



*Center for Excellence in  
Nuclear Technology, Engineering, and Research*

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To whom it may concern:

Enclosed is the annual operating report for the University of Utah TRIGA Nuclear Reactor, License No. R-126, Docket number 50-407, for the period of 1 July 2005 through 30 June 2006. This report fulfills the requirements of the TRIGA technical specifications (TTS) 6.10(5).

If there are any further questions or concerns regarding this report, please contact me at (801) 581-4188

Respectfully,

Melinda P. Krahenbuhl  
Reactor Administrator

A020

**The University of Utah TRIGA Reactor  
Annual Operating Report  
for the period  
1 July 2005 through 30 June 2006**

**A. NARRATIVE.**

**1. Operating Experience.**

The University of Utah Center for Excellence in Nuclear Technology, Engineering, and Research (CENTER) TRIGA Reactor, License No. R-126, Docket No. 50-407, was critical 31.467 hours and generated 1233.489 kilowatt-hours of thermal energy during this reporting year. The reactor was used for educational demonstrations, laboratory experiments, systems tests, power measurements and sample irradiations.

**2. Changes in Facility Design.**

The documents supporting a forthcoming upgrade in licensed power from 100 kW to 250 kW are being reviewed by the NRC. No facilities changes have occurred.

**3. Surveillance Tests.**

Documentation of all surveillance activities is retained and stored by the facility.

**a. Control Rod Worth**

Table 1.  
Summary of control rod worth, SDM, and ER

Core Configuration	#24-B	#24-B	#24-B	#24-B
Date	8/04/05	11/09/05	12/27/05	2/17/06
	Worth (\$)	Worth (\$)	Worth (\$)	Worth (\$)
Safety Rod	2.190	2.230	2.227	2.227
Shim Rod	1.467	1.415	1.553	1.557
Regulating Rod	0.270	0.267	0.273	0.270
Excess Reactivity	0.618	0.608	0.761	0.758
Shutdown Margin	1.119	1.074	1.066	1.068

**b. Control Rod Inspection.**

The Biennial Control Rod Inspection was performed during December 2005. The control rods were sequentially removed from the reactor core for visual inspection. Each control rod was found to be in good condition with no noticeable deterioration or corrosion having occurred since the last inspection. Rod drop times were measured on 8/04/05, 11/09/05, 12/27/05 and 2/17/06. All rod drop times were less than 1.0 seconds.

c. Reactor Power Level Instrumentation.

Calorimetric power calibrations were performed on 8/05/05, 11/23/05, 12/28/05 and 2/17/06 with the following results:

Date	Measured % Power	Calculated Power Level
8/05/05	90.05	89.86
11/23/05	92.10	88.00
12/28/05	93.00	93.43
2/17/06	89.00	86.30

d. Fuel Inspection

The Biennial Fuel Inspection was performed during December 2005. Each fuel element was visually inspected while keeping it submerged for shielding. No deterioration or excessive corrosion of in-core fuel elements was observed since the previous inspection. Pool water is sampled and analyzed periodically for evidence of fission product activity indicative of defective or deteriorating fuel. Analyses of pool water following full-power reactor operations lasting several hours have not shown any indication of fission product leakage.

e. Fuel Temperature Calibration.

Fuel temperature circuits were calibrated on 8/25/05 and 2/23/06. The circuits were calibrated to less than a 2°C error over the range 20°C to 400°C.

f. Reactor Safety Committee Audits.

Four Audits were completed during this period.

Table 2.  
Audit Summary

Audit	Period	auditor
Operation and Maintenance	1 Jan. 2005 to 30 Jun. 2005	Rian B. Smith
Radiation Safety and ALARA	1 Jan. 2005 to 30 Jun. 2005	Rian B. Smith
Operation and Maintenance	1 Jul. 2005 to 31 Dec. 2005	David M. Slaughter
Radiation Safety and ALARA	1 Jul. 2005 to 31 Dec. 2005	David M. Slaughter

No significant deviations from normal operating practices were identified by these audits.

g. Environmental Surveys.

Six environmental monitors are located in areas surrounding the CENTER. Rian B. Smith reported to the RSC a maximum exposure of 45 millirem per quarter to an environmental dosimeter located at building #80. Table 3 contains the average dose recorded for four prior years.

Table 3.  
Summary of environmental monitoring

Year	Average quarterly readings for the 6 environmental monitors (mrem)
2005	35.59
2004	35.58
2003	36.00
2002	34.04

B. ENERGY OUTPUT.

The reactor was critical for 31.467 hours and produced 0.051 megawatt-days (1233.489 kilowatt-hours) of energy during this reporting period. Since initial criticality, the reactor has been operated for a total of 3262.088 hours with an accumulated total energy output of 8.380 megawatt-days (201120.926 kilowatt-hours).

C. EMERGENCY SHUTDOWNS AND INADVERTENT SCRAMS:

There was no inadvertent scram occurred during this period. There were no emergency shutdowns.

D. MAJOR MAINTENANCE.

1) PH probe was installed for the reactor pool.

E. CHANGES, TESTS AND EXPERIMENTS PURSUANT TO 10 CFR 50.59.

As of the end of the reporting period, the current membership of the Reactor Safety Committee (RSC) as designated by the Licensee is as follows:

James M. Byrne, Chair  
David M. Slaughter  
Karen Langely, RSO of University of Utah  
Melinda P. Krahenbuhl, Reactor Administrator  
Dongok Choe, Reactor Supervisor  
Gary M. Sandquist  
Robert J. Huber  
James Thompson  
Rian B. Smith

The RSC has reviewed and approved several CENTER procedures that were modified to update and correct perceived deficiencies. The CENTER staff continues to review and update facility documentation to assure compliance with all applicable regulations.

F. RADIOACTIVE EFFLUENTS.

1. Liquid Waste - Total Activity Released: none

2. Gaseous Waste - Total Estimated Activity Released: 15.359  $\mu$ Ci.

The TRIGA Reactor was operated for 51.915 hours at power levels up to approximately 90 kW. At this power level argon-41 production is substantially below MPC values for unrestricted areas. The minimum detectable concentration of Ar-41 for the stack monitor has been found to be one-third of 10 CFR 20 appendix B limits for release to unrestricted areas. The average annual calculated concentration of Ar-41 generated during operations is estimated at  $6.835 \times 10^{-11} \mu\text{Ci/ml}$  approximately 0.002 % of the DAC for this radionuclide. The total amount of Ar-41 released was estimated at 15.359  $\mu$ Ci. No phosphorus-32 was released from CENTER during this period. The total amount of all gaseous radioactivity released was estimated at 15.359  $\mu$ Ci. A monthly summary of gaseous releases is given in Table 4.

Table 4.  
Summary of Monthly Gaseous Radioactive Effluent

Month	Ar-41 ( $\mu\text{Ci}$ )	Estimated Release P-32 and all others	Total ( $\mu\text{Ci}$ )
July	0.397	0	0.397
August	3.028	0	3.028
September	1.186	0	1.186
October	0.003	0	0.003
November	1.074	0	1.074
December	2.326	0	2.326
January	0.000	0	0.000
February	4.500	0	4.500
March	2.217	0	2.217
April	0.000	0	0.000
May	0.000	0	0.000
June	0.626	0	0.626

Total Activity of gaseous effluent: 15.359  $\mu\text{Ci}$

3. Solid Waste - Total Activity: None

No solid waste material was sent to the Radiological Health Department for disposal during the period of 1 July 2005 through 30 June 2006.

G. RADIATION EXPOSURES.

Personnel with duties in the reactor laboratory on either a regular or occasional basis have been issued an OSL dosimeter by the University of Utah Radiological Health Department. The duty category and monitoring period of personnel are summarized in Table 5.

Table 5.  
Summary of Monitored Personnel

Name	Monitoring Period	Duty Category
Jesse Reeves	2/01/06-6/30/06	Regular
Melinda Krahenbuhl	7/01/05-6/30/06	Regular
Dong-ok Choe	7/01/05-6/30/06	Regular
Brian A. Harper	7/01/05-6/30/06	Regular
Douglas Crawford	11/01/05-6/30/06	Regular
John D. Bess	7/01/05-6/30/06	Regular
Ward Chapman	7/01/05-6/30/06	Regular
Jorge Navarro	7/01/05-6/30/06	Regular
Christy Seiger Webster	7/01/05-6/30/06	Regular
Sang Kyu Lee	11/01/05-6/30/06	Regular
Roger Carrasquel	7/01/05-6/30/06	Regular
Ronald Carrasquel	7/01/05-7/31/05	Regular/Terminated
Rhett W. Christensen	7/01/05-2/28/06	Regular/Terminated
Nathan Brown	7/01/05-6/30/06	Regular

Measured Doses

7/1/05-6/30/06 Doses: <5 mrem average; 5 mrem highest measured

Dose Equivalent Limit

Maximum Permissible Dose Equivalent = 5000 mrem/year (1250/quarter).

Minimum Detectable Dose per Monthly Badge = 10 mrem.

Five hundred and two (502) individuals visited the reactor facility during the period 1 July 2005 to 30 June 2006. None of the visitors received a measurable dose. A summary of whole body exposures to CENTER personnel is presented in Table 6.

Table 6.  
Summary of Whole Body Exposures

Estimated whole body exposure range (rem):	Number of individuals in each range:
No Measurable Dose (Less than 0.10)	14
0.10 to 0.25	0
0.25 to 0.50	0
0.50 to 0.75	0
0.75 to 1.00	0
1.00 to 2.00	0
2.00 to 3.00	0
3.00 to 4.00	0
4.00 to 5.00	0
Greater than 5 rem	0

#### H. LABORATORY SURVEYS

Monthly surveys of the facility were conducted by the University of Utah Radiological Health Department during the reporting period. The surveys have not indicated any unusual radiation levels over previous years. Records of surveys are retained by the facility.

#### I. ENVIRONMENTAL STUDIES

Environmental monitoring conducted by the University of Utah Radiological Health Department indicated no unusual dose rates in the areas surrounding the Merrill Engineering Building, which houses the reactor facility.

Prepared by: *Offenberg* Date: 7/05/2006

Submitted by: *Offenberg* Date: 7/05/2006  
Reactor Supervisor

Approved by: *[Signature]* Date: 7/5/2006  
Reactor Administrator