

May 2, 2018

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

SUBJECT: NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY —  
U.S. NUCLEAR REGULATORY COMMISSION ROUTINE INSPECTION  
REPORT NO. 50-184/2018-201

Dear Dr. Dimeo:

From March 26 – 29, 2018, the U.S. Nuclear Regulatory Commission (NRC) conducted an inspection at the National Institute of Standards and Technology Center for Neutron Research facility. The enclosed report documents the inspection results which were discussed on March 29, 2018, with 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 inspectors reviewed selected procedures and records, observed various activities, and interviewed various personnel. 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, 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 Documents 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).

R. Dimeo

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If you have any questions concerning this inspection, please contact Craig Bassett at (240) 535-1842 or by electronic mail at [Craig.Bassett@nrc.gov](mailto:Craig.Bassett@nrc.gov).

Sincerely,

*/RA/*

Anthony J. Mendiola, Chief  
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Office of Nuclear Reactor Regulation

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

Enclosure:  
As stated

cc: See next page

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SUBJECT: NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY —  
 U.S. NUCLEAR REGULATORY COMMISSION ROUTINE INSPECTION  
 REPORT NO. 50-184/2017-201, DATE: MAY 2, 2018

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

Docket No. 50-184

License No. TR-5

Report No. 50-184/2018-201

Licensee: National Institute of Standards and Technology

Facility: National Bureau of Standards Test Reactor

Location: Gaithersburg, MD

Dates: March 26 – 29, 2018

Inspectors: Craig Bassett  
Mike Takacs

Accompanied by: Michael Balazik, Project Manager and Inspector Trainee

Approved by: Anthony J. Mendiola, Chief  
Research and Test Reactors Oversight Branch  
Division of Licensing Projects  
Office of Nuclear Reactor Regulation

Enclosure

## EXECUTIVE SUMMARY

National Institute of Standards and Technology  
National Bureau of Standards Test Reactor  
NRC Inspection Report No. 50-184/2018-201

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the National Institute of Standards and Technology (the licensee's) 20 Megawatt Class I test reactor facility safety program including: (1) organization and staffing, (2) review and audit functions and design change control, (3) procedures, (4) radiation protection program, (5) environmental monitoring program, (6) emergency preparedness, and (7) transportation of radioactive materials since the last U.S. Nuclear Regulatory Commission (NRC) inspection of these areas. The licensee's program was acceptably directed toward the protection of public health and safety and in compliance with NRC requirements.

### Organization and Staffing

- The organizational structure was consistent with technical specifications (TSs) Section 6.1 and Section 6.3.
- Health physics (HP) staffing appeared to be adequate for the current level of operations.

### Review and Audit Functions and Design Change Control

- The facility Safety Evaluation Committee (SEC) was meeting as required and reviewing the topics outlined in the TSs.
- The independent Safety Audit Committee was conducting annual audits as required.
- The design change control program being implemented at the facility satisfied NRC requirements.

### Procedures

- The procedure revision, control, and implementation program satisfied TSs requirement.

### Radiation Protection Program

- Surveys were being completed and documented as required.
- Postings met the regulatory requirements specified in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 19, "Notices, Instructions and Reports To Workers: Inspection and Investigations," and 10 CFR Part 20, "Standards for Protection against Radiation."
- Personnel dosimetry was being worn as required and recorded doses were within the NRC's regulatory limits.
- Radiation monitoring equipment was being maintained and calibrated annually.
- Radiation work permits (RWPs) 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 Monitoring Program

- Effluent monitoring satisfied NRC requirements and releases were within regulatory limits.
- Effluent monitoring equipment was being calibrated as required.

#### Emergency Preparedness

- The Emergency Plan (E-Plan) and Emergency Instruction Manual (or implementing procedures) were being audited and reviewed biennially as required.
- Drills and exercises were being held and follow-up critiques were conducted to identify corrective actions that could be taken as needed.
- Emergency preparedness training for staff and offsite personnel was being conducted as stipulated in the E-Plan.
- Adequate offsite emergency support was being provided by various agencies as required.

#### Transportation of Radioactive Materials

- The program for transportation of radioactive materials satisfied U.S. Department of Transportation (DOT) and NRC regulations.

## REPORT DETAILS

### Summary of Facility Status

The National Institute of Standards and Technology (NIST or the licensee) Center for Neutron Research (NCNR) continued to operate the 20 Megawatt test reactor, commonly known as the National Bureau of Standards Reactor (NBSR), in support of laboratory experiments and various types of research. During the inspection, the reactor was operating on the normal operations cycle.

#### 1. Organization and Staffing

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

To verify that the licensee was complying with the requirements specified in TS Section 6.1 and TS Section 6.3, the inspectors reviewed selected aspects of the following:

- Current NCNR organization
- Staffing of the NCNR HP group
- Management and staff responsibilities outlined in the TSs
- NBSR Administrative Rule 2.0, "Personnel Requirements"

##### b. Observations and Findings

The inspectors noted that the organizational structure of the Reactor Health Physics (RHP) group had not changed since the last inspection in the area of radiation protection (refer to NRC inspection report (IR) No. 50-184/2017-201). The group leader of the facility RHP group continued to report to the Director, NCNR as required by TS Section 6.3. The inspectors noted that this organization was as stipulated in TS Section 6.1.1 and as reflected in TS Figure 6.1

The inspectors also noted that the RHP group was fully staffed and composed of the group leader and 10 group members. Six of these individuals, including the group leader, were Health Physicists; the other five were HP technicians. The staffing level appeared to be adequate to support the current level of activity at the facility.

##### c. Conclusion

The organizational structure was consistent with TS Section 6.1 and TS Section 6.3 requirements. RHP group staffing appeared to be adequate for the current level of operations.

## 2. Review and Audit Functions and Design Change Control

### a. Inspection Scope (IP 69007)

The inspectors reviewed the following to ensure that the requirements of TS Section 6.2 and 10 CFR 50.59, "Changes, tests and experiments," were being implemented in accordance with NRC regulations:

- SEC meeting minutes for October 2016 through the present (Meeting Nos. 382 and 384) including subcommittee meeting minutes
- NBSR Procedure No. NBSR-0007-DOC-04, "Engineering Manual," Revision 4
- Reactor HP Procedure, HP-1.2, Revision A, "ALARA [as low as reasonably achievable] and Program Review"
- 2017 Reactor Audit in accordance with TS Section 6.2.4 (1-4), conducted by the Audit Subcommittee of the NCNR SEC, dated October 17, 2017
- 2016 Annual Report of the Safety Assessment Committee for calendar year (CY) 2016, dated March 2, 2017
- 2017 Annual Report of the Safety Assessment Committee for CY 2017, dated March 7, 2018
- Annual Review of the Reactor Radiation Protection Program, completed each year by the Group Leader, RHP group, for 2016 and 2017
- Quarterly Facility Audit Reports completed by RHP group staff members for 2016
- NBSR Engineering Change Notice (ECN) No. 1009, "Normal Air Monitor Upgrade"
- Operations Report No. 68, "NBSR Annual Report," for the period from January 1, 2015, through December 31, 2015, issued April 13, 2016
- Operations Report No. 69, "NBSR Annual Report," for the period from January 1, 2016, through December 31, 2016, issued April 25, 2017

### b. Observations and Findings

#### (1) Review and Audit Functions

Records of the meetings held by the SEC from October 2016 through the date of the inspection were reviewed. It was noted that the requirements stated in TS Sections 6.2.1 through 6.2.4 were being fulfilled. A charter had been approved for the SEC explaining the review and audit responsibilities of the committee. The meeting minutes showed that meetings were held at least semiannually as required by the SEC charter and reviews of proposed changes to the facility, experiments, and procedures were conducted by the SEC or a designated subcommittee. The minutes also indicated that the SEC provided appropriate guidance and direction for reactor operations and ensured suitable use and oversight of the reactor.

Other records reviewed by the inspectors showed that annual independent audits had been conducted by designated Safety Assessment Committees as required by TS Section 6.2.5. The

inspectors reviewed the last two audits and noted that the audit teams provided an independent review of the NCNR reactor operations and the performance of the SEC as outlined in the TSs. The audit teams also made various observations which the licensee had addressed or was in the process of addressing. The audits appeared to be beneficial to the licensee in addressing issues that could be improved.

It was noted that the facility radiation protection program was being reviewed annually as required by 10 CFR 20.1101(c). The inspectors also reviewed quarterly audits of the facility completed by HP staff members. The audits included observations of facility conditions, radiation and contamination surveys of various areas, and recommendations for improvements as required by procedure.

(2) Design Change Control

The inspectors met with the Quality Assurance Program Manager who managed the Engineering Change Request Program. The inspectors reviewed one change that had been proposed pertaining to radiation protection systems and/or equipment. The change was acceptably documented and was in the process of being reviewed in accordance with the TSs and the licensee's guidelines. It was noted that each of the ECNs included: (1) a design description, (2) safety considerations, and (3) a safety evaluation and conclusions. The design change program appeared to be implemented in accordance with NRC requirements.

c. Conclusion

The SEC was meeting as required and reviewing the topics outlined in the TSs. Annual audits were being conducted as required. The independent Safety Assessment Committee was conducting annual audits as required. The design change control program was being implemented by the licensee in accordance with NRC requirements.

**3. Procedures**

a. Inspection Scope (IP 69008)

The inspectors reviewed the following to ensure that the requirements of TS Section 6.4 regarding written procedures for radiation protection were being met:

- Procedure revision, review, and approval process
- SEC and subcommittee meeting minutes for October 2015 through the present
- NBSR Administrative Rule 5.0, "Procedures and Manuals," issued June 5, 2010
- Selected NCNR Health Physics Instructions (HPIs) for the RHP group (11 separate HPIs)

- NCNR Health Physics Procedure (HPP)-2.2, "Personnel Monitoring," dated February 13, 2017
- NCNR HPP-2.3, "Radiation Work Permits," dated February 8, 2017
- NCNR HPP-2.4, "Contamination Control," dated February 8, 2017
- NCNR HPP-2.7, "NCNR Experimenter Controls," dated January 1, 2016
- NCNR HPP-3.1, "Tritium Sample Analysis," dated January 2, 2016
- NCNR HPP-3.2, "Smear Sampling Analysis," dated January 2, 2016
- NCNR HPP-3.3, "Radiological Surveys," dated February 9, 2017

b. Observations and Findings

The inspectors noted that the RHP group at NCNR continued to use three types of procedures. One type consisted of high-level guidance documents developed by the NIST Office of Safety, Health, and Environment (OSHE), to implement the radiation safety program for the various NIST sites around the United States. Another type was the HPPs for the NBSR issued and used by the reactor operations group. These procedures applied only to the NCNR and the work conducted there. Nine of the 16 HPPs were revised and approved in 2016 and 2017. The third set of procedures consisted of instructions, the HPIs developed for the RHP group staff at the facility. The HPIs had been revised and reformatted using interdivisional procedures developed by the NIST Gaithersburg Radiation Safety Division (GRSD) as a basis. These instructions (11 total) had all been rewritten and approved in 2016.

Two ECNs were reviewed that related to the HPPs/HPIs. Both of the changes had undergone a 10 CFR 50.59 screening as part of the proposal process. The changes were documented in detail and included changes to procedures as required.

c. Conclusion

Licensee HP procedure changes were being reviewed and approved as required.

**4. Radiation Protection Program**

a. Inspection Scope (IP 69012)

The inspectors reviewed selected aspects of the following to verify compliance with 10 CFR Part 20, TS Section 3.7 and TS Section 4.7, and procedural requirements:

- Selected HPPs and HPIs
- ALARA policy as outlined in various HPPs
- Copies of RWPs for 2017 and to date in 2018
- Annual review of the NBSR Radiation Safety Program dated November 7, 2017
- Personnel dose summary for the NCNR for CY 2017 dated March 20, 2018
- Copies of Form 5 equivalent letters from NIST GRSD to those receiving in excess of 100 millirem (mrem) in CY 2016 (Forms for 2017 not yet available)

- Copies of completed radiation monitor calibration forms maintained in the NIST GRSD offices
- Selected HP survey records documented on “Duty HP Weekly Data Summary,” sheets for 2017 and to date in 2018
- Selected HP contamination survey records documented in the Smear Data Analysis Logbook for 2017 and to date in 2018
- Quarterly Facility Audit Reports, which included survey records, completed by RHP group staff members for 2017
- NIST Personnel Dosimetry Summary records for facility personnel for 2016 and the first three quarters of 2017 (the most recent records available)
- Calibration and periodic check records for portable radiation monitoring instruments documented on “NIST HP Survey Instrument Calibration,” forms
- Calibration records for area radiation monitors (ARMs) documented on the form “Confinement Area Radiation Monitors”
- Facility Annual Operations Reports for the past 2 years (Nos. 68 and 69)

The inspectors also observed the use of dosimetry and radiation monitoring equipment during tours of the facility. In addition, the inspectors accompanied the Duty HP during surveys in the C-200, C-100, basement, and guide hall areas.

b. Observations and Findings

(1) Surveys

The inspectors reviewed the results of selected surveys including: (1) daily general area radiation surveys of work areas, (2) weekly contamination surveys of controlled areas at the facility, (3) monthly general area radiation surveys of the interior uncontrolled areas and the area around the exterior of the NCNR, (4) radiation and contamination surveys conducted during the quarterly audits, and (5) contamination surveys of various items being removed from the controlled areas of the facility for 2017 and to date in 2018. The surveys had been completed as stipulated by procedure and the results were documented on the appropriate forms. Areas or items found to be contaminated were decontaminated and then surveyed again to verify there was no contamination present. The survey program appeared to be adequate.

One inspector accompanied the Duty HP during rounds of the facility to check on the radiation levels in the various areas and around experimental instruments in the facility. The Duty HP was knowledgeable and diligent in checking for any problems that might exist. The inspector also took radiation level readings in various areas. The readings noted by the inspector were similar to those found by the Duty HP and no anomalies were noted.

In addition, on various occasions during tours of the facility, the inspector noted that exit frisking was completed by facility personnel using hand and foot monitors and/or portal monitors. Frisking practices were found to be acceptable.

(2) Postings and Notices

The inspectors reviewed the postings at the entrances to, and inside, various controlled areas including the C-100 area, the basement area, the guide hall, and the "B" wing laboratories. 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 in the main hallways of the facility as well as near or above the racks where personnel dosimeters were stored.

(3) Dosimetry and Personnel Exposure

Through direct observation of licensee staff members, the inspectors determined that dosimetry was worn acceptably. An examination of the thermoluminescent dosimeter (TLD) results indicating radiation exposures at the facility for 2016 and the first three quarters of 2017 showed that occupational whole body doses, as well as doses to the public, were within 10 CFR Part 20 limits.

The facility also collected and analyzed urine samples for tritium bioassay purposes. The highest attributable doses in 2016 and 2017 from tritium were also within 10 CFR Part 20 limits.

The inspectors also verified that NRC Form 5 equivalent letters had been prepared for those facility personnel who had received a dose greater than 100 mrem during 2016. All those who should have received a letter had been issued the appropriate letter and form. The final dose data for 2017 had not yet been made available for NCNR personnel; thus, the letters/reports for the 2017 reporting period had not been issued to date.

(4) Calibration and Operation of Radiation Monitoring Equipment

The calibration records of ARMs inside confinement were reviewed. The ARMs were checked monthly and calibrated annually. The inspectors verified that the radiation monitoring instruments required in TS Section 3.7 and TS Section 4.7 were operable and were being tested and calibrated as required.

While reviewing the ARM calibration procedure and data for 2017, the inspectors noted that the ARM calibration procedure did not contain acceptance criteria for the surveillance. The requirement to perform an annual channel calibration is stated in TS 4.7.1(4). As defined in the NBSR TSs, a channel calibration is the adjustment of the channel such that its output corresponds with acceptable accuracy to known values of the parameter which the channel measures. During the review, the inspectors reviewed the 2014 ARM calibration procedure and data which did contain acceptance criteria for the surveillance. The acceptance criteria was removed from the procedure by the licensee at some point

prior to conducting the 2015 ARM calibration. The inspectors requested documentation for the revision to the ARM calibration procedure to understand the basis for the removal of the acceptance criteria. The licensee could not locate documentation on the removal of acceptance criteria during the inspection period. During the exit meeting, the inspectors informed the licensee that this issue will be tracked as an Unresolved Item (URI) and that it will be reviewed and dispositioned during a future inspection (URI 50-184/2018-201-01).

(5) Radiation Work Permit Program

The inspectors reviewed RWPs that had been written and used in 2017 and those issued to date in 2018. There were various "standing" RWPs that remained in effect for the entire year due to the repetitive nature of the work they covered such as maintenance work. Other RWPs were generated for specific work, such as fuel storage pool activities, instrument calibration work, and fuel handling. Many of the RWPs developed in 2017 were for work completed during the extended reactor shutdown from October to December. The work included projects such as shim arm drive repair, replacement of primary coolant water pumps, and reactor vessel inspection. 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 and approved as required. Completed packages of work performed under prior RWPs contained good information on the work accomplished and what precautions were effective. The maintenance of such work history data was a good practice and should prove very beneficial should those types of jobs be performed in the future

(6) Radiation Protection Program

The radiation protection program was established and described in various licensee documents including: (1) NIST Administrative Manual, Chapter 12, "Safety," Subchapter 12.03, "Ionizing Radiation Safety;" (2) HPPs for the NBSR; and (3) HPIs for the RHP group. 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. As noted above, the radiation protection program was reviewed each year as required by 10 CFR 20.1101(c).

The ALARA policy was also outlined in the aforementioned documents. The ALARA program provided guidance for keeping doses ALARA and was consistent with the requirements in 10 CFR Part 20. The ALARA program at the facility appeared to be effective.

The inspector also discussed the licensee's actions related to ALARA reviews for various work projects. As jobs or projects were developed, the separate groups involved would meet and discuss the scope of the work, the tools and materials needed, and the hazards involved. A member of the HP group was always in attendance to provide guidance

on the precautions and type of personal protective clothing required. The radiological aspects of the project reviews were documented through the issuance an RWP specific for the job delineating the controls and personal protective equipment needed. Jobs and projects were also discussed in safety meetings held by the NCNR Director and any problems were discussed and resolved. These meetings were generally held every month.

(7) Radiation Protection Training

The training program was set up so that all types of radiation workers, including NIST staff, as well as authorized beam users, pneumatic tube (rabbit) users, laboratory users, and radioisotope users visiting from other countries/organizations, received radiation protection training. The inspectors noted that individuals who required unescorted access to the reactor facility and/or who worked with radioactive material completed a course on radiation safety principles. As an alternative, if people could provide evidence that they had received such training at another facility, they would be given credit for the training at NIST. Refresher training was given every 2 years and completion was tied to a person's facility access authorization, which was also renewed biennially. Refresher training for reactor operators was presented as part of their biennial requalification program training.

The inspectors verified through records review, direct observation, and licensee interviews that facility employees, guest researchers, and emergency responders had received the required training at the required frequency. The training program was extensive and appeared to be adequate.

(8) Facility Tours

The inspectors observed conditions and/or activities in areas including the C-100 or the experimental floor area, the guide hall, and the "B" wing laboratories. The inspectors also toured other areas, including the C-200 area (which included the control room), portions of the basement area, including the pneumatic tube (rabbit) labs, and other selected areas including the spent fuel storage area and the process area. Control of radioactive material and access to radiation and high radiation areas was acceptable. As noted earlier, the postings and signs for these areas were appropriate.

c. Conclusion

The inspectors determined that the radiation protection and ALARA programs being implemented by the licensee satisfied regulatory requirements. Specifically, (1) surveys were being completed as required, (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 guest users. An URI

was opened to examine the licensee's review of the deletion of acceptance criteria from an ARM calibration procedure.

## 5. Environmental Monitoring 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 Section 3.7 and TS Section 4.7 were being conducted:

- Facility Operations Report No. 68
- GammaTracer data results for 2017
- Selected HP procedure and instructions
- TLD results for environmental stations for 2017
- Tritium and Argon-41 release data sheets for 2017
- NIST environmental sample analysis results for 2017
- Calibration records for the stack gas monitors documented on the form "Building Exhaust Stack Radiation Monitor," RM 4-1
- Calibration records for the fission product monitor documented on the form "Helium Sweep Gas Radiation Monitor," RM 3-2
- Calibration records for the secondary coolant monitor documented on the form "Secondary Cooling N16 Radiation Monitor," RM 3-1

### b. Observations and Findings

#### (1) Vegetation Sampling

Environmental vegetation samples were collected and prepared quarterly for analysis during April through September. Environmental soil samples were collected and prepared quarterly for analysis during October through March. Environmental water samples were collected and prepared quarterly for analysis throughout the year. The 2017 results of these various analyses were documented and the results showed no significant changes when compared with previous years.

NBSR procedure IP 8-2 Environmental Sampling, Revision 2 requires a health physicist to review all environmental sampling data and sign the data sheets. Contrary to this, the inspector noted that data sheets for grass samples (June 2017 and October 2017) and a water sample (September 2017) were not signed as required by procedure. The licensee was informed that the issue of ensuring that the environmental monitoring program results are properly documented and results reviewed in accordance with NBSR procedure would be considered by the NRC as an inspector followup item (IFI). The issue will be reviewed during a subsequent inspection (IFI 50-184/2018-201-02).

(2) Liquid and Airborne Releases

The inspectors reviewed the records documenting liquid and airborne releases to the environment for the past year. The inspectors determined that liquid and gaseous releases continued to be monitored as required by the TSs. The resultant amount of activity that was released was calculated as required by procedure and was acceptably documented. Separate calculations were performed by the licensee using the Environmental Protection Agency's COMPLY computer code. The inspector verified that the liquid effluent filter porosity was in accordance with NBSR effluent release procedures to meet the requirement of 10 CFR 20.2003(a)(1). The annual releases were determined to be within the annual dose constraints of 10 CFR 20.1101(d), 10 CFR 20.1301, "Dose limits for individual members of the public," and TS limits.

(3) Environmental Radiation Monitoring

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 10 CFR Part 20 regulatory limits. The inspectors selected a few locations to physical observe the locations of the TLD on the fence line. The inspector verified that the TLDs were adequately secured to the fence and acceptable weather protection was employed. The inspector also reviewed the calibration of the TLD reader used for reading the environmental TLDs.

The fence line of the NIST campus was monitored by GammaTracer detectors at 16 different locations. Review of the data recorded by the tracers showed no gamma exposure above background. All locations were below 50 mrem/year and 2 mrem/hour. The inspectors selected a few locations to physical observe the locations of the GammaTracer on the fence line. The inspector verified that the GammaTracer were adequately secured to the fence and acceptable weather protection was employed.

(4) Calibration of Monitors

The inspectors reviewed the calibration records of the stack gas, fission product, secondary coolant, and tritium monitoring systems. The systems were being calibrated annually according to procedures as required.

c. Conclusion

Effluent monitoring satisfied license and regulatory requirements and releases were within the TSs and regulatory limits. Effluent monitoring equipment was being calibrated as required. An IFI (50-184/2018-201-02) was opened to review the NBSR's requirements for documenting and reviewing environmental monitoring results.

## 6. Emergency Preparedness

### a. Inspection Scope (IP 69011)

In order to verify compliance with the NBSR E-Plan dated December 2008 (as amended July 1, 2017), the inspector reviewed selected aspects of:

- Emergency preparedness training records for 2016 and 2017
- Selected NIST reactor area inspection log sheets for the past 12 months
- Assistance provided by support groups (i.e., NIST Fire Department (FD), NIST Police Department (PD), and law enforcement officials from Montgomery County, Maryland)
- Records documenting annual evacuation drills and the latest biennial emergency exercise
- Documentation of inventories of emergency response supplies, equipment, and instrumentation
- NBSR EI Manual (containing the E-Plan implementing procedures)
- NBSR EI Procedure 0.2, "Emergency Organization Phone Numbers"
- NBSR EI Procedure 0.3, "Emergency Classification and Criteria"

### b. Observations and Findings

The E-Plan in use at the reactor and support facilities was the same as the latest version submitted to the NRC. The E-Plan was being audited and reviewed biennially as required. It was noted that operators were required to review the emergency procedures and be cognizant of their responsibilities in case of an emergency. The inspector verified that operators were reviewing the emergency procedures and understood their duties in response to emergency conditions.

Records showed that radio communications with the NIST PD were checked weekly. Other communications capabilities were checked periodically and phone numbers for the various support organizations were verified annually, as stipulated in the TSs. The inspector conducted an onsite tour of the licensee's Emergency Control Station, which was located in the basement, and determined that communication equipment, radiological response supplies, and radiation detection equipment were available as stipulated.

The most recent biennial emergency exercise was conducted February 1, 2018. The exercise had originally been scheduled for October 12, 2017, but had to be postponed. A critique was held following the drill to discuss those things that were done well and how to address the problems that occurred. The most recent drill was a tabletop drill conducted October 19, 2016. The drill included a simulated active shooter and involved many offsite support personnel.

Emergency preparedness and response training for NBSR personnel was being completed as required. This was accomplished through the initial training for incoming personnel and the refresher training provided for all NCNR employees. The licensee's HP group conducted biennial emergency response training for the NIST FD and PD personnel, as well. The inspector verified that the last training for these groups had been conducted during June and July 2016.

The inspector reviewed the results of selected emergency equipment inventories required by Section 8.5 of the E-Plan. It was noted that the emergency equipment in the lockers located in the A-wing front lobby/break area, in basement level 2, and in the C-200 area had been inventoried monthly. The lockers were being inventoried more frequently than the TSs required (an annual inventory was required).

The inspector verified that the memorandum of understanding between Montgomery County and NIST concerning firefighting assistance, dated October 16, 2007, remained in effect.

c. Conclusion

The emergency preparedness program was being conducted in accordance with the E-Plan.

**7. Transportation of Radioactive Material**

a. Inspection Scope (IP 86740)

The inspectors reviewed the following documents to determine compliance with NRC and DOT regulations governing the transport of radioactive material as specified in 10 CFR Part 20 and 10 CFR Part 71, "Packaging and Transportation of Radioactive Material," and 49 CFR Parts 171–178:

- Licenses of shipment recipients
- Material transfer request forms for 2017
- Radioactive material shipment records for 2017
- Training records for those designated as "shippers"

b. Observations and Findings

The inspectors reviewed records of shipments of radioactive material made during 2017. Through this review and discussions with licensee personnel, the inspectors 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 involved were calculated and dose rates measured as required. The records also indicated that the shipping containers were appropriate and had been labeled if required. Appropriate surveys were completed on radioactive material that was received from offsite. The radioactive material shipping records reviewed by the inspectors had been completed and maintained as required by NRC and DOT regulations.

The inspectors verified that the licensee was maintaining copies of consignees' radioactive material possession licenses as required. If the current copy of the license was not available at NCNR, the licensee was aware that they were required to contact the consignee and obtain a current copy before a shipment could be made.

The licensee also maintained on file the certificates of compliance pertaining to those shipping containers that were used to ship radioactive material as required. In addition, the inspectors verified that the licensee staff members assigned to complete and/or review the shipping paperwork were trained and that refresher training was being completed biennially as required by the International Air Transport Association. It was noted that DOT only requires shippers to take refresher training triennially.

c. Conclusion

The program for transportation of radioactive materials satisfied DOT and NRC regulations.

**8. Follow-up on Previously Identified Issues**

a. Inspection Scope (IP 92701)

The inspectors reviewed the actions taken by the licensee in response to a previously identified IFI 50-184/2015-201-01.

b. Observations and Findings

During an inspection in 2015, it was noted that the organizational structure had changed since the last inspection in the area of radiation protection (refer to NRC IR No. 50-184/2014-201). As noted in the 2014-201 IR, the group leader of the NIST reactor HPs group previously reported to the NIST campus Director of Radiation Protection. Because of an organizational change at NIST, the reactor HP group leader was reassigned and directed to report to the Director, NIST NCNR. The inspector noted that this change was not clearly reflected in the current TSs. The licensee indicated that they were preparing an amendment request to obtain NRC approval to modify the TSs to more accurately reflect the revised organizational structure. The licensee was informed that the submission of an amendment request for a change to the TSs would be followed by the NRC as an IFI.

During this inspection the inspectors discussed this issue with the licensee. It was noted that the licensee had submitted a request for a change to the facility license to revise the TSs to allow low power testing during or following fuel reloading. The request also included a page which reflected the current organizational structure that existed at the facility. This change request was subsequently reviewed and approved by the NRC. This was documented in a license amendment, Amendment No. 11 to the renewed facility operating license, issued December 15, 2017. This issue is closed.

c. Conclusions

One IFI was discussed and is considered closed.

## **9. Exit Interview**

The inspection scope and results were summarized on March 29, 2018, with members of licensee management. The inspectors described the areas inspected and discussed the preliminary inspection findings. The licensee acknowledged the results of the inspection and did not identify as proprietary any of the material provided to or reviewed by the inspectors during the inspection. Also, the licensee indicated that they would further review the issue of removing the acceptance criteria from the ARM calibration procedure.

## **PARTIAL LIST OF PERSONS CONTACTED**

### Licensee

P. Brand	Chief, Reactor Engineering and Chair, Hazards Review Committee
D. Brown	Senior Reactor Health Physicist and Leader, Reactor HP Group
K. Consani	Reactor Health Physicist
R. Dimeo	Director, NIST Center for Neutron Research
D. Hughes	Chief, Reactor Operations and Chair, Procedures Review Subcommittee
S. MacDavid	Instrumentation and Controls Supervisor, Reactor Engineering Group
F. Scarano	Reactor Health Physics Technician
R. Strader	Quality Assurance Program Manager
J. Tracy	Reactor Health Physicist

### Other Personnel

J. Shupe	Certified Health Physicist, Radiation Facilities Group, Gaithersburg Radiation Safety Division, OSHE
S. Yu	Physical Science Technician, Radiation Facilities Group, Gaithersburg Radiation Safety Division, OSHE

## **INSPECTION PROCEDURES USED**

IP 69004:	Class 1 Research and Test Reactor Effluent and Environmental Monitoring
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 69008:	Class 1 Research and Test Reactor Procedures
IP 69011:	Class I Research and Test Reactors Emergency Preparedness
IP 69012:	Class 1 Research and Test Reactor Radiation Protection
IP 86740:	Inspection of Transportation Activities
IP 92701:	Follow-up on Previously Identified Items

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

### Opened

50-184/2018-201-01	URI	Follow-up on the licensee's review of removing acceptance criteria from the ARM calibration procedure.
50-184/2018-201-02	IFI	Follow-up on the licensee's environmental monitoring program requirements for documenting and reviewing the results.

### Closed

50-184/2015-201-01	IFI	Follow-up on the licensee's actions to request approval to modify the TSs to more accurately reflect the current organizational structure with the facility HP group leader reporting to the Director of the NCNR.
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## LIST OF ACRONYMS USED

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
ALARA	As Low As Reasonably Achievable
ARM	Area Radiation Monitor
CY	Calendar Year
DOT	U.S. Department of Transportation
ECN	Engineering Change Notice
E-Plan	Emergency Plan
FD	Fire Department
GRSD	Gaithersburg Radiation Safety Division
HP	Health Physics
HPI	Health Physics Instruction
HPP	Health Physics Procedure
IFI	Inspector Followup Item
IP	Inspection Procedure
IR	Inspection Report
Mrem	Millirem
NBSR	National Bureau of Standards Reactor
NCNR	NIST Center for Neutron Research
NIST	National Institute of Standards and Technology
NRC	U.S. Nuclear Regulatory Commission
PD	Police Department
RHP	Reactor Health Physics
RWP	Radiation Work Permit
SEC	Safety Evaluation Committee
OSHE	Office of Safety, Health, and Environment
TLD	Thermoluminescent Dosimeter
TS	Technical Specification
URI	Unresolved Item