

ANNUAL REPORT ON THE OPERATION OF THE  
WASHINGTON STATE UNIVERSITY TRIGA REACTOR

Facility License R-76 for the Reporting Period of  
July 1, 1984 to June 30, 1985

A. Narrative Summary of the Year's Operation

1. Operating Experience

The Washington State University Reactor has accumulated 577 megawatt hours on Core 31-A during the reporting period. A total of 2780 irradiations for a total of 25,042 samples were performed. Also, 30 pulses greater than \$1.00 were performed during this reporting period. The quarterly operations summaries are shown in Table I, Section B.

2. There were no changes in design, performance characteristics, or operating procedures that related to reactor safety during the reporting period.
3. All surveillance tests and requirements were performed and completed within the prescribed time period. The results of all inspections revealed no abnormalities and were within expected values.

B. Energy and Cumulative Output

The quarterly operations summaries are given in Table I below.

Table I  
Fiscal Year Summary of Reactor Operations

	JAS	OND	JFM	AMJ	TOTALS
Hours of Operation	123	155	151	159	588
Megawatt Hours	123	145	151	158	577
No. of Irradiations	139	952	1188	501	2780
No. of Samples Irradiated	7061	7799	5283	4899	25042
No. of Pulses > \$1.00	0	28	0	2	30

The cumulative energy output since criticality of the TRIGA core since 1967 is 523 megawatt days. The mixed core of FLIP and Standard fuels installed in 1976 has accumulated 262 megawatt days.

C. Emergency Shutdowns and Inadvertent Scrams

During the reporting period, no emergency shutdowns occurred. The causes of the four inadvertent scrams that occurred during the reporting period are given in Table II below.

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Table II  
Inadvertent Scrams

Number	Cause
1	Period channel spike during startup
1	High radiation, reactor bridge due to sample removal
1	Pulse rod scram; no indication of cause
1	High startup rate due to loss of Log-N channel signal

D. Major Maintenance

There were no items in this category for this reporting period. All maintenance performed was routine, planned maintenance.

E. Changes, Tests and Experiments Carried Out Under 10 CFR 50.59

During the reporting period, one item was conducted and documented under 10 CFR 50.59.

In August, 1984, the 10 Kohm trip test potentiometer and test switch in the Wide Range Log-N Channel failed. An equivalent replacement part was installed and tested. The replacement of the part was documented under 10 CFR 50.59 and approved in-house.

F. 1. Radioactive Liquid Release

During the reporting period, the average release concentration was  $10.7 \times 10^{-9}$  microcuries/milliliter. This yielded a total of 0.79 microcuries released in a total of 20,432 gallons. The monthly releases are listed in Table III below.

Table III  
Radioactive Liquid Releases

Month	Quantity uCi	Concentration uCi/ml	Percent MPC*	Volume Gallons
July	0.55	$3.14 \times 10^{-8}$	31	4633
August	Release made/no detectable counts above background			4645
September	No release	-	-	-
October	No release	-	-	-
November	No release	-	-	-
December	0.12	$4.93 \times 10^{-9}$	4.9	6539
January	No release	-	-	-
February	No release	-	-	-
March	0.11	$5.99 \times 10^{-9}$	6.0	4615
April	No release	-	-	-
May	No release	-	-	-
June	0.01	$4.67 \times 10^{-10}$	0.5	4644

\*Based on a release limit of  $1.0 \times 10^{-7}$  uCi/cc for unknown mixture found in Technical Specifications 6.10, paragraph 5, page 36.

## 2. Radioactive Gaseous Release

During the reporting period, no significant quantity of any gaseous or particulate material with a half-life greater than eight days was released.

During the reporting period, at no time did the release exceed 20% of MPC for Argon-41.

The average monthly concentration of Argon-41 was  $1.17 \times 10^{-7}$  uCi/cc. This yielded a total of 7.8 curies released in  $6.7 \times 10^{13}$  cc of air. The monthly releases are summarized below in Table IV.

Table IV  
Monthly Argon-41 Releases

Month	Concentration Before Dilution uCi/cc	Percent MPC* After Dilution	Quantity mCi
July	$1.03 \times 10^{-7}$	1.03	584
August	$1.01 \times 10^{-7}$	1.01	573
September	$1.27 \times 10^{-7}$	1.27	697
October	$1.26 \times 10^{-7}$	1.26	714
November	$1.30 \times 10^{-7}$	1.30	713
December	$1.07 \times 10^{-7}$	1.07	607
January	$1.12 \times 10^{-7}$	1.12	635
February	$1.32 \times 10^{-7}$	1.32	676
March	$1.30 \times 10^{-7}$	1.30	737
April	$9.45 \times 10^{-8}$	0.94	518
May	$1.22 \times 10^{-7}$	1.22	692
June	$1.23 \times 10^{-7}$	1.23	675

\*Based on 10 CFR 20 limit of  $4.0 \times 10^{-8}$  uCi/cc (Table II, Cal. I), and a dilution factor of  $4.0 \times 10^{-3}$  (SAR 6.4.2) for an after dilution limit of  $1.0 \times 10^{-5}$  uCi/cc.

## 3. Radioactive Solid Waste Disposal

For waste generated by the Nuclear Radiation Center during the reporting period, one shipment was made to U.S. Ecology Company in Richland, Washington for disposal. A total of 1.0 millicuries in 15 cubic feet was packed in two 55-gallon drums for shipment. The shipments are tabulated in Table V below.

Table V  
W.S.U., N.R.C. Solid Radioactive Waste Disposal

Date	Volume in Cubic Feet	Activity in Millicuries
11/15/84	15.0	1.0

### G. Personnel and Visitor Radiation Exposures

The average quarterly exposures of Nuclear Radiation Center reactor staff and experimenters who routinely utilize the <sup>135</sup>U reactor are given in Table VI below. The maximum quarterly exposure of one individual, who is a reactor staff member, was 120 millirem.

A total of 1525 individuals and non-Nuclear Radiation Center staff experimenters visited the Center during the reporting period, out of which 483 entered posted radiation areas. As determined by pocket dosimeter, the average individual exposure for those entering posted radiation areas was 3.13 millirem with a maximum exposure of 30 millirem.

A total of 30 group tours visited the Nuclear Radiation Center during the reporting period consisting of 430 individuals. As determined by digital dosimeter, the average group exposure was 1.1 millirem with a maximum exposure of 15 millirem.

Table VI  
Average Quarterly Reactor/Experimenter Staff Exposure  
(in millirems)

Jul-Aug-Sep	Oct-Nov-Dec	Jan-Feb-Mar	Apr-May-Jun
17.6	12.5	7.5	9.2

### H. Reactor Facility Radiation Levels

The routine area radiation surveys of the building in non-reactor operating areas had an average level of 0.10 mRem/Hr while the average level in reactor operating areas was 0.15 mRem/Hr. The highest average was 0.36 mRem/Hr which occurred in the beam port room at the thermal column face. The lowest average was 0.02 mRem/Hr which occurred in the reactor shop area. The average level in the reactor control room was 0.03 mRem/Hr.

Routine building surveys for removable contamination in non-reactor operating areas had an average value of  $3.17 \times 10^{-5}$  uCi/100 cm<sup>2</sup> while the average value in reactor operating areas was found to be  $5.03 \times 10^{-5}$  uCi/100 cm<sup>2</sup>. The highest average value in reactor operating areas was  $16.58 \times 10^{-5}$  uCi/100 cm<sup>2</sup> which was found on the platform where experimenters stand to insert and withdraw samples from the reactor. The lowest average value in the reactor operating areas was  $0.96 \times 10^{-5}$  uCi/100 cm<sup>2</sup> which was found to be the reactor control room floor.

### I. Environmental Monitoring Program

The environmental monitoring program uses thermoluminescent dosimeters (TLD's) at locations in and around the reactor building facility.



The quarterly exposures near the Nuclear Radiation Center are listed in Table VII below. The normal ambient gamma radiation levels for this area (80-mile radius) average 250 uR/day as reported in the 19th Annual Report of the Environmental Radiation Program by the Office of Environmental Health Programs, Washington State Department of Social and Health Services.

The values observed indicate there is no significant effect on the environment radiation levels by reactor operation.

Table VII  
Environmental Radiation Levels in the  
Vicinity of the Nuclear Radiation Center\*

J-A-S	O-N-D	Exposure in uR/day		Median
		J-F-M	A-M-J	
165	102	**	**	134

\*For sampling stations located 50 meters or greater from the Nuclear Radiation Center.

\*\*Jan-Feb-Mar and Apr-May-Jun data not available from TLD vendor at the time this report was prepared. A completed exposure record will be provided when TLD exposures are received from vendor.

Quarterly exposures at readily accessible locations at the reactor facility are listed in Table VIII. No significant effect on the environment radiation levels by reactor operation was noted.

Table VIII  
Exposure Rates Adjacent to the Nuclear Radiation Center\*

	Exposures in uR/day				Median
	J-A-S	O-N-D	J-F-M	A-M-J	
Building Entrance	270	139	**	**	205
E. Lower Loading Dock	270	278	-	-	274
E. Pool Room Door	5116	139	-	-	2628
Storage Shed	791	333	-	-	562
N. Side of Building	251	194	-	-	223
W. Beam Room Door	288	167	-	-	228
W. Side of Building	288	333	-	-	311
W. Building Roof	581	139	-	-	360
E. Building Roof	428	278	-	-	353

\*For sampling stations located less than 50 meters of the Nuclear Radiation Center.

\*\*Jan-Feb-Mar and Apr-May-Jun data not available from TLD vendor at the time this report was prepared. Complete data report will be provided when TLD exposures are received from vendor.

Technical specifications ALARA effluent releases in 3.12(2) specify annual radiation exposure at the closest offsite extended occupancy shall not, on an annual basis, exceed the average local offsite background radiation by more than 20%. For the calendar year 1984, the average background radiation level for sampling points 400 meters or greater from the facility was 164 uR/day. The average radiation level at the closest extended occupied area 380 meters away was 160 uR/day, which yields a ratio of exposure to background of -2.1% indicating no exposure level above natural background.

Fiscal year 1984-1985 ratios for the reporting period will be provided when 1985 1st and 2nd quarter TLD data is available from the TLD vendor.

# WASHINGTON STATE UNIVERSITY

PULLMAN, WASHINGTON 99164-1300

NUCLEAR RADIATION CENTER

August 7, 1985

Director, Division of Reactor Licensing  
U.S. Nuclear Regulatory Commission  
Washington, DC 20545

Re: Docket No. 50-27  
Facility License R-76

Subject: Annual Report

Dear Sir:

In accordance with the Technical Specifications for Facility License R-76 and the provisions of 10 CFR 50.59, Paragraph (6), the attached annual report prepared by Jerry A. Neidiger, the Reactor Supervisor of the WSU facility, is hereby submitted. The report covers the period from July 1, 1984 to June 30, 1985.

Sincerely,

*W. E. Wilson*

W.E. Wilson  
Associate Director

WEW:mb

Enc.

cc: John Sheppard, Chairman  
Reactor Safeguards Committee  
C.J. Nyman, Dean of the  
Graduate School  
N.R.C.-Region V, Office of  
Inspection and Enforcement  
J.A. Neidiger

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