

June 6, 2014

Vitto Nuccio, Reactor Administrator  
Department of the Interior  
U.S. Geological Survey  
Box 25046., MS 975  
Denver, CO 80225

SUBJECT: UNITED STATES GEOLOGICAL SURVEY – NRC ROUTINE INSPECTION  
REPORT NO. 50-274/2014-201

Dear Mr. Nuccio:

On May 5-8, 2014, the U.S. Nuclear Regulatory Commission (NRC, the Commission) conducted an inspection at your U.S. Geological Survey TRIGA Reactor facility. The enclosed report documents the inspection results, which were discussed on May 8, 2014, with Ms. Betty Adrian, prior Reactor Administrator, Mr. Timothy DeBey, Reactor Supervisor, and other members of your staff.

During this inspection, the NRC staff examined activities conducted under your license as they relate to public health and safety, and 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. 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, with a copy to the inspector.

In accordance with Title 10 of the *Code of Federal Regulations* Section 2.390, "Public Inspections, Exemptions, and 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).

V. Nuccio

- 2 -

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

Sincerely,

/RA/

Taylor A. Lamb, Acting Chief  
Research and Test Reactors Oversight Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

Docket No. 50-274  
License No. R-113

Enclosure:  
NRC Inspection Report No. 50-274/2014-201

cc: See next page

U.S. Geological Survey

Docket No. 50-274

cc:

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University of Florida  
202 Nuclear Sciences Center  
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V. Nuccio

- 2 -

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DATE	06/05/14	06/06/14

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

Docket No: 50-274

License No: R-113

Report No: 50-274/2014-201

Licensee: United States Geological Survey

Facility: U. S. Geological Survey TRIGA Reactor

Location: Building 15, Denver Federal Center  
Denver Colorado

Dates: May 5-8, 2014

Inspector: Mike Morlang

Approved by: Taylor A. Lamb, Acting Chief  
Research and Test Reactors Oversight Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

## EXECUTIVE SUMMARY

United States Geological Survey  
U. S. Geological Survey TRIGA Reactor  
Report No. 50-274/2014-201

The primary focus of this routine, announced inspection was the on-site review of selected aspects of the U. S. Geological Survey (the licensee's) Class II research and test reactor safety program including: 1) organization and staffing, 2) operations logs and records, 3) procedures 4) surveillance and limiting conditions for operation, 5) experiments, 6) fuel handling, and 7) transportation since the last U.S. Nuclear Regulatory Commission (NRC) inspection of these areas. The licensee's program was acceptably directed toward the protection of public health and safety and in compliance with NRC requirements. No violations or deviations were identified.

### Organization and Staffing

- The organizational structure and functions were consistent with the requirements specified in Section H of the Technical Specifications and Section 3 of the Reactor Operations Manual.

### Operations Logs and Records

- Reactor operations and logs were acceptable and completed in accordance with procedural requirements.
- A Non-Cited Violation was issued for Operating the reactor in steady state mode with only one of two Technical Specification required safety channels in operation.

### Procedures

- The procedural control and implementation program met Technical Specification requirements.

### Surveillance and limiting conditions for operations

- The licensee's program for completing surveillance checks and tests and confirming Limiting Conditions for Operation satisfied Technical Specifications requirements.

### Experiments

- Conduct and control of experiments and irradiations met the requirements specified in the Technical Specifications Section I and the applicable Experiment Authorizations and procedures.

Fuel Handling

- Fuel handling activities and documentation were as required by the Technical Specifications and facility procedures.

Transportation of Radioactive Material

- Radioactive material was being shipped in accordance with the applicable regulations.

## REPORT DETAILS

### Summary of Plant Status

The U.S. Geological Survey's (USGS, the licensee) one megawatt TRIGA research and test reactor was typically operated in support of USGS programs directed at improving methods and techniques to enhance scientific knowledge about water and earth materials and support research projects from the Colorado School of Mines. During the inspection, the reactor was operated to support ongoing experimental and research work.

#### 1. Organization and Staffing

##### a. Inspection Scope (Inspection Procedure [IP] 69001)

The inspector reviewed selected aspects of the following regarding the licensee's organization and staffing to ensure that the requirements of Section H of Technical Specifications (TS), implemented through License Amendment Number (No.) 11 to the Facility Operating License, No. R-113, dated January 30, 2006, were being met:

- Current staff qualifications
- Staffing requirements for operation of the reactor
- Organizational structure for the Geological Survey TRIGA Reactor (GSTR) Facility
- Reactor Operations Manual (ROM), Section 3, "Nuclear Center Organization," dated April 2012 with the latest Revision (Rev.) dated April 2012
- U.S. Geological Survey TRIGA Reactor Annual Report for January 1, 2012 through December 31, 2012, submitted January 24, 2013
- U.S. Geological Survey TRIGA Reactor Annual Report for January 1, 2013 through December 31, 2013, submitted January 30, 2014
- U.S. Geological Survey TRIGA Reactor Quarterly (Operations) Report for each quarter between January 1, 2012 through March 31, 2014
- Reactor Operations Committee Meeting Minutes dated April 15, 2012, October 29, 2012, May 3, 2013, November 22, 2013 and April 25, 2014

##### b. Observations and Findings

The organizational structure and staff responsibilities had not changed since the last U.S. Nuclear Regulatory Commission (NRC) inspection (refer to NRC Inspection Report No. 50-274/2012-201). The facility remained under the direct control of the Reactor Supervisor (RS) and he was responsible to the Reactor Administrator for safe operation and maintenance of the reactor and its associated equipment. The operations staff consisted of the RS and three qualified senior reactor operators.

The organization and staff responsibilities were as specified in, and required by, Section H of the TS, Section 3 of the Reactor Operations Manual (ROM), and Figure 3.1 in the ROM. Section 3.4.1 of the ROM stated that the training and



qualification requirements contained in ANSI/ANS Standard 15.4, "Standards for Selection and Training of Personnel for Research Reactors" were the minimum for USGS TRIGA Reactor Facility personnel. The inspector confirmed that the reactor staff met ANSI/ANS 15.4 education, training, and experience requirements.

c. Conclusion

The licensee's organization and staffing were in compliance with the facility TS Section H and ROM Section 3.

**2. Operations Logs and Records**

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of the following to verify operation of the reactor in accordance with TS Sections C through E:

- Reactor Operations Logbooks Nos. 155-159, dated April 1, 2013 to present
- Staffing for operations as required by Section 5.2 of the ROM, Rev. 4 dated October 1995
- Daily TRIGA Prestart Test data sheet printouts for 2013 - 2014 to date
- Selected GSTR Facility Monthly Checklists from 2013 - 2014 to date, checklist Rev. 11, checklist revision dated April 2010
- Selected GSTR Facility Shutdown Checklists from 2013 - 2014 to date, checklist Rev. 13, checklist revision dated April 2002
- Selected GSTR Facility Start-Up Checklists from the 2013 - 2014 to date including Page 1 of the checklist, Rev. 12 dated April 2012, and Page 2 of the checklist, Rev. 8 dated April 2011
- ROM, Section 5, "Operating Procedures," Rev. 4, dated October 1995
- GSTR Procedure No. 1, "Procedure for Reactor Startup, Operation, and Shutdown," dated October 11, 1991 and last reviewed April 25, 2014
- GSTR Procedure No. 3, "Procedure for Control Rod Calibration," dated April 1990 and last reviewed April 25, 2014
- U.S. Geological Survey TRIGA Reactor Quarterly (Operations) Report for each quarter between January 1, 2012 through March 31, 2014
- Reactor Operations Committee Meeting Minutes dated April 15, 2012, October 29, 2012, May 3, 2013, November 22, 2013 and April 25, 2014
- U.S. Geological Survey TRIGA Reactor Annual Report for January 1, 2012 through December 31, 2012, submitted January 24, 2013
- U.S. Geological Survey TRIGA Reactor Annual Report for January 1, 2013 through December 31, 2013, submitted January 30, 2014

b. Observations and Findings

The inspector reviewed the operations logs from April 2012 through the present. The inspector also reviewed selected Daily Start-Up and Shutdown Checklists and Monthly Checklists. From the records reviewed, the inspector determined that reactor operations were carried out in accordance with written procedures as required by TS Section H.3. Information on the operational status of the facility was appropriately recorded in log books or on checklists as required by Section 3.C. of the Facility License and ROM Section 5. Scrams were identified in the logs and records, and were reported and resolved as required before the resumption of operations. Through interviews with operators and review of the logs, the inspector confirmed that shift staffing met the minimum requirements of at least two reactor staff members on duty whenever the reactor was operating as required by ROM Section 5.2.4.

The inspector observed the performance of the Reactor Startup Checklist, insertion of a sample into the reactor core for reactivity measurement and subsequent irradiation at full power. All evolutions were conducted using approved procedures and in a safe manner.

A TS violation was identified by the licensee on April 8, 2014 and was reported to the NRC on the same date. The Technical Specifications Section E.7 requires that two operating safety channels will be in service during steady state operations. Contrary to Section E.7, the reactor was operated in steady state mode for a period of seven (7) minutes at two (2) watts in preparation for a reactor pulse with one safety channel not operational. As the violation was discovered during low power, steady-state operations by the licensed reactor operator without any adverse automatic actions by the reactor safety systems, this incident is being treated as a Non-Cited Violation (NCV), consistent with Section 2.3.2 of the Enforcement Policy (NCV 05-274/2014-201-01).

c. Conclusion

Reactor operations and logs were acceptable and in accordance with procedural requirements. A Non-Cited Violation (NCV 05-274/2014-201-01) was issued for operating the reactor in steady state mode with only one of two TS required safety channels in operation.

### 3. Procedures

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

The inspector reviewed selected aspects of the following to ensure that safety standards and written instructions for those activities specified in TS Sections H.2 and H.3 were in effect:

- Observation of procedural implementation
- Selected ROM Chapters and GSTR procedures
- Records of changes and temporary changes to procedures
- ROM, Chapter 4, "Administrative Procedures," latest revision dated April 2014
- ROM, Chapter 5, "Operating Procedures," Revision 4, dated October 1995, which contained the various GSTR Procedures
- ROM, Chapter 8, "Radiation Protection Program," latest revision dated April 22, 2011
- Reactor Operations Committee Meeting Minutes dated April 15, 2012, October 29, 2012, May 3, 2013, November 22, 2013 and April 25, 2014

#### b. Observations and Findings

The inspector reviewed ROM Chapters 4, and 8, and selected GSTR procedures contained in ROM Chapter 5. These ROM Chapters and GSTR procedures provided guidance for the administrative, operations, and health physics (HP) functions of the facility. The inspector confirmed that written procedures were available for those tasks and items required by TS Sections H.2 and H.3. The licensee controlled changes to procedures and the ROC conducted the review and approval process as required. The inspector noted that the GSTR procedures were reviewed biennially as required by the ROM.

After reviewing the 2012 and 2013 training records and interviewing staff members, the inspector determined that the training of personnel on procedures was adequate. During tours of the facility, the inspector observed that personnel performed facility operations and tasks in accordance with applicable procedures.

#### c. Conclusions

The procedural control and implementation program was acceptably conducted and maintained.

#### 4. Surveillance and Limiting Conditions for Operations

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

To verify that the maintenance and surveillance programs were being conducted as required in TS Sections C through E, the inspector reviewed selected aspects of:

- Reactor Operations Logbooks Nos. 155-159, dated April 1, 2013 to present
- U.S. Geological Survey TRIGA Reactor Annual Report for January 1, 2012 through December 31, 2012, submitted January 24, 2013
- U.S. Geological Survey TRIGA Reactor Annual Report for January 1, 2013 through December 31, 2013, submitted January 30, 2014
- U.S. Geological Survey TRIGA Reactor Quarterly (Operations) Report for each quarter between January 1, 2012 through March 31, 2014
- Reactor Operations Committee Meeting Minutes dated April 15, 2012, October 29, 2012, May 3, 2013, November 22, 2013 and April 25, 2014
- Reactor Activity Calendar maintained by the RS
- Surveillance, calibration, and test data sheets and related records
- Selected GSTR Facility Monthly Checklists for the past 24 months, checklist Rev. 11, revision dated April 2010
- Selected GSTR Facility Shutdown Checklists for the past 24 months, checklist Rev. 14, revision dated April 2012
- Selected GSTR Facility Start-Up Checklists for the past 24 months including Page 1 of the checklist, Rev. 12 revision dated April 2012, and Page 2 of the checklist, Rev. 8, revision dated April 2011
- GSTR Procedure No. 2, "Procedure for Reactor Power Calibration," dated April 30, 1993 and last reviewed April 5, 2012
- GSTR Procedure No. 3, "Procedure for Control Rod Calibration," dated April 1990 and last reviewed April 25, 2014
- GSTR Procedure No. 7, "Procedure for Control Rod Measurement, Inspection, or Replacement," dated April 1990 and last reviewed April 25, 2014
- GSTR Procedure No. 12, "Procedure for Changing Demineralizer Resin," dated October 2000 and last reviewed November 22, 2013
- GSTR Procedure No. 13, "Procedure for Use of Leak Testing Device," dated April 1990 and last reviewed April 25, 2014
- GSTR Procedure No. 19, "Procedure for Test Equipment Calibration," dated April 30, 1993 and last reviewed May 3, 2013
- GSTR Procedure No. 21, "Procedure for Measuring Control Rod Drop Time," dated October 5, 1992 and last reviewed May 3, 2013

b. Observations and Findings

The inspector reviewed selected records of TS required checks, tests, and Limiting Conditions for Operation (LCO) verifications performed since January 2013. These included the daily checklists that provided documentation of control rod scram, withdraw prevent, and interlock functions, and weekly conductivity tests, as well as monthly surveillance checks of the reactor ventilation system, building alarms, radiological safety, and reactor water system. Other periodic surveillances and verifications were reviewed including power calibrations, control rod inspections and fuel elements inspections. The review showed that the periodic checks, tests, and LCO verifications for TS required surveillances were completed as required. The results of these activities were within prescribed TS limits and procedure parameters and in agreement with the previous surveillance results.

The various surveillance checks, inspections, and verifications reviewed were being tracked through the daily and/or monthly checklists. Documentation of completion of these activities was maintained in the checklists and/or in the operations or fuel logbooks. This system was found to provide adequate control of the reactor operational tests and checks, and LCO verifications. Good correlation was noted between the console logs, checklists and other log books.

c. Conclusion

The licensee's program for surveillance checks and LCO verifications satisfied TS requirements.

**5. Experiments**

a. Inspection Scope (IP 69001)

The inspector reviewed selected aspects of the following to verify that experiments were conducted in compliance with TS Section I:

- Reactor Operations Logbooks Nos. 155-159, dated April 1, 2013 to present
- Selected experiment authorizations, logs, and records
- Experiment program requirements contained in ROM Sections 4.5 through 4.8
- U.S. Geological Survey TRIGA Survey Reactor Experiment Authorization Forms including Parts I, II, and III for Experiment Nos. L-122, C-56, C-57, C-51, C-52, NR-2, NR-3 and O-25
- Selected U.S. Geological Survey TRIGA Survey Reactor Radioisotope Request and Receipt Forms which had been completed during October 2012 through the present
- U.S. Geological Survey TRIGA Reactor Annual Report for January 1, 2012 through December 31, 2012, submitted January 24, 2013

- U.S. Geological Survey TRIGA Reactor Annual Report for January 1, 2013 through December 31, 2013, submitted January 30, 2014
- Reactor Operations Committee Meeting Minutes dated April 15, 2012, October 29, 2012, May 3, 2013, November 22, 2013 and April 25, 2014

b. Observations and Findings

Experiments at the GSTR were categorized as either Class I or Class II experiments by the RS. This classification had to be reviewed and agreed upon by the ROC. Class I experiments were those that had been performed previously or were minor modifications to previous experiments. They were classified and approved by the RS. Class II experiments were new experiments or major modifications of previously existing ones. These were to be reviewed and approved by the ROC. All current experiments at the facility were also required to be reviewed on an annual basis by the RS.

The inspector reviewed various previously approved and six new experiment authorization forms. The authorization forms listed a description of the experiment, the experiment class, limiting conditions for reactor operations, personnel authorized to deliver and/or pick up samples, and the license number of the authorized recipient. All of the new experiments had the proper classification and review as required.

The review of current experiment authorizations, Radioisotope Request and Receipt (RR&R) forms, and related reactor log book entries, also confirmed that experiments were installed, performed, and removed as outlined in the approved experiment authorizations. The inspector also verified that the various RR&R Forms were used to list the radioisotopes produced during the irradiation and the disposition thereof. The inspector determined that the resulting radioisotopes were appropriately controlled and held for decay or transferred as required. This information was documented on the RR&R forms.

During the inspection, the inspector observed the insertion of a sample into the core and irradiation of the sample. All documentation for the experiment was reviewed by the inspector.

c. Conclusion

The control and performance of experiments were acceptable and in accordance with Experiment Authorization and TS Section I requirements.

## 6. Fuel Handling

### a. Inspection Scope (IP 69001)

To verify that reactor fuel was handled, moved, and inspected in compliance with TS Sections D and G, the inspector reviewed selected aspects of:

- Reactor Operations Logbooks Nos. 155-159, dated April 1, 2013 to present
- Fuel movement and examination records
- Fuel handling equipment and instrumentation
- Fuel Element Location Board maintained in the Reactor Room
- GSTR Fuel Book containing the various USGS TRIGA Reactor Fuel Element History sheets for all the elements at the facility
- GSTR Procedure No. 4, "Procedure for Fuel Loading and Unloading," dated April 1990, last revised April 2008, and last reviewed April 25, 2014
- GSTR Procedure No. 8, "Procedure for Measuring Fuel Elements," dated October 11, 1991, last revised April 2010, and last reviewed May 13, 2013
- GSTR Procedure No. 9, "Procedure for Locating Fuel Element Cladding Failure," dated April 1990, last revised April 2010, and last reviewed April 24, 2014
- U.S. Geological Survey TRIGA Reactor Quarterly (Operations) Report for each quarter between January 1, 2012 through March 31, 2014
- Reactor Operations Committee Meeting Minutes dated April 15, 2012, October 29, 2012, May 3, 2013, November 22, 2013 and April 25, 2014
- U.S. Geological Survey TRIGA Reactor Annual Report for January 1, 2012 through December 31, 2012, submitted January 24, 2013
- U.S. Geological Survey TRIGA Reactor Annual Report for January 1, 2013 through December 31, 2013, submitted January 30, 2014

### b. Observations and Findings

The inspector reviewed the GSTR fuel handling at the facility and found that the appropriate fuel logs and inspection records were being maintained. It was noted that fuel movements were planned and a written sequence was developed prior to completing the actual transfers and were documented in the console log book and appropriate fuel log book. Log entries were as specified in the facility procedures and fuel inspection met TS Section D.6 requirements. Through review of the fuel movement and inspection records, and through interviews with operations staff, the inspector verified that fuel was moved and controlled according to established procedure. The inspector also verified that fuel was being stored in the locations indicated by licensee records and as required in TS Section G.

c. Conclusion

Fuel handling activities, and the documentation thereof, were acceptable and in accordance with procedural and TS requirements.

**7. Transportation**

a. Inspection Scope (IP 86740)

To verify compliance with regulatory and procedural requirements for the transfer or shipment of licensed radioactive material, the inspector reviewed the following:

- GSTR HP Logbook #41
- Training records of staff members responsible for shipping licensed radioactive material
- ROM GSTR Procedure No. 18, "Instructions for Packaging Limited Quantities of Radioactive Materials," latest revision dated November 2009 and last review dated May 15, 2009
- Selected US Geological Survey TRIGA Reactor forms, "Radioisotope Request and Receipt Form," for 2012, 2013 and 2014 to date

b. Observations and Findings

The license routinely ships isotopes under the reactor license. A separate log was maintained with licenses of all facilities authorized to receive radioactive materials. Several of the licenses had expired and the inspector verified no radioactive shipments had been made to these facilities following the expiration of their license. To avoid confusion, the licensee kept the expired licenses in an inactive log. The records indicated that the radioisotope types and quantities were calculated and dose rates measured as required. The radioactive material shipment records reviewed by the inspector had been completed in accordance with DOT and NRC regulations.

Numerous log books of recent shipments were reviewed for correctness and accuracy. Training records were reviewed for all staff personnel to ensure they met the Department of Transportation requirements.

c. Conclusions

Radioactive material was being shipped in accordance with the applicable regulations

**8. Exit Meeting Summary**

The inspector reviewed the inspection results with members of licensee management at the conclusion of the inspection on May 8, 2014. The licensee acknowledged the findings presented 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 Personnel

B. Adrian	Prior Reactor Administrator
A. Buehrle	Senior Reactor Operator
T. DeBey	Manager, GSTR and Reactor Supervisor
C. Farwell	Senior Reactor Operator
B. Roy	Senior Reactor Operator

## **INSPECTION PROCEDURE (IP) USED**

IP 69001	Class II Research and Test Reactors
IP 86740	Transportation

## **ITEMS OPENED, CLOSED, AND DISCUSSED**

### Opened

05-274/2014-201-01	NCV	Operating the reactor in steady state mode with only one of two technical specification required safety channels in operation.
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### Closed

05-274/2014-201-01	NCV	Operating the reactor in steady state mode with only one of two technical specification required safety channels in operation.
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## **PARTIAL LIST OF ACRONYMS USED**

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
DOT	Department of Transportation
GSTR	Geological Survey TRIGA Reactor
LCO	Limiting Condition for Operation
NCV	Non-Cited Violation
No.(s)	Number(s)
NRC	U. S. Nuclear Regulatory Commission
Rev.	Revision
ROC	Reactor Operations Committee
ROM	Reactor Operations Manual
RR&R	Radioisotope Request and Receipt (form)
RS	Reactor Supervisor
TS	Technical Specifications
USGS	United States Geological Survey