UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001

November 6, 2017

The Honorable Kristine L. Svinicki
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: REPORT ON THE SAFETY ASPECTS OF THE CONSTRUCTION PERMIT APPLICATION FOR NORTHWEST MEDICAL ISOTOPES, LLC, RADIOISOTOPE PRODUCTION FACILITY

Dear Chairman Svinicki:

During the 648th meeting of the Advisory Committee on Reactor Safeguards (ACRS), November 2-3, 2017, we completed our review of the construction permit application for the Northwest Medical Isotopes, LLC (NWMI) radioisotope production facility. We reviewed the preliminary safety analysis report submitted by NWMI and the draft final safety evaluation report prepared by the NRC staff. Our Subcommittee on NWMI reviewed this matter during meetings on June 19, July 11, August 22 and 23, and September 21, 2017. During these reviews, we had the benefit of discussions with representatives of the staff and NWMI. We also had the benefit of the referenced documents. This report fulfills the requirement of Section 182b of the Atomic Energy Act of 1954, as amended, that the ACRS shall review each application under Section 103 or Section 104b for a construction permit or an operating license for a facility.

RECOMMENDATIONS

NWMI has submitted a preliminary design for a facility that addresses hazards associated with the extraction of ^{99}Mo from irradiated targets and the fabrication of targets for irradiation.

- Once the design is finalized, the proposed facility can be constructed and licensed for operation with adequate protection of the public health and safety and no undue risk to the environment.

- A construction permit for the proposed radioisotope production facility can be issued to NWMI.

BACKGROUND

NWMI was organized to be a supplier of the radioisotope ^{99}Mo for use in medical procedures. NWMI proposes to construct a facility to extract ^{99}Mo from irradiated urania targets enriched initially with slightly less than 20% ^{235}U. Irradiation of these targets will take place at research reactors in Oregon, Missouri, and possibly other places.

The extraction facility NWMI proposes will be located on a 7.4 acre site within the Discovery Ridge Research Park in Columbia, Missouri near the University of Missouri. This site is about 125 miles east of Kansas City and about 125 miles west of St. Louis. There is a regional airport within 6 miles of the facility and there are nearby heliports.

The proposed facility will be used to

- receive irradiated targets from the irradiation facilities, disassemble these targets, and acid dissolve the irradiated Urania,
- extract ^{99}Mo from solution by ion exchange and prepare the purified isotope for shipment,
- recover enriched uranium from solution and fabricate irradiation targets for shipment to research reactors, and
- store, handle and ship radioactive waste.

Targets will be irradiated at the research reactors for very short periods (~150 hours), so burnup will be quite modest. Dissolution of the irradiated material in nitric acid will be facile. Gaseous effluent produced during dissolution will include hydrogen, radioactive noble gases (Xe, Kr), and gaseous iodine radioisotopes. Noble gases will be retained on carbon absorber beds. Iodine will be retained in silver-modified zeolites.

The isotope ^{99}Mo will be extracted from the solution by ion exchange. No 'red oil' issues are expected to arise.

Target fabrication is based on a process that produces small urania particles. Valence adjustment is to be done by high temperature reduction in hydrogen. Episodically, enriched uranium metal will be received at the facility, dissolved, and used to augment the inventory of recycled target material.

DISCUSSION

Internal hazards posed by the proposed facility include:

- Criticality events, especially in solutions
- Fire
- Venting of radiotoxic vapors and gases from the facility
- Pipe and tank ruptures

Most of the proposed systems in the facility will be criticality safe by geometry. Otherwise, well established, double-contingency criticality safety practices have been adopted and conservatively applied. During the course of our review, NWMI reduced its upper subcritical limit and this change may lead to changes in facility systems and structures in the finalized design.

Fire is recognized as a threat to the facility. Strategies to detect, suppress, and extinguish fires have been defined. Selection of a strategy will be a part of the final design.

The facility is to have four nested ventilation zones. This is a widely accepted configuration to limit the possibility of inadvertent, uncontrolled release of radiotoxic gases, vapors, and particles. Ventilation flows will be to a 75-foot stack. HEPA filters will be used to mitigate particulate contamination in the ventilation flows.

Pipes and tanks in the facility are to be within lined cells and pathways to retain and collect any spilled solutions. Adequate allowances have been made for foaming in dissolution tanks.

External threats to the facility include natural events and man-made hazards. Measures to limit the probability of damage by high winds, wind-driven missiles, and external floods will be made in the final facility design. The proposed facility can be constructed to withstand expected seismic loads. Some additional attention will need to be given to high frequency (>10 Hz) seismic motions that do not threaten the structural integrity of the facility, but may affect internal systems.

Aircraft impact probabilities will be reassessed as a part of the final design to show that either these probabilities are sufficiently low or that the facility is sufficiently protected from aircraft impact. Threats to the facility posed by other man-made, external hazards such as highway traffic and nearby pipelines will be reassessed during the final design of the facility.

We conclude based on our review of the documents submitted by the applicant and our review of the staff safety evaluation report that the applicant has demonstrated adequate knowledge of the potential hazards and possible accidents at the proposed facility. They have sufficient knowledge of the requirements for adequate safety of the facility. The proposed quality assurance plan submitted by NWMI for the facility construction is sound and in compliance with the pertinent requirements. Furthermore, the applicant and the staff have documented topics that arose during the staff review and our review of the construction permit application that will receive particular consideration during design finalization.
A finalized design of the proposed facility can be constructed and subsequently licensed for operation with adequate protection of the public health and safety and no undue risk to the environment. A construction permit can be issued to NWMI.

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Sincerely,

/RA/

Dennis C. Bley, Chairman

REFERENCES

1. Northwest Medical Isotopes, LLC, “NRC Project No. 0803 – Northwest Medical Isotopes, LLC, Submittal Part 2 Construction Permit Application for a Radioisotope Production Facility,” July 20, 2015 (ML15210A182).

2. Northwest Medical Isotopes, LLC, “Docket No. 50-609, Northwest Medical Isotopes, LLC, Transmittal of Revision 3 of Chapters 1.0 through 18.0 of NWMI-2013-021, ‘Construction Permit Application for Radioisotope Production’,” September 8, 2017 (ML17257A019).

3. U.S. Nuclear Regulatory Commission, Draft Northwest Medical Isotopes, LLC Safety Evaluation Report, November 1, 2017 (ML17305A657).

4. U.S. Nuclear Regulatory Commission, NUREG-1537, Part 1, “Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors: Format and Content,” Revision 0, February 1996 (ML042430055).

5. U.S. Nuclear Regulatory Commission, NUREG-1537, Part 2, “Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors: Standard Review Plan and Acceptance Criteria,” Revision 0, February 1996 (ML042430048).

6. U.S. Nuclear Regulatory Commission, “Final Interim Staff Guidance Augmenting NUREG-1537, Part 1, ‘Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors: Format and Content,’ for Licensing Radioisotope Production Facilities and Aqueous Homogeneous Reactors,” October 17, 2012 (ML12156A069).

7. U.S. Nuclear Regulatory Commission, “Final Interim Staff Guidance Augmenting NUREG-1537, Part 2, ‘Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors: Standard Review Plan and Acceptance Criteria,’ for Licensing Radioisotope Production Facilities and Aqueous Homogeneous Reactors,” October 17, 2012 (ML12156A075).

8. U.S. Nuclear Regulatory Commission, NUREG-1520, "Standard Review Plan for Fuel Cycle Facilities License Applications," Revision 2, June 2015 (ML15176A258).

2. Northwest Medical Isotopes, LLC, “Docket No. 50-609, Northwest Medical Isotopes, LLC, Transmittal of Revision 3 of Chapters 1.0 through 18.0 of NWMI-2013-021, ‘Construction Permit Application for Radioisotope Production’,” September 8, 2017 (ML17257A019).

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8. U.S. Nuclear Regulatory Commission, NUREG-1520, "Standard Review Plan for Fuel Cycle Facilities License Applications," Revision 2, June 2015 (ML15176A258).

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