

U.S. National Academy of Sciences
*Committee on State of Molybdenum-99 Production and Utilization and
Progress toward Eliminating Use of Highly Enriched Uranium*

U.S. Nuclear Regulatory Commission Role in Disposition of Radioactive Waste Resulting from Molybdenum-99 Production

Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
November 3, 2015



Today's Presentation Will Cover...

- Applicable legislation, regulation, and guidance
- NRC responsibilities
- Types of radioactive waste
- Summary of SHINE radioactive waste considerations
- Summary of NRC review of anticipated radioactive waste management in construction permit applications

Legislation, Regulation, and Guidance Overview

- Atomic Energy Act of 1954
- Nuclear Waste Policy Act of 1982
- American Medical Isotopes Production Act of 2012 (AMIPA)
- NRC regulations [Title 10 of the *Code of Federal Regulations*) (10 CFR) Part 20, Subpart K, “Waste Disposal”]
- NRC licensing guidance (NUREG-1537 and Interim Staff Guidance)

NRC Responsibility

- NRC regulates storage and disposal of all commercially generated radioactive wastes in the United States
- Two broad classifications: high-level waste and low-level waste
 - High-level waste typically spent nuclear fuel
 - Low-level waste is typically stored on-site by licensees until it has decayed such that it may be disposed of as ordinary trash or may be shipped to a low-level waste disposal site
- Currently, four disposal sites receiving low-level waste regulated by Agreement States

Classifications of Low-Level Radioactive Waste

- Waste classification determined by consideration of both long-lived and shorter-lived radionuclides
- There are four classes of low-level radioactive waste:
 - Class A – waste that is usually segregated from other waste classes at the disposal site
 - Class B – waste that must meet rigorous requirements on waste form to ensure stability
 - Class C – in addition to Class B requirements, waste that also requires measures at the disposal facility to protect against inadvertent intrusion
 - Greater than Class C – waste that is generally not acceptable for near-surface disposal

Summary of Anticipated SHINE Waste Disposal

- All waste generated is low-level radioactive waste
- No spent nuclear fuel
- Nuclear Waste Policy Act of 1982 does not apply
- Only temporary onsite storage
- All waste has either commercial disposal or storage site

Low-level Radioactive Waste Generated by SHINE

Description	Waste Class	Volume as Shipped (ft ³)	Percent of Total Volume Shipped
Neutron Generator Extraction Columns Class A Trash	A	4338	30%
Other Liquid Wastes	A/B	9738	69%
Proprietary	B	79	<1%
Tc/I columns	C	23	<1%
Zeolite beds	GTCC	0.4	<1%
Cs/Ce Media	GTCC	23	<1%

Storage and Transportation of SHINE Waste

- Temporary on site storage
- Transportation to offsite facilities
 - Class A waste
 - EnergySolutions in Clive, Utah
 - Diversified Scientific Services, Inc. in Kingston, Tennessee
 - Class B, Class C, and Greater Than Class C wastes
 - Waste Control Specialists in Andrews, Texas

NRC Waste Review Areas

- Preliminary Safety Analysis Report:
 - Applicability of Nuclear Waste Policy Act and AMIPA
 - Radioactive waste management program
 - Radioactive waste controls
 - Release of radioactive waste
- Environmental Report:
 - Radioactive waste generation
 - Radioactive exposures to workers and the public
 - Handling, processing, and storage
 - Transportation
 - Disposal

NRC Review and Conclusions: Safety

- Radioactive Waste Management
 - SHINE has committed to follow applicable local and federal requirements
 - Personnel will be appropriately structured to perform functions
 - Facility systems are designed in a manner that will provide the capability to obtain the data needed to comply with requirements
- Radioactive Waste Controls
 - Appropriate controls are described for radioactive waste management on the waste streams and products designed to prevent uncontrolled exposures or escape of radioactive waste
 - Applicant described programmatic measures to evaluate the generation of radioactive wastes at the facility
- Release of Radioactive Waste
 - Radionuclides have been sufficiently identified
 - Releases of radioactive effluents will likely be sufficiently managed, controlled, and monitored so that limits in applicable regulations would not be exceeded

NRC Review and Conclusions: Environmental

- Human Health: SMALL
 - Facility design minimizes exposures
 - Operate in accordance with all applicable Federal and State of Wisconsin regulatory requirements
 - Dose to workers and the public within 10 CFR Part 20 dose limits
- Waste Management: SMALL
 - Waste management systems to minimize and safety handle waste
 - Engineered designs features to minimize radioactive contamination
 - Operate within the NRC's, DOT's, and State of Wisconsin's radiation protection requirements
- Transportation (Radiological): SMALL
 - Adhere to applicable NRC, DOT, and State of Wisconsin regulatory packaging and transportation requirements

Discussion



Background Information



Types of Radioactive Waste

- *Waste* means those low-level radioactive wastes containing source, special nuclear, or byproduct material that are acceptable for disposal in a land disposal facility. For the purposes of this definition, low-level radioactive waste means radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material
- *High-level radioactive waste* or HLW means: (1) Irradiated reactor fuel, (2) liquid wastes resulting from the operation of the first cycle solvent extraction system, or equivalent, and the concentrated wastes from subsequent extraction cycles, or equivalent, in a facility for reprocessing irradiated reactor fuel, and (3) solids into which such liquid wastes have been converted

Spent Nuclear Fuel

Spent Nuclear Fuel or Spent Fuel means fuel that has been withdrawn from a nuclear reactor following irradiation, has undergone at least one year's decay since being used as a source of energy in a **power reactor**, and has not been chemically separated into its constituent elements by reprocessing. Spent fuel includes the special nuclear material, byproduct material, source material, and other radioactive materials associated with fuel assemblies.

Responsibilities of Other Government Agencies

- *DOE* plans and carries out programs for DOE-generated radioactive wastes, develops waste disposal technologies, will establish a uranium lease and take-back program associated with molybdenum-99 (Mo-99) production
- *Environmental Protection Agency* develops standards and guidance for offsite radiation due to spent nuclear fuel and high-level and transuranic radioactive wastes
- *Department of Transportation (DOT)* regulates packaging and carriage of all hazardous materials including radioactive waste. Packaging must meet NRC regulations (Type A and B packaging under 10 CFR Part 71). DOT sets limits for external radiation levels and contamination, and controls the mechanical condition of carrier equipment and qualifications of carrier personnel

Nuclear Waste Policy Act of 1982

- NRC evaluates compliance with Section 302(b)(1)(B) of the Nuclear Waste Policy Act for disposal of high-level radioactive wastes and spent nuclear fuel
- Evaluation includes a review of any agreements with the Department of Energy (DOE) for disposal of high-level radioactive wastes and spent nuclear fuel
- As applicable, a summary and copy of the contract with DOE to dispose of high-level waste and irradiated fuel should be provided in the applicant's safety analysis report

American Medical Isotopes Production Act

- Requires DOE establish a uranium lease and take-back program
- Radioactive material resulting from the production of medical radioisotopes that has been permanently removed from a reactor or subcritical assembly, and for which there is no further use, is deemed to be low-level radioactive waste
- DOE would take title to, and be responsible for, the final disposition of radioactive waste created by the irradiation, processing, or purification of uranium leased from DOE for medical radioisotope production, if it determines that the producer does not have access to a disposal path

NRC Waste Regulations for Mo-99 Production

- Waste management programs of non-power production and utilization facilities evaluated according to 10 CFR Part 20, Subpart K, “Waste disposal”
 - Method for obtaining approval of proposed disposal procedures
 - Disposal of specific wastes
 - Transfer of disposal and manifests
 - Compliance with environmental and health regulations
 - Disposal of certain byproduct material

Additional NRC Waste Regulations

- 10 CFR Part 60, “Disposal of high-level radioactive wastes in geological repositories”
- 10 CFR Part 61, “Licensing requirements for land disposal of radioactive waste”
- 10 CFR Part 62, “Criteria and procedures for emergency access to non-federal and regional low-level waste disposal facilities”
- 10 CFR Part 63, “Disposal of high-level radioactive wastes in a geologic repository at Yucca Mountain, Nevada”
- 10 CFR Part 71, “Packaging and transportation of radioactive material”
- 10 CFR Part 72, “Licensing requirements for the independent storage of spent nuclear fuel and high-level radioactive waste, and reactor-related greater than Class C waste”