



OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

October 18, 2006

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 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 site visit, which was conducted during the period August 23 and 24, 2006, Oak Ridge Institute for Science and Education (ORISE) personnel observed contractor personnel performing FSS at the reactor facility, and performed side-by-side field measurements in order to validate the contractor's final survey procedures and results. ORISE personnel also reviewed several decommissioning related documents and discussed procedure implementation with site personnel. In addition, ORISE performed confirmatory surveys in three areas where decommissioning and FSS activities had been completed. This final report contains a summary of the inspection results and findings, and addresses comments received by the NRC on the draft report. If you have any questions, please direct them to me at 865.241.8893 or Scott Kirk at 865.574.0685.

Sincerely,

Sarah Roberts  
Health Physicist/Project Leader  
Survey Projects

SJR:km

Enclosure

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## FINAL

# SITE-SPECIFIC DECOMMISSIONING INSPECTION REPORT 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 site-specific decommissioning in-process inspection activities 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 describes the inspection activities performed on site during the period of August 23 and 24, 2006 specifically pertaining to the UWNR final status survey (FSS). As part of the in-process inspection, ORISE performed side-by-side field measurements with the contractor in order to corroborate the contractor's FSS results. In addition, confirmatory surveys were performed in three areas where remediation and FSS activities had been completed.

The licensee developed the 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 were taken from the Site-Specific Decommissioning Inspection Plan (ORISE 2006a). Observations and recommendations are noted under each checklist item. ORISE reviewed several UWNR documents and procedures. These include the Radiological Characterization Report (NES 1994a), the DP, and the FSSP. In addition, ORISE reviewed the contractor's instrument calibration and check-out records and FSS field data documentation forms.

### 1.0 GENERAL

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

**Observations:** ORISE staff reviewed the Radiological Characterization Report (NES 1994a) and the DP (NES 1994b), which discuss a plutonium spill that occurred in 1972. No other significant spills were noted.

**Recommendations:** None.

- 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.

**Observations:** ORISE staff toured the Reactor Building and adjacent retention tank area. UWNR personnel were performing underground pipe removal on the Reactor Floor and FSS surveys in the former Counting Room area.

**Recommendations:** None.

## 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<sup>2</sup>, 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<sup>2</sup>, 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 developed a document that was provided to ORISE on 9/1/06 entitled "Addendum to UW Comments Received 8/29/06, Radiological Contaminants of Concern at the UWNR." The document addresses the known contaminants of concern (COC) at the UWNR based on process knowledge and historical use, concrete samples collected during the site characterization, and smear

samples collected during initial D&D activities. The document states that HTDNs, including H-3 and C-14, were known to exist in activated areas of the biological shield. The document states that wet smears were collected on shield blocks and various surfaces of the reactor room to determine if C-14 and H-3 had migrated outside the reactor core. However, the document does not specify if additional concrete samples were collected following the removal of the activated portions of the biological shield to verify that all activated areas of concrete were removed, thus verifying that all areas of the bioshield that could contain HTDNs were removed. ORISE further recommends that the document be modified to provide additional detail regarding verification sampling activities that were performed following the removal of activation portions of the biological shield to provide assurance that all areas of the remaining reactor structure are free of HTDNs that could not be detected with field instrumentation.

- 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:** The contractor has committed to removing all embedded piping, with the exception of several pipe penetrations that remain in the reactor wall. Based on discussions with the ENERCON Project Engineer, the contractor intended to use a sodium-iodide (NaI) detector for the survey of interior pipe surfaces to demonstrate compliance with the FSS criteria. However, the contractor had not developed a technical basis or other document that discussed the instrument sensitivity or methods for demonstrating compliance with the Regulatory Guide 1.86 surface contamination limits.

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 FSS protocol for embedded piping be documented in the FSSP or other technical basis document. This document should provide justification to assure that the survey method will provide adequate measurement sensitivity and survey/scan coverage to demonstrate compliance with the release limits.

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 FSSP has been modified to remove the use of NaI detectors for the survey of embedded piping. The FSSP describes the survey approach for embedded piping, to include the collection of swabs and the removal of sections of pipe for survey.

Based on correspondence received by ORISE from the UWNR contractor on 9/1/06, the FSSP (Revision 3) has been modified to include the reactor monolith as a “general affected” area, which requires surface scans and direct measurements in addition to exposure rate measurements in order to demonstrate compliance with the Regulatory Guide 1.86 release criteria. Information pertaining to the instrument calibration methods to account for the uneven surfaces was not provided.

- 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).

**Observations:** Refer to Observations in Section 2.1.

**Recommendations:** Refer to Recommendations in Section 2.1.

### 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).

**Observations:** The DP and most current FSSP (Revision 2) were reviewed and classification approach discussed during the facility tour. The DP specifies two types of survey unit classification, affected and unaffected. The DP states that the Reactor Room, Radiochemistry Lab, and Crystal Spectroscopy Room (now referred to as the Counting Room) and Retention Tank are affected areas. The FSSP further delineates affected areas into “Alpha Affected” and “General Affected Areas,” and site areas and respective anticipated classifications are provided in the FSSP. The initial classification was based on historical process information and/or characterization surveys. Upon review of the current facility classification list, ORISE discovered that several areas that were initially classified as “Alpha Affected” per the FSSP, including the walls of the Reactor Room, Counting Room, Experiment Room, and Radiochemistry Lab, were reclassified as “General Affected.” These areas were initially classified as “Alpha Affected” (per Revision 2 of the FSSP) because they were impacted by the 1972 plutonium spill. However, the contractor reclassified the areas as “General Affected” because the original surface, an asbestos skim coat, has been removed as part of D&D activities. This change is classified as a

non-conservative change, because alpha contamination surveys are not required for “General Affected” areas.

**Recommendations:** ORISE recommends that the survey unit classifications remain “Alpha Affected” for the listed areas, given that there is a potential for remediation activities (including the removal of the skim coat) to result in the contamination of the surfaces. ORISE also recommends that survey unit classifications specified in the DP and the FSSP not be changed in a non-conservative manner without prior NRC approval.

**Follow up:** ORISE received a document entitled “Response to ORISE Comments” on 9/1/06. Per this document, the survey unit classifications originally specified in Revision 2 of the FSSP (ENERCON 2006a) will be applied, and will be reiterated in Revision 3 of the FSSP (ENERCON 2006b). Therefore, the Reactor Room, Counting Room, Experiment Room, and Radiochemistry Lab will be classified as “Alpha Affected.”

- 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).

**Observations:** All areas within the restricted area are considered “Affected”. The initial review of the average and maximum activity levels indicates that survey areas have been appropriately classified relative to the anticipated release limits. However, there are several areas that are classified as “Alpha Affected” per the FSSP that were later reclassified as “General Affected” (refer to Observations in Section 3.1)

**Recommendations:** Refer to Recommendations in Section 3.1.

## 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 using calibration sources of the appropriate energies for performing calibration of field instruments. The contractor is utilizing Tc-99 for calibrations for beta field measurements, which is conservative given the expected COCs for the facility. It should be noted that the contractor is not applying the ISO-7503 (ISO 1988) recommended surface efficiency for Tc-99 (0.25) given that the expected

beta-emitting COCs have maximum beta energies greater than 0.4 MeV (with the exception of H-3 and C-14, refer to Section 2.1). 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:** The FSSP has been modified to include the requirement for an additional response check of field instruments “at the conclusion of each FSS survey.” However, the FSSP does not specify the frequency of the response check (e.g., daily following the completion of survey, etc.). ORISE recommends that the FSSP be modified to specify the intended frequency of the additional response check.

- 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 Table 3-4 is not consistent with the typical alpha efficiencies that are being applied, nor with the nominal efficiency presented in Table 3-3 of the FSSP (0.112). 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.

- 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<sup>2</sup>.

**Recommendations:** ORISE recommends that the contractor calculate the appropriate scan speed required to detect 300 dpm/100 cm<sup>2</sup> 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.

## 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).

**Observations:** The contractor is not subtracting a material-specific background.

**Recommendations:** None

- 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.

**Observations:** The contractor has defined the survey unit boundaries based on contamination potential and area classification.

**Recommendations:** None

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

**Observations:** The required number of measurements is consistent with the guidance contained in NUREG/CR-5849 (refer to Table 3-2 of the FSSP).

**Recommendations:** None

- 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).

**Observations:** The required scan coverage specified in the FSSP is consistent with the guidance contained in NUREG/CR-5849 (refer to Table 3-2 of the FSSP).

**Recommendations:** None

- 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).

**Observations:** Section 4.1 of the FSSP specifies the average and maximum release criteria that are consistent with the Regulatory Guide 1.86 limits. The FSSP specifies that survey units may be classified from Unaffected to General Affected if any static or removable measurement exceeds 25% of the applicable beta release criteria. Alpha-affected areas require 100% scan coverage, therefore no reclassification criteria is necessary.

**Recommendations:** None

- 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<sup>2</sup>, 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.

- 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).

**Observations:** The required number of measurements is consistent with the guidance contained in NUREG/CR-5849 (refer to Table 3-2 of the FSSP). Direct measurements are also to be performed at areas of elevated activity identified during scanning.

**Recommendations:** None

- 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).

**Observations:** The contractor has or will remove embedded drain lines. The only remaining embedded pipes associated with the reactor are the pipe penetrations that remain in the bioshield structure. Based on discussions with site personnel, the contractor intended to survey the remaining embedded piping with NaI detectors and collect removable activity measurements (smears) in order to demonstrate compliance with the release criteria. However, the contractor had not documented a technical justification for this approach.

**Recommendations:** Refer to Recommendations in Section 2.2.

**Follow-up:** Refer to Follow-up in Section 2.2.

- 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).

**Observations:** The contractor does not intend to collect media samples at this time.

**Recommendations:** None

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

**Observations:** Chain-of-custody procedures have been established. However, the contractor does not intend to collect samples for off-site analysis during the FSS.

**Recommendations:** None

## 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.

**Observations:** Discussions with site survey technicians indicated a thorough understanding of the requirements of the site FSSP and procedures.

**Recommendations:** None

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

**Observations:** The survey protocols and procedures delineated in the site FSSP were followed by the site survey technicians based on observations of field surveys.

**Recommendations:** None

- 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<sup>2</sup>, which is less than 25% of the release limit of 5000 dpm/100 cm<sup>2</sup>.

**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.

## 7.0 CONFIRMATORY SURVEY MEASUREMENTS

**Procedures:** ORISE performed confirmatory surveys in three areas where the FSS had been completed, including the Control Room, the North Retention Tank, and the Counting Room. 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 2006c).

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 performed over 50 to 100% of the surface area in selected survey units. 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. ORISE and the licensee’s FSS contractor also performed side-by-side direct surface activity measurements at several locations for direct data comparison.

**Results:** The Control Room is an unaffected survey unit, and the North Retention Tank and Count Room are Alpha Affected survey units. Scans for beta radiation were performed on 60% of the accessible surfaces in the Control Room. Scans for alpha and beta radiation were performed on 60% of the accessible surfaces of the North Retention Tank and on 50% of the accessible surfaces on the Counting Room. Background count rates generally ranged from 200 to 400 counts per minute (cpm) for detectors in the beta mode, and from 0 to 2 cpm for detectors in the alpha mode. Beta scan results ranged from 167 to 415 cpm in the Control Room, from 230 to 360 cpm in the North Retention Tank, and from 216 to 425 cpm in the Counting Room. Alpha scan results ranged from 0 to 11 cpm in the North Retention Tank and from 0 to 12 cpm in the Counting Room.

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 1. One measurement location exceeded the site alpha release criteria of 100 dpm/100 cm<sup>2</sup> (measurement 1 on the North Retention Tank floor). However, the square-meter average for this location is well below the release limit. All other direct and removable results are below the site release criteria of 100 dpm/100 cm<sup>2</sup> (direct alpha), 20 dpm/100 cm<sup>2</sup> (removable alpha), 5000 dpm/100 cm<sup>2</sup> (direct beta), and 1000 dpm/100 cm<sup>2</sup> (removable beta).

The side-by-side measurement results are presented in Table 2. In general, the ORISE direct beta surface activity results are lower than the UWNR results, likely due to the difference in the applied background values. The direct alpha surface activity results are comparable, with the exception of location 6D, where the UWNR result is much higher than the ORISE result. However, the UWNR results are conservative when compared to the ORISE results.

**Findings:** None

## 8.0 QA/QC AND DATA MANAGEMENT PROCEDURES

Review the licensee's Quality Assurance/Quality Control (QA/QC) and data management procedures for the final status survey. Specifically:

- 8.1 Review the licensee's QA/QC procedures as they relate to final status survey personnel training requirements and final status survey data acceptance criteria.

**Observations:** The training requirements for the performance of the FSS are specified in Section 3.10 of the FSSP. Copies of the training records are maintained on site. Specific QA requirements for data acquisition, performance assessment, and data validation are specified in Sections 8.0, 9.0, and 10.0 of the FSSP. In addition, the site implements internal verification surveys as an added validation of FSS data quality.

**Recommendations:** None

- 8.2 Review the licensee's data management system that will be used to track field and analytical results.

**Observations:** The site is utilizing Microsoft Excel software to manage FSS data. In addition, a QA/QC Survey Logbook is maintained to document FSS surveys.

**Recommendations:** None

**TABLE 1**  
**CONFIRMATORY SURVEY MEASUREMENT RESULTS**  
**UNIVERSITY OF WASHINGTON RESEARCH AND TEST REACTOR**  
**SEATTLE, WASHINGTON**

Location Description	Measurement #	Direct Surface Activity (dpm/100 cm <sup>2</sup> )		Removable Surface Activity (dpm/100 cm <sup>2</sup> )	
		Alpha	Beta	Alpha	Beta
North Retention Tank Floor	1	110	410	-0.37	-3.8
	1A	0	500	---*	---
	1B	14	300	---	---
	1C	22	310	---	---
	1D	7	210	---	---
	1E	14	290	---	---
	AVERAGE	28	340	---	---
North Retention Tank Floor	2	7	260	-0.37	1.6
North Retention Tank Lower Wall	3	0	21	-0.37	7.0
North Retention Tank Lower Wall	4	7	100	-0.37	-2.7
North Retention Tank Floor	5	7	640	-0.37	-0.54
Count Room Floor, Location B,4	6	7	4600	-0.37	-2.7
Count Room Floor, Location B,4a	7	18	170	-0.37	0.54
Count Room Lower Wall, Location A,0	8	14	120	1.5	7.0
Count Room Lower Wall, Location D,1	9	14	21	-0.37	6.0
Count Room Floor, Location C,3	10	22	210	-0.37	2.7
Count Room Floor, Location A,1	11	4	160	-0.37	2.7

\* Measurement not collected at this location.

TABLE 2

COMPARISON OF DIRECT ALPHA AND BETA  
MEASUREMENT RESULTS  
UNIVERSITY OF WASHINGTON RESEARCH AND TEST REACTOR  
SEATTLE, WASHINGTON

Location Description	Measurement #	Net Alpha Activity (dpm/ 100 cm <sup>2</sup> )		Net Beta Activity (dpm/ 100 cm <sup>2</sup> )	
		ORISE	UWNR	ORISE	UWNR
Count Room, Location B,4	6	7	30	4600	4277
Count Room, Location B,4-1	6A	18	0	260	273
Count Room, Location B,4-2	6B	25	0	54	266
Count Room, Location B,4-3	6C	11	6	230	663
Count Room, Location B,4-4	6D	11	96	740	855
Count Room, Location B,4-5	6E	0	0	390	668
Count Room, Location B,4a	7	18	18	170	357
Count Room, Location A,0	8	14	12	120	152
Count Room, Location D,1	9	14	12	21	258
Count Room, Location C,3	10	22	36	210	341
Count Room, Location A,1	11	4	12	160	448

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