

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

Region I

Report No. 50-225/81-01

Docket No. 50-225

License No. CX-22

Priority --

Category G

Licensee: Rensselaer Polytechnic Institute

Department of Engineering and Science

Troy, New York 12181

Facility Name: Rensselaer Polytechnic Institute
Critical Facility

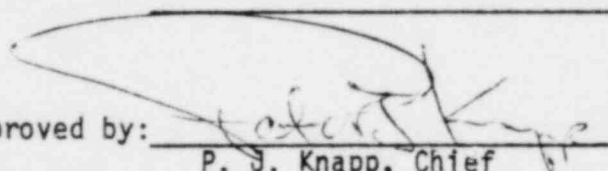
Inspection at: Schenectady, New York

Inspection Conducted: January 22-23, 1981

Inspector: 
R. L. Nimitz, Radiation Specialist

2/27/81
Date Signed

Date Signed

Approved by: 
P. J. Knapp, Chief
Radiation Support Section

2/27/81
Date Signed

Inspection Summary:

Inspection on January 22-23, 1981 (Report No. 50-225/81-01)

Areas Inspected: Special, announced inspection by one regional based inspector of the circumstances, licensee evaluations and corrective actions following flooding of the Critical Facility on or about January 14, 1981. Areas inspected included: procedures, surveys, notifications, posting and labeling, records, event circumstances, and releases. The inspection involved 12 inspector-hours on site by one regional based inspector.

Results: Of the seven areas inspected, no items of noncompliance were identified in four areas, one item of noncompliance was identified in each of the remaining areas (Failure to perform notifications as required by Technical Specification 6.6.2.a, Paragraph 6; Paragraph 4a; Failure to maintain records consistent with 10 CFR 20 as required by 10 CFR 20.401(b), Paragraph 4b; Failure to establish a procedure required by Technical Specifications 6.4, Paragraph 5).

DETAILS

1. Persons Contacted

(2) D. R. Harris, Director - Critical Facility

(1) R. Lahey, Chairman - Department of Nuclear Engineering

P. R. Nelson, Supervisor - Critical Facility

(1) (2) R. Ryan, Director - Office of Radiation and Nuclear Safety

(1) denotes those individuals present at the January 22, 1981 exit interview.

(2) denotes those individuals present at the January 23, 1981 exit interview.

2. Inspection Purpose and Scope

The purpose of this special inspection effort was to review the circumstances and licensee corrective actions associated with an event on or about January 15, 1981 which resulted in flooding of the Critical Facility. Also reviewed was the failure of the reactor moderator tank transfer line due to water freezing in the line on or about January 14, 1981.

3. Event Description

During an inspection of the Critical Facility reactor room on the morning of January 14, 1981, the Facility Supervisor noted water to be in the sump of the reactor pit. This sump is located at the bottom of the reactor pit and contains the reactor moderator storage tank.

Based on sump and storage tank dimensions, the Facility Supervisor estimated a total of approximately 1200 gallons of reactor moderator water had in some manner leaked to the sump. The supervisor notified the director of the Critical Facility of the presence of the water and indicated that the water had been sampled and was found not to be radioactive. The Facility Supervisor believed the water to have leaked from a separated moderator pump gasket on the discharge of the pump. The separation was believed to be the result of water freezing in the line. This water was left in the sump while the supervisor spent the remainder of the day (January 14, 1981) repairing the facility heating system.

Upon arrival at the Facility at 9:30 a.m. on January 15, 1981, the Facility Supervisor found water running out the facility's truck bay door. Entry into the facility and investigation by the supervisor

indicated that a drinking water fountain line had apparently cracked and separated due to water contained in the line freezing. The water running from the cracked line resulted in the reactor sump and pit being filled with an estimated 20,000 gallons of water.

The Facility Supervisor sampled the water in the pit and determined it to be non-radioactive. This information was transmitted to the Facility Director. Following discussions between the Facility Supervisor and Director, a decision was made to contact campus maintenance personnel to pump the pit contents to the facility's parking lot. The pumping was started at approximately 2:00 p.m., January 15, 1981 and was completed at approximately 6:00 p.m. on that same day.

4. Liquid Effluent Releases

a. Surveys

The inspector reviewed this event with respect to the requirements of 10 CFR 20.201, "Surveys" and 10 CFR 20.106, "Radioactivity in effluents to unrestricted areas."

10 CFR 20.201, paragraph (b), requires that each licensee shall make or cause to be made surveys as may be necessary for him to comply with the regulations of 10 CFR Part 20. Paragraph (a) of 20.201 defines a survey as an evaluation of the radiation hazards incident to the production, use, release, disposal or presence of radioactive materials or other sources of radiation under a specific set of conditions.

10 CFR 20.106 limits the amount of radioactive material a licensee may discharge in effluents to unrestricted areas.

The inspector's review and discussion of the event with the licensee's Supervisor of the Critical Facility indicated that the potentially contaminated water from the reactor pit was pumped to the facility parking lot, an unrestricted area. This parking lot was noted to adjoin the Mohawk River.

The review of the liquid sampling and analyses performed by the licensee indicate a sample of the reactor moderator in the sump had been collected and counted on January 14, 1981 and a sample of the water in the pit had been collected and counted on January 15, 1981 prior to pumping. Both samples were determined by the Critical Facility Supervisor to have no radioactivity greater than background.

The inspector reviewed the sample results and noted the samples to have been 1000 milliliter liquid samples evaporated to dryness and counted on a thin window (approximately 2 mg/cm^2) G.M. tube. The inspector discussed this sampling method with licensee representatives and indicated that this analysis method would not, unless some specific ratios had been developed, provide an indication of tritium or alpha emitter concentrations in the liquid discharged. The inspector noted this to be necessary due to the low energy of the tritium beta radiation and the high linear energy transfer of the alpha particles which would preclude their counting by the GM system.

Inspector discussions with licensee representatives regarding the above indicated that because the power level of the Critical Facility reactor was low and the facility was operated infrequently, the probability of these contaminants reaching detectable levels was low. The inspector acknowledged these comments and noted that based on these comments and the power history of the facility it did not appear necessary to evaluate these contaminants on a routine basis. The gross beta-gamma analysis would serve to identify any unusual changes in moderator activity level.

The inspector noted, however, that no procedural guidance or instruction had been developed to infer the concentrations of other radioactive contaminants based on a gross beta-gamma activity analysis of the liquid.

Discussions with licensee representatives indicated that as a result of the above, the current liquid waste disposal procedure for the critical facility would be revised to include specific survey requirements, permissible discharge limits and action levels. This procedure is to be revised to be similar to the procedures in place for the linear accelerator which were indicated as containing these items.

These discussions indicated the procedure would be established and implemented prior to further releases from the critical facility.

Following inspector identification of the above, the licensee performed an analysis of the water remaining in the moderator tank and re-analyzed the sample of the liquid pumped from the pit. The following results were obtained:

Table 1

<u>Source</u>	<u>Analysis</u>	<u>Result</u> ⁽¹⁾ (uCi/ml)	<u>% of 10 CFR 20</u> ⁽²⁾ <u>Appendix B</u> <u>Concentration</u>
Sump liquid following release	^3H	< 1.1E-6	<< 1
Sump liquid prior to release	gross alpha (planchet)	< 3.6E-10	1
Sump liquid prior to release	gross beta (planchet)	< 5.0E-9	16

(1) All results are lower limits of detection

(2) Based on most restrictive Appendix B value

b. Records

The inspector reviewed the survey records of previous liquid releases from the reactor moderator storage tank. The records reviewed included those dating back to 1971.

10 CFR 20.401, "Records of surveys, radiation monitoring, and disposal," requires in paragraph (b) that each licensee maintain records in the same units used in this part, showing the results of surveys required by 10 CFR 20.201(b). As discussed in paragraph 4a above, the licensee is required by 10 CFR 20.201(b) to survey liquid releases to ensure compliance with 10 CFR 20.106. This latter requirement (10 CFR 20.106) provides for discharge limits in concentration units, i.e., microcuries/milliliter (uCi/ml). This requirement is provided to ensure arbitrary units are not utilized and that the final result includes all the appropriate corrections. For liquid surveys these would include such items as efficiency and absorption corrections.

In reviewing the release and sampling records, the inspector noted that for all releases of the reactor moderator storage tank made back through 1971 none of the records were maintained in the same units used in 10 CFR 20. Rather, all tank liquid survey records were maintained in units of counts per minute (CPM) gross beta-gamma. This included releases made during January 1973 and September 1971 when the sample count rate (CPM) was higher than the background count rate. The inspector noted that although these count rates were slightly higher than the background count rates, these units were not compatible with 10 CFR 20 and the inspector could not, with the information provided, relate these units to the appropriate limits of 10 CFR 20. Consequently, the inspector indicated that failure to maintain records of surveys consistent with the requirements of 10 CFR 20.401(b) constitute noncompliance with that requirement (50-225/ 81-01-02)

5. Procedures

The inspector reviewed this event with respect to licensee adherence to applicable procedures required by the facility Technical Specifications.

Technical Specification 6.4, Operating Procedures, requires that written procedures, including applicable checklists, be reviewed and approved by the NSRB and be in effect and followed for the operations specified therein. Included in these operations are corrective actions to be taken to correct specific and foreseen malfunctions such as primary coolant system leaks.

Inspector review of the licensee's procedures and discussions with licensee representatives indicated that the licensee's corrective action procedures did address primary coolant system leaks, however, the procedure did not provide specific guidance for what action to take following a primary coolant leak. Rather, the procedure directed the reader to section 6.5 of the emergency procedures. Section 6.5 of the emergency procedures provided guidance for actions to be taken for a water leak from the city water supply and provided no specific guidance relative to primary coolant system leaks. This included lack of guidance for Notification of the NRC, entry into the spill area, how to remove the water, where to place the water or potential radioactivity and radiological hazards. The inspector noted this lack of procedure guidance directly resulted in at least one item of noncompliance (notifications) which is discussed in this report.

The inspector discussed the above with licensee representatives and indicated that a city water leak procedure, as evidenced by the event, was inadequate for primary coolant leaks and did not satisfy the primary coolant system leak procedure requirement.

The discussions with licensee representatives indicated that, although several options were available for disposal of the water, after the moderator leak was identified on January 14, 1981, personnel were unsure as to what actions to take due to the lack of procedure guidance. These actions included whether or not to notify the NRC, where to place the water or how to remove the water. The discussions indicated that meetings were held subsequent to the leak to discuss these items.

As a result of the above, the inspector indicated to licensee representatives that failure to have in effect a corrective action procedure for primary coolant leaks is noncompliance with Technical Specification 6.4. (50-225/81-01-03)

Licensee representatives indicated that the facility would remain in a shutdown condition pending establishment of a NSRB reviewed or revised procedure detailing actions to be taken in the event of a primary coolant leak.

6. Notifications

Technical Specification 6.6, Reporting Requirements, requires in section 6.6.2a that in the event of a reportable operational occurrence as defined in section 1 of the Technical Specifications, the licensee is to notify the Director of the appropriate NRC Regional Office within 24 hours. This notification is to be made by telephone and telegraph.

Technical Specification 1.m, Reportable Occurrence, as referenced above, defines a reportable occurrence as, among other items, the occurrence of any facility condition that results in abnormal degradation of one of the several boundaries which are designed to contain the radioactive materials resulting from the fission process or a condition arising from natural or offsite manmade events that affect or threaten to affect safe operation of the facility. These conditions are described in Technical Specifications Section 1.m.5 and 1.m.7, respectively.

The inspector reviewed the event and the licensee's notification of the Director of NRC Region I with respect to the above requirement.

Review of the event indicated that, as described in paragraph 3 of this report, on or about January 14, 1981 a gasketed joined line separated due to freezing which caused the reactor moderator sump tank to partially drain to the floor. This sump tank and line, in the event of an accident condition, would contain the radioactive primary coolant (moderator) and would therefore act as a boundary to contain the radioactive materials resulting from the fission process. Additionally, the inspector noted that the freezing of the lines, both the sump tank line and the water cooler line, were the result of a natural event, i.e., freezing. Further, the freezing of the water coolant line resulted in flooding of the entire facility, including the cable trays leading from the reactor control panel to the reactor control mechanisms. This flooding would therefore threaten to affect safe operation of the facility, possibly due to electrical problems. The inspector noted that the reactor itself was above the water and was not, according to the inspector's discussion with the Supervisor of the Critical Facility, submerged in the water.

The above reporting requirements were discussed with the licensee's representatives denoted in paragraph 1 of this report. The inspector indicated that the sump tank was a fission product boundary and a leak in this tank was a degradation of a fission product boundary. Additionally, the inspector indicated that the flooding of the facility, a condition arising from natural events, i.e., freezing, could threaten to affect safe operation of the facility through flooding of the electrical control cables.

As a result, the inspector indicated to licensee representative that failure to notify the NRC Region I office within 24 hours of the event as required by Technical Specification 6.6.2.a. constitutes noncompliance with that requirement. (50-225/81-01-04)

Licensee representatives indicated an NSRB reviewed and approved procedure for reporting unusual and/or significant events would be established and implemented upon review of current regulatory requirements.

Based on an inspector telephone discussion with licensee representatives on March 13, 1981, the procedure would be established and implemented by April 1, 1981.

7. Additional Item

In reviewing and discussing this event with licensee representatives the inspector noted these individuals indicated that an apparently different core was in the reactor than that which the current technical specifications had been written for. The present core apparently operated at a much smaller power level than the previous core. The inspector noted that this change appeared to require a change to facility's technical specifications to reflect this change. As a result the inspector indicated this matter would remain an unresolved item pending further review (50-225/81-01-05).

8. Unresolved Items

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable items, items of noncompliance, or deviations. An unresolved item disclosed during the inspection is discussed in Paragraph 7.

9. Exit Interview

The inspector met with licensee representatives (denoted in paragraph 1) at the conclusion of the inspection on January 23, 1981 and summarized the purpose scope and findings of the inspection.

Licensee representatives made the following statements:

- The Critical Facility would remain in a shutdown condition pending establishment and implementation of an NSRB reviewed or revised procedure which details actions to be taken in the event of a primary coolant leak (paragraph 5).
- An NSRB reviewed procedure which provides guidance for reporting of unusual and/or significant events at the Critical Facility would be established and implemented subsequent to review of current regulatory requirements for reporting (paragraph 6).
- A revised procedure for releasing liquid effluents from the Critical Facility will be established and implemented prior to further releases from this facility (paragraph 4.a.).