

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

Facility License R-76 for the period
of July 1, 1983 to June 30, 1984

A. Narrative Summary of the Year's Operation

1. Operating Experience

The Washington State University Reactor has accumulated 503 megawatt hours on Core 31-A during the reporting period. A total of 16,295 irradiations for a total of 35,202 samples were performed. In addition, 28 pulses greater than \$1.00 were performed during this 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	TOTAL
Hours of Operation	98	126	164	119	507
Megawatt Hours	98	125	161	119	503
No. of Irradiations	247	1255	13181	1612	16295
No. of Samples Irradiated	2864	7179	18093	7066	35202
No. of Pulses > \$1.00	0	5	22	1	28

The cumulative energy output since criticality of the TRIGA core since 1967 is 499 megawatt days. The mixed core of FLIP and Standard fuels installed in 1976 has accumulated 238 megawatt days.

C. Emergency Shutdowns and Inadvertent Scrams

During the reporting period, no emergency shutdowns occurred. The causes of the 5 inadvertent scrams which occurred during the reporting period are given in Table II on the next page.

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Table II
Inadvertent Scrams

Number	Cause
1	Safety Channel #1; momentary loss of building power
1	Log-N Channel H.V. Failure; line spike
1	Safety Channel #1; line spike while pulsing
2	Reactor Scram; technician working inside console

D. Major Maintenance

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

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

During the reporting period, two changes to the facility were conducted and documented under 10 CFR 50.59.

The first item involved a facility modification and consisted of installing a recirculation line, check valves and a 3-way valve in the discharge line of the liquid waste sampling tank. This allows us to recirculate the tank's contents prior to sampling and analysis of the tank's contents. The modification constituted a change in the liquid waste collection system as described in the Safety Analysis Report. Since the change did not involve either a change in procedures or a new hazard than that described in the Safety Analysis Report, the 10 CFR 50.59 modification was approved in house by the reactor staff and the Reactor Safeguards Committee.

The second facility modification involved replacing the mechanical cooling system pressure gauges with pressure transducers and electric readouts and relocating the cooling system control panel from the north wall in the Control Room to a section in the Reactor Console. The change involved neither a change in the facility description, change in procedures nor a test or experiment not described in the Safety Analysis Report and therefore was approved in house.

F. 1. Radioactive Liquid Release

During the reporting period, the average release concentration was 4.16×10^{-8} uCi/ml. This yielded a total of 2.8 microcuries released in a total of 18,120 gallons of liquid effluent. The monthly releases are given in Table III on the next page.

Table III
Radioactive Liquid Releases

Month	Quantity uCi	Concentration uCi/ml	Percent MPC*	Volume Gallons
July	1.4	8.1×10^{-8}	81	4582
August	No release	-	-	-
September	0.9	4.88×10^{-8}	48	4813
October	No release	-	-	-
November	0.03	1.80×10^{-9}	1	4738
December	No release	-	-	-
January	No release	-	-	-
February	No release	-	-	-
March	0.5	3.46×10^{-8}	34	3987
April	No release	-	-	-
May	No release	-	-	-
June	No release	-	-	-

*Based on a release limit of 1.0×10^{-7} uCi/ml for unknown mixture found in Technical Specifications 6.10 paragraph 5.

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 4.42×10^{-8} uCi/cc. This yielded a total of 2.9 curies released in 6.69×10^{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	2.13×10^{-9}	0.02	12
August	1.45×10^{-8}	0.15	82
September	2.08×10^{-8}	0.21	114
October	2.59×10^{-8}	0.26	146
November	6.01×10^{-8}	0.60	329
December	1.03×10^{-7}	1.03	583
January	8.05×10^{-8}	0.80	456
February	1.00×10^{-7}	1.00	530
March	3.72×10^{-9}	0.04	21
April	4.60×10^{-8}	0.46	252
May	3.59×10^{-8}	0.36	203
June	3.84×10^{-8}	0.38	210

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

3. Radioactive Solid Waste Disposal

For waste generated by the Nuclear Radiation Center during the reporting period, two shipments were made to U.S. Ecology Company in Richland, Washington for disposal. A total of 14.55 millicuries in 15 cubic feet was packaged in 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
11/17/83	7.5	10.83
5/24/84	7.5	3.72

G. Personnel and Visitor Radiation Exposure

The average quarterly exposures of Nuclear Radiation Center reactor staff and experimenters who routinely utilize the WSU reactor are given in Table VI below. The maximum quarterly exposure for two individuals, who are reactor staff members, is 150 millirem each.

A total of 1372 individuals and non-Nuclear Radiation Center staff experimenters visited the Center during the reporting period, out of which 506 entered posted radiation areas. As determined by pocket dosimeters, the average individual exposure for those entering posted radiation areas was 3.42 millirem with a maximum exposure of 32 millirem.

A total of 33 group type tours visited the Nuclear Radiation Center during the reporting period consisting of 301 individuals. As determined by dosimeter, the average group exposure was 0.68 millirem with a maximum exposure of 4 millirem.

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

Jul-Aug-Sep	Oct-Nov-Dec	Jan-Feb-Mar	Apr-May-Jun*
24	14	52	13

*April badge results only. May and June badge results not available from vendor at the time this report was prepared.

H. Reactor Facility Radiation Levels

The routine area radiation surveys of the building in non-reactor operating areas had an average level of 0.20 mRem/hr. while the average level in reactor operating areas was 0.49 mRem/hr. The highest average was 4.39 mRem/hr. which occurred in the beam port room at the thermal column face. The lowest average level was 0.02 mRem/hr. which was found 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 2.27×10^{-5} uCi/100 cm² while the average value in reactor operating areas was 3.30×10^{-5} uCi/100 cm². The highest average value in the reactor operating areas was 4.13×10^{-5} uCi/100 cm² 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 0.86×10^{-5} uCi/100 cm² 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. Normal ambient gamma radiation levels for this area (80 mile radius) average 240 uR/day as reported in the 18th 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 operations.

Table VII
Environmental Radiation Levels in the
Vicinity of the WSU Nuclear Reactor*

J-A-S	O-N-D	Exposure in uR/day		Median
		J-F-M	A-M-J	
143	248	**	**	196

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

**January-February-March and April-May-June data not available from TLD vendor at the time this report was prepared. Completed exposure report will be provided when TLD exposures are received from vendor.

Quarterly exposure rates at readily accessible locations at the reactor facility are listed in Table VIII. Again, no significant effect on the environment radiation levels by reactor operations was observed.

Table VIII
Exposure Rates Adjacent to the WSU Reactor*

	Exposures in uR/day		JFM	AMJ	Median
	JAS	OND			
Building Entrance	167	237	**	**	202
E. Lower Loading Dock	67	250	-	-	159
E. Pool Room Door	5300	224	-	-	2762
Storage Shed	1167	217	-	-	692
N. Side of Building	133	230	-	-	182
W. Beam Room Door	200	230	-	-	215
W. Side of Building	400	217	-	-	309

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

**January-February-March and April-May-June data not available from the TLD vendor at the time this report was prepared. Complete data report will be provided when TLD exposures are received from TLD 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 1983, the average background radiation level for sampling points 400 meters or greater from the facility was 237 uR/day. The average radiation level at the closest extended occupied area 380 meters away was 255 uR/day which yields a ratio of exposure to background of 7.6%.

Fiscal year 1983-1984 ratios for the reporting period will be provided when 1984 1st and 2nd quarter TLD data is available from the vendor.

WASHINGTON STATE UNIVERSITY

PULLMAN, WASHINGTON 99164

C. Thomas

NUCLEAR RADIATION CENTER

August 15, 1984

Director, Division of Reactor Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 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, 1983 to June 30, 1984.

Sincerely,

W. E. Wilson

W.E. Wilson
Associate Director

WEW:mt

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

Add: R. Carter 4/11/84
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