

U. S. NUCLEAR REGULATORY COMMISSION  
REGION I

Report No.: 50-184/94-01  
Docket No.: 50-184  
License No.: TR-5  
Licensee: U. S. Department of Commerce  
National Institute of Standards and Technology  
Gaithersburg, Maryland 20899  
Facility Name: National Bureau of Standards Reactor (NBSR)  
Inspection At: Gaithersburg, Maryland  
Inspection Conducted: February 17 and 18, 1994

Inspector:

Thomas Dragoun  
Thomas Dragoun, Project Scientist, Effluents  
Radiation Protection Section (ERPS), Facilities  
Radiological Safety and Safeguards Branch (FRSSB)

3/30/94  
date

Approved By:

Judith A. Joustra  
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Division of Radiation Safety and Safeguards

3/30/94  
date

**Areas Reviewed:** Radiation protection procedures, radiological controls, personnel protective clothing, dosimetry, exit surveys, training, radiation surveys, and preparations for an upcoming extended reactor outage, including as low as reasonably achievable (ALARA).

**Results:** No safety concerns or violations of NRC requirements were observed. Preparations for the outage demonstrated excellent radiation protection preplanning. Also noted was the planned incorporation of improved equipment accessibility to enhance ALARA performance.

## Details

### 1.0 Individuals Contacted

#### 1.1 Licensee Personnel

- \*T. Raby, Chief, Reactor Operations
- \*J. Rowe, Chief, Reactor Radiation Division
- \*L. Slaback, Supervisory Health Physicist
- J. Torrence, Deputy Chief, Reactor Operations

#### 1.2 NRC Personnel

- \*S. PettiJohn, Non-Reactor Assessment Staff, AEGD
- \*Taruniyati Handayani, Badan Tenaga Atom Nasional (Indonesian National Atomic Energy Agency)

\*Attended the Exit Interview on February 18, 1994. Other personnel were contacted or interviewed during the inspection.

### 2.0 Radiation Protection Procedures

Procedures for implementing the radiation protection program are required by Technical Specification (TS) 7.4 and the revised 10 CFR 20.1101. The inspector reviewed the licensee procedures contained in the manual, "Health Physics Procedures for the NBSR", issued on January 1, 1994. The procedures were clear, comprehensive, and reflected the requirements in the new Part 20 that was effective January 1, 1994. The inspector noted that licensee procedure H.P.4.2 used the interpretation of "significant portion of the body" as an area of 900 cm<sup>2</sup> when dealing with beams of radiation. The licensee stated that the definition in ANSI-15.11 will be used until written guidance is issued by the NRC concerning beams. Within the scope of this review, the inspector concluded that the licensee's policies and procedures were appropriate.

### 3.0 Radiological Controls

Radiological controls were reviewed during a tour of the Guide Hall, B-Wing Labs, Hot Labs, Warm Labs, Reactor Building, Spent Fuel Pool, and radioactive material storage areas. Forms NRC-3 were conspicuously posted as required. Radiation areas, high radiation areas, and contaminated areas were posted as required. The inspector confirmed the general radiation levels using a calibrated portable ion-chamber survey meter provided by the licensee. No airborne activity or very high radiation areas were noted. The high radiation areas associated with the neutron beams in the Guide Hall were equipped with infrared sensors to detect human entry and activate a visual alarm signal. This method of control is an option provided by 10 CFR 20.1601. The inspector

noted a few drums of radioactive material inside a roped-off, contaminated area on the operating floor inside the reactor building that were labeled but no supplemental information was provided such as radionuclide or amount of activity. The licensee stated that the health physics staff would review the labeling of radioactive material to ensure that adequate information was provided to personnel who are using or handling the material. This matter will be reviewed in a future inspection.

#### **4.0 Personnel Protective Clothing**

The protective clothing in use generally consisted of rubber gloves, lab coats, and plastic shoe covers. This was appropriate to the potential level of radioactive material contamination. Additional types of clothing were stored in cabinets for use in the spent fuel pool or equipment room areas where contamination levels could be higher. The clothing is laundered on site and surveyed prior to re-issue. Within the scope of this review, no safety concerns were identified.

#### **5.0 Personnel Dosimeters**

Thermoluminescent dosimeters are provided by the Navy, are NVLAP accredited, and provide the dosimetry of record. The computerized recordkeeping system is capable of summing external and internal exposures as required by 10 CFR 20.1202. This capability may be exercised due to the presence of tritium in the reactor building in sufficient quantities to result in recordable internal exposures. A review of records indicated that all exposures were below the revised 10 CFR 20.1201 limits. Within the scope of this review, no safety concerns were identified.

#### **6.0 Exit Survey**

Personnel are frisked for surface contamination by automatic portal monitors at the major exits from the controlled areas. No radioactive material is permitted outside the controlled areas. For example, researchers are not allowed to bring samples to office areas. The friskers will also detect small quantities of radioactive material. Within the scope of this review, the exit surveys were determined to be adequate.

#### **7.0 Personnel Training**

The licensee has implemented a computer-based (Windows environment), interactive training program that was developed in-house. All personnel with unescorted access to the controlled areas are required to complete this program. The length of the self-paced training lasts from one to four hours, depending on the student. The licensee stated that,

with the number of foreign-language personnel using the facility, this type of training has proven to be more effective than spoken presentations. The inspector selected random topics required by 10 CFR 19.12 and the licensee demonstrated the program content related to these topics. No deficiencies were noted. The inspector suggested a minor clarification to a topic and the licensee demonstrated the ease with which the staff can modify the program content. Within the scope of this review, the licensee's training program was determined to be innovative and effective.

### **8.0 Radiation Surveys, Sampling, or Monitoring**

The inspector reviewed the conduct of the routine radiation surveys with the Supervisory HP and reviewed selected survey data. Dose rate and surface contamination surveys are conducted weekly. Airborne activity is monitored by Continuous Air Monitors (CAM) placed in several locations inside the controlled area. The CAM will detect gaseous, particulate, and airborne iodine radioactivity and provide a audible and visual local alarm. The HP technicians (techs) who conduct the surveys are well experienced and are rotated so that areas are not always surveyed by the same tech. Survey data are reviewed for abnormalities by a designated staff health physicist who countersigns the record. This assignment is also rotated among the staff. The inspector noted that neutron dose rates were not logged. The licensee stated that a detailed neutron survey is done when a new experiment is started. Usually, the neutron dose rate is <20% of the total, with the gamma dose rate dominating. Thereafter, only the gamma dose rate is monitored to detect abnormalities. The inspector also noted that some readings were recorded as "mr/hr". The licensee stated that the conversion factors to change the readings to "mrem/hr" would be incorporated into a program document. Also, techs were using different symbols on survey maps to indicate the location of a dose rate measurement or a smear location. The inspector stated that the use of symbols should be consistent since the surveys were a legal record of radiological conditions in the facility. The licensee stated that appropriate changes would be made to the records. These matters will be reviewed in a future inspection. Within the scope of this review, no safety concerns were noted.

### **9.0 Outage Planning**

In May 1994 the reactor will be shut down for a 10-month extended outage to install a redesigned cryogenic system that will yield a higher cold neutron flux in the Guide Hall. Other changes to be made include improved equipment accessibility to reduce exposures to experimenters, reactor system modifications, and increased shielding in the Guide Hall due to the projected increase in neutron flux. The licensee has identified all of the radiation work permits required for the major work activities and has projected the worst case radiological conditions. ALARA considerations have been factored into the

engineered design and preparations for the work. The licensee's preplanning for the outage was considered to demonstrate excellent attention to detail.

#### 10.0 Exit Interview

The inspector met with the licensee representatives indicated in Section 1.0 of this report on February 18, 1994, and summarized the scope and findings of this inspection. The licensee had no comments regarding the inspection findings.