UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 19, 2019

Dr. Wei Ji, Director
Reactor Critical Facility
Rensselaer Polytechnic Institute
JEC room 5040
110 8th Street
Troy, NY 12180-3590

SUBJECT: RENSSELAER POLYTECHNIC INSTITUTE – NUCLEAR REGULATORY COMMISSION ROUTINE INSPECTION REPORT NO. 05000225/2019201

Dear Dr. Ji:

From August 12-16, 2019, the U.S. Nuclear Regulatory Commission (NRC) conducted an inspection at the Rensselaer Polytechnic Institute research reactor. The inspection included a review of activities authorized for your facility. The enclosed report documents the inspection results which were discussed on August 16, 2019, with you, Dr. Shekhar Garde, Dean for the School of Engineering, and members of your staff.

The inspection examined activities conducted under your license as they relate to public health and safety, compliance with the Commission's rules and regulations, and compliance with the conditions of your license. Within these areas, the inspection consisted of selected examination of procedures and representative records, observations of activities, and interviews with personnel.

Based on the results of this inspection, the NRC has determined that a Severity Level IV violation of NRC requirements occurred. This violation is being treated as a non-cited violation (NCV), consistent with Section 2.3.2 of the Enforcement Policy. The NCV is described in the subject inspection report. No response to this letter is required, however, if you contest the violation or significance of the NCV, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington DC 20555-0001.

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.

Should you have any questions concerning this inspection, please contact Mr. Michael Takacs at (301) 415-2042 or electronic mail at Michael.Takacs@nrc.gov.

Sincerely,

/RA/

Anthony Mendiola, Chief
Research and Test Reactors Oversight Branch
Division of Licensing Projects
Office of Nuclear Reactor Regulation

Docket No. 50-225
License No. CX-22

Enclosure:
As stated

cc: See next page

cc:

Mayor of the City of Schenectady
Schenectady City Hall
105 Jay St.
Schenectady, NY 12305

Dr. Shekhar Garde
Dean, School of Engineering
Rensselaer Polytechnic Institute
110 8th Street
Troy, NY 12180-3590

Reactor Operations Supervisor
Rensselaer Polytechnic Institute
JEC Room 2049
Department of Mechanical Aerospace
and Nuclear Engineering
110 8th Street
Troy, NY 12180-3590

Chief, Radiation Section
Division of Environmental Remediation
NY State Dept. of Environmental
Conservation
625 Broadway
Albany, NY 12233-7255

Radiation Safety Officer
Rensselaer Polytechnic Institute
21 Union Street
Gurley Building 2nd Floor
Troy, NY 12180

RCF Supervisor
Rensselaer Polytechnic Institute
NES Building, Room 1-10,
MANE Department
110 8th St.
Troy, NY 12180

Annette Chism, Director EH&S
Rensselaer Polytechnic Institute
21 Union Street
Gurley Building 2nd Floor
Troy, NY 12180

State Liaison Officer Designee
Senior Project Manager
Radioactive Waste Policy and Nuclear
Coordination
New York State Energy Research &
Development Authority
17 Columbia Circle
Albany, NY 12203-6399

Test, Research, and Training
Reactor Newsletter
Attention: Ms. Amber Johnson
Dept of Materials Science and Engineering
University of Maryland
4418 Stadium Drive
College Road, MD 20742-2115

SUBJECT: RENSSELAER POLYTECHNIC INSTITUTE – NUCLEAR REGULATORY COMMISSION ROUTINE INSPECTION REPORT NO. 05000225/2019201
DATE: SEPTEMBER 19, 2019

DISTRIBUTION:

PUBLIC	XYin, NRR	NParker, NRR
RidsNrrDlpProb	AMendiola, NRR	GCasto, NRR
RidsNrrDlpPrlb	LTran, NRR	
MTakacs, NRR	PROB R/F	

ADAMS ACCESSION NO.: ML19252A179 *concurred via email NRC-002

OFFICE	NRR/DLP/PROB/SS*	NRR/DLP/PROB/LA*	NRR/DLP/PROB/BC
NAME	MTakacs	NParker	AMendiola
DATE	9/10/2019	9/9/2019	9/19/2019

OFFICIAL RECORD COPY

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

Docket No:	50-225
License No:	CX-22
Report No:	05000225/2019201
Licensee:	Rensselaer Polytechnic Institute
Facility:	Reactor Critical Facility
Location:	Schenectady, NY
Dates:	August 12-16, 2019
Inspector:	Michael Takacs
Approved by:	Anthony Mendiola, Chief Research and Test Reactors Oversight Branch Division of Licensing Projects Office of Nuclear Reactor Regulation

Enclosure

EXECUTIVE SUMMARY

Rensselaer Polytechnic Institute
Reactor Critical Facility
Nuclear Regulatory Commission
Inspection Report No. 05000225/2019201

The primary focus of this announced safety inspection was the onsite review of selected aspects of the Rensselaer Polytechnic Institute's (RPI's or the licensee's) 100 watt, Class II research reactor safety program which includes: (1) procedures, (2) experiments, (3) health physics, (4) design changes, (5) committees, audits and reviews, and (6) inspection of transportation activities. The licensee's safety program was acceptably directed toward the protection of public health and safety and generally in compliance with the U.S. Nuclear Regulatory Commission (NRC) requirements. One previous inspection follow-up item (IFI) was closed, two IFIs were opened, and one Severity Level IV non-cited violation (NCV) was identified.

Procedures

- Procedure review and approval satisfied technical specification (TS) requirements.
- One NCV was identified for failure to connect the detector cable to its safety system channel during reactor startup.
- One IFI was opened regarding the licensee's revision to the Reactor Critical Facility (RCF) pre-startup procedure pertaining to the test cable status for each safety system channel.
- One IFI was opened regarding a loose cap screw that prevented control rod number 3 from fully seating following a scram.

Experiments

- One previously issued IFI was closed regarding incorporating the screening criteria information into the safety analysis document for new experiments.
- No new experiments have been conducted since the last inspection.

Health Physics

- Postings met regulatory requirements.
- Personnel dosimetry was being worn and recorded doses were within the NRC's regulatory limits.
- Radiation monitoring equipment was being maintained and calibrated as required.
- The radiation protection program satisfied regulatory requirements.

- The radiation protection training program was being administered as required.

- Environmental monitoring satisfied regulatory requirements.

Design Changes

- No changes, tests, or experiments, subject to the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) 50.59, “Changes, tests and experiments,” were performed.

- One IFI from the previous inspection was closed, IFI 50-225/2017-201-01, regarding licensee submission of the 10 CFR 50.59(c)(2) screening criteria requirements.

Committees, Audits and Reviews

- Audits and reviews were generally being conducted by designated individuals and reviewed by the Nuclear Safety Review Board (NSRB) in accordance with the requirements specified in TS Section 6.2, “Review and Audit.”

Inspection of Transportation Activities

- No radioactive material was transferred to or from the RCF since the last inspection.

REPORT DETAILS

Summary of Facility Status

The RPI RCF Class II research reactor, although licensed to operate at a maximum steady-state thermal power of 100 watts, is limited to a maximum thermal power of 15 watts as specified by RCF operating procedure. The RCF is currently only operated in order to maintain operator proficiency and reactor surveillance activities. During the inspection, the reactor was started up for the purpose of operator proficiency but had to be shutdown before operations could continue due to operator error. The reactor remained shutdown for the remainder of the inspection.

1. Procedures

a. Inspection Scope (Inspection Procedure (IP) 69001)

The inspector reviewed the following to ensure that the requirements of TS Section 6.4, "Procedures," were being met concerning written procedures:

- RCF Pre-Startup Procedure, version 8.4; dated April 2018
- RCF Operating Procedure, version 3.0; dated July 2013
- RCF Emergency Procedures, version 3.1; dated March 2017
- Reactor operations logbook entries from September 2017 to the present

b. Observations and Findings

The inspector determined that written procedures were available for the activities delineated in TS Section 6.4. The licensee updated several procedures which were approved by the NSRB before they were implemented. The inspector reviewed the updated procedures and found them to be acceptable.

On August 14, 2019, the inspector observed a reactor operator (RO) performing a routine reactor startup based on the RCF pre-startup procedure referenced above. At 19:24, during the reactor startup evolution with the reactor critical, the RO informed the senior reactor operator (SRO) that one of the three safety system channels, log power channel PP2, was not responding to the increase in reactor power. The two other safety system channels, linear power channels LP2 and LP3, were both indicating an increase in reactor power during the reactor startup. The SRO on watch instructed the RO to shutdown the reactor. Upon investigation, the SRO discovered that the input to power channel PP2 was still connected to its test cable and not to its neutron detector cable as required by the RCF pre-startup procedure. The SRO also observed that power channels LP1 and LP2 were properly connected to their associated neutron detector cables and both had indicated that reactor power had reached approximately 0.14 watts before the reactor was scrammed.

The inspector observed that this particular issue had been promptly identified by the licensee, followed by an immediate shutdown of the reactor. The licensee also reported the occurrence to the NRC Headquarters Operations Center as

required by TS Section 6.7, “Required Actions in the Event of a Reportable Occurrence,” specification 2. To prevent recurrence, the licensee has committed to revise the procedure, “RCF Pre Startup Procedure,” version 8.4, dated August 2018, to include a new step requiring the posting of a warning tag on the reactor control shim switch to alert the operator that the safety system channel input for PP2, LP1 or LP2 is connected to its test source cable and not to its associated neutron detector cable. This revision to the procedure will be tracked as IFI 05000225/2019201-02. The inspector reviewed reactor logbook entries, including interviews with licensee staff, and determined that this problem had not occurred within the past two years. In addition, the inspector noted while observing the reactor startup, that this occurrence was due solely to operator error.

TS Section 3.2, “Reactor Control and Safety Systems,” specification 6, requires that all three safety system channels (PP2, LP1, and LP2) are operable during reactor operation. The inspector informed the licensee that the failure to have all three safety system channels operable during reactor operation was a Severity Level IV violation consistent with Section 6.1.d.1. of the NRC Enforcement Policy. However, the inspector noted that all of the criteria under Section 2.3.2, “Non-Cited Violation,” of the NRC Enforcement Policy were satisfied. As a result, the inspector informed the licensee that this Severity Level IV violation would be treated as an NCV and will be identified as NCV 05000225/2019201-01.

In addition to the above occurrence, following the reactor scram, the rod bottom light for one of the four control rods (control rod number 3) was not lit and its digital rod position indication at the console indicated that it was stuck at 1.7 inches from the bottom. The remaining control rods indicated full insertion with their associated rod bottom lights lit. With the reactor shutdown, the licensee drained the reactor tank and then entered the reactor tank. Upon investigation, the licensee determined that a loose object was lodged at the bottom of control rod number 3. This loose object was a 1 ½ inch long by ¼ inch wide steel cap screw. The licensee was able to retrieve the cap screw, which allowed the control rod to be fully inserted. The inspector informed the licensee that this event will be tracked as IFI 05000225/2019201-03 regarding the source of the loose cap screw that prevented control rod number 3 from fully seating to its normal rod bottom position.

c. Conclusion

Procedure review and approval satisfied TS requirements. One NCV was identified for failure to connect the neutron detector cable to its associated safety system channel during reactor startup. In addition, one IFI was opened regarding the licensee’s plan to revise the RCF pre-startup procedure pertaining to the test cable status for each safety system channel. Another IFI was also opened regarding the source of the loose cap screw that prevented control rod number 3 from fully seating following the reactor scram. Before granting approval for a reactor restart, the NSRB will: (1) review the NCV, (2) review and approve the revision to the RCF pre-startup procedure, and (3) determine the source of the loose cap screw. Once the approval for the reactor restart is granted, the licensee will perform rod drop tests prior to resuming normal reactor operations.

2. Experiments

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of the following to verify compliance with TS Section 3.8, “Experiments,” and TS Section 6.5, “Experiment Review and Approval”:

- Reactor operations logbook entries from September 2017 to the present
- Annual Operating Reports for 2017 and 2018

b. Observations and Findings

Through review of the reactor operations logbook and interviews with licensee staff, the inspector determined that the review and approval process for new experiments would be conducted as required by licensee procedures and in accordance with the TS.

c. Conclusion

No new experiments have taken place since the last inspection.

3. Health Physics

a. Inspection Scope (IP 69001)

To verify compliance with 10 CFR Part 19, “Notices, Instructions and Reports to Workers: Inspection and Investigations and 10 CFR Part 20, “Standards for Protection against Radiation,” and TS Sections 3.7, 4.7, “Radiation Monitoring,” and TS Section 6.3, “Radiation Safety,” the inspector reviewed selected aspects of:

- Dosimetry records from 2017 to present
- Calibration certificates for portable survey instruments for the past year
- NSRB quarterly radiation safety audits
- Radiation training records
- Radiation Safety Annual Report for 2018
- Annual Operating Reports for 2017 and 2018

b. Observations and Findings

(1) Postings and Notices

The inspector reviewed the postings required by 10 CFR Part 19 at the entrances to various controlled areas including the reactor room and the fuel vault. The areas were found to be properly posted and no unmarked radioactive material was found in the facility. A copy of the current NRC Form 3, “Notice to Employees,” was also posted.

(2) Dosimetry

The inspector observed that the dosimetry was used acceptably by facility personnel. The licensee used a National Voluntary Laboratory Accreditation Program-accredited vendor to process personnel dosimetry. An examination of the records for the inspection period showed that all exposures were within NRC limits and within licensee action levels.

(3) Radiation Monitoring Equipment

The inspector reviewed the surveillances for the radiation monitoring equipment for the inspection period which include checks and calibration. Survey meters are sent to an outside company called "Radiation Safety and Control Services," for calibration, with some survey meters currently out for calibration. The inspector determined that the licensee was adhering to TS Section 4.7.

(4) Radiation Protection Program

The inspector verified that the radiation protection program was reviewed annually as required. Annual radiation worker training was conducted online or in classroom as required.

(5) Environmental Monitoring

The inspector reviewed environmental monitoring dosimetry records for the inspection period. Several thermoluminescent dosimeters were placed in locations around the perimeter of the RCF. Records for 2017 to the present indicate that doses were well below the applicable regulatory limits and were typically at background levels.

(6) Surveys

The inspector verified that quarterly leak testing was performed by the Radiation Safety Officer on the three Cobalt-60 sources located inside the fuel vault, the plutonium-beryllium source in the reactor tank, and the criticality monitor plutonium source located outside of the fuel vault.

c. Conclusion

Based on the observations made and the records reviewed, it was determined that: (1) postings met regulatory requirements, (2) personnel dosimetry was being worn and recorded doses were within the NRC's regulatory limits, (3) radiation monitoring equipment was being maintained and calibrated as required, (4) the radiation protection program satisfied regulatory requirements, (5) environmental monitoring met regulatory requirements, and (6) surveys of sealed sources also satisfied regulatory requirements.

4. Design Changes

a. Inspection Scope (IP 69001)

To ensure that facility changes were reviewed and approved as required by TS Section 6.2 and 10 CFR 50.59(c)(2), the inspector reviewed selected aspects of:

- Annual Operating Reports for 2017 and 2018
- Reactor operations logbook entries from September 2017 to the present
- NSRB meeting minutes from May 2017 to May 2019

b. Observations and Findings

Through review of applicable records and interviews with licensee personnel, the inspector verified that no changes, tests, or experiments, subject to 10 CFR 50.59 requirements, were performed since the last inspection.

c. Conclusion

No changes, tests, or experiments have occurred since the last inspection.

5. Committees, Audits and Reviews

a. Inspection Scope (IP 69001)

The inspector reviewed the following to ensure that the audits and reviews stipulated in TS Section 6.2 were being completed:

- NSRB meeting minutes from May 2017 to May 2019
- NSRB Audit Forms 1-4 for 2018 and 2019
- Annual Operating Reports for 2017 and 2018

b. Observations and Findings

The inspector verified that the NSRB conducted meetings at least semiannually, as required by TS Section 6.2. The inspector reviewed the NSRB meeting minutes since the last inspection and determined that the NSRB provided appropriate guidance and direction for reactor operations. In addition, the inspector noted that since the last inspection, the required audits of reactor operations, procedures, equipment, and emergency preparedness had been completed and documented by a designated individual and reviewed by the NSRB as required.

c. Conclusion

Audits and reviews were generally being conducted by designated individuals and reviewed by the NSRB in accordance with the requirements specified in TS Section 6.2.

6. Inspection of Transportation Activities

a. Inspection Scope (IP 86740)

The inspector reviewed selected aspects of:

- Annual Operating Reports for 2017 and 2018
- Interviews with RCF staff

b. Observations and Findings

No radioactive material was transferred to or from the reactor since the last inspection. If needed, material would be transferred to the university's radioactive material license issued by the State, and then packaged and shipped by RPI Environmental Health and Safety personnel.

c. Conclusion

No radioactive material was transferred to or from the RCF since the last inspection.

7. Previously Identified Inspection Follow-up Items

a. Inspection Scope (IP 92701)

The inspector reviewed the actions taken by the licensee to address the previously identified IFI 50-225/2017-201-01.

b. Observation and Findings

During the previous inspection in September 2017, the inspector found that although a new experiment had been approved by the NSRB, the requirement under TS Section 6.5 to document the 10 CFR 50.59(c)(2) screening criteria information had not been incorporated into the safety analysis document. The inspector discussed this matter with the RCF Director. The RCF Director was later able to provide the associated screening criteria information for the new experiment and agreed to incorporate this information into the above-mentioned safety analysis document, as well as include this type of information into all future safety analysis reports. The inspector opened IFI 50-225/2017-201-01 to follow up on the submission of the 10 CFR 50.59(c)(2) screening criteria requirements.

During this inspection, the inspector verified that the licensee incorporated the 10 CFR 50.59(c)(2) screening criteria information into the above-mentioned safety analysis document for the previously approved experiment. The licensee also agreed to include this information into all new experiments.

c. Conclusion

IFI 50-225/2017-201-01 was reviewed and the inspector determined that this issue is closed.

8. Exit Interview

The inspection scope and results were discussed on August 16, 2019, with licensee representatives. The inspector discussed the findings for each area reviewed. The licensee acknowledged the inspection findings and did not identify as proprietary any of the material provided to, or reviewed by, the inspector during the inspection.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

S. Garde	Dean, School of Engineering
W. Ji	Reactor Critical Facility Director
G. Winters	Reactor Critical Facility Operations Supervisor
H. Kang	NSRB Chair
A. Chism	Environmental Health and Safety Director
M. Arha	Radiation Safety Officer

INSPECTION PROCEDURES USED

IP 69001	Class II Research and Test Reactors
IP 86740	Inspection of Transportation Activities (N/A for this inspection)
IP 92701	Follow-up

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

NCV 05000225/2019201-01	Failure to connect the detector cable to its associated safety system channel during reactor startup
IFI 05000225/2019201-02	Follow-up on licensee's revision to the RCF pre-startup procedure regarding test cable status for each safety system channel
IFI 05000225/2019201-03	Follow-up on the source of the loose cap screw that prevented control rod number 3 from fully seating following a scram

Closed

IFI 50-225/2017-201-01	Follow-up on licensee's action to incorporate the 10 CFR 50.59(c)(2) screening criteria information into the safety analysis document for all new experiments.
NCV 05000225/2019201-01	Failure to connect the detector cable to its associated safety system channel during reactor startup

Discussed

None

LIST OF ACRONYMS USED

10 CFR	Title 10 of the *Code of Federal Regulations*
IFI	Inspection Follow-Up Item
IP	Inspection Procedure
NCV	Non-cited Violation
NRC	Nuclear Regulatory Commission
NSRB	Nuclear Safety Review Board
RCF	Reactor Critical Facility
RO	Reactor Operator
RPI	Rensselaer Polytechnic Institute
SRO	Senior Reactor Operator
TS	Technical Specification