



Department of the Interior
US Geological Survey
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U.S. Nuclear Regulatory Commission
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Dear NRC staff,

We have revised (corrected) the 2014 annual report for the U.S. Geological Survey TRIGA non-power reactor facility. The revision consists of the correction of Table 1 on page 3 of the report.

The facility docket number is 50-274.

Sincerely,

Timothy M. DeBey
Reactor Supervisor

Enclosure

Copy to:
Geoffrey Wertz OWFN 12 D20

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NRK

U.S. GEOLOGICAL SURVEY TRIGA REACTOR

ANNUAL REPORT

JANUARY 1, 2014 - DECEMBER 31, 2014

NRC LICENSE No. R-113

DOCKET NO. 50-274

I. Personnel Changes:

Michael Feller terminated his student employment on 8/14/2014.

II. Operating Experience

The Geological Survey TRIGA Reactor (GSTR) was in normal operation for the year 2014. No major facility changes were made during the year.

A synopsis of irradiations performed during the year is given below, listed by the organization submitting the samples to the reactor staff:

| Organization | Number of Samples |
|----------------------|-------------------|
| USGS – INAA | 1349 |
| USGS - Geochronology | 626 |
| USGS – other | 46 |
| Non-USGS | 3575 |
| Total | 5596 |

A. Thermal power calibrations were performed in March, July, and September, with minor adjustments made to the instrumentation.

B. During the report period, 200 daily checklists and 12 monthly checklists were completed in compliance with technical specifications requirements for surveillance of the reactor facility.

C. Tours were provided to individuals and groups during the year for a total visitor count of approximately 535.

III. Tabulation of Energy Generated

| | <u>MWh operated</u> | <u>Critical hours</u> | <u>Pulses</u> |
|---------------|---------------------|-----------------------|---------------|
| <u>Jan</u> | 47.895 | 51h 3m | 0 |
| <u>Feb</u> | 12.021 | 14h 16m | 0 |
| <u>Mar</u> | 52.129 | 54h 49m | 0 |
| <u>Apr</u> | 60.067 | 62h 35m | 0 |
| <u>May</u> | 49.585 | 52h 15m | 0 |
| <u>June</u> | 42.333 | 44h 28m | 0 |
| <u>July</u> | 20.636 | 24h 55m | 0 |
| <u>Aug</u> | 67.567 | 70h 12m | 0 |
| <u>Sept</u> | 22.724 | 25h 28m | 0 |
| <u>Oct</u> | 95.055 | 104h 24m | 1 |
| <u>Nov</u> | 28.322 | 36h 37m | 4 |
| <u>Dec</u> | 51.583 | 53h 44m | 0 |
| <u>Totals</u> | 549.917 | 594h 46m | 5 |

IV. Unscheduled Shutdowns

| <u>Number</u> | <u>Date</u> | <u>Cause</u> | |
|---------------|-------------|--|--|
| 1118 | 2/28/14 | NPP high power; cause could not be identified | |
| 1119 | 5/7/14 | NPP high power due to a nearby lightning strike and associated electrical noise. | |
| 1120 | 12/23/14 | Loss of control system communication due to UIT computer power supply failure. | |

V. Significant Maintenance Operations

| | |
|------|--|
| 2/14 | Replaced ion exchange resin and prefilter cartridges |
| 4/14 | Replaced purification prefilter with activated carbon filters |
| 4/14 | Replaced "rod down" and "drive up" limit switches on Shim 2 |
| 4/14 | Replaced water temperature and fuel temperature Action Pak modules with universal signal conditioners, as approved by Reactor Committee |
| 5/14 | Replaced lower pulley on cooling tower fan drive |
| 5/14 | Replaced west sleeve bearing on cooling tower fan drive with a ball bearing |
| 7/14 | Replaced all neoprene diaphragms in associated primary water system valves (one in purification system and two in primary piping of heat exchanger outlet) |
| 7/14 | Replaced output transistor on "failure" signal line for RAM 10 |
| 7/14 | Replaced ion exchange resin |

9/14 Removed CT from tank, cleaned and reinstalled
 9/14 Moved control console to west wall of control room
 10/14 Replaced main exhaust motor
 10/14 Replaced west bearing on cooling tower fan drive
 11/14 Replaced piping on purification system from outlet of flow meter to tank discharge
 12/14 Replaced UIT (control console) computer

VI. Summary of 10 CFR 50.59 changes

No 50.59 changes were made to the facility in CY 2014. Two activities were screened for 50.59 applicability and both were evaluated to not require a full 50.59 evaluation or NRC approval.

VII. Radioactivity Releases

A. Listed below are the total amounts of radioactive gaseous effluents released to the environment beyond the effective control of the reactor facility.

Table 1. Gaseous Effluents Released to the Environment

| Month | Argon-41 (Ci) | R-113 License Allowable (Ci) | Tritium -HTO (mCi) * | 10CFR20 Allowable (mCi) |
|-----------------------|------------------|------------------------------------|-------------------------|-------------------------------|
| January | 0.997 | 5.833 | 0.00 | 124 |
| February | 0.111 | 5.833 | 0.46 | 124 |
| March | 0.696 | 5.833 | 0.66 | 124 |
| April | 0.123 | 5.833 | 0.12 | 124 |
| May | 0.094 | 5.833 | 0.11 | 124 |
| June | 0.244 | 5.833 | 0.11 | 124 |
| July | 0.667 | 5.833 | 0.00 | 124 |
| August | 1.816 | 5.833 | 0.08 | 124 |
| September | 0.633 | 5.833 | 0.00 | 124 |
| October | 2.207 | 5.833 | 0.12 | 124 |
| November | 0.641 | 5.833 | 0.09 | 124 |
| December | 0.434 | 5.833 | 0.00 | 124 |
| Total | 8.663 | 70.00 | 1.75 | 1488 |
| % of Allowable | 12.376% | ----- | 0.118% | ----- |

* **Note:** The tritium concentrations are estimates based on the amount of water lost by evaporation from the reactor multiplied by the concentration of tritium as HTO. Tritium sample analyses were performed by Test America Laboratories.

B. No liquid releases were made during calendar year, 2014. One 55-gallon drum of solid waste was shipped to Clive, Utah during the calendar year, 2014. Part of the waste in this drum was from the reactor facility.

C. Throughout the year Na-24, Cr-51, Co-60, Ce-139, Ce-141, Au-198, Mn-56, Zn-65, Br-82, Br-82m, Br-80, and Br-80m were observed on the CAM filter analyses. The conservative estimated releases for these isotopes are in Table 2.

Table 2. Releases of Other Isotopes in 2014.

| Isotope | μCi | μCi/ml | 10 CFR 20 limits (uCi/ml) | % of limit |
|----------------|------------|---------------|----------------------------------|-------------------|
| Na-24 | 3.39E-02 | 2.28E-15 | 7.00E-09 | 3.26E-05 |
| Cr-51 | 7.03E-04 | 4.72E-17 | 3.00E-08 | 1.57E-07 |
| Co-60 | 9.64E-05 | 6.48E-18 | 2.00E-10 | 3.24E-06 |
| Ce-139 | 4.01E-06 | 2.69E-19 | 9.00E-10 | 2.99E-08 |
| Ce-141 | 1.64E-05 | 1.10E-18 | 8.00E-10 | 1.37E-07 |
| Au-198 | 4.16E-06 | 2.80E-19 | 2.00E-09 | 1.40E-08 |
| Mn-56 | 1.63E+00 | 1.09E-13 | 2.00E-08 | 5.46E-04 |
| Zn-65 | 4.96E-05 | 3.34E-18 | 4.00E-10 | 8.34E-07 |
| Br-82 | 6.63E+01 | 4.45E-12 | 5.00E-09 | 8.90E-02 |
| Br-82m | 8.18E+01 | 5.50E-12 | 1.00E-09 | 5.50E-01 |
| Br-80 | 9.91E+01 | 6.66E-12 | 3.00E-07 | 2.22E-03 |
| Br-80m | 6.83E+01 | 4.59E-12 | 2.00E-08 | 2.29E-02 |

VIII. Radiation Monitoring

Our program to monitor and control radiation exposures included the four major elements below during the operating year.

1. Nineteen gamma-sensitive area monitors are located throughout the Nuclear Science Building. A remote readout panel is located in the reactor health physics office. High alarm set points range from 2 mR/hr to 50 mR/hr. High level alarms are very infrequent and due to sample movements.

2. One Continuous Air Monitor (CAM) does sampling of the air in the reactor bay. An equilibrium concentration of about 1.5×10^{-8} μCi/ml present for two minutes will result in an increase of about 500 cpm above background. The alarm setpoints are a low-level alarm set at 3000 cpm (changed to 5000 cpm in October) and the high level alarm set at 10000 cpm. Reactor bay air is sampled during all reactor operations. The fixed particulate air filter is changed each week and counted on a HPGE gamma spectrometer counting system. The charcoal filter, fitted behind the particulate air filter, is also changed and counted weekly. In all instances, sample data were less than airborne concentration values in 10 CFR Part 20, Appendix B, Table 2 for all particulate radioisotopes produced by the reactor.

3. Contamination wipe surveys and radiation surveys with portable survey instruments are performed at least once a month. All portable instruments are calibrated with a 3-Curie (initial activity) Cs-137 source traceable to NBS, and wipes are counted on a Gamma Products G5000w low-level counting system. The highest removable contamination found was equal to 940.1 pCi/100 cm² beta-gamma, located in the reactor bay on the floor near the north wall, just east of the lead storage cave. This area was successfully decontaminated below MDA. The next highest removable contamination found was equal to 238.8 pCi/100 cm² beta-gamma, located in the reactor bay on the floor just south of the white table. No areas were greater than 4.4 pCi/100 cm² alpha contamination. This area did not require decontamination.

The roof area over the reactor tank is roped off and posted as a radiation area (averaging 2.5 mR/hr) during 1 MW operations.

4. LiF TLD dosimeters were used at seven outdoor environmental stations. Reactor facility visitors are issued self-reading dosimeters. Reactor staff personnel are issued beta, gamma, albedo neutron badges.

Table 3. Personnel Monitoring Results (12/1/12 – 11/30/13)

| Employee code | Whole Body (Rem) Deep Dose Equiv. | Whole Body (Rem) Shallow Dose Equiv. | Extremity (Rem) |
|---------------|--------------------------------------|---|-----------------|
| E0888 | 0.438 | 0.499 | 0.897 |
| E0607 | 0.224 | 0.235 | 0.925 |
| E0707 | 0.511 | 0.635 | 1.147 |
| E0908 | 0.170 | 0.568 | 0.760 |
| E0712 | 0.033 | 0.033 | 0.070 |
| E0614 | 0.000 | 0.000 | 0.000 |

Reactor visitors and occasional experimenters wore pocket dosimeters that resulted in no individual's reading that was greater than 1.0 mrem per a visit and no cumulative total greater than 4.5 mrem.

Table 4. Environmental Dose Results

| Location | Dose Jan-Mar (RAD) | Dose Apr-June (RAD) | Dose July-Sept. (RAD) | Dose Oct.- Dec. (RAD) | Total (RAD) |
|------------------------|--------------------------|---------------------------|-----------------------------|-----------------------------|----------------|
| Exhaust Stack | 0.093 | 0.053 | 0.041 | 0.055 | 0.242 |
| Cooling Tower Fence | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| West Vehicle Gate | 0.036 | 0.017 | 0.000 | 0.000 | 0.053 |

| | | | | | |
|-------------------------------|-------|-------|-------|-------|-------|
| West Room 151 Gate | 0.086 | 0.071 | 0.066 | 0.076 | 0.223 |
| Southwest Light Pole | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Control badge (background) | 0.052 | 0.051 | 0.052 | 0.054 | 0.209 |
| Southeast Light Pole | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Rx Fence Loading Dock | 0.101 | 0.055 | 0.053 | 0.086 | 0.209 |

Note: Above totals have the background subtracted (see control badge)..All TLDs were supplied and analyzed by Mirion Technologies.

X. Environmental Monitoring

There were several isotopes detected on the CAM filters throughout the year resulting in very small releases of Na-24, Cr-51, Co-60, Ce-139, Ce-141, Au-198, Mn-56, Zn-65, Br-82, Br-82m, Br-80, and Br-80m through the normal air exhaust on the roof. The amounts released are shown in Table 2. Routine biennial environmental soil and water samples were taken in the summer of 2014. The soil samples were analyzed on high-purity germanium detectors. The water samples were analyzed on a low background alpha/beta counter. No reactor produced-isotopes were found in the soil samples and all sample results are consistent with historical data.