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Nuclear Radiation Center

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August 12, 1992

Regional Administrator
U.S. Nuclear Regulatory Commission
Region V
1450 Maria Lane, Suite 210
Walnut Creek, CA 94596

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

Dear Sir:

In accordance with the Technical Specifications for Facility License R-76 and the provisions of 10 CFR 50.59, pa . ph (6), the attached Annual Report prepared by Jerry A. Neidiger, Reactor Supervisc. .ne WSU facility, is hereby submitted. The report covers the period July 1, 1991 to June 30, 1992.

Sincerely,

Gerald E. Tripard
Director

Enclosure

cc: NRC, Region V, Office of Regional Administrator
J. A. Neidiger
American Nuclear Insurer

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

Facility License R-76 for the Reporting Period of
July 1, 1991 to June 30, 1992

A. Narrative Summary of the Year's Operation

1. Operating Experience

The Washington State University Reactor has accumulated 67 Megawatt hours on Core 32-A and 407 Megawatt hours on Core 32-B for a total of 474 Megawatt hours during the reporting period. A total of 287 irradiations for a total of 5098 samples were performed. In addition, 20 pulses greater than $1.00 of reactivity addition were performed during this reporting period. The quarterly operations summaries are shown in Table I, section B., on page 2.

A minor core change was performed 09/25/91 which consisted of interchanging a fuel cluster and a reflector element, removal of a pneumatic transfer system (Flexo-rabbit) sample irradiation end and its replacement with a reflector element. Core designation was from Core 32-A to Core 32-B.

Major modification item performed included the installation of 3.5" diameter irradiation hole in 21" x 13.75" x 9.5" graphite loaded aluminum box. The box was mounted externally to the south face of the core grid box and will be used for Silicon ingot irradiation experiments.

2. There were no changes in design, performance characteristics, or 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 one abnormality and is summarized below.

09/23/91 - During the reactor core change from Core 32-A to Core 32-B a damaged reflector element was discovered. Reflector R-14 was not in the reactor core at the time, but in the process of being removed from storage to be placed in the reactor core. Damage to the reflector consisted of swelling and cracked aluminum cladding. As a result of the discovery of a damaged reflector element, selective reflectors currently in the reactor core were removed and inspected. No other abnormalities were discovered. The inspection results were documented and presented to the Reactor Safeguards committee for their evaluation and recommendations.

B. Energy and Cumulative Output

The quarterly operations summaries are given in Table I below.

TABLE I
Fiscal Year Summary of Reactor Operations

	J-A-S	O-N-D	J-F-M	A-M-J	TOTALS
Hours of Operation	87	167	137	152	543
Megawatt Hours	68	142	118	146	474
No. of Irradiations	58	97	59	73	287
No. of Samples Irradiated	1368	1153	1502	1075	5098
No. Pulses > $1.00	0	13	5	2	20

The cumulative energy output since criticality of the TRIGA core since 1967 is 681 Megawatt Days. The mixed core of FLIP and Standard fuels installed in 1976 has accumulated 420 Megawatt Days.

C. Emergency Shutdowns and Inadvertent Scrams

There were no emergency shutdowns that occurred during the reporting period. The dates and causes of the 8 inadvertent SCRAMS are listed below.

11/15/91 - Loss of Reactor Console power due to operator error.
11/26/91 - Safety Channel #2 switched to Trip Test-Operator Trainee error.
12/12/91 - Loss of building power due to high winds.
01/22/92 - Short startup rate period while at 100% power - cause unknown.
04/27/92 - Loss of Reactor Console power due to operator error.
05/07/92 - Safety Channel #2 loss of power due to operator error.
06/29/92 - High Power Trip Safety #1-power spike during pulsing operations.
06/29/92 - High Power Trip Safety #1-power spike during pulsing operations.

D. Major Maintenance

All major maintenance performed was routine planned maintenance items.

E. Changes, Tests and Experiments Performed Under 10 CFR 50.59 Criteria

There was one change performed under 10 CFR 50.59 criteria during the reporting period and is described below.

06/16/92 - Modification to the Linear Power Channel was performed by installing a second isolated output to allow interfacing to a computer for data collection capability.

F. Radioactive Effluent Discharges

1. Radioactive Liquid Releases

A total of 24.84 microcuries was released in 1,754,649 liters of liquid during the reporting period. This yields an average release concentration of liquid waste of 1.42×10^{-8} microcuries per milliliter. The monthly releases are listed in Table II below.

TABLE II
Radioactive Liquid Releases

Month	Quantity, uCi	Concentration, uCi/ml	Percent MPC[1]	Volume, Liters
Jul.(1991)	0.20	1.05×10^{-8}	10.5	18,549
Aug.	0.66	1.92×10^{-8}	19.1	34,068
Sep.	0.39	2.11×10^{-8}	21.1	18,507
Oct.	3.45	1.10×10^{-8}	11.0	311,899
Nov.	11.14	2.61×10^{-8}	26.1	426,765
Dec.	3.21	1.05×10^{-8}	10.5	305,731
Jan.(1992)	2.43	8.04×10^{-9}	8.0	303,009
Feb.	NO RELEASE			
Mar.	1.08	7.67×10^{-9}	7.7	141,939
Apr.(2)	0.30	1.61×10^{-8}	16.1	18,560
	0.43	8.53×10^{-9}	8.5	51,361
May.	0.57	7.48×10^{-9}	7.5	76,449
Jun.	0.98	2.06×10^{-8}	20.6	47,812

[1] Based on a release limit of 1.00×10^{-7} uCi/ml 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 that eight days was released.

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

A total of 3.58 Curies of Argon-41 was released in 5.88×10^{13} cc of air, which yields an average monthly concentration of Argon-41 of 6.09×10^{-8} uCi/cc. The monthly releases are summarized in Table III on page 4.

TABLE III
Monthly Argon-41 Releases

Month	Concentration Before Dilution, uCi/cc	Percent MPC[1] Before Dilution	Quantity mCi
Jul.(1991)	4.73×10^{-8}	1.89	236
Aug.	5.74×10^{-8}	2.30	287
Sep.	5.45×10^{-8}	2.18	264
Oct.	5.13×10^{-8}	2.05	256
Nov.	1.13×10^{-7}	4.52	547
Dec.	5.83×10^{-8}	2.33	291
Jan.(1992)	6.06×10^{-8}	2.42	303
Feb.	5.05×10^{-9}	0.20	24
Mar.	9.16×10^{-8}	3.66	458
Apr.	5.75×10^{-8}	2.30	278
May.	6.66×10^{-8}	2.66	233
Jun.	6.22×10^{-8}	2.49	301

[1] Based on 10 CFR 20 limit of 1.0×10^{-8} uCi/cc (Table 2, Col. 1), and dilution factor of 4.0×10^{-3} (S.A.R. 6.4.2) for a before dilution limit of 2.5×10^{-6} uCi/cc. (20% of limit is 5.0×10^{-7} uCi/cc).

3. Radioactive Solid Waste Disposal

No solid waste generated by the Nuclear Radiation Center reactor was shipped off-site during the reporting period.

G. Personnel and Visitor Radiation Exposures

The average quarterly exposures of Nuclear Radiation Center reactor staff and experimenters who routinely utilize the W.S.U. reactor are given in Table IV on page 5. The maximum quarterly exposure of one individual, who is a reactor staff member and who routinely prepares irradiated samples for shipment and calibrates radiation survey meters, was 50 millirem, whole body.

A total of 2352 non-Nuclear Radiation Center staff or routine facility user individuals visited the Center during the reporting period, out of which 1043 enter posted Radiation Areas. As determined by digital pocket dosimeter and an exposure recorded, the average individual exposure was <1.0 millirem with a maximum exposure of 2 millirem.

A total of 27 group tours, consisting of 439 individuals, visited the Center during the reporting period. As determined by digital pocket dosimeter and an exposure recorded, the average group exposure was <1.0 millirem with a maximum of 2.0 millirem.

TABLE IV

Average Quarterly Reactor and Experimenter Staff Exposure

(in millirem)

Jul-Aug-Sep	Oct-Nov-Dec	Jan Feb-Mar	Apr-May-Jun[1]
<10	23.0	<10	<10

[1] June's film badge results not available from the vendor at the time this report was prepared.

H. Reactor Facility Radiation and Contamination Levels

The routine area radiation surveys of the building in non-reactor vital areas[1] had an average dose level of 0.02 mR/Hr., while routinely accessible reactor vital areas had an average dose level of 0.14 mR/Hr. The highest average dose level in a routinely accessible reactor vital area was 1.95 mR/Hr., which occurred in Room 101A, Purification Pump Pit. The lowest average dose in a routinely accessible reactor vital area was 0.03 mR/Hr., which occurred in Room 201A, the Reactor Shop area. The average dose in the Reactor Control Room was 0.04 mR/Hr. The average dose in the radiochemistry sample hoods was 0.33 mR/Hr. The highest average on site dose level was 26 mR/Hr. which occurred in Room 2A, Cave Room, which is a locked storage area where radioactive material and radioactive sources are stored.

Routine building surveys for removable contamination in non-reactor vital areas[1] had an average level of 0.15×10^{-7} uCi/cm^2, while the average level in the reactor vital areas was 4.10×10^{-7} uCi/cm^2. The highest average value in the reactor vital areas was 37.93×10^{-7} uCi/cm^2 which was found on the platform where experimenters stand to insert and withdraw their samples from the reactor. The lowest average value in the reactor vital areas was 0.05×10^{-7} uCi/cm^2 which was in Room 2A, the Cave west floor. The average level of removable contamination in the radiochemistry sample hoods was 3.91×10^{-7} uCi/cm^2.

[1] A non-reactor vital area is an area in the building where radioactive materials are used or stored but which is not a part of the Licensed reactor facility.

I. Environmental Monitoring Program

The environmental monitoring program uses thermoluminescent dosimeters (TLD's) at locations both near and at distances around the reactor building facility. The quarterly exposures in the vicinity of the Nuclear Radiation Center are listed in Table V below. The average ambient gamma radiation levels for this area (80 mile radius) is 65 mRem/yr, (178 uRem/day) as reported in the 27th Annual Report of the Environmental Radiation Program, Washington State Department of Social and Health Services.

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

TABLE V
Environmental Radiation Levels in the
Vicinity of the Nuclear Radiation Center[1]

(Exposure in uR/day)

Jul-Aug-Sep	Oct-Nov-Dec	Jan-Feb-Mar	Apr-May-Jun	Median
208	203	162	172	186

[1] For sampling stations located 25 meters or greater from the Nuclear Radiation Center.

Quarterly exposures at locations at the reactor facility are listed in Table VI on page 7. No significant effect on the environmental radiation levels by reactor operation was noted.

TABLE VI
Environmental Radiation Levels Adjacent
to the Nuclear Radiation Center[1]

(Exposure in uR/day)

Location	Jul-Aug-Sep	Oct-Nov-Dec	Jan-Feb-Mar	Apr-May-Jun	Median
E. Loading Dock	278	185	194	212	217
Rad. Storage Shed	370	315	278	365	332
Cooling Tower Fence	278	204	181	200	216
Liquid Waste Tank	296	296	181	188	240
Pool Room W. Roof	287	204	181	176	212
Building W. Side	324	278	208	212	256
Pool Room Exh. Vent	241	111	125	141	158
Pool Room W. Vent	454	333	458	471	429
Pool Room E. Vent	426	315	264	306	328
Pool Room E. Roof	222	204	139	141	177
S. Bldg. Entrance	259	241	181	176	214

[1] For sampling stations located less that 25 meters of the Nuclear Radiation Center.

Underlined locations indicate areas that are readily accessible.

Technical Specifications ALARA effluent releases in 3.12(2) specify annual radiation exposures at the closest off-site extended occupancy shall not, on an annual basis, exceed the average local off-site background radiation level by more than 20%. For the reporting period, the average total background radiation level for sampling points 400 meters or greater from the facility was 160 uR/day, while the average total radiation level at the closest extended occupied area 380 meters away was 166 uR/day. This yields a ratio of 3.7%, indicating no significant exposure level above natural background.