

26 July, 2010

U.S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, D.C. 20555

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 2009 through 30 June 2010. 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) 587-9696.

Respectfully,



Tatjana Jevremovic, Ph.D.  
Chair Professor and Director

A020  
MLR

# **The University of Utah TRIGA Reactor (UUTR)**

## **Annual Operating Report**

**for the period  
1 July 2009 through 30 June 2010**

**Dr. Dong-OK Choe, UUTR Supervisor  
Dr. Tatjana Jevremovic, UNEP & UUTR Director**

## A. NARRATIVE

### 1. Operating Experience

The University of Utah TRIGA Reactor (UUTR), License No. R-126, Docket No. 50-407, was critical 68.866 hours and generated 2071.227 kilowatt-hours of thermal energy during this reporting year. The reactor was used for educational demonstrations and training, laboratory experiments, systems tests, power measurements and sample irradiations.

### 2. Changes in Facility Design

No changes in facility design took place. However, the facility and associated laboratories were upgraded. The upgrade included cleaning of the space, painting and modernizing the space of control room and students' prep-room by replacing the old and used furniture.

The UUTR core power upgrade including a new reactor core design is under investigation.

### 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	8/26/09	12/18/09	2/22/10	4/30/10
	Worth (\$)	Worth (\$)	Worth (\$)	Worth (\$)
Safety Rod	2.297	2.293	2.263	2.243
Shim Rod	1.587	1.517	1.530	1.550
Regulating Rod	0.290	0.277	0.277	0.287
Excess Reactivity	1.137	0.586	0.635	0.819
Shutdown Margin	0.744	1.207	1.172	1.018

#### b. Control Rod Inspection

The Biennial Control Rod Inspection was performed during December 2009. The control rods were sequentially removed from the reactor core for visual inspection. Each control rod was found to be in a good condition with no noticeable deterioration or corrosion having occurred since the last inspection. Rod drop times were measured on 8/26/09, 12/18/09, 2/22/10 and 4/30/10. All rod drop times were less than 1.0 seconds.

## c. Reactor Power Level Instrumentation

Calorimetric power calibrations were performed on 8/27/09, 12/22/09, and 2/22/10 with the results shown in Table 2.

*Table 2. Summary of calorimetric power calibration*

Date	Measured % Power	Calculated Power Level
8/27/09	91.6	88.63
12/22/09	89.0	88.85
2/22/10	90.2	88.98

## d. Fuel Inspection

The Biennial Fuel Inspection was performed during December 2009. 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. B-1 stainless steel fuel element was replaced with R6-6 stainless steel element because B-1 element has a bent end-pin. B-1 element was moved to R6-1 location.

## e. Fuel Temperature Calibration

Fuel temperature circuits were calibrated on 8/26/09 and 2/18/10. The circuits were calibrated to less than a 2°C error over the range 20°C to 400°C. The replacement of B-1 did not affect on the fuel temperature in the UUTR core.

## f. Reactor Safety Committee Audits

Four Audits were completed during this period. The data are shown in Table 3. No significant deviations from normal operating practices were identified by these audits.

*Table 3. Audit summary*

Audit	Period	auditor
Operation and Maintenance	1 Jan. 2009 to 30 Jun. 2009	James R. Parry/INL
Radiation Safety and ALARA	1 Jan. 2009 to 30 Jun. 2009	James R. Parry/INL
Operation and Maintenance	1 Jul. 2009 to 31 Dec. 2009	James R. Parry/INL
Radiation Safety and ALARA	1 Jul. 2009 to 31 Dec. 2009	James R. Parry/INL

### g. Environmental Surveys

Six environmental monitors are located in the areas surrounding the UUTR. James R. Parry at Idaho National Laboratory (INL) reported to the RSC a maximum exposure of 48 millirem per quarter to an environmental dosimeter located at building #80 and ERG. Table 4. shows the average dose recorded in last four years.

*Table 4. Summary of environmental monitoring around the UUTR*

Year	Average quarterly readings for the 6 environmental monitors (mrem)
2009	34.56
2008	39.26
2007	37.94
2006	36.74
2005	37.53
2004	35.58

## B. ENERGY OUTPUT

The UUTR reactor was critical for 68.866 hours and produced 0.0863 megawatt-days (2071.227 kilowatt-hours) of energy during this reporting period. Since initial criticality, the reactor has been operated for a total of 3447.112 hours with an accumulated total energy output of 8.634 megawatt-days (207220.682 kilowatt-hours).

## C. EMERGENCY SHUTDOWNS AND INADVERTENT SCRAMS:

There was one inadvertent SCRAM occurred during this period. It occurred at 3/19/2010 because of feedback from the reactor power select switch. There were no emergency shutdowns. Summary of the inadvertent scrams are given in Table 5.

*Table 5. Summary of Inadvertent SCRAMS*

Date	Run Number	Type	Cause	Action
3/19/10	1669	Linear Power	Power switch connection-Feedback from the reactor power switch	N/A

## D. MAJOR MAINTENANCE

1) Floor tiles and ceiling tiles for reactor room and MEB 1205 area were

replaced.

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

- a) All floor tiles and ceiling tiles were replaced in the reactor room and MEB 1205 area. Guardrail around the reactor pool was replaced. All outgoing trashes were surveyed with TBM 3S detector. A wipe test of selected surface (rail, and flooring, etc.) was performed to check for removable beta-gamma contamination.
- b) The B-1 stainless steel fuel element was replaced with the R6-6 stainless steel fuel element. The B-1 element has a bent end-pin and it was about 2 inches higher than the other element. B-1 was placed at R6-1 position. The MCNP5 simulation was performed showing that there was no change in UUTR core criticality.

#### **F. REACTOR SAFETY COMMITTEE**

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  
Tatjana Jevremovic, Director UNEP and UUTR  
Karen Langely, RSO of University of Utah  
Dongok Choe, Reactor Supervisor  
Gary M. Sandquist  
Robert J. Huber  
James Thompson  
James R. Parry  
Paul Tikalsky  
Alireza Haghighat  
Rian B. Smith

The UNEP staff continues to review and update facility documentation to assure compliance with all applicable regulations.

#### **G. RADIOACTIVE EFFLUENTS**

1. Liquid Waste - Total activity released: none

2. Gaseous Waste - Total estimated activity released: 22.733  $\mu\text{Ci}$ .

The TRIGA Reactor was operated for 68.866 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 from the CAM system 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 operation is estimated to be  $1.012 \times 10^{-10}$   $\mu\text{Ci}/\text{ml}$  approximately 1.012 % of the DAC for this radionuclide. The total amount of Ar-41 released was estimated to be 22.733  $\mu\text{Ci}$ . No phosphorus-32 was released from the UUTR and associated facilities during this period. The total amount of all gaseous radioactivity released was estimated to be 22.733  $\mu\text{Ci}$ . A monthly summary of gaseous releases is given in Table 6. Total activity of gaseous effluent is therefore 22.733  $\mu\text{Ci}$ .

*Table 6. Summary of Monthly Gaseous Radioactive Effluent*

Month	Ar-41 ( $\mu\text{Ci}$ )	Estimated Release P-32 and all others	Total ( $\mu\text{Ci}$ )
July, 09	0.0	0	0.0
August, 09	2.508	0	2.508
September, 09	0.0	0	0.0
October, 09	0.0	0	0.0
November, 09	1.606	0	1.606
December, 09	2.706	0	2.706
January, 09	0.887	0	0.887
February, 09	4.565	0	4.565
March, 09	0.059	0	0.059
April, 09	0.006	0	0.006
May, 09	5.413	0	5.413
June, 09	4.983	0	4.983

### 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 2009 through 30 June 2010.

## H. RADIATION EXPOSURES

The University of Utah Radiological Health Department has issued to all personnel with duties in the reactor laboratory on either a regular or occasional basis an OSL dosimeter. The duty category and monitoring period of personnel are summarized in Table 7.

*Table 7. Summary of Monitored Personnel*

Name	Monitoring Period	Duty Category
Dong-ok Choe	7/01/09-6/30/10	Regular
Brian A. Harper	7/01/09-5/31/10	Regular/Terminated
Douglas Crawford	7/01/09-6/30/10	Regular
Jorge Navarro	7/01/09-6/30/10	Regular
Brandalyn Bassett	7/01/09-6/30/10	Regular/Terminated
Margaret Fitch	7/01/09-6/30/10	Regular/Terminated
Ward L. Steven	7/01/09-6/30/10	Regular
Kingston J. Micha	7/01/09-6/30/10	Regular
Minjeong Cho	7/01/09-12/31/09	Regular/Terminated
Jonathan Gebel	7/01/09-3/30/10	Regular/Terminated
Benjamin Marble	7/01/09-6/30/10	Regular
Clendennen Crystal	1/01/10-4/30/10	Regular/Terminated
Jesse Reeves	1/01/10-6/30/10	Regular
Jensen Mathew	3/01/10-6/30/10	Regular
Troy Bowden	4/01/10-6/30/10	Regular
Tatjana Jevremovic	5/01/10-6/30/10	Regular
Nader Satvat	6/01/10-6/30/10	Regular
Todd Sherman	6/01/10-6/30/10	Regular

Measured Doses

7/1/09-6/30/10 Doses: <7 mrem average; 7 mrem highest measured

Dose Equivalent Limit

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

Minimum Detectable Dose per Monthly Badge = 10 mrem.

Three hundred and eighty nine (389) individuals visited the reactor facility during the period 1 July 2009 to 30 June 2010. None of the visitors received a measurable dose. A summary of the whole body exposures to the personnel is presented in Table 8.



*Table 8. Summary of Whole Body Exposures*

Estimated whole body exposure range (rem)	Number of individuals in each range
No Measurable Dose (Less than 0.10)	18
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

**I. 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.

**J. 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 UUTR reactor facility.

Prepared by: Dongok Choe

Date: 7/24/2010

Submitted by: Dongok Choe  
Reactor Supervisor

Date: 7/24/2010

Approved by: Tatjana Jevremovic  
Director

Date: 7/26/2010