May 21, 2007

Dr. Mani Soma, Acting Dean College of Engineering University of Washington Box 352180 Seattle, WA 98195-2180

SUBJECT: NRC INSPECTION REPORT NO. 50-139/2006-204

Dear Dr. Soma:

On August 21-24, and November 7 and 8, 2006, the U.S. Nuclear Regulatory Commission (NRC) conducted an inspection at your University of Washington Nuclear Reactor facility. Also included as part of the inspection were various telephone conferences from August 2006 through May 2007. Further, the inspection included a review of the Final Status Survey Report (FSSR) dated December 13, 2006, as supplemented on February 26 and March 12, 2007, which was submitted following decommissioning of the facility and site. The survey information in the FSSR indicated that remediation was complete and that all residual radioactivity was quantified, documented, and below the NRC limits. The enclosed report documents the results of the inspection, the conferences, and the review. The results of the onsite inspection were discussed on August 24 and on November 8, 2006, with Jeff Angeley, Associate Construction Manager, University of Washington; representatives of LVI Services, Inc. (the decommissioning contractor); a representative of the Oak Ridge Institute for Science and Education (ORISE, an NRC contractor); and, other licensee and contractor personnel associated with the decommissioning project. The results of the ORISE surveys and the review of the FSSR were discussed by means of a final teleconference on May 11, 2007, with Jeff Angeley and Stanley Addison, Radiation Safety Officer.

The onsite inspection examined decommissioning activities conducted under your license as they relate to safety and compliance with the NRC's rules and regulations and with the conditions of your license. Various aspects of your decommissioning and radiation protection programs were also inspected, including selected procedures and records, decontamination efforts, and survey activities. Licensee and contractor personnel were interviewed as well. The onsite inspection also involved the in-process inspection of final status survey activities and side-by-side field measurements that were performed at your University of Washington Nuclear Reactor facility by our contractor, ORISE, on August 23 and 24, and November 8, 2006. As a result of the inspection and FSSR review, the inspector determined that the decommissioning activities, including the final status survey, were conducted in accordance with the University of Washington Nuclear Reactor Decommissioning Plan utilizing the guidance of NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination," and Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors." The FSSR you submitted demonstrated that all survey units met the criteria in 10 CFR 20.1402 for unconditional release.

Based on the results of this inspection, it was determined that you have met the requirements for license termination given in 10 CFR 50.82(a)(11) in that: 1) the decommissioning of the University of Washington Nuclear Reactor was performed in accordance with the approved Decommissioning Plan, and 2) your final status survey and associated documentation demonstrated that the facility and site have met the radiological criteria for decommissioning set

Dr. Soma

forth in 10 CFR Part 20, Subpart E. The NRC will reply to your request of December 13, 2006, for license termination by separate letter in the near future. No response to this letter is required.

In accordance with Section 2.390 of Title 10 of the Code of Federal Regulations, "Public Inspections, Exemptions, Requests for Withholding," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of NRC's Agencywide Document Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Johnny H. Eads, Branch Chief Research and Test Reactors Branch B Division of Policy and Rulemaking Office of Nuclear Reactor Regulation

Docket No: 50-139 License No: R-73

Enclosure: NRC Inspection Report No. 50-139/2006-204 with Attachments

cc w/encl.: See next page

Dr. M. Carette, Assistant to the Dean College of Engineering University of Washington Box 352180 Seattle, WA 98195-2180

Stanley Addison, Radiation Safety Officer Environmental Health and Safety University of Washington Hall Health Center Box 354400 Seattle, WA 98195-4400

Marty Howlett, Project Manager Capital Projects Office University of Washington University Facilities Annex 2 Box 352205 Seattle, WA 98195-2205

Test, Research, and Training Reactor Newsletter University of Florida 202 Nuclear Sciences Center Gainesville, FL 32611 Dr. Soma

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U. S. NUCLEAR REGULATORY COMMISSION OFFICE OF NUCLEAR REACTOR REGULATION

Docket No:	50-139
License No:	R-73
Report No:	50-139/2006-204
Licensee:	University of Washington
Facility:	University of Washington Nuclear Reactor Facility
Location:	More Hall Annex University of Washington Seattle, WA
Dates:	August 2006 through May 2007
Inspector:	Craig Bassett
Approved by:	Johnny H. Eads, Branch Chief Research and Test Reactors Branch B Division of Policy and Rulemaking Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

University of Washington University of Washington Nuclear Reactor Facility Report No: 50-139/2006-204

The primary focus of this routine, announced inspection involved the on-site review of selected decommissioning activities and the in-process inspection of final status survey activities being performed at the University of Washington Nuclear Reactor Facility. The decommissioning activities reviewed during this inspection included: organizational structure and staffing, review and audit functions, work controls, radiation safety, emergency preparedness, physical security, reporting requirements, and transportation of radioactive materials. The inspector was assisted by NRC contractor personnel from the Oak Ridge Institute for Science and Education (ORISE). The inspection also included a review of the Final Status Survey Report (FSSR) submitted following decommissioning of the facility and site. The licensee's programs were acceptably directed toward the protection of public health and safety, and in compliance with NRC requirements. The inspector concluded that the requirements for license termination given in 10 CFR 50.82(a)(11) were met in that: 1) the decommissioning of the University of Washington Nuclear Reactor was performed in accordance with the approved Decommissioning Plan, and 2) the final status survey and the associated documentation demonstrated that the facility and site have met the radiological criteria for decommissioning set forth in 10 CFR Part 20, Subpart E.

Organization and Staffing

- The licensee's organization was in compliance with the requirements specified in the Technical Specifications and the Decommissioning Plan and the staffing used for the project was acceptable.
- The Decommissioning Contractor had followed the established schedule and the decommissioning was completed in September 2006.

Review and Audit and Design Change Functions

- The review and audit functions outlined in the Technical Specifications and Decommissioning Plan were completed by the Technical and Safety Committee as required.
- Audits were conducted as required by Decommissioning Plan Section 7.2.5.
- The change review and approval process was focused on safety and met program requirements.

Decommissioning Activities and Work Controls

• The decommissioning activities were conducted in accordance with the applicable procedures and the work controls that were implemented during the project appeared to be appropriate.

Radiation Protection Program

• Surveys were completed and documented as required by 10 CFR Part 20.1501(a) to permit evaluation of the changing radiological conditions during decommissioning.

- Notices and postings met regulatory requirements.
- The personnel dosimetry program was acceptably implemented and doses were in conformance with licensee and 10 CFR Part 20 limits.
- Portable survey meters, radiation monitoring, and counting lab instruments were maintained and calibrated as required.
- Appropriate training had been provided to workers.
- The Radiation Protection Program implemented by the Decommissioning Contractor satisfied regulatory requirements.

Emergency Preparedness

• Emergency response was sufficient for the radiological hazards present during the project and as required by the Environmental Health and Safety Plan.

Physical Security

• The physical protection features established for the University of Washington Nuclear Reactor met Technical Specifications and Decommissioning Plan requirements.

Inspection of Transportation Activities

• The radioactive material removed from the site was shipped in accordance with the applicable regulations.

Radionuclides of Concern and Release Criteria

• The licensee had followed the established radiological release criteria guidance as required.

In-Process Inspection and Final Status Survey Review

• Based on the results of Decommissioning Contractor document reviews and confirmatory measurements, the final survey requirements of the Decommissioning Plan and Final Status Survey Plan were satisfied.

Final Status Survey Report

• The final status survey and associated documentation demonstrated that the facility and site have met the radiological criteria for decommissioning set forth in 10 CFR Part 20, Subpart E.

Other Documents Required for License Termination

• The license termination requirements specified in 10 CFR Parts 30, 40, and 70 were addressed in a letter from the University of Washington and no issues remain.

REPORT DETAILS

Background Information

On October 13, 1959, the University of Washington (UW) was issued Construction Permit Number (No.) CPRR-40 to build a ten kilowatt (10 Kw) Universal Training Reactor (UTR-10), an Argonaut-type research and test reactor (RTR). The RTR, generally referred to as the University of Washington Nuclear Reactor (UWNR), was installed in the More Hall Annex and UW received an operating license, No. R-73, dated March 31, 1961. The reactor was fueled with high enriched uranium. Initial criticality was achieved in April 1961 and in April 1967, UW applied for and received authority to increase the rated power level to 100 Kw. The UWNR was operated in support of research, experiments, and education.

During reactor operations, only one incident occurred which caused a radiological problem. On June 13, 1972, a plutonium foil failed during an oscillator experiment. Approximately 42 milligrams of plutonium dust mixed with other isotopes releasing a combined activity of about 20,000 microcuries throughout the Reactor Room. The licensee immediately initiated actions to decontaminate the area and the majority of the contamination was removed. There was some remaining radioactivity on the floor of the Reactor Room and on the "plaza" that surrounded the Reactor Room. To prevent transfer of the contamination, the floor was painted and covered with composition tile.

During the 1987-1988 time frame, the UW administration made the decision to shutdown the facility. Consequently, on June 30, 1988, the reactor ceased operations after generating a total of 303,443 kilowatt-hours. The fuel was subsequently removed from the core and all fuel was shipped offsite to a Department of Energy facility on February 14, 1990. All special nuclear material and source material was shipped offsite or transferred to the UW state materials license.

UW submitted an application for license renewal and a change of status for their RTR facility license from operating to possession only on August 10, 1989. This application was later revised by letter dated August 31, 1989, and supplemental information submitted on February 14 and May 2, 1994. A license renewal authorizing possession but not operation of the reactor was issued by the NRC on July 28, 1994.

By 1993, UW administration had decided that the area where the UWNR was located was needed for other purposes and the decision was made to decontaminate and decommission the facility. An application was made to the NRC for permission to begin such a project and a contractor, NES, Inc., was asked to conduct the appropriate surveys of the site and develop a decommissioning plan. A characterization survey of the UWNR was performed in November 1993 to determine the nature and extent of the radiological contamination at the facility. The contractor completed their work and submitted a plan, "University of Washington Nuclear Reactor Decommission Plan," to UW in July 1994. The Decommissioning Plan (DP) was then submitted to the NRC for review and approval.

The NRC approved the DP and issued the licensee an "Order Authorizing Dismantling of the Facility and Disposition of Component Parts" on May 1, 1995, contingent on funds being available to conduct the decommissioning activities. Funds were not initially available but were appropriated for the project in 2005 and decommissioning activities were initiated in early 2006. Decontamination and decommissioning (D&D) activities were conducted by a Decommissioning Contractor, LVI Services, Inc. (LVI), and its partner ENERCON Services, Inc. (ENERCON), in accordance with the NRC approved DP developed by NES, Inc. The LVI team began project

planning in January 2006 by developing plans and procedures needed for the D&D project. The LVI team began radiological D&D activities in early April 2006 and completed them in August 2006. The low level radioactive waste generated was shipped to U.S. Ecology in Hanford, Washington for disposal and the mixed waste was shipped to Energy Solutions in Clive, Utah.

The Final Status Surveys in support of license termination commenced in August 2006 and were completed in October. The Final Status Survey Report (FSSR) was submitted to the NRC on December 13, 2006, as supplemented on February 26 and March 12, 2007. According to the report, all contaminated systems and components had been removed from the site. Potentially contaminated surfaces identified during site characterization surveys were removed and/or remediated.

The NRC requested that personnel from Oak Ridge Institute for Science and Education (ORISE) perform confirmatory surveys and assist in conducting an in-process inspection of final status survey activities at UW. The in-process inspection and side-by-side field measurements were performed at UWNR on August 23 and 24, and November 8, 2006.

1. Organization and Staffing

a. Inspection Scope (Inspection Procedure (IP) 69013)

The inspector reviewed the following regarding the licensee's organization and staffing to ensure that the requirements of the Technical Specifications (TS) Sections III.A and III.B and the DP Section 2.3 were being met:

- UWNR DP, Revision (Rev.) 2, dated July 18, 1994
- organization and staffing for decommissioning activities
- TS for the UWNR Facility, Amendment No. 16, dated July 28, 1994
- administrative controls and management responsibilities specified in the TS and in the DP
- Annual Report for the UWNR for the period July 1, 2002 to June 30, 2003, dated July 23, 2003
- Annual Report for the UWNR for the period June 1, 2004 to August 18, 2005, dated August 18, 2005

b. Observations and Findings

In reviewing the TS and the DP the inspector noted that the President of the University and the Dean of the College of Engineering were designated as being responsible for managing the UWNR. Line responsibility for radiological safety at the facility included the UW Radiation Safety Officer (RSO). During active decommissioning, management of the facility and project was to be delegated to the Technical and Safety Committee (TSC) as stipulated in the DP. As outlined in the DP, the TSC was to be assisted in the oversight of the project by the University's Environmental Health and Safety Office, by the University's Capital Projects Office, and by the UW RSO. The Decommissioning Contractor (DC), the Executive Engineer for the project, and the Project Health Physicist were to report to the TSC through the UW Associate Construction Manager.

Through discussions with licensee representatives and contractor personnel, the inspector determined that management responsibilities and the organization at the

facility met the requirements specified in the TS and the DP. The inspector verified that the President of the University and the Dean of the College of Engineering continued to retain overall responsibility for the facility. During decommissioning, direction of the facility was overseen by the TSC. An Executive Engineer, hired as a consultant for the licensee, provided overall contractual direction and support to the decommissioning contractor.

Roles and responsibilities of the DC were also reviewed. The DC had responsibility for, and was performing administrative, engineering, and decommissioning work, waste packaging and disposal, and was tasked to complete the final release survey.

The inspector determined that the licensee and contractor staffing levels were adequate during the project to support the activities conducted at the facility.

The inspector noted that DC personnel were following the schedule for completion of the decommissioning project. Decommissioning activities, with the exception of the final surveys, were completed by the end of September 2006.

c. <u>Conclusions</u>

The licensee's organization was in compliance with the requirements specified in the TS and the DP and the staffing level was acceptable. The DC followed the established schedule and the major decommissioning activities were completed in September 2006.

2. <u>Review and Audit and Design Change Functions</u>

a. Inspection Scope (IP 69013)

The inspector reviewed the following to ensure that the requirements of TS Section III.C and DP Section 7.2.5 were being completed as required:

- TSC review and audit functions
- UWNR DP, Rev. 2, dated July 18, 1994
- TSC meeting minutes since February 2004 to date
- TS for the UWNR Facility, Amendment No. 16, dated July 28, 1994
- Audits conducted by the DC, by UW contract personnel, and by UW auditors
- "Alternate Procedure Acceptance Plan," including Appendix A, "More Hall Reactor Decommissioning Plan Change Evaluation Form," issued by UW
- Completed Appendix A forms describing proposed changes to the DP and the accompanying evaluations
- NRC's "Order Authorizing Dismantling of Facility and Disposition of Component Parts," issued May 1, 1995
- NRC's "Order Modifying Requirements for Dismantling of Facility and Disposition of Component Parts," issued January 31, 2006
- Procedure No. UW-MCP-QA-01, "Quality Assurance Program Plan for the University of Washington More Hall Annex Decontamination and Decommissioning (D&D) Project," Rev. 0, dated February 12, 2006

b. Observations and Findings

(1) Review and Audit Functions

The inspector reviewed the TSC meeting minutes documenting the meetings that have occurred since February 2004. The TSC met nearly every month to consider issues arising during the final preparations for the project. It was noted that the members of the TSC were appointed by the Dean of the College of Engineering and included the RSO as required by TS Section III.C and DP Section 2.3.2. Records showed that safety reviews were conducted as required in the TS and the DP. Topics of these reviews were consistent with the requirements to provide guidance, direction, and oversight. The inspector determined that the TSC performed its function as required by TS Section III.C and DP Section 2.3.2.

Audits were also conducted as required in those areas outlined in the TS and DP and at the required frequency. The DC Audit Program met the requirements specified in DP Section 7.2.5. The audits conducted by the DC appeared to be thorough and corrective actions were taken when necessary.

(2) Design Change Functions

The inspector determined that changes to the DP required a staff review and evaluation followed by review and subsequent approval by the TSC and the Advising Health Physicist (HP). The inspector reviewed various changes that had been processed during the project. The inspector determined that the review and approval process had been completed in accordance with procedure and the changes had been reviewed and approved by the TSC as required. From the review, it was also apparent that the change review and approval process was focused on safety and met program requirements.

c. <u>Conclusions</u>

TSC membership and conduct of their DP review functions were in accordance with TS Section III.C and DP Section 2.3.2 requirements. Audits were conducted as required by DP Section 7.2.5. The change review and approval process focused on safety and met program requirements.

3. <u>Decommissioning Activities and Work Controls</u>

a. Inspection Scope (IP 69013)

To verify that the licensee was meeting the requirements of TS Section II and licensee procedures, the inspector reviewed selected aspects of:

- UWNR DP, Rev. 2, dated July 18, 1994
- TS for the UWNR Facility, Amendment No. 16, dated July 28, 1994
- requirements for maintaining safety during decommissioning of the UWNR
- Procedure Number (No.) UW-MCP-AD-01, "Project Management Plan for the University of Washington More Hall Annex D&D Project," Rev. 1, dated February 22, 2006

- Procedure No. UW-MCP-EP-01, "Emergency Action Plan for the University of Washington More Hall Annex D&D Project," Rev. 1, dated March 21, 2006
- Procedure No. UW-MCP-HS-01, "Health and Safety Plan for the University of Washington More Hall Annex D&D Project," Rev. 1, dated February 17, 2006
- Procedure No. UW-MCP-OP-01, "Decommissioning Work Plan for the University of Washington More Hall Annex D&D Project," Rev. 0, dated February 17, 2006
- Procedure No. UW-MCP-OP-02, "Final Status Survey Plan for the University of Washington More Hall Annex D&D Project," Rev. 3, dated August 29, 2006
- Procedure No. UW-MCP-OP-03, "Bioshield Removal Work Procedure for the University of Washington More Hall Annex D&D Project," Rev. 1, dated June 24, 2006
- Procedure No. UW-MCP-OP-08, "Decontamination Work Procedure for the University of Washington More Hall Annex D&D Project," Rev. 0, dated February 28, 2006
- Procedure No. UW-MCP-OP-10, "Reactor System Removal Work Procedure for the University of Washington More Hall Annex D&D Project," Rev. 0, dated February 28, 2006
- Project Manual, Volume 1, "More Hall Annex Decontamination and Decommissioning," UW#10492, dated October 27, 2005
- b. Observations and Findings

On June 30, 1988, the reactor ceased operations after generating a total of 303,443 kilowatt-hours. The DC and LVI team began the decommissioning project planning in January 2006 by developing plans and procedures needed for the D&D project. The LVI team began radiological D&D activities in early April 2006 and completed them in August 2006.

Decommissioning activities focused on the dismantling and removal of the reactor proper, its support structures, auxiliary equipment and components, and the biological shield. During the NRC inspection, the inspector examined the following selected tasks from DP Section 2.2, entitled, "Decommissioning Activities, Tasks, and Schedules:"

2.2.1.6. 1) <u>Radiochemistry Laboratory</u> - Removal of sinks, water lines, drain lines, the fume hood and associated ventilation, lab equipment, and the decontamination of remaining floor and wall areas.

2.2.1.6. 2) <u>Crystal Spectroscopy Room</u> - Removal of secondary coolant system and the Reactor Room ventilation, and the decontamination of remaining floor and wall areas.

2.2.1.7 <u>Reactor Decommissioning - Group 1</u> - Decontaminate equipment and materials which do not have induced radioactivity but which may have surface contamination, i.e., shield blocks and wall and floor coatings.

2.2.1.7 <u>Reactor Decommissioning - Group 2</u> - Remove and dispose of components that do have induced radioactivity, i.e., shield tank, activated graphite in the thermal column, lead bricks, piping, beam ports, and fuel boxes.

2.2.1.7 <u>Reactor Decommissioning - Group 3</u> - Remove and dispose of the monolith concrete located inside the sphere of activation.

2.2.1.7 <u>Reactor Decommissioning - Group 4</u> - Decontaminate if possible or dispose of as radioactive waste equipment, tools, and systems which may have become contaminated during the decommissioning operations.

In order to verify that the above tasks had been performed in accordance with the DP, the inspector reviewed the related records, interviewed DC personnel, and observed work in progress. During the inspection, the inspector also toured the work areas and noted that workers were properly using the required equipment. Planned safety precautions for various jobs, such as excavations and confined space entry to survey the piping system and tunnels, were appropriate. The inspector determined that the above tasks were accomplished as required by procedure and in accordance with the approved plan.

c. Conclusions

The decommissioning activities were conducted in accordance with the applicable procedures and the DP as required. The established work controls appeared to be appropriate.

4. Radiation Protection Program

a. Inspection Scope (IP 69013)

The inspector reviewed the following selected aspects of the radiation protection program to verify compliance with 10 CFR Parts 19 and 20, TS, and DC administrative requirements:

- radiological signs and posting
- UWNR DP, Rev. 2, dated July 18, 1994
- radiation safety training for contractor personnel
- personnel dosimetry records for those working at the facility
- TS for the UWNR Facility, Amendment No. 16, dated July 28, 1994
- Procedure No. UW-MCP-EP-01, "Emergency Action Plan for the University of Washington More Hall Annex D&D Project," Rev. 1, dated March 21, 2006
- Procedure No. UW-MCP-HS-01, "Health and Safety Plan for the University of Washington More Hall Annex D&D Project," Rev. 1, dated February 17, 2006
- Procedure No. UW-MCP-HS-02, "Respirator Protection Program for the University of Washington More Hall Annex D&D Project," Rev. 0, dated January 26, 2006
- Procedure No. UW-MCP-HS-03, "Occupational Radiation Monitoring and Control Procedure for the University of Washington More Hall Annex D&D Project," Rev. 0, dated March 8, 2006
- Procedure No. UW-MCP-RC-01, "Radiation Control Plan for the University of Washington More Hall Annex D&D Project," Rev. 2, dated May 1, 2006
- Procedure No. UW-MCP-RC-02, "Radiological Air Monitoring and Particulate Control Procedure for the University of Washington More Hall Annex D&D Project," Rev. 1, dated March 31, 2006
- Procedure No. UW-MCP-RC-03, "Radiation Work Permit Procedure for the University of Washington More Hall Annex D&D Project," Rev. 0, dated February 20, 2006

- Procedure No. UW-MCP-RC-04, "Routine Radiological Survey Procedure for the University of Washington More Hall Annex D&D Project," Rev. 1, dated March 15, 2006
- Procedure No. UW-MCP-RC-07, "External Dosimetry Procedure for the University of Washington More Hall Annex D&D Project," Rev. 0, dated March 1, 2006
- Procedure No. UW-MCP-RC-09, "Air Sampling Procedure for the University of Washington More Hall Annex D&D Project," Rev. 0, dated April 24, 2006

b. Observations and Findings

(1) Surveys

During the decommissioning project, daily, weekly, monthly, and other special contamination and radiation surveys, outlined in the procedures, were completed by HP personnel. Any contamination detected in concentrations above established action levels was noted and the areas were decontaminated. Results of the surveys were typically documented on survey maps and posted at the entrances of the various areas surveyed so that facility workers would be knowledgeable of the radiological conditions that existed therein.

During the inspection the inspector accompanied a licensee contractor staff member on various tours of the Reactor Room and associated areas. The radiation levels noted by the inspector, using a contractor survey meter, were similar to those listed on survey maps of the areas. No anomalies were noted.

(2) Notices and Postings

During tours while work was in progress, the inspector observed that caution signs, postings, and controls were acceptable for the hazards involving radiation and contaminated areas and were implemented as required by 10 CFR 20, Subpart J. Through observations of and interviews with DC personnel, the inspector confirmed that personnel complied with the signs, postings, and controls. No unmarked radioactive material was noted in the facility. The inspector confirmed that available copies of NRC Form-3, "Notice to Employees," were the current version and were posted in the facility as required by 10 CFR Part 19.

(3) Dosimetry

The dosimetry program requirements and procedures were acceptable. A National Voluntary Laboratory Accreditation Program accredited vendor was used to provide dosimetry for personnel and area monitoring. The inspector confirmed that dosimetry was being issued to staff and licensee contractors as required by 10 CFR 20.1502. A review of the results of the dosimeters sent to the vendor for processing indicated that, of exposures received by decommissioning contract personnel, the highest whole body exposure received by a single individual was 323 millirem. Based on the dosimeter results, the inspector concluded that occupational exposures were well within NRC limits specified in 10 CFR 20.1201 and DP Section 3 guidelines.

It was also noted that a baseline bioassay sample was collected from each person who would be working inside the Reactor Room or working with contamination material before commencing work. Follow-up and/or final bioassay samples were conducted in October 2006. The results indicated that no internal exposure was received.

(4) Radiation Monitoring Equipment

The calibration and periodic checks of the portable survey meters, radiation monitoring, and counting lab instruments were performed by the DC staff or by certified vendors. The portable survey meter calibrations were tracked and controlled using a database. The inspector confirmed that the licensee's calibration procedures and frequencies satisfied TS Section II.A and 10 CFR 20.1501(b) requirements, and the American National Standards Institute N323 "Radiation Protection Instrumentation Test and Calibration" or the instrument manufacturers' recommendations.

The inspector reviewed the calibrations performed for selected instruments in use at the facility. The meters and monitors were calibrated semiannually and records were maintained as required. All instruments checked during the inspection had current calibrations appropriate for the types and energies of radiation they were used to detect and/or measure.

(5) Radiation Work Permit Program

The inspector reviewed the Radiation Work Permits (RWPs) that had been written and were being used during the decommissioning project. It was noted that the instructions specified in Procedure No. UW-MCP-RC-03, "Radiation Work Permit Procedure for the University of Washington More Hall Annex D&D Project," had been adequately followed. Appropriate review by management and HP personnel had been completed. The controls specified in the RWPs were acceptable and applicable for the type of work being done.

(6) Radiation Protection Training

The inspector reviewed the training given to DC personnel. The training satisfied the requirements of 10 CFR Part 19 and the training program was acceptable

(7) Radiation Protection Program

The DC's Radiation Protection Program and As Low As Reasonably Achievable (ALARA) Program were established and described in the DP and implemented through various procedures. The programs contained instructions concerning organization, training, monitoring, surveys, personnel responsibilities, material use, record keeping, emergencies, radiation safety, and maintaining doses ALARA. The ALARA program provided guidance for keeping doses as low as reasonably achievable which was consistent with the guidance in 10 CFR Part 20. The programs, as established, appeared to be acceptable.

c. Conclusions

The inspector determined that the radiation protection program implemented by the licensee during the decommissioning project satisfied regulatory requirements because: 1) surveys were completed and documented as required by 10 CFR Part

5. <u>Emergency Preparedness</u>

a. Inspection Scope (IP 69013)

The inspector reviewed selected aspects of the following to evaluate the UW emergency response capability:

- Environmental Health and Safety Plan (EH&S Plan), dated August 2002
- emergency response facilities, supplies, equipment and instrumentation
- Procedure No. UW-MCP-EP-01, "Emergency Action Plan for the University of Washington More Hall Annex D&D Project," Rev. 1, dated March 21, 2006

b. Observations and Findings

The campus EH&S office maintained its own safety/emergency plan and the UW had an onsite medical clinic. The licensee indicated that fire, ambulance, and other medical services were provided by the city and county.

Training and tours of the UWNR were provided to emergency personnel prior to the start of active decommissioning. The licensee stated that the training was commensurate with the residual radiation hazard at the UWNR.

c. <u>Conclusions</u>

Emergency response, as required by the EH&S Plan, was sufficient for the radiological hazards that were present at the UWNR.

6. <u>Physical Security</u>

a. Inspection Scope (IP 81401)

The inspector reviewed selected aspects of the following to evaluate security of the UWNR facility:

- UWNR DP, Rev. 2, dated July 18, 1994
- TS for the UWNR Facility, Amendment No. 16, dated July 28, 1994
- Procedure Number (No.) UW-MCP-AD-01, "Project Management Plan for the University of Washington More Hall Annex D&D Project," Rev. 1, dated February 22, 2006
- Procedure No. UW-MCP-EP-01, "Emergency Action Plan for the University of Washington More Hall Annex D&D Project," Rev. 1, dated March 21, 2006
- Procedure No. UW-MCP-OP-01, "Decommissioning Work Plan for the University of Washington More Hall Annex D&D Project," Rev. 0, dated February 17, 2006

b. Observations and Findings

The UW Police Department maintained its own security program and provided security and control to all buildings on university property, including the UWNR facility.

Through discussions with licensee and contractor personnel, the inspector determined that the reactor room was maintained secure under a lock security system as required

by the TS Section I.B.2 and DP Section 8. The inspector verified that access to the reactor room during working hours was controlled by one person, the Safety & Compliance Manager for LVI as required. It was also noted that the fenced work area, as well as the entrance doors to the reactor room, were locked during non-working hours as required by TS Section I.B.3.

c. Conclusions

The physical protection features of the UWNR met TS and DP requirements.

7. Inspection of Transportation Activities

a. Inspection Scope (IP 86740)

The inspector reviewed selected aspects of the following to ensure that transportation requirements of 10 CFR, 49 CFR, and licensee procedures were being met:

- radioactive material accountability and transfer records
- radioactive material possession limits specified in licenses of consignees
- Procedure No. UW-MCP-WM-01, "Waste Shipment Plan for the University of Washington More Hall Annex D&D Project," Rev. 2, dated June 28, 2006
- Procedure No. UW-MCP-WM-02, "Radioactive Waste Packaging Procedure for the University of Washington More Hall Annex D&D Project," Rev. 1, dated June 28, 2006

b. Observations and Findings

Through records review and discussions with DC personnel, the inspector determined that various shipments of radioactive waste were made from the facility. The records indicated that the radioisotope types and quantities were calculated and dose rates measured as required. The radioactive material shipment records reviewed by the inspector had been completed in accordance with Department of Transportation (DOT) and NRC regulations.

The inspector verified that the licensee maintained copies of shipment recipients' licenses to possess radioactive material as required and that the licenses were verified to be current prior to initiating a shipment. The training of the staff members responsible for shipping the material was also reviewed. The inspector verified that the shippers' had had training covering the DOT requirements.

c. Conclusions

Radioactive material was shipped from the UWNR site in accordance with the applicable regulations.

8. Radionuclides of Concern and Release Criteria

a. Inspection Scope (IP 69013)

To verify compliance with the limits specified in the UW DP, the inspector reviewed selected aspects of the following:

- UWNR DP, Rev. 2, dated July 18, 1994
- TS for the UWNR Facility, Amendment No. 16, dated July 28, 1994
- LVI Services, ENERCON Services, Ind., "Final Status Survey Plan for the University of Washington More Hall Annex D&D Project," Rev. 3, dated August 29, 2006

- Procedure Number (No.) UW-MCP-AD-01, "Project Management Plan for the University of Washington More Hall Annex D&D Project," Rev. 1, dated February 22, 2006
- Procedure No. UW-MCP-HS-01, "Health and Safety Plan for the University of Washington More Hall Annex D&D Project," Rev. 1, dated February 17, 2006
- Procedure No. UW-MCP-OP-01, "Decommissioning Work Plan for the University of Washington More Hall Annex D&D Project," Rev. 0, dated February 17, 2006
- Procedure No. UW-MCP-OP-02, "Final Status Survey Plan for the University of Washington More Hall Annex D&D Project," Rev. 3, dated August 29, 2006
- University of Washington, College of Engineering Letter, "Re: Termination of NRC License No. R-73, Final Status Survey Report for the University of Washington More Hall Annex Decommissioning Project," dated December 13, 2006

b. Observations and Findings

Radionuclides of concern at the UWNR were identified as those that had been previously reported or were anticipated based upon knowledge of past site operations. Based upon historical site assessment, potential radiological contaminants were those that resulted from neutron activation due to reactor operations and/or radiological spills. The NES 1994 Site Radiological Characterization Report indicated that activation products were potential contaminants in the biological shield and reactor core components. These radionuclides were listed as: H-3, C-14, Mn-54, Fe-55, Co-60, Zn-65, Ag-110, Ag-108, Cs-137, Eu-152, and Eu-154. Because there was never any indication that fuel leaked at the facility, Sr-90 was not identified as a radionuclide of concern at the UWNR. The Characterization Report also identified Pu-239, Pu-240, and Pu-241 as potential contaminants resulting from the June 1972 failed plutonium foil experiment in the Reactor Room.

During the decommissioning of the facility, the various rooms and other areas were classified into three categories because they all did not have the same potential for residual contamination and, thus, did not need the same level of survey coverage to ensure that they met the release criteria. The areas were first classified into "affected" and "unaffected" areas. Affected areas were those that had potential radioactive contaminated based on plant operating history or were known to have been contaminated based on past history or radiological surveillance. Unaffected areas were simply those that were not contaminated. The affected areas were further classified into "general affected" and "alpha affected" based on plant history and the characterization surveys that were performed previously. Alpha affected areas were those that were found to have alpha contamination in excess of 25% of the established release criteria or that were directly impacted by the plutonium foil incident that occurred in 1972.

Unrestricted release criteria for materials and building surfaces used by the licensee was based on the NRC Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors." The release criteria are summarized in Table 1 below.

Emitter Type	Average Static	Maximum Static	Removable
Alpha	100 dpm/100 cm ² (over not more than 1-m ²)	300 dpm/100 cm ² (over not more than 100-cm ²)	20 dpm/100 cm ²
Beta	5,000 dpm/100 cm ² (over not more than 1-m ²)	15,000 dpm/100 cm ² (over not more than 1-m ²)	1,000 dpm/100 cm ²
Gamma (Interior)	Net result ≤5 microRem/hr at 1-m (averaged over 100-m²)	10 microRem/hr at 1-m	N/A
Gamma (Exterior)	Net result ⊴10 microRem/hr at 1-m (averaged over 100-m²)	Net result \le 10 microRem/hr at 1-m (averaged over 100-m ²)	N/A

It was noted that the list of potential isotopes that could be present at the facility included hard-to-detect radionuclides (HTDN) such as H-3, C-14, and Fe-55. ORISE indicated that these isotopes could not be detected or quantified using the DC's survey instrumentation. Consequently, for these HTDNs, the licensee was asked to provide a technical basis to discuss the known contaminants, the potential for HTDN to be present in the combination of radionuclides, and the methods used for detection of the HTDNs. The DC collected and analyzed a composite concrete sample from the interior surfaces of the bioshield walls. Results indicated a 1.86 to 1 ratio of H-3 to detectable beta-emitters (i.e., C0-60 and Eu-152). No other HTDN were detected in the sample. The DC then adjusted the beta surface activity limit to 1,700 dpm/100 cm² specifically for the interior bioshield walls (the area where H-3 was detected following active decommissioning) to account for the presence of the HTDN H-3. This was determined to be adequate.

In reviewing the survey documentation, the inspector determined that the licensee had followed the established radiological release criteria guidance.

c. Conclusions

The licensee had followed the established radiological release criteria guidance.

9. In-Process Inspection and Final Status Survey Review

a. Inspection Scope (IP 69013)

To verify compliance with the limits specified in the UW DP and the Final Status Survey Plan, the inspector reviewed selected aspects of the following:

- UWNR DP, Rev. 2, dated July 18, 1994
- TS for the UWNR Facility, Amendment No. 16, dated July 28, 1994
- NES, Inc, "University of Washington Nuclear Reactor Decommissioning Project; Investigation and Analysis Phase; Radiological Characterization Report," Rev. 3, dated July 18, 1994
- LVI Services, ENERCON Services, Ind., "Final Status Survey Plan for the University of Washington More Hall Annex D&D Project," Rev. 3, dated August 29, 2006
- LVI Services, ENERCON Services, Ind., "Final Status Survey Report for the University of Washington More Hall Annex Decontamination and Decommissioning Project," Rev. 2, dated February 22, 2007
- Procedure Number (No.) UW-MCP-AD-01, "Project Management Plan for the University of Washington More Hall Annex D&D Project," Rev. 1, dated February 22, 2006

- Procedure No. UW-MCP-HS-01, "Health and Safety Plan for the University of Washington More Hall Annex D&D Project," Rev. 1, dated February 17, 2006
- Procedure No. UW-MCP-OP-01, "Decommissioning Work Plan for the University of Washington More Hall Annex D&D Project," Rev. 0, dated February 17, 2006
- Procedure No. UW-MCP-OP-02, "Final Status Survey Plan for the University of Washington More Hall Annex D&D Project," Rev. 3, dated August 29, 2006
- University of Washington, College of Engineering Letter, "Re: Termination of NRC License No. R-73, Final Status Survey Report for the University of Washington More Hall Annex Decommissioning Project," dated December 13, 2006

b. Observations and Findings

The inspector and the ORISE team reviewed the UWNR DP, the NES Radiological Characterization Report, the Final Status Survey Plan, and the procedures used by the DC for the decommissioning project. Document reviews consisted of comparing the Characterization Report and the Final Status Survey Plan methodologies and survey requirements for consistency. Also included were reviews of the final status survey procedures, how information was evaluated to assure that areas identified as exceeding the release criteria had been adequately decontaminated, and verification of residual levels of radioactivity. The ORISE team specifically reviewed: 1) identification of contaminants and derived concentration guideline limits, 2) area classification, 3) final status survey procedures and instrumentation, 4) analytical procedures and comparison activities, 5) in-process audit of radiological survey technicians, and 6) confirmatory survey measurements.

The review indicated that, in general, the procedures, methods, and data submitted by the DC and the licensee were appropriate and adequately reflected the radiological status of the UWNR facility. Throughout most of the facility, the DC used direct scans and exposure rate measurements to determine and detect the presence of any radioactivity. However, ORISE noted that the DC's technical staff had decided to perform only exposure rate measurements on the reactor bioshield to demonstrate compliance with the unrestricted release limits. This decision was made because all the decommissioning work that had been done had left the remaining interior surface of the bioshield rough and uneven. However, no technical basis had been established to assure that exposure rate measurements would be adequate. The DC performed a series of co-located surface activity measurements with a 17.5 cm² Geiger-Mueller (GM) detector and a larger 126 cm² gas-proportional detector to assure that the rough surfaces of the interior of the bioshield walls did not decrease the efficiency of the gas-proportional detector. The FSSR reported that the two detectors were comparable. This appeared to be adequate.

ORISE performed alpha and beta surface confirmatory scans using gas proportional detectors coupled with ratemeter-scalers with audible indicators. Survey areas included alpha affected areas and one general affected area. 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. Two measurement locations on the interior surfaces of the bioshield walls exceeded the modified release criteria of 1,700 dpm/100 cm² (beta surface activity) but were less than the modified maximum release criteria of 5,100 dpm/100 cm². All other results were less than the site release criteria. The DC removed the two areas of elevated activity during a sampling event to characterized the bioshield interior surfaces for HTDNs. The locations were resurveyed and the results were less than the modified release criteria. These actions appeared to be adequte.

c. <u>Conclusions</u>

Based on the results of DC document reviews and confirmatory measurements, the final survey requirements of the DP and Final Status Survey Plan were satisfied.

10. Final Status Survey Report Review

a. Inspection Scope (IP 69013)

To verify that the final status surveys were completed in accordance with the requirements and guidance listed in: 1) the approved procedures listed in Attachment A, 2) the regulatory requirements and guidance documents listed in Attachment B, and 3) the requirements in 10 CFR 50.82(a)(9)(ii)(D) and 10 CFR 20.1501(a) and (b), the inspector reviewed:

- UWNR DP, Rev. 2, dated July 18, 1994
- NES, Inc, "University of Washington Nuclear Reactor Decommissioning Project; Investigation and Analysis Phase; Radiological Characterization Report," Rev. 3, dated July 18, 1994
- LVI Services, ENERCON Services, Ind., "Final Status Survey Plan for the University of Washington More Hall Annex D&D Project," Rev. 3, dated August 29, 2006
- LVI Services, ENERCON Services, Ind., "Final Status Survey Report for the University of Washington More Hall Annex Decontamination and Decommissioning Project," Rev. 2, dated February 22, 2007

b. Observations and Findings

The inspector reviewed the maps and detailed survey unit descriptions submitted with the FSSR and concluded that all impacted areas had been included, were surveyed, and an appropriate report had been submitted to the NRC as required.

The inspector and ORISE technical staff provided comments on the FSSR and discussed the findings with the licensees' staff during various telephone conferences. The comments generally consisted of the need for clarification or additional information but did not change the conclusions regarding the release ability of the survey units. In letters to the NRC dated February 26 and March 12, 2007, the licensee submitted detailed changes to the FSSR to address these comments. The FSSR, as amended, was determined to be acceptable for demonstrating compliance with the radiological criteria for license termination.

c. <u>Conclusions</u>

The amended FSSR provided the radiological data that indicated that the entire facility satisfies the criteria for unconditional release.

11. Other Documents Required for License Termination

a. Inspection Scope (IP 69013)

To verify that the license termination requirements specified in 10 CFR Parts 30, 40, and 70 were completed as required, the inspector reviewed the following:

- onsite review of activities and documents
- Letter from UW to the NRC, dated May 3, 2007

b. Observations and Findings

In addition to the license termination requirements of 10 CFR Part 50, Parts 30, 40, and 70 also have requirements for forwarding of specific records to NRC prior to license termination. These requirements include:

10 CFR 30.51(d)	Prior to license termination, each licensee authorized to possess radioactive material with a half-life greater than 120 days, in an unsealed form, shall forward the following records to the appropriate NRC Regional Office: (1) Records of disposal of licensed material made under 20.2002 (including burials authorized before January 28, 1981), 20.2003, 20.2004, 20.2005; and (2) Records required by 20.2103(b)(4).
10 CFR 30.51(f)	Prior to license termination, each licensee shall forward the records required by 30.35(g) to the appropriate NRC Regional Office.
10 CFR 40.61(d)	Prior to license termination, each licensee authorized to possess source material, in an unsealed form, shall forward the following records to the appropriate NRC Regional Office: (1) Records of disposal of licensed material made under 20.2002 (including burials authorized before January 28, 1981), 20.2003, 20.2004, 20.2005; and (2) Records required by 20.2103(b)(4).
10 CFR 40.61(f)	Prior to license termination, each licensee shall forward the records required by 40.36(f) to the appropriate NRC Regional Office.
10 CFR 70.51(a)	Prior to license termination, licensees shall forward the following records to the appropriate NRC Regional Office: (1) Records of disposal of licensed material made under 20.2002 (including burials authorized before January 28, 1981), 20.2003, 20.2004, 20.2005; and (2) Records required by 20.2103(b)(4); and (3) Records required by 70.25(g).

Record Forwarding Requirements

UW addressed each of these requirements in a letter to NRC dated May 3, 2007, as described below.

UW addressed the requirements of 10 CFR 30.51(d)(1), 10 CFR 40.61(d)(1), and 10 CFR 70.51(a)(1) by stating, "The University of Washington More Hall Annex facility did not dispose of radioactive material per items 1, 3, or 4 from the above group. Liquid discharges to the sanitary sewerage system did occur. The discharges to the sanitary sewerage system were documented and reported to the United States NRC Document Control Desk in the annual reports. No releases of radioactive materials to the sewer occurred following final purging of reactor holding tanks in September of 1991. That final release was reported to the NRC Document Control Desk in the annual report dated January 28, 1992."

UW addressed the requirements of 10 CFR 30.51(d)(2), 10 CFR 40.61(d)(2), and 10 CFR 70.51(a)(2) collectively because they deal with the submittal of records required by 10 CFR 20.2103(b)(4). 10 CFR 20.2103(b)(4) addresses records associated with the release of radioactive effluents to the environment prior to 1994. UW indicated that

the results of effluent measurements were transferred to the NRC Document Control Desk by means of the More Hall Annex Reactor Annual Report. Further, there were no releases of radioactive effluents to the atmosphere of any kind following termination of reactor operations on June 30, 1988. The results of effluent measurements during decommissioning were included in the FSSR submitted to the NRC on December 13, 2006. No airborne or liquid radioactive materials were released during the decommissioning of the reactor facility.

Therefore, with these submittals, UW contends that it has met the requirements of 10 CFR 30.51(d)(2), 10 CFR 40.61(d)(2), and 10 CFR 70.51(a)(2).

Due to the similarity of the requirements, UW also addressed the requirements of 10 CFR 30.51(f), 10 CFR 40.61(f), and 10 CFR 70.51(a)(3) collectively. These regulations require the licensee to forward information important to decommissioning as required by paragraphs (1), (2), (3), and (4) of 10 CFR 30.35(g), 10 CFR 40.36(f), and 10 CFR 70.25(g), respectively. UW stated that it has met these requirements through the submittal of: (1) NES, Inc. "University of Washington Nuclear Reactor Decommissioning Project; Investigation and Analysis Phase; Radiological Characterization Report;" and, (3) University of Washington, College of Engineering Letter, "Re: Termination of NRC License No. R-73, Final Survey Report for the University of Washington More Hall Annex Decommissioning Project."

The inspector reviewed selected documents and determined that UW has met the requirements of 10 CFR Parts 30, 40, and 70 for forwarding of specific records to NRC prior to license termination.

c. Conclusions

The license termination requirements specified in 10 CFR Parts 30, 40, and 70 were addressed in a letter from the University of Washington and no issues remain.

12. Exit Interview

The onsite inspection scope and results were summarized on August 23 and November 8, 2006, with members of licensee staff, the DC management and staff, and others associated with the project. The inspector described the areas inspected and discussed the inspection findings. No dissenting comments were received from the licensee. The licensee did not identify as proprietary any of the material provided to or reviewed by the inspector. As noted above, various telephone conferences were also held with the licensee and their contractors. The results of the ORISE surveys and a review of the FSSR were discussed by means of teleconference on May 11, 2007, with licensee representatives.

PARTIAL LIST OF PERSONS CONTACTED

Licensee Personnel

- S. Addison Radiation Safety Officer, Environmental Health and Safety Office, UW
- J. Angeley Associate Construction Manager, Capital Projects Office South Campus Construction Office, UW
- B. Pankow Health and Safety Supervisor, Environmental Health and Safety Office, UW

Licensee Contractor Personnel

- R. Arusell Site Superintendent/Project Manager, ICONCO/LVI Demolition Services, under contract with LVI Services, Inc.
- T. Brautigam Radiation Safety Officer/Waste Management, Enercon Services, Inc., under contract with LVI Services, Inc.
- D. Cronshaw LVI Project Manager/Director of Operations, LVI Services Inc.
- M. Hayne Safety and Compliance Officer, under contract with LVI Services Inc.
- D. Jordan Radiation Safety Officer, under contract with LVI Services Inc.
- T. Meek Advising Health Physicist and Radiation Safety Officer for the D&D Project, under contract with UW
- R. Moss Executive Engineer, Project Manager/Health and Safety Specialist, Energy Solutions, under contract with UW

NRC Contractor Personnel

S. Roberts Health Physicist/Project Leader, Survey Projects, Oak Ridge Institute for Science and Education (ORISE)

INSPECTION PROCEDURE USED

- IP 69013 Research and Test Reactor Decommissioning
- IP 81401 Plans, Procedures, and Reviews
- IP 86740 Transportation Activities

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None.

<u>Closed</u>

None.

LIST OF ACRONYMS USED

ALARA	As Low As Reasonably Achievable
CFR	Code of Federal Regulations
DC	Decommissioning Contractor
D&D	Decontamination and Decommissioning
DP	Decommissioning Plan
dpm	disintegrations per minute
EH&S	Environmental Health and Safety
ENERCON	subcontractor to LVI
FSSR	Final Status Survey Report
HTDN	Hard-to-detect (radio)nuclides
HP	Health Physics/Physicist
IP	Inspection Procedure
kW	Kilowatt
LVI	Decommissioning contractor for current work
NES	Decommissioning contractor for characterization work
NRC ORISE PIC RSO RTR RWP TS TSC UW UWNR	Oak Ridge Institute for Science and Education Pocket Ion Chamber Radiation Safety Officer Research and Test Reactor Radiation Work Permit Technical Specification Technical and Safety Committee University of Washington University of Washington Nuclear Reactor

Attachment A

University of Washington Submittals, LVI Procedures, and Related References:

University of Washington Training Reactor Hazards Summary Report, College of Engineering, University of Washington, May 1960

University of Washington, College of Engineering Letter, Re: Application for Possession Only License, dated August 10, 1989 (and a subsequent revision dated August 31, 1989, and modifications dated February 14, and May 2, 1994)

NRC Letter, "Issuance of Amendment No. 16 to Facility License No. R-73 - The University of Washington Argonaut Reactor," dated July 28, 1994 (converting the operating license to a possession only license and renewing the license)

Technical Specifications for the UWNR Facility, Amendment No. 16, dated July 28, 1994

NES, Inc, "University of Washington Nuclear Reactor Decommissioning Project; Investigation and Analysis Phase; Radiological Characterization Report," Rev. 3, dated July 18, 1994

NES, Inc., "University of Washington Nuclear Reactor Decommissioning Plan," Rev. 2, dated July 18, 1994

NRC Letter, "Order Authorizing Dismantling of Facility and Disposition of Component Parts," issued May 1, 1995

NRC Letter, "Order Modifying Requirements for Dismantling of Facility and Disposition of Component Parts," issued January 31, 2006

University of Washington, College of Engineering Letter, "Re: Termination of NRC License No. R-73, Final Status Survey Report for the University of Washington More Hall Annex Decommissioning Project," dated December 13, 2006

University of Washington, College of Engineering Letter, "Re: Records Required to be Forwarded to Nuclear Regulatory Commission (NRC) Region IV Office Prior to Termination of the University of Washington (UW) More Hall Annex Nuclear Reactor, License #73," dated May 3, 2007

University of Washington, "Alternate Procedure Acceptance Plan," including Appendix A, "More Hall Reactor Decommissioning Plan Change Evaluation Form"

University of Washington Training Reactor Hazards Summary Report, College of Engineering, University of Washington, dated May 1960

Project Manual, Volume 1, "More Hall Annex Decontamination and Decommissioning," UW#10492, dated October 27, 2005

LVI Services, ENERCON Services, Ind., "Final Status Survey Plan for the University of Washington More Hall Annex D&D Project," Rev. 2, dated July 26, 2006

LVI Services, ENERCON Services, Ind., "Final Status Survey Plan for the University of Washington More Hall Annex D&D Project," Rev. 3, dated August 29, 2006

LVI Services, ENERCON Services, Ind., "Final Status Survey Report for the University of Washington More Hall Annex Decontamination and Decommissioning Project," Rev. 1, dated December 6, 2006

LVI Services, ENERCON Services, Ind., "Final Status Survey Report for the University of Washington More Hall Annex Decontamination and Decommissioning Project," Rev. 2, dated February 22, 2007

Procedure No. UW-MCP-AD-01, "Project Management Plan for the University of Washington More Hall Annex D&D Project," Rev. 1, dated February 22, 2006

Procedure No. UW-MCP-EP-01, "Emergency Action Plan for the University of Washington More Hall Annex D&D Project," Rev. 1, dated March 21, 2006

Procedure No. UW-MCP-HS-01, "Health and Safety Plan for the University of Washington More Hall Annex D&D Project," Rev. 1, dated February 17, 2006

Procedure No. UW-MCP-HS-02, "Respirator Protection Program for the University of Washington More Hall Annex D&D Project," Rev. 0, dated January 26, 2006

Procedure No. UW-MCP-HS-03, "Occupational Radiation Monitoring and Control Procedure for the University of Washington More Hall Annex D&D Project," Rev. 0, dated March 8, 2006

Procedure No. UW-MCP-OP-01, "Decommissioning Work Plan for the University of Washington More Hall Annex D&D Project," Rev. 0, dated February 17, 2006

Procedure No. UW-MCP-OP-02, "Final Status Survey Plan for the University of Washington More Hall Annex D&D Project," Rev. 3, dated August 29, 2006

Procedure No. UW-MCP-OP-03, "Bioshield Removal Work Procedure for the University of Washington More Hall Annex D&D Project," Rev. 1, dated May 24, 2006

Procedure No. UW-MCP-OP-05, "Equipment Removal Work Procedure for the University of Washington More Hall Annex D&D Project," Rev. 0, dated February 28, 2006

Procedure No. UW-MCP-OP-06, "Retention Tank Removal Work Procedure for the University of Washington More Hall Annex D&D Project," Rev. 1, dated May 24, 2006

Procedure No. UW-MCP-OP-07, "Ventilation Removal Work Procedure for the University of Washington More Hall Annex D&D Project," Rev. 0, dated February 28, 2006

Procedure No. UW-MCP-OP-08, "Decontamination Work Procedure for the University of Washington More Hall Annex D&D Project," Rev. 0, dated February 28, 2006

Procedure No. UW-MCP-OP-09, "Asbestos Abatement Work Plan for the University of Washington More Hall Annex D&D Project," Rev. 1, dated March 21, 2006

Procedure No. UW-MCP-OP-10, "Reactor System Removal Work Procedure for the University of Washington More Hall Annex D&D Project," Rev. 0, dated February 28, 2006

Procedure No. UW-MCP-OP-11, "Lead Removal Work Plan for the University of Washington More Hall Annex D&D Project," Rev. 0, dated February 28, 2006

Procedure No. UW-MCP-OP-12, "Work Plan for Fugitive and Silica Dust Control for the University of Washington More Hall Annex D&D Project," Rev. 0, dated February 28, 2006

Procedure No. UW-MCP-QA-01, "Quality Assurance Program Plan for the University of Washington More Hall Annex D&D Project," Rev. 0, dated February 12, 2006

Procedure No. UW-MCP-RC-01, "Radiation Control Plan for the University of Washington More Hall Annex D&D Project," Rev. 2, dated May 1, 2006

Procedure No. UW-MCP-RC-02, "Radiological Air Monitoring and Particulate Control Procedure for the University of Washington More Hall Annex D&D Project," Rev. 1, dated March 31, 2006

Procedure No. UW-MCP-RC-03, "Radiation Work Permit Procedure for the University of Washington More Hall Annex D&D Project," Rev. 0, dated February 20, 2006

Procedure No. UW-MCP-RC-04, "Routine Radiological Survey Procedure for the University of Washington More Hall Annex D&D Project," Rev. 1, dated March 15, 2006

Procedure No. UW-MCP-RC-05, "Decontamination Acceptance Procedure for the University of Washington More Hall Annex D&D Project," Rev. 0, dated March 1, 2006

Procedure No. UW-MCP-RC-06, "Sample Collection Procedure for the University of Washington More Hall Annex D&D Project," Rev. 0, dated February 20, 2006

Procedure No. UW-MCP-RC-07, "External Dosimetry Procedure for the University of Washington More Hall Annex D&D Project," Rev. 0, dated March 1, 2006

Procedure No. UW-MCP-RC-08, "Testing Samples Using the Liquid Scintillation Counter (LSC) Procedure for the University of Washington More Hall Annex D&D Project," Rev. 0, dated April 24, 2006

Procedure No. UW-MCP-RC-09, "Air Sampling Procedure for the University of Washington More Hall Annex D&D Project," Rev. 0, dated April 24, 2006

Procedure No. UW-MCP-RC-10, "Volumetric Release Procedure for the University of Washington More Hall Annex D&D Project," Rev. 0, dated March 1, 2006

Procedure No. UW-MCP-WM-01, "Waste Shipment Plan for the University of Washington More Hall Annex D&D Project," Rev. 2, dated June 28, 2006

Procedure No. UW-MCP-WM-02, "Radioactive Waste Packaging Procedure for the University of Washington More Hall Annex D&D Project," Rev. 1, dated June 28, 2006

Attachment B

NRC and other Government Agency Publications:

American National Standards Institute (ANSI) ANSI N323, "Radiation Protection Instrumentation Test and Calibration," dated 1978

ANSI Z88.2, "Practices for Respiratory Protection," dated 1980

Code of Federal Regulations, Title 10, Part 50.82, Application for Termination of License

Code of Federal Regulations, Title 29, Part 1926, Safety and Health Regulations for Construction

International Standards Organization (ISO) (Standard) 7503-1, "Evaluation of Surface Contamination - Part 1 Beta-emitters and Alpha Emitters," dated August 11, 1988

ISO (Standard) 7503-3, "Evaluation of Surface Contamination-Part 3, Isomeric Transitional and Electron Capture Emitters, Low Energy Beta-emitters," dated November 14, 1996

NRC Draft Regulatory Guide DG4006, "Demonstrating Compliance with the Radiological Criteria for License Termination," <u>Federal Register</u> dated August 4, 1998 (63 FR 41604)

NUREG-1505, "A Nonparametric Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys," Draft Report for Comment, dated August 1995

NUREG-1506, "Measurement Methods for Radiological Surveys in Support of New Decommissioning Criteria," Draft Report for Comment, dated August 1995

NUREG-1507, "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions," Draft Report for Comment, dated August 1995

NUREG-1727, "NMSS Decommissioning Standard Review Plan," dated September 2000

NUREG-1757, "Consolidated NMSS Decommissioning Guidance," Vol. 1, Rev. 1, and Vol. 2, dated September 2003

NUREG/CR-2082, "Monitoring for Compliance with Decommissioning Termination Survey Criteria," dated June 1981

NUREG/CR-3473, "Long Lived Activation Products in Reactor Materials," dated August 1984

NUREG/CR-5512, "Residual Radioactive Contamination from Decommissioning," dated October 1992

NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination," draft dated June 1992

NUREG/CR-6062, "Performance of Portable Radiation Survey Instruments," dated December 1993

Regulatory Guide 1.179, "Standard Format and Content of License Termination Plans for Nuclear Power Reactors," dated January 1999

Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors," dated June 1974

Regulatory Guide 3.65, "Standard Format and Content of Decommissioning Plans for Licenses Under 10 CFR Parts 30, 40, and 70," dated August 1989

Attachment C

ORISE Communication with NRC

ORISE Letter, "Subject: Final Site-Specific Decommissioning Inspection Plan for the University of Washington Research and Test Reactor, Seattle, Washington (Docket No. 50-139)," dated April 11, 2007

ORISE Letter, "Subject: Final Site-Specific Decommissioning Inspection Report for the University of Washington Research and Test Reactor, Seattle, Washington (Docket No. 50-139)," dated October 18, 2006

ORISE Letter, "Subject: Document Review—Comments on the Final Status Survey Report for the University of Washington More Hall Annex Decontamination and Decommissioning Project, Seattle, Washington (Docket No. 50-139)," dated January 4, 2007

ORISE Letter, "Subject: Final Site-Specific Decommissioning Inspection Report #2 for the University of Washington Research and Test Reactor, Seattle, Washington (Docket No. 50-139)," dated March 20, 2007