U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

REGION III

Report No. 70-152/79-01

Docket No. 70-152 License No. SNM-142

Licensee: Purdue University
Bionucleonics Department
LaFayette, IN 47907

Facility Name: Fast Breeder Blanket Facility

Inspection At: Purdue University, West LaFayette, IN

Inspection Conducted: January 30 and 31, 1979

Inspector: for C. C. Peck W. L. Fisher 2/14/79

Approved By: W. L. Fisher, Chief W. L. Fisher 2/14/79
Fuel Facility Projects and
Radiation Support Section

Inspection Summary

Inspection on January 30 and 31, 1979 (Report No. 70-152/79-01)
Areas Inspected: Routine, unannounced health and safety inspection, including: organization, facility changes and modifications, safety committees, procedures, operations review, and criticality safety. Radiation protection, including: surveys, exposure control, instrument calibrations, and posting and labeling. The inspection involved 9 inspector-hours on site by one NRC inspector.
Results: Of the ten areas inspected, no items of noncompliance or deviations were found in nine areas. One apparent item of noncompliance was identified in one area (infraction - inoperative criticality monitor - Paragraph 3).

DETAILS

1. Persons Contacted

*Dr. F. M. Clikeman, FBBF Project Director
*Dr. P. L. Ziemer, Radiological Control Officer
Dr. R. R. Landolt, Assistant Radiological Control Officer
Gary Harms, Graduate Student
L. J. Bollinger, Radiological Control Technician

*Denotes those present at the exit interview.

2. General

The inspection began at 1:00 p.m. at the Fast Breeder Blanket Facility (FBBF), located in the basement room of the Physics Building. The purpose of the inspection was to examine the licensee's compliance with the requirements of SNM-142 for the FBBF, and with the radiation protection requirements of that license.

The expiration date for SNM-142 is January 31, 1979. On December 28, 1978, the licensee requested renewal of the license by application submitted pursuant to 10 CFR 70.33(b). The only changes requested were in the small quantities of radioactive materials used in FBBF experiments.

3. Operations Review

The FBBF was in operation during the inspection, with the californium-252 neutron source in its raised position. The facility was shut down temporarily from a control console to permit entry into the concrete shield in which the FBBF is enclosed. In the event entry is attempted with the source in the raised or operating position, an interlock associated with the door latch causes the source to drop to its storage location beneath the FBBF.

Inside the shield after shutdown, radiation levels were low, on the order of 0.1 mR/hr at the top of the blanket. When the facility is in operation, a wall-mounted instrument provides a readout of radiation level at the console outside. It was observed that a sign was posted at the emergency pushbutton inside the shield instructing that the button be pushed to lower the source in the unlikely event that an individual were

inside the shield with the source in a raised position. This posting was suggested during a previous inspection (Report No. 70-152/78-02).

The shielded enclosure is ventilated through an exhaust duct to a stack which leads to the roof of the building. There is a HEPA filter in the duct and air samplers both upstream and downstream of the filter. It was noted that the air flow of 500 cfm through the duct was sufficient to maintain a pressure differential of 0.07 inches of water between the inside and outside of the shielded enclosure. The license application dated August 10, 1976 states that a minimum differential of 0.05 inches will be maintained. The ventilation system is operated continuously.

Fuel rod work, which may consist of cutting up rods and inserting and removing experimental foils, is accomplished in a shielded hood equipped with hatches to permit access with gloved hands. The hood is located in the room outside the FBBF shield. The hood ventilation system is similar to that of the FBBF shield. A ventilation duct conducts air from the hood to an exhaust stack. There is a HEPA filter in the duct with air samplers upstream and downstream of the filter. In addition, there is a sampler located on top of the hood, to permit sampling near the breathing zone of an individual working in the hood. Air flow through the duct is about 350 cfm.

Radiation monitoring equipment, criticality dosimeters, and criticality monitors are located as described in the licensee's application. One of the two criticality monitors was operable. The instrument was tested and alarmed at about 10 mR/hr. The second criticality monitor was inoperable at the time of the inspection. The instrument has been unreliable since it was installed before startup, because of a faulty detector. After experiencing some delay, a replacement has been obtained and will be installed. Inasmuch as License Condition 12 of SNM-142 states that an alarm system meeting the requirements of 10 CFR 70.24, as described in the license application of August 10, 1976 shall be required, the inoperable criticality alarm is considered an item of noncompliance.

License Condition 14 of SNM-142 requires that radiation levels outside the facility be measured after start of operation of the FBBF to compare with levels calculated prior to operation. Measurements were made after startup. At locations outside the room in which the FBBF is located readings were only slightly

higher than natural background (0.011 mR/hr gamma). Comparison with the pre-operational calculations was close in most instances.

With the exception of the inoperable criticality monitor, no items of noncompliance were identified.

4. Organization and Safety Committees

There have been no significant changes in the group associated with FBBF. The director, assistant director, five graduate students, and a radiation technician have access to the FBBF area.

The Radiological Control Committee is responsible for the university's radiation safety program. Meetings are held to review and approve plans, procedures, proposed changes, and other methods of safety significance. The inspector examined meeting minutes related to the FBBF.

No items of noncompliance were identified.

5. Procedures

Procedures are prepared by the FBBF Project Director and approved by the Radiological Control Administration Group. Three procedures, prepared since the inspection of February 1978 (Report 78-01), were reviewed by the inspector:

No. 8 Cutting Rods
No. 9 Operating Source Drive Mechanisms of the FBBF Facility
No. 10 Activating Foils in the FBBF Facility

No items of noncompliance were identified.

6. Criticality Safety

License Condition 15 of SNM-142 requires that the FBBF not be operated with a measured k_{eff} greater than 0.45. The calculated k_{eff} was 0.400 before fuel loading. Measurements made after fuel loading showed a k_{eff} of 0.402.

The maximum calculated k_{eff} under flooded conditions is 0.71. This is less than the 0.75 limit permitted by the license.

No items of noncompliance were identified.

7. Surveys

A summary of direct radiation surveys made after the FBBF was in operation was presented in Paragraph 3.

The inspector examined survey and monitoring records for the period July 1978 through January 1979. The records showed no instances of significant contamination.

Leak tests of sealed sources are made at six month intervals. Recent tests of a 1-curie plutonium-beryllium source and a small cobalt-60 source, which are stored in the FBBF area, disclosed no detectable contamination. The californium-252 source in the FBBF assembly is leak tested by surveying for contamination at the nearest accessible point above the source. The test showed no contamination.

Dosimeters are mounted on the walls in the FBBF area, one inside the shield and three on external walls. At the end of 1978, the total exposure to the dosimeter inside the shield was 410 mrads beta-gamma. The other three dosimeters indicated 20-30 mrads beta-gamma.

No items of noncompliance were identified.

8. Exposure Control

Pocket dosimeters are issued to all individuals who enter the FBBF area. Those who frequent the FBBF are assigned film badges. Dose during 1978 for individuals in this group ranged from 20 to 50 mrems. The badges are designed to measure beta, gamma and fast neutrons.

TLD ring badges are used when handling FBBF fuel. The highest dose recorded in 1978 for any individual in the FBBF group was 320 mrems.

No items of noncompliance were identified.

9. Instrument Calibration

Portable survey instruments used at the FBBF are calibrated every six months against standard sources. Records of the most recent calibrations, during August and September 1978, were examined. Six general survey instruments for measuring beta and gamma radiation were calibrated during this period.

No items of noncompliance were identified.

10. Posting, Labeling, and Controls

The notices required by 10 CFR 19.11 were posted at the entrance to the FBBF. Radiation areas were adequately posted. There were no high radiation areas or airborne radioactivity areas at the time of the inspection.

In a previous inspection (Report 70-152/78-02) it was suggested that a sign be posted at the entrance to the FBBF shield to require persons entering during a power failure to carry a radiation survey instrument. A power failure would cause the californium source to drop to its storage container, lowering the radiation to a safe level. However, a power outage would also cause the radiation monitoring instruments to fail, so there would be no evidence that the source had been safety stored. A precautionary sign requiring use of a survey meter has been placed at the shield entrance.

The entrance to the FBBF shield is locked except during entry of authorized personnel. The entrance to the area is required to be locked when no one is in the area.

No items of noncompliance were identified.

11. Exit Interview

The inspector explained the scope and findings of the inspection with the licensee representatives denoted in Paragraph 1 at the conclusion of the inspection.

The infraction described in Paragraph 3 was discussed.