U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No.: 50-57/93-03

Docket No.: 50-57

License No.: R-77

Licensee: State University of New York at Buffalo (SUNY-Buffalo)
Rotary Road, South Campus
Buffalo, New York

Facility Name: Buffalo Materials Research Center (BMRC)

Inspection At: Buffalo, New York

Inspection Conducted: December 8-10, 1993

Inspector: _____ 1/25/94
Thomas Dragoun, Project Scientist, Effluents — date
Radiation Protection Section (ERPS), Facilities
Radiological Safety and Safeguards Branch (FRSSB)

Approved By: _____ 1/27/94
Judith Joustra, Chief, ERPS, FRSSB, — date
Division of Radiation Safety and Safeguards

Areas Reviewed: A review of circumstances and corrective actions regarding the failure of a tube in the reactor water heat exchanger on September 8, 1993, similar tube leaks on December 7, 1993, and basement flooding due to overfilling the Make-up Water Tank on November 24, 1993. Recent staffing changes and performance of the analytical laboratory were also reviewed.

Results: The licensee's response to the three events was appropriate. The long term and short term corrective actions also were appropriate. No safety concerns or violations were observed.

DETAILS

1.0 Persons Contacted

M. Adams, BMRC Operations Manager
L. Henry, SUNY-Buffalo
M. Pierro, SUNY Radiation Safety Officer
J. Slawson, BMRC Senior Health Physicist
D. Vasbinder, BMRC Director/Analytical Services Manager

All above personnel attended the Exit Interview on December 10, 1993.

2.0 Organization and Staffing

On the first day of this inspection the licensee announced changes in the upper management organization of the facility. The Buffalo Materials Research Center (BMRC) General Manager (Mr. L. Henry) resigned from the contractor, Buffalo Materials Inc.(BMR), that operates the BMRC for SUNY-Buffalo and transferred to SUNY-Buffalo as a special assistant to the Vice President for Research. The president (Mr. L. Henken) of Materials Engineering Associates (MEA), the parent company for BMR, became the BMRC General Manager and assumed all administrative responsibility. The General Manager will remain located at the MEA corporate headquarters. The BMRC Manager of Analytical Services (Mr. D. Vasbinder) became the BMRC Director, a position that has been vacant for several years. The licensee stated that these changes may be temporary pending the outcome of negotiations to renew the contract between SUNY and MEA/BMR which expires in March 1994. The inspector noted that the positions affected by these changes did not have specific training or qualification requirements delineated by the Technical Specifications nor specific qualifications recommended by ANSI Standard 15.4, "Selection and Training of Personnel for Research Reactors". The inspector also noted that the line management and personnel in the facility reactor operations and health physics departments had not changed. Within the scope of this review, no safety concerns were noted. The status of the organization will be reviewed during the next inspection.

3.0 Primary Heat Exchanger Tube Leaks

Primary water from the reactor pool flows through the shell side of an aluminum heat exchanger and is cooled by secondary water from the cooling tower flowing through the tube side. The cooling tower is filled from the city water system and overflows to the sanitary sewage system. Technical Specification (TS) 4.5.3 requires the licensee to monitor water additions to the reactor pool. TS 4.6 requires monitoring of liquid wastes discharged to the sanitary sewer system. The licensee conducted weekly gross beta-gamma activity analysis on the secondary water. On September 7, 1993, the licensee

from the pool that week. Make-up was expected to be about 30 gallons for that week. A sample of secondary water taken from the heat exchanger revealed detectable sodium-24 (Na-24), which is the most prevalent radioactive isotope in reactor water during operation. Licensee management concluded that a primary-to-secondary leak occurred in the heat exchanger and ordered the reactor shut down. A radiological survey in and around the cooling tower was conducted which included: water and sludge in the cooling tower basin, and airborne particulate activity, surface soil, and vegetation in areas adjacent to the tower. Water, soil, and vegetation samples were also taken by two New York State (NYS) agencies - Department of Health (DOH) and Department of Environmental Conservation (DEC). No activity was detected in samples taken outside the cooling tower. The licensee detected Na-24 in cooling tower water taken soon after the leak was detected. However, this material decayed quickly due to its 15 hour half-life and was not detected in later samples. The state agencies reported trace quantities of antimony-124 and iodine-131 in tower water, but the concentrations were well below discharge limits. The Nuclear Safety Committee (NSC) met on September 10, 1993, and approved the proposed corrective actions identified below. On September 13, 1993, the cooling tower water was drained to the sanitary sewer and the sludge in the basin was removed and placed in disposal drums until it can be classified. The heat exchanger was disassembled and inspected. Only one tube in the heat exchanger was found to be leaking. This tube was plugged, the heat exchanger was reassembled, the primary and secondary water systems were refilled, and the reactor returned to routine operation with increased surveillance on pool level and secondary water activity.

Corrective actions taken included increasing the frequency of gross beta-gamma analysis of secondary water from weekly to daily in order to assure more prompt detection of any additional leaks. Further, the counting apparatus was changed from a thin window Geiger-Müller (G-M) detector to a phoswich detector in order to increase the detection sensitivity. This improved the minimum level of detection for Na-24 from about 5E-7 μCi/ml to about 1E-7 μCi/ml. These values are about 0.1% of the discharge limit for Na-24 in water to the sanitary sewer. On December 6, 1993, the daily sampling again detected Na-24 at the minimum detectable activity (MDA) concentration in the secondary water. The reactor was shut down and the radiological surveys in and around the cooling tower were repeated. The NYS Department of Health also responded but these survey results were not available during the inspection. Due to the early detection of the leak, the licensee only identified MDA levels of Na-24 in the cooling tower water. Inspection of the heat exchanger revealed that two additional tubes had failed. These tubes were plugged and the heat exchanger was undergoing hydrostatic testing during this inspection. There are a total of 454 tubes in the heat exchanger.

The Director stated that, pending review by the NSC and SUNY management, the actions to be taken in response to the tube failures will include the following:

1) Sampling of secondary water will be increased to twice daily, with one of the samples to be analyzed on a sensitive gamma detection system to detect gamma only emitters.

2) Power levels will be kept to the minimum level required and the reactor will be operated in natural circulation mode to avoid use of the cooling tower whenever possible.

3) Efforts to replace the heat exchanger will be expedited.

These actions were subsequently confirmed in a letter to the NRC dated January 5, 1994. Within the scope of the review, no safety concerns or violations of regulatory requirements were noted. The licensee's short term corrective actions were good. The long term actions appear to be appropriate and will be reviewed in a future inspection (Followup Item 50-57/93-03-01).

4.0 Overflow of the Make-Up Water Tank

On November 24, 1993, during performance of the system shutdown and security checks at the end of the day, a senior reactor operator (SRO) lined up the make-up water system to add water to the reactor pool. After filling, he secured the flow from the make-up tank (MU tank) to the reactor pool but failed to secure the flow of demineralized water to the MU tank. On November 26, 1993, personnel discovered that the MU tank had overflowed and flooded the basement of the reactor building with about 25,000 gallons of water. Areas affected included the primary pump pit, the N-16 decay vault, and the old waste system pit. The water was pumped to the sanitary sewer after sampling indicated that radioactivity levels were below NRC and New York State discharge limits.

The licensee determined that no equipment was damaged by the flooding. The primary pump motor was dried out, meggered, and returned to service. Licensee assumptions indicated that up to several hundred gallons of water may have leached into the ground from the basement. However, since the activity in the water was near the minimum detectable activity, this was not a safety concern. Licensee evaluation of this matter is continuing. In a preliminary report prepared by the licensee's staff for the NSC, the cause of this event was attributed to personnel error. After its review, the NSC directed that all reactor operators be briefed on the prohibitions against system manipulations after the shutdown and security checks are complete. This was done. In addition, the shutdown and security checks are to be reviewed to determine if any changes are required as a result of this event. Action on this item was underway at the time of the inspection. This matter will be reviewed in a future inspection (Followup Item 50-57/93-03-02). Within the scope of this review, no violations of regulatory requirements were noted.

5.0 Analytical Laboratory Performance

The inspector reviewed the performance of the analytical laboratory through a tour of the facilities, interviews with the laboratory manager, review of procedures HPP 2, "Radioactive Waste Water Release" and HPP 3, "Contaminated Water Analysis", and a review of records. The procedures and records were determined to be adequately detailed. Laboratory equipment for beta-gamma analysis consisted of a thin end window

GM detector and a high efficiency phoswich detector. These were calibrated quarterly using chlorine-36, strontium-90, and carbon-14 standard sources. Liquid samples were prepared and counted using generally accepted techniques. The minimum detectable activity (MDA) values for the analyses were adequate. However, permission to release liquid wastes was based on gamma analysis in accordance with generally accepted practice. The gamma counting procedure is described below.

Gamma counting was accomplished with a lithium-doped germanium detector, an installed intrinsic germanium detector, or a portable intrinsic detector. Background was determined daily and calibrations are performed quarterly. The isotope library in the computer software was modified to account for the isotopes that are normally observed. Control charts are not maintained since the lab manager is the primary user of this equipment. The use of control charts is not a regulatory requirement. Liquid samples are counted in a standard marinelli beaker configuration. The MDA values were adequate to ensure compliance with release limits.

Within the scope of this review, no safety concerns or violations of regulatory requirements were noted.

6.0 Exit Interview

The inspector met with the licensee personnel denoted in Section 1.0 of this report, at the conclusion of this inspection. The scope and findings of the inspection were presented at that time. The licensee acknowledged the findings.