

*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 2008 through 30 June 2009. 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) 587-3066

Respectfully,

  
Dongok Choe, Ph.D.  
Reactor Administrator

A020  
NER

**The University of Utah TRIGA Reactor  
Annual Operating Report  
for the period  
1 July 2008 through 30 June 2009**

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 28.400 hours and generated 927.072 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. Fume hood system for ventilation and radio-chemistry laboratory was upgraded during the period of Oct. 2008 ~ Dec. 2008.

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
Date	8/27/08	2/24/09
	Worth (\$)	Worth (\$)
Safety Rod	2.290	2.170
Shim Rod	1.563	1.553
Regulating Rod	0.293	0.323
Excess Reactivity	0.865	0.856
Shutdown Margin	0.991	1.020

b. Control Rod Inspection

The Biennial Control Rod Inspection was performed during December 2007. 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 8/27/08, and 2/24/09. All rod drop times were less than 1.0 seconds.

c. Reactor Power Level Instrumentation

Calorimetric power calibrations were performed on 8/28/08, and 2/26/09 with the following results:

Date	Measured % Power	Calculated Power Level
8/28/08	91.6	89.61
2/26/09	92.0	90.45

d. Fuel Inspection

The Biennial Fuel Inspection was performed during December 2007. 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 8/26/08 and 2/26/09. 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. 2008 to 30 Jun. 2008	Rian B. Smith
Radiation Safety and ALARA	1 Jan. 2008 to 30 Jun. 2008	Rian B. Smith
Operation and Maintenance	1 Jul. 2008 to 31 Dec. 2008	Rian B. Smith
Radiation Safety and ALARA	1 Jul. 2008 to 31 Dec. 2008	Rian B. Smith

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 50 millirem per quarter to an environmental dosimeter located at building #80 and ERG. 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)
2008	39.26
2007	37.94
2006	36.74
2005	37.53
2004	35.58
2003	36.00

B. ENERGY OUTPUT

The reactor was critical for 28.400 hours and produced 0.0386 megawatt·days (927.072 kilowatt·hours) of energy during this reporting period. Since initial criticality, the reactor has been operated for a total of 3379.396 hours with an accumulated total energy output of 8.549 megawatt·days (205166.346 kilowatt·hours).

C. EMERGENCY SHUTDOWNS AND INADVERTENT SCRAMS:

Table 4.  
Summary of Inadvertent SCRAMS

Date	Run Number	Type	Cause	Action
3/16/09	1621	Linear Power	Power switch connection- Feedback from the reactor power switch	N/A
4/08/09	1623	Linear Power	High voltage interrupt from second floor	N/A

There was 2 inadvertent SCRAMs occurred during this period . There were no emergency shutdowns. Summary of the inadvertent scrams are in Table 4.

D. MAJOR MAINTENANCE

- 1) New computer monitoring system for reactor control panel was installed.
- 2) Computer based Thermal power calibration, control rod drops measurements, and flow meter reading systems are completed.
- 3) New fume hood system was installed (Oct. 2008 ~ Dec. 2008).

#### 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, (Resigned from RSC member as of Apr 30, 2009)  
Karen Langely, RSO of University of Utah  
Melinda P. Krahenbuhl  
Dongok Choe, Reactor Administrator/ Reactor Supervisor  
Gary M. Sandquist  
Robert J. Huber  
James Thompson  
Rian B. Smith

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: 11.475 $\mu$ Ci

The TRIGA Reactor was operated for 28.40 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 less than two-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 5.106E-11 $\mu$ Ci/ml approximately 0.002 % of the DAC for this radionuclide. The total amount of Ar-41 released was estimated at 11.475  $\mu$ Ci. No phosphorus-32 was released from CENTER during this period. The total amount of all gaseous radioactivity released was estimated at 11.475  $\mu$ Ci. A monthly summary of gaseous releases is given in Table 5.

Table 5.  
Summary of Monthly Gaseous Radioactive Effluent

Month	Ar-41 ( $\mu\text{Ci}$ )	Estimated Release P-32 and all others	Total ( $\mu\text{Ci}$ )
July,08	0.0	0	0.0
August,08	2.508	0	2.508
September,08	0.0	0	0.0
October,08	0.0	0	0.0
November,08	0.0	0	0.0
December,08	0.045	0	0.045
January,09	0.076	0	0.076
February,09	2.496	0	2.496
March,09	0.762	0	0.762
April,09	4.165	0	4.165
May,09	1.212	0	1.212
June,09	0.210	0	0.210

Total Activity of gaseous effluent: 11.475  $\mu\text{Ci}$

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 2008 through 30 June 2009.

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 6.

Table 6.  
Summary of Monitored Personnel

Name	Monitoring Period	Duty Category
Dong-ok Choe	7/01/07-6/30/08	Regular
Brian A. Harper	7/01/07-6/30/08	Regular
Douglas Crawford	7/01/07-6/30/08	Regular
Jorge Navarro	7/01/07-6/30/08	Regular
Brandalyn Bassett	7/01/07-6/30/08	Regular
Margaret Fitch	7/01/07-6/30/08	Regular
Randall W Morrill	7/01/07-6/30/08	Regular/Terminated
David M Slaughter	7/01/07-6/30/08	Regular
Craig L. Seth	10/01/07-6/30/08	Regular/Terminated
Read A. Edward	7/01/07-6/30/08	Regular/Terminated
Ward L. Steven	10/01/07-6/30/08	Regular
Chazell E. Russell	2/01/08-6/30/08	Regular/Terminated
Kingston J. Micha	2/01/08-6/30/08	Regular
Minjeong Cho	4/01/09-6/30/09	Regular
Jonathan Gebel	3/01/09-6/30/09	Regular

Measured Doses

7/1/06-6/30/07 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.

Four hundred and thirty five (435) individuals visited the reactor facility during the period 1 July 2008 to 30 June 2009. None of the visitors received a measurable dose. A summary of whole body exposures to CENTER personnel is presented in Table 7.

Table 7.  
Summary of Whole Body Exposures

Estimated whole body exposure range (rem):	Number of individuals in each range:
No Measurable Dose (Less than 0.10)	15
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: *C. Furuzon* Date: 7/7/2009

Submitted by: *C. Furuzon* Date: 7/7/09  
Reactor Supervisor

Approved by: *C. Furuzon* Date: 7/7/09  
Reactor Administrator