U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Docket/Report: 50-193/88-01

Licensee: Rhode Island Atomic Energy Commission
South Ferry Road
Narragansett, Rhode Island 02882

Facility: Rhode Island Atomic Energy Commission

Inspection At: Narragansett, Rhode Island

Dates: March 28-31, 1988

Inspector: E. Conner, Project Engineer

Approved By: Elbe C. McCabe, Jr 5/11/88
E. C. McCabe, Chief, Reactor Projects Section 1B Date

Summary:

Areas Inspected: A routine unannounced onsite inspection of licensee activities including: facility tour, action taken on previous inspection findings, facility operation, Technical Specifications and surveillance, requalification training, experiments, health physics, independent audit, and emergency planning.

Results: Inaccuracies in the Technical Specifications were identified to the licensee. One violation was identified in the area of fuel element burnout limit records. Unresolved items identified were personnel monitoring upon leaving the reactor room and review/approval of logs and check sheets.

TABLE OF CONTENTS

DETAILS

1. Persons Contacted

*F. DiMeglio, Director, Rhode Island AEC Nuclear Science Center
*M. Doyle, Assistant Director
N. Jacob, Radiation Safety Officer
E. Spring, Senior Facility Engineer
W. Simoneau, Reactor Supervisor
B. Smith, Senior Reactor Operator

*Present at Exit Interview.

2. Inspection Scope

The inspector discussed operations with the staff, toured the reactor/experimentation facility, and observed reactor startups and shutdowns, control rod worth measurements, instrumentation repair, and use of beam ports.

3. Licensee Action on Previous Inspection Findings

3.1 (Closed) UNR 50-193/86-02-01, Posting of Site Boundary

The previous inspection found that Technical Specifications (TSs) required conspicuously posted signs to prevent unauthorized entry into the Restricted/Exclusion Area were not adequate. The licensee agreed to place additional signs.

After the above inspection, the licensee posted signs around the facility and included an audit of signs on their quarterly check sheet. The inspector noted the posted signs around the area, including some in the woods.

The licensee also requested a change to TS Section A to redefine the Restricted Area to be the reactor building and attached office/laboratory wing (the Restricted Area was previously defined the same as the Exclusion Area). This change was authorized as TS Amendment 15, issued on October 27, 1987. The new TSs continue to require posting signs around the 3-acre Nuclear Science Center site.

The inspector had no further questions.

3.2 (Open) UNR 50-193/86-02-02, Incorporate Acceptance Criteria Tolerances to Surveillance Data Sheets

The previous inspection found that many surveillance data records had parameter acceptance criteria, but no tolerance margins were specified. The record data often varied substantially from the acceptance criteria. The licensee agreed to:

a. Make the documents, logs, addendums, and surveillance consistent in requiring acceptance criteria;

b. Identify a tolerance on all acceptance criteria to determine when further evaluation is required; and

c. Incorporate limits on acceptability for determining when equipment or systems are inoperable.

The inspector reviewed the daily, monthly, and quarterly surveillance check sheets. The above corrections were made to all but the Quarterly Control Blade Check Sheet. The licensee committed to specify tolerances for blade speed, release time, and drop time on this sheet. This item remains open pending completion of licensee actions.

3.3 (Closed) 50-193/86-02-03, Calibration of the Oscilloscope Used to Calibrate Other Installed Instrumentation

The previous inspection found that all equipment used for calibration, except the Oscilloscope, were calibrated and traceable to National Standards. Since the Oscilloscope is routinely used to calibrate other installed instruments and had not been calibrated since being received from the vendor two years prior, its calibration was left unresolved.

The inspector discussed this issue with the Reactor Supervisor. They have devised a method of calibrating the Oscilloscope against a signal from a scaler. The scaler is calibrated utilizing US Naval Observatory time. Using a count-down on the seconds (clicks), an accurate start is made on a particular minute (buzzer). The scaler counts pulses for about 30 minutes and is then stopped. This calibration is at least accurate to 0.05% (1/1800 seconds). This is an acceptable tolerance and, therefore, Oscilloscope calibration, using this method, is acceptable. The licensee stated that no adjustment to the Oscilloscope has been necessary since it was purchased.

3.4 (Closed) 50-193/86-02-04, Update of NRC Form 3 - Notice to Workers

The previous inspection found the posted NRC Form 3, Notice to Workers, was out of date. The inspector confirmed that the present NRC Form 3 was current (dated 9/84).

3.5 (Closed) 50-193/86-02-05, Enriched Uranium (EU)

The previous inspection found that, although the inventory of accessible EU reads greater than 100 Rem per hour at three feet, problems with getting an approved cask might require re-irradiation in order to maintain the fuel exemption and, therefore, this issue should be reinspected. Since that time, the licensee has shipped two casks of expended fuel to be reprocessed.

The inspector reviewed the EU inventory records and found the total EU inventory in the storage racks to be less than 5,000 grams. Therefore, in accordance with 10 CFR 73.60, keeping the radiation dose rate above 100 rems per hour at 3 feet is not required. The issue of EU inventory records is readdressed in Section 5.20.

4. Facility Operation Review

The facility is primarily used by University of Rhode Island graduate students for neutron activation analysis experiments. The reactor is brought to 100% power Monday through Friday about 8:00 a.m. and shutdown about 4:00 p.m. Complete startup and shutdown check lists are performed daily. Nuclear Instrumentation (NI) calibrations are performed by physically moving a calibrated source adjacent to the detectors. Reactor protection system (RPS) operability checks are also physically performed by latching control rods, "Shim and Regulating Rods," and performing a functional "scram" of the system by placing a neutron source near the Log N detector of the Nuclear Instrumentation system to cause an increasing meter indication. Other RPS system functional checks are similarly performed.

The inspector reviewed the shift schedule to verify staffing. Operators are on a two hour watch rotation and normally on watch four hours a day, five days a week. Staffing of the facility is in accordance with Technical Specification requirements. However, one problem was noted. A relatively new Senior Reactor Operator (SRO) was signing (with some reluctance) the Restart Check Sheet, following an unplanned trip, as both the Reactor Operator (RO) and SRO. He was to confirm, as the SRO, that the cause of the scram was understood and corrected prior to restart. This is required by TS K.1.d (see Section 5.12). The inspector discussed this issue with the Director, pointing out the desirability of having independent review of operations such as reactor trips prior to restart. Agreement with this concept was communicated to the SRO by the inspector and the licensee staff. A more seasoned SRO said he had acted as the RO or SRO, but not both at the same time. The licensee committed to have an assigned SRO and a separate RO on duty during operation. The inspector had no further questions.

5. License and Technical Specification Review

By reviewing plant parameters, logs and other data along with interviews of the staff, the inspector confirmed that the following License and TS requirements were met.

5.1 License Condition 3.c.(3) states that records of emergency shutdowns and inadvertent trips, including reasons therefore, shall be kept. A record review showed that, of the 46 trips in 1986, 17 had no indication of the cause and 20 were due to range switching on the power range Nuclear Instruments (NI) circuits. Of 32 trips in 1987, 20 were due to power range NIs. The causes of the trips with no indications had been corrected by

inspection and cleaning of the control blade magnets. Although the reasons for a trip were sometimes sketchy, the required records cross-referenced the control room logs and were, therefore, acceptable.

5.2 License Condition 3.c.(4) requires recordkeeping of maintenance involving substitution or replacement of reactor equipment or components. From January 1, 1986 to the present, these records show 21 work items in 1986, 18 work items in 1987, and 5 work items to date in 1988. The 1988 work was installation of a new regulating rod gear box, replacement of the chain on the regulating rod position counter, replacement of exhaust blower belts, calibration of temperature detectors, and primary flow detector calibration. No problems were identified.

5.3 The new TS Section A page, revised by Amendment 15, was not in the control room copy. This out-of-date page was replaced. Since no other such problems were identified, this is considered an isolated incident.

The licensee has typed the TSs into a word processing system and was in the process of verifying the accuracy of the retyped version. The inspector found the retyping useful since the old TS were hard to read due to previous amendments. There are numerous out-of-date TS requirements. The inspector encouraged the licensee to review TS content and propose revisions as needed to improve TS accuracy and clarity.

5.4 TS Section B.1 requires the building to be gas tight, such that a negative differential pressure can be maintained dynamically with all gas leaks occurring inward. The inspector observed that the normal atmospheric to reactor building delta-pressure was -0.2 inches of water. Records showed that this delta-pressure decreased to -0.8 inches of water when building confinement is established. See Section 5.14 for further evaluation.

5.5 TS F.2.b requires an independent protection system after normal working hours (see Section 6.1). The licensee calls this system a "Supervisory Monitoring System," but this name is not used in the TS. This TS paragraph requires the subject protection system be separate from the system described in Section K.3.a. However, K.3.a relates to Site Operations. The licensee says that Section K.3.a once covered the Burglar Alarm System. While no inadequacy in the facility was identified in this case, this is an example showing the desirability of TS updating.

The inspector confirmed that TS F.2.b(3), Decrease of 2 Inches in Reactor Pool Water Level, and F.2.b(5), Alarm Conditions from Radiation Monitors (Reactor Bridge, Demineralizer, Thermal Column, Primary Heat Exchanger, and Fuel Safe), provide the required alarms at the Narragansett Police Station and Providence Alarm Company.

5.6 TS F.2.e addresses the control blade interlocks. The inspector confirmed Item (4), startup channel neutron counter rate above 3 cps (counts per second. The value was greater than 4 cps all week. Also, compliance with Item (5), that the startup counter is not being moved was found.

5.7 TS F.2.f and Table F.1 provide servo system interlocks and reactor safety system trips. The inspector selected 4 interlocks/trips: Log N channel period greater than 30 seconds for servo operation; pool water level trips the reactor at 2 inches decreasing; bridge misalignment trip; and any safety blade disengaged trips the reactor. These were on the Pre-Startup Check Sheet - Monthly Addendum data sheets, and were up to date.

5.8 TS G.3.a, b, and c on other radiation monitoring equipment were reviewed. Item a requires a portable neutron monitor for measuring fast and thermal neutrons to be available. It is kept in the beam port area. Item b requires reactor excursion monitors to be placed in the facility. The licensee identified 6 gamma and neutron dosimeters around the facility. Item c states "A radiation monitor shall be provided to monitor all persons leaving the reactor room for beta-gamma contamination." Although a beta-gamma monitor with two probes (one on each side of the hallway) is provided, personnel leaving the reactor room do not routinely monitor themselves. The inspector discussed this practice with the Radiation Protection Officer and the Director. They pointed out that daily smears are taken at 13 points and weekly smears at 65 points in the facility and that all experiments leaving the reactor room must be checked out in a lab room. The Director said that the TS wording was carefully chosen to require a monitor but not unnecessary monitoring each time someone left the reactor room. He agreed to investigate the practice at other research reactors and then review this practice at RIAEC. This issue will remain unresolved pending the Director's followup review (UNR 50-193/88-01-01).

5.9 TS H.2 specifies irradiated fuel storage requirements. The inspector ensured irradiated fuel outside the reactor was stored in the 18 fuel assembly racks with the outside faces covered with neutron absorbing material.

5.10 TS J.1 specifies the organization of the RIAEC Reactor Utilization Committee to be 5 specific (by title and/or by qualifications) individuals. The title of the specified Director of Operations is now "Director" and the Reactor Facility Health Physicist is now "Radiation Protection Officer." In addition, the Assistant Director for Reactor Operations has been added to committee membership. The TS should be updated to reflect the new titles.

The inspector reviewed the minutes of the most recent joint meeting of the Reactor Utilization Committee and the Radiation Safety Committee. (It has been their practice to combine these meetings for several years.) TS membership, review of reactor use and safety, and procedure reviews requirements were met.

5.11 TS J.5 requires that personnel of the Civil Defense Agency and of local fire departments shall have received training from the Civil Defense Training Officer in the use of radiological instruments. The April 1987 updated Emergency Plan (EP) contains agreements with offsite agencies. Each agreement is signed to show acceptance by the agency. The Director contacted the Civil Defense Training Officer and confirmed the required training was up-to-date.

5.12 TS K.1.d is the requirement that the operator shall not attempt to restart the reactor following an automatic scram or unexplained power decrease until the senior operator has determined the cause of the scram or power decrease and has authorized a startup. This TS was addressed in Section 4 of this report.

5.13 TS K.2 specifies controls for experiments. The inspector reviewed K.2.d, Absolute Reactivity of Any Single Independent Experiment Limited to 0.006, and K.2.e, Calculate Reactivity Worth of Any Single Independent Experiment Not Rigidly Fixed in Place Shall Not Exceed 0.0008. The 0.006 reactivity limit is estimated by the experimentor, approved by the Utilization Committee, and then measured experimentally (delta rod blade positions for critical state) when installed in the facility. Early in reactor life, a "rabbit" filled with Cadmium was introduced in the movable system next to the core. No detectable reactivity was seen. Thus, any rabbit containing poison material is below the limit. The inspector reviewed some experimental evaluations and had no further questions.

5.14 TS K.3.b(2)(a)5 is the specification for negative differential pressure between the outside and inside of the building. The delta pressure is to be at least 0.5 inches of water as indicated by the manometer located in the control room (see Section 5.4). The manometer was replaced with a gage a number of years ago. The inspector questioned the calibration of the gage. Although the Reactor Supervisor said it had been calibrated, no record of its calibration could be found. The licensee committed to add this gage calibration to the surveillance program. Also, the TS (manometer vs. gage) should be corrected. This item is unresolved pending licensee action on updating the TS (UNR 50-193/88-01-02).

5.15 TS K.3.b(d) limits the exhaust rate through the cleanup system to 4500 cubic feet per minute (cfm) with not more than 1500 cfm coming from the reactor room and passing through the charcoal scrubber. This is to be tested weekly. The purpose of this TS is to ensure adequate dilution flow in case of a release. The facility ventilization system is set to have a 3000 cfm exhaust rate. Over the years, improvements have been made to reduce the reactor room in-leakage. The resultant reactor building flow through the filters is now about 525 cfm producing a -0.7 to 0.8 inches of water delta-pressure. Thus, TS requirements are met.

5.16 TS K.3.e limits the size of the reactor core to 35 elements and requires a minimum of four operable control elements (blades). The licensee has used a 30 element core with four control blades for a number of years. Thus, this requirement is met.

5.17 TS K.3.e(3) specifies the shutdown margin (1% delta K/K in the cold, xenon-free, critical condition with the most reactive control blade and regulating rod withdrawn), the maximum servo regulating rod worth (less than 0.7% delta K/K), and the maximum reactivity addition rate for the regulating rod (0.0002 delta K/K/sec) and for the control blade (0.0002 delta K/K/sec).

By letter dated February 25, 1988, the licensee informed the NRC that TS requirements for the servo regulating rod were inconsistent. The TSs involved are:

-- E.7, Servo rod stoke of 26 inches maximum.

-- K.3.e(3)(a)2, Maximum worth of 0.7% delta K/K.

-- K.3.e(3)(b)1, Maximum eactivity rate of 0.0002 delta K/K/sec.

-- K.3.e(4)(e)1, Drive withdrawal rate less than 78 inches per minute.

This inconsistency was found during retyping and reviewing the TS. It is possible that the 0.0002 delta K/K/sec should have been 0.002 delta K/K/sec or their limit was intended to refer to only the servo operations (automatic control) of the reactor. The licensee's corrective action, however, was to replace the servo gear box with one that reduced the rod withdrawal rate to within the 0.0002 delta K/K/sec. The new gear box was installed within a week.

Failure to meet the TS K.3.e(3)(b)1 maximum reactivity addition rate of 0.0002 delta K/K/sec for the servo regulating element is a violation. However, in accordance with 10 CFR Part 2, Appendix C, Section V.A.3, no notice of violation is planned because: (1) this violation was identified by the licensee; (2) it would be a level IV or V violation; (3) it was appropriately reported to the NRC; (4) it was corrected within a reasonable time; and (5) it was not a violation that could be reasonably expected to have been prevented by corrective action for a previous violation.

5.18 TS K.3.e(4)(b)1 limits the cold, clean excess reactivity to 0.047 delta K/K. When fuel element Number 175 was added to the core on March 21, 1988, the measured excess reactivity was 1.49% or 0.0149 delta K/K. This is well within TS requirements.

5.19 TS K.3.e(4)(d) provides the control element drive performance requirements. The inspector observed the quarterly surveillance on drive withdrawal rates, control blade release times, and total control blade drop times. The data collected was less than the TS allowed values of 3.6 inches per minute, 100 milliseconds, and 900 millisecond, respectively.

5.20 TS K.3.e(4)(f) provides a fuel density limit of 0.5 E21 fissions per cubic centimeter and requires its determination at least quarterly for all fuel elements with burnup. This limit prevents fuel swelling due

to fission gas buildup. The inspector reviewed the Change in Reactor Core calculational sheets since the 1986 NRC inspection. It was noted that no determination of fission density was performed between 9/30/86 and 2/13/87 and again between 10/27/87 and 2/24/88. The licensee stated that insufficient reactivity would be available to operate the reactor long before the fission density limit would be reached. Nonetheless, failure to determine the fuel element burnup on a quarterly basis is a violation. Also, this violation illustrates the need for updating the TS to reflect current operations (VIO 50-193/88-01-03).

6. Licensee Notifications

The licensee has made the following notifications to NRC Region I since the February 1986 inspection.

6.1 Loss of Supervisory Monitoring

By letters dated April 7, 1987 and March 8, 1988, RIAEC notified NRC Region I of failures of the telephone lines between Narragansett, Rhode Island and the Rhode Island Electric Protection (RIEP) Company in Providence, Rhode Island. Loss of this telephone line disables the Supervisory Monitoring Systems addressed in Section 5.5. It also disables one-half of the Burglar Alarm System, leaving in service the half alarming at the Narragansett Police Station. Licensee response to these phone failures is to sent someone to the facility to monitor conditions until the telephones are restored. The inspector had no further questions on this issue or on the licensee's corrective actions.

6.2 Licensed Power Level Exceeded

By letter dated April 7, 1987, the licensee notified NRC Region I of short (few second) duration operation at 2.1 MW due to replacement of Safety Channel 1. The average power level for the period shortly before and after this event remained within the license limit of 2 MW. Corrective actions included moving neutron detectors into a slightly higher neutron flux field and reminding the operators of the importance of a slow, closely monitored power increase. The inspector had no further questions.

6.3 Malfunction of Safety Channel

By letter dated December 10, 1987, the licensee notified Region I that linear level safety Channel 2 had dropped to zero. The operator shut down the reactor for repair and retesting of the defective channel. (RIAEC reactor has no low level trip.) The remaining channel (Channel 1) was capable of tripping the reactor. The inspector agreed with the operator actions taken and had no further questions

6.4 Servo Regulating rod TS Violated

By letter dated February 25, 1988, the licensee identified the servo regulating rod maximum reactivity addition rate addressed in Section 5.17 of this report. Licensee corrective actions were appropriate.

6.5 Loss of Nuclear Science Center Master Key Control

By letter dated March 8, 1988, the licensee confirmed their telephone notification of the subject event. One of the employees had left his key ring, with a facility key, unattended. The inspector confirmed that locks had then been changed and key control had been discussed with the facility staff, and had no further questions.

7. Requalification Training

The requalification training program was not reviewed during this inspection. There is an existing issue regarding unproctored examinations. This is the subject of NRC Region I letter of April 30, 1987. The inspector encouraged the licensee to work toward resolution of this issue. The licensee committed to use proctors in the 1988 requalification examinations.

8. Experiments

Experiments performed at Rhode Island Atomic Energy Commission are primarily Neutron Activation Analysis. Reviews were conducted to verify that all types of experiments were reviewed and approved, that a safety evaluation was performed for each, that predicted parameters were determined and ascertained within tolerance by the licensee, and that irradiated items were properly accounted for. No unacceptable conditions were identified.

9. Independent Audit

The inspector discussed third party audits with the Director, who said that they had tried reciprocal audits with the University of Lowell. The Assistant Director for Reactor Operations had visited Lowell a few times to audit. The last report was prepared in 1979. He recalled Lowell personnel auditing RIAEC. However, no reports of findings were received. The Director is considering an audit agreement with a facility with a facility more like RIAEC in use and operation than Lowell, possibly the University of Michigan. The inspector stressed good documentation commitments in any such audit program. This matter will be reinspected.

10. Work Areas

The inspector noted that the large amount of unused equipment/apparatus around the facility and the general disarray of work areas. This concern was discussed with the licensee. The licensee had received a similar comment from a fire insurance inspector and has initiated plant cleanup as corrective action. Licensee resolution of this matter will be reinspected.

During the daily response check of NIs, the inspector observed an SRO handling the rope attached to the source with his bare hands. The source is kept in a holder at the edge of the pool, moved next to each NI, lowered to get the desired response and then returned to the holder. The SRO washed the pool water off his hands after this evolution. No contamination survey was made. The inspector discussed this operation with the SRO and the Director. Normally, there is a survey instrument in the pool work area. It was being used elsewhere. The pool water is sampled weekly and normally reads less than 1 E-3 uCi/ml. The predominate isotope is Magnesium-27. Protective clothing is used for most pool activities such as fuel element movement. The licensee committed to use gloves when moving this source and keep the GM detector near the pool for monitoring this type of operation. These commitments will be confirmed during a future inspection.

11. Record Control

Responsibility for records, control logs, surveillance/maintenance data, experiments, etc., is assigned to individual staff personnel. Only the completed control logs are stored in a safe. The licensee stated that other records could be reproduced from the control logs, if necessary. However, this would take considerable work. The inspector recommended a more centralized storage system with fire protection being considered. The Director indicated this has been discussed.

Another issue involving facility records was reviewed and approval of completed logs/check sheets. For example, the primary flow alarm and trip data was missing (not recorded) in the March Pre-Startup Check Sheet - Monthly Addendum. Management review and approval by the appropriate responsible staff should have identified this missing data. Approval is not currently documented on the logs. Adequacy of management review is left unresolved (UNR 50-193/88-02-04).

12. Technical Specifications

As discussed in Section 5, there are numerous TSs that are no longer applicable (out of date). The licensee was encouraged to utilize their word processing capabilities (the present TSs have been entered into a word processing system) to correct/update TS requirements. The Research Reactor Standard TS is an appropriate model.

13. Emergency Planning

The Nuclear Science Center Emergency Plan, dated April 1987, was reviewed (Section 5.11 addresses the EP). Drills and Table-Top lectures are to be held annually to cover medical, radiation, and communication problems. Records show drills were held on March 5 and October 3, 1986 and January 26, 1988. The licensee said one was planned for late 1987, but was postponed until after the holidays due to vacations (see Section 5.11 for evaluations of training). The Emergency Plan is up to date. The inspector had no further questions.

14. Exit Interview

At the conclusion of the inspection on March 31, 1988, the inspector met with the Director and Assistant Director for Reactor Operations and reviewed the scope and findings (i.e., violation and unresolved items in Paragraphs 5 and 11). The inspector noted the licensee's candor and good cooperation. At no time during this inspection was written material provided to the licensee by the inspector.