Department of the Interior
US Geological Survey
Box 25046 MS-974
Denver CO, 80225
January 24, 2013

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

Dear NRC staff,

The 2012 annual report is herein submitted for the U.S. Geological Survey TRIGA non-power reactor facility. This report is generated in compliance with our license conditions.

The facility docket number is 50-274.

Sincerely,

Timothy M. DeBey
Reactor Supervisor

Enclosure

Copy to:
Paulette Torres, MS OWFN 12 D20

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NRR

U.S. GEOLOGICAL SURVEY TRIGA REACTOR

ANNUAL REPORT

JANUARY 1, 2012 - DECEMBER 31, 2012

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

I. Personnel Changes:

None.

II. Operating Experience

The Geological Survey TRIGA Reactor (GSTR) was in normal operation for the year 2012. 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	1784
USGS - Geochronology	1109
USGS – other	38
Non-USGS	4063
Total	6994

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

B. During the report period, 222 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 610.

III. Tabulation of Energy Generated

	MWh operated	Critical hours	Pulses
Jan	**142.216**	142h 35m	0
Feb	**69.557**	74h 27m	0
Mar	**145.525**	164h 49m	0
Apr	**74.608**	84h 25m	11
May	**74.186**	76h 0m	0
June	**89.304**	92h 10m	0
July	**128.729**	134h 21m	0
Aug	**73.514**	75h 47m	0
Sept	**121.539**	127h 41m	0
Oct	**50.081**	56h 30m	0
Nov	**154.002**	161h 22m	4
Dec	**67.856**	73h 55m	0
Totals	1191.117	1266h 9m	15

IV. Unscheduled Shutdowns

Number	Date	Cause
1099	2/24/12	DAC watchdog due to CSC/DAC network error
1100	4/3/12	NPP high power due to overshoot on square wave
1101	4/6/12	CSC watchdog due to CSC/DAC network error
1102	4/9/12	CSC watchdog due to computer lockup
1103	4/9/12	CSC watchdog due to computer lockup
1104	4/12/12	CSC watchdog due to computer lockup
1105	6/5/12	NPP high power due to noise spike
1106	6/5/12	NPP high power due to noise spike
1107	6/5/12	NPP high power due to noise spike
1108	7/10/12	NPP high power due to noise spike
1109	7/18/12	NPP high power due to noise spike
1110	7/19/12	NPP high power due to noise spike
1111	7/19/12	NPP high power due to noise spike
1112	7/27/12	NPP high power due to noise spike
1113	9/18/12	NPP high power due to AC power surge
1114	12/4/12	Scram due to computer shutdown
1115	12/6/12	NPP high power due to trainee error

V. Significant Maintenance Operations

2/12	Replaced spacer at bottom of Shim 1 rod drive dashpot.
3/12	Replaced Magnehelic ΔP gauge on HEPA exhaust filter for Rm 151.
4/12	Replaced HX outlet low pressure sensor switch on secondary pipe.
7/12	Replaced potentiometer R79, signal coaxial cable, and CIC detector for NPP-1000 power channel.
7/12	Installed low voltage motor controls for cooling pumps and cooling tower fans.
7/12	Replaced prefilter and pipe connections for purification system.
8/12	Replaced Action Pak signal conditioners on Ar-41 monitor and RAM 4 with new Universal signal conditioners.
8/12	Replaced shaft seal on primary cooling pump.
8/12	Replaced potentiometer R6 on NPP-1000 power channel
9/12	Repositioned roll pin on Shim 1 drive connecting rod to stop it from rubbing on dashpot spacer.
10/12	Replaced backup battery on RAM 6.
11/12	Replaced ion exchange resin.
11/12	Cleaned out drain line on secondary pipe (inlet pipe to cooling tower).
12/12	Installed central thimble sample oscillator.

VI. Summary of 10 CFR 50.59 changes

There were two 50.59 changes that were evaluated and approved by the Reactor Operations Committee in CY 2012. One was to install a sample oscillator for central thimble samples. This change would allow central thimble samples to be oscillated vertically with a maximum stroke of 3 inches and an oscillation period of approximately 2 minutes. This change was implemented in December, 2012.

The second 50.59 change involved a change in the signal conditioners used for control console input signals. The original signal conditioners were built in ~1988 and are now obsolete, difficult to maintain, and no longer manufactured. The new signal conditioners are similar to those installed in new control consoles provided by General Atomics. This change was only been implemented for two signals in CY2012 and the remaining units will be changed as allowed by staff availability.

VII. Radioactivity Releases

A. Listed below are the total amounts of radioactive gaseous effluent 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	1.159	5.833	0.13	124
February	1.027	5.833	0.00	124
March	1.644	5.833	0.14	124
April	0.922	5.833	0.00	124
May	0.756	5.833	0.13	124
June	1.151	5.833	0.00	124
July	1.998	5.833	0.40	124
August	0.802	5.833	0.18	124
September	0.815	5.833	0.00	124
October	0.578	5.833	0.18	124
November	0.763	5.833	0.00	124
December	0.992	5.833	0.17	124
Total	12.607	70.00	1.33	1488
% of Allowable	18.01%	----------	0.089%	----------

* **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. A solid low-level waste shipment of 15.0 cu.ft., part of which was reactor generated, was shipped this calendar year.

C. Throughout the year Na-24 and Br-82 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 2012

Isotope	µCi	µCi/ml	10 CFR 20 limits (µCi/ml)	% of limit
Na-24	1.25E-02	8.37E-16	7.00E-09	1.20E-05
Br-82	1.78E-03	1.20E-16	5.00E-09	2.40E-06

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) samples the air in the reactor bay. An equilibrium concentration of about 1.5 x 10^{-8} μCi/ml present for two minutes will result in an increase of about 400 cpm above background. The alarm setpoints are a low-level alarm set at 3000 cpm 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 G5000 low level counting system. The highest removable contamination found was equal to 880 pCi/100 cm^2 beta-gamma, located in the reactor bay on top of the west brown table on the south side. This area was successfully decontaminated below MDA. The next highest removable contamination found was equal to 648.9 pCi/100 cm^2 beta-gamma, located in the reactor bay on top of the west white table on the north side. No areas were greater than 9.8 pCi/100 cm^2 alpha contamination.

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 four 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 (12/1/11 – 11/30/12)

Employee code	Whole Body (Rem) Deep Dose Equiv.	Whole Body (Rem) Shallow Dose Equiv.	Extremity (Rem)
E0888	0.320	0.345	1.033
E0607	0.250	0.253	1.233
E0707	0.249	0.270	2.111
E0908	0.108	0.108	0.268

Reactor visitors and occasional experimenters wore pocket dosimeters that resulted in no individual's reading that was greater than 4.0 mrem per a visit and no cumulative total greater than 19.9 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	0.044	0.129**	0.058	0.128	0.359
Cooling Tower Fence	0.007	0.058**	0.000	0.000	0.065
West Vehicle Gate	0.000	0.077**	0.032	0.029	0.138
West Room 151 Gate	0.047	0.114**	0.065	0.056	0.282
Southwest Light Pole	0.001	0.085**	0.018	0.012	0.116
Control (background)	0.044*	0.014**	0.053	0.045	0.156
Southeast Light Pole	0.010	0.038**	0.017	0.000	0.065
Rx Fence Loading Dock	0.051	0.133**	0.092	0.107	0.383

*Control badge exhibited an unusual response and was not used. The control dose was estimated by averaging the last four control badges.

**All badges showed an unusual response due to an unknown chemical contaminate. All readings are estimates and the control badge was conservatively estimated low by using a background dose rate of 0.15 mrem/day (dose rate at sea level).

Note: Above totals have the background subtracted (see control). Environmental 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 and Br-82 through the normal air exhaust on the roof. The amounts released are shown in Table 2.

Environmental soil and water samples were taken and analyzed. No elevated readings or reactor-produced isotopes were identified (fallout Cs-137 was identified).