

ANNUAL REPORT OF THE OPERATION
OF THE WASHINGTON STATE UNIVERSITY
TRIGA REACTOR - FACILITY LICENSE R-76
For the Period July 1, 1978 to June 30, 1979

A. Narrative Summary of Year's Operation

The W.S.U. TRIGA reactor has accumulated 643 megawatt hours during the reporting period. The quarterly operation summaries are shown in Table I.

Table I - Fiscal 1979 Summary of Reactor Operation

	<u>JAS</u>	<u>OND</u>	<u>JFM</u>	<u>AMJ</u>	<u>TOTAL</u>
Hours of Operation	211	101	170	200	682
Megawatt Hours	192	90	169	192	643
Number of Irradiations	735	347	123	196	1401
Number of Samples Irradiated	2505	1213	1028	1990	6736

In addition, nineteen pulses were performed. Ten of these had \$2.00 of reactivity inserted per pulse. The remainder were performed with less than a \$2.00 reactivity insertion per pulse. For the \$2.00 pulses, the average peak power was 601 megawatts with an average peak fuel temperature of 331°C.

The cumulative energy output since the initial criticality of the TRIGA core in 1967 is 9161 megawatt hours. The mixed core of FLIP and Standard fuels installed in 1976 has accumulated 2900 megawatt hours since initial criticality.

B. Emergency Shutdowns and Inadvertent Scrams

No emergency shutdowns occurred during the reporting period.

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The descriptions and/or causes of the 12 inadvertent scrams which occurred during the reporting period are listed in Table II.

Table II - Inadavertent Scrams

<u>Number</u>	<u>Description or Cause</u>
2	High Power Scram when downscaling to 1 kW range
2	Log Power Channel high voltage supply suffered line voltage transient
3	Pulse rod released with no indication
1	Released pulse rod and all blades with no indication
1	Released all blades with no indication
1	Released number 1 blade with no indication
1	Released pulse rod and blades 1 and 4 with no indication
1	Released pulse rod and blade number 1 with no indication

C. Charges, Test and Experiments Carried Out Under 10 CFR 50.59

There were no items in this category during the reporting period.

D. Major Maintenance Operations

There were no items in this category during the reporting period.

E. Radioactive Liquid Release

During the reporting period the average monthly relase concentration was 1.95×10^{-8} microcuries/cm³. This yielded a total of 4.33 microcuries released in a total of 48,663 gallons of liquid effluent. The monthly releases are shown in Table III. The majority of the liquid effluent releases result from experiment activities performed elsewhere in the Nuclear Radiation Center.

Table III - Radioactive Liquid Releases

	Quantity μCi	Concentration $\mu\text{Ci}/\text{cm}^3$	Percent of MPC	Volume gallons
July	0.091	0.501×10^{-8}	1.25	4810
August	0.116	0.650×10^{-8}	1.63	4708
September	0.400	2.20×10^{-8}	5.50	4761
October		No release		
November		No release		
December	0.390	2.12×10^{-8}	5.30	4915
January	0.269	1.48×10^{-8}	3.70	4801
February	1.33	7.17×10^{-8}	17.9	4886
March	0.990	5.39×10^{-8}	13.5	4853
April	0.516	2.74×10^{-8}	6.90	9951
May		No release		
June	0.224	1.19×10^{-8}	2.98	4978

F. Radiactive Gaseous Releases

No significant quantity of gaseous or particulate material with a half life greater than eight days was released during the reporting period.

The average monthly concentration of Argon-41 was 1.91×10^{-7} microcuries/ cm^3 . This yielded a total of 8.13 Curies released in 1.50×10^9 cubic feet of air. The monthly releases are summarized in Table IV.

G. Radioactive Solid Waste Disposal

Two shipments of solid waste were made to the Nuclear Engineering Company of Richland, Washington for disposal. A total of 18.326 Curies in a total of 360 cubic feet were packaged in 55 gallon drums for

shipment. Over 95% of the radioactivity was received from campus facilities other than the Reactor and Nuclear Radiation Center. The shipments are tabulated below in Table V.

Table IV - Monthly Argon-41 Releases

	Concentration before dilution microCi/ml	Percent of MPC after dilution	mCi
July	1.98×10^{-7}	1.32	701
August	1.81×10^{-7}	1.20	641
September	2.32×10^{-7}	1.54	821
October	1.90×10^{-7}	1.23	673
November	1.35×10^{-7}	0.90	478
December	1.14×10^{-7}	0.76	404
January	2.90×10^{-7}	1.90	1027
February	1.83×10^{-7}	1.22	648
March	1.72×10^{-7}	1.14	609
April	1.52×10^{-7}	1.02	538
May	2.37×10^{-7}	1.58	839
June	2.12×10^{-7}	1.41	751

Table V - W.S.U. Solid Radioactive Waste Disposal

Date	Volume in cubic feet	Activity in Curies
5-23-79	195	16.206
7-26-78	165	2.126

H. Personnel and Visitor Radiation Exposures

The quarterly exposures of the reactor operating personnel are shown in Table VI below. A total of 950 visitors visited the Reactor on tours. Determined from pocket dosimeters, the average individual

exposure was 3 millirem with a maximum of 20 millirem.

Table VI - Reactor Personnel Exposures
Exposures in millirems, tabulated by Quarters

Name	J	JAS	OND	JFM	AM*	Lifetime Exposure at beginning of year
Hawley	-	-	-	0	0	200
Lovas	0	0	- °	-	-	210
Neidiger	0	0	15	0	0	1593
Rosenberg	0	15	0	0	0	3732
Sikorski	0	0	0	0	0	3900
Wilson	0	0	0	0	0	3715

* June data to be provided when obtained
° Left in September

I. Reactor Facility Radiation Levels

The routine surveys of radiation levels in reactor operating areas indicate an average radiation level of 0.45 mRem/hr. The highest (average) level was 2.6 mRem/hr which occurred in the locked radiation source storage area. The lowest (average) level was 0.03 mRem/hr, found in the reactor control rooms.

Routine surveys for removable contamination in reactor operating areas indicate an average value of 4.1×10^{-5} microCi/100 cm². The lowest (average) value of 5.5×10^{-6} microCi/100 cm² was found in the reactor control rooms. The highest (average) value, 1.8×10^{-4} microCi/100 cm², occurred near the tubes used for transferring irradiated samples to the laboratories.

The survey results indicate that radiation levels and removable contamination are very low and present no hazards to personnel or visitors.

J. Environmental Monitoring Program

Initiated in 1974, the environmental monitoring program uses thermoluminescent dosimeters (TLD's) for locations in and around the reactor facility. The water samples taken in the vicinity of Washington State University are analyzed for gross beta-gamma activity.

The daily exposure rates near the Nuclear Radiation Center are listed in Table VII as the quarterly averages. Daily exposure rates from locations throughout the State of Washington are also included. No significant variation from the data collected for the June 30, 1978 annual report is observed with the values from this year.

Table VII - Environmental Radiation Levels in the
Vicinity of the WSU Nuclear Radiation Center ¹
and throughout the State of Washington ²

(Exposure Rates in microroentgens per day)

	3rd quarter 1978	4th quarter 1978	1st quarter 1979	2nd quarter 1979	Yearly Median
WSU	253	178	177	183	180
State of Washington	190	188	161	Not available	188

Notes: ¹ From sampling stations located within 50-500 meters of the Nuclear Radiation Center.

² From 17 locations throughout the State of Washington. compiled by the Department of Emergency Services.

Exposure rates at readily accessible locations at the reactor facility are listed in Table VIII. There is no significant effect of reactor operation on the environmental radiation levels as indicated by the results.

Table VIII - Exposure Rates Above Ambient Background
per Megawatt Hour of Reactor Operation

Location	Exposure Rates in μ R per Mw hr				Median
	3-78	4-78	1-79	2-79	
Entrance	67	52	63	44	58
Lower Loading Dock	0	40	34	54	37
Storage Shed	0	28	23	0	12
Pool Room (Overhead Door)	135	174	286	74	154
North Side of Building	28	52	29	0	28
Beam Room Door	45	64	11	0	28

The gross beta-gamma activity of the water samples taken from locations in the vicinity of Washington State University are shown in Table IX. The results indicate that there are no effects correlated with operation of the Washington State University TRIGA reactor.

Table IX - Summary of Selected Water Sample Specific Activities
for July, 1978 through June, 1979

Sample Location	No. of Samples	Average Specific Activity pCi/liter	Range of Values pCi/liter
Pullman Sewage Effluent	12	0.4	0 - 0.8
South Fork of Palouse	12	0.5	0 - 1.0
Palouse River - Colfax	12	0.2	0 - 0.5
Snake River	12	0.2	0 - 0.5
Tap Water	11	0.9	0 - 6.7