

United States Department of the Interior

GEOLOGICAL SURVEY BOX 25046 M.S. <u>424</u> DENVER FEDERAL CENTER DENVER, COLORADO 80225

IN REPLY REFER TO:

U.S. GEOLOGICAL SURVEY TRIGA REACTOR

ANNUAL REPORT

JANUARY 1, 1986 - DECEMBER 31, 1986

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

I. Administrative Changes

Effective October 1, 1986, the administration of the reactor facility was transferred from the Chief Geologist to the Branch of Geochemistry, Geologic Division. The new organization chart for the GSTR is shown in Figure 1.

II. Operating Experience

The prime function of the Geological Survey TRIGA Reactor (GSTR) for the year 1986 continued to be the provision of neutrons for the various research programs being conducted by the U.S. Geological Survey. Irradiations were also performed for other government agencies and educational institutions.

A listing of irradiations performed during the year 1986 is given below:

Organization	Samples 1986
Geologic Division (Denver)	14,511
Geologic Division (Reston)	2,761
Geologic Division (Menlo Park)	253
University of Georgia	28
Rensselear Polytechnic Institute	17
Brigham Young University	7
Oregon State University	84
University of Southern California	1
Colorado School of Mines	3
Michigan Technological University	2
University of Wyoming	18
University of Colorado	2

Total

17,687

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The operation of the reactor has been normal. The primary activities are listed below:

- A. Thermal power calibrations at 50 KW were performed in May, July, September, and October.
- B. No Class II experiments were performed during 1986.
- C. During the report period, 187 daily checklists and 12 monthly checklists were completed in compliance with technical specifications requirements for surveillance of the reactor facility.
- D. Tours of the reactor facility were provided to groups during the year. Some of the major groups visiting the facility were affiliated with:

Colorado School of Mines Highland High School Bennett High School Solar Energy Research Institute Colorado State University Colorado College Green Mountain High School Lakewood High School

Approximately 200 visitors were admitted to the facility during the year.

A television news segment on the reactor was filmed by CBS affiliate KMGH in May.

III. Tabulation of Energy Generated

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Month	Megawatt Hours	Time Reactor Was Critical	Number of Pulses
January 1986	99.319	108 hours 09 minutes	0
February 1986	96.887	104 hours 28 minutes	0
March 1986	76.013	85 hours 03 minutes	0
April 1986	87.871	92 hours 55 minutes	0
May 1986	114.578	129 hours 55 minutes	0
June 1986	122.600	127 hours 29 minutes	0
July 1986	108.501	115 hours 53 minutes	0
August 1986	92.632	102 hours 25 minutes	0
September 1986	65.814	73 hours 26 minutes	0
October 1986	106.592	112 hours 54 minutes	0
November 1986	61.274	67 hours 45 minutes	0
December 1986	77.036	82 hours 05 minutes	0
	1109.117	1202 hours 27 minutes	0

IV. Unscheduled Shutdowns

1.	Manual Scram - "Sample failed to leave reactor" signal from pneumatic system. Sample returned. Missed "window"	Serial	#358
2.	Manual Scram - Area monitor #1 set off while unloading central thimble	Serial	#359
3.	Manual Scram - CTD stopped running	Serial	#360
4.	Linear Scram - Resetting bulk water alarm for monthly checklist	Serial	#361
5.	Manual Scram - Th standard set off area monitor #2 during pneumatic system operation. New standard obtained	Serial	#362
6.	Period Scram - AC power dip	Serial	#363
7.	Manual Scram - Low level alarm on CAM	Serial	#364
8	Manual Scram - Building evacuation alarm setoff by fire dept. during test of sprinkler system	Serial	#365
9.	Manual Scram - Lost CTD program	Serial	#366
10.	Loss of magnet current - Safety rod drive ON light burned out	Serial	#367
11.	Manual Scram - Test sample unaccounted for in pneumatic system. Sample recovered	Serial	#368
12.	AC power dip	Serial	#369
13.	AC power dip	Serial	#370
14.	Linear Scram - Operator's error while adjusting rod bank	Serial	#371
15.	Linear Scram - Momentary AC power loss	Serial	#372
16.	Manual Scram - "Rabbit failed to leave reactor" signal from pneumatic system	Serial	#373
17.	AC power loss	Serial	#374
18.	Manual Scram - Loss of program on CTD	Serial	#375
19.	Linear Scram - Physical shock to range sw.	Serial	#376

20.	Linear Scram - Physical shock to range sw.	Serial	#377
21.	AC power dip	Serial	#378
22.	Loss of power - Relay K-16 burned out.	Serial	#379
23.	Linear Scram - Transient while banking T.R.	Serial	#380
24.	Linear Scram - Physical shock to range sw.	Serial	#381
25.	Manual Scram - "Rabbit failed to leave reactor" signal on pneumatic system Sample recovered	Serial	#382
26.	Period Scram - noise on log channel	Serial	#383
27.	Manual Scram - CTD program stopped running. Pneumatic system	Serial	#384

V. Major Maintenance Operations

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1. CIC serial #853101 was installed in the linear channel in July.

2. The demineralizer resin was changed in May and November.

VI. Summary of 10 CFR 50.59 changes

There were no 10 CFR 50.59 changes or tests during this report period.

V11. 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) (Curies)	10 CFR 20 Allowable (Curies)
January 1986	0.84	5.8	See Note #2	0.25
February 1986	1.35	5.8	Below	0.25
March 1986	0.69	5.8		0.25
April 1986	0.98	5.8		0.25
May 1986	0.89	5.8		0.25
June 1986	0.81	5.8		0.25
July 1986	0.67	5.8		0.25
August 1986	1.03	5.8		0.25
September 1986	0.43	5.8		0.25
October 1986	0.77	5.8		0.25
November 1986	0.67	5.8		0.25
December 1986	0.50	5.8		0.25
Total	9.63	70.0		3.00
% of allowable	13.75%			

(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 times the concentration of tritium as HTO). Tritium water samples were taken as scheduled during 1986. However, due to the Survey's water quality lab shutdown and a new contractor schedule (for H_3 analysis), no results have been received from April through December 1986.

B. No radioactive liquid effluents were released from the reactor facility during the year 1986.

C. Four 55 gal drums of low level solidified resin was shipped for burial in Nevada in 1986.

The total amount of radioactive waste released from the reactor facility during 1986 is estimated to be approximately 29.0 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 with Portland cement prior to release in 55-gallon drums.

V111. Radiation Monitoring

- A. Our program to monitor and control radiation exposures included the four major elements below during the operating year 1986.
- Eighteen area monitors (17 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 are documented in appropriate Log Books.
- 2. One Continuous Air Monitor (CAM) sampling the air in the reactor bay. An equilibrium concentration of 3.0 x 10⁻⁸ Ci/ml present for two minutes will result in an increase of 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 and counted daily 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. Contamination wipe surveys and radiation surveys with portable survey instruments are performed at least once a month. All portable instruments are calibrated with a certified 3-Curie Cs-137 source and wipes are counted on a Gamma Products G4020 Low Level counting system.

Wipe surveys have shown the reactor area remains free of tactile contaminations except for intermittent low level activity on work table tops and sample storage caves. Instrument surveys indicate no fixed areas of contamination and radiation leaking at outside wall surfaces have been less than 0.5 mR/hr at our maximum power level. The maximum count for a wipe (beta + gamma/100 cm²) was 2464 pCi on the floor near the demineralizer pump. No alpha contamination was detected.

4. Personnel, X and gamma, beta and neutron film badges are assigned to all permament occupants of the Nuclear Science Building. CaSO₄:Dy dosimeters have been used at four outdoor environmental stations. Reactor facility visitors are issued L-49 self-reading dosimeters.

			Rem-1986		
		Gamma	Beta	Neutror	
Reactor	Staff Whole Body Cumulative Do	se for Calendar Yea	ar (thru 11-19-86)		
	Highest	0.160	0.000	0.000	
	Hands Cumulative Shallow Dose for Calendar Year				
	Highest	1.280	0.000	0.000	
Reactor	Experimenters				
	Whole Body Cumulative Do	se for Calendar Yea	<u>ir</u>		
	Highest	0.000	0.000	0.000	
	Hands Cumulative Dose for Calendar Year				
	Highest	0.000	0.000	0.000	
Reactor	Visitors				

These monitoring results are categorized below:

All readings were less than 1.0 mrem.

Environmental Stations

Rem 1986

Exhaust Stack	0.1114
West	0.0097
Southwest	0.0011
Southeast	0.0002

1X. Environmental Monitoring

Pursuant to reactor operating procedures, soil and water samples are collected every second year. Both water and soil samples were collected in 1986.

A. Water Sample results are as follows:

Sample No.	Location	mCi/ml alpha	mCi/ml Beta
W-1	on the Federal Center 3rd & Center Ave.	0.0 ± 1.3	0.8 ± 1.4
W-2	Federal Center Duck Pond	5.4 ± 2.2	4.3 ± 1.7
W-3	Ward Reservoir #1	69 ± 6	29 ± 2
W-4	Sloans Lake	0.0 ± 2.8	8.8 ± 1.9
W-5	Clear Creek	1.2 ± 1.9	2.8 ± 1.6
W-7	Kendrick Reservoir	4.6 ± 2.4	6.8 ± 1.7

B. Soil Samples

Soil samples have been prepared and are being counted by Colorado State University Environmental Surveillance program laboratory. Results will be forthcoming.



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January 28, 1987



Administrator, RIV U.S. Nuclear Regulatory Commission 611 Ryan Plaza Drive, Suite 1000 Arlington, TX 76011

Gentlemen:

The enclosed annual report of the U.S. Geological Survey TRIGA reactor is submitted in accordance with license conditions.

Sincerely,

Donald H Rusling

Donald H. Rusling Reactor Supervisor

Enclosure (2)

cc: Document Control Desk (2)