

October 25, 2016

Dr. Cameron Goodwin, Director
Rhode Island Nuclear Science Center
16 Reactor Road
Narragansett, RI 02882-1165

SUBJECT: RHODE ISLAND ATOMIC ENERGY COMMISSION – U.S. NUCLEAR
REGULATORY COMMISSION ROUTINE INSPECTION REPORT
NO. 50-193/2016-203

Dear Dr. Goodwin:

From September 12-15, 2016, the U.S. Nuclear Regulatory Commission (NRC or the Commission) conducted an inspection at the Rhode Island Nuclear Science Center Reactor facility. The enclosed report documents the inspection results, which were discussed on September 15, 2016 with the Assistant Director and other members of your staff.

This inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. The inspectors observed various activities in progress, interviewed personnel, and reviewed selected procedures and representative records. Based on the results of this inspection, no findings of non-compliance were identified. No response to this letter is required.

In accordance with Title 10 of the *Code of Federal Regulations*, Section 2.390, "Public inspections, exemptions, requests for withholding," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (Agencywide Documents Access and Management System (ADAMS)). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

C. Goodwin

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If you have any questions concerning this inspection, please contact Craig Bassett at 301-466-4495 or by electronic mail at Craig.Bassett@nrc.gov.

Sincerely,

/RA/

Anthony J. Mendiola, Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-193
License No. R-95

Enclosure:
As stated

cc: See next page

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Test, Research, and Training
Reactor Newsletter
University of Florida
202 Nuclear Sciences Center
Gainesville, FL 32611

C. Goodwin

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DATE	10/24/2016	10/13/2016	10/25/2016

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U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION

Docket No: 50-193

License No: R-95

Report No: 50-193/2016-203

Licensee: Rhode Island Atomic Energy Commission

Facility: Rhode Island Nuclear Science Center Research Reactor

Location: Narragansett, Rhode Island

Dates: September 8–10, 2016

Inspectors: Craig Bassett
Gary Morlang

Approved by: Anthony J. Mendiola, Chief
Research and Test Reactors Oversight Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

EXECUTIVE SUMMARY

Rhode Island Atomic Energy Commission Rhode Island Nuclear Science Center Reactor Facility NRC Inspection Report No. 50-193/2016-203

The primary focus of this routine, announced operations inspection was the onsite review of selected aspects of the Rhode Island Atomic Energy Commission's (RIAEC or the licensee) two megawatt Class I research reactor safety program including: (1) organizational structure and staffing, (2) review and audit and design change functions, (3) reactor operations, (4) operator requalification, (5) maintenance and surveillance, (6) fuel handling, (7) experiments, (8) procedures, and (9) emergency preparedness. The review covered the period of time from the last U.S. Nuclear Regulatory Commission (NRC) inspection of these areas to the present. The licensee's program was acceptably directed toward the protection of public health and safety and in compliance with the NRC requirements.

Organizational Structure and Staffing

- The organization structure appeared to be in compliance with Technical Specifications (TS) requirements.
- The present staffing level appeared to be adequate for current conditions.

Review and Audit and Design Change Functions

- The Nuclear and Radiation Safety Committee (NRSC) was meeting as required, and reviewing the topics outlined in the TS. Audits were being completed as required.
- Facility modifications and procedure changes were being evaluated in accordance with the requirements specified in Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.59.

Reactor Operations

- Reactor operations were conducted in accordance with the applicable procedures and were acceptable.

Operator Requalification

- Operator requalification was being completed as required by the licensee's Operator Requalification Program, and the program was being maintained up-to-date.
- Operators were receiving their biennial physical examinations as required.

Maintenance and Surveillance

- The program, established and implemented by the licensee, was being used to effectively complete maintenance activities at the facility.

- The surveillance program currently in use by the licensee satisfied TS requirements.

Fuel Handling

- Fuel movements were conducted in accordance with TS and procedural requirements.
- Fuel inspections were being completed annually as required.

Experiments

- The program for reviewing, authorizing, and conducting experiments satisfied TS and procedural requirements.

Procedures

- The procedural review, revision, and implementation program satisfied the requirements of TS Section 6.5, "Operating Procedures."

Emergency Preparedness

- The licensee maintained an effective emergency preparedness program through implementation of the Emergency Plan and the associated implementing procedures.

REPORT DETAILS

Summary of Facility Status

The licensee's Rhode Island Nuclear Science Center (RINSC) two megawatt Class I research reactor continued to be operated in support of research, service, education, training, and surveillance. During the inspection, the reactor was operated to irradiate samples and for a tour.

1. Organizational Structure and Staffing

a. Inspection Scope (Inspection Procedure (IP) 69006)

The inspectors reviewed the following regarding the licensee's organization and staffing to ensure that the requirements of Sections 6.1 - 6.3 of the RINSC TS, Amendment No. 30, dated December 19, 2013, were being met:

- RINSC organizational structure and staffing
- Reactor Logbook – Numbers (Nos.) 61 and 62
- Listing of the members of the Rhode Island Atomic Energy Commission
- Listing of the members of the RINSC Nuclear and NRSC

b. Observations and Findings

The inspectors reviewed the facility organization and staffing. The organization had not changed since the previous inspection and continued to be staffed as required. The Director continued to have responsibility for all activities in the facility as stipulated in the TS. Also, a licensed senior reactor operator (SRO) was assigned to each shift with the responsibility for all activities during that shift. The organizational structure at the facility appeared to be in compliance with the TS. The inspectors verified that shift staffing met TS requirements. It was also noted that the NRSC consisted of the appropriate individuals required by the TS.

In addition, it was noted that most staff members had collateral duties to perform at the facility. Despite this fact, the inspectors concluded that staffing appeared to be adequate given the current level of operation at the facility. An increase in the workload would necessitate a larger staff.

c. Conclusion

The organizational structure appeared to be in compliance with TS requirements. The present staffing level appeared to be adequate for current conditions.

Enclosure

2. Review and Audit and Design Change Functions

a. Inspection Scope (IP 69007)

The inspectors reviewed selected aspects of the following with respect to the review and audit program and design change activities to ensure compliance with TS Section 6.4, entitled "Review and Audit":

- NRSC Charter, Revision (Rev.) 4, approval dated November 23, 2015
- NRSC meeting minutes from May 2015 through the date of this inspection
- 10 CFR 50.59 screen/review forms for the latest proposed modifications or changes to the facility
- 10 CFR 50.59 screen/review forms pertaining to modifications or changes to facility procedures
- RINSC Administrative Procedure AP-03, "Facility Modifications," Rev. 1
- RINSC Annual Report for the period from July 1, 2014, through June 30, 2015, submitted to the NRC on August 28, 2015
- RINSC Annual Report for the period from July 1, 2015, through June 30, 2016, submitted to the NRC on August 25, 2016

b. Observations and Findings

(1) Review and Audit Functions

The inspectors reviewed the NRSC meeting minutes and associated records from May 2015 through the present. The records showed that meetings were being held and safety reviews and audits were conducted by various members of the NRSC or other designated persons as required, and at the required frequency. Topics of these reviews and audits were consistent with TS requirements to provide guidance, direction, and oversight for the facility, and acceptable use of the reactor.

(2) Design Change Functions

Through interviews with licensee personnel, the inspectors determined that various changes had been proposed for implementation at the facility. However, none had progressed past the proposal stage, and thus had not been submitted to the NRSC for review.

The inspectors assessed the 10 CFR 50.59 review process used at the facility. It was noted that the licensee's procedure provided guidance concerning the review of facility modifications and changes to procedures using the 10 CFR 50.59 review and evaluation process. Also, a Screening Form was used to determine whether or not a full 10 CFR 50.59 review and evaluation was required for any change being contemplated.

The inspectors noted that one recent Screening Form indicated that an upgrade to the Reactor Bay area radiation monitors had “screened out” and therefore did not require a 10 CFR 50.59 review. This issue was discussed with the licensee. The licensee indicated that what they believed to be the current Safety Analysis Report (SAR), specifically the Low-Enriched Uranium (LEU) SAR, did not mention the monitors. Because they were not mentioned in the LEU SAR, the issue had “screened out.” The NRC indicated that the SAR currently in effect for the facility was the original SAR. The LEU SAR was essentially an amendment to the original SAR and did not completely replace it. The original SAR, as amended by the LEU SAR, did mention radiation monitors, and therefore a more complete 10 CFR 50.59 review was required. The licensee was informed that the issue of completing a 10 CFR 50.59 review of the upgrades to the reactor confinement area radiation monitors would be considered an unresolved item (URI) and would be reviewed during a future inspection or would be resolved during the pending license renewal (URI 50-193/2016-203-01).

c. Conclusion

The NRSC was meeting as required and reviewing the topics outlined in the TS. Audits were being completed as required. Design changes were being evaluated in accordance with 10 CFR 50.59 requirements.

3. Reactor Operations

a. Inspection Scope (IP 69006)

The inspectors reviewed selected portions of the following documents to verify that the licensee was operating the reactor and documenting activities in accordance with TS Sections 6.1 and 6.2 and procedural requirements:

- Reactor Logbook Nos. 61 and 62
- Selected Pre-Startup Check Sheet (NSC-1) forms
- Selected Reactor Operations Request (NSC-49) forms
- Selected RINSC Reactor Operations Data (NSC-18) forms
- Selected Shift Record Data Sheet (NSC-11) forms
- Selected Shutdown Check Sheet (NSC-1C) forms
- RINSC Annual Report for the past two reporting periods as noted previously
- Periodic Maintenance Notebook containing the documentation of maintenance items
- Various RINSC Operating Procedures including: OP-01, “Reactor Operation Request,” Rev. 2; OP-02, “RINSC Pre-Start Checkout,” Rev. 17; OP-03, “Reactor Power Changes,” Rev. 7; and, OP-04, “Abnormal Procedures,” Rev. 4

b. Observations and Findings

The inspectors reviewed various forms of documentation that were required to be completed for reactor operations. The inspectors also reviewed portions of recent reactor logbooks to verify compliance with the staffing requirements of TS 6.1.2 and 6.1.3. It was noted that appropriate documentation was being completed and shift staffing was as required by the TS.

The inspectors observed various activities involving the reactor including a reactor start-up, reactor operation in support of a tour, and a test of the coolant system which resulted in a reactor scram. An SRO and reactor operator (RO) were properly assigned for those operations. Reactor operations were conducted in an appropriate manner and in accordance with procedure.

c. Conclusion

Reactor operations were generally conducted in accordance with the applicable procedures and were acceptable.

4. Operator Requalification

a. Inspection Scope (IP 69003)

The inspectors reviewed selected aspects of the following to ensure compliance with the licensee's operator requalification program outlined in RINSC Administrative Procedure AP-02, "Reactor Operator Requalification," Rev. 3:

- Reactor Logbook Nos. 61 and 62
- Individual RO and SRO requalification files containing copies of the following:
 - Operator Requalification Program Checklist forms
 - Annual Operational Requalification Exam forms
 - Biennial Operator Requalification Examinations
 - Letters from the NRC to the licensed operators documenting the issuance of an RO or SRO license
- Copies for each individuals' NRC Form 396, "Certification of Medical Examination by Facility Licensee"
- American National Standards Institute/American Nuclear Society 15.4-2007, "Selection and Training of Personnel for Research Reactors," Section 7, "Medical certification and monitoring of licensed personnel"

b. Observations and Findings

There were three licensed SROs and two ROs on staff at the facility. The licenses of these operators were reviewed and determined to be current. It was noted that one person was in training and it was anticipated that he would take an NRC license examination in early 2017.

A review of the logs and records showed that training was being conducted in accordance with the licensee's requalification and training program. Procedure reviews and examinations had been documented as required. Information regarding facility changes and other relevant information had been routed to all licensed operators who then acknowledged their review of this information.

The inspectors verified that quarterly reactor operations, reactivity manipulations, other required operations activities, and reactor supervisor activities were being generally completed as required, and the appropriate records were being maintained. It was noted that one RO had failed to complete 4 hours of reactor operation for the second quarter of 2016. That operator had been restricted from any solo reactor operation until the operator had been given an oral exam on facility and procedure changes, and had performed a minimum of 6 hours of supervised reactor operations in accordance with the Requalification Plan. Following completion of those requirements, the operator would be recertified.

Records indicating the successful completion of the annual operations tests and supervisory observations were also maintained. Biennial written exams were also being administered to the qualified operators as well. All operators were current and had completed those tests and exams.

The inspectors also noted that all operators were receiving biennial medical examinations within the allowed time frame as required. The inspectors determined that the program was being maintained up-to-date. No problems or anomalies were noted.

c. Conclusion

Operator training and requalification was being conducted in accordance with the licensee's Operator Requalification Program. Operators were receiving their biennial physical examinations as required.

5. Maintenance and Surveillance

a. Inspection Scope (IP 69006, 69010)

The inspectors reviewed the following to verify compliance with TS Section 3.0, "Limiting Conditions for Operation," and to determine if the periodic surveillance tests on safety systems were performed as stipulated in TS Section 4.0, "Surveillance Requirements":

- RINSC Maintenance Board for 2016 (spreadsheet)
- Reactor Data Notebook and associated documents
- RINSC Annual Report for the past two reporting periods as noted previously
- Confinement System Notebook and associated documents
- Primary Water Analysis Notebook and associated documents

- Secondary Water Analysis Notebook and associated documents
- Instrumentation Calibration Notebook and associated documents including:
 - Nuclear Instrument Calibration forms
 - Calibration of Various Monitors as documented on forms: NSC-12, NSC-13, NSC-46
- Maintenance Notebook and associated documents including:
 - RINSC Emergency Generator Maintenance Checklist forms (NSC-44)
 - Alarm, Scram, and Interlock Check Sheet forms (NSC-1A)
 - Completion of Testing Various Reactor Parameters as documented on forms NSC-43
- Various RINSC Reactor Parameter Testing Procedures including: TP-01, "Shim Safety Rod Drop Time Measurement," Rev. 1; TP-03, "Control Rod Reactivity Worths," Rev. 0; TP-04, "Control Rod Reactivity Insertion Rates," Rev. 2; and, TP-05, "Determining Shutdown Margin and Excess Reactivity," Rev. 0

b. Observations and Findings

(1) Maintenance

The inspectors reviewed the licensee's tracking mechanism for maintenance and surveillance activities. The inspectors verified that these activities were completed in accordance with TS and licensee procedures, and that the results met procedural requirements.

The maintenance records indicated that problems were addressed and preventive maintenance operations completed, as required by procedure. Records showed that routine maintenance activities were conducted at the required frequencies and in accordance with the TS and/or the applicable procedure.

(2) Surveillance

The inspectors reviewed various surveillance records including nuclear instrumentation calibration forms, shim safety blade inspection forms, reactivity worth calculation forms, and alarm, scram, and interlock check sheets. The data recorded in the reactor logbooks and on the surveillance records indicated that the verifications and calibrations had generally been completed on schedule and in accordance with licensee procedures. The results reviewed by the inspectors were noted to be within the TS and procedurally-prescribed parameters. Maintenance and surveillance activities ensured that equipment remained consistent with the SAR and TS requirements.

c. Conclusion

The program for conducting maintenance and for completing surveillance activities was being carried out in accordance with TS and procedural requirements.

6. Fuel Handling

a. Inspection Scope (IP 69009)

The inspectors reviewed the following to verify compliance with TS 4.9.b and 6.9.1.g, which require visual inspection of fuel elements every 5 years on a rotating basis and maintenance of records associated with fuel inventories and transfers, respectively:

- Reactor Logbook Nos. 61 and 62
- RINSC Inspection Procedure IP-01, "Core Element Movement and Inspection," Rev. 1
- Reactor Data Notebook; fuel element inspection sheet and 10 year forecast

b. Observations and Findings

The inspectors reviewed the licensee's fuel handling process and verified that fuel was moved according to an established protocol and inspected in accordance with a specific inspection schedule. The inspectors reviewed documentation of selected fuel movements and interviewed facility staff about the process. A plan for each series of fuel movements was developed prior to the activity and used for core refueling, core rearrangement, and performing inspections of fuel elements. It was noted that fuel inspections had been completed and that the inspection documents contained descriptions of fuel conditions, as well as any discolorations and markings.

The inspectors also compared the location of fuel elements in the reactor core with the information maintained on the fuel status board in the control room and on the fuel movement sheets for the latest core, LEU Core No. 6. No problems or anomalies were noted. It was also noted that the fuel handling equipment was properly stored and secured.

c. Conclusion

Fuel movements were conducted in accordance with written procedures that met TS requirements. Fuel inspections were being completed annually as required.

7. Experiments

a. Inspection Scope (IP 69005)

The inspectors reviewed selected aspects of the following to verify that the licensee was in compliance with TS Sections 3.1, 3.8, 4.1, and 4.8:

- Reactor Logbook Nos. 61 and 62
- 2014 Operating Data Notebook – Volume 1 of 1
- Experimental administrative controls and precautions
- Various RINSC Operating Procedures including: OP-01, "Reactor Operation Request," Rev. 2; OP-02, "RINSC Pre-Startup Checkout," Rev. 17; and, OP-03, "Reactor Power Changes," Rev. 7
- Various RINSC Experiment Procedures including: XP-01, "Reactor Experiment Request," Rev. 2; XP-02, "Reactor Experiment Approval," Rev. 5; XP-03, "Rabbit Irradiations," Rev. 1; XP-04, "Incore Irradiations," Rev. 1; XP-10, "Dry Irradiation Facility Irradiations," Rev. 0; and, XP-12, "Gamma Tube Irradiations," Rev. 1

b. Observations and Findings

The majority of the experiments conducted at the facility were ones that have been in place for several years. However, since the last inspection in this area, two new experiments had been reviewed and approved and two others were being developed. The experiments involved irradiation of Graphene and irradiation of Tetrac (tetraiodothyroacetic acid). The inspectors verified that each of the experiment proposals included a discussion of the proposed experiment, as well as the hazards involved and the anticipated results. The experiments had been reviewed and approved by the reactor staff and were subsequently reviewed and approved by the NRSC as required.

The inspectors verified that the appropriate irradiation request forms for the various operations were completed and approved as required. The inspectors also noted that all experiments were being conducted using approved methods and with the cognizance of the SRO on duty in accordance with TS and procedural requirements. The experiments were documented on the appropriate forms and in the operations log as required. Engineering and radiation protection controls were implemented as required to limit exposure of the workers handling the irradiated samples.

c. Conclusion

The program for reviewing, authorizing, and conducting experiments satisfied TS and procedural requirements.

8. Procedures

a. Inspection Scope (IP 69008)

To verify that facility procedures were being prepared, reviewed, revised, and implemented as required by TS Section 6.5, "Operating Procedures," the inspectors reviewed selected aspects of:

- Reactor Logbook Nos. 61 and 62
- RINSC Maintenance Procedure MP-01, "Confinement Ventilation Systems Surveillance," Rev. 1, NRSC approval dated July 26, 2016
- RINSC Maintenance Procedure MP-02, "Emergency Air Filter Efficiency Test," Rev. 4, NRSC approval dated May 17, 2016
- RINSC Maintenance Procedure MP-11, "Emergency Power Systems Operational Test," Rev. 1, NRSC approval dated September 12, 2016
- RINSC Operating Procedure OP-02, "RINSC Pre-Start Checkout," Rev. 17, NRSC approval dated March 14, 2016
- RINSC Operating Procedure OP-03, "Reactor Power Changes," Rev. 7, NRSC approval dated March 21, 2016
- NRSC meeting minutes from May 2015 through the date of this inspection

b. Observations and Findings

Procedures had been developed for the safe, routine operation of the reactor. Records showed that procedures for potential malfunctions (e.g., radioactive releases and contaminations, and abnormal events) had also been developed and were available. The inspectors verified that substantive procedural changes, as well as all new procedures, were being screened in accordance with the licensee's 10 CFR 50.59 process. Following that, the procedures were reviewed and approved by the NRSC as required by TS.

Through observation of various activities at the facility, including reactor operation, the inspectors determined that licensee personnel conducted activities in accordance with applicable procedures.

c. Conclusion

The procedural review, revision, and implementation program satisfied TS Section 6.5 requirements.

9. Emergency Preparedness

a. Inspection Scope (IP 69011)

The inspectors interviewed staff members, reviewed the following documents, and visited the support organization facility discussed below to verify compliance

with regulatory requirements and the RINSC Emergency Plan, Rev. 5, NRSC approval dated October 20, 2015:

- Emergency Preparedness Notebook containing documentation of various activities including:
 - Fire Alarms Tests
 - Completion of annual Emergency Supply Inventories documented on Form NSC-83
 - Emergency training and drills conducted during the past two years
 - Emergency Communication Tests conducted with various support agencies
- RINSC Emergency Procedure EP-01, "Emergency Plan Implementing Procedures," Rev. 3
- Letter of Agreement between Narragansett Police Department and RINSC, signed by Mr. M. J. Davis and by Chief S. Corrigan, dated March 10, 2016
- Letter of Agreement for Medical Services, signed by L. Sivaprasad, MD, Vice President of Medical Affairs and Chief Medical Officer, Rhode Island Hospital, addressed to Dr. C. Goodwin, RIAEC, dated June 23, 2016
- Letter of Agreement between Narragansett Fire Department and RINSC, signed by Mr. M. J. Davis and Chief S. Partington on December 15, 2016

b. Observation and Findings

The inspectors reviewed the Emergency Plan in use at the reactor and verified that it was being reviewed and updated biennially as required. The inspectors reviewed the associated implementing procedures as well, and noted that they were also reviewed biennially and revised as needed.

Through records review and interviews with staff personnel (e.g., emergency responders), the inspectors determined that they were knowledgeable of the proper actions to take in case of an emergency. Training for these individuals was accomplished annually through evacuation and emergency drill participation, as well as biennially through the Reactor Operator Requalification program. Training for support organization personnel was provided whenever those organizations were available and/or requested such training.

The documentation of the training and drills conducted during the past 2 years was reviewed. Through drill scenarios and records review, and personnel interviews, off-site emergency responders were determined to be knowledgeable of the appropriate actions to take when responding to an emergency at the RINSC facility. Emergency and evacuation drills had been conducted annually as required by the Emergency Plan. Critiques following each drill had been conducted as required and the results documented. Recommendations were made to correct any deficiencies noted during the drill.

The inspectors verified that the Letters of Agreement that had been established between the RINSC facility and the Narragansett Police Department and Narragansett Fire Department remained in effect. These agreements stipulated that police and fire personnel would respond during an emergency and would provide support for the facility. The inspectors also verified that the agreement between the reactor facility and Rhode Island Hospital remained in effect. That agreement indicated that the hospital would provide RINSC personnel with needed support in case an individual became contaminated and needed emergency medical care.

Communications capabilities with support groups were acceptable and the various items of equipment (e.g., telephones and the building public address system) were in use daily. Portable radios were also available for use as needed and were checked annually. Emergency call lists had been revised and updated as needed and were available in the control room and in various areas around the facility as required, as well as in the Emergency Support Center.

The inspectors visited the facility ESC located in a separate building and observed the emergency supplies, instruments, and information maintained in the locker located there in accordance with the Emergency Plan. The licensee maintained records indicating that the emergency supplies were inventoried on an annual basis as part of the surveillance program required by the Emergency Plan.

The inspector and the RINSC Health Physicist visited Rhode Island Hospital in Providence, RI. The hospital appeared to be sufficiently equipped to handle a radiological emergency involving anyone from the RINSC facility. There appeared to be a good working relationship between the facility staff and the hospital personnel.

c. Conclusion

The licensee maintained an effective emergency preparedness program through implementation of the Emergency Plan and the associated implementing procedures.

10. Follow-up on Previously Identified Item

a. Inspection Scope (IP 92701)

The inspectors reviewed two URIs identified during previous inspections that took place in September 2015 and September 2013.

b. Observation and Findings

- (1) URI – 50-193/2015-202-01 – Follow-up and Review the licensee's actions to determine the cause of the reactor scram that occurred on November 10, 2014.

During an inspection in September 2015, the inspector reviewed a scram event reported by the licensee. According to the licensee's Annual Report for July 2014–June 2015, an overpower scram occurred on November 10, 2014. This apparently happened while an SRO was attempting to bring the idled cooling Loop No. 1 on line and switch over from using cooling Loop No. 2 to Loop No. 1. This was done to try to bring coolant temperature down because it was suspected that Loop No. 2 was not performing as it should. Initially the licensee theorized that once the cold water from Loop No. 1 was injected into the core, it had a large positive reactivity impact creating a rapid increase in power which resulted in an overpower automatic reactor scram (i.e., raised the power level to the trip set point of 115 percent).

During the exit meeting with the licensee, the inspector indicated that there appeared to be several unanswered questions concerning this event. During a subsequent exit meeting with the licensee on September 17, 2015, the licensee indicated that they had investigated the event further. They indicated that they had tried to re-create the coolant flow circumstances that existed on November 10, 2014. During their test, with the reactor shutdown but the pumps operating, they tried to swap from one cooling loop to another. Under those circumstances they got a low flow scram. Following that test, they concluded that the scram that occurred last November was a low flow scram and not an overpower scram. The licensee was informed that the issue would be considered a NRC Violation and would be reviewed during a subsequent inspection. Subsequently, the licensee conducted a complete review of the overpower event and documented their conclusion that the scram was caused by low flow. They submitted a written report to the NRC.

During this inspection the overpower scram changed to a low primary coolant flow scram was reviewed. The inspectors completed a detailed visual inspection of the primary and secondary coolant systems from the reactor core to the cooling towers. This included all valves, instrumentation and piping arrangements. After reviewing all trend displays and data collected, possible scenarios were evaluated.

First of these was a cold water slug entering the core and causing a spike in reactor power. Temperature traces of primary coolant temperature do not indicate a sudden decrease in core inlet temperature. The actual temperature drop was only 5 degrees Fahrenheit over an eleven minute period. This is well within the capabilities of the automatic control system as demonstrated by calculations that show the control system is capable of handling an instantaneous temperature change of 20 degrees Centigrade. This temperature is read by a remote detector in the combined line from both the primary coolant pumps and is displayed on the trace of core inlet temperature.

The second possible scenario considered was an air slug from the primary cooling system entering the area of the core near the in-core detectors. This is, in fact, not possible since the reactor pool maintains a positive head on the cooling system at all times, therefore keeping the system full of water. If an air slug were to enter the pool it would be in the area of the top of the core where the gate valve opens. This air would immediately rise to the surface of the pool and not be able to reach the area of the core where the in-core nuclear instrumentation detectors are located.

The third scenario discussed was electrical interference through the installed electrical system developed when the primary coolant pump in loop 1 was started. The power supplies for the primary cooling pumps are separate from the power supplies for the nuclear instrumentation. They are physically located on different floors of the building and not tied together in any way.

Documented in the console log book as previously mentioned, is that both wide range channel alarms had gone off at 115 percent power. The traces of the wide range power do not show any spikes in the power signal. The standard fluctuation of the signal is normally less than 5 percent. The only conceivable cause for this is a noise spike in the system of unknown origin. The power supply system for the entire facility is very old and in need of replacement, it is hard to ascertain what may have caused this noise spike.

On September 14, 2016, at 1100 following a tour of the facility by URI faculty members, an attempt was made to duplicate the events of November 10, 2014. Both inspectors observed the test to shift the primary cooling loops. Reactor power was lowered to 90 percent of full power. Primary pump number 2 was in operation with flow at 2050 gallons per minute (gpm). Primary pump number 1 was started, this reduced the flow in loop 2 to about 1850 gpm. Primary loop 1 flow jumped to 1680 gpm and leveled off at 1640 gpm. Within a minute a low primary flow scram was automatically generated; this occurs between 1600 and 1680 gpm. As documented by the licensee, the original scram in November 2014 was in fact caused by a low primary flow alarm. The reason for the wide range channel 1 and 2 high power trips has not been duplicated. The licensee plans to do some additional testing and, as a matter of routine operations, not to shift primary cooling loops while the reactor is operating. As a result of the above considerations, this URI will be closed. However, other issues concerning the reactor cooling system will continue to be reviewed during the license renewal process.

- (2) URI – 50-193/2013-202-01 – Follow-up on the issue of digital instrumentation and control modifications to the facility.

During an NRC inspection in September 2013, it was noted that various 10 CFR 50.59 reviews dealt with digital instrumentation and control modifications made at the facility. The licensee had reviewed these changes under the requirements in 10 CFR 50.59, and concluded that the changes did not require prior NRC approval. The design change review had been conducted, as directed, by their RINSC procedure, and had been reviewed and approved by the NRSC. However, during the inspection, the inspectors discussed with the licensee whether the modification had introduced the possibility of a common cause failure and whether the newly installed equipment was of high quality. This issue was also discussed during a conference call with the licensee and other NRC staff members on October 23, 2013. The licensee was informed that this issue would be tracked as a URI.

During this inspection the inspectors reviewed this issue. The inspectors noted that the digital instrumentation that had been placed into operation did not replace any of the analog equipment relied upon for safe reactor operation, but was functioning in conjunction with the analog equipment. The digital equipment had operated in this configuration for several years without any apparent problems noted. This issue is considered closed. However, general issues concerning reactor instrumentation will continue to be reviewed as part of the license renewal process.

c. Conclusion

URI 50-193/2015-202-01 involving an apparent overpower reactor scram was reviewed and closed. URI 50-193/2013-202-01 involving digital instrumentation and control modifications at the facility was reviewed and closed.

11. Exit Interview

The inspectors presented the inspection results to licensee management at the conclusion of the inspection on September 15, 2016. The inspectors described the areas inspected, and discussed in detail the inspection observations. The licensee acknowledged the findings presented and did not identify as proprietary any of the material provided to or reviewed by the inspectors during the inspection.

PARTIAL LIST OF PERSONS CONTACTED

Licensee Personnel

C. Chichester	Chairman, Rhode Island Atomic Energy Commission
J. Davis	Assistant Director, Rhode Island Nuclear Science Center
C. Hathaway	Health Physicist
M. Marrapese	Principle Reactor Operator (in training)
P. Martin	Reactor Supervisor/Senior Reactor Operator
B. Sirr	Facility Engineer

Other Personnel

G. Donovan	Radiological Safety Technician, Rhode Island Hospital
S. Mathews	Senior Medical Physicist, Landauer Medical Physics (contractor working for Rhode Island Hospital)
S. Patefield	Director, Facilities/Engineering Management, Rhode Island Hospital

INSPECTION PROCEDURES USED

IP 69003	Class 1 Research and Test Reactor Operator Licenses, Requalification, and Medical Examinations
IP 69005	Class I Research and Test Reactor Experiments
IP 69006	Class 1 Research and Test Reactors Organization and Operations and Maintenance Activities
IP 69007	Class I Research and Test Reactor Review and Audit and Design Change Functions
IP 69008	Class I Research and Test Reactor Procedures
IP 69009	Class 1 Research and Test Reactors Fuel Movement
IP 69010	Class 1 Research and Test Reactors Surveillance
IP 69011	Class 1 Research and Test Reactors Emergency Preparedness
IP 92701	Follow-up on Previously Identified Items

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-193/2016-203-01	URI	Review the results of the licensee's 10 CFR 50.59 review of the upgrades to the Area Radiation Monitors in the Reactor Bay Confinement.
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Closed

50-193/2015-202-01	URI	Follow-up and Review the licensee's actions to determine the cause of the reactor scram that occurred on November 10, 2014.
50-193/2013-202-01	URI	Follow-up on the issue of digital instrumentation and control modifications to the facility.

LIST OF ACRONYMS USED

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
ADAMS	Agencywide Document Access Management System
IP	Inspection Procedure
gpm	Gallons per minute
Nos.	Numbers
NRC	U.S. Nuclear Regulatory Commission
NRSC	Nuclear and Radiation Safety Committee
NSC	Nuclear Science Center
RIAEC	Rhode Island Atomic Energy Commission
RINSC	Rhode Island Nuclear Science Center
RO	Reactor Operator
SAR	Safety Analysis Report
SRO	Senior Reactor Operator
TS	Technical Specifications
URI	Unresolved Item