

NUCLEAR REGULATORY COMMISSION  
WASHINGTON STATE UNIVERSITY  
FACILITY OPERATING LICENSE NO. R-76  
DOCKET NO. 50-027  
WASHINGTON STATE UNIVERSITY MODIFIED TRIGA  
NUCLEAR RADIATION CENTER REACTOR (NRCR)  
ENVIRONMENTAL ASSESSMENT AND FINDING OF  
NO SIGNIFICANT IMPACT

[NRC-2011-0083]

The U.S. Nuclear Regulatory Commission (NRC or the Commission) is considering the issuance of a renewed Facility Operating License No. R-76, to be held by Washington State University (WSU or the licensee), which would authorize continued operation of the Washington State University Modified TRIGA Nuclear Radiation Center Reactor (NRCR), located in the Dodgen Research Facility on Roundtop Drive in Pullman, Whitman County, Washington. Therefore, as required by Title 10 of the *Code of Federal Regulations* (10 CFR) Section 51.21, the NRC is issuing this Environmental Assessment and Finding of No Significant Impact.

## **Environmental Assessment**

### **Identification of Proposed Action**

The proposed action would renew Facility Operating License No. R-76 for a period of twenty years from the date of issuance of the renewed license. The proposed action is in accordance with the licensee's application dated June 24, 2002, as supplemented by letters dated August 15, 2007, June 13, 2008, and April 7, 2010. In accordance with 10 CFR 2.109, the existing license remains in effect until the NRC takes final action on the renewal application.

**Need for the Proposed Action**

The proposed action is needed to allow the continued operation of the NRCR to routinely provide teaching opportunities, services and research for numerous institutions for a period of twenty years.

**Environmental Impacts of the Proposed Action**

The NRC has completed its safety evaluation of the proposed action to issue a renewed Facility Operating License No. R-76 to allow continued operation of the NRCR for a period of twenty years and concludes there is reasonable assurance that the NRCR will continue to operate safely for the additional period of time. The details of the NRC staff's safety evaluation will be provided with the renewed license that will be issued as part of the letter to the licensee approving its license renewal application. This document contains the environmental assessment of the proposed action.

The NRCR is located 1.27 kilometers (0.79 miles) east of the French Administration Building on the main campus of WSU. The NRCR is located in the Dodgen Research Facility. The Dodgen Research Facility is a multi-purpose building constructed primarily of concrete, brick, steel, and aluminum. The entrance to the Dodgen Research Facility is secured and an access code is required for entry. Emergency exit doors in the Dodgen Research Facility are key-locked from the outside and only a few individuals are issued the key. Entry into the NRCR from the Dodgen Research Facility requires a special key or confirmation of identity through closed-circuit television and verbal contact with the reactor operators. There are three outside entrances allowing direct access to the NRCR. These entrances are secured and the area around each one is surrounded by a fence and jersey barriers. The exclusion zone is considered to be the perimeter of the reactor building. A road and unused land is located west of the site. Until late

2008, the site was surrounded for a distance of 400 meters (1300 feet) in all directions by grazing land for livestock which was owned by WSU. The land has since been converted into a golf course which surrounds the NRCR in all directions except the west. The land remains uninhabited. The golf course is separated from the NRCR by 100 to 200 meters (330 to 660 feet) of land. There is a parcel of land abutting the NRCR of about 10,000 square meters (109,000 square feet) of virgin prairie land which, by regulation or policy, WSU has no plans to use. The closest building is 411 meters (1350 feet) west of the NRCR. The closest occupied dwellings are 626 meters (2060 feet) to the west-southwest.

The NRCR is a pool-type, light water moderated and cooled research reactor licensed to operate at a maximum steady-state power level of 1 megawatt thermal power (MW(t)). The reactor is also licensed to operate in a pulse mode to a peak power of approximately 2,000 MW(t). The fuel is contained in a reactor vessel suspended from a movable bridge and is located near the bottom of an 8 meter (25 feet) deep concrete pool containing approximately 242,000 liters (63,930 gallons) of water. The reactor is fueled with standard low-enriched uranium TRIGA (Training, Research, Isotopes, General Atomic) fuel. A detailed description of the reactor can be found in the NRCR Safety Analysis Report (SAR). There have been two major modifications to the Facility Operating License since renewal of the license on August 11, 1982. Orders were issued: (1) allowing for an increase in the possession limits for Uranium-235; and (2) conversion from high-enriched uranium fuel to low-enriched uranium fuel as amendments to the license.

The licensee has not requested any changes in the NRCR design or operating conditions as part of the application for license renewal. No changes are being made in the types or quantities of effluents that may be released off site. The licensee has systems in place for controlling the releases of radiological effluents and implements a radiation protection program to monitor personnel exposures and releases of radioactive effluents. Accordingly, there would be no increase in routine occupational or public radiation exposure as a result of the license renewal.

As discussed in the NRC staff's safety evaluation, the proposed action will not significantly increase the probability or consequences of accidents. Therefore, license renewal would not change the environmental impact of NRCR operation. The NRC staff evaluated information contained in the licensee's application and data reported to the NRC by the licensee for the last five years of operation to determine the projected radiological impact of the NRCR on the environment during the period of the renewed license. The NRC staff finds that releases of radioactive material and personnel exposures were all well within applicable regulatory limits. Based on this evaluation, the NRC staff concludes that continued operation of the reactor would not have a significant environmental impact.

#### I. Radiological Impact

##### Environmental Effects of Reactor Operations:

Gaseous radioactive effluents are vented from the reactor building by the NRCR exhaust system via two vents. The vents discharge the effluents to a common stack located on the roof of the Dodgen Research Facility. The effluents are discharged at a volumetric flow rate of approximately  $5.504 \text{ E}+12$  milliliters per month (4,500 cubic feet per minute). The only significant radionuclide found in the gaseous effluent stream is Argon-41. The licensee performed measurements of Argon-41 production over a five-year period to obtain an average release rate. Licensee calculations, based on those measurements, indicate that annual Argon-41 releases result in an offsite concentration of  $2.1 \text{ E}-10$  microcuries per milliliter (uCi/ml), which is below the limit of  $1.0 \text{ E}-08$  uCi/ml specified in 10 CFR Part 20, Appendix B for air effluent releases. The NRC staff performed independent calculations and found the licensee's calculations to be reasonable. The NRC staff also reviewed measurements and calculations performed by the licensee to estimate the potential release of tritium resulting from evaporation of the reactor pool water, and found them to be reasonable. The potential airborne tritium concentration was found

to be a small fraction of the air effluent concentration limit specified in 10 CFR Part 20, Appendix B. Total gaseous radioactive releases reported to the NRC in the licensee's annual reports were less than 0.1 percent of the air effluent concentration limits set by 10 CFR Part 20, Appendix B. The potential radiation dose to a member of the general public resulting from this concentration is approximately 0.001 milliSieverts (mSv) (0.1 millirem (mrem)) and this demonstrates compliance with the dose limit of 1 mSv (100 mrem) set by 10 CFR 20.1301. Additionally, this potential radiation dose demonstrates compliance with the air emissions dose constraint of 0.1 mSv (10 mrem) specified in 10 CFR 20.1101(d).

The licensee disposes of liquid radioactive waste by discharge to the sanitary sewer. The Radiation Safety Office (RSO), which is part of the WSU Department of Environmental Health and Safety, monitors the levels of radioactive waste discharged to the sanitary sewer. Discharge of liquid waste is initially to a holdup tank where levels of radioactive waste are measured and the contents diluted, if necessary to meet 10 CFR Part 20 discharge limits to the sanitary sewer. The RSO calculated that discharges to the sanitary sewer were in the order of  $4 \times 10^{-8}$  uCi/ml. The NRC staff reviewed the licensee's procedures and results and found they met the requirements of 10 CFR 20.2003 for disposal by release to the sanitary sewer.

An NRC inspection was performed from September 8 – 10, 1998, to review the circumstances behind the leakage of pool water through the concrete of the reactor pool wall. The licensee determined that leakage was due to the porosity of the concrete and the penetrations for the beam tubes. The pool water which leaked either evaporated or collected in the fuel storage area and drained into the facility waste holding tank where it was analyzed and found to comply with the release limits of 10 CFR Part 20, Appendix B for liquid effluent. The reactor pool leak was successfully repaired in 1999. The NRC inspection report related to the reactor pool leakage concluded that management of liquid effluents was appropriate and identified no findings of significance.

The licensee monitored the activity level in the waters in the vicinity of the NRCR, including the South Fork of the Palouse River, local tap water, and effluent from the sewage treatment plant and did not detect elevated levels of radioactive material attributable to the operation of the NRCR.

The RSO oversees the handling of solid low-level radioactive waste generated at the NRCR. Solid radioactive waste consists mainly of spent ion resins and neutron activation products which are packaged by the licensee for shipment by a low-level waste broker in accordance with all applicable regulations for transportation of radioactive materials. If neutron activated or other licensed material is removed from the NRCR by the RSO or a researcher, the licensed material is transferred to the University for uses authorized under its broad scope byproduct material license. The licensee transferred the irradiated high-enriched uranium and FLIP fuels to Idaho National Engineering Laboratory in August 2009. The remaining unirradiated FLIP fuel will be transferred to Oak Ridge National Laboratory. To comply with the Nuclear Waste Policy Act of 1982, WSU entered into a contract with the U.S. Department of Energy (DOE) that provides that DOE retains title to the fuel utilized at the NRCR and that DOE is obligated to take the fuel from the site for final disposition.

As described in Section 7, "Personnel and Visitor Radiation Exposures," of the NRCR Annual Reports from 2004 through 2009, personnel exposures are well within the limits set by 10 CFR 20.1201, and as low as reasonably achievable (ALARA). The RSO tracks personnel exposures, which are usually less than 0.85 mSv (85 mrem) per year whole body. The WSU ALARA program requires the RSO to investigate any annual personnel exposures greater than 90 mrem deep dose, 940 mrem extremities or 10 mrem fetal dose. Personnel monitors were mounted in locations throughout the controlled access areas of the NRCR, the control room, reactor hall, and beam room. The monitors provide a quarterly measurement of total radiation exposures at those locations. These dosimeters typically measure annual doses of less than 0.5

mSv (50 mrem) in the control room and less than 2 mSv (200 mrem) in the reactor hall and beam room. The above information is based on the NRC staff's review of the past five years of radiation exposure data as monitored by the licensee using NVLAP-approved and processed dosimetry. No changes in reactor operation that would lead to an increase in occupational dose are expected as a result of the proposed action.

The licensee conducts an environmental monitoring program to record and track the radiological impact of NRCR operation on the surrounding unrestricted area. The program consists of quarterly exposure measurements at 12 locations adjacent to the Nuclear Radiation Center and at 24 control locations away from any direct influence from the reactor. The RSO administers the program and maintains the appropriate records. Over the past five years, the survey program indicated that radiation exposures at the monitoring locations were not significantly higher than those measured at the control locations. Year-to-year trends in exposures are consistent between monitoring locations. Also, no correlation exists between total annual reactor operation and annual exposures measured at the monitoring locations. Based on the NRC staff's review of the past five years of data, the NRC staff concludes that operation of the NRCR does not have any significant radiological impact on the surrounding environment. No changes in reactor operation that would affect offsite radiation levels are expected as a result of license renewal.

#### Environmental Effects of Accidents:

Accident scenarios are discussed in Chapter 13 of the NRCR SAR. The maximum hypothetical accident (MHA) is the uncontrolled release of the gaseous fission products contained in the gap between the fuel and the fuel cladding in one fuel element in the reactor building and into the environment. The licensee conservatively calculated doses to NRCR personnel and the maximum potential dose to a member of the general public. The NRC staff performed independent calculations to verify that the doses represent conservative estimates for the MHA.

Occupational doses resulting from this accident would be well below the 10 CFR Part 20 limit of 50 mSv (5,000 mrem). Maximum doses for members of the general public resulting from this accident would be well below the 10 CFR Part 20 limit of 1 mSv (100 mrem). The proposed action will not increase the probability or consequences of accidents.

## II. Non-Radiological Impacts

The NRCR core is cooled by a light water primary system consisting of the reactor pool, a heat removal system, and an evaporative cooling system. Cooling occurs by natural convection, with the heated coolant rising out of the core and into the bulk pool water. The heated coolant is dissipated by using a heat exchanger and an evaporative induced draft cooling tower located on the north side of the NRCR. Higher pressure is maintained on the secondary side of the heat exchanger so that, in case of the failure of the heat exchanger, coolant would flow back into the pool. The cooling tower transfers heat to the atmosphere by evaporation, an average of 120,000 liters (32,000 gallons) per month. A minor amount of heat removal occurs due to evaporation (5,000 liters (1,330 gallons) per month) of coolant from the reactor pool's surface. Replacement water is pumped from dedicated wells not associated with the municipal well water system of Pullman, Washington. Coolant leakage from the primary pump or the heat exchanger is diverted to a hold up tank for analysis, dilution, and transfer to the sanitary sewer.

Release of thermal effluents from the NRCR will not have a significant effect on the environment. According to the licensee, Washington State University maintains and complies with the appropriate Washington Department of Health permit for secondary water discharge. Given that the proposed action does not involve any change in the operation of the reactor and the heat load dissipated to the environment, the NRC staff concludes that the proposed action will not have a significant impact on the local water supply.

National Environmental Policy Act (NEPA) Considerations:

The NRC has responsibilities that are derived from NEPA and from other environmental laws, which include the Endangered Species Act (ESA), Coastal Zone Management Act (CZMA), National Historic Preservation Act (NHPA), Fish and Wildlife Coordination Act (FWCA), and Executive Order 12898 Environmental Justice. The following provides a brief discussion of impacts associated with these laws and other requirements.

I. Endangered Species Act

No effects on the terrestrial or aquatic habitat in the vicinity of the plant, or to threatened, endangered, or protected species under the Endangered Species Act would be expected.

II. Coastal Zone Management Act

The NRCR is not located within any managed coastal zones, nor would NRCR effluents and emissions impact any managed coastal zones.

III. National Historic Preservation Act

The NHPA requires Federal agencies to consider the effects of their undertakings on historic properties. The National Register of Historic Places (NRHP) lists 9 historic sites located in and around Pullman, Washington with two of the sites on the WSU main campus. None of the sites are located within 0.8 kilometers (0.5 miles) of the NRCR and all are to the west of the NRCR except one site to the south. Given the distance between the NRCR and the 9 historical sites listed in the NRHP, continued operation of the NRCR will not impact any historical sites. Based on this information, the NRC staff finds that the potential impacts of license renewal would have no adverse effect on historic and archaeological resources.

#### IV. Fish and Wildlife Coordination Act

The licensee is not planning any water resource development projects, including any modifications related to impounding a body of water, damming, diverting a stream or river, deepening a channel, irrigation, or altering a body of water for navigation or drainage.

#### V. Executive Order 12898 – Environmental Justice

The environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health and environmental effects on minority and low-income populations that could result from the relicensing and the continued operation of the NRCR. Such effects may include human health, biological, cultural, economic, or social impacts. Minority and low-income populations are subsets of the general public residing around the NRCR, and all are exposed to the same health and environmental effects generated from activities at the NRCR.

Minority Populations in the Vicinity of the NRCR – According to 2000 census data, 9.5 percent of the population (approximately 159,000 individuals) residing within a 50-mile radius of the NRCR identified themselves as minority individuals. There are 14 counties that fall entirely or partly within the 50-mile radius, seven in Washington and seven in Idaho. The largest minority was American Indian (5,800 persons or 3.6 percent), followed by Asian (4,300 persons or 2.7 percent). For Whitman County, (where the NRCR is located), the 2000 Census data shows that about 13.3 percent of the population identified themselves as minorities, with persons of Asian origin comprising the largest minority group (6.6 percent). According to American Community Survey 3-year average census data estimates for 2006-2008, the minority population of Whitman County, as a percent of the total population, had increased to 16.6 percent.

Low-income Populations in the Vicinity of the NRCR – According to 2000 Census data, approximately 3,700 families and 25,000 individuals (approximately 9.6 and 15.7 percent, respectively) residing within a 50-mile radius of the NRCR were identified as living below the

Federal poverty threshold in 1999. The 1999 Federal poverty threshold was \$17,029 for a family of four.

According to American Community Survey 3-year average census data estimates for 2006 - 2008, the median household income for Washington was \$57,234, while 11.6 percent of the state population and 7.9 percent of families were determined to be living below the Federal poverty threshold. Whitman County had a lower median household income average (\$35,945) and higher percentages (25.1 percent) of individuals and families (9.0 percent) living below the poverty level, respectively.

Impact Analysis – Potential impacts to minority and low-income populations would mostly consist of radiological effects, however, radiation doses from continued operations associated with this license renewal are expected to continue at current levels, and would be well below regulatory limits.

Based on this information and the analysis of human health and environmental impacts presented in this environmental assessment, the NRC staff finds that the proposed action would not have disproportionately high and adverse human health and environmental effects on minority and low-income populations residing in the vicinity of NRCR.

#### Environmental Impacts of the Alternatives to the Proposed Action:

As an alternative to license renewal, the NRC staff considered denying the proposed action. If the NRC denied the application for license renewal, reactor operations would cease and decommissioning would be required. The NRC notes that, even with a renewed license, the NRCR will eventually be decommissioned, at which time the environmental effects of decommissioning would occur. Decommissioning would be conducted in accordance with an NRC-approved decommissioning plan which would require a separate environmental review under 10 CFR 51.21. Cessation of reactor operations would reduce or eliminate radioactive effluents and emissions. However, as previously discussed in this environmental assessment,

radioactive effluents and emissions from reactor operations constitute a small fraction of the applicable regulatory limits. Therefore, the environmental impacts of license renewal and the denial of the application for license renewal would be similar. In addition, denying the application for license renewal would eliminate the benefits of teaching opportunities, research, and services provided by the NRCR.

Alternative Use of Resources:

The proposed action does not involve the use of any different resources or significant quantities of resources beyond those previously considered in the issuance of Amendment No. 10 to Facility Operating License No. R-76 for the Washington State University Nuclear Research Center Reactor dated August 11, 1982, which renewed the Facility Operating License for a period of 20 years.

**Agencies and Persons Consulted**

In accordance with the agency's stated policy, the staff consulted with the State Historic Preservation Officer between May 13 and October 21, 2010, and the State Liaison Officer between May 13 and December 2, 2010, regarding the environmental impact of the proposed action. The consultation involved a thorough explanation of the environmental review, the details of this environmental assessment, and the NRC's findings. The State officials stated that they understood the NRC review and had no comments regarding the proposed action.

### III. Finding of No Significant Impact

On the basis of the environmental assessment, the NRC staff concludes that the proposed action will not have a significant effect on the quality of the human environment. Accordingly, the NRC staff has determined not to prepare an environmental impact statement for the proposed action.

For further details with respect to the proposed action, see the licensee's application dated June 24, 2002 (ML092390202), as supplemented by letters dated August 15, 2007 (ML072410493), June 13, 2008 (ML082380266), and April 7, 2010 (ML101031097). Documents may be examined, and/or copied for a fee, at the NRC's Public Document Room (PDR), located at One White Flint North, 11555 Rockville Pike (first floor), Rockville, Maryland. Publicly available records will be accessible electronically from the Agencywide Documents Access and Management System (ADAMS) Public Electronic Reading Room on the NRC Web site <http://www.nrc.gov/reading-rm/adams.html>. Persons who do not have access to ADAMS or who encounter problems in accessing the documents located in ADAMS should contact the NRC PDR Reference staff at 1-800-397-4209, or 301-415-4737, or send an e-mail to [pdr@nrc.gov](mailto:pdr@nrc.gov).

Dated at Rockville, Maryland this 8<sup>th</sup> day of April, 2011

FOR THE NUCLEAR REGULATORY COMMISSION

**/RA/**

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