

## Northwest Medical Isotopes, LLC Radioisotope Production Facility Overview



U.S. Nuclear Regulatory Agency – Regulatory Information Conference  
Progress Toward a Reliable Domestic Supply of Mo-99  
March 14, 2018



1

---

---

---

---

---

---

---

---

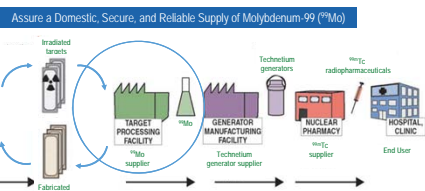
---

---

---

---

## NWMI Mission



- Captive Network of University Research Reactors
  - Reliability/assurance of supply
  - Multiple shipments/week
- Radiisotope Production Facility (RPF)
  - Fabrication of LEU targets
  - <sup>99</sup>Mo production
  - Uranium recycle and recovery
- Domestic <sup>99</sup>Mo Generator Distributors
  - Hold FDA Drug Master File
  - No changes to generators
  - No changes to supply chain



2

---

---

---

---

---

---

---

---

---

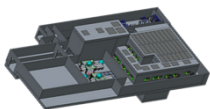
---

---

---

## Primary Assumptions

- Single radioisotope production facility → RPF
  - RPF includes target fabrication, <sup>99</sup>Mo production, and uranium recycle and recovery
  - <sup>99</sup>Mo produced by a fission-based method using LEU – “Gold standard for <sup>99</sup>Mo production”
  - Nominal capacity 3,500 6-day curies (Ci); surge capacity of 1,500 6-day Ci
- Use network of university reactors
  - Same LEU target design used for all reactors
  - Intellectual property obtained for LEU target
    - U.S., Australia, Russia, South Africa, Korea, Europe, China → Allowed
    - India → Pending
- Fission product releases will comply with environmental release criteria
- Generate Class A, B, and C wastes; no greater than Class C (GTCC) waste



3

---

---

---

---

---

---

---

---








---


---

---

---

### NWMI Team

Commercial Irradiation Services University Reactors	Radioisotope Production Facility	Technology Demonstration
 	<p style="font-size: small;">Engineering Design</p>   <p style="font-size: small;">Nuclear Criticality, Shielding, and Safety Analysis</p>  <p style="font-size: small;">Preconstruction/Construction</p>  <p style="font-size: small;">Environmental Assessments and Permitting</p> 	    



---

---

---

---

---

---

---


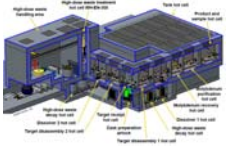
---


---

---

### Project Status

- > Extensive testing (cold and hot chemistry) complete; optimization continues
- > Continuing additional full-scale commercial generator testing in-progress
- > NRC Construction Permit (CP) Application submitted
  - Final Environmental Impact Statement (EIS) published by NRC → May 2017
  - Full Advisory Committee on Reactor Safeguards (ACRS) → May 2017
  - ACRS subcommittee meetings in June/July → ACRS recommendation received in October 2017
  - Commission Meeting on January 23, 2018 → CP approval is imminent
- > Initiated final design and NRC Operating License Application → Submission in late 2018
- > Preconstruction activities initiated → Construction to be initiated in late 2Q 2018



---

---

---

---

---

---


---

---





---

---


### NWMI RPF Site and University Reactor Network Locations



FUTURE HOME OF  
**NWMI**  
WELCOME TO COLUMBIA/  
BOONE COUNTY

- > 7.4 acre parcel optioned
- > Anchor of isotope "ecosystem"
- > 6 mi to MURR
- > 3<sup>rd</sup> Reactor selection complete but not yet socialized
- > 5 mi to regional airport



---

---

---

---

---

---

---

---

---

---

### NRC Licensing Strategy

- Combine several license activities and submit one application that covers all applicable regulations for construction/operation of the RPF under 10 CFR 50

<p><b>10 CFR 50 Activities</b></p> <ul style="list-style-type: none"> <li>- Irradiated target receipt</li> <li>- Irradiated target disassembly</li> <li>- Target dissolution</li> <li>- <sup>99</sup>Mo separations, purification, and packaging</li> <li>- Uranium (U) recycle and recovery</li> <li>- Waste management</li> <li>- Associated laboratory and support</li> </ul>	<p><b>10 CFR 70 Activities</b></p> <ul style="list-style-type: none"> <li>- Receipt of low-enriched uranium (LEU) (from DOE)</li> <li>- Production of LEU microspheres</li> <li>- Target fabrication and testing</li> <li>- Shipping/loading of fabricated targets</li> <li>- Laboratory and support areas</li> </ul>	<p><b>10 CFR 30 Activities</b></p> <ul style="list-style-type: none"> <li>- Handling of byproduct material</li> </ul>
--	---	---

- University reactor(s) and cask licensee(s) will amend their current operating licenses

NWMI 7

---

---

---

---

---

---

---

---

---

---

---

---

### Proposed Schedule (Calendar Year)

- Start date of site preparation/construction → Q2 2018
- End date of construction → Q3 2019
- Start date of facility startup and cold commissioning (pre-operational) → Q4 2019
- Date of hot commissioning and commercial operations → Q1 2020
- Date of decommissioning: 2050

NWMI 8

---

---

---

---

---

---

---

---

---

---

---

---

### RPF Operating Characteristics

- 1 LEU target material production
- 2 LEU target material encapsulation
- 3 LEU target material packaging
- 4 Irradiated target disassembly
- 5 Irradiated target dissolution
- 6 Dissolved LEU solution processing
- 7 Purified <sup>99</sup>Mo production
- 8 <sup>99</sup>Mo packaging
- 9 LEU solution treatment and recycling

- 1 LEU target material is fabricated (both fresh LEU and recycled U)
- 2 LEU target material encapsulated using metal cladding → LEU target
- 3 LEU targets are packaged and shipped to university reactors for irradiation
- 4 After irradiation, targets are shipped back to RPF
- 5 Irradiated LEU targets disassembled
- 6 Irradiated LEU targets dissolved into a solution for processing
- 7 Dissolved LEU solution is processed to recover and purify <sup>99</sup>Mo
- 8 Purified <sup>99</sup>Mo is packaged/shipped to a radiopharmaceutical distributor
- 9 LEU solution is treated to recover U and is recycled back to Step 1

NWMI 9

---

---

---

---

---

---

---

---

---

---

---

---

### RPF Description

- First level footprint -52,000 square feet (ft<sup>2</sup>)
  - Target fabrication area
  - Hot cell processing area (dissolution, <sup>99</sup>Mo, and <sup>235</sup>U recovery)
  - Waste management, laboratory, and utility areas
- Basement -2,000 ft<sup>2</sup> (tank hot cell, decay vault)
- Second level -17,000 ft<sup>2</sup> (utility, ventilation, offgas equipment)
- Waste Management Building -1,200 ft<sup>2</sup>
- Administration Building (outside secured RPF area) -10,000 ft<sup>2</sup>
- High bay roof - 65 ft
- Mechanical area, second floor - 46 ft
- Top of exhaust stack - 75 ft
- Loading dock (back) roof - 20 ft
- Support and admin (front) roof - 12 ft
- Depth below grade for hot cell/high-integrity container (HIC) storage - 15 ft



10

---

---

---

---

---

---

---

---

---

---

### Questions?



11

---

---

---

---

---

---

---

---

---

---