United States Department of the Interior

GEOLOGICAL SURVEY
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DENVER FEDERAL CENTER
DENVER, COLORADO 80225

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

January 16, 1992

Mr. A. Bill Beach
Director, DRSS, Region IV
U.S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 1000
Arlington, TX 76011

Dear Mr. Beach:

The attached annual report of the U.S. Geological Survey TRIGA reactor facility is submitted in accordance with license conditions. The facility docket number is 50-274.

Sincerely,

Timothy M. DeBey

Timothy M. DeBey
Reactor Supervisor

Enclosure

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U.S. GEOLOGICAL SURVEY TRIGA REACTOR

ANNUAL REPORT

JANUARY 1, 1991 - DECEMBER 31, 1991

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

I. Administrative Changes

None.

II. Operating Experience

The Geological Survey TRIGA Reactor (GSTR) was in normal operation for the year 1991. A digital control console was installed in April after receiving an amendment to the Technical Specifications.

A total of 214 irradiation requests were processed during the year, with the average request representing 83 samples and 8.9 full-power hours of reactor operation. 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
Geologic Division - Geochemistry	15,392
Geologic Division - Isotope Geology	1,340
Geologic Division - Cent. Mineral Res.	657
Geologic Division - West. Mineral Res.	0
Geologic Division - Sedimentary Proc.	12
Non-USGS users	366
Total	17,767

A. Thermal power calibrations at about 900 kW were performed in February and September, with only minor adjustments required. A power calibration was also performed in April, after the new control console installation.

B. Two new Class I experiments and two new Class II experiment were approved during this period. The Class II experiments involved the installation of a vertical beam tube in the reactor tank to allow the irradiation of electronic components and the installation of additional in-core irradiation tubes to study neutron embrittlement of metal samples.

C. During the report period, 199 daily checklists and 12 monthly checklists were completed in compliance with technical specifications requirements for surveillance of the reactor facility.

D. Tours were provided to individuals and groups during the year for a total visitor count of approximately 220.

E. Five standard fuel elements from the Michigan State reactor were installed in the core during April. All of these replaced high-burnup elements in the B-ring. A total reactivity gain of about $.40 was achieved. In December, the Shim 1 and Regulating rods were replaced with new, standard fueled follower control rods. A total reactivity gain of about $.65 was achieved.

III. Tabulation of Energy Generated

Month	Megawatt Hours	Time Reactor Was Critical	Number of Pulses
January	102.325	105 hours 46 minutes	0
February	157.930	159 hours 43 minutes	0
March	91.218	93 hours 45 minutes	0
April	54.211	69 hours 31 minutes	6
May	144.754	147 hours 27 minutes	0
June	103.500	105 hours 2 minutes	0
July	105.981	114 hours 57 minutes	0
August	43.201	45 hours 37 minutes	0
September	90.358	91 hours 46 minutes	0
October	135.000	136 hours 47 minutes	0
November	79.480	80 hours 54 minutes	0
December	103.439	115 hours 18 minutes	0
Totals	1211.397	1266 hours 33 minutes	6

IV. Unscheduled Shutdowns

Serial No.	Date	Cause
445	2/21/91	Period scram due to noise spike on log. channel.
446	3/14/91	Manual scram due to lost magnet current to safety rod
447	3/28/91	Linear scram due to bad connection to ion chamber.
448	3/28/91	Linear scram due to bad BNC connector insulation.
449	4/22/91	NPP1000 scram while adjusting rods at high power.
450	4/24/91	NP1000 hi voltage scram due to trip misadjustment.
451	4/24/91	Software scram due to computer lockup.
452	5/1/91	CSC watchdog scram due to computer lockup.
453	5/1/91	CSC watchdog scram due to computer lockup.
454	5/2/91	CSC watchdog scram due to computer lockup.
455	5/7/91	CSC watchdog scram due to computer lockup.
456	5/8/91	CSC watchdog scram due to computer lockup.
457	5/8/91	CSC watchdog scram due to computer lockup.
458	5/9/91	CSC watchdog scram due to computer lockup.
459	5/15/91	CSC watchdog scram due to computer lockup.
460	5/20/91	CSC watchdog scram due to computer lockup.
461	6/3/91	CSC watchdog scram due to computer lockup.
462	6/5/91	CSC watchdog scram due to computer lockup.
463	6/13/91	CSC watchdog scram due to computer lockup.
464	6/14/91	CSC watchdog scram due to computer lockup.
465	6/19/91	NPP1000 hi power scram due to noise from lightning.
466	6/25/91	NM1000 scram due to data error.
467	7/11/91	CSC watchdog scram due to computer lockup.
468	7/12/91	CSC watchdog scram due to computer lockup.
469	7/15/91	CSC watchdog scram due to computer lockup.
470	7/29/91	NM1000 scram due to data error.

471	7/30/91	NM1000 scram due to data error.
472	7/31/91	NM1000 scram due to data error.
473	7/31/91	NM1000 scram due to data error.
474	8/14/91	NM1000 scram due to data error.
475	8/29/91	CSC watchdog scram due to computer lockup.
476	9/5/91	CSC watchdog scram due to computer lockup.
477	9/9/91	CSC watchdog scram due to computer lockup.
478	9/17/91	CSC watchdog scram due to computer lockup.
479	9/19/91	CSC watchdog scram due to computer lockup.
480	10/7/91	CSC watchdog scram due to computer lockup.
481	10/7/91	CSC watchdog scram due to computer lockup.
482	10/8/91	CSC watchdog scram due to computer lockup.
483	10/16/91	Manual scram due to loss of room underpressure.
484	10/17/91	Software scram due to database timeout.
485	10/22/91	CSC watchdog scram due to computer lockup.
486	11/7/91	CSC watchdog scram due to computer lockup.
487	11/29/91	CSC watchdog scram due to computer lockup.
488	12/9/91	CSC watchdog scram due to computer lockup.
489	12/17/91	CSC watchdog scram due to computer lockup.
490	12/18/91	CSC watchdog scram due to computer lockup.

V. Major Maintenance Operations

The original analog control console was replaced with a new, digital control console in April. This change was allowed by Technical Specification Amendment Number 6. The new console has analog safety channels and a hard-wired scram bus. As noted in the list of unscheduled scrams, many shutdowns have been caused by the computer portion of the new console. Most of these problems are due to computer lockups and communication errors between equipment. Other less significant maintenance items include the relocation of the argon monitoring system to eliminate cold-weather freezing problems and the painting of the reactor room floor. Ion exchange resin was replaced twice during the year, in February and July.

VI. Summary of 10 CFR 50.59 changes

There were three 50.59 changes at the facility during this report period. Two new irradiation facility types were evaluated by the safety committee and approved for use, and a new type of experiment involving the irradiation of iron specimens for neutron damage studies was evaluated and approved by the safety committee. The two new facility types are an 8" diameter vertical beam tube that was installed in April and two 1.5" diameter in-core irradiation tubes, one of which was temporarily installed for testing in December. The safety committee evaluations of the changes made under the provisions of 10CFR50.59 concluded that the items:

(1) do not increase the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report,

(2) do not create the possibility for an accident or malfunction of a different type than any evaluated previously in the safety analysis report, and,

(3) do not reduce the margin of safety as defined in the basis for any technical specification.

VII. Radioactivity Releases

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

Month	Argon-41 (Curies)	License (R-113) Allowable (Curies)	Tritium (HTO) (uCuries)	10 CFR 20 Allowable (Curies)
January	1.17	5.8	174.9	0.25
February	1.33	5.8	220.7	0.25
March	0.81	5.8	178.2	0.25
April	0.36	5.8	145.4	0.25
May	1.08	5.8	340.7	0.25
June	0.52	5.8	172.6	0.25
July	0.83	5.8	163.5	0.25
August	0.16	5.8	199.9	0.25
September	0.63	5.8	95.4	0.25
October	0.90	5.8	249.8	0.25
November	0.76	5.8	177.1	0.25
December	0.78	5.8	172.6	0.25
Total	9.33	70.0	2290.8 uCi	3.00
% of allowable	13.4%		0.1%	

Note #1: The argon activities reported are integrated values obtained from the facility's gaseous stack monitor. Calculated values have been substituted for measured values in the few instances when the monitoring system was down for maintenance or repair.

Note #2: 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 are being performed by Colorado State University.

B. No contaminated reactor water was released into the Federal Center sewage system during the year.

C. Four 55-gal. drums of low level solid waste and solidified resin were shipped for burial in Nevada during the year.

The total amount of radioactive waste released from the reactor facility during the year is estimated to be approximately 20 mCi.

Note: The principal radioactive waste generated at the reactor facility is the demineralizer resin - used resin with small quantities of rinse water is solidified in 55-gallon drums with Portland cement prior shipment.

VIII. Radiation Monitoring

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

1. Fifteen area monitors (14 gammas, 1 neutron) located throughout the Nuclear Science Building. To provide a background signal, a small check source is attached to the scintillation detector. High alarm set points range from 2 mR/hr to 50 mR/hr. High level alarms have been infrequent and due to instrument malfunctions.

2. One Continuous Air Monitor (CAM) sampling the air in the reactor bay. An equilibrium concentration of 3.0×10^{-8} uCi/ml present for two minutes will result in an increase of 400 cpm above background. There are two alarm set points. A low-level alarm is set at 3,000 cpm, and the high level alarm is set at 10,000 cpm.

Reactor bay air is sampled during all reactor operations. The fixed particulate air filter is changed each day of reactor operation and counted on a Gamma Products G4020 Low Level counting system. The charcoal filter, fitted behind the air filter, is changed and counted weekly. In all instances, final sample calculations show less than MPC (10 CFR Part 20, Appendix B, Table 11) concentrations for all isotopes in question in the reactor bay.

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 Cs-137 source traceable to NBS and wipes are counted on a Gamma Products G4020 Low Level counting system.

Six areas of contamination were noted during routine wipe surveys. Beta activity ranging from 23 pCi to 161 pCi/100 cm^2 was noted on a table top and floor area. The contamination was removed with soap and water. The roof hatch over the reactor bay continues to be roped off and posted as a radiation area (averaging 2.5 mR/hr) during routine 1 MW operations.

4. Personnel, X and gamma, beta and neutron film badges are assigned to all permanent occupants of the Nuclear Science Building. $CaSO_4$:Dy dosimeters have been used at four outdoor environmental stations. Reactor facility visitors are issued L-40 self-reading dosimeters. Reactor staff personnel are issued albedo neutron badges.

Personnel monitoring results are categorized below:

	Rem-1991		
	Gamma	Beta	Neutron
Reactor Staff			
Whole Body Cumulative Dose for Calendar Year (thru 11-30-91)			
Highest	0.175	0.175	0.000
Hands Cumulative Shallow Dose for Calendar Year			
Highest	0.000	0.000	0.000

Body Cumulative Dose for Calendar Year			
Highest	0.045	0.045	0.000
Cumulative Dose for Calendar Year			
[illegible]	0.220	0.220	0.000

[illegible] Occasional Experimenters

[illegible] individual reading was greater than 6 mrem.

Environmental Station

	Rem 1991
Exhaust Stack	0.1303
West	0.0068
Southwest	0.0006
Southeast	0.0020

IX. Environmental Monitoring

Pursuant to reactor procedures, soil and water samples are collected every second year. Environmental soil and water samples were not collected in 1991.

There have been no uncontrolled radioactivity releases from the reactor to the present date. Thus, the data on file from past years to the present are considered to be background information.