USGS
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Department of the Interior
US Geological Survey
Box 25046 MS-974
Denver CO, 80225
January 11, 2018

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington DC 20555

Dear NRC staff,

Enclosed is the 2017 annual report for the U.S. Geological Survey TRIGA non-power reactor facility.

The facility docket number is 50-274.

Sincerely,

Brycen Roy
Reactor Supervisor

Enclosure

Copy to:
Geoffrey Wertz OWFN 12 D20

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NRR

U.S. GEOLOGICAL SURVEY TRIGA REACTOR

ANNUAL REPORT

JANUARY 1, 2017 - DECEMBER 31, 2017

NRC LICENSE No. R-113 DOCKET NO. 50-274

I. Personnel Changes:

Tim DeBey resigned from the reactor facility effective December 9, 2017.

II. Operating Experience

The Geological Survey TRIGA Reactor (GSTR) was in normal operation for the year 2017. 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	159
USGS - Geochronology	811
USGS – other	22
Non-USGS	2417
Total	3409

A. A thermal power calibration was performed in October, with adjustments made to the instrumentation as required.

B. During the report period, 193 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 780.

III. Tabulation of Energy Generated

	MWh operated	Critical hours	Pulses
Jan	**32.683**	35h 49m	0
Feb	**24.032**	25h 20m	0
Mar	**71.117**	73h 10m	0
Apr	**28.891**	31h 06m	2
May	**35.015**	36h 57m	0
June	**120.800**	122h 26m	0
July	**66.535**	69h 34m	0
Aug	**103.118**	105h 39m	1
Sept	**26.266**	31h 06m	0
Oct	**28.719**	43h 10m	4
Nov	**23.819**	31h 30m	0
Dec	**58.206**	59h 34m	0
Totals	**619.201**	665h 21m	7

IV. Unscheduled Shutdowns

Five (5) unscheduled shutdowns occurred in 2017. These were:

Number	Date	Cause :
1133	07/19/17	Loss of communication; CSC shut down due to overheating from CPU fan failure
1134	09/20/17	NPP1000 high power due to short in shim 2 rod drive
1135	10/10/17	Loss of building 15 power, operator scrammed reactor
1136	10/26/17	DAS watchdog scram; cause could not be identified
1137	12/04/17	DAS watchdog scram; cause could not be identified

V. Significant Maintenance Operations

01/17 Replaced PVC on purification system pump suction
01/17 Changed 4 prefilters for hood exhaust system
02/17 Replaced CPU fan in CSC computer
02/17 Replaced 3.6V battery in NM1000
05/17 Replaced solenoid valve for bubbler
06/17 Replaced pressure switch on primary pump discharge pipe
06/17 Replaced trim pots for NM1000 Campbell unit Hi and Lo test points
07/17 Replaced electrolytic capacitors and potentiometers in ratemeter and amplifier modules of Ar-41 NIM modules
08/17 Changed Sensoray board 2 in the DAC computer

09/17 Replaced evacuation alarm switch
09/17 Replaced ion exchange resin
09/17 Replaced incandescent bulbs with LEDs in illuminated paddle switches on console
09/17 Calibrated the conductivity meter
10/17 Replaced the flow meter on the purification system
10/17 Replaced 1-turn potentiometer with 10-turn potentiometer in bulk water temperature test circuit
11/17 Replaced regulating rod translator unit
11/17 Replaced regulating rod, shim 1, and shim 2 rod down limit switches with new limit switch system
11/17 Replaced regulation rod magnet tape

VI. Summary of 10 CFR 50.59 changes

No 50.59 changes were made to the facility in CY 2017. One activity was screened for 50.59 applicability and it was evaluated not to 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 in CY 2017

Month	**Argon-41** (Ci)	**R-113 License Allowable** (Ci)	Tritium -HTO (mCi) *	**10CFR20 Allowable** (mCi)
January	0.5673	5.833	0.113	124
February	0.4289	5.833	0.009	124
March	0.7189	5.833	0.047	124
April	0.9772	5.833	0.085	124
May	0.8553	5.833	0.087	124
June	1.3981	5.833	0.065	124
July	1.2283	5.833	0.091	124
August	0.2342	5.833	0.071	124
September	0.1493	5.833	0.041	124
October	0.1509	5.833	0.100	124
November	0.0411	5.833	0.000	124
December	0.0893	5.833	0.092	124
Total	6.8388	70.00	0.801	1488
% of Allowable	9.7697%	----------	0.054%	----------

* **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 ALS Laboratories.

B. No liquid releases were made during the 2017 calendar year.

C. During the year Na-24 and Br-82 were detected on CAM filter analyses. Conservative estimated releases for these isotopes are in Table 2.

Table 2. Releases of Non-Gaseous Isotopes in CY 2017.

Isotope	µCi	µCi/ml	10 CFR 20 limit (uCi/ml)	% of limit
Na-24	0.9679E-3	1.302E-14	7.00E-09	1.859E-4
Br-82	3.2314E-3	4.346E-14	5.00E-09	8.691E-4

VIII. Radiation Monitoring

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

1. Ten (10) gamma-sensitive area monitors, and one (1) neutron-sensitive area monitor, 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. These monitors are calibration-checked annually.

2. One Continuous Air Monitor (CAM) samples 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. Two alarm setpoints are a low-level alarm set at 5,000 cpm and a high level alarm set at 10,000 cpm. Reactor bay air is sampled during all reactor operations. The fixed particulate air filter is normally changed each week and counted on a HPGE gamma spectrometer. The charcoal filter, positioned behind the particulate air filter, is also normally changed and counted weekly. Filter data showed radioisotope concentrations less than allowable airborne concentration limits given in 10 CFR Part 20, Appendix B, Table 2 for all particulate radioisotopes produced by the reactor.

3. Contamination wipe surveys and portable instrument radiation surveys are performed at least once a month. The 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 during the April surveys, at 37341 pCi/100 cm^2 beta-gamma, located in the reactor bay on the end of the west table. Gamma spectroscopy revealed this contamination to be Tc-99m and Mo-99. The source of this contamination was very likely to be a threading lubricant for the CT rods, which contains molybdenum, which was activated by the neutron flux in the core. These rods are often unthreaded

from each other on this table. Subsequent decontamination returned the contamination activity levels to normal. Future manipulation of the CT rods were done after a sufficient decay period to allow this activated lubricant to decay. The next highest contamination was found during the June surveys, at 750 pCi/100 cm^2 beta-gamma, on the mobile lead shield near the ion exchange resin tank. This shield is seldom cleaned, so small amounts of residual contamination likely built up over time. This area was subsequently decontaminated to levels below the removable contamination limit. No areas were greater than 9.3 pCi/100 cm^2 alpha contamination, which does not require decontamination as it is well below the limit of 90 pCi/100 cm^2 alpha.

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

Table 3. Personnel Monitoring Results (12/1/16 – 11/30/17)

Employee code	Whole Body (Rem) Deep Dose Equiv.	Whole Body (Rem) Shallow Dose Equiv.	Extremity (Rem)
E0888	0.341	0.390	0.590
E0707	0.536	0.691	0.809
E0908	0.179	0.213	0.472
E0715	0.132	0.154	0.133

Reactor visitors and visiting experimenters wore electronic pocket dosimeters which showed that no individual's reading greater than 13.0 mr in a single visit or as a cumulative annual dose.

Table 4. Environmental Dose Results (Oct 2016 through Sept 2017)

Location	Dose Oct.- Dec. (RAD)	Dose Jan-Mar (RAD)	Dose Apr-June (RAD)	Dose July-Sept. (RAD)	Total (RAD)
Control (Background)	0.057	0.053	0.064	0.061	0.235
Main Exhaust	0.044	0.050	0.024	0.063	0.181
West Vehicle Gate	0.027	0.074	0.022	0.019	0.142
West Room 151 Gate	0.075	0.074	0.061	0.062	0.272
Cooling Tower	0.014	0.000	0.000	0.000	0.014
SE Light Pole	0.000	0.000	0.000	0.000	0.000
SW Light Pole	0.000	0.000	0.000	0.000	0.000
Rx Fence Loading Dock	0.039	0.037	0.045	0.038	0.159
Tunnel	0.028	0.023	0.017	0.022	0.090

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

IX. Environmental Monitoring

Very small releases of two non-gaseous isotopes were detected on the CAM filters during the year. These two isotopes (Na-24 and Br-82) were discharged through the normal air exhaust above the roof of the reactor bay. The amounts released are shown in Table 2.