THE UNIVERSITY OF UTAH

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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 2016 through 30 June 2017. 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) 581-4188.

Respectfully,

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The University of Utah TRIGA Reactor (UUTR)

Annual Operating Report

for the period
1 July 2016 through 30 June 2017

Ryan C. Schow, UUTR Supervisor

A. NARRATIVE

1. Operating Experience

The University of Utah TRIGA Reactor (UUTR), License No. R-126, Docket No. 50-407, was critical for 92.585 hours and generated 1,775.232 kilowatt-hours of thermal energy during this reporting year. The reactor was used for educational demonstrations and training, laboratory experiments, reactor systems tests, reactor power measurements and sample irradiations.

2. Changes in Facility Design

No major changes to the facility occurred during this reporting period.

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 Date	#24-B 12/9/16	#24-B 2/28/17
	Worth ($)	Worth ($)
Safety Rod	2.193	2.160
Shim Rod	1.440	1.423
Regulating Rod	0.283	0.283
Excess Reactivity	0.686	0.666
Shutdown Margin	1.037	1.040

b. Control Rod Inspection

The biennial control rod inspection was performed during May of 2016 and was not required to be performed from July 1, 2016 to June 30, 2017.

c. Reactor Power Level Instrumentation

Calorimetric power calibrations were performed on 10/5/16, 10/7/16 and 3/3/17 with the results shown in Table 2. The calibration performed on 10/5/16 was completed at a lower power level of 50 kW due to replacement of ion-chambers and maintenance. The percent power indication was much higher than the thermal power calculated results due to a new chamber and placement of that chamber. The percent power chamber was moved physically further from the core and a follow-

up calibration was performed on 10/7/16. The adjustment of the percent power monitoring channel procedure was performed on 10/12/16 following the calorimetric results received on 10/7/16.

Table 2. Summary of calorimetric power calibrations

Date	Percent Power Indication	Linear Power Indication	Thermal Calculated Power Level
10/5/16	96.8	50.0	50.7
10/7/16	85.0	90.0	89.9
3/3/17	89.3	90.0	90.7

d. Fuel Inspection

The biennial fuel inspection was performed during April and May of 2016 and was not required to be performed from July 1, 2016 to June 30, 2017.

e. Fuel Temperature Calibration

Fuel temperature circuits were calibrated on 9/2/16 and 2/7/17. The circuits were calibrated to less than or equal to 2°C error over the range from 20 °C to 400 °C.

f. Reactor Safety Committee (RSC) Audits

Three 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. Audit summary

Audit	Period	Auditor
Operation and Maintenance	1 Jan. 2016 to 30 Jun. 2016	James M. Byrne
Radiation Safety and ALARA	1 Jul. 2015 to 30 Nov. 2016	Fred Monette
Operation and Maintenance	1 Jul. 2016 to 31 Dec. 2016	James M. Byrne

g. Environmental Surveys

Eight environmental monitors are located in the areas surrounding the UUTR. A maximum exposure of 36 mrem in a quarter to an environmental dosimeter located in the Building 80 was measured. Table 4 shows the average dose recorded in last five years.

Table 4. Summary of environmental monitoring around the UUTR

Year	Average quarterly readings for the 8 environmental monitors (mrem)
2016	31.18
2015	32.06
2014	33.81
2013	33.88
2012	35.56
2011	35.13

B. ENERGY OUTPUT

The UUTR reactor was critical for 92.585 hours and produced 0.074 megawatt·days (1,775.232 kilowatt·hours) of energy during this reporting period. Since initial criticality, the reactor has been operated for a total of 3975.281 hours with an accumulated total energy output of 9.416 megawatt·days (225981.813 kilowatt·hours).

C. EMERGENCY SHUTDOWNS AND INADVERTENT SCRAMS:

There were five inadvertent SCRAMs that occurred during this period: 12/9/16, 1/10/17, 1/17/17, and two on 4/6/17, because of erratic indication when operating the linear power selector switch. Summary of the inadvertent scrams and unplanned shutdowns is given in Table 5.

Table 5. Summary of Inadvertent SCRAMS and Unplanned Shutdowns

Date	Run Number	Type	Cause	Action
12/9/16	1914	Linear Power	Linear power indication oscillated when operating the reactor power selector switch	Reactor power selector switch examined
1/10/17	1916	Linear Power	Linear power indication oscillated when operating the reactor power selector switch	Reactor power selector switch examined
1/17/17	1918	Linear Power	Linear power indication oscillated when operating the reactor power selector switch	Reactor power selector switch examined
4/6/17	1939	Linear Power	Linear power indication oscillated when operating the reactor power selector switch	Reactor power selector switch examined

D. MAJOR MAINTENANCE

- The log power and period control electronic circuit was replaced in September 2016

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

None.

F. REACTOR SAFETY COMMITTEE

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

James M. Byrne, Chair
Tatjana Jevremovic
Fred Monette, RSO of University of Utah
Ryan Schow, Reactor Supervisor
Donald Wall
Rian Smith
Benjamin Huffman

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: 22.102 μCi.
The UUTR was operated for 92.585 hours at power levels 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-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 9.83×10^{-11} μCi/ml that is approximately 0.0033 % of the DAC. The total amount of Ar-41 released was estimated to be 22.102 μCi. 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 22.102 μCi. A monthly summary of gaseous releases is given in Table 6. Total activity of gaseous effluent was therefore 22.102 μCi.

Table 6. Summary of Monthly Gaseous Radioactive Effluent

Month	Power (kWh)	Ar-41 (μCi)	Ar-41 (μCi/ml)	Estimated Release P-32 and all others	% of DAC
Jul 16	0.628	0.008	3.47746E-14	0	0%
Aug 16	0.219	0.003	1.21268E-14	0	0%
Sep 16	1.43	0.018	7.91843E-14	0	0%
Oct 16	313.071	3.898	1.73359E-11	0	0.0006%
Nov 16	143.969	1.792	7.97209E-12	0	0.0003%
Dec 16	178.126	2.218	9.86348E-12	0	0.0003%
Jan 17	262.613	3.270	1.45418E-11	0	0.0005%
Feb 17	91.66	1.141	5.07555E-12	0	0.0002%
Mar 17	511.197	6.364	2.83068E-11	0	0.0009%
Apr 17	272.319	3.390	1.50793E-11	0	0.0005%
May 17	0	0	0	0	0%
Jun 17	0	0	0	0	0%
Total	1775.232	22.102	9.8301E-11	**0**	0.0033%

3. Solid Waste - Total activity: None
   No solid waste material was sent to the Radiation Safety for disposal during the period of 1 July 201 through 30 June 2017.

H. PERSONNEL RADIATION EXPOSURES

UNEP Personnel
The University of Utah Radiation Safety 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. A summary of the whole-body exposures to the UNEP personnel is presented in Table 8.

Measured Doses
7/1/16-6/30/17 Doses: 9 mrem average; 16 mrem highest measured

Dose Equivalent Limit
Maximum Permissible Dose Equivalent = 5000 mrem/year (1250/quarter).
Minimum Detectable Dose per Monthly Badge = 1 mrem.

Visitors
Six hundred and eighty-three (683) individuals visited the reactor facility

during the period 1 July 2016 to 30 June 2017. None of the visitors received a measurable dose.

Table 7. Summary of Monitored Personnel

Name	Monitoring Period	Duty Category
Albright, Lucas	07/01/16-6/30/17	Regular
Allred, Michael	07/01/16-6/30/17	Regular
Burak, Adam	07/01/16-6/30/17	Regular
Burnham, Steven	07/01/16-6/30/17	Regular
Craynor, Elliott	01/01/17-6/30/17	Regular
Curtis, Jonathan	01/01/17-6/30/17	Regular
Cutic, Avdo	07/01/16-6/30/17	Regular
Doane, Samuel	07/01/16-6/30/17	Regular
Dupre, Jean-Nicolas	07/01/16-6/30/17	Regular
Faure, Quentin	07/01/16-6/30/17	Regular
Fitzhugh, Richard	07/01/16-6/30/17	Regular
Foley, Amanda	07/01/16-6/30/17	Regular
Gallagher, Joshua	10/01/2016-6/30/17	Regular
Han, Dahee	07/01/16-6/30/17	Regular
Horvath, David	07/01/16-6/30/17	Regular
Jevremovic, Tatjana	07/01/16-6/30/17	Regular
Kanno, Nicholas	07/01/16-6/30/17	Regular

Kavouras, John	07/01/16-6/30/17	Regular
Kim, Donghoon	07/01/16-6/30/17	Regular
Lai, Trent	07/01/16-6/30/17	Regular
Lintereur, Azaree	07/01/16-6/30/17	Regular
Lund, Matthew	07/01/16-6/30/17	Regular
Novy, Rebecca	07/01/16-6/30/17	Regular
Okabe, Parker	07/01/16-6/30/17	Regular
Olsen, Calan	01/01/17-6/30/17	Regular
Palmer, Alan	01/01/17-6/30/17	Regular
Porter, JoCee	07/01/16-6/30/17	Regular
Reinhart, Cameron	07/01/16-6/30/17	Regular
Saenz, Brittney	07/01/16-6/30/17	Regular
Schow, Ryan C	07/01/16-6/30/17	Regular
Takasugi, Cole	07/01/16-6/30/17	Regular
Thomas, Bryce	01/01/17-6/30/17	Regular
Thomas, Ryan	01/01/17-6/30/17	Regular
Tuttle, Jacob	04/01/17-6/30/17	Regular
Winkle, Samantha	07/01/16-6/30/17	Regular
Wu, Tingshiuan	01/01/17-6/30/17	Regular
Wilson, Dylan	07/01/16-12/31/16	Regular/Terminated

Alroumi, Fawaz	07/01/16-12/31/16	Regular/Terminated
Flygare, Joshua	07/01/16-12/31/16	Regular/Terminated
Gee, Wimonphan	07/01/16-12/31/16	Regular/Terminated
Hatfield, Andrew	07/01/16-12/31/16	Regular/Terminated
Hawkins, Casey	07/01/16-12/31/16	Regular/Terminated
Heffeman, Sean	10/01/16-12/31/16	Regular/Terminated
Hinrichs, Benny	07/01/16-12/31/16	Regular/Terminated
King, Travis	07/01/16-12/31/16	Regular/Terminated
Lee, Sangkyu	07/01/16-12/31/16	Regular/Terminated
Levinthal, Joseph	07/01/16-12/31/16	Regular/Terminated
Lusk, Robert	07/01/16-12/31/16	Regular/Terminated
McDonald, Luther	07/01/16-12/31/16	Regular/Terminated
Morgan, David	07/01/16-12/31/16	Regular/Terminated
Olsen, Adam	07/01/16-12/31/16	Regular/Terminated
Rapich, Jason	07/01/16-12/31/16	Regular/Terminated
Schwerdt, Ian	07/01/16-12/31/16	Regular/Terminated
Tamplin, Michelle	07/01/16-12/31/16	Regular/Terminated
Minko, Aliaksei	07/01/16-4/30/17	Regular/Terminated

Table 8. Summary of whole body exposures to the UNEP personnel

Estimated whole body exposure range (rem)	Number of individuals in each range
Less than 0.1	55
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 Radiation Safety 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 Radiation Safety indicated no unusual dose rates in the areas surrounding the Merrill Engineering Building, which houses the UUTR reactor facility.

Prepared by: Ryan Schow Date: 7/12/2017
Reactor Supervisor

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Reactor Supervisor