ENVIRONMENTAL IMPACT APPRAISAL FOR THE CONTINUED OPERATION OF THE WASHINGTON STATE UNIVERSITY MODIFIED TRIGA REACTOR

Submitted to:

U.S. Nuclear Regulatory Commission

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May 1979

6.0 (e) Radiation Levels

An extensive Environmental Radiation Monitoring Program was instituted at the WSU Nuclear Radiation Center in July of 1974. The program involves measuring the integrated radiation exposure for a period of three months at 40 points at the site and associated environs. Commercially available thermoluminescent dosimeters (TLD's) of the $CaSO_4$:Dy type provided and processed by the Radiation Detection Company, Sunnyvale, California, are utilized.

Table I lists the average exposure rate above ambient background per megawatt hour of reactor operation for a number of locations at the site. The two highest exposure points are on the roof directly above the pool and at the freight door to the pool room. The maximum possible on-site exposure at a readily accessible location would be to an indivi-ual standing at the pool room freight door for the 1000 hours per year that the reactor operates. The total maximum annual exposure at this on-site point would be 87 mrem/year.

The exposure rates at points from 50 meters to 24 kilometers from the Nuclear Radiation Center have also been monitored quarterly since 1974. The average exposure rate at the 24 locations involved is 188 ± 30 μR per day. No statistically significant variations in the above background exposure rates at the sample locations have been observed or any exposure attributable to the operation of the WSU reactor. In addition, the average exposure rates at these locations which are 50 meters from the site are not statistically different on a quarterly basis than the average of the background exposure rates at 17 locations in the State of Washington monitored by the State of Washington Department of Emergency Services. Thus, no significant effect on the radiation levels in the environment surrounding the facility has been observed to date.

TABLE 1

Median Exposure Rates per Megawatt Hour
of Reactor Operation in Close Proximity
to the Nuclear Radiation Center

Location	(Adjacent to Room)	Exposure (μR/MW-Hr)
Front Entrance	50V	32
Pool Room Freight Door	201	87
North Side of Building	201B	10
Roof above Control Room	201B	16
Roof above Pool	201	152
Roof above Laboratory Area	214	0
West Side Door at Beam Room	2X	14
Storage Building	217A	21
Lower Loading Dock	123A	17

(1) The irradiation meets all the specifications of Section 3.10 for an experiment.

(2) The expected radiation field produced in air by the device or sample upon removal from the reactor pool is not more than 10 rem/hr beta and gamma equivalent at 1 ft; otherwise, it shall be classed as an experiment.

(3) The device or material is encapsulated in a suitable container.

(4) The reactivity worth of the device or material is 0.25$ or less; otherwise, it shall be classed as an experiment.

(5) The device or material does not remain in the reactor for more than a 15-day period; otherwise, it shall be classed as an experiment.

Basis: This specification is intended to provide assurance that the special class of experiments called irradiations will be performed in a manner that will not permit any safety limit to be exceeded.

3.12 As Low As Reasonably Achievable (ALARA) Radioactive Effluent Releases

Applicability: This specification applies to the measures required to ensure that the radioactive effluents released from the facility are in accordance with ALARA criteria.

Objective: The objective is to limit the annual population radiation exposure owing to the operation of the WSU TRIGA reactor to a small percentage of the normal local background exposure.

Specifications:

(1) In addition to the radiation monitoring specified in Section 5.4, an environmental radiation monitoring program shall be conducted to measure the integrated radiation exposure in and around the environs of the facility on a quarterly basis.

(2) The annual radiation exposure due to reactor operation, at the closest offsite point of extended occupancy shall not, on an annual basis, exceed the average local offsite background radiation by more than 20%.

(3) Whenever practicable, the reactor shall be operated 4 in. or more from the thermal column in order to minimize the production of argon-41.

(4) The total annual discharge of argon-41 into the environment shall not exceed 20 Ci per year.

(5) In the event of a significant fission product leak from a fuel rod or a significant airborne radioactive release from a sample being irradiated, as detected by the continuous air monitor, the reactor shall be shut down until the source of the leak is located and eliminated. However, the reactor may be continued to be operated on a short-term basis as needed to assist in determining the source of the leakage.

(6) Before discharge, the facility liquid effluents collected in the holdup tanks shall be analyzed for their beta-gamma activity content. The total annual quantity of liquid effluents released (above background) shall not exceed 1 Ci per year.

Basis: The simplest and most reliable method of ensuring that ALARA release limits are accomplishing their objective of minimal facility-caused radiation exposure to the general public is to actually measure the integrated radiation exposure in the environment on and off the site.

3.13 Primary Coolant Conditions

Applicability: This specification applies to the quality of the primary coolant in contact with the fuel cladding.

Objectives: The objectives are (1) to minimize the possibility for corrosion of the cladding on the fuel elements, and (2) to minimize neutron activation of dissolved materials.

Specifications:

(1) Conductivity of the pool water shall be no higher than 5×10^{-6} mhos/cm.

(2) The pH of the pool water shall be between 5.0 and 7.5.

Bases: A small rate of corrosion continuously occurs in a water-metal system. In order to limit this rate, and thereby extend the longevity and integrity of the fuel cladding, a water cleanup system is required. Experience with water quality control at many reactor facilities has shown that maintenance within the specified limits provides acceptable control.

By limiting the concentrations of dissolved materials in the water, the radioactivity of neutron activation products is limited. This is consistent with the ALARA principle, and tends to decrease the inventory of radionuclides in the entire coolant system, which will decrease personnel exposures during maintenance and operations.