UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TEXAS 76011-4005

June 10, 2003

Mr. Stephen M. Quennoz, Vice President
Power Supply/Generation
Portland General Electric Company
Trojan Nuclear Plant
71760 Columbia River Highway
Rainier, Oregon 97048

SUBJECT: ADDENDUM TO NRC INSPECTION REPORT 50-344/2003-02; RESULTS OF CONFIRMATORY (BASELINE) SURVEY OF EMBEDDED PIPING

Dear Mr. Quennoz:

This letter refers to the baseline confirmatory survey that was conducted during the April 21-24, 2003, inspection at Portland General Electric's (PGE) Trojan Nuclear Plant. This survey was conducted by Oak Ridge Institute for Science and Education (ORISE), Environmental Survey and Site Assessment Program, on behalf of the NRC. The survey was conducted in embedded dirty radwaste system piping located in the auxiliary building.

Section 4.2 of the subject inspection report states that the results of the surveys will be evaluated by the NRC after ORISE has analyzed and reported its results to the NRC. The purpose of this letter is to provide you with the staff's evaluation of the survey results and to provide you with a copy of the final ORISE report. The NRC's analysis is provided in Enclosure 1 to this letter, and the final ORISE report is provided in Enclosure 2.

A review of side-by-side measurements taken at six locations with elevated residual activity levels indicated significant differences between some of your staff's results as compared to those of ORISE. At this time, the differences are attributed to the response of survey instrumentation used by PGE versus the instrumentation used by ORISE. In particular, PGE's instrumentation tends to average out radioactivity levels over longer lengths of piping, resulting in poor identification of localized areas of elevated radioactivity. At the close of the onsite inspection, PGE had not indicated what steps will be taken to address and resolve these differences.

In the near future, your staff is expected to submit final status survey reports for these portions of the dirty radwaste system and associated rooms and cubicles to the NRC for review. The information provided in these reports, as well as the information provided in this and future confirmatory surveys and NRC inspections, will be used in the NRC's determination of whether to approve the unrestricted release of embedded piping and the rooms in which the embedded piping is located. The NRC's evaluations will include an assessment of how PGE has addressed and resolved the observations noted in Enclosure 1. The NRC's evaluation will be provided to you under separate correspondence at a later date, after PGE has formally submitted the associated final status survey reports to the NRC for review.

During the April 21-24, 2003, inspection, the NRC created Inspection Followup Item No. 50-344/0302-02 to ensure NRC review of the discrepancies identified with the embedded piping surveys. The NRC will conduct a followup evaluation of the issues discussed in Enclosure 1 during a future inspection as part of the NRC's review and closure of the Inspection Followup Item. Accordingly, no written response is requested from you at this time.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter, its enclosures, and your response (if any) will be made available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

If you have any questions concerning this letter, please contact Mr. Robert J. Evans, Senior Health Physicist, at (817) 860-8234 or the undersigned at (817) 860-8191.

Sincerely,

/RA/

D. Blair Spitzberg, Ph.D., Chief
Fuel Cycle and Decommissioning Branch

Docket No.: 50-344
License No.: NPF-1

Enclosures:
1. Embedded Piping Confirmatory (Baseline) Survey Analysis
2. Final Report - Confirmatory (Baseline) Survey of Auxiliary Building Embedded Piping, Trojan Nuclear Plant, Rainier Oregon, May 2003.

cc w/enclosures:
Lansing G. Dusek
Manager, Plant Support
Portland General Electric Company
Trojan Nuclear Plant
71760 Columbia River Highway
Rainier, Oregon 97048

Chairman
Board of County Commissioners
Columbia County
St. Helens, Oregon 97501

David Stewart-Smith
Oregon Office of Energy
625 Marion Street NE
Salem, Oregon 97301

Lloyd K. Marbet
19142 S.E. Bakers Ferry Road
Boring, Oregon 97009

Jerry Wilson
Do It Yourself Committee
570 N.E. 53rd
Hillsboro, Oregon 97124

Eugene Roselie
Northwest Environment Advocates
133 S.W. 2nd Avenue
Portland, Oregon 97204

Douglas Nichols, Esq.
Vice President, General Counsel and Secretary
Portland General Electric Company
121 SW Salmon Street
Portland, Oregon 97204

Michael B. Lackey
General Manager, Trojan
Portland General Electric Company
Trojan Nuclear Plant
71760 Columbia River Highway
Rainier, Oregon 97048

bcc w/enclosure 1 (via ADAMS e-mail distribution):
EECollins
DBSpitzberg
JBuckley, NMSS/DWM/DCB
JCDehmel, NMSS/DWM/DCB
CMCraig, NMSS/DWM/DCB
RJEvans
EMGarcia
FCDB File
NBHolbrook
RIV Materials Docket Files - 5th Floor

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ENCLOSURE 1

EMBEDDED PIPING CONFIRMATORY (BASELINE) SURVEY ANALYSIS

During the inspection of April 21-24, 2003 (NRC Inspection Report 50-344/2003-02), representatives from the Oak Ridge Institute for Science and Education (ORISE), under contract with the NRC, conducted a series of radiological surveys on embedded drain piping located in the auxiliary building. The piping was part of the former dirty radwaste system. The purpose of the surveys was to compare survey results generated by the licensee as a preparatory step leading to the issuance of final status survey reports for these systems. The major objectives of the surveys were to determine residual levels of activity in piping after remediation, compare these results with those of the licensee, identify any differences in survey measurements between survey techniques and instrumentation used by ORISE and the licensee, and conduct a preliminary evaluation of the results against derived concentration guideline level ($DCGL_W$) established for embedded piping.

A survey plan was developed by NRC/ORISE following a review of the licensee's draft survey packages, walkdown of the survey units, and discussions with the licensee's staff. The survey methodology consisted of internal surface scans using beta particulate radiation detectors with measurements taken at fixed locations along the piping. The survey equipment consisted of four ratemeters/dataloggers (Ludlum Model 2221) connected to an array of four Geiger-Mueller pancake detectors (Ludlum 44-9), mounted at 90^o intervals on a single shuttle with each detector connected to its own ratemeter.

For some portions of the embedded piping, visual inspections were conducted using the licensee's remote video monitoring system to assess the internal conditions of the piping. The piping was found free of loose residues and standing water before initiating the surveys. The detector array was pulled through the embedded piping and readings were observed and recorded as the shuttle traveled through the embedded piping. In addition, a series of fixed measurements were made at specific locations using scan readings to identify areas with the highest activity levels. Portions of the system with smaller piping diameter were surveyed with a sodium iodide detector. This survey equipment consisted of a ratemeter/datalogger (Ludlum Model 2221) connected to a sodium iodide detector (Ludlum 44-2).

The licensee's radiation detection system was built by Ludlum Measurements, Inc. using specifications developed by the licensee. At the time of the onsite inspection, the specifications of the system were still considered proprietary; however, the staff was able to review detector diagrams and to discuss with licensee's staff the important operating features of the system. The inspectors found the detector design and operating features acceptable to detect the two primary radionuclides of concern, cobalt-60 and cesium-137.

Three segments of the embedded drain piping, part of the former dirty radwaste system, were evaluated as part of this baseline survey. The portions of the system were designated as survey units No. P61203A, P61203B, and P61203C, comprising about 115 linear feet of 4-inch diameter piping. In addition, some portions of the system with smaller diameter piping (2-inch drop-down floor drains) were surveyed at accessible locations using a 1-inch by 1-inch sodium iodide detector. This part of the survey included nine sections, with lengths varying from 1.5 to 2 feet. These portions of the piping were assigned a Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) Class 1 survey status.

A review of ORISE's 20 beta survey results indicated that residual radioactivity, when noted, was typically spotty and isolated over short sections of the 4-inch piping (typically less than 1 meter), and that most measurements were found to be non-distinguishable from instrument background levels (typically less than 50 cpm). Similarly, the gamma survey results for the 2-inch piping revealed gross activity levels ranging from about 1,600 to 3,800 cpm, as compared with a detector background level of about 1,300 cpm.

A review of side-by-side measurements taken at six locations with elevated residual activity levels indicated significant differences with some of the licensee's results, with PGE's results being lower than those of ORISE. The differences ranged from -0.06 to 1.23, expressed as the ratio of PGE to ORISE results. For two measurement locations, the results were noted to be above the DCGL of 100,000 dpm/100 cm^2 for embedded piping, specifically:

- Survey unit P61203B; 320,000 dpm/100 cm^2 versus 43,736 dpm/100 cm^2 at location No. 20; and

- Survey unit P61203C; 170,000 dpm/100 cm^2 versus 74,183 dpm/100 cm^2 at location No. 16.

Of the 20 fixed measurement points, these 2 locations were the only ones that exceeded the embedded piping DCGL. However, the measurement results (totaling 80) from each of the 4 detectors revealed much more variability, ranging from -800 to 1,300,000 dpm/100 cm^2. Of the 80 measurement results, 6 were found to be at or above the DCGL. They were:

- Survey unit No. P61203A; 120,000 dpm/100 cm^2 at location No. 4;

- Survey unit No. P61203B; 1,300,000 dpm/100 cm^2 at location No. 20 and 190,000 dpm/100 cm^2 at location No. 10; and

- Survey unit No. P61203C; 100,000 dpm/100 cm^2 at location No. 13, 200,000 dpm/100 cm^2 at location No. 15, and 690,000 dpm/100 cm^2 at location No. 16.

The differences in survey results are most likely attributed to the types of survey instrumentation used by the licensee (single sodium iodide detector) versus ORISE (four Geiger-Mueller pancake probes). The licensee's gamma radiation detection system has a greater field of view than the beta detector array used by ORISE. The licensee's detection system tends to detect sources of radiation that are well beyond and behind the immediate physical position of the detector at any point within the pipe. In addition, the detector is sensitive to the presence of radiation scatter from nearby embedded piping, such as parallel or crossing runs and connections into the pipe being monitored. The response is also affected by the presence of concrete, which may have competing effects depending on its thickness and source-to-detector geometry. The photon energy response of the detector to the spectrum of gamma radiation scattered from the piping and through concrete is expected to be somewhat different than the radiation emitted by the standard used for calibration.

In addition, the detector array used by ORISE was sensitive to beta particle emitters, while the gamma detector assembly used by PGE was not sensitive to beta emitters. Accordingly, the response of the gamma radiation detector system is expected to: (1) yield results that are

averaged over larger internal surface areas or pipe lengths, (2) report lower activity levels because of this averaging, (3) not detect the presence of radionuclides that are pure beta emitters, and (4) not be as effective as the ORISE system in identifying areas with elevated localized residual radioactivity.

Other potential sources of difference might be the calibration method and interpretation of measurement results. The licensee procured five radioactive standards from Isotopes Products Laboratory specifically designed to address the calibration geometry of the gamma radiation detector used in surveying embedded piping. The standards include three cobalt-60 and two cesium-137 calibration sources, provided with National Institute of Standards and Technology traceable certificates. In converting instrument results to radiological units directly comparable to the DCGL, the licensee elected to use the efficiency factor of cesium-137 rather than cobalt-60, while the basis of the DCGL assumes that the primary contaminant is cobalt-60. Under actual survey conditions, the response of the instrument is expected to vary since the detector measures radiation from sources which have configurations that are much different than that of the calibration standards. The areas with elevated activity levels include irregular physical dimensions as compared to the well defined dimensions of the standards, and with radioactivity with highly varying distributions as compared to the evenly distributed activity levels over the plane and volume of the standards.

At the close of the onsite inspection, PGE had not indicated what steps will be taken to address and resolve these differences. The licensee indicated that the grouting of embedded piping will be considered only after the piping has been shown to be in compliance with the DCGL and the NRC has been given an opportunity to conduct any additional confirmatory surveys. The calculation package[1] presenting the basis of the DCGL for embedded piping addresses criteria for its implementation (Sections 4.0 and 6.7 to 6.28). Among others, the criteria specify that a survey unit be flagged for further investigation when the mean gross surface activity level approaches 80 percent of the DCGL or when the mean gross surface activity exceeds 100,000 dpm/100 cm^2 (beta-gamma) to ensure that the release criteria are met; that more rigorous shielding calculations be conducted whenever external exposure rates near the 5 millirems per year criterion; that the evaluation pays particular attention to areas with the highest pipe density and concrete overlay of less than 5 inches thick; and that any piping with levels exceeding the DCGL needs to be evaluated for further actions, such as development and application of area factors and $DCGL_{EMC}$, or be subjected to remediation.

In the near future, PGE is expected to submit final status survey reports for these portions of the dirty radwaste system as well as reports for the associated rooms and cubicles to the NRC for review and approval. The information provided in these reports, as well as the information provided in this and other confirmatory surveys and NRC inspections, will be used in the NRC's determination of whether to approve the unrestricted release of embedded piping, rooms, and cubicles in which the dirty radwaste system is located. The NRC evaluation will assess how PGE has addressed and resolved the above noted observations and will ensure that the sum of the doses from all sources of residual radioactivity (the room itself and all associated embedded pipe present in walls, floor, and/or ceiling) does not exceed the annual dose limit of 25 millirems

[1] Dose Modeling for Embedded Piping, PGE Calculation Package No. RPC 2000-08, Revision 0, approved October 11, 2000.

in any portion of the survey unit. This decision will be provided to the licensee under separate correspondence at a later date once PGE has formally submitted the associated final status survey reports to the NRC.