

*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 2002 through 30 June 2003. 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) 581-8499

Respectfully,

David M. Slaughter  
Reactor Administrator

A020

**The University of Utah TRIGA Reactor  
Annual Operating Report  
for the period  
1 July 2002 through 30 June 2003**

**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 45.666 hours and generated 1343.827 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 application to upgrade licensed power from 100 kW to 1.1 MW, are being internally reviewed before submission to 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        | #24        |
|--------------------|------------|------------|
| Date               | 8/20/02    | 2/20/03    |
|                    | Worth (\$) | Worth (\$) |
| Safety Rod         | 2.15       | 2.23       |
| Shim Rod           | 1.44       | 1.50       |
| Regulating Rod     | 0.27       | 0.28       |
| Excess Reactivity  | 0.74       | 0.79       |
| Shutdown Margin    | 0.97       | 0.99       |

**b. Control Rod Inspection.**

The Biennial Control Rod Inspection was performed during December 2001. 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 8/20/02, and 2/20/03. All rod drop times

were less than 1.0 seconds.

**c. Reactor Power Level Instrumentation.**

Calorimetric power calibrations were performed on 8/30/02, and 2/08/03 with the following results:

| Date    | Measured % Power | Calculated Power Level |
|---------|------------------|------------------------|
| 8/30/02 | 89.4 kW          | 82.1 kW*               |
| 2/08/03 | 89.5 kW          | 96.7 kW*               |

\* Power channels were calibrated

**d. Fuel Inspection**

The Biennial Fuel Inspection was performed during December 2001. 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 8/21/02 and 2/21/03. 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 2002 to 30 June 2002 | Jim Byrne     |
| Radiation Safety and ALARA | 1 Jan 2002 to 30 June 2002 | Karen Langley |
| Operation and Maintenance  | 1 July 2002 to 31 Dec 2002 | Rian Smith    |
| Radiation Safety and ALARA | 1 July 2002 to 31 Dec 2002 | Rian 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. Table 3 contains the average dose recorded for three prior years.

**Table 3.**  
**Summary of environmental monitoring**

| Year | Average quarterly readings for the 6 environmental monitors (mrem) |
|------|--|
| 2002 | 34.04  |
| 2001 | 26.5   |
| 2000 | 34.8   |

**B. ENERGY OUTPUT.**

The reactor was critical for 45.666 hours and produced 0.056 megawatt-days (1343.827 kilowatt-hours) of energy during this reporting period. Since initial criticality, the reactor has been operated for a total of 3147.873 hours with an accumulated total energy output of 8.213 megawatt-days (197118.274 kilowatt-hours).

**C. EMERGENCY SHUTDOWNS AND INADVERTENT SCRAMS:**

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

**Table 4.**  
**Summary of Inadvertent SCRAMS**

| Date     | Run Number | Type          | Cause   | Action                              |
|----------|------------|---------------|---|-------------------------------------|
| 11/8/02  | 1445       | Percent power | Feed back from pool light circuit                       | Relocated pool light power. restart |
| 12/30/02 | 1450       | Linear Power  | Voltage fluctuation due to construction in the building | None restart.                       |
| 1/27/03  | 1452       | Linear power  | Range on Contact switch                                 | None restart                        |

**D. MAJOR MAINTENNANCE.**

- CAM chart recorder gears off-line: gear shaft bushing replaced
- Ventilation system

**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, Reactor Administrator  
Karen Langely, RSO of University of Utah  
Melinda P. Krahenbuhl, Reactor Supervisor  
Gary M. Sandquist, Secretary  
Deter Gehmlich  
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: 16.731  $\mu\text{Ci}$ .

The TRIGA Reactor was operated for 45.666 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  $7.445\text{E-}11\mu\text{Ci/ml}$  approximately 0.002 % of the DAC for this radionuclide. The total amount of Ar-41 released was estimated at 16.731  $\mu\text{Ci}$ . No phosphorus-32 was released from CENTER during this period. The total amount of all gaseous radioactivity released was estimated at 16.731  $\mu\text{Ci}$ . 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<br>P-32 and all others | Total ( $\mu\text{Ci}$ ) |
|-----------|--------------------------|--|--------------------------|
| July      | 0.003                    | 0  | 0.003                    |
| August    | 0.168                    | 0  | 0.168                    |
| September | 5.484                    | 0  | 5.484                    |
| October   | 0.667                    | 0  | 0.667                    |
| November  | 5.575                    | 0  | 5.575                    |
| December  | 0.917                    | 0  | 0.917                    |
| January   | 0.066                    | 0  | 0.066                    |
| February  | 3.360                    | 0  | 3.360                    |
| March     | 0.001                    | 0  | 0.001                    |
| April     | 0.491                    | 0  | 0.491                    |
| May       | 0.000                    | 0  | 0.000                    |
| June      | 0.000                    | 0  | 0.000                    |

**Total Activity of gaseous effluent: 16.731  $\mu\text{Ci}$**

**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 2002 through 30 June 2003.

**G. RADIATION EXPOSURES.**

Personnel with duties in the reactor laboratory on either a regular or occasional basis have been issued a 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**

| <b>Name</b>          | <b>Monitoring Period</b> | <b>Duty Category</b> |
|----------------------|--------------------------|----------------------|
| David M. Slaughter   | 7/1/02-6/30/03           | regular              |
| Gary M. Sandquist    | 7/1/02-6/30/03           | regular              |
| Melinda Krahenbuhl   | 7/1/02-6/30/03           | regular              |
| Dong-ok Choe         | 7/1/02-6/30/03           | regular              |
| Justin L. Wilde      | 7/1/02-6/30/03           | regular              |
| Brenda Shelkey       | 7/1/02-6/30/03           | regular              |
| Heidi A. Walk        | 7/1/02-6/30/03           | Regular/terminated   |
| Michael LeBaron      | 7/1/02                   | Terminated           |
| Dimitre Assenov      | 7/1/02-6/30/03           | regular              |
| John D. Bess         | 7/1/02-6/30/03           | regular              |
| Jennifer L. Killpack | 7/1/02                   | Terminated           |
| Ward Chapman         | 7/1/02-6/30/03           | regular              |
| James R. Parry       | 7/1/02-6/30/03           | regular              |

**Measured Doses**

5/1/02-4/30/03 Doses <10 mrem average; 4 mrem highest measured\*

\*Dosimetry is on a bimonthly rotation May 2003 will be included in next years annual report.

**Dose Equivalent Limit**

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

Minimum Detectable Dose per Monthly Badge = 10 mrem.

Five hundred and thirty-five individuals visited the reactor facility during the period 1 July 2002 to 30 June 2003. 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<br>(rem): | Number of individuals in each range: |
|---|--------------------------------------|
| No Measurable Dose<br>(Less than 0.10)        | 13                                   |
| 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

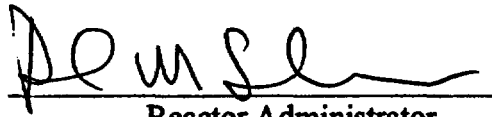
Monthly surveys of the facility were conducted by the University of Utah Radiological Health Department during the reporting period. The surveys have not indicated any unusual radiation levels over previous years. Records of surveys are retained by the facility.

#### 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:  Date: July 8, 2003

Submitted by:  Date: July 8, 2003  
Reactor Supervisor

Approved by:  Date: 7/8/03  
Reactor Administrator