U. S. Geological Survey TRIGA Reactor

ANNUAL REPORT

January 1, 1981 - December 31, 1981

NRC License No. R-113 - Docket No. 50-274

I. Administrative Changes

There have been no administrative changes during this period.

II. Operating Experience

The prime function of the Geological Survey TRIGA Reactor (GSTR) for the year 1981 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 Governmental agencies and educational institutions.

A listing of all irradiations performed during the year 1981 is listed below.

Organization	Samples (1981)
Geologic Division (Denver)	22,695
Oregon State University	42
Geologic Division (Menlo Park)	28
University of Georgia	21
Geologic Division (Reston)	15
University of Utah	3
	22,804

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The specifics of operations relating to performance characteristics, changes in the facility design, or operating procedures are:

A. Thermal power calibrations at 50 KW were performed in January and June, 1981.

B. Three standard and one thermocouple TRIGA fuel elements were added to the core in January 1981.

C. The control rods were inspected and calibrated in January 1981.

D. No Class II experiments were approved during this period.

E. During the report period, 189 daily checklists and 12 monthly checklists were completed in compliance with Technical Specification requirements for surveillance of the reactor facility.

F. Tours of the reactor facility were provided to 18 groups during the year. The major groups visiting the facility were affiliated with:

Rockwell International
Bendix Corporation
Southern Methodist University
University of Wyoming
Highland High School
University of Utah
Colorado School of Mines
Marathon Oil Company
Colorado State University
Green Mountain High School

During the year, 242 visitors were admitted to the reactor facility.

III. Tabulation of Energy Generated

Month	Megawatt Hours	Time Reactor Was Critical	Pulsing Number - K/B
January 1981	58.815	83 hours 31 minutes	0
Feburary 1981	59.117	68 hours 28 minutes	0
March 1981	51.052	58 hours 18 minutes	0
April 1981	118.896	132 hours 46 minutes	0
May 1981	77.098	84 hours 14 minutes	0
June 1981	66.223	76 hours 53 minutes	0
July 1981	64.761	77 hours 24 minutes	0
August 1981	79.528	87 hours 45 minutes	0
September 1981	64.179	69 hours 49 minutes	0
October 1981	54.600	71 hours 34 minutes	0
November 1981	76.699	86 hours 00 minutes	0
December 1981	72.962	81 hours 39 minutes	0
Total	843.930	978 hours 21 minutes	0

IV. Unscheduled Shutdowns

Emergency Shutdowns - number and reason

1. Automatic Scram - Physical shock to console. Serial #268
2. Automatic Scram - Transient during range change. Serial #278

Unscheduled Shutdowns - number and reason

1. Manual Scram - Pneumatic system. "Sample stuck in transit out" signal. Broken capsule - all pieces returned. Serial #269
2. Manual Scram - Pneumatic system - CTD (Controller-Timer-Display)stopped running. Serial #270
3. Manual Scram - Pneumatic system - "A" sample changer stuck. Serial #271
4. Manual Scram - Pneumatic system - CTD stopped running. Serial #272
5. Manual Scram - Pneumatic system - CTD stopped running. Serial #273
6. Manual Scram - Pneumatic system - CTD stopped running. Serial #274
7. Manual Scram - Pneumatic system - "Sample stuck in transit out" signal. Photo-cell failure. Serial #275

8. Manual Scram - Pneumatic system - CTD stopped running. Serial #276

9. Manual Scram - Pneumatic system - CTD lost program. Serial #277

10. Manual Scram - Lost magnet current to Reg. rod. Serial #279

11. Manual Scram - Lost magnet current to Reg. rod. Serial #280

12. Manual Scram - Pneumatic system - "Sample stuck in transit out" signal. Photo-cell failure. Serial #281

13. Manual Scram - Pneumatic system - CTD lost program. Serial #282

14. Manual Scram - Pneumatic system - "Sample stuck in transit in" signal. Capsule stuck in changer block. Serial #283

V. Major Maintenance Operations

A. Water Systems

1. The demineralizer resin was changed once during the year.

2. Repairs were made to make-up valve and sump pump on secondary water system.

B. Control Rods

1. The control rods were inspected and calibrated.

VI. Summary of 10 CFR 50.59

One incident was reveiwed under 10 CFR 50.59 and is described below:

During the control rod inspection on January 5, 1981, a scribe used to align the bolt pattern in the Reg. rod extension shaft was dropped into the pool. Turbulence of the water prevented the scribe from being observed when it was dropped. The scribe was approximately 4-inches long and approximately 1/2-inches in diameter.

At the time the scribe was dropped, fuel was out of four positions in the B-ring, and two positions in the G-ring (G-5 and G-10). Fuel was removed from the remainder of the B-ring and the hexagonal section in the center of the core (including the central thimble) was removed. A light was lowered into the

opening and an inspection was made with binoculars. The entire area was clear. Inspections through binoculars were also made of the other vacant fuel positions. Binoculars were also used to thoroughly inspect the top of the core, the tank, and with the aid of a large mirror, the area under the core. No sighting of the scribe was made. The bottom of the pool was vacuumed, but that also failed to locate the scribe.

Evaluation of the possible hazards indicate the most likely events would be interference with the movement of a fuel element, or interference with the movement of a control rod. Fuel elements are infrequently moved. The operator can feel when the element is properly seated, therefore it is not believed this presents a safety problem. The small size of the scribe would indicate that it would not interfere with more than one control rod at any given time. Since the control rods were in their positions at the time the scribe was dropped, it would not have been able to fall into the guide hole in the upper grid plate with the control rod; however, it is possible for the movement of the tank water to cause the scribe to migrate. The most serious hazard would appear to be the interference with a control rod in a manner to prevent it from returning to the core when the reactor is scrammed. With the most reactive control rod stuck out, the shutdown margin should be in excess of 57 cents ($0.57) so that the reactor could be safely shutdown.

The movements of the control rods were carefully checked, and found to be operating in a normal manner. Travel times and drop times were measured and compared to previous measurements. There was not any indication of interference.

There was no indication of any problem with the control rods and all fuel elements appeared to be properly seated; therefore, the decision was made to resume operations. Surveillance of the top of the core and the tank continues on a periodic basis, the fuel element positions will be thoroughly inspected whenever an element is removed for any reason. Special attention will be given to the checks of control rod action during the daily and monthly checks.

It was concluded that the maximum credible accident if the scribe is in the core would not result in a violation of the Technical Specifications nor would the control rod stuck out condition consititute an unreviewed safety question.

The written evaluation by the reactor staff was reviewed by the Reactor Operations Committee and it was concluded that continued operation of the reactor did not involve an unreviewed safety question. A copy of the Committee's determination is attached.

VII. Radioactive Releases

A. Listed below are the total amounts of radioactive gaseous effluents released to the enviorns 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 1981	0.65	5.8	8.1×10^{-5}	0.25
February 1981	0.55	5.8	11.2×10^{-5}	0.25
March 1981	0.33	5.8	11.9×10^{-5}	0.25
April 1981	1.10	5.8	7.6×10^{-5}	0.25
May 1981	0.84	5.8	9.9×10^{-5}	0.25
June 1981	0.50	5.8	7.6×10^{-5}	0.25
July 1981	0.43	5.8	8.4×10^{-5}	0.25
August 1981	0.54	5.8	8.3×10^{-5}	0.25
September 1981	0.66	5.8	10.2×10^{-5}	0.25
October 1981	0.33	5.8	5.9×10^{-5}	0.25
November 1981	0.43	5.8	9.1×10^{-5}	0.25
December 1981	0.79	5.8	12.3×10^{-5}	0.25
Total	7.15	70.8	1.10×10^{-3}	3.00
% of allowable	10.1%		0.036%	

(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).

B. There were no radioactive liquid effluents released from the reactor duing the year 1981.

C. No radioactive waste shipment was made during 1981.

VIII. Radiation Monitoring

A. Our program to monitor and control radiation exposures included the four major elements below during the operating year 1981.

1. 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 3×10^{-8} μCi/cc present for two minutes will result in an increase of 900 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 Beckman Low Beta II 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 II) 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 each month. All portable instruments are calibrated with a certified 3-curie Cs-137 source and wipes are counted on a Beckman Low Beta II counting system.

Wipe surveys have shown the reactor area remains free of tactile contamination except for intermittent low level activity on work tabletops, the sample storage caves and floor. During 1981 the most activity detected on a wipe was 790 pCi beta plus gamma per 100 cm^2 on a table top. 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 of 1 MW.

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-49 self-reading dosimeters.

These monitoring results are categorized below:

	Rem - 1981		
Reactor Staff	**Gamma**	**Beta**	**Neutron**
Whole Body			
Highest	0.035	0.000	0.00
Mean	0.010	0.000	0.00
Hands			
Highest	0.100	0.000	0.00
Mean	0.080	0.000	0.00
Reactor Experimenters			
Whole Body			
Highest	0.015	0.000	0.00
Mean	0.005	0.000	0.00
Hands			
Highest	0.060	0.000	0.00
Mean	0.037	0.000	0.00

Reactor Visitors

All readings were less than 1.0 mrem.

Environmental Stations

	Rem 1981
Exhaust Stack	0.0902
West	0.0131
Southwest	0.0008
Southeast	0.0003

*Personnel monitoring results are for the fourth quarter of 1980 and the first three quarters of 1981.

IX. Environmental Monitoring

Pursuant to reactor operating procedures, soil and water samples are collected every second year. Samples were not collected in 1981.

United States Department of the Interior

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IN REPLY REFER TO:

In the meeting of 23-24 February 1981, the Reactor Operations Committee reviewed the action of the GSTR operating staff concerning the metal scribe which was inadvertently dropped into the U.S. Geological Survey TRIGA Reactor pool on 5 January 1981 as described in the attached report.

The Reactor Operations Committee is in agreement that the operating staff did show adequate and proper concern over the incident and did undertake as thorough as was practical search for the missing scribe. The Committee also agrees with the conclusion that the most serious potential consequence of the failure to locate and remove the scribe would be an eventual interference with one of the control rods in a manner that might prevent the rod from returning to its fully inserted position following a reactor scram. By virtue of the fact that the Technical Specifications address such a stuck rod situation and that with such a stuck rod the reactor can and will be safely shutdown with the remaining control rods, the Reactor Operations Committee is in agreement that subsequent operation of the reactor does not constitute an unreviewed safety question as per CFR 50.59 (a)(2)(iii).

R. Douglas O'Dell

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Chairman
Reactor Operations Committee