June 4, 2009

Dr. Robert Dimeo, Director
NIST Center for Neutron Research
National Institute of Standards and Technology
U.S. Department of Commerce
100 Bureau Drive, Mail Stop 8561
Gaithersburg, MD 20899-8561

SUBJECT: NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY - NRC ROUTINE INSPECTION REPORT NO. 50-184/2009-201

Dear Dr. Dimeo:

On May 11-14, 2009, the U.S. Nuclear Regulatory Commission (NRC, the Commission) conducted an inspection at National Institute of Technology (NIST) Center for Neutron Research (Inspection Report No. 50-184/2009-201). The inspection included a review of activities authorized for your facility. The enclosed report documents the inspection results, which were discussed during the exit interview on May 14, 2009, with members of your staff.

This inspection was an examination of activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. 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 concern or noncompliance with NRC requirements was identified. No response to this letter is required.

In accordance with Title 10 of the *Code of Federal Regulations* Part 2.390 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 (Agencywide Document Access and Management 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, please contact Patrick Isaac at 301-415-1019 or by electronic mail at Patrick.Isaac@nrc.gov.

Sincerely,

/RA/

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

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

Enclosure: As stated
cc w/encl: See next page

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Test, Research, and Training
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University of Florida
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Gainesville, FL 32611

Should you have any questions concerning this inspection, please contact Patrick Isaac at 301-415-1019 or by electronic mail at Patrick.Isaac@nrc.gov.

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

Docket No:	50-184
License No:	TR-5
Report No:	50-184/2009-201
Licensee:	National Institute of Standards and Technology (NIST)
Facility:	National Bureau of Standards Reactor (NBSR)
Location:	Gaithersburg, MD
Dates:	May 11 - 14, 2009
Inspectors:	Patrick J. Isaac Gary M. Morlang
Approved by:	Johnny H. Eads, Chief Research and Test Reactors Branch B Division of Policy and Rulemaking Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

National Institute of Standards and Technology
National Bureau of Standards Reactor
NRC Inspection Report No. 50-184/2009-201

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the National Institute of Science and Technology (the licensee's) Class I research reactor facility safety programs including review and audit and design change function; radiation protection; effluent and environmental monitoring; fuel movement; and transportation activities. The licensee's programs were acceptably directed toward the protection of public health and safety, and in compliance with NRC requirements.

Review and Audit and Design Change Functions

- Within the scope of this review, the licensee's programs for overall safety review, review of new experiments, and review of changes to the facility were found to be in conformance with Technical Specification and regulatory requirements.

Radiation Protection

- Radiation protection practices were found to be in compliance with regulatory requirements and ALARA principles. Surveys were completed as required, postings met regulatory requirements, personnel dosimetry and radiation monitoring programs were maintained as required

Effluent and Environmental Monitoring

- Effluent monitoring verified that releases were in compliance with license and regulatory requirements. Environmental monitoring was performed in accordance with Technical Specification requirements; no adverse environmental impact was observed.

Fuel Movement

- The license maintained and followed procedures which effectively implemented Technical Specification requirements for fuel handling.

Transportation Activities

- Radioactive material was shipped for offsite disposal in licensed disposal facilities pursuant to procedures and regulatory requirements.

REPORT DETAILS

Summary of Facility Status

The licensee's National Institute of Standards and Technology (NIST) Center for Neutron Research (NCNR) Test Reactor, a 20-megawatt test reactor commonly known as the National Bureau of Standards Reactor (NBSR), continued to be operated in support of laboratory experiments and various types of research. During the inspection, the reactor was operated continuously on a 24-hour per day basis.

1. Review and Audit and Design Change Functions

a. Inspection Scope (IP 69007)

To verify that the licensee was complying with the requirements specified in Section 7.2, Safety Evaluation Committee (SEC), and 7.3, Safety Audit Committee (SAC) of the NBSR Technical Specifications (TS), and to verify that any experiment or procedure changes or modifications to the facility were being reviewed as required by 10 CFR 50.59, the inspectors reviewed the following:

- NIST [Annual] Report # 61, March 18, 2009
- NCNR Safety Evaluation Committee Minutes, Meeting No. 366, November 13, 2008
- Safety Audit Committee Annual report Year 2008, December 2008
- NCNR Reactor Safety Evaluation Committee Charter, July 28, 2008
- [Charter of the] NBSR Irradiation Subcommittee of the NBSR SEC, July 28, 2008
- [Charter of the] NBSR Beam Experiment Subcommittee of the NBSR SEC, October 27, 2008
- Guidelines for Completing Engineering Change Notices, Rev. 2, July 2007
- NBSR Engineering Manual, Rev. 3, July 2008
- Engineering Change Notices (ECN) #540 (June 3, 2008) through #569 (May 4, 2009)

b. Observations and Findings

Records of the meetings held by the SEC showed that meeting frequency, quorum, and committee makeup was as required by TS. The inspector reviewed the charters of the SEC and SAC and interviewed the chairman of the SEC. The level of oversight provided by the committees was in accordance with TS and 10 CFR Part 50.59.

The inspector interviewed the Chief of Engineering and met with the Quality Assurance Engineer who manages the engineering change process. The inspector also reviewed selected ECN for year 2008. All the reviewed ECN had impact analysis performed and all were properly documented and approved. All the reviewed ECN were classified Level 1, meaning that they didn't warrant a

50.59 screening. The inspector found no issues with the engineering change review process.

c. Conclusions

Within the scope of the inspection, the licensee's programs for overall safety review, review of new experiments, and review of changes to the facility were found to be in conformance with Technical Specification and regulatory requirements.

2. Radiation Protection

a. Inspection Scope (IP 69012)

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

- Selected health physics survey records documented on "Duty HP Weekly Data Survey" for 2008 and 2009
- TLD Monitoring Records, 2008
- Personnel Dosimetry Summary, 2008
- Draft report to SEC re: Personnel Exposure Summary for the NBSR for Calendar Year 2008
- Health Physics Procedures for NBSR Operations, dated May 1, 2008

b. Observations and Findings

During the inspection the inspector made an extensive tour of the facility with a Health Physicist (HP) on his daily rounds as he conducted a radiation survey. The Health Physicist was especially mindful of the exposure rate in accessible areas around experiments and areas where experimenters spent the majority of their time. The observed readings were indicative of good ALARA practices.

The inspector reviewed the postings at the entrances to various controlled areas throughout the facility. The postings were acceptable and indicated the radiation hazards present. Copies of current notices to workers, required by 10 CFR Part 19, were posted near the racks where personnel dosimeters were stored.

Through direct observation of licensee staff and researchers at the NCNR, the inspector determined that dosimetry was acceptably worn by facility personnel. An examination of the records for the calendar year 2008 showed that all personnel exposures were well within NRC limits. All monitored NCNR personnel reported an annual Total Effective Dose Equivalent (TEDE) of less than 0.5 rem or 10% of the limit. The highest exposed individual received 0.43 rem.

The inspector interviewed NIST Safety, health and Environment (SH&E) Division personnel who calibrates the portable survey meters typically used at the NCNR.

The calibration stickers on selected portable survey meters, friskers, and area radiation monitors (ARMs) in use at the facility were all current.

The inspector noted that individuals who required unescorted access to the research reactor facility completed a Radiation Safety Principles course. Refresher training was given every two years and completion thereof was tied to a person's facility access authorization.

c. Conclusions

Radiation protection practices were found to be in compliance with regulatory requirements and ALARA principles. Surveys were completed as required, postings met regulatory requirements, personnel dosimetry and radiation monitoring programs were maintained as required.

3. Effluent and Environmental Monitoring

a. Inspection Scope (IP 69004)

The inspector witnessed effluent processing operations and reviewed the following to verify compliance with the requirements of 10 CFR Part 20 and TS Section 5.9, Environmental Monitoring:

- Gamma Tracer Data Files (Monthly), Locations 1-16, January 1, 2007 to present
- Thermal Luminescent Dosimetry (TLD) Results for Environmental Stations, Quarterly Reports 4th Quarter 2007 to present
- Sanitary Sewerage Releases, January 1, 2008 to present
- Gaseous Effluent Analysis File
- Stack Charcoal Filter Analysis Data Files, 2008 and 2009
- Report on Compliance with the Clean Air Act for Radionuclide Emissions from the COMPLY Code – VI.6, by D. Brown, January 27, 2009
- Report on Compliance with the Clean Air Act for Radionuclide Emissions from the COMPLY Code – VI.6, by D. Brown, January 29, 2008
- Environmental Analysis Files for 2008 and 2009
- 5,000 Gallon Tank Release Analysis for 2008 and 2009
- Environmental Soil, Water, and Grass Sample Analysis for 2008 and 2009

b. Observation and Findings

The licensee monitored both quarterly doses and continuous dose rates at the facility fence line for each of the 16 nominal sectors. The inspector viewed some of the monitoring devices. Doses were recorded on TLDs; dose rates were recorded continuously and down-loaded as monthly plots of daily average readings. The data indicated doses of 16 to 26 millirems per quarter, equal to the natural background dose for that area. The licensee also collected and analyzed water and vegetation samples from the environment surrounding the

facility in compliance with TS 5.9. There were no indications of radioactivity from the licensee's operation adversely impacting the environment.

Liquid waste from reactor drains, primarily humidity removed from environmental air supplied for ventilation, was collected in tanks for batch release after sampling and analysis. Release concentrations were below 10 CFR Part 20 limits, measured prior to dilution by a factor of 120 with other site effluents. The most limiting liquid effluent was tritium with a total release for 2008 of 3.96 Curies relative to a Part 20 annual limit of 5.0 Curies.

The licensee reported two predominant gaseous releases, Argon-41 (Ar-41) and Tritium (H-3). The Ar-41 was monitored continuously at the exhaust stack while H-3 was collected in a cold trap and measured in an alpha/beta counter. A charcoal filter through which an exhaust gas sample passed was routinely analyzed for other effluents but nothing else of significance was identified. The COMPLY computer code was used at level four to determine the maximum dose to the public. For 2008, effluents of 657 Curies of H-3 and 1585 Curies of Ar-41 were calculated to result in a dose of 0.7 millirems to the hypothetical maximally exposed member of the public relative to an annual limit of 100 millirem.

The inspectors reviewed the environmental soil, water, and vegetation samples that were collected and analyzed during 2008 and first quarter 2009. These samples had all been collected and analyzed within the appropriate time frame required by procedure.

c. Conclusions

Effluent monitoring verified that releases were in compliance with license and regulatory requirements. Environmental monitoring was performed in accordance with TS requirements; no adverse environmental impact was observed.

4. Fuel Movement

a. Inspection Scope (IP 69009)

The following documents were reviewed to verify safe handling, storage, inspection, and use of reactor fuel elements in compliance with TS Sections 3.7, Fuel Handling and Storage, 3.8, Fuel Handling Within the Reactor Vessel, and 7.4 (6), [Procedures for] handling of irradiated and un-irradiated fuel elements:

- Operating and Refueling Procedures for the NBSR
- Operating Instruction OI 6.1, Fueling and Defueling Procedures, Issued December 14, 2006
- Core Loading 591 Performed March 31, 2009 (Approved March 31, 2009)
- Core Loading 590 Performed February 10, 2009 (Approved February 10, 2009)
- Transportation Quality Assurance Inspection of New Fuel Receipt

- Operations Checklist for New Fuel Receipt, Issued April 20, 2009
- Reactor Console Logbook # 132, April 2, 2009 to Present
- Reactor Console Logbook # 131, December 18, 2008 to April 2, 2009
- Reactor Console Logbook # 130, September 13,2008 to December 18, 2008

b. Observations and Findings

The inspectors reviewed the core loading designs and fuel handling records for the previous year. They also reviewed the procedures governing fuel handling activities. The procedures reviewed were found to meet the requirements of the TS cited above. The fuel handling records reviewed indicated that the written procedures were followed.

The inspectors reviewed the documentation of a complete core unload (# 587) to the fuel pool that occurred September 15-17, 2008 and complete core loading (# 588) on October 1, 2008. The core unload was done to facilitate replacement of the shim control rods. Fuel movements were properly documented in the reactor log book and fuel movement/core loading log book.

c. Conclusions

The licensee maintained and followed procedures which effectively implemented Technical Specification requirements for fuel handling.

5. Transportation

a. Inspection Scope (IP 86740)

The inspector reviewed the following to verify compliance with regulatory and procedural requirements for transferring licensed material:

- Waste Characterization and Shipment Files for 2008 and 2009
- NIST Packaging and Shipping Quality Assurance Program for 10 CFR Part 71 – Transport of Radioactive Materials Rev. 4 dated July 2008
- Transportation Plan for Shipping NIST Material

b. Observations and Findings

Through records reviews and the discussions with licensee personnel, the inspector determined that the licensee had one shipment of solid metal oxide waste in 2008. This shipment contained the non-fuel sections of 92 fuel elements that had been cut into pieces. 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 DOT and NRC regulations.

c. Conclusions

Radioactive material was shipped for offsite disposal in licensed disposal facilities pursuant to the licensee's procedures and regulatory requirements.

6. Exit Interview

The inspection scope and results were summarized on May 14, 2009, with members of licensee management. The inspectors described the areas inspected and discussed the inspection findings. No dissenting comments were received from the licensee.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

P. Brand, Chief of Reactor Engineering
D. Brown, Senior Health Physicist
R.G. Downing, NCNR Safety Evaluation Committee Chairman
C. Drewry, Quality Assurance Engineer
T. Myers, Chief, Reactor Operations
W. Richards, Chief of Operations and Engineering

INSPECTION PROCEDURES USED

IP 69004	Class 1 Research and Test Reactor Effluent and Environmental Monitoring
IP 69007	Class 1 Research and Test Reactor Review and Audit and Design Change Functions
IP 69009	Class 1 Research and Test Reactor Fuel Movement
IP 69012	Class 1 Research and Test Reactor Radiation Protection
IP 86740	Class 1 Research and Test Reactor Transportation

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Discussed

None

Closed

None

LIST OF ACRONYMS USED

10 CFR	Title 10 of the *Code of Federal Regulations*
ADAMS	Agencywide Document Access Management System
CFR	*Code of Federal Regulations*
ECN	Engineering Change Notice
HP	Health Physicist
IP	Inspection Procedure
NBSR	National Bureau of Standards Reactor
NCNR	NIST Center for Neutron Research
NIST	National Institute of Standards and Technology
NRC	Nuclear Regulatory Commission
PARS	Publicly Available Records
Rev.	Revision
SAC	Safety Audit Committee
SEC	Safety Evaluation Committee
TLD	Thermal Luminescent Dosimetry
TS	Technical Specification