

26 July, 2012

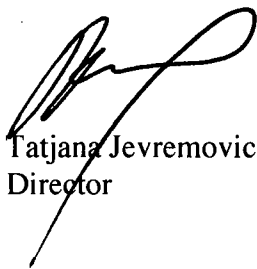
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To whom it may concern:

Enclosed please find 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 2011 through 30 June 2012. This report fulfills the requirements of the TRIGA Technical Specifications 6.7.1.

If there are any further questions or concerns regarding this report, please contact me at (801) 587-9696.

Respectfully,



Tatjana Jevremovic, Ph.D.  
Director

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KRR

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

## **Annual Operating Report**

**for the period  
1 July 2011 through 30 June 2012**

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

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## A. NARRATIVE

### A.1. Operating Experience

The University of Utah TRIGA Reactor (UUTR), License No. R-126, Docket No. 50-407, was critical for 85.301 hours and generated 4,928.939 kilowatt-hours of thermal energy during this reporting year. The reactor was used for educational demonstrations and training, class laboratory experiments, reactor systems tests, reactor power measurements and neutron activation analysis and various samples irradiations.

### A.2. Upgrade and Changes in the Facility

The grating on the top of the reactor tank was installed in December 2011, as shown in Figure 1. The facility and associated laboratories were upgraded with new counting instrumentations. The upgrade included the security system of the facility and cleaning of the space. Figures 2 shows newly established counting stations, radio-chemistry laboratory, microscopy lab, and laboratory preparation area.

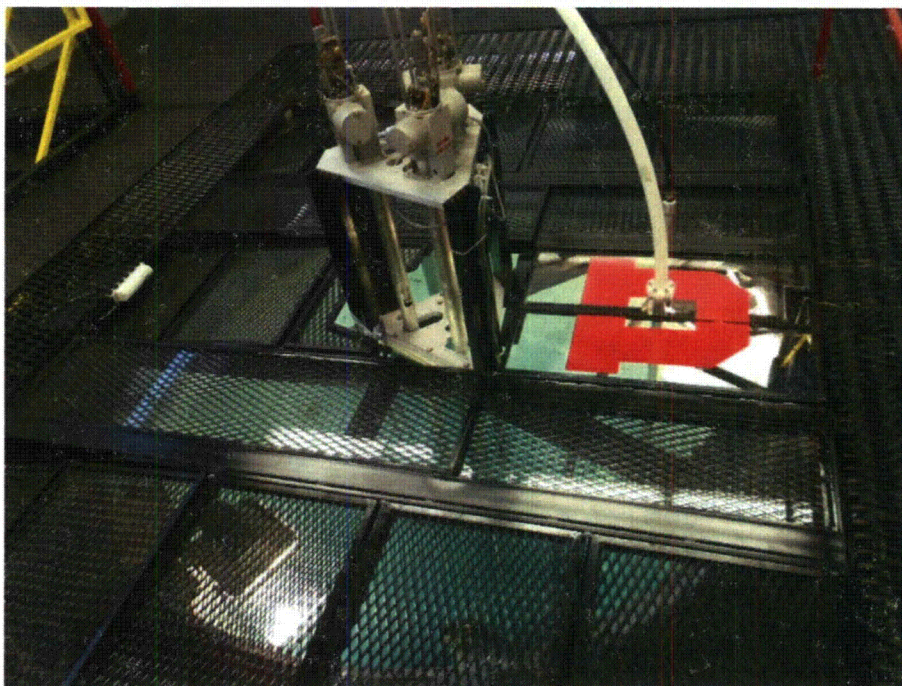


Figure 1. New grating of the UUTR installed in December of 2011





*Figure 2. UNEF Counting stations, radio-chemistry laboratory, microscopy laboratory and laboratory preparation area*

### **A.3. Surveillance Tests**

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

#### **A.3.a Control Rod Worth**

Control rod worth measurements were performed semiannually and after the biennial fuel inspection. The results are summarized in Table 1. The control rod worth varies within less than 1.5 % of the measurements for the safety and shim control rod, and less than 6 % for the regulating control rod. Shut down margin (SDM) and excess reactivity (ER) were calculated based on the three-control rod worth values. Both SDM and ER vary within 12 %.

*Table 1. Summary of control rod worth, shut down margin, and excess reactivity*

<b>Core Configuration Date</b>	<b>#24-B 08/02/11</b>	<b>#24-B 12/29/11</b>	<b>#24-B 02/28/12</b>
	Worth (\$)	Worth (\$)	Worth (\$)
<b>Safety Rod</b>	2.220	2.200	2.247
<b>Shim Rod</b>	1.490	1.493	1.507
<b>Regulating Rod</b>	0.280	0.270	0.263
<b>Excess Reactivity</b>	0.860	0.755	0.809
<b>Shutdown Margin</b>	0.910	1.008	0.961

### A.3.b Control Rod Inspection

The biennial control rod inspection was performed during December of 2011 when 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. Rod drop times were measured on 08/02/11, 12/29/11, and 02/28/12. All rod drop times were less than 1.0 second.

### A.3.c Reactor Power Level Instrumentation

Calorimetric power calibrations were performed on 8/20/10, and 2/25/11 with the results shown in Table 2. The errors for the measured and calculated reactor power of each power calibration was less than 5%, providing calibration of the reactor power channels is not required.

*Table 2. Summary of calorimetric power calibration*

<b>Date</b>	<b>Measured % Power</b>	<b>Calculated Power Level</b>
08/05/11	92.50	88.41
12/29/11	92.90	93.92
02/24/12	90.60	86.88

### A.3.d Fuel Inspection

The biennial fuel inspection was performed during December of 2011 when each fuel element was visually inspected while keeping it submerged in reactor tank water in assuring the required shielding. No deterioration or excessive corrosion of in-core fuel elements was observed. 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 the presence of fission products.

### A.3.e Fuel Temperature Calibration

Fuel temperature circuits were calibrated on 08/30/11 and 02/24/12. The circuits were calibrated to less than a 2 °C error over the range from 20 °C to 400 °C.

### A.3.f Reactor Safety Committee (RSC) Audits

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

*Table 3. Reactor Safety Committee audit summary*

<b>Audit</b>	<b>Period</b>	<b>Auditor</b>
<b>Operation and Maintenance</b>	01/01/12 to 06/30/12	James R. Parry/INL
<b>Radiation Safety and ALARA</b>	01/01/12 to 06/30/12	James R. Parry/INL
<b>Operation and Maintenance</b>	07/01/11 to 12/31/11	James R. Parry/INL
<b>Radiation Safety and ALARA</b>	07/01/11 to 12/31/11	James R. Parry/INL

### A.3.g Environmental Surveys

Six environmental monitors are located in the areas surrounding the UUTR. James R. Parry of Idaho National Laboratory (INL) reported to the RSC a maximum exposure of 50 mrem per quarter on the

environmental dosimeter located in building #80. Table 4 shows the average dose recorded in last five years.

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

<b>Year</b>	<b>Average quarterly readings for 9 environmental monitors (mrem)</b>
<b>2011</b>	35.13
<b>2010</b>	36.00
<b>2009</b>	34.56
<b>2008</b>	39.26
<b>2007</b>	37.94

## **B. ENERGY OUTPUT**

The UUTR reactor was critical for 85.301 hours and produced 0.205 megawatt·days (4,928.939 kilowatt·hours) of energy during this reporting period. Since initial criticality, the reactor has been operated for a total of 3,649.643 hours with an accumulated total energy output of 9.033 megawatt·days (216,795.716 kilowatt·hours).

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

There were six inadvertent SCRAMs occurred during this period: 10/21/2011, 10/28/2011, 03/29/2012 (3), and 04/05/2012 because of feedback from mechanical errors of the pool water scram switch. There were no emergency shutdowns. Summary of the inadvertent scrams is given in Table 5.

*Table 5. Summary of inadvertent SCRAMs*

<b>Date</b>	<b>Run Number</b>	<b>Type</b>	<b>Cause</b>	<b>Action</b>
<b>10/21/11</b>	1758	Pool water	Pool water scram switch- Feedback from the pool water scram switch	Reset pool water scram
<b>10/28/11</b>	1759	Pool water	Pool water scram switch- Feedback from the pool water scram switch	Reset pool water scram



<b>03/29/12 (3)</b>	1781	Pool water	Pool water scram switch- Feedback from the pool water scram switch	Reset pool water scram
<b>04/05/12</b>	1782	Pool water	Pool water scram switch- Feedback from the pool water scram switch	Reset pool water scram

#### **D. MAJOR MAINTENANCE**

There was no major maintenance in this report period.

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

The grating on the top of the reactor tank was installed in December of 2011.

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

As of the end of this reporting period, the current members of the RSC as designated by the Licensee are 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

### G.1. Liquid Waste

Total activity released: There was no liquid waste release in this report period.

### G.2. Gaseous Waste

Total estimated activity released: Total 61.365  $\mu\text{Ci}$  of gaseous waste was released in this report period. The UUTR was operated for 85.301 hours at power levels of up to approximately 90 kW. At this power level Ar-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-thirds 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  $2.731 \times 10^{-10}$   $\mu\text{Ci}/\text{ml}$  that is approximately 0.008 % of the DAC. The total amount of Ar-41 released was estimated to be 61.365  $\mu\text{Ci}$ . No P-32 was released from the UUTR and associated facilities during this period. The total amount of all gaseous radioactivity released was estimated to be 61.365  $\mu\text{Ci}$ . A monthly summary of gaseous releases is given in Table 6. Total activity of gaseous effluent was therefore 61.365  $\mu\text{Ci}$ .

Table 6. Summary of monthly gaseous radioactive effluent

Month	Ar-41 ( $\mu\text{Ci}$ )	Ar-41 ( $\mu\text{Ci}/\text{ml}$ )	Estimated Release P-32 and all others	% of DAC
Jul 11	8.296	$3.690 \times 10^{-11}$	0	0.001
Aug 11	5.364	$2.390 \times 10^{-11}$	0	0.001
Sep 11	6.769	$3.010 \times 10^{-11}$	0	0.001
Oct 11	8.943	$3.980 \times 10^{-11}$	0	0.001
Nov 11	0.000	0	0	0.000
Dec 11	3.663	$1.630 \times 10^{-11}$	0	0.001
Jan 12	4.450	$1.980 \times 10^{-11}$	0	0.001
Feb 12	10.562	$4.700 \times 10^{-11}$	0	0.002
Mar 12	9.211	$4.100 \times 10^{-11}$	0	0.001
Apr 12	2.589	$1.150 \times 10^{-11}$	0	0.000
May 12	1.165	$5.180 \times 10^{-12}$	0	0.000
Jun 12	0.353	$1.570 \times 10^{-12}$	0	0.000
<b>Total</b>	<b>61.365</b>	<b><math>2.731 \times 10^{-10}</math></b>	<b>0</b>	<b>0.009</b>

### ***G.3. Solid Waste***

Total activity: There was no solid waste release in this report period. No solid waste material was sent to the Radiological Health Department for disposal during the period of 1 July 2011 through 30 June 2012.

## **H. PERSONNEL RADIATION EXPOSURES**

### ***H.1. UNEP Personnel***

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 optically stimulated luminescence (OSL) dosimeter. The duty category and monitoring period of personnel are summarized in Table 7. Table 8 represents a summary of personnel who stopped working at UNEP during this report period. A summary of the whole body exposures to the UNEP personnel is presented in Table 9.

### ***H.2. Measured Doses***

In this report period, the average personnel dose was less than 2 mrem; the highest measured dose for UNEP personnel was 2 mrem.

### ***H.3. Dose Equivalent Limit***

According to 10 CFR 20.1201 (a) (1) (i), maximum permissible occupational dose equivalency is 5,000 mrem/year (1,250 mrem/quarter). All UNEP personnel's occupational doses are within the 10 CFR 20.1201 limits. The radiation doses for personnel and laboratory at UNEP are determined monthly using OSL dosimeters. Minimum detectable dose of the OSL dosimeter is 10 mrem/month.

### ***H.4. Visitors***

Five hundred and fifteen (515) individuals visited the reactor facility during the period 1 July 2011 to 30 June 2012. None of the visitors received a measurable dose.

*Table 7. Summary of monitored personnel during the report period*

Name	Monitoring Period	Duty Category
Dongok Choe	07/01/11-6/30/12	Regular
Douglas Crawford	07/01/11-6/30/12	Regular
Jorge Navarro	07/01/11-6/30/12	Regular
Zachary Heinz	09/01/11-6/30/12	Regular
Gregory Moffitt	01/01/12-6/30/12	Regular
Jesse Reeves	07/01/11-6/30/12	Regular
Tatjana Jevremovic	07/01/11-6/30/12	Regular
Aliaksei Minko	10/01/11-6/30/12	Regular
Todd Sherman	07/01/11-6/30/12	Regular
Andrew Voyles	07/01/11-6/30/12	Regular
Haori Yang	07/01/11-6/30/12	Regular
Joseph Levinthal	07/01/11-6/30/12	Regular
Ian Schwerdt	07/01/11-6/30/12	Regular
Christopher Dances	07/01/11-6/30/12	Regular
Hermilo Hernandez	10/01/11-6/30/12	Regular
Jason Rapich	07/01/11-6/30/12	Regular
Steven Burnham	07/01/11-6/30/12	Regular
Daniel Telenko	07/01/11-6/30/12	Regular
Philip Babitz	07/01/11-6/30/12	Regular
Avdo Cutic	07/01/11-6/30/12	Regular
Jennifer Gibson	07/01/11-6/30/12	Regular
Brooklyn Noble	12/01/11-6/30/12	Regular
Andrey Rybalkin	10/01/11-6/30/12	Regular
Christian Adjei	10/01/11-6/30/12	Regular
Dallon Boyd	03/01/12-6/30/12	Regular
Samuel Brown	04/01/12-6/30/12	Regular
Tierra Duffield	10/01/11-6/30/12	Regular
Mark Young	02/01/12-6/30/12	Regular
Samantha Winkle	09/01/11-6/30/12	Regular
Blane Wilkinson	10/01/11-6/30/12	Regular
Can Liao	10/01/11-6/30/12	Regular

*Table 8. Summary of personnel who stopped working at UNEP during the report period*

Luis Ortiz R.	04/01/11-6/30/12	Regular/Discontinued
Thomas Van Hook	10/01/11-6/30/12	Regular/Discontinued
Ryan Bartling	09/01/11-6/30/12	Regular/Discontinued

*Table 9. Summary of whole body exposures to the UNEP personnel*

<b>Estimated whole body exposure range (rem)</b>	<b>Number of individuals in each range</b>
No. of Measurable Dose (Less than 0.10)	34
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 this reporting period. The surveys have not indicated any unusual radiation levels over previous years. Records of surveys are retained at 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.

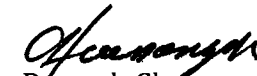


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