

July 20, 2004

Dr. Patrick D. Gallagher, Director
NIST Center for Neutron Research
National Institute of Standards and Technology
U. S. Department of Commerce
Gaithersburg, MD 20899

SUBJECT: NRC INSPECTION REPORT NO. 50-184/2004-201

Dear Dr. Gallagher:

This letter refers to the inspection conducted on June 28 - July 1, 2004, at the National Bureau of Standards Reactor. The inspection included a review of activities authorized for the 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 observations of activities in progress. Based on the results of this inspection, no safety concerns or noncompliances of NRC requirements were identified. 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 available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) <http://www.nrc.gov/reading-rm/adams.html>.

Should you have any questions concerning this inspection report, please contact Craig Bassett at 404-562-4712.

Sincerely,

/RA/

Patrick M. Madden, Section Chief
Research and Test Reactors Section
New, Research and Test Reactors Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 50-184
License No. TR-5

Enclosure: NRC Inspection Report No. 50-184/2004-201
cc w/enclosure:
Please see next page

National Institute of Standards
and Technology

Docket No. 50-184

cc:

Montgomery County Executive
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Rockville, MD 20858

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Dr. Seymour H. Weiss, Chief
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Test, Research, and Training
Reactor Newsletter
University of Florida
202 Nuclear Sciences Center
Gainesville, FL 32611-8300

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U.S. Department of Commerce
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U. S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION

Docket No: 50-184

License No: TR-5

Report No: 50-184/2004-201

Licensee: U. S. Department of Commerce

Facility: National Bureau of Standards Reactor

Location: National Institute of Standards and Technology
Gaithersburg, Maryland

Dates: June 28 - July 1, 2004

Inspectors: Craig Bassett
Kevin Witt

Approved by: Patrick M. Madden, Section Chief
Research and Test Reactors Section
Operating Reactor Improvements Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

This routine, announced inspection included onsite review of various aspects of the licensee's programs concerning radiation protection, material control and accounting, and transportation of radioactive material as they relate to the licensee's 20 Megawatt Class 1 Research Reactor. The licensee's programs were directed toward the protection of public health and safety and were in compliance with NRC requirements. No safety concerns or violations of regulatory requirements were identified.

Organization and Staffing

- The licensee's organization and staffing remain in compliance with the requirements specified in the Technical Specifications Section 7.1.

Review and Audit Functions

- Reviews were being conducted by the Safety Evaluation Committee and an annual audit was being completed by the Safety Audit Committee in compliance with requirements specified in the Technical Specifications Sections 7.2 and 7.3.

Procedures

- Licensee Health Physics procedure changes were being reviewed and approved as required.

Health Physics

- Surveys were being completed and documented as stipulated by procedure.
- Postings met the regulatory requirements specified in 10 CFR Parts 19 and 20.
- Personnel dosimetry was being worn as required and recorded doses were within the NRC's regulatory limits.
- Portable radiation monitoring equipment was being maintained and calibrated as required.
- Radiation Work Permits were generated as needed to provide guidance and precautionary requirements for on-going and emergent work at the facility.
- The radiation protection training program being implemented by the licensee satisfied regulatory requirements.

Environmental Protection Program

- Effluent monitoring satisfied license and regulatory requirements and releases were within the Technical Specification and regulatory limits.

Transportation of Radioactive Materials

- Radioactive waste and spent fuel was shipped in accordance with the applicable regulations.

Report Details

Summary of Plant Status

The licensee's 20 megawatt Test Reactor continued to be operated in support of laboratory work and numerous experiments. During the inspection, the reactor was shutdown for maintenance and refueling.

1. Organization and Staffing

a. Inspection Scope (Inspection Procedure (IP) 69006)

The inspectors reviewed the following regarding the licensee's organization and staffing to ensure that the requirements of Technical Specification (TS) Section 7.1, dated March 31, 1997, were being met:

- organizational structure
- management responsibilities
- staffing requirements for safe operation of the facility

b. Observations and Findings

Through discussions with licensee representatives, the inspectors determined that management responsibilities and the organizational structure at the facility had not changed since the previous NRC inspection in the area of radiation protection (refer to NRC Inspection Report No. 50-184/2003-202 issued May 14, 2003). The organizational structure and staffing at the facility were as required by TS.

With respect to facility staffing, the inspectors reviewed various Health Physics (HP) records and logs and discussed facility operations with licensee personnel. As a result, the inspectors determined that the staffing at the facility was acceptable to support the ongoing activities.

c. Conclusions

The licensee's organization and staffing remain in compliance with the requirements specified in the TS Section 7.1.

2. Review, Audit, and Design Functions

a. Inspection Scope (IP 69007)

The inspectors reviewed the following to ensure that the reviews and audits stipulated in TS Sections 7.2 and 7.3 were being completed:

- Safety Evaluation Committee (SEC) meeting minutes for 2003 to date
- Safety Audit Committee (SAC) audit conducted during October 2003
- Health Physics Instruction 1-2, "Health Physics Skills, Duties, and Audits," dated March 2001
- TS duties specified for the SEC and the SAC
- Quarterly Audits conducted by the Reactor Health Physics Group for 2003 and 2004

b. Observations and Findings

The inspectors reviewed the SEC meeting minutes from January 2003 to the present. These meeting minutes showed that the SEC met as required by the TS with a quorum being present. The inspectors also noted that, during the meetings, the SEC had considered the types of topics outlined by the TS. Review of the committee meeting minutes indicated the SEC provided appropriate guidance and direction for reactor operations, and ensured suitable use and oversight of the reactor.

It was noted that the SAC completed annual audits of the facility operations and the performance of the SEC. The inspectors reviewed the SAC audit conducted during October 2 and 3, 2003. The inspectors noted that the audit report appeared to be thorough and the resulting findings were acceptable.

The inspectors also verified that the licensee had completed annual reviews of the Radiation Protection Program as required by 10 CFR 20.1101(c) and quarterly audits required by procedure. This annual review, coupled with quarterly audits conducted by Reactor HP personnel, was sufficient to ensure that all aspects of the program had been reviewed and areas were noted where improvements could be made. Commitments and/or improvements noted in the quarterly audits were reviewed and progress was noted. The reviews and audits were acceptable.

Through interviews with the licensee the inspectors determined that no design changes had been made to systems or equipment related to radiation protection.

c. Conclusions

Reviews were being conducted by the SEC and an annual audit was being completed by the SAC according to the requirements specified in the TS.

3. Procedures

a. Inspection Scope (IP 69008)

The inspectors reviewed the following to ensure that the requirements of TS Section 7.4 were being met concerning written procedures:

- the process used to revise, review, and approve facility procedures
- Health Physics Instruction (HPI) 1-0, "Health Physics Policies," dated March 2001
- HPI 1-2, "Health Physics Skills, Duties, and Audits," dated March 2001
- HPI 3-2, "Radiation Work Permit," dated March 2001
- HPI 3-3, "Reactor Survey Operations," dated March 2001
- HPI 3-8, "Contaminated Materials at NBSR," dated March 2001

b. Observations and Findings

The inspectors determined that the licensee's written procedures and instructions concerning radiation and radioactive contamination control activities were being reviewed and revised as needed. New procedures and major changes were

required to be reviewed and approved by the SEC. None had been proposed since the last inspection. Minor changes did not require SEC approval but were reviewed and approved by the Chief of the Occupational Health and Safety Division and/or the Deputy Chief, Reactor Operations and Engineering.

c. Conclusions

Licensee Health Physics procedure changes were being reviewed and approved as required.

4. Health Physics

a. Inspection Scope (IP 69012)

The inspectors reviewed selected aspects of the following to verify compliance with 10 CFR Part 20, TS Section 5.7, and procedural requirements:

- Radiation Work Permit (RWP) Log -2
- selected health physics survey records outlined in HPI 3-1
- Reactor Operator Running Quarterly Dose Record
- National Institute of Standards and Technology (NIST) Personal Dosimetry Summary records for 2003 through 2004 to date
- calibration and periodic check records for portable radiation monitoring instruments and Area Radiation Monitors
- ALARA Policy stated in various Health Physics Procedures and Health Physics Instructions
- HPI 1-0, "Health Physics Policies," dated March 2001
- HPI 1-2, "Health Physics Skills, Duties, and Audits," dated March 2001
- HPI 1-4, "Radiological Safety Training," dated December 1993
- HPI 2-2, "Personnel Monitoring Issuance/Return," dated December 1993
- HPI 3-1, "Reactor Inplant Monitoring Summary," dated December 1993
- HPI 3-2, "Radiation Work Permit," dated March 2001
- HPI 3-3, "Reactor Survey Operations," dated March 2001
- HPI 7-4, "Survey Instrument Calibration (beta/gamma)" dated October 1995
- HPI 7-4, "Survey Instrument Calibration (neutron)" dated January 1990

b. Observations and Findings

(1) Surveys

The inspectors reviewed selected daily general area radiation surveys of work areas during reactor operation, weekly contamination surveys of controlled areas at the facility, and selected monthly general area radiation surveys of the interior uncontrolled areas and the area around the exterior of the NIST Center for Neutron Research (NCNR) for 2004. The surveys had been completed as stipulated by procedure and the results were documented on the appropriate forms. Areas found to be contaminated were decontaminated and then surveyed again to verify the status.

Because the reactor was shutdown for maintenance during the inspection, the inspectors toured various areas of the facility, including the Experiment Floor

area (C100 area) around the reactor and selected areas in the basement, and discussed survey techniques and expected readings with the Senior Health Physicist. From the discussion it appeared that the appropriate techniques and practices were being used during facility surveys.

Also during this inspection the inspectors observed various maintenance activities. It was noted that good radiation protection work practices were used and that the appropriate exit frisking was being completed when the workers exited the controlled areas as required.

(2) Postings and Notices

The inspectors reviewed the postings at the entrances to various controlled areas including the C100 area, the basement area, and radioactive material storage areas. The postings were acceptable and indicated the radiation hazards present. Other postings also showed the industrial hygiene hazards present in the areas. The facility's radioactive material storage areas were noted to be properly posted. No unmarked radioactive material was found in the facility. Copies of current notices to workers, required by 10 CFR Part 19, were posted near or above the racks where personnel dosimeters were stored in the main hallways of the facility.

(3) Dosimetry

The licensee's thermoluminescent dosimeters (TLDs) were processed by the Navy as stipulated in a Memorandum of Understanding between NIST and the National Naval Medical Center Hospital in Bethesda, dated December 1983. An examination of the records for the past year (2003) showed that all exposures were within NRC limits. The majority of the records showed that NCNR personnel received exposures of less than fifty millirem for the year. The highest annual whole body exposure received by a single individual (including dose from bioassay results) for the past year was 377 millirem (mr) Total Effective Dose Equivalent (TEDE). The highest annual extremity exposure for the past year was 890 mr shallow dose equivalent. It was also noted that, of the 883 individuals monitored during 2003, 198 people received zero (0) mr and over ninety percent (90%) received less than 50 mr TEDE.

Through direct observation of licensee staff and other researchers working at NCNR, the inspectors determined that dosimetry was acceptably worn by facility personnel.

(4) Calibration of Radiation Monitoring Equipment

The calibration of portable survey meters was typically completed by NIST Occupational Health and Safety Division personnel. Calibration of fixed radiation detectors, air monitoring instruments, and other instrumentation associated with the reactor was completed by the Reactor Engineering Group. The calibration records of selected portable survey meters, friskers, area radiation monitors (ARMs), and continuous air monitors (CAMs) in use at the facility were reviewed. The portable instruments were being calibrated semi-

annually and records were being maintained as required. The ARMs and CAMs were checked monthly and calibrated annually.

During the inspection the inspectors observed the calibration range at NIST operated by Occupational Health and Safety Division personnel. The calibration equipment had recently been upgraded by the vendor. The calibration range appeared to be adequate and appropriate techniques for use of the facility were discussed. Proper precautions and controls had been established and were being implemented to maintain doses ALARA. No problems were noted.

While reviewing the records of the calibration of the ARMs, the inspectors noted that the calibration sheets used during ARM calibrations gave specific upper and lower limits for the detectors. The recorded values obtained during certain calibration attempts were noted to be outside the specified limits. The issue was discussed with personnel from the Reactor Engineering Group but the individual who typically conducted the calibrations was not present during the week of the inspection. Consequently, the apparent anomaly could not be explained. The licensee was informed that this issue would be identified as an Inspector Follow-up Item (IFI) and would be reviewed during a subsequent inspection (IFI 50-184/2004-201-01).

(5) Radiation Work Permit Program

The inspectors reviewed selected Radiation Work Permits (RWPs) that had been written and used during 2004 to date. There were five "standing" RWPs that remained in effect for the entire year due to the repetitive nature of the work they covered. Other RWPs were generated as needed. It was noted that the controls specified in the RWPs were acceptable and applicable for the work being done. Also, the RWPs had been reviewed, approved, and as required.

As noted previously, various maintenance and other work activities were observed during the inspection. The inspectors verified that the workers had "signed in" on the appropriate RWPs and that the specified radiological controls specified were being observed.

(6) Radiation Protection Program

The Radiation Protection Program was established and described in various licensee documents including: 1) U.S. Department of Commerce, NIST, Administrative Manual, Chapter 12, "Safety," Subchapter 12.03, "Radiation Safety," dated October 13, 1989, 2) Health Physics Procedures for the NBSR, current as of September 13, 2001, 3) Health Physics Instructions, the most recent revision dated June 2002, and 4) Good Work Practice Guides. These documents were revised as needed and were approved by the appropriate organizations. The inspectors noted that the documents contained acceptable instructions concerning audits, safety, training, and personnel responsibilities. It was noted that the Radiation Protection Program was reviewed each year as required by 10 CFR 20.1101(c).

The ALARA Policy was also outlined and established in the aforementioned documents. The ALARA program provided guidance for keeping doses as low as reasonably achievable and was consistent with the guidance in 10 CFR Part 20.

(7) Radiation Protection Training

The training program was set up so that authorized radioisotope users and all radiation workers, including NIST staff, received radiation protection training. The inspectors noted that individuals who required unescorted access to the research reactor facility and/or who worked with radioactive material completed a Radiation Safety Principles course or provided evidence that they had received such training at another facility. The training was conducted by the NCNR and the program was determined to be acceptable. The inspectors verified, through records review and licensee interviews, that facility employees and guests had received the required training.

(8) Facility Tours

The inspectors toured the Control Room, the C100 area or Experimental Floor, the new fuel and spent fuel storage areas, the Guide Hall, and other selected support laboratories and offices. Control of radioactive material and control of access to radiation and high radiation areas was acceptable. As noted earlier, the postings and signs for these areas were appropriate.

c. Conclusions

The inspectors determined that the Radiation Protection and ALARA Programs being implemented by the licensee satisfied regulatory requirements because: 1) surveys were being completed as stipulated; 2) postings met regulatory requirements; 3) personnel dosimetry was being worn as required and doses were within the NRC's regulatory limits; 4) radiation monitoring equipment was being maintained and calibrated as required; and 5) radiation protection training was provided to facility employees and guests.

5. Environmental Protection Program

a. Inspection Scope (IP 69004)

The inspectors reviewed selected aspects of the following to ensure that the requirements in 10 CFR Part 20 were being met and the calibrations and monitoring required in TS Sections 5.7.2 and 5.9 were being conducted:

- TLD results for Environmental Stations for 2003 through the date of the inspection
- Gaseous Release Log and associated calculations and records
- calibration and periodic check records for CAMs and the Fission Product Monitor
- National Institute of Standards and Technology Reactor (NBSR) Operations Report No. 56 (Annual Report) for the period from January 1, 2003, through December 31, 2003
- HPI 8-1, "Liquid Radioeffluent Release," dated November 2000

- HPI 8-2, "Environmental Sampling," dated December 1993
- HPI 8-4, "Reactor Stack Monitoring," dated December 1993
- HPI 8-5, "Environmental Thermoluminescent Dosimetry," dated December 1993
- HPI 8-6, "Environs Radiation Surveys," dated December 1993

b Observations and Findings

Environmental soil and vegetation samples were collected and prepared for analysis using generally accepted techniques in accordance with HPI 8-2. The results of the analyses were acceptably documented and the results, which showed no significant changes when compared with the past year, were outlined in the licensee's Annual Report.

The inspectors reviewed the records documenting liquid and airborne releases to the environment for the past two years. The inspectors determined that liquid and gaseous releases continued to be calculated as required by procedure and were acceptably documented. The releases were determined to be within the annual dose constraints of 10 CFR 20.1101(d), 10 CFR Part 20, Appendix B concentrations, and TS limits. Calculations using the COMPLY Code indicated an annual dose to members of the public of 0.7 mr for 2003.

On-site gamma radiation monitoring was completed using the reactor facility stack effluent monitor and various environmental TLDs in accordance with the applicable procedures. The data indicated that there were no measurable doses above any regulatory limits. These results were also reported in the facility Annual Report for 2003. Through observation of the facility, the inspectors found no new potential release paths.

The inspectors reviewed the calibration records of the CAMs and stack monitoring system. These systems had been calibrated annually according to procedure.

c. Conclusions

The environmental monitoring program satisfied TS requirements.

6. Shipment of Radioactive Material

a. Inspection Scope (IP 86740)

The inspectors reviewed the following to verify compliance with procedural requirements for transferring licensed material:

- radioactive waste shipment records for 2003
- spent fuel shipment records for 2003
- HPI 4-2, "Receiving of Radioactive Material," dated December 1994
- HPI 4-13, "Shipping Radioactive Material," dated March 1996
- HPI 8-3, "Disposal of Radioactive Waste," dated December 1993

The inspectors also interviewed licensee personnel.

b. Observations and Findings

In the past, NIST had requested an exemption from complying with Department of Transportation (DOT) regulations when shipping new fuel. The DOT informed NIST that, as a federal agency transporting hazardous materials using federal employees and federal vehicles to conduct federal business (not commercial business), NIST was exempt from DOT regulations. However, as an internal policy, NIST decided to continue to comply with DOT regulations except for unirradiated fuel.

The transport of radioactive material, other than unirradiated fuel, was reviewed. Through records review and discussions with licensee personnel, the inspectors determined that the licensee had shipped radioactive waste and spent fuel since the previous inspection in this area. The records indicated that the radioisotope types and quantities of these materials were calculated and dose rates measured as required. The records also indicated that the shipping containers were appropriate and had been labeled as required. All radioactive material shipment records reviewed by the inspectors had been completed in accordance with DOT and NRC regulatory requirements.

c. Conclusions

The program for transportation of radioactive materials satisfied NRC requirements.

7. Follow-up on Previously Identified Issues

a. Inspection Scope

The inspectors reviewed the actions taken by the licensee following identification of an Inspector Follow-up Item (IFI) during a previous inspection in March of 2001 and documented in NRC Inspection Report Nos. 50-184/2001-201.

b. Observations and Findings

IFI 50-184/2001-201-01 - Follow-up on the licensee's actions to locate records on inplant monitoring that could not be located during the inspection.

During a previous inspection, the inspector had reviewed various items including records of inplant monitoring listed in HPI No. 3-1. At the time of the inspection, some of the inplant monitoring records could not be located. When asked about this situation, the Health Physics supervisor indicated that the duty of records check might be added to the responsibilities of the HP designated to conduct the quarterly audit at the facility.

The inspectors reviewed this issue during the current inspection and found that the licensee was maintaining the proper records and that the inplant monitoring records were readily available for review. Although the Designated HP duties or responsibilities were not revised, the availability of the records demonstrates that they are being tracked and maintained as required. This issue is considered closed.

c. Conclusions

The licensee had taken action to resolve a previously identified issue and it was closed.

8. Exit Interview

The inspection scope and results were summarized on July 1, 2004, with members of licensee management. The inspectors 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

D. Brown, Senior Health Physicist
P. Gallagher, Director, NIST Center for Neutron Research
T. Myers, Deputy Chief, Reactor Operations and Engineering
W. Richards, Senior Nuclear Engineer
M. Suthar, Chief, Reactor Engineering
S. Weiss, Chief, Reactor Operations and Engineering

Other Personnel

R. Clement, Group Leader, Laboratory Health Physics Group, Occupational Health and Safety Division
T. Mengers, Chief, Health Physics, Occupational Health and Safety Division

INSPECTION PROCEDURES USED

IP 69004: Class 1 Research and Test Reactor Effluent and Environmental Monitoring
IP 69006: Class 1 Research and Test Reactor Organization, Operations, and Maintenance Activities
IP 69007: Class 1 Research and Test Reactor Review and Audit and Design Change Functions
IP 69008: Class 1 Research and Test Reactor Procedures
IP 69012: Class 1 Research and Test Reactor Radiation Protection
IP 86740: Inspection of Transportation Activities

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-184/2004-201-01 IFI Review the licensee's actions concerning ARM calibration values that exceeded the specified limits.

Closed

50-184/2001-201-01 IFI Follow-up on the licensee's actions to locate records on inplant monitoring that could not be located during the inspection.

LIST OF ACRONYMS USED

ARM Area Radiation Monitor
CAM Continuous Air Monitor
CFR Code of Federal Regulations
DOT Department of Transportation
HPI Health Physics Instruction
IFI Inspector Follow-up Item
IP Inspection procedure

mr	millirem
NBSR	National Bureau of Standards Reactor
NCNR	NIST Center for Neutron Research
NIST	National Institute of Standards and Technology
NRC	Nuclear Regulatory Commission
RWP	Radiation Work Permit
SAC	Safety Audit Committee
SEC	Safety Evaluation Committee
TEDE	Total Effective Dose Equivalent
TLD	Thermoluminescent Dosimeter
TS	Technical Specifications