U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 87-03

Docket No. 50-05 Priority -- Category F

License No. R-2

Licensee: The Pennsylvania State University
University Park, Pennsylvania

Facility Name: Breazeale Nuclear Reactor

Inspection At: University Park, Pennsylvania

Inspection Conducted July 20-21, 1987

Inspectors: A. Weadock 8/21/87
A. Weadock, Radiation Specialist date

A. Weadock for 8/21/87
M. Markley, Radiation Specialist date

Approved by: R. L. Nimitz for 8/21/87
M. Shanbaky, Chief, Facilities Radiation Protection Section date

Inspection Summary: Inspection on July 20-21, 1987 (Report No.50-05/87-03).

Areas Inspected: Routine, announced inspection of Radiation Controls activities associated with the reactor license. Areas inspected included: posting and labeling, instrument calibration, surveys, exposure controls, and reports and audits.

Results: Within the scope of the above review, no violations were identified.

Details

1.0 Persons Contacted

During the course of this routine inspection, the following personnel were contacted.

*M. Voth - Director, Breazeale Nuclear Reactor
*R. Granlund - University Health Physicist
*T. Flinchbaugh - Reactor Supervisor
D. Raupach - Reactor Utilization Specialist
W. Ford - Health Physics Technician

*Attended the exit interview on July 21, 1987.

2.0 Purpose

The purpose of this routine inspection was to review Radiation Controls activities conducted in association with the licensee's reactor license. The following areas were reviewed:

- status of previously identified items,
- posting and labeling,
- instruments and monitor calibration,
- surveys,
- exposure controls,
- reports and audits.

3.0 Status of Previously Identified Items

3.1 (Closed) Follow-Up Item (85-01-03): Review licensee reactor facility and environmental Ar-41 measurements.

The inspector reviewed a licensee report titled "Ar-41 Measurements at Penn State Breazeale Reactor" dated July 30, 1986. This report describes a recent series of Ar-41 surveys made inside and outside the reactor building during reactor operation. The inspector determined that the survey methodology was adequate. Results indicate that Ar-41 concentrations both inside and outside the reactor building remain below 10 CFR 20 limits during extended reactor operation.

3.2 (Closed) Follow-Up Item (85-01-01): Health Physics (HP) staff neutron detector not calibrated at frequency required by materials license.

An NRC inspection of the University material licenses was conducted during April, 1986. No violations concerning instrument calibration were identified during that inspection. During the current inspection, the subject neutron detector was noted to be within the calibration frequency as required by the reactor portable survey

instrument calibration procedure. The inspector also determined the reactor staff has procured a new portable neutron detector which will be under the responsibility of and maintained by the reactor staff.

3.3 (Closed) Unresolved Item (85-01-02): Adequacy of calibration procedures for reactor bay radiation monitors.

The licensee recently revised the reactor bay and beam hole lab area radiation monitor calibration procedures to include monitor response acceptance criteria. The inspector reviewed monitor calibration frequencies and actual calibration data and determined the licensee is performing satisfactory area monitor calibrations. Details are discussed in Section 5.0.

4.0 Posting and Labeling

The inspectors toured the Pennsylvania State Breazeale Reactor (PSBR) immediately following the entrance interview. Posting of the facility and labeling of radioactive materials were in accordance with 10 CFR 20.203 requirements. The inspectors noted improvements in posting and housekeeping which included the following:

- "Radioactive Material" signs were on the walls adjacent to posted laboratory doors such that the posting was not obscured when the door was open.

- Temporary "Radiation Area" postings were established for work in progress.

The inspectors identified this as an area of improvement over the previous inspection.

No violations were identifed in this area.

5.0 Instrument Calibration

The licensee's program for calibration of area radiation monitors, air activity monitors, and portable survey instruments was reviewed by the following methods:

- inspection of in-place equipment and stored instruments for calibration stickers;

- review of selected area monitor and portable survey instrument calibration records;

- review of the following procedures:

- CCP-10,"Calibration of Area Radiation Monitors"

- CCP-12,"Calibration of Portable Survey Instruments and Functional check of Pocket Dosimeters."

- CCP-8, "Calibration of Air Monitors."

Within the scope of the above review, no violations were identifed. The inspector noted substantial improvement in the performance of Technical Specification required area radiation monitor calibrations. The licensee has revised their calibration procedures to include specific monitor acceptance criteria for use during calibration. Review of calibration data indicated these criteria were met during calibration. Required calibration frequencies (annual) for area radiation monitors, air monitors, and portable instruments were generally adhered to. One concern with instrument calibration was noted, however, and is discussed below.

The licensee maintains a bench top proportional counter in a laboratory room in the reactor building. This instrument is used routinely by the reactor staff and periodically by the Health Physics (HP) staff to count smears. The inspector noted that the period between the last two calibrations had extended to approximately 15 months; specifically, from April, 1986 to July, 1987. Subsequent investigation into why this instrument had been allowed to exceed an annual frequency identified the following deficiencies:

- no specific calibration procedure existed for this instrument;
- although source-checked daily, no source-check acceptance criteria had been established;
- both the HP and reactor groups thought the other group was responsible for calibrating and maintaining the instrument.

The inspector was able to verify, by review of calibration and source check data contained in the instrument logbook, that the counter had been adequately calibrated and had not subsequently significantly declined in response during the 15 month period. Consequently, sample analysis results were considered valid during the period.

The inspector indicated to the licensee that the above deficiencies implied a lack of clear responsibility for the instrument. The licensee acknowledged this and committed to making the following improvements in this area:

- clear responsibility for calibrating and maintaining the proportional counter would be assigned to one of the involved groups;

- a calibration procedure for the instrument would be developed.

Implementation of the above committment will be reviewed during a subsequent inspection in this area (05/87-03-01).

6.0 Surveys

Routine daily contamination surveys of the unrestricted areas of the reactor building are performed by the reactor staff in accordance with AOP-4, "Daily Smear Surveys." More extensive routine surveys of the reactor facility are performed by the University HP staff.

The inspectors reviewed selected routine and job-specific facility surveys performed during 1987 and 1986. Surveys were performed as required and were considered adequate in scope to identify radiological hazards. The inspector did note, however, that instrument type, serial numbers, and calibration dates were often not included on survey forms completed by both the reactor staff and HP technicians. The inspector identified this as an improvement item to the licensee.

The Reactor Director indicated that the reactor staff would be briefed concerning the need to include instrument identification on completed survey forms. The University Health Physicist indicated his staff had been briefed concerning this subject in the past. A revision to the survey forms requiring instrument parameters to be recorded is now being considered as a means to upgrade documentation.

Scope and content of licensee surveys will continue to be reviewed during subsequent inspections.

7.0 Exposure Controls

7.1 Controls During Experimentation

The inspector evaluated the licensee's radiological controls for irradiation experiments by the following methods:

- discussion with licensee personnel;
- observation of a neutron radiography experiment on July 20, 1987;
- observation of licensee efforts to retrieve an unsecured experiment from the reactor pool on July 21, 1987;
- review of selected portions of control room logbooks #41 and 42;
- review of selected control room start-up "daily checkout sheets,"
- review of selected "PSBR Experiment Evaluation and Authorization" sheets;
- review of the following procedures:
    - SOP-1,"Reactor Operation using a Beam Port Experimental Facility,"
    - SOP-8,"Release of Irradiated Experiments;"
    - AOP-1, "Hot Cell Entry Procedure."

Within the scope of the above review, no violations were identified. The licensee exhibited strong positive control over the performance of irradiation experiments. Experimental irradiation requests by various users are reviewed and approved by a member of the reactor staff prior to irradiation. Part of this review includes checking the estimated experiment activity against the users byproduct license limits, which are maintained in a authorization book in the control room. This book contains specific radiological controls to be implemented during the irradiation of certain experiments.

The inspector observed the performance of a neutron radiography experiment on July 20, 1987, and noted that the requirements of SOP-1 were implemented. Changes in area dose rates, with consequent change in area posting requirements were recognized and addressed in the procedure.

On July 21, 1987, at approximately 1115, while the inspector was in the PSBR control room and the reactor was operating at 1 MW, the East reactor bay area radiation monitor went to an ALERT condition. The licensee indicated the ALERT setpoint for this monitor, positioned approximately 3 feet over the reactor pool was 15 millirem/hr. Immediate survey and inspection of the pool area by an operator revealed no obvious cause for the increased radiation level. However, since the operator's survey verified the monitor reading, the reactor was immediately scrammed.

Subsequent inspection revealed that an experiment, positioned in the core during startup, had become unsecured and floated to the top of the pool. Survey of the experiment indicated approximately 30 mr/hr at 1 meter. With the assistance of the machine shop, the licensee was able to quickly modify a long pipe which was used to capture and store the experiment under water to allow for decay. A long handled tool was used to direct the experiment into the pipe.

Licensee actions in the above incident demonstrated an effective reliance on instrument indications, and good recognition of and response to radiological conditions.

7.2 Dosimetry

The inspector reviewed the 1986 quarterly and annual personnel radiation monitoring exposure records as well as area monitoring results. These records were provided by Landauer as contracted by the Health Physics Office. Selected individual exposure records were reviewed, indicating no significant exposures.

The inspector did note, during the above review, that one individual working in the reactor facility ostensibly received a 280 mrad skin exposure during the last quarter of 1986. This exposure appeared anomalous for the following reasons:

- the individual, although monitored for several years, had never received previous exposure;

- no commensurate whole body dose was recorded;

- skin exposure situations are not typical at research reactors.

The licensee's Health Physics staff acknowledged the above exposure appeared atypical and should have been noted during their review of the exposure records. Subsequent preliminary questioning of the worker by the licensee failed to identify any changes in work habits or operations that would account for the observed exposure. The inspector noted that the above anomalous exposure was well within regulatory limits and was the single anomaly noted.

8.0 Reports and Audits

The following reports, audits and Reactor Safeguard Committee meeting minutes were reviewed during the course of this inspection:

- July 1, 1985 to June 30, 1986 Annual Opeating Report of the Penn State Breazeale Reactor facility (PSBR);
- 1986 annual audit of the PSBR,
- Reactor Safeguard Committee meeting minutes for meetings held on October 10, 1986; February 2, 1987; April 13, 1987; and July 17, 1987.

Within the scope of the above review, no violations were identified. The licensee was meeting Technical Specification required frequencies for audits, operating reports, and committee meetings. Minutes of the Reactor Safeguards Committee were quite thorough and demonstrated a high level of awareness and concern by the committee regarding potential radiological concerns.

The inspector also noted that, although not specifically required by the licensee's Technical Specifications, the 1986 PSBR audit included a review of facility radiological controls. No procedural or regulatory violations were noted in the radiological controls section of the audit. However, several recommendations were made which have already been or are in the process of being responded to by the Health Physics staff.

9.0 Exit Meeting

An exit meeting was held on July 21, 1987 with the members of the licensee's staff denoted in Section 1.0. At that time, the scope, content, and findings of the inspection were summarized by the inspectors.