

July 24, 2013

Dr. Jeffrey Geuther, Manager  
KSU Nuclear Reactor Facility  
Department of Mechanical and  
Nuclear Engineering  
112 Ward Hall  
Kansas State University  
Manhattan, KS 66506-5204

SUBJECT: KANSAS STATE UNIVERSITY - NRC ROUTINE, ANNOUNCED INSPECTION  
REPORT NO. 50-188/2013-201

Dear Dr. Geuther:

From June 24–27, 2013, the U.S. Nuclear Regulatory Commission (NRC or the Commission) conducted an inspection at the Kansas State University Nuclear Reactor Facility (Inspection Report No. 50-188/2013-201). The inspection included a review of activities authorized for your facility. The enclosed report presents the results of that inspection.

This inspection was an examination of 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. Within these areas, the inspection consisted of selective examinations of procedures and representative records, interviews with personnel, and observations of activities in progress.

Based on the results of this inspection, the NRC has determined that one Severity Level IV violation of NRC requirements occurred. This violation is being treated as non-cited violation (NCV), consistent with Section 2.3.2 of the Enforcement Policy. This violation is described in the subject inspection report. 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, D.C. 20555-0001, with copies to: (1) the Director, Office of Nuclear Reactor Regulation, United States Nuclear Regulatory Commission, Washington, DC 20555-0001; and (2) the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, D.C. 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 and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of NRC's document system (Agencywide Document Access and Management System (ADAMS)). ADAMS is accessible from the NRC Web site at (the Public Electronic Reading Room) <http://www.nrc.gov/reading-rm/adams.html>.

Should you have any questions concerning this inspection, please contact Gary Morlang at 301-415-4092 or by electronic mail at [Gary.Morlang@nrc.gov](mailto:Gary.Morlang@nrc.gov).

Sincerely,

*/RA/*

Gregory T. Bowman, Chief  
Research and Test Reactors Oversight Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

Docket No. 50-188  
License No. R-88

Enclosure:  
As stated

cc w/encl.: See next page

Kansas State University

Docket No. 50-188

cc:

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Gainesville, FL 32611

Should you have any questions concerning this inspection, please contact Gary Morlang at 301-415-4092 or by electronic mail at [Gary.Morlang@nrc.gov](mailto:Gary.Morlang@nrc.gov).

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

Docket No: 50-188

License No: R-88

Report No: 50-188/2013-201

Licensee: Kansas State University

Facility: TRIGA Mark II Research Reactor

Location: Manhattan, Kansas

Dates: June 24–27, 2013

Inspectors: Gary (Mike) Morlang  
Osvaldo (Ossy) Font

Approved by: Gregory T. Bowman, Chief  
Research and Test Reactors Oversight Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

## EXECUTIVE SUMMARY

Kansas State University  
TRIGA Mark II Research Reactor Facility  
NRC Inspection Report No. 50-188/2013-201

The primary focus of this routine, announced inspection was the onsite review of selected aspects of the Kansas State University (the licensee's) Class II research reactor facility safety programs including: (1) operations logs and records; (2) surveillance and limiting conditions for operation; (3) experiments; (4) health physics; (5) effluents and environmental monitoring; (6) design changes; (7) committees, audits, and reviews; and (8) transportation of radioactive material. The licensee's programs were acceptably directed toward the protection of public health and safety, and were generally in compliance with the U.S. Nuclear Regulatory Commission (NRC) requirements.

### Operations Logs and Records and Surveillance and Limiting Conditions for Operation

- The inspectors reviewed Event Notification 49117, which described the failure of an in-core instrumented fuel element thermocouple.
- One non-cited violation of Technical Specification 3.3.3 was identified because the licensee operated the reactor without the required fuel temperature measuring channel being operable.

### Experiments

- Experiments were being reviewed and performed in accordance with Technical Specification requirements and the licensee's written procedures.
- One inspector follow-up item was identified to review the licensee's implementation of experiment procedure upgrades during a future inspection.

### Health Physics

- The radiation safety program was conducted in compliance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 20 requirements, Technical Specifications, and licensee procedures.

### Environmental Protection

- Effluent monitoring satisfied license and regulatory requirements and releases were within the specified regulatory and Technical Specification limits.

### Design Changes

- The review and evaluation of changes to the facility and procedures satisfied NRC requirements specified in 10 CFR 50.59.

Committees, Audits, and Reviews

- The Reactor Safety Committee provided the oversight required by the Technical Specifications.

Transportation

- Due to the nature of the licensee operations, only one shipment had been made from the reactor facility under the reactor license during the past several years. The inspectors determined that this shipment was conducted in accordance with NRC requirements.

## REPORT DETAILS

### Summary of Facility Status

The Kansas State University's (KSU's or the licensee's) 1250 kilowatt reactor continued to be operated in support of the University's academic program in nuclear engineering laboratory instruction and research. The reactor was operated only for short sample irradiations during the inspection.

#### 1. Operations Logs and Records and Surveillance and Limiting Conditions for Operation

##### a. Inspection Scope (Inspection Procedures (IP) 69001)

In order to follow up on Event Notification 49117, which was submitted by the licensee on June 14, 2013, in response to the failure of an in-core thermocouple, the inspectors performed a partial inspection of these areas and reviewed records related to the event.

- Technical Specifications (TS) for KSU TRIGA Reactor, dated March 13, 2008
- Operations Logbook, dated March 8, 2013, to present
- Daily Checklist, dated October 2011
- SOT-1 Instrument and Equipment Checkout, Rev. 4, dated August 13, 2007
- Training Manual, dated 2011
- Test and Maintenance Procedure No. 28, "Temperature Channel Calibration," dated March 14, 2008
- Fuel Element Thermocouple Surveillance performed June 19, 2013

##### b. Observations and Findings

On June 13, 2013, the licensee identified anomalous indications associated with a fuel temperature thermocouple and subsequently determined that the fuel temperature thermocouple wire was grounded, resulting in the fuel temperature reading on the control console indicating approximately 60–70 °C below the actual value. The faulty fuel temperature reading had been logged during operations at approximately 500 kilowatts on three previous operations over several days without being identified by operators.

The inspectors reviewed the operation logs for the period and referenced the facility's TS. The inspectors determined that TS 3.3.3 requires at least one fuel temperature measuring channel to be operating during reactor power operations; however, the affected thermocouple provided an input to the single fuel temperature monitoring channel, and so with that thermocouple wire grounded, there were no operable fuel temperature measuring channels, contrary to TS 3.3.3.



Following identification of this issue, the licensee implemented a number of corrective actions, including improvement of insulation on thermocouple wires, installation of a new instrumented fuel element in the core, addition of a second fuel temperature readout on the console from the newly installed instrumented fuel element, and development of a reactor startup instrument values reference list. The licensee also implemented additional staff training to improve operator's ability to identify anomalous conditions and reinforce use of reference lists.

As discussed above, the inspectors determined that the facility had operated without an operational fuel temperature indicator, contrary to the TS 3.3.3. The inspectors determined that this issue represented a Severity Level IV violation of NRC requirements, consistent with Enforcement Policy Section 6.1.d.1. However, because this issue is non-repetitive and was identified by the licensee, and because the licensee took prompt and comprehensive corrective actions, this issue is being treated as a non-cited violation consistent with Section 2.3.2.b of the Enforcement Policy (NCV 50-188/2013-201-01).

c. Conclusion

One non-cited violation of TS 3.3.3 was identified because the licensee operated the reactor without the required fuel temperature measuring channel being operable.

## 2. Experiments

a. Inspection Scope (IP 69001)

In order to verify that any existing experiments and newly proposed experiments met all TS requirements, the inspectors reviewed selected aspects of:

- TS for KSU TRIGA Reactor, dated March 13, 2008
- KSU TRIGA Mark II Experiment 1, dated April 7, 2011
- KSU TRIGA Mark II Console Logbooks, dated July 19, 2011, to June 22, 2013
- KSU TRIGA Mark II By-Product Logbook, dated October 2011 to the present
- Reactor Safety Committee (RSC) meeting minutes for 2012 and 2013

b. Observations and Findings

The licensee maintained a file of existing experiments. The facility's TS, which were issued on March 13, 2008, when the facility's license was renewed, require any new experiments to be approved by the RSC. Two new experiments had been approved by the RSC since the last inspection.

In 2011 a miscalculated experiment resulted in a higher than expected dose rate due to an incorrect sample mass value. The higher dose rate was not apparent until after the sample was removed and the radiation area monitors alarmed. At

this point the licensee was unable to reinsert the experiment and was forced to place the sample in the intended shielded area. The licensee determined that the cause of this issue was miscommunication with the department that provided the sample mass information. As a corrective action, the licensee plans to revise their experiment procedure to require information associated with an experiment (i.e., the sample) to be submitted in writing. The inspector opened Inspector Follow-Up Item 50-188/2013-201-01 and will review the implementation of this procedure change during a future inspection.

c. Conclusion

Experiments were being reviewed and performed in accordance with TS requirements and the licensee's written procedures. One inspector follow-up item was identified to review the licensee's implementation of experiment procedure upgrades during a future inspection.

**3. Health Physics and Environmental Protection**

a. Inspection Scope (IP 69001)

The inspector reviewed the following to verify compliance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 20 requirements:

- KSU Annual Report to U.S. NRC, January–December 2011, dated June 25, 2012
- KSU Annual Report to U.S. NRC, January–December 2012, dated June 5, 2013
- Radiation Dosimetry Report for 2011 to 2013 year to date
- Radiation Safety Manual for KSU, dated August 2007
- Test and Maintenance Procedure 13, "Portable Radiation Meter Calibration," dated March 14, 2008
- Test and Maintenance Procedure 20, "Liquid Scintillation Assay Methods," dated March 14, 2008
- Test and Maintenance Procedure 3-1, "Remote Area Monitor Calibration," dated January 27, 1987
- Test and Maintenance Procedure 8, "Calibration of Continuous Air Monitor," dated March 14, 2008
- Nuclear Reactor Facility Monthly Radiation and Smear Surveys, May 2010 to May 2013
- Sump Discharge Calculations for 2011 and 2012

b. Observations and Findings

The inspectors toured the facility to interview and observe licensee personnel and practices regarding the use of dosimetry and radiation monitoring equipment, placement of radiological signs and postings, use of protective clothing, and practices for handling and storing radioactive material or contaminated equipment.

The inspectors reviewed records of monthly radiation surveys and smears performed by the reactor staff and health physics technicians, and found the results to be generally low and consistent with facility postings and readings of instruments observed by the inspectors. A copy of the current NRC Form 3, "Notice to Radiation Workers," was posted as required by 10 CFR Part 19.

Dosimetry results were reviewed by the inspectors. The highest whole body dose received in calendar year 2011 was 51 mrem, for calendar year 2012 was 50 mrem, and the highest 2013 year-to-date dose is 28 mrem. In 2011, the highest dose to the extremities determined by a ring dosimetry was 900 mrem. This was higher than normal due to the miscalculated experiment described above, but far less than the regulatory limit of 50,000 mrem.

The Environmental Health and Safety personnel have the responsibility and facilities for the calibration of all portable radiation detectors on the campus. The calibration records of selected devices were reviewed.

The inspectors reviewed the annual reports for the 2010 to 2012 period. There were a total of six liquid discharges from the reactor bay sump during those 3 years. All isotope levels were below 10 CFR Part 20, Appendix B limits.

c. Conclusion

The radiation safety program was conducted in compliance with 10 CFR Part 20 requirements, TS, and licensee procedures.

**4. Design Changes**

a. Inspection Scope (IP 69001)

The inspectors reviewed the following to ensure that if design changes were made, they were reviewed and approved in accordance with 10 CFR 50.59, the TS, and the licensee's administrative procedures:

- KSU Annual Report to U.S. NRC, January–December 2011, dated June 25, 2012
- KSU Annual Report to U.S. NRC, January–December 2012, dated June 5, 2013
- TS for KSU TRIGA Reactor, dated March 13, 2008
- Annual 10 CFR 50.59 Reports for 2011 and 2012
- Console Log Books from November 2, 2011, to present
- 10 CFR 50.59 Evaluation Reports for 2012 and 2013 to date
- Standard Operating Procedure 5, Attachment 2, "Evaluation of Change and Program Effectiveness," dated July 5, 2006
- RSC Annual Operating Audit, dated April 27, 2012, and March 1, 2013

b. Observations and Findings

The licensee had performed a 10 CFR 50.59 evaluation for 12 facility modifications and numerous procedure changes since the last inspection in this area. The facility modifications included items such as relocation of the continuous air monitors to the upper level of the reactor bay and modifications to the beam ports for new experiments.

c. Conclusion

The review and evaluation of changes to facilities and procedures satisfied NRC requirements specified in 10 CFR 50.59.

**5. Committees, Audits, and Reviews**

a. Inspection Scope (IP 69001)

The inspectors reviewed the following to ensure that audits and reviews stipulated in the facility's TS were conducted by the RSC:

- Console Logbooks from November 2, 2011, to present
- TS for KSU TRIGA Reactor, dated March 31, 2008
- KSU Annual Report to U.S. NRC, January–December 2011, dated June 25, 2012
- KSU Annual Report to U.S. NRC, January–December 2012, dated June 5, 2013
- RSC Semiannual Meeting minutes from August 19, 2011, to March 1, 2013
- Semiannual Management Audits from July 8, 2011, to February 22, 2013

b. Observations and Findings

The inspectors verified that the RSC conducted meetings at the required frequency with a quorum present, pursuant to TS requirements and that the RSC conducted the required audits, reviewed and approved procedures and experiments, and provided direct oversight of reactor operations.

c. Conclusion

The RSC provided the oversight required by the TS.

## 6. Transportation

### a. Inspection Scope (IP 86740)

The inspectors interviewed licensee personnel and determined that only one shipment of radioactive material had been conducted under the R-88 license since the last inspection in this area. The inspectors also reviewed the following:

- Training Certificate, dated February 15, 2012.
- KSU Annual Report to U.S. NRC, January–December 2011, dated June 25, 2012
- KSU Annual Report to U.S. NRC, January–December 2012, dated June 5, 2013
- RSC Semiannual Meeting minutes from August 19, 2011 to March 1, 2013
- KSU Shipment Manifest, May 13, 2013
- UPS Shipment Receipt, May 13, 2013
- UPS Proof of Delivery, May 14, 2013

### b. Observations and Findings

There was only one individual authorized to ship material at the facility. The inspectors verified that this individual had been properly trained and that his certification was up-to-date. The one shipment made since the last inspection in this area was an irradiated sample that was shipped as an excepted package-limited quantity of material. The inspectors confirmed that this shipment had been conducted in accordance with regulations.

### c. Conclusion

Due to the nature of the licensee operations, only one shipment had been made from the reactor facility under the reactor license since the previous inspection. The inspectors determined that this shipment was conducted in accordance with NRC requirements.

## 7. Exit Interview

The inspectors presented the inspection results to licensee management at the conclusion of the inspection on June 27, 2013. The inspectors described the areas inspected and discussed in detail the inspection observations. The licensee acknowledged the observations 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

R. Bridges	Head of Radiation Safety Office, Environmental Health and Safety Division and Campus Radiation Safety Officer
J. Geuther	Reactor Manager
C. Whitten	Reactor Operator

## **INSPECTION PROCEDURES USED**

IP 69001	Class II Research and Test Reactors
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## **ITEMS OPENED, CLOSED, AND DISCUSSED**

### Opened

50-188/2013-201-01	NCV	Inoperable fuel temperature measuring channel due to a grounded fuel thermocouple wire resulting in a reading below the actual value.
50-188/2013-201-01	IFI	Update Experiment 1 procedure to require experimental information be submitted in writing.

### Closed

50-188/2013-201	NCV	Inoperable fuel temperature measuring channel due to a grounded fuel thermocouple wire resulting in a reading below the actual value.
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### Discussed

None

## **PARTIAL 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
KSU	Kansas State University
NRC	U.S. Nuclear Regulatory Commission
RSC	Reactor Safety Committee
TS	Technical Specifications