Washington State University
Nuclear Radiation Center
Pullman, WA 99164-1300
509-335-8641
FAX 509-335-4433

August 8, 1994

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555

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, paragraph (6), the attached Annual Report prepared by Jerry A. Neidiger, Reactor Supervisor of the WSU facility, is hereby submitted. The report covers the period July 1, 1993 to June 30, 1994.

Sincerely,

G E Tripard

Gerald E. Tripard
Director

GET/pw

Enclosure

cc: J.A. Neidiger
NRC, Region IV, Office of Regional Adminstrator
American Nuclear Insurers

IE47
1/1

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

Facility License R-76 for the Reporting Period of
July 1, 1993 to June 30, 1994

A. Narrative Summary of the Year's Operation

1. Operating Experience

The Washington State University Reactor has accumulated 413 Megawatt hours on Core 33-X hours during the reporting period. A total of 264 irradiations for a total of 5902 samples were performed. In addition, 23 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., below.

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 no abnormalities.

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	140	148	92	107	478
Megawatt Hours	123	126	76	88	413
No. of Irradiations	68	61	55	80	264
No. of Samples Irradiated	1770	900	1426	1806	5902
No. Pulses > $1.00	5	7	2	9	23

The cumulative energy output since criticality of the TRIGA core since 1967 is 727 Megawatt Days, The mixed core of FLIP and Standard fuels installed in 1976 has accumulated 461 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 4 inadvertent SCRAMS are listed in Table II on page 2.

TABLE II
Inadvertent SCRAMS

DATE	CAUSE
12/07/93	Operator error while up-scaling Safety Channel #1.
02/24/94	Operator trainee error. Exceeded Safety Channel #2 set-point (118%) during startup.
04/25/94	No Indication. Building power fluctuations due to high winds.
05/26/94	Power spike on Safety Channel #1 during pulsing operations.

D. Major Maintenance

09/30/93 Replacement of Liquid Waste Tank discharge pump.

All other major maintenance performed was routine planned maintenance items.

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

There was only one item performed and documented under 10 CFR 50.59 criteria during the reporting period and was documented as such to ensure the Reactor Safeguards Committee approval of the modification to satisfy Technical Specification requirement 6.5 and 6.6 for Quality Assurance criteria. On 03/14/94, the Reactor Pool Room ventilation system indication was relocated to the reactor console auxiliary equipment rack and the ventilation system control panel was removed from the reactor control room and relocated in the reactor pool room.

F. Radioactive Effluent Discharges

1. Radioactive Liquid Releases

A total of 49.67 microcuries was released in 1,474,874 liters of liquid during the reporting period. This yields an average release concentration of liquid waste of 3.37×10^{-8} microcuries per milliliter. The monthly releases are listed in Table III on page 3.

TABLE III
Radioactive Liquid Releases

Month	Quantity, uCi	Concentration, uCi/ml	Percent Release Limit[1]	Volume, Liters
Jul.(1992)	29.19	3.08×10^{-8}	7.7	958,324
Aug.	14.25	1.97×10^{-8}	49.3	72,403
Sep.	No Release	-	-	-
Oct.	2.94	3.54×10^{-8}	8.9	82,927
Nov.	0.21	4.15×10^{-9}	1.0	51,537
Dec.	No Release	-	-	-
Jan.(1993)	No Release	-	-	-
Feb.	0.98	8.34×10^{-9}	41.7	116,933
Mar.	0.68	1.74×10^{-8}	87.0	39,348
Apr.	0.96	1.15×10^{-8}	57.5	83,436
May.	No Release	-	-	-
Jun.	0.46	5.70×10^{-9}	28.5	9,967

(1) Based on a release limit of 4.0×10^{-7} uCi/ml for unknown mixture, 10 CFR 20, Table I, Column 2 for July through December, 1993.

Release limit of 2.0×10^{-8} uCi/ml for unknown mixture, 10 CFR 20 Table 3 used effective January 1, 1994.

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 the Effluent Release Limit.

A total of 3.64 Curies of Argon-41 was released in 5.86×10^{13} cc of air, which yields an average monthly concentration of Argon-41 of 6.20×10^{-8} uCi/cc. The monthly releases are summarized in Table IV on page 4.

TABLE IV
Monthly Argon-41 Releases

Month	Conc. Before Dilution, uCi/ml	% Release Limit[1] Before Dilution	Quantity mCi
Jul.(1992)	7.70×10^{-8}	3.1	385
Aug.	6.51×10^{-8}	2.6	325
Sep.	5.58×10^{-8}	2.2	270
Oct.	7.30×10^{-8}	2.9	365
Nov.	8.20×10^{-8}	3.3	397
Dec.	4.83×10^{-8}	1.9	241
Jan.(1993)	4.09×10^{-8}	1.6	204
Feb.	6.30×10^{-8}	2.5	285
Mar.	6.85×10^{-8}	2.7	342
Apr.	4.95×10^{-8}	2.0	240
May	5.01×10^{-8}	2.0	250
Jun.	6.86×10^{-8}	2.7	332

[1] Based on 10 CFR 20 air reference level release concentration limit of 1.0×10^{-8} uCi/ml for ^{41}Ar (Table 2, Col.1), and a 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/ml).

3. Radioactive Solid Waste Disposal

The four (4) solid waste shipments transferred to Thomas Gray & Associates for disposal during the reporting period, are listed in Table V below.

TABLE V
Radioactive Solid Waste Disposal Shipments

DATE	ACTIVITY in milliCuries	VOLUME in Cubic Feet
12/01/93	1.136	7.5 compacted
12/01/93	0.006	10.0 non-compacted
02/10/94	0.001	12.0 non-compacted
04/21/94	0.001	22.0 non-compacted

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 VI 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 40 millirem, whole body.

A total of 2339 non-Nuclear Radiation Center staff or routine facility user individuals visited the Center during the reporting period, out of which 1026 enter Restricted Areas. As

determined by digital pocket dosimeter and an exposure recorded, the average individual exposure was <1.0 millirem.

A total of 32 group tours, consisting of 417 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.

TABLE VI
Average Quarterly Reactor and Experimenter Staff Exposure
(in millirem)

Jul-Aug-Sep	Oct-Nov-Dec	Jan-Feb-Mar	Apr-May-Jun[1]
7.1	5.7	2.5	8.6

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

Note: 10 mR minimum exposure reported by vendor.

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 0.025 mR/Hr., while routinely accessible reactor vital areas had an average dose level of 0.048 mR/Hr. The highest average dose level in a routinely accessible reactor vital area was 0.090 mR/Hr., which occurred in Room 201, Reactor Pool Room, South side. The lowest average dose in a routinely accessible reactor vital area was 0.020 mR/Hr., which occurred in Room 201A, the Reactor Shop area. The average dose in the Reactor Control Room was 0.030 mR/Hr. The average dose in the radiochemistry sample hoods was 0.080 mR/Hr. The highest average on site dose level was 8.06 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 1.55×10^{-8} uCi/cm^2, while the average level in the reactor vital areas was 1.46×10^{-8} uCi/cm^2. The highest average value in the reactor vital areas was 14.00×10^{-8} 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 0.73×10^{-8} uCi/cm^2 which was in Room 201, the Reactor Room Floor. The average level of removable contamination in the radiochemistry sample hoods was 12.66×10^{-8} 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 License 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 VII on page 6. The average ambient gamma radiation levels for this area (80 mile radius) is 243 uRem/day as reported in the 30th Annual Report of the Environmental Radiation Program, Washington State Department of Health, Environmental Health Program, Table A-12, page 131.

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

TABLE VII

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
165	177	138	***[2]	160

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

[2] Apr-May-Jun TLD results not available from vendor at the time this report was prepared.

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

TABLE VIII

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	203	203	188	***[2]	198
Rad. Storage Shed	246	203	306	***	252
Pool Rm Truck Door	261	215	271	***	249
Cooling Tower Fence	159	177	165	***	167
Liquid Waste Tank	159	190	165	***	171
Building Roof West	101	165	no reading	***	133
Building W. Side	174	215	188	***	192
Pool Room Exh. Vent	101	152	106	***	120
Pool Room W. Vent[3]	348	316	259	***	308
Pool Room E. Vent	203	215	176	***	198
Building Roof East	101	165	129	***	132
S. Bldg. Entrance	174	177	176	***	176

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

[2] Apr-May-Jun TLD results not available from vendor at the time this report was prepared.

[3] Pool Room West Vent. TLD on roof, directly above reactor core.

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 98 uR/day, while the average total radiation level at the closest extended occupied area 930 meters away was 102 uR/day. This yields a ratio of -4.8%, indicating no exposure level above natural background.

J. ALARA Program

As part of the new 10 CFR 20 regulations we have implemented a new Radiation Protection Program. In this program we have a section entitled ALARA program. The purpose of this program is to reduce radiation exposure to as low a level that is socially, technically,and economically practical. There have been a number of activities implemented over the last year that are related to our commitment to ALARA.

1. We have redesigned the sign-in sheet for people entering the facility in order to monitor where they are going and what they are doing more carefully.

2. We have added 5 more TLDs to our environmental monitoring program to make sure there are no unexpected or unintended radiation levels around the facility.

3. We are in the process of adding two new security fences excluding the public from access to locations near the building where the radiation levels are slightly above background. One has been completed and the other is under construction.

4. We have made and are continuing to make training videos for facility personnel covering routine and emergency procedures involving radioactive materials.

5. We are making a special effort to optimize the shielding design for a new BNCT treatment facility that may be added to he reactor fulfilling our program step 3.f. heading, "Radiological design as an integral aspect of facility and experiment design."

Washington State University
Nuclear Radiation Center
Pullman, WA 99164-1300
509-335-8641
FAX 509-335-4433

August 8, 1994

Regional Administrator
U.S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-8064

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, paragraph (6), the attached Annual Report prepared by Jerry A. Neidiger, Reactor Supervisor of the WSU facility, is hereby submitted. The report covers the period July 1, 1993 to June 30, 1994.

Sincerely,

GE Tripard

Gerald E. Tripard
Director

GET/pw

Enclosure

cc: J.A. Neidiger
American Nuclear Insurers
U.S. NRC, Document Control Desk