



Portland General Electric Company

Stephen M. Quennoz
Trojan Site Executive

October 23, 1996

VPN-061-96

Trojan Nuclear Plant
Docket 50-344
License NPF-1

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

Dear Sirs:

Generic Letter 96-04, Boraflex Degradation in Spent Fuel Pool Storage Racks, Response

Generic Letter 96-04 requires holders of operating licenses for nuclear power reactors to respond by October 24, 1996 (120 days from June 26, 1996, the date of the Generic Letter). Although the Trojan Nuclear Plant has been shutdown since November 9, 1992 and the License has been modified since May 5, 1993 to be a possession only license, PGE provides the attached response to the subject Generic Letter.

The attached response provides the basis for the adequacy of the generally encapsulated Boraflex currently installed in the Trojan Spent Fuel Pool. Recognizing the shutdown nature of the facility (with no plans for the receipt of new fuel), the continual decay of the currently stored fuel, the comparatively recent installation of the spent fuel storage racks (approximately 11 years) and their design, the margin for the prevention of criticality in the Trojan spent fuel pool is consistent with the Generic Letter guidance through the period when fuel is scheduled to be removed from the spent fuel pool and placed into dry storage.

If you have any questions, please contact me or Mr. C. P. Yundt, of my staff at (503) 556-7492.

Sincerely,

Stephen M. Quennoz
Trojan Site Executive

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Attachment
Enclosure 280067

- c: L. J. Callan, NRC Region IV
D. Stewart-Smith, ODOE
Dr. B. D. Spitzberg, NRC Region IV
R. A. Scarano, NRC Region IV
M. T. Masnik, NRC, NRR

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NRC REQUESTED INFORMATION (GL 96-04)
BORAFLEX PROGRAM

NRC Request

All licensees of power reactors with installed spent fuel pool storage racks containing the neutron absorber Boraflex are requested to provide an assessment of the physical condition of the Boraflex, including any deterioration, on the basis of current accumulated gamma exposure and possible water ingress to the Boraflex and state whether a subcritical margin of 5-percent can be maintained for the racks in unborated water. Monitoring programs or calculational models in effect or being developed, or an estimation of anticipated concerns based on the specific rack design, are considered an appropriate basis for this response.

PGE Response

The spent fuel storage racks at the Trojan facility have been replaced twice, since original construction. The most recent rerack was performed to provide adequate storage space to support planned operation of the facility until the year 2011. The most recent spent fuel pool rerack was reviewed and authorized by the NRC, as documented in License Amendment Number 88 to the Facility Operating License No. NPF-1 for the Trojan Nuclear Plant, dated June 8, 1984.

In order to support the greater spent fuel density and planned higher fuel enrichments, a neutron absorbing material was designed into the currently installed spent fuel storage racks. This neutron absorbing material is Boraflex, which is installed in a cavity between the four walls of each storage cell and a preformed sheet of stainless steel metal and extends the length of the stored fuel assemblies. Boraflex is not provided on the storage cell sides facing the fuel pool walls. The preformed metal wrapper surrounds the Boraflex material, but is open at the top and bottom to provide venting of any gases that may be generated. The venting of the annulus allows gas generated by the chemical degradation of the Boraflex silicone polymer binder during heating and irradiation to escape and prevents bulging or swelling of the storage cell. Each Boraflex sheet is supported in the square annular cavity formed by the square inner stainless steel tube and the outer wrapper by a lower spacer plate.

To provide added assurance that no unexpected corrosion or degradation of materials would compromise the integrity of the storage racks, PGE committed to conduct a long term fuel storage cell surveillance program. Surveillance samples are in the form of removable stainless steel clad Boraflex sheets, which are proto-typical of the fuel storage cell walls. These specimens are removed and examined periodically.

The Trojan Nuclear Station began its Boraflex monitoring program in October of 1985. The spent fuel rack neutron absorber packet assemblies (surveillance samples) were initially loaded into the spent fuel pool on October 3, 1985. Irradiated fuel was initially stored in the racks on May 18, 1985. Trojan's surveillance program is designed to permit samples of the Boraflex material used in the spent fuel storage

racks to be exposed simultaneously to gamma radiation and borated pool water and to be periodically removed from the spent fuel pool and examined for changes in the physical properties of the material. Sufficient samples are available so that the principal physical property (sample hardness) can be determined as a function of exposure on a regularly scheduled basis.

The accelerated surveillance program provides material behavior data for a given exposure in advance of the time at which the Boraflex material in the fuel racks is expected to reach the same exposure. The long term surveillance program, however, may be a more accurate indicator of environmental effects on the Boraflex material since it more closely duplicates the spent fuel pool conditions to which the material is exposed and is the only method we now use for testing (Trojan was shutdown November 9, 1992).

Accelerated exposure was achieved by providing a Boraflex sample holder which was moved each outage to a new storage location surrounded by freshly discharged fuel. It was estimated that the accelerated sample exposure level would be at least twice that of Boraflex material in the fuel storage racks. Since the plant is no longer operational, no freshly discharged fuel is available for further accelerated exposure. However, the accelerated samples will continue to be tested at the long term intervals in order to provide early indication of potential degradation. With no more new fuel being added to the spent fuel pool and given that the accelerated sample exposure level is at least twice that of Boraflex material in the fuel storage racks, the accumulated gamma exposure on the accelerated samples do not indicate that we will have a deterioration problem prior to our removal of the spent fuel for dry cask storage.

Long term exposure is achieved by providing a second Boraflex sample holder which was initially surrounded by freshly discharged fuel. The long term sample holder occupies the same location in a fuel rack with no movement of nearby fuel throughout the long term surveillance program. This essentially duplicates the exposure history that the Boraflex material experiences during its lifetime.

Trojan analyzes the sample packets for physical condition, by visual observation, hardness measurement, dimensional measurements and weight measurement. These measurements are used for assessments of the neutron absorber qualities of the Boraflex within the spent fuel racks and are available on site for review. The next sample will be obtained in October of 1997 (± 6 months). This sample is expected to be the last sample to be taken since Trojan is progressing towards placing its spent fuel into dry cask storage around 1998.

Evidence from Millstone and Trojan (in May 1991) has shown that Boraflex material is subject to water flow erosion of exposed surfaces. Trojan Boraflex is, according to our vendor, not considered to be 'exposed' and is not subject to flow erosion. The potential exists, however, that Boraflex shrinkage may create gaps, which could require subsequent criticality analysis or compensatory action, such as not storing new fuel assemblies (with maximum enrichment) that do not have a control rod in one of them in adjacent, side-by-side locations.

The 5-percent subcriticality margin can be maintained for the Trojan spent fuel storage racks in unborated water. Trojan's rerack safety evaluation report states that under all conditions, the spent fuel pool racks remain less than $0.95 K_{eff}$. This assumes 4.5-percent enriched new fuel, worst case conditions. Under normal conditions no credit is taken for soluble boron in the pool. There have not been any abnormal results in the long term nor in the accelerated samples to indicate that the 5-percent subcriticality margin

would not be maintained. In addition, no new fuel is planned to be installed in the pool, since operation of the plant has been terminated. Also, the maximum initial enrichment of fuel in the pool is approximately 3.8-percent as compared to the design enrichment of 4.5-percent. Trojan maintains a spent fuel pool boron concentration of at least 2000 ppm to provide adequate margin for accident conditions as described in the Basis of Technical Specification 3.1.2.

NRC Request

All licensees are further requested to submit to the NRC a description of any proposed actions to monitor or confirm that this 5-percent subcriticality margin can be maintained for the lifetime of the storage racks and describe what corrective actions could be taken in the event it cannot be maintained. Licensees should describe the results from any previous post operational blackness tests and state whether blackness testing, or other in-situ tests or measurements, will be periodically performed. Chronological trends of pool reactive silica levels, along with the timing of significant events such as refuelings, pool silica cleanups, etc., should be provided. Implications of how these pool silica levels relate to Boraflex performance should be described.

PGE Response

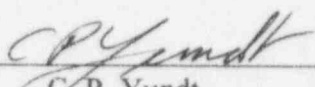
As stated previously, PGE is performing periodic surveillances of the Boraflex material. Trojan has not seen any abnormal boraflex results. It appears that the Boraflex hardness value changes are essentially complete with respect to time and irradiation. The Trojan spent fuel pool silica levels are currently approximately 17 ppm and are monitored on a monthly basis. PGE initially sampled the spent fuel pool for silica during the early 1990's. The levels at that time varied from 4.1 ppm to 8.0 ppm. Silica in our makeup water sources varied from 2.3 ppm to 16.2 ppm. Calculations performed in November of 1995 conservatively indicate that 11 ppm of silica in the spent fuel pool comes from makeup water sources. Industry guidance sets an "alert level" at 10 ppm. The 10 ppm industry guidance was added to the 11 ppm makeup water value to establish a 21 ppm alert level. There has not been an increase in silica levels since implementing the monitoring program in November of 1995. With no abnormal observations in the boraflex samples and no significant increase in fuel pool silica levels, we have concluded that we do not have a boraflex degradation problem.

The Trojan Quality Control Department conducted a surveillance of the spent fuel pool Boraflex program in 1995. The silica issues as well as our specimen sampling frequency was reviewed and evaluated to ensure that the Boraflex was not significantly degrading. The surveillance concluded that the Boraflex monitoring program is adequate. There have been no post operational blackness tests performed, nor are any planned. As mentioned before, Trojan is expected to begin placing its spent fuel into dry cask storage sometime in 1998. The Boraflex issue will no longer be an issue once the spent fuel is removed from the current spent fuel storage racks.

STATE OF OREGON,)
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)
COUNTY OF COLUMBIA)

I, C. P. Yundt, being duly sworn, subscribe to and say that I am acting for the Trojan Site Executive, for Portland General Electric Company, the licensee herein; that I have full authority to execute this oath; that I have reviewed the foregoing; and that to the best of my knowledge, information, and belief the statements made in it are true.

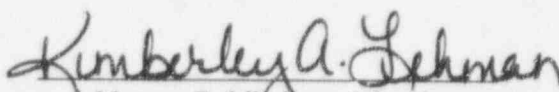
Date October 23, 1996



C. P. Yundt,
General Manager Plant Support and
Technical Functions
Portland General Electric Company

On this day personally appeared before me, C. P. Yundt; to me known to be the individual who executed the foregoing instrument, and acknowledged that he signed the same as his free act.

GIVEN under my hand and seal this 23rd day of October, 1996.



Notary Public in and for the
State of Oregon

Residing at Columbia County
My commission expires 6-1-97

