

July 6, 2000

Dr. J. M. Rowe, Director  
Center for Neutron Research  
National Institute of Standards and Technology  
U.S. Department of Commerce  
Gaithersburg, MD 20899

SUBJECT: NRC ROUTINE, ANNOUNCED INSPECTION REPORT NO. 50-184/00202

Dear Dr. Rowe:

This letter refers to the inspection conducted from April 4 - 7, May 10, May 12, and June 20 - 22, 2000, at the National Bureau of Standards Reactor. 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 concern or noncompliance to NRC requirements was identified. No response to this letter is required.

In accordance with 10 CFR 2.790 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 <http://www.nrc.gov/NRC/ADAMS/index.html> (the Public Electronic Reading Room).

Should you have any questions concerning this inspection, please contact Mr. Marvin Mendonca at 301-415-1128.

Sincerely,

*/RA/*

Ledyard B. Marsh, Chief  
Events Assessment, Generic Communications  
and Non-Power Reactors Branch  
Division of Regulatory Improvement Programs  
Office of Nuclear Reactor Regulation

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

Enclosure: NRC Inspection Report No.50-184/00202

cc w/enclosure: Please see next page

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U. S. NUCLEAR REGULATORY COMMISSION

Docket No: 50-184

License No.: TR-5

Report No.: 50-184/00202

Licensee: National Institute of Standards and Technology (NIST)

Facility: National Bureau of Standards Reactor

Location: Gaithersburg, Maryland

Dates: April 4 - 7, May 10, May 12, and June 20 - 22, 2000,

Inspectors: Marvin Mendonca  
Takafumi Ikeda

Approved by: Ledyard B. Marsh, Director  
Events Assessment, Generic Communications and  
Non-Power Reactors Branch  
Division of Regulatory Improvement Programs  
Office of Nuclear Reactor Regulation

## EXECUTIVE SUMMARY

This routine, announced inspection included onsite review of selected aspects since the last inspection of the areas as summarized below.

The licensee's programs were acceptably directed toward the protection of public health and safety, and in compliance with NRC requirements.

### ORGANIZATIONAL STRUCTURE AND FUNCTIONS

The organizational structure and functions were consistent with Technical Specification requirements. The licensee staffing was established to provide for succession planning.

### OPERATIONS

The operations program satisfied Technical Specification requirements. Operators and the Operations organization were extremely attentive to reactor safety.

### DESIGN CONTROL

The design change program satisfied NRC requirements.

### REVIEW AND AUDIT

The review and audit program met Technical Specification requirements. Additional licensee initiatives showed the licensee's commitment to improvements in all areas.

### RADIATION PROTECTION

The radiation protection program satisfied NRC requirements. Additionally, supplemental monitoring and tracking provided additional assurance that NIST would maintain safe radiation protection conditions.

### ENVIRONMENTAL PROTECTION

The environmental protection program satisfied NRC requirements.

### OPERATOR REQUALIFICATION

The licensee conducted operator re-qualification as required by the Re-qualification Program.

### MAINTENANCE

The maintenance program satisfied NRC requirements.

### SURVEILLANCE

The surveillance program met Technical Specification requirements.

## FUEL HANDLING

The fuel handling program satisfied licensee Technical Specification and procedural requirements.

## EXPERIMENTS

The program for experiments satisfied Technical Specification and procedural requirements.

## PROCEDURES

The procedural control and implementation program satisfied Technical Specification requirements.

## EMERGENCY PREPAREDNESS

NIST conducted the emergency preparedness program in accordance with the Emergency Plan.

## TRANSPORTATION

The program for transportation of radioactive materials satisfied NRC requirements.

## Report Details

### Summary of Plant Status

During the inspection the licensee operated the reactor continuously, except during shutdowns for maintenance and refueling, to support experimental research.

#### 1. ORGANIZATIONAL STRUCTURE AND FUNCTIONS

##### a. Scope (39745)

The inspectors reviewed selected aspects of:

- organization and staffing
- qualifications
- management responsibilities
- administrative controls

##### b. Observations and Findings

The organizational structure and staffing had not changed since the last inspection. The organizational structure and staffing at the facility were as required by Technical Specification. The inspectors noted increased operator and management staffing to provide for succession and transition on potential retirements. Qualifications of the staff met Technical Specification requirements. Review of the annual Operations Report dated March 24, 2000, verified that the licensee administered management responsibilities as required by Technical Specifications for review of shutdowns, maintenance, changes, effluents, and exposures.

##### c. Conclusions

The organizational structure and functions were consistent with Technical Specification requirements. The licensee staffing has been established to provide for succession planning.

#### 2. OPERATIONS

##### a. Scope (39745)

The inspectors reviewed selected aspects of:

- operational logs and records
- staffing for operations
- selected operational, startup, or shutdown activities

##### b. Observations and Findings

The operating logs were clear and provided an indication of operational activities. The inspectors verified documentation of an August 20, 1999, reactor scram, and evaluation through the reactor restart checklist Operating Instruction 1.1b. The logs and observations showed that shift staffing exceeded Technical Specification requirements.

Records also showed that operational conditions and parameters were consistent with license and Technical Specification requirements, e.g., power and flow. Observation of operator rounds and control room console logs in accordance with "Reactor Area Inspection Log" further confirmed that these conditions and requirements were satisfied. The operators' response to low D<sub>2</sub>O level was prompt to correct the annunciator response. Operators exhibited sound communication and coordination during reactor evolutions. The Operations groups command and control function also ensured they promptly monitored and addressed reactor conditions. Conduct of pre-start checks and reactor startup were as required by procedures and Technical Specifications.

c. Conclusions

The operations program satisfied Technical Specification requirements. Operators and the Operations organization were extremely attentive to reactor safety.

3. DESIGN CONTROL

a. Scope (40745)

The inspectors reviewed selected aspects of:

- facility design changes and records
- facility configuration

b. Observations and Findings

The inspectors reviewed Engineering Change Notice No. 453 on the replacement of Neutron Guide Isolation Valves. The licensee approved this change in confinement isolation valves on March 3, 1999, and installation, procedures and testing were completed on June 25, 1999. They acceptably reviewed the changes in accordance with 10 CFR 50.59 and applicable administrative controls. The change was not an unreviewed safety question nor did it require a change to the Technical Specifications.

c. Conclusions

The design change program satisfied NRC requirements.

4. REVIEW AND AUDIT

a. Scope (40745)

The inspectors reviewed selected aspects of:

- safety review records
- audit records
- responses to safety reviews and audits
- review and audit personnel qualifications

b. Observations and Findings

Records of the Safety Evaluation Committee (SEC) meetings on October 8, November 11, and April 8, 1999, showed that they conducted the safety reviews at the Technical Specification required frequency. Topics of these reviews were also consistent with Technical Specification requirements to provide guidance, direction, and oversight that ensured acceptable use of the reactor.

The audit records dated November 11, 1999, for the Safety Audit Committee showed that audits had been completed. These audits were in those areas outlined in the Technical Specifications and at the required frequency.

The inspectors noted that the licensee acceptably detailed the safety reviews and audits and that the licensee responded and took corrective actions as needed.

The safety review and audit personnel qualifications and numbers satisfied Technical Specification requirements.

The inspectors noted a practice on experimental review process that used expert review before consideration by the SEC. This process provided for a more effective and efficient review (similar to Engineering Change Notice process). Additionally, the inspectors noted that a panel of the Board on Assessment of NIST Programs existed which is appointed by the National Academy of Science. This panel provided reviews for fiscal years 1997, 1998, and 1999, that included reactor programs. These programs are licensee initiatives that provide additional assurance that the facility is safely operated.

c. Conclusions

The review and audit program met Technical Specification requirements. Additional licensee initiatives showed the licensee's commitment to improvements in all areas.

5. RADIATION PROTECTION

a. Scope (83743)

The inspectors reviewed selected aspects of:

- the Radiation Protection Program
- radiological signs and posting
- routine surveys and monitoring
- dosimetry records
- maintenance and calibration of radiation monitoring equipment
- As Low As Reasonably Achievable (ALARA) reviews

b. Observations and Findings

The radiation protection program had not changed since the last inspection. As documented in a memorandum dated November 18, 1999, the licensee reviewed the radiation protection program at least annually in accordance with 10 CFR 20.1101(c). The review included applicable areas and changes to programs to update procedures for regulatory changes. The licensee showed that the air emissions or radioactive material to the environment met the 10 millirem constraint specified in 10 CFR 20.1101(d).

NRC Form 3, "Notice to Employees," was posted in accordance with 10 CFR 19.11. Caution signs, postings and controls to radiation areas were as required in 10 CFR 20, Subpart J.

Observed licensee personnel followed indicated precautions on entering radiation areas. Use of dosimeters and exit frisking practices were in accordance with radiation protection requirements.

The licensee used a National Voluntary Laboratory Accreditation Program-accredited vendor to process dosimetry. Radiological exposure records showed that occupational doses and doses to the public were within 10 CFR Part 20 limitations. Training records showed that selected personnel were acceptably trained in radiation protection practices and access was controlled.

Radiation monitoring and survey activities exceeded those required. The licensee conducted supplementary measurements and tracking of radiation levels. Equipment used for these activities were maintained, calibrated, and used acceptably.

ALARA reviews were acceptably done. The inspectors noted that health physics and reactor operations work together to reduce exposures, e.g., on experimental facilities in the cold neutron guide hall. Health physics monitored total and area doses and presented results to the Safety Evaluation Committee. ALARA principles were considered at all phases observed by the inspectors (e.g., review of the Safety Evaluation Committee minutes on personnel stay times in radiation areas).

The licensee did not require a respiratory protection program. If a planned special exposure program were needed, the licensee said they would develop applicable procedures.

c. Conclusions

The radiation protection program satisfied NRC requirements. Additionally, supplemental monitoring and tracking provided additional assurance that safe radiation protection conditions would be maintained.

6. ENVIRONMENTAL PROTECTION

a. Scope (69004)

The inspectors reviewed selected aspects of:

- the environmental monitoring program
- annual reports
- release records
- counting and analysis program

b. Observations and Findings

Records showed that environmental samples were collected, prepared, and analyzed consistently with Health Physics Instruction (HPI) 8-2, Environmental Sampling. Laboratory equipment was maintained and calibrated in accordance with HPI 7-8, Calibration of Gamma Spectroscopy System. The inspectors found the provisions of HPI 8-5 on Environmental Thermoluminescent Dosimetry also acceptably implemented. The inspector observed monitoring of an environmental water sample. The counting procedure was consistent with guidance and records tracked the sample to ensure a proper accounting. Data showed no measurable doses above background. This was acceptably documented in the Annual Reports. Observation of the facility found no new potential release paths.

The program for the monitoring and storage of radioactive liquid, gases, and solids for release or disposal was consistent with applicable licensee procedures. Radioactive material was monitored and released when below acceptable limits or was acceptably transferred to the broad-scope license for disposition. The principles of As Low As Reasonably Achievable were acceptably carried out to reduce radioactive releases. Monitoring equipment was acceptably maintained and calibrated. Records were current and acceptably maintained.

c. Conclusions

The environmental protection program satisfied NRC requirements.

7. OPERATOR REQUALIFICATION

a. Scope (69003)

The inspectors reviewed selected aspects of:

- the requalification Program
- operator licenses
- operator training records
- operator physical examination records
- operator examination records
- operator active duty status

b. Observations and Findings

The Requalification Program was maintained up-to-date. Selected operator licenses were also current. Records showed that training of these operators were consistent with the Requalification Program requirements. Physical examinations of these operators were conducted as required. Records showed that written and operating examinations of the operators were acceptably done. Logs showed that operators maintained active duty status as required.

c. Conclusions

Operator requalification was conducted as required by the Requalification Program.

8. MAINTENANCE

a. Scope (39745)

The inspectors reviewed selected aspects of:

- maintenance procedures
- equipment maintenance records

b. Observations and Findings

The inspectors observed selected portions of a safety rod assembly. The work was conducted in accordance with approved drawing E-40-033 dated March 18, 1997, and instructions dated January 4, 2000. Further, this maintenance activity was consistent with the requirements of 10 CFR 50.59.

An Instrument Service Report showed that corrective maintenance activities on shim blade #3 clutch was addressed as required by procedure.

Records showed that routine maintenance activities were conducted at the required frequency and in accordance with the Technical Specifications, applicable procedure or equipment manual.

Maintenance activities ensured that equipment remained consistent with the Safety Analysis Report and Technical Specification requirements.

c. Conclusions

The maintenance program satisfied NRC requirements.

9. SURVEILLANCE

a. Scope (61745)

The inspectors reviewed selected aspects of:

- surveillance and calibration procedures,
- surveillance, calibration and test data sheets and records

b. Observations and Findings

Surveillance of the rate of movement and scram time of each safety rod were completed on schedule and following licensee procedures. All the recorded results were within the Technical Specifications Limiting Conditions of Operation and procedurally prescribed parameters. The records and logs for this surveillance were complete and were maintained as required.

c. Conclusions

The surveillance program satisfied Technical Specification requirements.

10. FUEL HANDLING

a. Scope (60745)

The inspectors reviewed selected aspects of:

- fuel handling procedures
- fuel handling equipment and instrumentation
- fuel handling and examination records

b. Observations and Findings

Operating Instruction 6.1 "Fueling and Defueling Procedures" provided a prescribed method to move and handle fuel consistent with the provision of the Technical Specifications and the licensee safety analyses. Fuel movement and fuel examination records and observations showed that the fuel was moved and tested as required. Records and observations also showed that fuel handling and monitoring equipment was operable. Personnel were knowledgeable of the procedural and equipment requirements for criticality control and assurance of fuel integrity. Radiological precautions were also met following applicable Radiation Work Permits.

c. Conclusions

The fuel handling program satisfied licensee Technical Specification and procedural requirements.

11. EXPERIMENTS

a. Scope (69005)

The inspectors reviewed selected aspects of:

- experimental program requirements
- procedures
- logs and records
- experimental administrative controls and precautions

b. Observations and Findings

The irradiations at the facility were generally routine procedures that had been in place for several years. The inspectors reviewed one changed irradiation request 2S416 dated February 5, 1999, for irradiations of material in a higher flux location. The changed irradiation request addressed the change in conditions acceptably with restrictions for specific irradiation conditions and radiation protection precautions. The experiment was completed with the cognizance of the Reactor Supervisor and a Senior Reactor Operator and according to Technical Specification requirements. The experiment was documented in appropriate experimental logs, data sheets, and operator logs. The inspectors discussed the radiation protection features of the Vertical Prompt Gamma Facility with an experimenter. The experimenter explained engineering and radiation protection controls. The inspectors also observed development of a new experimental instrument. This development included testing using light instead of neutrons to reduce exposures.

c. Conclusions

The program for experiments satisfied Technical Specification and procedural requirements.

12. PROCEDURES

a. Scope (42745)

The inspectors reviewed selected aspects of:

- administrative controls
- records for changes and temporary changes
- procedural implementation
- logs and records

b. Observations and Findings

Administrative controls of changes and temporary changes to the procedure on "Reloading Plan after Installation of New Shims," and associated review and approval processes were as required by Administrative Rule 15.0. Training of personnel on the procedure and the changes was acceptable. Personnel conducted activities following

applicable procedures. Procedures for potential malfunctions (i.e., fire, contaminated injured individual, and fuel failure annunciation) were current.

c. Conclusions

The procedural control and implementation program satisfied Technical Specification requirements.

13. EMERGENCY PREPAREDNESS

a. Scope (82745)

The inspectors reviewed selected aspects of:

- the Emergency Plan
- implementing procedures
- emergency response facilities, supplies, equipment, and instrumentation
- training records
- offsite support
- emergency drills and exercises

b. Observations and Findings

The Emergency Plan (E-Plan) in use at the reactor and emergency facilities was the same as the version most recently approved by the NRC. The E-Plan was audited and reviewed as required. Implementing procedures were reviewed and revised as needed to employ the E-Plan effectively. The inspectors verified that operators understood their duties in response to emergency conditions. Facilities, supplies, instrumentation, and equipment were being maintained, controlled, and inventoried as required in the Emergency Control Station by the E-Plan.

According to the licensee, the Bethesda Naval Medical Hospital said that the current agreement was acceptable.

Records showed that communications capabilities were checked on October 1, 1999, as stipulated in the E-Plan. Emergency drill, evacuation, had been conducted on October 27, 1999, as required by the E-Plan. Emergency exercise was conducted in December 1999. Critiques were held following the exercise to discuss the strengths and weaknesses identified during the exercise and to develop possible solutions to any problems identified. The results of these critiques were documented and filed. Emergency preparedness and response training was being completed as required. Training for NIST fire fighting and police personnel was conducted although not required by the E-Plan.

c. Conclusions

The emergency preparedness program was conducted in accordance with the Emergency Plan.

14. TRANSPORTATION

a. Scope (86740)

The inspectors reviewed selected aspects of:

- radioactive materials shipping procedures
- radioactive materials transportation and transfer records

b. Observations and Findings

Records showed that the radioactive material for disposal was transferred to the broad scope license following licensee requirements. This program for radioactive material transport is consistent with license requirements.

The transport of radiological samples was also reviewed. Records showed that the radioisotope type and quantities were calculated and dose rates were measured. These records also showed that transportation of the radioactive materials were in accordance with DOT and NRC requirements.

c. Conclusions

The program for transportation of radioactive materials satisfied NRC requirements.

15. EXIT INTERVIEW

The inspectors presented the inspection results to members of the licensee management on April 7, and June 22, 2000. The licensee acknowledged the findings presented.

## PARTIAL LIST OF PERSONS CONTACTED

Licensee

Richard Beasley, Reactor Supervisor  
Daniel Flynn, Senior Reactor Operator  
Liz Mackey, Research Chemist  
Mike McDonald, Senior Reactor Operator  
Tom Myers, Reactor Supervisor  
Nate Pickford, Senior Reactor Supervisor and Nuclear Engineer  
Henry J. Prask, Chair Safety Evaluation Committee  
Tawfik Raby, Chief Reactor Operations and Engineering  
Michael Rowe, Director NIST Center for Neutron Research  
Lester A. Slaback, Supervisory Health Physicists  
James F. Torrence, Deputy Chief and Nuclear Engineer  
Seymour H. Weiss, Deputy Director NIST Center for Neutron Research  
Dan Wilkison, Reactor Supervisor.

## INSPECTION PROCEDURES USED

IP 39745 Class I Non-Power Reactors Organization and Operations and Maintenance Activities  
IP 40745 Class I Non-Power Reactor Review and Audit and Design Change Functions  
IP 42745 Class I Non-Power Reactor Procedures  
IP 60745 Class I Non-Power Reactor Fuel Movement  
IP 61745 Class I Non-Power Reactor Surveillance  
IP 69003 Class I Non-Power Reactor Operator Licenses, Requalification, and Medical Activities  
IP 69004 Class I Non-Power Reactor Effluent and Environmental Monitoring  
IP 69005 Class I Non-Power Reactor Experiments  
IP 82745 Class I Non-Power Reactor Emergency Preparedness  
IP 83743 Class I Non-Power Reactors Radiation Protection  
IP 86740 Inspection of Transportation Activities

## LIST OF ACRONYMS USED

ALARA as low as reasonably achievable  
HPI Health Physics Instruction  
NIST National Institute of Standards and Technology  
SEC Safety Evaluation Committee