberry, personally known to me to be the person whose name is subscribed to the within instrument and acknowledged to me that he executed the same in his authorized capacity, and that by his signature on the instrument the person, or the entity upon behalf of which the person acted, executed the instrument.

WITNESS my hand and official seal.

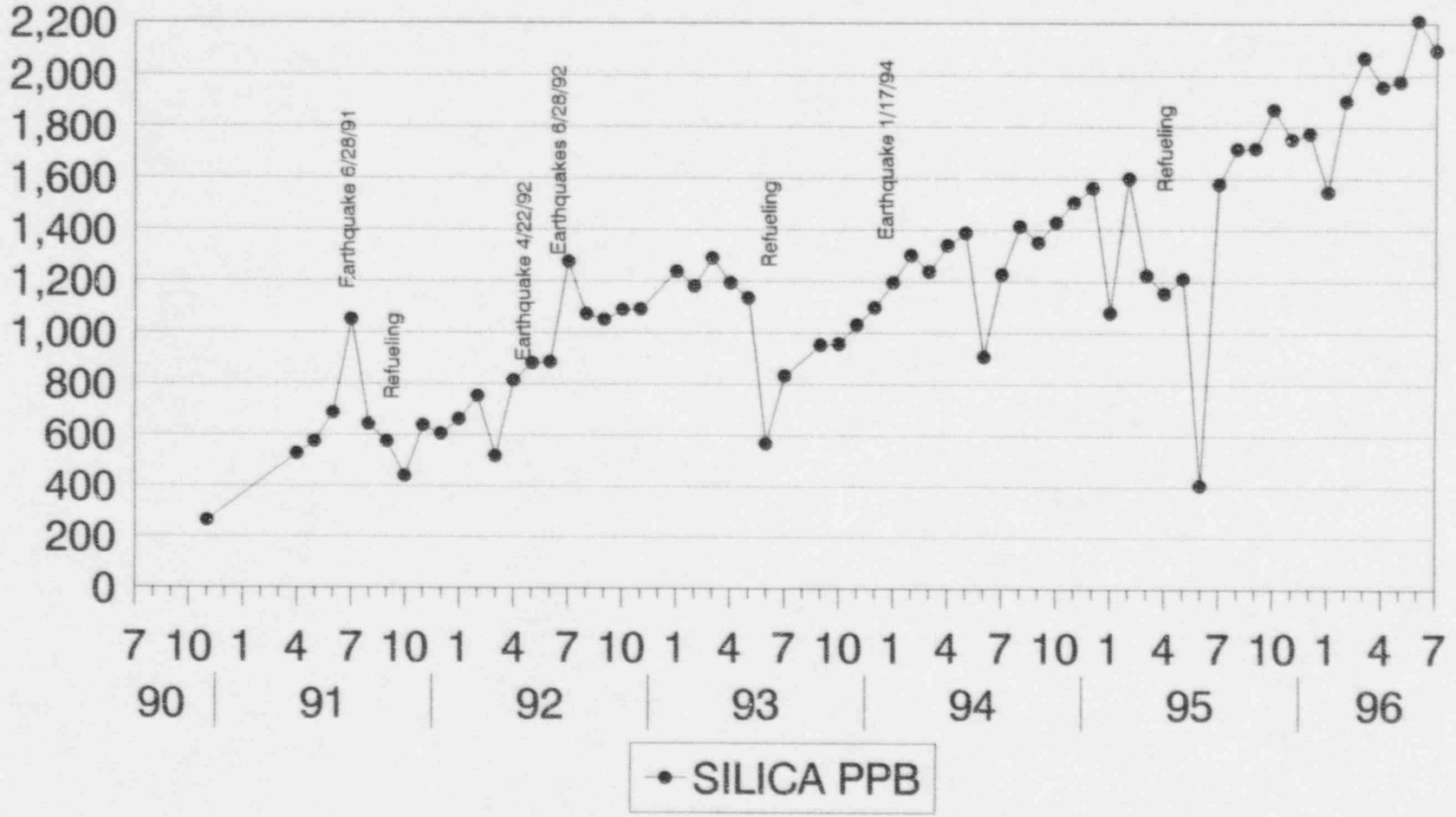
MARIANE SANCHEZ
COMM. # 1033763
Notary Public — California
ORANGE COUNTY
My Comm. Expires OCT 14, 1998

Enclosure

cc: L. J. Callan, Regional Administrator, NRC Region IV
J. E. Dyer, Director, Division of Reactor Projects, Region IV
K. E. Perkins, Jr., Director, Walnut Creek Field Office, NRC Region IV
J. A. Sloan, NRC Senior Resident Inspector, San Onofre Units 2 & 3
M. B. Fields, NRC Project Manager, San Onofre Units 2 and 3

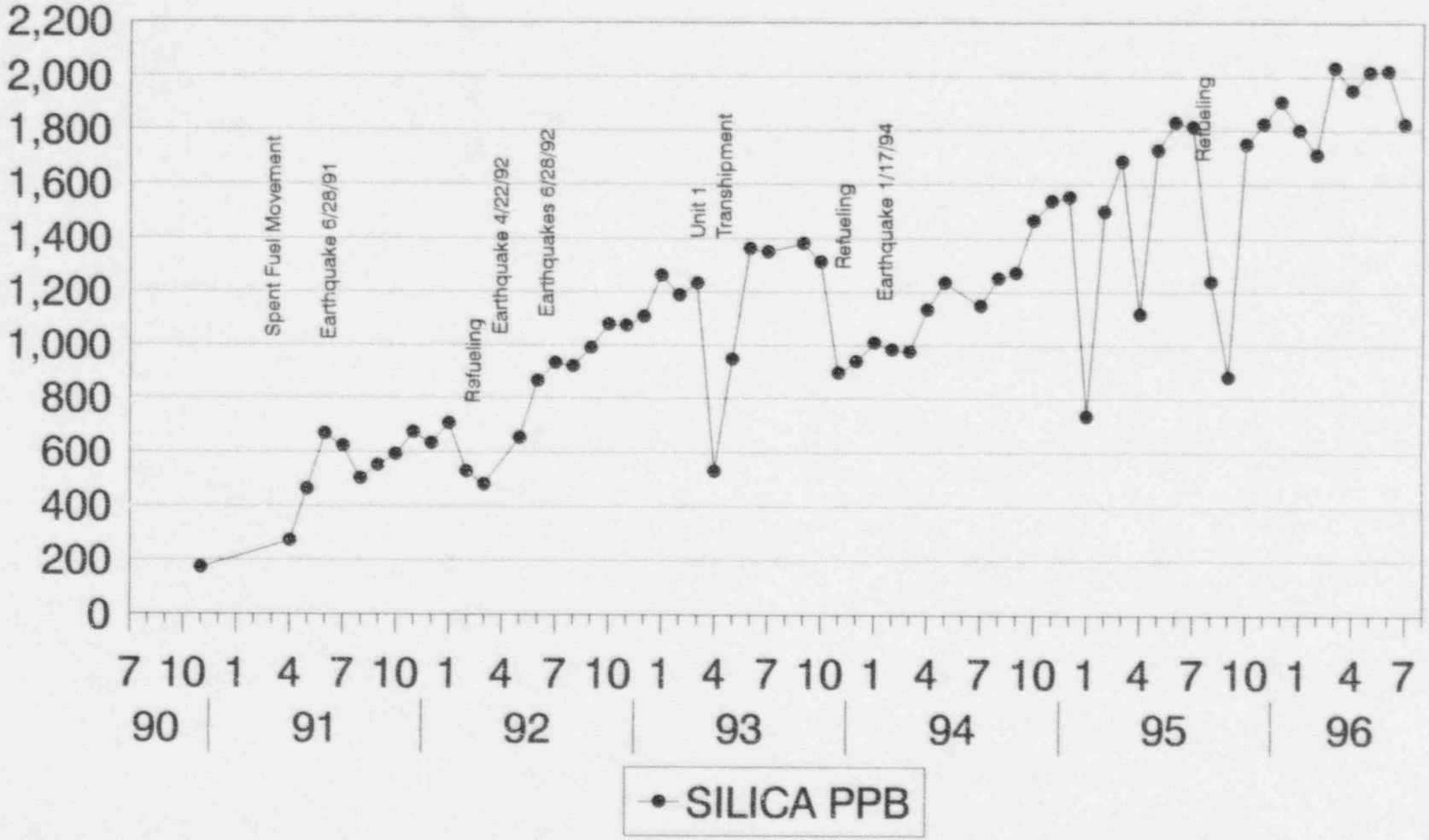
SONGS UNIT 2 SFP CHEMISTRY

1990-1996



SONGS UNIT 3 SFP CHEMISTRY

1990-1996



Spent Fuel Pool Silica Levels