

December 2, 2005

Dr. William A. Baeslack III  
Dean, College of Engineering  
142A Hitchcock Hall  
Ohio State University  
2070 Neil Avenue  
Columbus, OH 43210

SUBJECT: NRC INSPECTION REPORT NO. 50-150/2005-202

Dear Dr. Baeslack:

This letter refers to the inspection conducted on October 3-6, 2005, at the Ohio State University Research Reactor. The inspection included a review of activities authorized for your facility. The enclosed report presents the results of that inspection.

Areas examined during the inspection are identified in the report. Within these areas, the inspection consisted of selective examinations of procedures and representative records, interviews with personnel, and observation of activities in progress. No response to this letter is required.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>.

Should you have any questions concerning this inspection, please contact Mr. Kevin Witt at 301-415-4075.

Sincerely,

**/RA/**

Brian E. Thomas, Branch Chief  
Research and Test Reactors Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

Docket No. 50-150  
License No. R-75

Enclosure: NRC Inspection Report No. 50-150/2005-202  
cc w/enclosure: Please see next page

Ohio State University

Docket No. 50-150

cc:

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

Docket No.: 50-150

License No.: R-75

Report No.: 50-150/2005-202

Licensee: Ohio State University

Facility: Ohio State University Research Reactor

Location: Columbus, Ohio

Dates: October 3-6, 2005

Inspector: Kevin M. Witt

Approved by: Brian Thomas, Branch Chief  
Research and Test Reactors Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

## EXECUTIVE SUMMARY

Ohio State University  
Report No: 50-150/2005-202

The primary focus of this routine, announced inspection was the on-site review of selected aspects of the licensee's non-power training reactor operation including: organization and staffing; committees, audits and reviews; operations logs and records; procedures; requalification training; maintenance and surveillance; radiation protection; transportation; design changes; fuel handling logs and records; and emergency preparedness.

### Organization and Staffing

- The licensee's organization and staffing remain in compliance with the requirements specified in Technical Specification Section 6.1.

### Committees, Audits, and Reviews

- Review and oversight functions required by the Technical Specification were acceptably completed by the Committee on Reactor Operations.

### Operations Logs and Records

- Based on the logs, procedures, and associated records reviewed and the observations made during the inspection, the inspector determined that reactor operations and log maintenance were acceptable and in accordance with License, Technical Specification, and procedural requirements.

### Procedures

- The procedural control and implementation program satisfied Technical Specification requirements.

### Requalification Training

- Operator requalification was being conducted and completed as required by the Operator Requalification Program.

### Maintenance and Surveillance

- Maintenance logs, records, performance, and reviews satisfied Technical Specification and procedure requirements.
- The program for tracking and completing surveillance checks and verifications satisfied Technical Specification requirements.

### Radiation Protection Program

- Surveys were being completed and documented acceptably to permit evaluation of the radiation hazards present.

- Postings met the regulatory requirements specified in 10 CFR Parts 19 and 20.
- Personnel dosimetry was being worn as required and doses were well within the licensee's procedural action levels and NRC's regulatory limits.
- Radiation monitoring equipment was being maintained and calibrated as required.
- The Radiation Protection Program being implemented by the licensee satisfied regulatory requirements.
- Effluent monitoring satisfied license and regulatory requirements and releases were within the specified regulatory and Technical Specification limits.

#### Transportation

- Radioactive material was generally being shipped in accordance with the applicable regulations.

#### Design Changes

- No significant nor minor changes had been made at the facility since the last operations inspection

#### Fuel Handling Logs and Records

- Fuel movements and inspections in general were completed and documented in accordance with the requirements specified by procedure.

#### Emergency Preparedness

- The emergency response program was conducted in accordance with the requirements stipulated in the Emergency Plan.

## REPORT DETAILS

### **Summary of Plant Status**

The licensee's five-hundred kilowatt research reactor continues to be operated in support of undergraduate instruction, laboratory experiments, reactor operator training, and various types of irradiation projects. During the inspection, the reactor was operated to support a student research experiment and production of radioisotopes for an annual calibration. Records show that the reactor was operated for a total of 1036 hours from July 1, 2003 to June 30, 2005.

### **1. Organization and Staffing**

#### **a. Inspection Scope (Inspection Procedure [IP] 69001)**

The inspector reviewed the following regarding the licensee's organization and staffing to ensure that the requirements of the Technical Specification (TS) Sections 6.1 and 6.2 were being met:

- C organizational structure
- C management responsibilities and authorities
- C staffing requirements for safe operation of the research reactor facility
- C console log entries for 2004 and 2005

#### **b. Observations and Findings**

The inspector determined that the organizational structure at the facility had not changed since the previous NRC inspection in June 2003 (refer to NRC Inspection Report No. 50-150/2003-01). However, the Director of the Engineering Experiment Station (EES) was new, as documented in a letter to the NRC, dated July 27, 2004. The Director of the EES position is the contact person for communications between the NRC and the Ohio State University (OSU). The Associate Director continued to be responsible for the day-to-day operation of the Ohio State University Research Reactor (OSURR) and ensures that all operations are conducted in a safe manner. The responsibility and authority of these positions remained unchanged. Discussions with the Director of the Nuclear Reactor Laboratory (NRL) indicated that management support and commitment to continued safe operation of the facility has not changed.

The previous inspection report noted the organizational structure of the Office of Radiation Safety had changed from what is stated in the TSs. The licensee submitted an amendment request to the NRC, dated November 9, 2004, changing the organization structure in the Technical Specifications (TSs). The NRC has reviewed the request and sent a letter to the licensee, dated August 15, 2005, requesting additional information to be provided within 90 days. The licensee is currently working on the response to the NRC.

The licensee communicated to the inspector that one research associate has left the facility and a replacement will be hired sometime in the future. The staff member who had recently left obtained a Senior Reactor Operator (SRO) license on July 20, 2004. The licensee plans to rehire the individual for part time work and does not intend to cancel the SRO license in the near term.

Through a review of résumés and discussions with personnel, the inspector determined that the operations staff and Reactor Operations Committee (ROC) members satisfied the TS qualification requirements. A review of reactor console records confirmed that the staffing requirements during reactor operations were met.

c. Conclusions

The licensee's organization and staffing remain in compliance with the requirements specified in the TSs.

**2. Committees, Audits, and Reviews**

a. Inspection Scope (IP 69001)

The inspector reviewed the following to ensure that the audits and reviews stipulated in TS Section 6.2, 10 CFR 50.59, and 10 CFR 20.1101 were being completed:

- C AP-08, "NRL Audit," Revision 3, dated October 1, 2002
  - Health Physicists Audit for CY03
  - Radiation Protection Program Review for 2004, dated December 13, 2004
- C Reactor Operations Committee (ROC) membership and qualifications
- C ROC meeting minutes for October 7, 2003; March 2 and September 16, 2004; and March 14 and September 28, 2005
- C Audit of the Nuclear Reactor Laboratory Operations for CY04 (covering the period from December 1, 2003 to October 31, 2004), dated December 16, 2004
- C Audit of the Nuclear Reactor Laboratory Operations for CY03 (covering the period from December 6, 2002 to November 26, 2003), dated December 22, 2003
- C The Ohio State University Research Reactor Annual Report for FY 2003/2004, dated September 2004
- C The Ohio State University Research Reactor Annual Report for FY 2004/2005, dated September 2005

b. Observations and Findings

The composition and meeting frequency of the ROC satisfied the TS requirements. The minutes of the meetings demonstrated that the ROC provided the review and oversight required by the TS. Issues brought up by the ROC were resolved in an appropriate time frame and were noted in ROC meeting minutes. Visitors participated in meetings to discuss proposed ideas for experiments at the OSURR. All aspects of operations at the facility were discussed and the ROC provided ample input for the safe operation of the facility.

Designated members of the ROC, including others such as separate Research and Test Reactor facility personnel, conducted audits of the technical specifications as required and the full ROC reviewed the results. The inspector noted that there were

no significant issues discovered and that the licensee took appropriate corrective actions in response to the audit findings. The inspector verified that the licensee had completed annual reviews of the Radiation Protection Program as required by 10 CFR Part 20. All aspects of the program had been reviewed. The inspector noted that the safety reviews and audits, and the associated findings, were acceptably detailed and that the licensee responded and took corrective actions as needed. ROC review of equipment changes proposed in accordance with 10 CFR 50.59 were thorough.

c. Conclusions

Review and oversight functions required by the TS were acceptably completed by the ROC.

**3. Operations Logs and Records**

a. Inspection Scope (IP 69001)

The inspector reviewed the following to ensure that selected records were maintained as required by TS Sections 6.6.1 and 6.7:

- C Procedure AP-03, "Filling Requests for Reactor Operations" Revision 5, dated March 27, 1996
- C Form AP-03 Attachment D, "Request for Reactor Operation" Revision 5, dated March 27, 1996
- C Procedure AP-04, "Approval of Requests for Reactor Operations" Revision 3, dated October 3, 2003
- C Procedure AP-10, "Console Operating Experience Record" Revision 4, dated December 29, 1995
- C Procedure AP-11, "Record Keeping" Revision 2, dated March 29, 1996
- C Procedure AP-13, "Personnel Required for Reactor Operation" Revision 3, dated March 6, 1996
- C Procedure AP-15, "Logging Emergency Scrams" Revision 2, dated March 6, 1996
- C Form AP-15 Attachment A, "Record of 'Emergency' Scrams," Revision 2, dated March 6, 1996
- C Procedure OM-08, "Reactor Operation Logbook Records" Revision 7, dated November 30, 2000
- C Procedure IM-03, "OSURR Pre-Start Checkout" Revision 13, dated February 13, 2003
- C Procedure IM-04, "Post-Shutdown Checkout" Revision 10, dated November 30, 2000
- C selected Pre-Startup Checklist and Operation Records for 2004 to present
- C OSURR Log Book, dated June 19, 2003 to February 27, 2004; March 1, 2004 to October 6, 2004; October 7, 2004 to April 21, 2005; and April 21, 2005 to present
- C reactor startup, operations, and shutdown activities during the inspection

- C ROC meeting minutes for October 7, 2003; March 2 and September 16, 2004; and March 14 and September 28, 2005
- C The Ohio State University Research Reactor Annual Report for FY 2003/2004, dated September 2004
- C The Ohio State University Research Reactor Annual Report for FY 2004/2005, dated September 2005

b. Observations and Findings

Annual reports contained the data required to be recorded by the TSs. Console log entries were highly detailed and descriptive. Logs and records were clear, well organized, and readily retrievable. Records show that the reactor was operated for a total of 1036 hours from July 1, 2003 to June 30, 2005.

The operating logs were complete and provided an acceptable indication of operational activities. Logs and records also showed that operational conditions and parameters were consistent with license and TS requirements. Scrams that occurred during reactor operations were recorded on Form AP-15 Attachment A as well as in the reactor operations log. Scrams that occurred during the inspection period did indicate some problems with the reactor safety systems (refer to Section 9.B of this report), but were typically spurious signals and operator error. Further investigation of scram trends resulted in the replacement of faulty equipment that was thoroughly reviewed under the licensee's OSURR Modification Request Procedure. All scrams were resolved before the resumption of operations under the authorization of the SRO on duty.

The inspector reviewed selected OSURR Pre-Start Checkout and Operation Records dating from January 2004 through the date of this inspection. The inspector determined that reactor operations were carried out following written procedures as required by TS Section 6.4.1. Logs and records also showed that operational conditions and parameters were consistent with license and TS requirements and that TS operational limits had not been exceeded. Sample irradiations were approved by filling out the "Request for Reactor Operation" form. In accordance with facility procedure, requests for reactor operations are approved by an SRO, normally the associate director. The procedure for approving reactor operations has ten items that must be reviewed in order for the request to be approved. The procedure also gives a list of approved experiments, which are experiments that do not need to be sent to the ROC for approval. Any new experiment must be reviewed and approved by the ROC.

The inspector conducted observations of the reactor staff on October 5 to 6, 2005, and reviewed OSURR Pre-Start Checkout and Operation Record forms and associated records and logs. The inspector noted that the licensed SRO on duty and the research associates were knowledgeable and competent. Observation of operational activities also confirmed that reactor operations were carried out in accordance with written procedures and TS requirements.

c. Conclusions

Based on the logs, procedures, and associated records reviewed and the observations made during the inspection, the inspector determined that reactor operations and log maintenance were acceptable and in accordance with license, TS, and procedural requirements.

**4. Procedures**

a. Inspection Scope (IP 69001)

The inspector reviewed the following to ensure that the requirements of TS Section 6.3 were being met concerning written procedures:

- C Procedure AP-06, "Format for Writing, Revising, and Approving Procedures" Revision 7, dated March 21, 1996
- C Procedure AP-06 Attachment C, "Procedure Change Sheet" Revision 7, dated March 21, 1996
- C Procedure AP-07, "Review of Procedures" Revision 16, dated February 11, 2003
- C Procedure AP-08, "NRL Audit" Revision 3, dated October 1, 2002
- C Procedure RS-18, "Environmental Monitoring" Revision 0, dated August 29, 2003
- C ROC meeting minutes for October 7, 2003; March 2 and September 16, 2004; and March 14 and September 28, 2005
- C The Ohio State University Research Reactor Annual Report for FY 2003/2004, dated September 2004
- C The Ohio State University Research Reactor Annual Report for FY 2004/2005, dated September 2005

b. Observations and Findings

The inspector determined that written procedures were available for the activities delineated in TS Sections 6.3.1 and 6.3.2 and were approved by the ROC as required. The clarity and detail sections in the procedures was acceptable for the intent of the procedure. Attachment A to procedure AP-07 provides a routing slip, which is used to circulate revised procedures to the reactor operators and is retained with the original copy as proof of review. Procedures were reviewed biennially in accordance with Procedure AP-06 and updated as needed. The inspector verified that all procedures were reviewed on a rotating basis and the ROC was informed of the results of the review. The licensee used Attachment C to Procedure AP-06, "Procedure Change Sheet" to distribute procedure changes to the staff. All procedure changes were reviewed and approved by an SRO who did not submit the change. All changes to procedures were also submitted to the ROC.

The inspector noted that procedures had been developed for reactor operations and safety. Review of procedures indicated that a new procedure entitled, "Environmental Monitoring", had been approved by the ROC and the associate director in accordance

with the abilities granted by the TSs. The inspector noted that the new procedure lays out an effective method of ensuring compliance with public radiation exposure limits as defined in the NRC regulations.

c. Conclusions

The procedural control and implementation program satisfied Technical Specification requirements.

**5. Requalification Training**

a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify compliance with the requirements in 10 CFR Part 55 and the NRC approved Requalification Plan:

- C operator active license status
- C logs and records of reactivity manipulations, data for 2003 to present
- C training records
- C operator physical examination records
- C annual written examinations for 2001 and 2002
- C Procedure AP-09, "RO/SRO Requalification" Revision 7 dated September 25, 1996
- C Procedure AP-10, "Console Operating Experience Record" Revision 4 dated December 29, 1995
- C Procedure AP-10 Attachment A, "OSURR Console Operating Experience" Revision 4 dated December 29, 1995
- C OSURR Log Book, dated June 19, 2003 to February 27, 2004; March 1, 2004 to October 6, 2004; October 7, 2004 to April 21, 2005; and April 21, 2005 to present

b. Observations and Findings

There are currently three SROs employed at the facility, in addition to one SRO who is waiting to be re-employed at the facility. The inspector verified that the operators' licenses were current. Records showed that operators were given annual written examinations and annual operations tests as required. Logs indicated that operators maintained active duty status as required by operating the reactor the required number of hours quarterly and by taking the annual operating examinations. Tallies of operating hours for each licensed operator is maintained on a daily basis when the reactor is run. The inspector verified that physical examinations of the operators were conducted biennially as required. The Operator Requalification Program was being maintained up-to-date. The inspector also verified that the operators were reviewing the contents of all abnormal and emergency procedures on a regularly scheduled basis.

c. Conclusions

Operator requalification was being conducted and completed as required by the Operator Requalification Program.

## 6. Maintenance and Surveillance

### a. Inspection Scope (IP 69001)

To determine that surveillance activities and calibrations were being completed as required by TS Sections 3.0 and 4.0, the inspector reviewed:

- C selected Pre-Startup Checklist and Operation Records for 2003 to 2005
- C surveillance tracking logs
- C Form AP-03 Attachment D, "Request for Reactor Operation" Revision 5, dated March 27, 1996
- C Procedure IM-01, "Scram Checks" Revision 8, dated August 25, 2005
- C Procedure IM-05, "Core Reactivity Data" Revision 2, dated May 26, 2004
- C Procedure IM-07, "Rod Parameter Testing" Revision 5, dated December 16, 1997
- C Procedure IM-12, "Reactor Instrumentation Calibration/Checks" Revision 7, dated October 31, 2002
- C Procedure OM-16, "Power Calibration" Revision 2, dated November 4, 2002
- C Procedure RS-03, "Calibrating Gaseous Effluent Monitor" Revision 6, dated January 20, 2004
- C OSURR Log Book, dated June 19, 2003 to February 27, 2004; March 1, 2004 to October 6, 2004; October 7, 2004 to April 21, 2005; and April 21, 2005 to present
- C The Ohio State University Research Reactor Annual Report for FY 2003/2004, dated September 2004
- C The Ohio State University Research Reactor Annual Report for FY 2004/2005, dated September 2005

### b. Observations and Findings

#### (1) Maintenance

The inspector reviewed the maintenance records related to 2003, 2004 and 2005 scheduled and unscheduled preventative and corrective maintenance activities. This review indicated that all maintenance activities were controlled and documented in the maintenance and/or operations log consistent with the requirements in 10 CFR 50.59. Implementation of changes to equipment, systems, tests or experiments are done by any of the SROs at the facility. After all maintenance items are completed, system operational checks are performed to ensure the affected systems function before returning them to service.

#### (2) Surveillance

Within the scope of this review, the inspector determined that surveillance, test, and Limiting Conditions for Operation (LCO) verifications and calibrations were completed on schedule and in accordance with licensee procedures, checklists, or equipment manufacturers recommendations. All the recorded results were within the TS prescribed parameters. The records and logs reviewed were complete and were being maintained as required. The licensee has an effective

logging system that ensures that all required surveillances are completed within the specified time frame. All other routine checks are also placed on this log, which is located on the outer window of the control room. The location of the log is easily visible to all operators and is constantly reviewed to ensure that all required surveillances are completed.

The inspector noted that selected daily, monthly, quarterly, semiannual, and annual checks, tests, and/or calibrations for TS-required surveillance and LCO verifications were completed as stipulated. The verifications were completed on schedule and in accordance with licensee procedures. All the recorded results were within the TS and procedurally prescribed parameters. The records and logs were noted to be generally complete and were being maintained as required.

c. Conclusions

Based on the records reviewed, the inspector determined that 1) the licensee's maintenance program was being implemented as required, and 2) the licensee's surveillance program and their associated calibrations and verifications satisfied TS requirements.

## 7. **Radiation Protection Program**

a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify compliance with 10 CFR Part 20 and TS Section 4.6:

- C Health Physics Procedure RS-HP-AP-1.1, "Authorization for the Use of Radioactive Material"
- C Health Physics Procedure RS-HP-OP-4.0, "Radiation Safety Instrumentation Program" Revision 1, dated January 14, 2003
- C Health Physics Procedure RS-HP-OP-4.1, "Calibration of Radiological Survey Instruments" Revision 2, dated August 20, 2001
- C Health Physics Procedure RS-HP-OP-3.1, "Decontamination and Release of Material" Revision 2, dated November 18, 2002
- C Health Physics Procedure RS-HP-OP-3.2, "Performing Radiation and Contamination Surveys" Revision 3, dated January 13, 2003
- Health Physics Procedure RS-HP-OP-3.4, "Air Sampling and Analysis" Revision 1, dated January 1, 2003
- Health Physics Procedure RS-HP-OP-3.7, "Emergency Response" Revision 1, dated January 13, 2003
- Health Physics Procedure RS-HP-SNM-1.0, "Special Nuclear Material Acquisition, Control, Receipt, Movement, and Inventory Reporting" Revision 2, dated January 4, 2000
- Nuclear Reactor Lab Procedure RS-08, "NRL Smear Survey" Revision 10, dated April 3, 2003
- Nuclear Reactor Lab Procedure RS-09, "Area Radiation Surveys" Revision 6, dated May 19, 2004

- Nuclear Reactor Lab Procedure RS-15, "Radiation Safety Instruction" Revision 7, dated July 15, 2004
- C Nuclear Reactor Lab Procedure RS-18, "Environmental Monitoring" Revision 0, dated August 29, 2003
- Personnel monthly dosimetry results for 2003 to present
- Environmental dosimetry results for 2003 to present
- Calibration of Nuclear Engineering Instruments
- Health Physicists Audit for CY03
- Radiation Protection Program Review for 2004, dated December 13, 2004
- C Audit of the Nuclear Reactor Laboratory Operations for CY04 (covering the period from December 1, 2003 to October 31, 2004), dated December 16, 2004
- C Audit of the Nuclear Reactor Laboratory Operations for CY03 (covering the period from December 6, 2002 - November 26, 2003), dated December 22, 2003
- NRL Monthly Inspection Forms, dated June 20, 2003 to present
- Radiation Safety Survey Forms, dated June 20, 2003 to present
- The Ohio State University Research Reactor Annual Report for FY 2003/2004, dated September 2004
- The Ohio State University Research Reactor Annual Report for FY 2004/2005, dated September 2005

b. Observations and Findings

The Radiation Safety Section (RSS) of the Environmental Health and Safety (EHS) Office applies the radiation protection program uniformly to the two licensed activities on campus (broad scope and the reactor). The licensee's program for radiological health and safety related to the reactor license was evaluated during this inspection.

(1) Surveys

The inspector reviewed monthly radiation and contamination surveys of the licensee's controlled areas and monthly radiation wipe surveys completed by campus RSS Health Physics (HP) personnel. The surveys had been completed in accordance with the applicable procedure. The results were documented on the appropriate forms, evaluated as required, and corrective actions taken when readings or results exceeded set action levels. No abnormal elevated readings were discovered during the inspection period. The survey also included a checklist of items to be verified such as the adequacy of warning signs and postings in the area. The number and location of survey points was adequate to characterize the radiological conditions.

Surveys by the reactor staff were conducted in accordance with operating procedures RS-08 and RS-09. These surveys were generally completed weekly and reviewed on a monthly basis by the RSS HP personnel. The survey data sheets included an acceptance range for the data to allow identification of abnormal conditions. Any readings that exceeded a certain level required an explanation and a signature from an SRO.

Reactor water samples were evaluated quarterly utilizing a gamma spectroscopy system. Monitoring of the reactor water did not indicate abnormal

readings. The samples that were taken indicate that the reactor integrity has not been compromised and shows no trend of breakdown, release, or degradation.

(2) Postings and Notices

The inspector reviewed the postings at the entrances to various controlled areas including the Reactor Bay, and radioactive material storage areas. The postings were acceptable and indicated the radiation and contamination hazards present. The facility's radioactive material storage areas were noted to be properly posted. No unmarked radioactive material was found in the facility. A copy of current notices to workers required by 10 CFR Part 19 was posted at the entrance to the Reactor Bay as well.

(3) Dosimetry

The licensee used a National Voluntary Laboratory Accreditation Program-accredited vendor, Landauer, to process personnel dosimetry. Through direct observation, the inspector determined that dosimetry was acceptably used by facility personnel. For visitors to the facility and high school students, a personal ionization chamber (PIC) dosimeter is issued for each group of eight people.

An examination of the records for the inspection period showed that all exposures were well within NRC limits and within licensee action levels. In September 2003, the licensee drained the reactor pool in order to fix a slight water leak that had been noticed around Beam Port 1. The RSS created a radiation work permit in order to closely control the high doses that were encountered. The cumulative dose received by the nine personnel entering the pool was 5126 millirem (mrem) as measured by the PIC's that were worn by the workers. The highest deep dose equivalent (DDE) exposure measured by the Optically Stimulated Luminescence (OSL) dosimeters for an individual was 1296 mrem, which is well below regulatory limits. The licensee felt that the doses received were minimized as much as they possibly could while getting the necessary work completed.

There are currently 12 people at the facility that are being monitored, in addition to the RSS personnel that perform duties less than full-time at the facility. Extremity monitoring, accomplished through the use of finger rings, also showed relatively low doses to the hands of staff members. All of the personnel associated with the facility received an annual whole body exposure less than 300 mrem for 2004. The doses received during 2003 were slightly higher due to the work inside of the pool. The licensee maintains a program to notify radioactive material users if they exceed a certain dose in any given month. Any users that exceed these levels are monitored closely to ensure that their exposures do not exceed any occupational dose limits.

(4) Radiation Monitoring Equipment

The calibration of portable survey meters and friskers was typically completed by RSS personnel at the EHS office while fixed radiation detectors and air monitoring instruments were calibrated by OSURR personnel at the facility. The inspector visually observed the calibration equipment and verified that the sources and electronics used were sufficient to conduct the calibrations. The calibration records of portable survey meters, friskers, fixed radiation detectors, and air monitoring equipment in use at the facility were reviewed. Calibration frequency met the requirements established in the applicable procedures while records were being maintained as required.

(5) Radiation Protection Program

The inspector also verified that the OSU radiation protection program was being reviewed annually as required. Part of the annual OSU NRL audit ensured that the radiation protection at the facility was being conducted as required by the applicable procedures. No issues related to the radiation protection program at the OSU NRL were identified in the audit of the program.

The licensee's radiation protection program was established in the OSU Radiation Safety Guidebook and Records Manual and in the Radiation Safety Standards for the Ohio State University. The program required that all personnel who had unescorted access to the Reactor Bay (a radiation area) would receive training in radiation protection, policies, procedures, requirements, and facilities prior to entry. An interactive computer based "short course" consisting of six modules provided the initial training. Completion of an annual lecture and short test was required for continued access to the Reactor Bay. The training covered the topics required to be taught in 10 CFR Part 19 and the results of an examination indicated that the staff understood what was presented.

(6) Facility Tours

The inspector toured the Reactor Room and the accompanying laboratories. Control of radioactive material and control of access to radiation and high radiation areas were acceptable. The postings and signs for these areas were appropriate. The inspector also determined that there were no measurable releases of gaseous or liquid radioactive material from the research reactor facility.

(7) Environmental Monitoring

Several OSL dosimeters are placed in strategic locations around the restricted and unrestricted areas outside of the reactor bay. Records show that annual doses were generally minimal, but there were two dosimeters that measured an annual exposure in excess of 100 mrem. The licensee has implemented a new procedure, which shows that the dose attributable to the operation of the OSURR is less than 100 mrem (refer to Section 12.b(2) of this report). The

licensee has stated that the excess exposure measured by the OSL dosimeters is a result of continuous exposure to all operations. The licensee has implemented occupancy factors for determining the maximum dose a member of the general public could receive in unrestricted areas.

All gaseous releases from the facility are measured with a gaseous effluent monitor. As seen in the annual reports issued by the licensee, the release of Argon-41 from the facility for the previous two years is less than the limit specified in 10 CFR Part 20. The licensee uses the Environmental Protection Agency computational code "COMPLY," which shows that the licensee is in compliance with 10 CFR 20.1301(a)(1). There were two instances of liquid releases from the facility during the inspection period, which were shown to be within the regulatory limits. The licensee measures the radioactivity of liquid effluents released from the facility and divides it by 80% of the water intake to the University campus to determine a concentration of radiation. The licensee compares the concentration of the release against applicable limits established in 10 CFR 20 Appendix B.

c. Conclusions

The inspector determined that, (1) surveys were being completed and documented acceptably to permit evaluation of the radiation hazards present, (2) postings met the regulatory requirements specified in 10 CFR Parts 19 and 20, (3) personnel dosimetry was being worn as required and doses were well within the licensee's procedural action levels and NRC's regulatory limits, (4) radiation monitoring equipment was being maintained and calibrated as required, (5) the Radiation Protection Program being implemented by the licensee satisfied regulatory requirements, and (6) effluent monitoring satisfied license and regulatory requirements and releases were within the specified regulatory and TS limits

**8. Transportation**

a. Inspection Scope (IP 86740)

To verify compliance with regulatory and procedural requirements for transferring or shipping licensed radioactive material, the inspector reviewed the following:

- C Certificate of Compliance documentation and test results for Department of Transportation (DOT) Type 7A packages used for shipments
- C selected records of various types of radioactive material shipments
- C Procedure RS-11, "Routine Shipment of Radioactive Material" Revision 4 dated March 20, 2002

b. Observations and Findings

Through records review and discussions with licensee personnel, the inspector determined that the licensee had shipped various types of radioactive material since the previous inspection in this area. The records indicated that the radioisotope types

and quantities were calculated and dose rates measured as required. Most of the shipments made were labeled as excepted quantities of radioactive materials, labelling thus exempting the packages from labeling and shipping paper requirements. There were very few Type A shipments made during the inspection period. A majority of the radioactive material shipment records reviewed by the inspector had been completed in accordance with Department of Transportation (DOT) and NRC regulations. During the review of licensee shipping procedures, the inspector noted that the procedures had not been updated since a major rule change was implemented on October 1, 2004. The licensee was using the older version of the tables and had not realized that some of the limits had changed for different types of shipping packages. The licensee agreed that they would review the procedure and determine which sections needed to change in order to be in compliance with NRC and DOT regulations. This issue will be considered by the NRC as an Inspector Follow-up Item (IFI) and will be reviewed during the next inspection at the facility (IFI 50-150/2005-202-01).

The inspector verified that the licensee maintained copies of shipment recipients' license to possess radioactive material as required and that the license 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' training met DOT requirements.

The inspector noted one shipment that occurred on April 7, 2005, did not have the proper page numbering on the shipping papers. The front cover of the shipping papers did not list the type of label used and the Transport Index (TI). The licensee stated that several pieces of paper had been provided to the shipper as part of the shipping papers. When reviewing the papers, the inspector found the type of label used and the TI, but it was not clear that the additional sheets of paper were part of the shipping papers. The cover sheet provided to the shipper as part of the shipping paper did not have an indication specifying how many pages were included with the shipping paper.

10 CFR 71.5(a) requires that a licensee who transports licensed material outside of the site of usage, as specified in the NRC license, or where transport is on public highways, or who delivers licensed material to a carrier for transport, comply with the applicable requirements of the regulations appropriate to the mode of transport of the DOT in 49 CFR Parts 170 through 189. 49 CFR 172.201(c) states, "A shipping paper may consist of more than one page, if each page is consecutively numbered and the first page bears a notation specifying the total number of pages included in the shipping paper." As part of their corrective actions, the licensee plans to review the shipping procedures and determine if additional clarification is needed. The licensee was informed that improper page numbering was an apparent violation of 49 CFR 172.201(c). This violation is being treated as a Non-Cited Violation, consistent with Section VI.A.8 of the NRC Enforcement Policy (NCV 50-150/2005-202-02).

c. Conclusions

Radioactive material was generally being shipped in accordance with the applicable regulations.

## 9. Design Changes

### a. Inspection Scope (IP 69001)

In order to verify that any modifications to the facility were consistent with 10 CFR 50.59 and TS Section 6.2, the inspector reviewed:

- C facility design changes and records for the past two years
- C facility configuration and associated records
- C Form AP-14 Attachment A, "OSURR Modification Request Form," Revision 4, dated April 25, 2001
- C Procedure AP-14, "OSURR Modification Request," Revision 4, dated April 25, 2001
- C Completed "OSURR Modification Request Form" Nos. 39-42

### b. Observations and Findings

Facility design changes were controlled by the OSURR administrative procedure AP-14. The inspector confirmed that questions asked by the ROC following a review and replies from the reactor staff were documented and incorporated into the modification packages using the appropriate form, AP-14 Attachment A. ROC review of equipment changes proposed in accordance with 10 CFR 50.59 were thorough. One of the main safety systems that was generating spurious scram signals was the Period meter. The licensee determined the cause of the problem and proposed a solution by replacing the amplifier. The issue was brought before the ROC and was quickly approved. After the change to the instrument was made, post installation testing verified that the system still met all of the applicable requirements, including TS requirements.

The inspector also reviewed other 10 CFR 50.59 evaluations and corresponding design change packages for various changes. From these reviews, the inspector determined that the facility design change evaluations had adequate supporting documentation and information. Additionally, the inspector found that the 10 CFR 50.59 reviews and approvals conducted by the ROC were focused on safety and met TS and OSURR procedure requirements. Post installation verification testing of the changed systems were thorough and adequately documented when completed. Procedure and drawing changes were included in the change packages and were consistent with the requirements for facility changes.

### c. Conclusions

Based on the records reviewed, the inspector determined that the licensee's design change program was being implemented as required.

## 10. Fuel Handling Logs and Records

### a. Inspection Scope (IP 69001)

In order to verify adherence to fuel handling and inspection requirements specified in TS Section 4.3, the inspector reviewed:

- C Procedure OM-02, "Control Rod Annual Inspections" Revision 1, dated June 5, 1997
- C Procedure OM-07, "Fuel Element Inspections" Revision 6, dated April 25, 2001
- C Procedure AP-05, "SNM Inventory" Revision 4, dated December 16, 2003
- C Form AP-05 Attachment B, "NRL Fuel Element Inspection" Revision 4, dated December 16, 2003
- fuel handling and inspection procedures
- selected operations logs and records

### b. Observations and Findings

The inspector determined that the licensee was maintaining the required records of the various fuel movements that had been completed and verified that the movements were conducted and recorded in compliance with procedure. All fuel movements were noted in the Reactor Log Book and generally included one fifth of the fuel elements every year for the fuel plate inspections as well as all of the control rods. The inspector noted that the latest core loading or configuration had been in place since September 22, 2003.

The inspector verified that the representative fuel plates and control rods were being inspected annually as required by TS. The procedures and the controls specified for these operations were acceptable.

### c. Conclusion

Fuel movements and inspections in general were completed and documented in accordance with the requirements specified by procedure.

## 11. Emergency Preparedness

### a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify the implementation of the Emergency Plan:

- Procedure EP-01, "Emergency Procedures" Revision 18 dated March 12, 2004
- Procedure EP-03, "Response to Scrams and Alarms" Revision 0 dated January 31, 1996
- Procedure EP-04, "Emergency Equipment Inventory" Revision 4 dated May 8, 2001
- C Emergency Preparedness Plan for the Ohio State University Nuclear Reactor Laboratory, dated September 2004

- C Critiques of drills held November 19, 2003 and December 10, 2004
- Inventory of emergency supplies, dated November 26, 2003 and November 9, 2004
- C Audit of the Nuclear Reactor Laboratory Operations for CY04 (covering the period from December 1, 2003 to October 31, 2004), dated December 16, 2004
- C Audit of the Nuclear Reactor Laboratory Operations for CY03 (covering the period from December 6, 2002 to November 26, 2003), dated December 22, 2003

b. Observations and Findings

The Emergency Plan (E-Plan) in use at the OSU NRL facility has recently been updated and was submitted to the NRC with a cover letter dated November 9, 2004. The licensee was not required to obtain commission approval for these changes in accordance with 10 CFR 50.54(q), since the changes did not decrease the effectiveness of the plan. The E-Plan was audited and reviewed annually as required. Implementing procedures were reviewed and revised as needed to effectively implement the E-Plan. Emergency facilities, instrumentation, and equipment were being maintained and controlled, and supplies were being inventoried annually as required in the E-Plan.

The inspector noted that emergency response relies on the University resources such as campus police, firefighters, and emergency medicine technicians. No formal agreements for support by outside agencies was required. The inspector talked with the Columbus Fire Department lieutenant about the support role the fire department provides to the licensee. The deputy fire chief was very confident of the services that they provide and did not have any suggestions for more communications with the licensee.

Emergency drills had been conducted annually as required by the E-Plan. The drill for 2003 was a practical exercise, while the drill in 2004 was a table-top exercise. Critiques were written following the drills to document the strengths and weaknesses identified during the exercises and to develop possible solutions to any problems noted. Drill scenarios were challenging and involved response by most of the support organizations. Emergency preparedness and response training for reactor staff and the emergency responders was completed biennially and is documented as it occurs. Critiques indicated that the E-Plan was properly implemented. All problems identified during the drills were subsequently corrected and future drills will ensure that similar issues do not occur again. The drill for 2005 is currently being planned and will occur before the end of the year.

c. Conclusions

The emergency response program was conducted in accordance with the requirements stipulated in the Emergency Plan.

## 12. Follow-up on Previous Open Items

### a. Inspection Scope (IP 69001)

The inspector reviewed the actions taken by the licensee following identification of Inspector Follow-up Items during a previous inspection.

### b. Observations and Findings

#### (1) IFI 50-150/2003-201-01 - Revise procedures AP-05 and RS-HP-SNM-1.0

NRC Inspection Report No. 50-150/2003-201, dated June 23, 2003, outlined the situation. During that inspection, the inspector noted that operations procedure AP-05 regarding Special Nuclear Material (SNM) inventories and a corresponding health physics procedure RS-HP-SNM-1.0 Revision 2 needed some minor revisions to conform with the recent changes in the reporting requirements of the Nuclear Materials Management and Safeguards System (NMMSS). Facility management stated that this would be completed by August 31, 2003.

During this inspection, the inspector confirmed that the procedure had been revised in accordance with accepted protocols of the NMMSS. The licensee revised the procedure and approved it on December 16, 2003. The inspector also noted that the procedure was easy to understand and allowed for licensee management to use it independently. This issue is considered closed.

#### (2) IFI 50-150/2003-201-02 - Review environmental dosimetry program and the impact of the State agency radiation meter calibration activities.

NRC Inspection Report No. 50-150/2003-201, dated June 23, 2003, outlined the situation. During that inspection, the inspector noted significant anomalies in the environmental dosimetry data used to monitor the exposure to the public involving hundreds of mrem. The questionable results were from the dosimeters located in the exterior area at the rear of the reactor building. In this area there is a nearby building occupied by the State of Ohio Emergency Response agency. The reactor staff believed that this agency was calibrating radiation survey instruments in the building and the scattered radiation caused the elevated dosimeter readings. The licensee stated that the documentation for environmental dosimetry program will be reviewed and the impact of the State agency activities will be assessed.

During this inspection, the inspector confirmed that the licensee had implemented occupancy factors to determine the maximum possible dose attributable to reactor operations. A new procedure (Procedure RS-18, "Environmental Monitoring" Revision 0, dated August 29, 2003) has been approved by the ROC that describes the measurements and calculations showing that the licensee is in compliance with 10 CFR 20.1302(b)(1). The licensee is continually evaluating dose rates in the classroom outside of the

reactor building and will ensure that the maximum dose any member of the general public in an unrestricted area is less than 100 mrem. This issue is considered closed.

c. Conclusions

The issue regarding the effort to revise both the operating procedure and health physics procedure involving SNM inventory and control was closed. The previously identified situation involving anomalies in environmental dosimetry results was closed.

**13. Exit Interview**

The inspection scope and results were summarized on October 6, 2005, with members of licensee management. The inspector described the areas inspected and discussed in detail the inspection findings. No dissenting comments were received from the licensee.

## **PARTIAL LIST OF PERSONS CONTACTED**

### **Licensee**

R. Anderson, Health Physicist, Assistant Radiation Safety Officer  
R. Conti, Lieutenant, Columbus Fire Department  
A. Fentiman, Chair, Nuclear Engineering Program  
A. Kauffman, Associate Director, Nuclear Reactor Laboratory  
R. Myser, consultant Ex-Associate Director  
R. Peterson, Director, Office of Radiation Safety, Radiation Safety Officer  
J. Talnagi, Senior Reactor Operator  
S. Zalesni, Senior Reactor Operator

## **INSPECTION PROCEDURES USED**

IP 69001	Class II Non-Power Reactors
IP 86740	Inspection of Transportation Activities

## **ITEMS OPENED, CLOSED, AND DISCUSSED**

### **Opened**

50-150/2005-202-01	IFI	Follow-up to verify that the licensee reviews their shipping procedure and determine which sections need to change in order to be in compliance with current NRC and DOT regulations.
50-150/2005-202-02	NCV	The licensee failed to denote proper page numbering on the shipping paper for one Type A shipment.

### **Closed**

50-150/2003-201-01	IFI	Revise procedures AP-05 and RS-HP-SNM-1.0
50-150/2003-201-02	IFI	Review environmental dosimetry program and the impact of the State agency radiation meter calibration activities

## **LIST OF ACRONYMS USED**

ADAMS	Agencywide Documents Access and Management System (NRC's system)
AP	Administrative Procedures
CFR	Code of Federal Regulations
DDE	Deep Dose Equivalent
DOT	Department of Transportation
E-Plan	Emergency Plan
EES	Engineering Experiment Station
EHS	Environmental Health and Safety
EP	Emergency Procedures
HP	Health Physics

IFI	Inspector Follow-up Item
IM	Instrumentation Use and Maintenance
IP	Inspection Procedure
LCO	Limiting Conditions for Operation
MREM	millirem
NCV	Non-Cited Violation
NMMSS	Nuclear Materials Management and Safeguards System
NRC	Nuclear Regulatory Commission
NRL	Nuclear Reactor Laboratory
OM	General Reactor Operations and Maintenance
OSL	Optically Stimulated Luminescence
OSU	The Ohio State University
OSURR	The Ohio State University Research Reactor
PIC	Personal Ionization Chamber
ROC	Reactor Operations Committee
RS	Radiation Safety
RSS	Radiation Safety Section
SNM	Special Nuclear Material
SRO	Senior Reactor Operator
TI	Transport Index
TS	Technical Specifications