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02/25/2019

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NRR/DLP/PRLB
3WFN MS 8 C28

SUBJECT: Docket No. 50-602 R-126, 2018 ANNUAL REPORT FOR THE UNIVERSITY OF TEXAS TRIGA II NUCLEAR RESEARCH REACTOR

Sir:

Attached is the 2018 Annual Report for the University of Texas TRIGA II Nuclear Reactor. If there are any questions, please feel free to contact P. M. Whaley at whaley@mail.utexas.edu or 512 232 5374.

Sincerely,

P. M. Whaley

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NRR

2018 ANNUAL REPORT FOR THE UNIVERSITY OF TEXAS TRIGA II NUCLEAR RESEARCH REACTOR (DOCKET 50-602)

INTRODUCTION

The University of Texas System (UTS) was established by the Texas Constitution in 1876, with the University of Texas at Austin the flagship institution. The Nuclear Engineering Teaching Laboratory was established at the J. J. Pickle Research Campus with a TRIGA II Nuclear Research Reactor, critical in 1992. The reactor is licensed to the University of Texas under USNRC License R-129, a class 104 research reactor. A second USNRC license for special nuclear materials, SNM-180, authorizes possession of a subcritical assembly, neutron sources, and various equipment at NETL. Other activities at the NETL using radioisotopes fall under a broad scope, State of Texas license (L00485).

The NETL TRIGA II Reactor Technical Specifications (section 6.6.1) requires an annual report to the Nuclear Regulatory Commission. This Annual Report covers the period from January through December 2018. The report is organized to summarize the status of current organization during the reporting period (line management organization, oversight committees, and independent oversight activities) followed by the information as detailed in Technical Specifications.

ORGANIZATION

Line Management

Figure 1 presents the four levels of management identified in Technical Specifications.

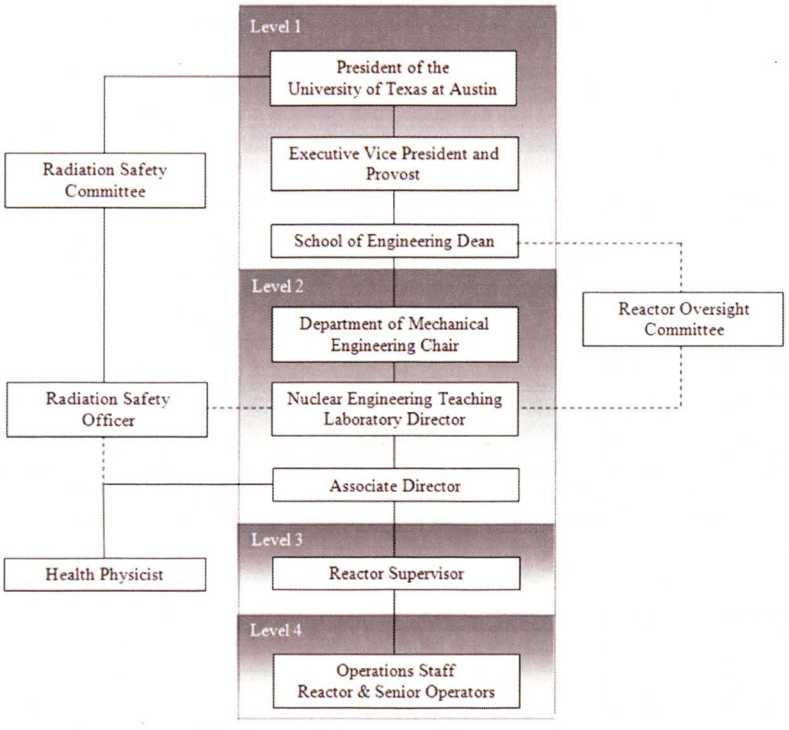

Figure 1: Line Management Organization

Table 1: Level 1

The University of Texas at Austin Administration
Greg L. Fenves, PhD, President
Maurie McInnis, PhD, Executive Vice President and Provost
Sharon Wood, PhD, Dean, Cockrell School of Engineering

There were no changes in Level 1 personnel during 2018.

Table 2: Level 2

Mechanical Engineering and NETL Administration
Dr. Richard Neptune, Chair, Mechanical Engineering Department
Dr. Dale Klein, Interim Director
Dr. W. Charlton, Director
P. M. Whaley, Associate Director

Dr. W. Charlton replaced Dr. Dale Klein (interim Director) in 2018 (ADAMS ML 18030A629).

Table 3: Level 3

NETL Reactor Supervisor
Larry Hall, Reactor Manger

There was no change in the reactor manager during 2018.

Table 4: Level 4

NETL Reactor Operators/Senior Reactor Operators
P. M. Whaley: Senior Operator
Larry Hall: Senior Operator
Tracy Tipping (health Physicist, Laboratory Manager) Reactor Operator
Walker Payne (UT Graduate) Reactor Operator
Issac Kravitz (UT graduate student) Reactor Operator
Briana Barth (UT undergraduate student) Reactor Operator – *License issued 06/2018*
Ray Pool (UT undergraduate) *Licensed issued 06/2018 - License Terminated 08/2018*
Jim Terry (Electronic Technician) Reactor Operator – *License issued 06/2018*
Jacob Navar (UT Graduate) Reactor Operator – *License Terminated 08/2018*
Matt Stokely (UT graduate student) – *License Terminated 09/2018*

Three reactor operator licenses were issued and three terminated in 2018.

Oversight Committees

Table 5: 2017-2018 University Radiation Safety Committee

Kevin N. Dalby, Ph.D., Chair, Professor, College of Pharmacy
Dan Jaffe, Ph.D., Vice Chair, Vice President for Research
W. Scott Pennington, ex-officio, Radiation Safety Officer, Environmental Health and Safety
Jack L. Ritchie, Ph.D., Department Chair, Professor, Department of Physics
John Salsman, Director, Environmental Health and Safety (& acting Radiation Safety Officer)
Christopher S. Sullivan, Ph.D., Associate Professor, Department of Molecular Biosciences
J. Steven Swinnea, Ph.D., Texas Materials Institute X-Ray Facility Manager
Tracy N. Tipping, NETL Health Physicist and Laboratory Manager
Karen M. Vasquez, Ph.D., Professor, College of Pharmacy

Table 6: 2017-2018 Reactor Oversight Committee

Derek Haas (ME), Chair
Howard Liljestrand (CAEE)
Dale Klein (ME)
Rick Neptune, ex-officio (ME)
John G. Ekerdt, ex-officio
Lawrence R. Jacobi (External Representative)
Larry Hall, ex-officio (NETL)
Tracy Tipping, ex-officio (NETL)
Mike Whaley, ex-officio (NETL)
Scott Pennington (Radiation Safety Officer)
John Salsman, Director, Environmental Health and Safety (acting Radiation Safety Officer)

Independent Oversight Activities

Table 7: Inspections and Reviews

USNRC License(s) Inspection	
R-129	6-9 November 2018
SNM-180	None
State of Texas License Inspection	
L00485 (89)	None
Reactor Oversight Committee Review	
Semi Annual Review	2 May 2018
Semi Annual Review	9 Nov 2018
Other	
UT Fire Marshal Fire Safety	13 Apr 2018
UT Fire Safety Systems	9 Oct 2018

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ANNUAL REPORT

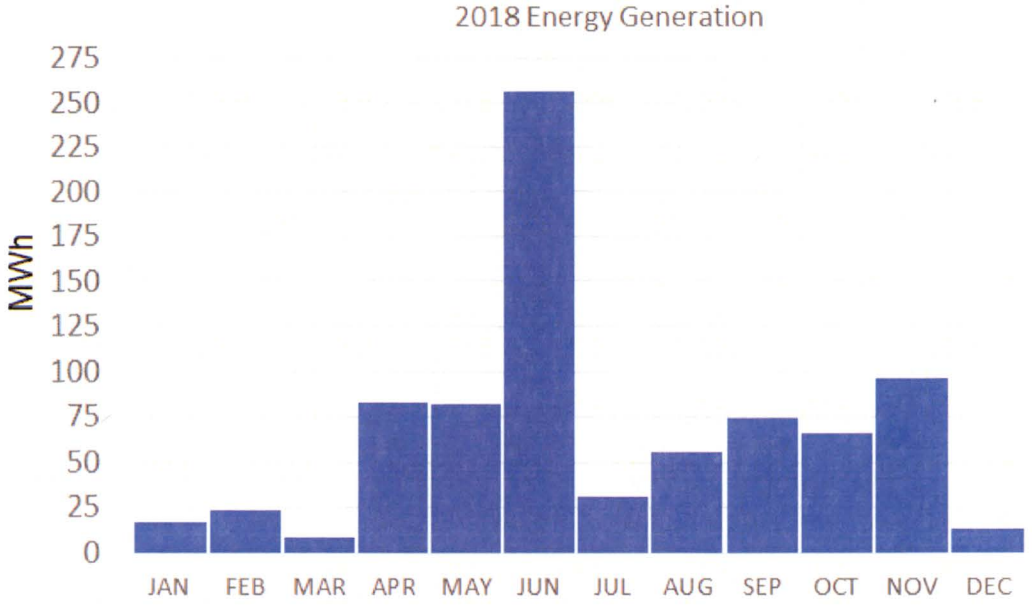
The Technical Specifications requires "Routine annual reports covering the activities of the reactor facility during the previous calendar year" three months following the end of each prescribed year. Specific information required in the annual report is provided in Table 8. Items in bold face indicate expanded text follows.

Table 8: Required Annual Report Information		
Information		Addressed as
a.	A narrative summary of reactor operating experience including the energy produced by the reactor or the hours the reactor was critical, or both.	**Narrative Summary**
		Energy produced: 33.9 MWD
		Hours critical: 1233 h
b.	The unscheduled shutdowns including, where applicable, corrective action taken to preclude recurrence.	**Tabulation of Unscheduled Shutdowns**
		Analysis and Corrective Action
c.	Tabulation of major preventive and corrective maintenance operations having safety significance.	**Statement of Surveillance Activities**
		Description of Significant Corrective Maintenance
d.	Tabulation of major changes in the reactor facility and procedures, and tabulation of new tests or experiments, or both, that are significantly different from those performed previously, including conclusions that no new or unanalyzed safety questions were identified.	**Description of Facility Modifications**
		Description of Procedure Changes
		Description of New Tests/Experiments
		50.59 Summary
e.	A summary of the nature and amount of radioactive effluents released or discharged to the environs beyond the effective control of the owner-operator as determined at or before the point of such release or discharge. The summary shall include, to the extent practicable, an estimate of individual radionuclides present in the effluent. If the estimated average release after dilution or diffusion is less than 25% of the concentration allowed or recommended, a statement to this effect is sufficient.	There were no liquid discharges in 2018
		Argon 41 Discharge
f.	A summarized result of environmental surveys performed outside the facility.	**Environmental Surveys**
g.	A summary of exposures received by facility personnel and visitors where such exposures are greater than 25% of that allowed or recommended.	No exposures in 2018 exceeded 25% of limits

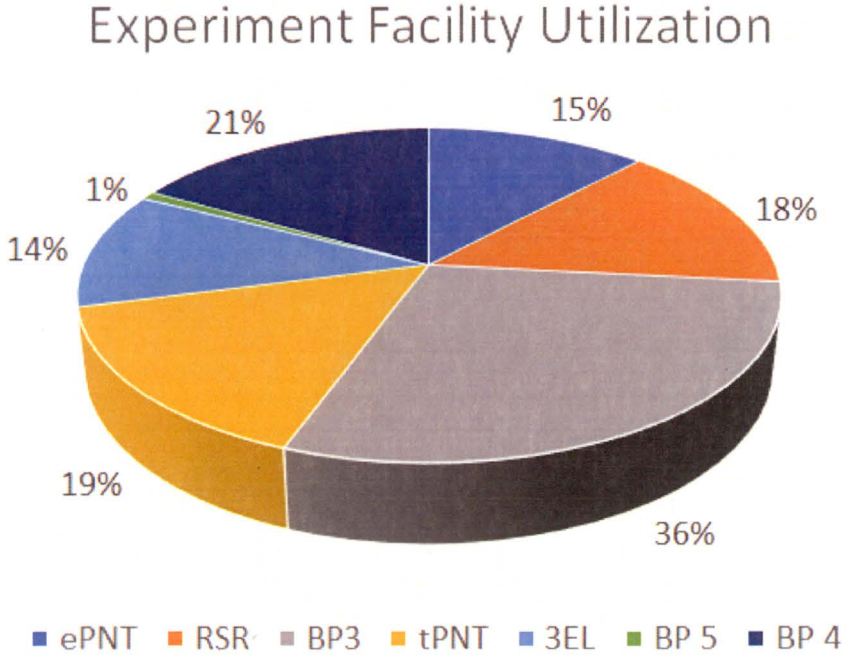
[Table 8.a] Narrative Summary

The UT-TRIGA reactor operated on 201 days in 2018, producing a total energy output of 813 MWh. There were routine maintenance outages in January, July, and December; the maintenance outage scheduled for January 2019 was completed prior to Christmas break (The University is secured over Christmas break, typically from the Friday before Christmas through January 1) to support an experiment schedule. There were week-long outages in March and October for fuel receipt, and August for fuel inspection as described below. Although the reactor

was not available for operations for almost 2 months of 2018, energy generation was above average principally, but not totally, attributed to operations in June.



A set of operations was conducted in June with continuous 24/7 irradiations to supply high specific activity radioisotopes (for a PNNL experiment) in a 3El facility. There were 35 days of operations for training and education, including preparation for NRC examination and reactor-based laboratory classes. There were 817 samples irradiated during 166 days of experiment operations (45 experiments run: 9 for research, 26 for service work and 10 for internal experiments. The distribution of utilization across experiment facilities is provided below.



Other Significant Operations and Events:

Fuel Receipt, Lightly Irradiated TRIGA Fuel from Interim Storage

In March and September two sets of lightly burned fuel elements were transferred from INL interim storage to UT inventory.

Spent Fuel Inspection

The UT TRIGA is recognized by DOE as a priority when spent fuel shipping to the interim storage facility authorized for TRIGA fuel resumes. A transportation Quality Assurance Program was submitted to the USNRC for approval in 2018, with response to Request for Additional Information in progress. Idaho National Laboratory conducted an on-site inspection of candidate elements to support acceptance at the storage facility.

License Non-Compliance

During an audit of compliance with the Technical Specifications and license, it was noted that one item on the SNM inventory (enriched uranium foil) exceeded the license possession limit. A physical inventory was conducted, and foils were identified in excess of the SNM inventory. Although technically not reportable, a notification of the license non-compliance was provided to the NRC Program Manager with a commitment to correct the SNM inventory and submit a license amendment request following radiological measurements to define actual inventory.

Transmission of SGI by Email by Unauthorized Person

A UT information system manager transmitted Safeguards Information with unsecured email. Personnel in the organization were authorized for access to SGI, but the manager was not. Although technically not reportable, NETL Staff contacted the security specialist for research reactors to verify this was a regulatory violation and the proposed corrective action was acceptable. UT information security used NIST recommended methodology to remove the email, access to the SGI was restricted. Corrective action to prevent recurrence is in progress.

[Table 8.b part 1] Tabulation of Unscheduled Shutdowns

UNSCHEDULED SHUTDOWNS			
1/24/2018	NM%PWR	Playback indicated 100 W prior to trip	Spurious NM
1/31/2018	NP%PWR	Playback indicates NPP setpoint reached	Operator Error
2/05/2018	FT 1	Playback indicated 315 C prior to trip	Spurious FT
3/08/2018	NM%PWR	Playback indicated 95% prior to trip	Spurious NM
4/03/2018	FT 1	Playback indicated 426 C prior to trip	Spurious FT
5/07/2018	FT 1	Playback indicated 311 C prior to trip	Spurious FT
6/13/2018	NM%PWR	Operator err Bank rods 950 KW	Operator error

UNSCHEDULED SHUTDOWNS			
7/10/2018	NP%PWR	Playback indicated 100% prior to trip	
7/12/2018	NM%PWR	Adjust NM 1000 circuit constant	Operator error
8/29/2018	FT 1	426 C observed/Playback failed	Spurious FT
9/18/2018	NM%PWR	Operator err Bank rods 950KW	Operator error

[Table 8.c part 2] Analysis and Corrective Actions

Temperature Trips

There were four temperature channel trips in 2018 related to spurious signals in fuel temperature measuring channel. In all cases, time dependent data indicates fuel temperatures were normal and the trips occurred because of signal transients not indicative of actual fuel temperature. Attempts to isolate the trip to a specific component or recreate the failure have not been successful. The failure mode is conservative and acceptable until either the channel fails in a more consistent mode or the characteristics leading to the actuations allow the cause to be identified.

Operator Errors

There were four reactor scrams that occurred because of errors by operators. One occurred under a reactor operator trainee; signal instability at high power is compensated by operating at a lower steady state power level, and the operator did not recognize the potential for a spurious scram as the signal varied. Two occurred during power adjustment/rod position balancing. One occurred while an NM 1000 constant was being adjusted.

Spurious NM 1000 Power Level Trips

Historically, the NM 1000 accounts for a large fraction of spurious trips. A residual signal bias has also been frequently observed, requiring a discharge to allow the channel to fall into shutdown range. During the July maintenance outage, the fission chamber and integral cable was replaced and re-terminated. Based on experience to date, this may have affected the incidence of spurious NM 1000 scrams.

[Table 8.c part 1] Statement of Surveillance Activities

The facility conducts two major maintenance outages each year, one in January (before the start of the spring semester) and one mid-summer. In 2018 the maintenance scheduled for the January 2019 outage was completed in December 2018 to support an experiment operation schedule. All surveillances and scheduled maintenance activities were completed during the reporting year at the required frequencies. All results met or exceeded the requirements of the Technical Specifications.

Table 8.c part 2] Description of Significant Corrective Maintenance

DAC Power Supply Replacement

During a routine preoperational checkout a failed power supply in the digital to analog converter was identified and replaced.

Particulate Cam Repair

During a preoperational checkout the air flow on the air particulate detector was found to be unacceptably low. The carbon vane rotors were replaced, and the instrument returned to service.

NM 1000 Fission Chamber and Cable Replacement

The NM-1000 power level channel has had recurring issues that required the detector be denergized and a residual bias be grounded. Ongoing troubleshooting and repairs have been ineffective to resolve the issue, but the likely cause was determined to be associated with the detector and cable. Therefore the detector and associated cabling was replaced during an maintenance outage.

[Table 8.d part 1] Description of Facility Modifications

Argon Cam

A new argon continuous air monitor was installed in 2015 and has been operated in parallel with the original instrument since. Operating experience since installation has demonstrated agreement between the two instruments, and the original (obsolete) instrument was retired from service and removed. In 2018 the original GA argon continuous air monitor was removed. Revisions were made to the calibration procedure and preoperational checks to reflect the use of the new argon continuous air monitor.

Area Monitors

Ludlum Model 425 neutron and gamma area monitors were installed 2017 and operated in parallel with Eberline RMS II area monitors since. In 2018 the Eberline RMS II area monitors were removed. Revisions were made to the calibration procedure and preoperational checks to reflect the use of the new area monitor system.

Reactor Bay Lighting

Stadium lights were replaced by LED lights in the Reactor Bay and Neutron Generator room.

Building Boiler

The reactor bay and HVAC system cools incoming air to reduce humidity, then a 'hot deck' uses hot water to heat the air to comfort levels. The boiler that supplies the hot water was installed to replace obsolete equipment.

Beam Port 4/5 Shielding and Access

Development of a gamma and fast neutron imaging facility at BP4 created interference with access to the radiography facility at BP5. The access to BP5 was relocated.

[Table 8.d part 2] Description of Procedure Changes

With the replacement of the original off gas monitor with a new Argon Cam, the calibration procedure was revised to support the new instrument and preoperational checks were revised to reflect the new instrument.

With the removal of Eberline RMS II area monitors, replaced by Ludlum Ludlum Model 425 neutron and gamma area monitors, revisions were made to the calibration procedure and preoperational checks to reflect the use of the new area monitor system.

The reactor power level instrument calibration procedure (SURV2) was revised to allow use of more modern equipment to ensure ease of adaptability for more accurate data collection.

[Tabl8 8.d part 3] New Tests or Experiments

A pneumatic facility located in a 3-EL cannister was approved. Facility design is in progress.

Minor changes were made to the gamma imaging and fast neutron facilities experiment.

[Table 8.d part 4] 50.59 Summary

Modifications for which no Technical Specifications change is required and the criteria for NRC approval prior to implementation was not met.

19 Dec 2018: Replace Eberline RMS II area monitors with Ludlum 375 area monitors (initial installation accomplished previously, with operation in parallel for > 1 year); calibration procedure and minor procedure changes in preoperational checks were implemented.

01 Sep 2018: Replaced DAC power supply with equivalent; calibration procedure and minor procedure changes in preoperational checks (no Technical Specifications change required; criteria for NRC approval prior to implementation not met)

02 Jul 2018: Replace Fission Chamber and Cable; replace EMI protection (metal enclosure) with grounding strap.

21 Jun 2018: Replaced reactor bay stadium lights with LED warehouse lighting; calibration procedure and minor procedure changes in preoperational checks (no Technical Specifications change required; criteria for NRC approval prior to implementation not met)

20 Apr 2018: Replace APD carbon vane with OEM parts; calibration procedure and minor procedure changes in preoperational checks (no Technical Specifications change required; criteria for NRC approval prior to implementation not met)

12 Feb 2018: Replace GA Argon Monitor with Canberra 100 G-B-1 SP Continuous Air Monitor (Initial installation 12/2015, operating in parallel since installation); calibration procedure and minor procedure changes in preoperational checks; calibration procedure and minor procedure changes in preoperational checks (no Technical Specifications change required; criteria for NRC approval prior to implementation not met)

The pneumatic facility in a 3-EL cannister is in the design phase; a 10CFR50.59 review will be completed following review of final design and prior to installation

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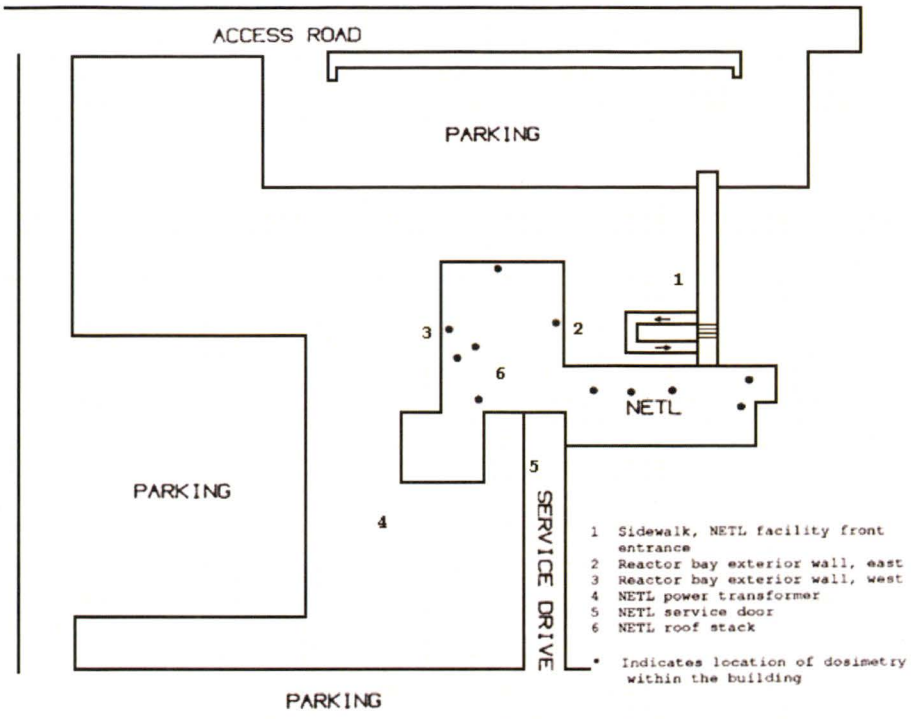
[Table 8.e] Argon 41 Discharge

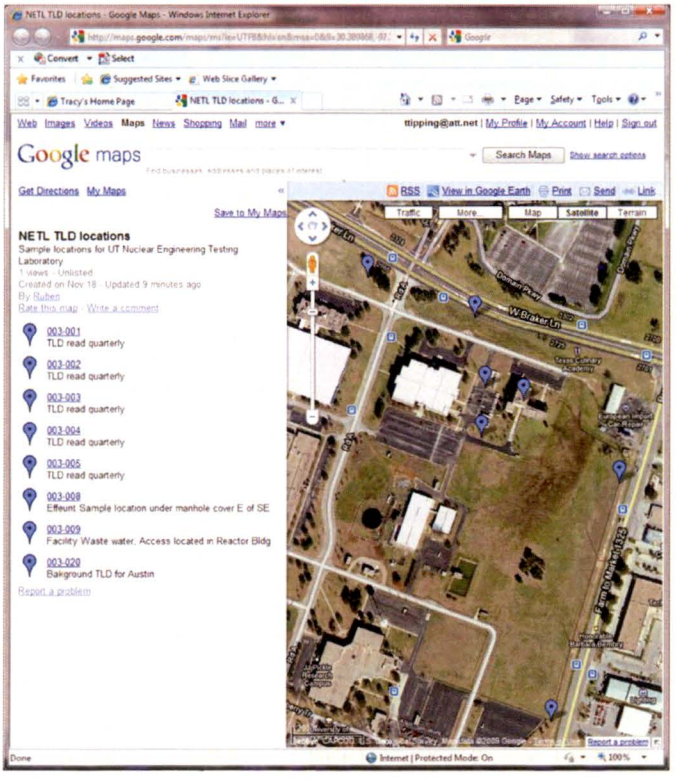
The principal radioactive effluent for the UT reactor is Argon 41. There were 1.7×10^6 μCi of argon-41 discharged during calendar year 2018, approximately 2% of the value permitted by Technical Specifications.

[Table 8.f] Environmental Surveys

NETL monitors exterior locations indicated as positions 1 through 6 on the exterior dosimeter map. For 2018, "minimal" doses (< 1 mrem) were reported for positions 1, 4, 5, and 6 for 2018. A dose of one mrem was reported for positions 2 and 3 for 2018. This is well below the 100 mrem annual limit for dose to the general public.



NETL Environmental Monitor Locations (External Dosimeter Map)



The Texas Department of State Health Services monitors exterior locations near NETL indicated as positions 1 through 5 on the TDSHS TLD map. As yet, TDSHS has not reported any doses for 2018.