ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

March 20, 2007

Mr. Craig Bassett
Mail Stop 12G-13
Office of Nuclear Reactor Regulation
Division of Policy and Rulemaking
U.S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: FINAL SITE-SPECIFIC DECOMMISSIONING INSPECTION REPORT #2 FOR THE UNIVERSITY OF WASHINGTON RESEARCH AND TEST REACTOR, SEATTLE, WASHINGTON (DOCKET NO. 50-139)

Dear Mr. Bassett:

Enclosed is the subject report for the in-process inspection of final status survey (FSS) activities underway at the University of Washington Research and Test Reactor located at the More Hall Annex, Seattle, Washington. During the second site visit, which was conducted November 8, 2006, Oak Ridge Institute for Science and Education (ORISE) personnel performed a review of several decommissioning related documents and discussed procedure implementation with site personnel as a follow-up to findings and recommendations documented in the Final Site-Specific Decommissioning Inspection Report (dated October 18, 2006). In addition, ORISE performed confirmatory surveys on the Reactor Floor area. This report contains a summary of the inspection results and findings. Comments received from the NRC have been incorporated. If you have any questions, please direct them to me at 865.241.8893 or Scott Kirk at 865.574.0685.

Sincerely,

Sarah Roberts

Sarah Roberts
Health Physicist/Project Leader
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SJR:ar

Enclosure

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FINAL

SITE-SPECIFIC DECOMMISSIONING INSPECTION REPORT #2 FOR THE UNIVERSITY OF WASHINGTON RESEARCH AND TEST REACTOR SEATTLE, WASHINGTON

At the request of the Nuclear Regulatory Commission's (NRC) Office of Nuclear Reactor Regulation (NRR), the Oak Ridge Institute for Science and Education (ORISE) performed a second site-specific decommissioning in-process inspection at the University of Washington Research and Test Reactor facility (UWNR), located at the More Hall Annex, Seattle, Washington. These activities were performed in accordance with the ORISE site-specific decommissioning inspection plan (ORISE 2006a), submitted to and approved by the NRC, and the ORISE Survey Procedures and Quality Assurance Manuals (ORISE 2006b and 2005). This report addresses the contractor's follow-up to the ORISE recommendations provided in the Site-Specific Decommissioning Inspection Report (issued October 16, 2007). In addition, confirmatory surveys were performed on the Reactor Floor area.

The licensee developed the Final Status Survey (FSS) portion of the Decommissioning Plan (DP) (NES 1994b) utilizing the guidance of NUREG/CR-5849 (NRC 1992) and Regulatory Guide 1.86 (NRC 1974). The FSS process was evaluated against the requirements of Section 4.0 of the DP, which was approved by the NRC on May 1, 1995. The FSS process was also evaluated against the requirements of the Final Status Survey Plan (FSSP) (ENERCON 2006a and b), which was developed by the licensee to provide procedural guidance for the implementation of the FSS.

The following applicable checklist items from the Site-Specific Decommissioning Inspection Report (ORISE 2006c) represent those items where ORISE identified findings and /or areas for improvement. The contractor has taken action to address each issue, as discussed in the Follow-Up sections below. Several issues identified by ORISE were addressed in Revision 2 of the Final Status Survey Report (FSSR) (ENERCON 2007). Therefore, this document was also reviewed and is referenced in several areas of the report.

1.0 GENERAL

1.1 Review past records of spills or other releases of radioactive material and documentation of cleanup.

No additional actions necessary (refer to ORISE 2006c)

1.2 Tour plant areas to obtain familiarity with the facility, surrounding areas, and decommissioning work completed. Review the licensee's plans and schedule for completing further decontamination work and surveying of the facility.

No additional actions necessary (refer to ORISE 2006c)

2.0 IDENTIFICATION OF CONTAMINANTS AND DCGLS

2.1 Review previous measurement and analytical results to confirm the nature of the site information and contaminants at the site, as required by Sections 4.1 and 4.3.2 of the DP. In particular, review the data that relate to the licensee's determination of radionuclide ratios, fractional contributions to total activity and variability.

Observations: The DP specifies that the NRC Regulatory Guide 1.86 limits will be applied for unrestricted release surveys at the UWNR. The contractor has selected the most conservative surface contamination limit for alpha-emitters (100 dpm/100 cm^2, averaged over a one-square meter area), given that the potential for plutonium contamination exists at the site. The selected surface contamination limit for beta-gamma emitters at the UWNR is 5,000 dpm/100 cm^2, which appears to be appropriate given the list of potential isotopes presented in Table 4-2 of the FSSP. However, Table 4-2 of the FSSP also lists hard-to-detect radionuclides (HTDN) such as H-3, C-14, and Fe-55, which could not be detected and/or quantified using the contractor's field survey instruments (which are calibrated to Tc-99).

Information provided in Radiological Characterization Report (NES 1994a) and the FSSP (ENERCON 2006a) was reviewed. The Characterization Report discussed that elevated levels of Cs-137, Co-60, and Eu-152/154 were detected in floor drains, sink traps, and in the process pit sump and retention tanks, and that gross beta-gamma and plutonium isotope surface contamination exceeding the Regulatory Guide 1.86 criteria was detected in several areas inside the restricted area. The FSSP (Table 4-2) included a list of potential isotopes of concern and discusses the inclusion of Pu-241 as another potential contaminant. However, ORISE could not locate a technical basis or other document to justify the Decommissioning Release Criteria presented in Table 4-1 of the FSSP, which are based on the limits specified in Regulatory Guide 1.86 (NRC 1974).

Recommendations: The selected surface contamination limit for beta-gamma emitters should be justified with a technical basis or other document that discusses the known contaminants of concern, the potential for HTDN in the radionuclide mix, and the methods for detection of the HTDNs (modification of the release limit, liquid scintillation analysis, etc.), if applicable.

Follow-up: The licensee included a discussion of the HTDN evaluation for the interior bioshield walls in Revision 2 of the FSSR (ENERCON 2007). Sections 5.4 and 5.5 of the referenced report describe the method the contractor utilized to adjust the beta surface activity limit of 5,000 dpm/100 cm^2 to account for the presence of H-3. The contractor collected a composite concrete sample from the interior surfaces of the bioshield walls that indicated a 1.86 to 1 ratio of H-3 to the detectable beta-emitters (Co-60 and Eu-152). No other HTDN were detected in the sample. The contractor then adjusted the beta surface activity limit to 1,700 dpm/100 cm^2 specifically for the interior bioshield walls to account for the presence of the hard-to-detect H-3. ORISE agrees that this represents a sound technical method for

accounting for the potential presence of H-3 on the interior bioshield walls. No additional actions are recommended.

2.2 Review the technical basis developed for the FSS instrumentation to be used for structural surfaces and embedded piping surveys to demonstrate compliance with the release criteria. Verify that the licensee has accounted for all media for which the FSS will be designed (based on the requirements of Regulatory Guide 1.86).

Observations: Based on discussions with the contractor's technical staff, a decision had been made to perform only exposure rate measurements on the remaining portions of the reactor bioshield to demonstrate compliance with the unrestricted release limits. This decision was made because aggressive decontamination efforts rendered a rough and uneven surface on the interior walls of the bioshield structure. However, a technical basis had not been developed to assure that exposure rate measurements would be adequate to demonstrate compliance with the unrestricted release criteria for surface activity specified in Regulatory Guide 1.86 and in the DP.

Recommendations: ORISE recommends that the contractor develop a technical basis document to justify the survey/sampling scheme for the uneven surfaces of the bioshield structure in order to assure compliance with the Regulatory Guide 1.86 release limits. The technical basis could include surface contamination measurements with instruments that are appropriately calibrated to account for the source-to-detector distance, or it could include a sampling plan that would specify a minimum required number of samples that would be utilized to demonstrate compliance with the release limits in lieu of performing surface contamination measurements.

Follow-up: The contractor included a discussion of surface activity data evaluation in Section 7.1.3.16 of Revision 2 of the FSSR (ENERCON 2007). The contractor performed a series of co-located surface activity measurements with the 17.5 cm^2 Geiger-Mueller (GM) and the larger 126 cm^2 gas-proportional detector to assure that the rough surfaces of the interior bioshield walls did not decrease the efficiency of the gas-proportional detector. The FSSR states that the data collected with the two detectors were comparable. No additional actions are recommended.

2.3 Evaluate how the Release Criteria will be implemented—e.g., use of surrogate measurements and modified Release Criteria, Elevated Measurement Comparison—to determine how samples/measurements will be compared, and implementation of the unity rule (based on the guidance of NUREG/CR-5849 and best industry practices).

No additional actions necessary (refer to ORISE 2006c)

3.0 AREA CLASSIFICATION

3.1 Based on plant area tours and review of characterization and other survey results, evaluate the licensee's technical basis for site classification as Affected versus Unaffected areas (based on the requirements of Section 4.3 of the DP).

No additional actions necessary (refer to ORISE 2006c)

3.2 For Affected Areas, review the available information and data used for initially classifying the areas (based on the requirements of Section 4.3 of the DP).

No additional actions necessary (refer to ORISE 2006c)

4.0 FINAL STATUS SURVEY PROCEDURES AND INSTRUMENTATION

4.1 Building Surface Survey Instrumentation

4.1.1 Review the following information to assure instrumentation is capable of measuring surface activity levels specified in Regulatory Guide 1.86 and Table 4-1 of the FSSP. Review the calibration and performance check procedures. Ensure calibrations will account for any environmental or other factors that could potentially impact performance. Evaluate the appropriateness of the calibration source energies in determining instrument efficiencies and any applied weighting factors relative to the radionuclides of concern. Evaluate the licensee's selection of surface efficiency value(s). Review the survey instrumentation operational checkout procedures and acceptance parameters.

Observations: The contractor is conducting performance checks of field survey instruments once daily, at the beginning of the day prior to use. This is contrary to a recommendation in Section 6.5.4 of the MARSSIM, which states "For most portable radiation survey equipment, MARSSIM recommends that a response check be performed twice daily when in use-typically prior to beginning the day's measurements and again following the conclusion of the measurements on the same day."

Recommendation: Although it is understood that the licensee has not committed to following the guidance in the MARSSIM, ORISE recommends that the licensee perform response checks of field survey instruments a minimum of twice daily, at the beginning of the day and at the end of the day, as an added quality control measure.

Follow-up: Revision 2 of the FSSR (ENERCON 2007), Section 5.3.3, states that operational checks were performed for field survey instruments at the beginning of each day and at the conclusion of each FSS survey. This approach is consistent with ORISE's recommendation. No additional actions are recommended.

4.1.2 Review the following information to assure instrumentation is capable of measuring surface activity levels specified in Regulatory Guide 1.86 and Table 4-1 of the FSSP. Review both the scanning and static measurement minimum detectable concentration (MDC) determinations.

Observations: The equation specified in the FSSP for the determination of scan MDC is not appropriate for alpha-emitting radionuclides in order to demonstrate compliance with the Regulatory Guide 1.86 criteria.

Recommendation: Section 3.8.4 of the FSSP, Revision 2 (ENERCON 2006a), states that "MDC calculations will be performed using the formulae contained in MARSSIM." Therefore, ORISE recommends that the FSSP should be modified to include the correct equation for the *a priori* determination of scan MDC for alpha-emitting radionuclides (refer to Section 6.7.2.2 of the MARSSIM) in order to demonstrate compliance with the Regulatory Guide 1.86 release criteria.

Follow-up: The FSSP has been modified to include the correct calculation for the determination of scan MDC for alpha-emitters. A table is also provided in the FSSP that specifies the calculated probability of detection based on site-specific instrument parameters (Table 3-4). However, the detection efficiency for alpha-emitters specified in Tables 3-3 and 3-4 is not consistent with the typical alpha efficiencies that are being applied. ORISE observed during the site visit typical alpha efficiencies in the range of 0.08 to 0.09, which is much lower than the value cited in Table 3-4 of the FSSP (0.214). ORISE recommends that the *a priori* scan MDC should be recalculated using the appropriate detection efficiency. This recommendation was reiterated in an ORISE comment letter issued on January 4, 2007 (ORISE 2007) pertaining to the FSSR (ENERCON 2006c), as this issue was not addressed in Revision 1 of the FSSR.

As a follow-up to a Request for Additional Information (RAI) submitted to the licensee by the NRC, Section 5.3.1 of the FSSR was revised (Revision 2) (ENERCON 2007) to incorporate the calculation of the *a priori* scan MDC using the correct efficiency (0.105). The scan rate required to achieve the minimum desired probability of initial detection is consistent with the scan rate required by the FSSP and the contractor's procedures. Therefore, although the FSSP was not revised as recommended by ORISE, the scanning procedures were appropriate to achieve the desired level of sensitivity, as indicated by the FSSR (Revision 2) (ENERCON 2007). No additional actions are recommended.

4.1.3 Review the procedures for field use of instrumentation and evaluate whether any *a priori* factors that may impact use in the field have been accounted for, such as scan speed and background variability. Review training records of personnel who will operate survey instrumentation (based on requirements specified in Section 3.10 of the FSSP).

Observations: The contractor is determining the instrument background on a daily basis, and the instrument backgrounds are being determined in the facility. Therefore temporal and spatial variations in background are being accounted for. Section 3.9.1.1 of the FSSP (Revision 2) specified a scan speed of 1 probe-width per second (for alpha/beta scans). However, this scan speed is typically not appropriate for alpha-emitters in order to achieve an adequate MDC to detect 300 dpm/100 cm^2.

Recommendations: ORISE recommends that the contractor calculate the appropriate scan speed required to detect 300 dpm/100 cm^2 alpha surface activity (refer to item 4.1.2).

Follow-up: The FSSP has been modified to specify a scan rate of one-half to one-third probe width per second (ENERCON 2006b). However, the appropriate efficiency was not utilized to determine this scan rate (refer to item 4.1.2). ORISE recommends that the scan rate should be determined using the appropriate detection efficiency. This recommendation was reiterated in an ORISE comment letter issued on January 4, 2007 (ORISE 2007) pertaining to the FSSR (ENERCON 2006c), as this issue was not addressed in Revision 1 of the FSSR.

As a follow-up to a Request for Additional Information (RAI) submitted to the licensee by the NRC, Section 5.3.1 of the FSSR was revised (Revision 2) (ENERCON 2007) to incorporate the calculation of the *a priori* scan MDC using the correct efficiency (0.105). The scan rate required to achieve the minimum desired probability of initial detection is consistent with the scan rate required by the FSSP and the contractor's procedures. Therefore, although the FSSP was not revised as recommended by ORISE, the scanning procedures were appropriate to achieve the desired level of sensitivity, as indicated by the FSSR (Revision 2) (ENERCON 2007). No additional actions are recommended.

4.2 Final Status Survey Procedures

Review final status survey procedures and planning documents for the following:

4.2.1 Verify the adequacy of reference areas selected by the licensee for assessing background contributions to surface activity levels and other volumetric media (based on NUREG/CR-5849 guidance).

No additional actions necessary (refer to ORISE 2006c)

4.2.2 Review procedures for establishing survey unit boundaries (based on NUREG/CR-5849 guidance and the requirements of Section 3.5 of the FSSP). Review maps showing preliminary survey unit designations.

No additional actions necessary (refer to ORISE 2006c)

4.2.3 Review procedures for determining the required number of measurements (based on NUREG/CR-5849 guidance).

No additional actions necessary (refer to ORISE 2006c)

4.2.4 Review procedures for required scan coverage based on survey unit classification (based on requirements of Section 4.3 of the DP and NUREG/CR-5849 guidance).

No additional actions necessary (refer to ORISE 2006c)

4.2.5 Review methods for evaluating areas of elevated activity detected during scans (based on the requirements of Regulatory Guide 1.86 and NUREG/CR-5849 guidance).

No additional actions necessary (refer to ORISE 2006c)

4.2.6 Review proposed investigation levels and adequacy relative to the required and actual scan MDCs (based on requirements of Regulatory Guide 1.86 and Section 4.3.2 of the DP).

Observations: Section 4.3.2 of the DP states that "For direct methods of surface monitoring, the scanning speed will be slow enough to ensure a source detection probability of at least 25% of the guideline level." The calculated scan MDC for beta surface activity, as specified in Table 3-3 of the FSSP, is less than 25% of the release criteria for gas proportional detectors, but is not less than 25% of the release criteria for beta friskers. Furthermore, the scan MDC for alpha surface activity specified in Table 3-3 of the FSSP is 160 dpm/100 cm^2, which is not less than 25% of the release criteria.

Recommendations: ORISE recommends that the licensee develop and submit a technical basis to the NRC to justify the deviation from the requirements of the DP. ORISE recognizes that standard FSS instrumentation is not capable of detecting radioactivity at 25% of the Regulatory Guide 1.86 release criteria when utilized for scanning, nor is there a regulatory requirement that scanning instrumentation should be capable of detecting radioactivity at these levels. Current guidance contained in the MARSSIM states that instrumentation used for scanning should be capable of detecting radioactivity at or below the $DCGL_{EMC}$. However, because the licensee has deviated from a requirement in the DP, a justification should be provided.

Follow-up: As indicated in the licensee responses to RAIs (UW 2007), a 10 CFR 50.59-type change was approved by the University Technical Safety Committee to change the DP requirement for scan MDCs to be less than the maximum release criteria (versus 25% of the release criteria). This change is consistent with the contractor's procedures. No additional actions are recommended.

4.2.7 Review selection process for measurement locations in survey units (based on guidance contained in NUREG/CR-5849 and Section 4.3 of the DP).

No additional actions necessary (refer to ORISE 2006c)

4.2.8 Review proposed procedures and any associated factors for surveying embedded piping or other difficult to access or inaccessible areas (based on Regulatory Guide 1.86 requirements).

No additional actions necessary (refer to ORISE 2006c)

4.2.9 Review methods for determining when media sampling is required for structural surfaces areas (based on requirements in Section 3.9.5 of the FSSP).

No additional actions necessary (refer to ORISE 2006c)

4.2.10 Review sampling and chain-of-custody procedures (based on requirements of Section 4.3.3 of the DP).

No additional actions necessary (refer to ORISE 2006c)

5.0 ANALYTICAL PROCEDURES AND COMPARISON ACTIVITIES

5.1 Review the laboratory instrumentation and analytical methods that will be used for sample analysis. Determine appropriateness and sensitivity of the selected equipment for the radionuclides of concern.

Observations: Not evaluated per agreement with NRC.

5.2 Review the licensee's procedures for sample collection, packaging, chain-of-custody, and shipping.

Observations: Not evaluated per agreement with NRC.

6.0 IN-PROCESS AUDIT OF RADIOLOGICAL SURVEY TECHNICIANS

Review the licensee's radiological survey technician's implementation of the final status survey. Specifically:

6.1 Understanding of the concepts of the FSSP and associated documents and procedures as outlined in the Final Status Survey Training Manual.

No additional actions necessary (refer to ORISE 2006c)

6.2 Adherence to the specifications of the survey instructions generated by the licensee for final status survey field implementation.

No additional actions necessary (refer to ORISE 2006c)

6.3 Performance of surface scans—evaluate the procedures/protocols for identifying areas of elevated direct radioactivity for investigation. Compare the procedures/protocols for adequacy relative to the *a priori* scan MDC determination.

Observations: Section 3.6 of the revised FSSP (Revision 3) states that "An area may be reclassified from Unaffected to General Affected if results warrant the increase. This may be done if any static or removable activity beta measurement yields positive results > 25% of the applicable beta release criteria and the results have been determined not to be from external activities…" The nominal MDA for direct beta measurements per Table 3-3 of the FSSP is 335 dpm/100 cm^2, which is less than 25% of the release limit of 5000 dpm/100 cm^2.

Recommendations: ORISE recommends that the reclassification criteria be more clearly stated. The use of the word "may" does not represent a clear commitment to reclassify a given survey unit based on the specified criteria.

Follow-up: Based on a review of the data in the FSSR (ENERCON 2007), the contractor appropriately and conservatively applied the classification criteria discussed in Section 3.6 of the FSSP (Revision 3). No additional actions are recommended.

7.0 CONFIRMATORY SURVEY MEASUREMENTS

Procedures: ORISE performed confirmatory surveys in four survey units (SUs) on the Reactor Floor, including SUs 1-2, 1-3, 1-4, and 1-5. Confirmatory survey activities were performed in accordance with ORISE Survey Procedures and Quality Assurance Manuals (ORISE 2006b and 2005). Smear samples were analyzed in accordance with the requirements of the ORISE Laboratory Procedures Manual (ORISE 2006d).

ORISE performed alpha and beta surface scans using Ludlum Model 43-68 gas proportional detectors coupled to Ludlum Model 2221 ratemeter-scalers with audible indicators. Scans were generally performed on 100% of the floor surfaces, 50 to 100% of the lower wall surfaces, and judgmental areas on the upper wall/ceiling surfaces. The scan density for each area is presented in Table 1. Areas of elevated direct radioactivity were marked for further investigation. Direct and removable surface activity measurements were collected at areas of elevated activity identified during scanning.

Results: All surveyed areas were Alpha Affected survey units, with the exception of the interior bioshield walls, which were General Affected. Beta scan results were generally from 900 to 2,400 counts-per-minute (cpm) with the floor monitor, and from 230 to 450 cpm with the 43-68 detector. Alpha scan results generally ranged from 0 to 50 cpm.

Direct and removable measurements were only collected at areas of elevated activity that were identified by an increase in the audible count rate during scanning. The direct measurement results are presented in Table 3. Two measurement locations on the interior surfaces of the bioshield walls exceeded the modified release criteria of 1,700 dpm/100 cm^2 (beta surface activity), but were less than the modified maximum release criteria of 5,100 dpm/100 cm^2. All other results were less than the site release criteria.

Findings: ORISE recommends that the contractor collect additional measurements around the two elevated locations on the bioshield walls to verify that the square-meter average is less than 1,700 dpm/100 cm^2. These additional measurements were not performed by ORISE during the site visit because the modified release criteria had not been determined at that time, and the results were less than the existing release criteria of 5,000 dpm/100 cm^2.

Follow-up: As indicated in the licensee responses to RAIs (UW 2007), the contractor removed the two areas of elevated activity during the sampling event to characterize the bioshield interior surfaces for HTDNs. The locations were resurveyed following the removal of the areas of elevated activity, and results were less than the modified release criteria. Therefore, no additional actions are recommended.

8.0 CONCLUSION

During the period of August through November 2006, ORISE performed a comprehensive IV at the University of Washington Research and Test Reactor Facility. The objective of the ORISE IV was to validate the licensee's final status survey processes and data, and to assure the requirements of the DP and FSSP were met. Based on the results of the IV, it is ORISE's conclusion that the final survey requirements of the DP and FSSP were satisfied and that the levels of radioactivity at the University of Washington Research and Test Reactor Facility are commensurate with the radiological release guideline criteria.

TABLE 1

SCAN DENSITY FOR SELECTED SURVEY UNITS
UNIVERSITY OF WASHINGTON RESEARCH AND TEST REACTOR
SEATTLE, WASHINGTON

Survey Unit	Area	Surface	Scan Density (% of Surface Area)
1-2	Experiment Room	Floor	100
		Lower Walls	50-75
		Upper Walls	65
1-3	Reactor Room North Wall	Lower Walls	50-75
		Upper Walls	40-50
1-3	Reactor Room South Wall	Lower Walls	50-75
1-3	Reactor Room West Wall	Lower Walls	50-75
		Upper Walls	50
1-3	Reactor Room Floor	Floor	100
1-3	Process Pit	Floors/Walls	100
1-3	Fuel Storage Pit (Sections A0 and B0)	Floor	100
1-3	Top of Bioshield, North Section	Floor	100
1-3	Interior Bioshield Surfaces	Floor/Walls	75
1-3	Crane Rails	Rail	25
1-4	Crystal Spectroscopy Room	Floor	100
		Lower Walls	75
1-5	Radiochemistry Laboratory	Floor	100
		Lower Walls	50-75

TABLE 2

SCAN RESULTS
UNIVERSITY OF WASHINGTON RESEARCH AND TEST REACTOR
SEATTLE, WASHINGTON

Area	Scan Ranges (cpm)					
	Floors[a]		Lower Walls[b]		Upper Walls/Ceiling[b]	
	α	α+β	α	α+β	α	α+β
Experiment Room	0 to 15	1,000 to 1,600	0 to 31	250 to 380	0 to 31	250 to 380
Reactor Room North Wall	N/A	N/A	0 to 35	250 to 380	0 to 27	230 to 390
Reactor Room South Wall	N/A	N/A	0 to 37	250 to 450	---[c]	---
Reactor Room West Wall	N/A	N/A	0 to 41	250 to 350	0 to 31	260 to 430
Reactor Room Floor	0 to 50	1,100 to 2,400	N/A	N/A	N/A	N/A
Process Pit	0 to 35	300 to 450	0 to 35	300 to 450	N/A	N/A
Fuel Storage Pit	0 to 40	280 to 380	N/A	N/A	N/A	N/A
Top of Bioshield	0 to 22	230 to 350	N/A	N/A	N/A	N/A
Interior Bioshield Surfaces	N/A	0 to 300[d]	N/A	0 to 300[d]	N/A	0 to 300[d]
Crane Rails	0 to 17	280 to 380	N/A	N/A	N/A	N/A
Crystal Spectroscopy Room	0 to 50	900 to 1,900	0 to 37	250 to 380	---	---
Radiochemistry Laboratory	0 to 12	900 to 1,500	0 to 33	250 to 350	---	---

[a]Observed background for floor monitor ranged from 0 to 50 cpm (alpha) and 900 to 2400 cpm (alpha + beta).
[b]Observed background for the 43-68 detector generally ranged from 0 to 40 cpm (alpha) and 250 to 450 cpm (alpha + beta).
[c]Not performed.
[d]Scanning performed with Geiger-Mueller (GM) detector. Observed background generally ranged from 40 to 50 cpm.

TABLE 3

CONFIRMATORY SURVEY MEASUREMENT RESULTS
UNIVERSITY OF WASHINGTON RESEARCH AND TEST REACTOR
SEATTLE, WASHINGTON

Location Description	Measurement/ Smear #	Direct Surface Activity (dpm/100 cm²)		Removable Surface Activity (dpm/100 cm²)			
		ALPHA	BETA	ALPHA	BETA	H-3	C-14
Reactor Room Floor, Grid A7	1A/1B	48	3,500	1.5	0.54	44	30
Bioshield Floor, Grid B1	2A/2B	8	3,700	-0.37	1.6	99	46
Bioshield North Wall, Grid D0	3A/3B	63	1,400	-0.37	-2.7	-18	3.8
Bioshield South Wall, Grid E-1	4A/4B	8	1,800	-0.37	1.6	38	13

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