

May 19, 2011

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
NON-ROUTINE INSPECTION REPORT NO. 50-184/2011-203

Dear Dr. Dimeo:

On April 18-20, 2011, the U. S. Nuclear Regulatory Commission (NRC, the Commission) conducted a non-routine, announced inspection at the National Institute of Standards and Technology Center for Neutron Research facility (Inspection Report No. 50-184/2011-203). The enclosed report documents the inspection results, which were discussed on April 20, 2011, with you and members of your staff.

This inspection examined 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. The inspector closely observed various activities in progress, interviewed personnel, and reviewed a few selected procedures and representative records,. Based on the results of this inspection, no findings of significance were identified. No response to this letter is required.

In accordance with Title 10 of the *Code of Federal Regulations* Section 2.390, "Public inspections, exemptions, and requests for withholding," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (Agencywide Document Access and Management System (ADAMS)). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Should you have any questions concerning this inspection, please contact Craig Bassett at (301) 466-4495 or by electronic mail at Craig.Bassett@nrc.gov.

Sincerely,
/RA/

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

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

Enclosure: NRC Inspection Report No. 50-184/2011-203
cc w/encl: See next page

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

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ACCESSION NO.: ML111320003

*** concurrence via e-mail**

TEMPLATE #: NRC-002

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DATE	4/22/2011	5/12/2011	5/19/2011

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

Docket No: 50-184

License No: TR-5

Report No: 50-184/2011-203

Licensee: National Institute of Standards and Technology

Facility: National Bureau of Standards Reactor

Location: Gaithersburg, MD

Dates: April 18-20, 2011

Inspector: Craig Bassett

Approved by: Johnny H. Eads, Jr., Chief
Research and Test Reactors Oversight Branch
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. 50-184/2011-203

The primary focus of this non-routine, announced inspection was the onsite observation of selected crew activities at the National Institute of Standards and Technology (NIST, the licensee's) Class I twenty Megawatt (20MW) test reactor (commonly known as the National Bureau of Standards Reactor (NBSR)). The inspection consisted of observation and/or discussion of the licensee's safety program related to outage and maintenance activities including: 1) organization and staffing; 2) design change function; 3) outage and maintenance work; 4) fuel handling and movement; and, 5) radiation protection. The licensee's safety program during these non-routine activities was acceptably directed toward the protection of public health and safety, and in compliance with NRC requirements. No violations or deviations were identified.

Organizational Functions and Staffing

- The organizational structure was consistent with Technical Specification Section 6.1 requirements.
- The operations staffing levels for the outage appeared to be adequate for the level of activities that had been planned.
- Health physics staffing for the outage was to augmented as needed.
- Other groups at NIST were using their on-site personnel and contractors to assist them in completing various tasks during the outage.

Design Change Functions

- The design change program being implemented at the facility satisfied the U. S. Nuclear Regulatory Commission (NRC) requirements.

Outage and Maintenance Activities

- Shift turnovers and operator cognizance of facility conditions were acceptable.
- Outage activities were being coordinated through daily Outage Status meetings and weekly Outage Planning/Status meetings.

Fuel Handling

- Fuel movement was accomplished in accordance with Technical Specification and procedural requirements.

Radiation Protection

- Surveys were completed and documented.
- Postings and notices met regulatory requirements.
- Staff personnel were wearing the appropriate personal protective clothing and dosimetry as required.
- Proper control was being maintained over the various outage activities.

REPORT DETAILS

Summary of Facility Status

The National Institute of Standards and Technology (NIST, the licensee) NIST Center for Neutron Research (NCNR) reactor, a 20-megawatt test reactor commonly known as the National Bureau of Standards Reactor (NBSR), entered into an extensive outage and maintenance period on April 3, 2011. The outage is expected to last about 12 months. During the inspection, the reactor was shutdown and being defueled so that various system and facility upgrades and improvements could be completed.

1. Organizational Functions and Staffing

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

To verify that the licensee was complying with the requirements specified in Section 6.1, "Organization," of the NBSR Technical Specifications (TS), designated as Appendix A of the NBSR Renewed Facility Operating License, dated July 2, 2009, the inspector reviewed selected aspects of the following:

- NBSR Console Logbook Number (No.) 139
- Current NBSR and NCNR organization and staffing
- Management and staff responsibilities outlined in the TS
- NBSR Administrative Rules (AR) 1.0, "Responsibilities of Operations Personnel," issued July 30, 2009
- NBSR AR 2.0, "Personnel Requirements," issued July 30, 2009

b. Observations and Findings

Through discussions with licensee personnel and review of pertinent documents, the inspector determined that the licensee's organizational structure had not changed since the last U. S. Nuclear Regulatory Commission (NRC) inspection (refer to NRC Inspection Report No. 50-184/2010-202). As a result, the organizational structure remained consistent with the requirements of TS Section 6.1 and Figure 6.1.

In discussing staffing for the outage with management personnel, the inspector noted that the licensee planned to maintain continuous (three shift) staffing at the reactor facility throughout the outage. The swing-shift and mid-shift staffing would be limited and those personnel would be assigned a reduced amount of work. This provided an adequate number of operators for the level of day-shift activity expected at the facility. It was also noted that the Health Physics (HP) group had anticipated staffing needs throughout the outage and separate Health Physicists and/or HP Technicians had been assigned to review and cover specific jobs and work evolutions that were to take place during the outage. This appeared to be an appropriate allocation of resources during this period.

The inspector asked the licensee about periods of time when additional HP coverage might be needed because of the amount of ongoing work or when radiologically challenging tasks were in progress. The licensee indicated that arrangements were being formalized with the NIST campus Radiation Safety

Officer to reassign HP personnel from other areas at NIST to the NCNR on a short term basis as needed. This appeared to be an adequate solution to the possible problem.

Other groups had also anticipated personnel needs during the outage and contractor personnel had been hired to assist with specific tasks. This ensured that the various jobs that were planned to be completed during the outage would be accomplished as scheduled.

c. Conclusion

The organizational structure was consistent with TS Section 6.1 requirements. The operations and augmented health physics staffing levels for the outage appeared to be adequate for the planned level of activities. Other groups were using their on-site personnel and/or had hired contractors to assist them in completing various tasks during the outage.

2. Design Change Functions

a. Inspection Scope (IP 69007)

The inspector reviewed the following to ensure that the requirements of Title 10 of *Code of Federal Regulations* (10 CFR) Section 50.59, were being implemented effectively:

- NBSR Procedure No. NBSR-0007-DOC-04, "Engineering Manual," Rev. 4 dated June 2009
- NBSR Procedure No. NCNR-1000-DOC-00, "Engineering Change Control for NBSR Reactor Operations and Engineering, NCNR," dated July 10, 2007
- NBSR Procedure No. NBSR-0001-DOC-03, "NBSR Reactor Engineering Document Control Plan," Rev. 3 dated May 11, 2009
- NBSR Engineering Change Request (ECR) No. 559, "NBSR Thermal Shield Cooling System Upgrades: Moving Coolant by Vacuum," Level II review, approval dated April 28, 2009
- NBSR Engineering Change Notice (ECN) No. 559, "NBSR Thermal Shield Cooling System Upgrades: Moving Coolant by Vacuum," Major ECN – Level II review, NCNR Director approval dated December 8, 2010
- NBSR ECR No. 583, "Pool Coating," Level I review, approval dated April 22, 2010
- NBSR ECN No. 583, "Pool Coating," Minor ECN – Level I review, approval dated March 18, 2011

b. Observations and Findings

The inspector met with the Quality Assurance Engineer who managed the engineering change process. The inspector reviewed selected requests for changes to the facility and/or equipment that had been proposed for the outage.

The change requests were designated as “Minor Engineering Change Requests (ECRs)” or “Major ECRs” and numbered sequentially during the year. Each ECR documented what was proposed to be changed, the facility drawings that would need to be changed, the procedures that would require revision, and any tests or measurements that would need to be completed following the change.

Once an ECR was approved, an “Engineering Change Notice (ECN)” was developed to implement the ECR. Each ECN also contained sections detailing the design description, safety considerations and analysis, a safety evaluation, and 10 CFR 50.59 screening criteria results. Minor ECRs were required to be reviewed and approved by the Chief, Reactor Operations and the Chief, Reactor Engineering. Major ECRs were to be reviewed by various groups including Reactor Operations, Electrical Engineering, Mechanical Engineering, Health Physics, and the SEC, and were approved by the Chief, Reactor Operations and Engineering and the Director, NCNR.

The ECRs reviewed by the inspector had been properly prepared and reviewed. The ECNs reviewed by the inspector demonstrated that the anticipated changes were acceptably documented and reviewed in accordance with the TS and the licensee’s guidelines and that the work and the required document revisions were scheduled to be completed as stipulated. It was noted that all such changes were being tracked to completion by the licensee. None of the changes reviewed by the inspector met any of the criteria of 10 CFR 50.59(c)(2).

c. Conclusion

The design change program being implemented by the licensee satisfied NRC requirements.

3. Outage and Maintenance Activities

a. Inspection Scope (IP 69006 and 69012)

To ensure that maintenance activities were being completed and to determine that surveillance activities and calibrations were being completed as required by TS Section 4, the inspector reviewed selected aspects of:

- NBSR Console Logbook No. 139
- NBSR Reactor Shift Supervisor Logbook No. 37
- Shift Supervisors Instructions and Special Log sheets
- Reactor Technical Specification Log Book, Volume 2
- NBSR AR 1.0, “Responsibilities of Operations Personnel,” issued July 30, 2009
- NBSR AR 2.0, “Personnel Requirements,” issued July 30, 2009
- NBSR Operating Instruction (OI) 6.1, “Fueling and Defueling Procedures”, most recent issue dated February 5, 2010, with Pen and Ink changes made March 2, 2011

b. Observations and Findings

(1) Outage and Maintenance Activities

A review of outage Gantt charts and various logbooks and specific instructions indicated that activities being conducted were generally on schedule and proceeding as planned. Outage and maintenance activities were being tracked and overseen by personnel assigned to cover each task. Many of the jobs to be completed during the outage have been in the planning stages for many months, or in some cases for several years, prior to the outage

(2) Outage Oversight and Shift Turnover Activities

The operating logs and records were clear and provided an indication of ongoing activities. The logs and records demonstrated that shift staffing was as required by TS. Through direct observations the inspector verified that shift turnover briefings were held during each shift change and that activities of the previous shift were discussed in detail. The records kept and the briefings that were given ensured that the operators were aware of the conditions in the facility and the status of equipment.

In addition, on Monday and Tuesday, the inspector attended the daily Outage Status Meeting held each afternoon at 3:00 p.m. The briefings included persons from each of the various groups involved in the outage activities, as well as members of upper management. The briefings ensured that all scheduled and contract work was coordinated and being tracked. The meetings also provided a forum for scheduling conflicts or other problems to be brought up so that the issues could be resolved. Weekly Outage Planning/Status meetings were also being held. Project managers were required to brief management on the current status of each project and indicate the progress that had been made toward the final goals of the outage.

c. Conclusion

Shift turnovers and operator cognizance of facility conditions were acceptable. The outage was being conducted according to a specific schedule. Oversight functions were being acceptably completed.

4. Fuel Handling

a. Inspection Scope (IP 69009)

The inspector reviewed selected aspects of the following to verify that fuel movement and handling was being conducted as required by TS Sections 3.9 and 5.3:

- Pool Log No. 3
- NBSR Console Logbook No. 139

- Core Loading/Reloading Sheet No. 605
- Core Loading, Offloading, and Reloading Verification and Sign-off sheets
- NBSR AR 6.0, "Refueling Operations," issued August 22, 2006
- NBSR OI 6.1, "Fueling and Defueling Procedures", most recent issue dated February 5, 2010, with Pen and Ink changes made March 2, 2011
- NBSR OI 6.2, "Operation of the Fuel Transfer System," most recent issue dated July 27, 2009

b. Observations and Findings

The inspector observed core unloading and fuel handling operations which were ongoing at the Reactor Top and in the Pool Storage room. Operating Instructions 6.1 and 6.2 provided prescribed methods to move and handle fuel consistent with the provisions of the TS and the licensee safety analysis. The inspector noted that the fuel unloading and handling was conducted in accordance with the established procedures. Fuel was moved and controlled as required and the appropriate records were completed to document the fuel moves. The inspector also reviewed records for the current fuel movements and found them to be complete and properly documented.

The inspector observed and noted that the fuel movements were verified by various individuals (on the Reactor Top and at the Storage Pool) as required and that fuel elements were placed into the designated locations. The Inspector also verified that fuel handling and monitoring equipment was operable and being used appropriately. The inspector further verified that operations personnel were familiar with and knowledgeable of the procedural requirements that ensured criticality control and fuel integrity.

It was noted that the fuel elements were not inspected following discharge from the core other than a verification of each element's serial number. The licensee indicated that the elements would be visually inspected (i.e., to ensure that the cooling channels were clear, etc.) prior to being reloaded into the core.

c. Conclusion

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

5. Radiation Protection

a. Inspection Scope (IP 69012)

The inspector reviewed the following to verify compliance with 10 CFR Part 20 and the applicable licensee TS requirements and procedures:

- NIST dosimetry reports for 2010
- Radiation Work Permit (RWP) No. 1-11, "C-200 Reactor Top – Refueling," issued January 25, 2011

- RWP No. 2-11, "C-004 Storage Pool – Transfer Fuel," issued January 25, 2011
- Selected radiation and contamination survey records of the Reactor Top area and the Storage Pool area
- Radiological signs and posting in the C-100 area, the Reactor Top area, and the Storage Pool area

The inspector also toured the Process Room and observed the use of dosimetry and survey meters. In addition, the inspector conducted a radiation survey using a licensee meter.

b. Observations and Findings

(1) Surveys

Appropriate contamination and radiation surveys had been completed in the Reactor Top and Storage Pool areas by HP staff members. No contamination had been detected in those areas. Results of the surveys were documented on survey maps and posted at the entrances to the various areas surveyed so that the operators would be aware of the radiological conditions that existed therein.

(2) Postings and Notices

Copies of current notices to workers were posted in appropriate areas in the facility. The copies of NRC Form-3 noted at the facility were the latest issue, as required by 10 CFR Part 19, and were posted in various areas throughout the facility such as on the main bulletin board and in main hallways. The inspector determined that radiological signs, as well as the survey maps noted above, were typically posted at the entrances to controlled areas. Other postings also showed the industrial hygiene hazards that were present in the areas as well.

(3) Dosimetry Results and Personal Protective Clothing Usage

The inspector observed the use of personal protective clothing (PCs) during the fuel handling operations. Each individual involved was wearing the PCs required by the Radiation Work Permit (RWP) that had been generated for that activity. It was also noted that each individual conducted an appropriate personal survey (or frisk) upon exiting a contaminated area.

Through direct observation the inspector determined that dosimetry was acceptably used by facility personnel. The inspector noted that the licensee's dosimeters were supplied by Harshaw and were processed by the Navy at the National Naval Medical Center Hospital in Bethesda, Maryland. An examination of the records for the calendar year 2010 showed that all exposures were well within NRC limits. No records were yet available for the first quarter of 2011.

An examination of the dosimetry results indicating radiological exposures at the facility for 2010 showed that over half of the facility personnel received occupational exposures of zero to only a few millirem above background. The highest annual whole body exposure received by a single individual for 2010 was 444 mr Total Effective Dose Equivalent (TEDE). The highest annual extremity exposure for 2010 was 4066 mr Skin Dose Equivalent (SDE).

The facility also collected urine samples for Tritium (H-3) bioassay purposes. The highest attributable dose in 2010 from H-3 was 51.4 mr Committed Effective Dose Equivalent (CEDE).

The licensee indicated that they were not going to be tracking exposures specifically for the outage. No data base or other mechanism had been established to monitor or track outage-related dose. The only dose tracking that was to be done was by recording the dose received by each individual at the end of a work evolution as required by the applicable RWP. This was accomplished by means of issuing each person working under the auspices of an RWP a Pocket Ion Chamber which could be read and the information recorded as required.

(4) Facility Tours

On various occasions during the inspection, the inspector toured the main floor of the Reactor Building, or C100 area, the Reactor Top and Control Room area, or C200 area, the Storage Pool and Process Room areas, the basement area, the existing Guide Hall area and the new Guide Hall which is currently under construction, as well as other support areas with licensee representatives. Various outage activities were in progress in almost every area. No unmarked radioactive material was noted and no other anomalies were noted. The inspector noted that facility radioactive material storage areas were properly posted. Radiation and High Radiation Areas were posted as required and properly controlled.

c. Conclusion

The inspector determined that the Radiation Protection Program, as implemented by the licensee, satisfied regulatory requirements because: 1) surveys were completed and documented acceptably to permit evaluation of the radiation hazards present; 2) postings met regulatory requirements; 3) personnel were wearing the proper personal protective clothing and dosimetry as required; and, 4) proper control was being maintained over the various outage activities.

7. Exit Interview

The inspection scope and results were summarized on April 20, 2011, with members of licensee management. The inspector 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, Reactor Engineering and Chair, Hazards Review Committee
D. Brown	Senior Health Physicist and Chair, Irradiation Subcommittee
R. Dimeo	Director, NIST Center for Neutron Research
D. Flynn	Reactor Supervisor/Senior Reactor Operator and Irradiation Coordinator
D. Hughes	Deputy Chief, Reactor Operations
M. Middleton	Cryogenic General Engineer and Member, Audit Subcommittee
J. Moody	Senior Reactor Operator
W. Mueller	Reactor Supervisor/Senior Reactor Operator
T. Myers	Chief, Reactor Operations
S. O'Kelly	Chief, Reactor Operations and Engineering
W. Schuster	Quality Assurance Program Manager and Member, Audit Subcommittee

INSPECTION PROCEDURES USED

IP 69006:	Class 1 Research and Test Reactors Organization, Operations, and Maintenance Activities
IP 69007:	Class 1 Research and Test Reactors Review and Audit and Design Change Functions
IP 69009:	Class 1 Research and Test Reactors Fuel Movement
IP 69012:	Class 1 Research and Test Reactor Radiation Protection

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

None

LIST OF ACRONYMS USED

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
ADAMS	Agencywide Document Access Management System
AR	Administrative Rules (procedures)
ECN	Engineering Change Notice
ECR	Engineering Change Request
HP	Health Physics
IP	Inspection Procedure
IR	Inspection Report
NBSR	National Bureau of Standards Reactor
NCNR	NIST Center for Neutron Research
NIST	National Institute of Standards and Technology

Nos.	Numbers
NRC	Nuclear Regulatory Commission
OI	Operating Instruction
PCs	Personal Protective Clothing
Rev.	Revision
RWP	Radiation Work Permit
TS	Technical Specification