



## NWMI Overview and Status Mo-99 Topical Meeting

Carolyn C. Haass, Chief Operating Officer  
September 13, 2016

# NRC Regulatory Strategy

- Combine several license activities and submit one application that covers all applicable regulations for construction/operation of the Radioisotope Production Facility (RPF) under 10 CFR 50 and 10 CFR 70

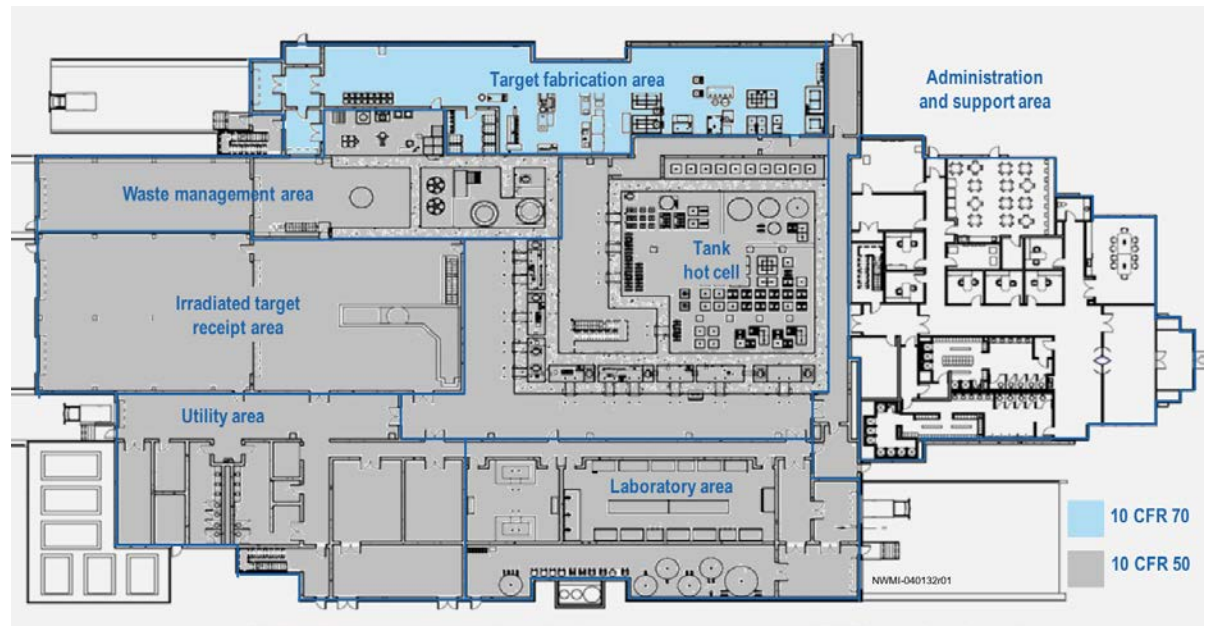
## 10 CFR 50 Activities

- Irradiated target receipt
- Irradiated target disassembly
- Target dissolution
- $^{99}\text{Mo}$  separations, purification, and packaging
- Uranium (U) recycle and recovery
- Waste management
- Associated laboratory and support
- Handling of byproduct material (integration with 10 CFR 30 activities)

## 10 CFR 70 Activities

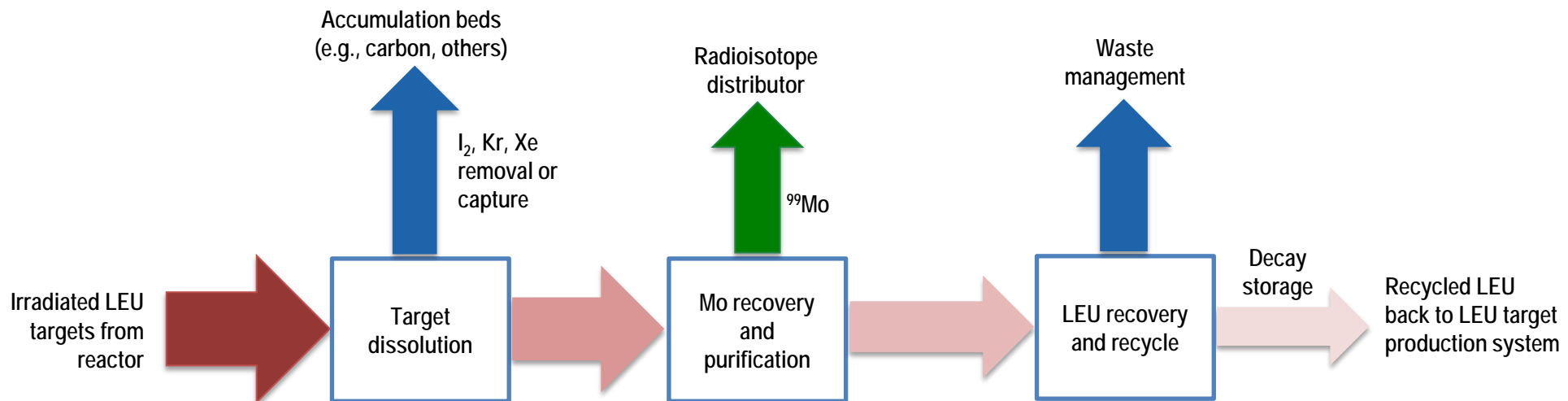
- Receipt of low-enriched uranium (LEU) (from DOE)
- Production of LEU microspheres
- Target fabrication and testing
- Shipping/loading of fabricated targets

- University reactor(s) and cask licensee(s) will amend their current operating licenses
- ~40 State/Local permits are required to be completed and approved prior to construction and operation of RPF

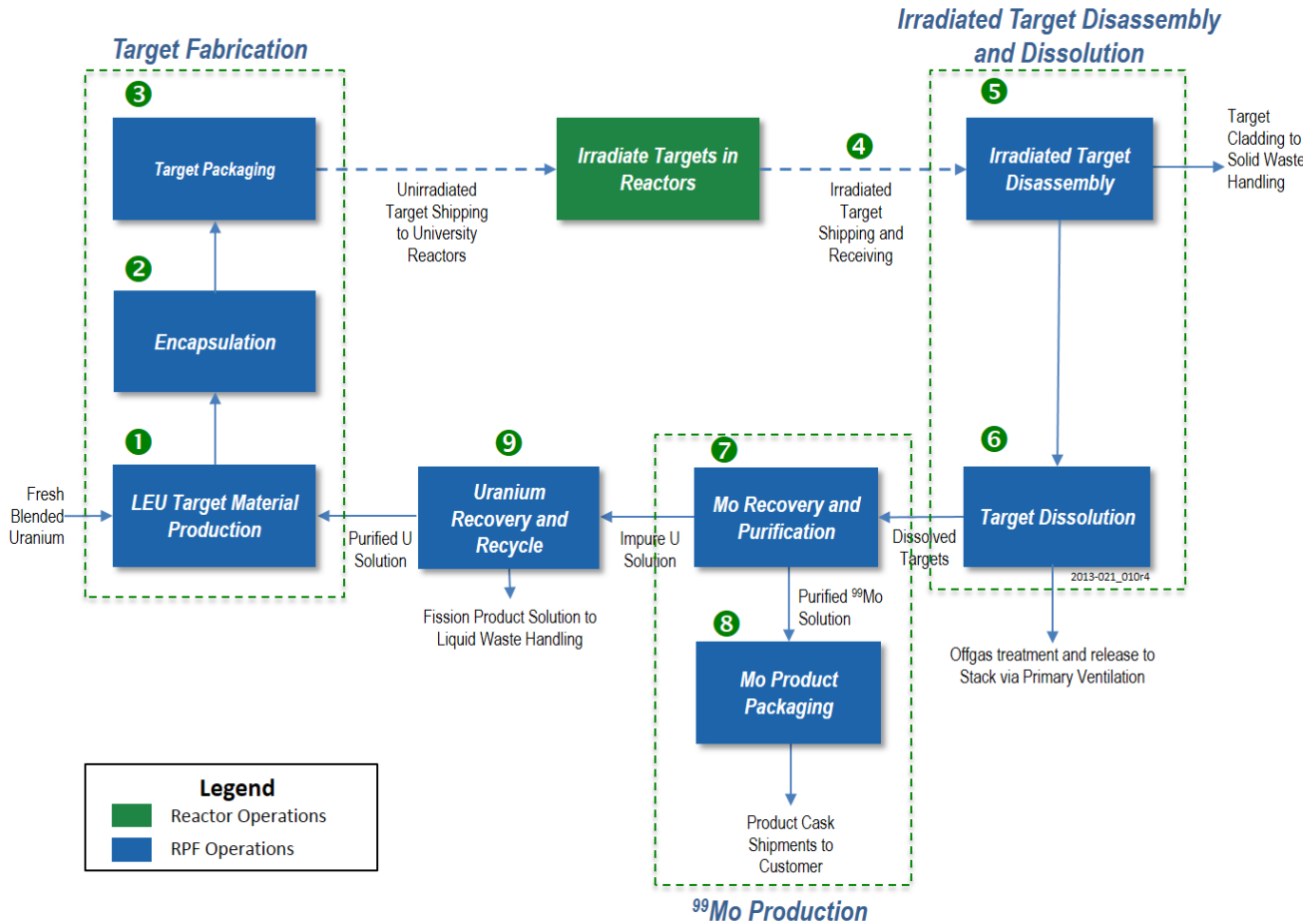


# Primary Assumptions

- Single Radioisotope Production Facility (RPF)
  - Use low-enriched uranium (LEU)
  - $^{99}\text{Mo}$  produced using a fission-based method – “Gold Standard”
  - Nominal weekly capacity 3,500 6-day Ci; surge capacity of 1,500 6-day Ci
  - Recover  $^{99}\text{Mo}$  from LEU targets using standard chemical processes
- Use network of university reactors to maximize existing infrastructures and facility
  - Use same target design for all reactors
- Recycle processed LEU for reuse as target material
- Fission product releases will comply with environmental release criteria
- Generate Class A, B, and C wastes; no greater than Class C (GTCC) waste
- Uranium processing and storage will meet all required safeguards and security requirements



# RPF Process Flow Diagram



- 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

# Facility Description

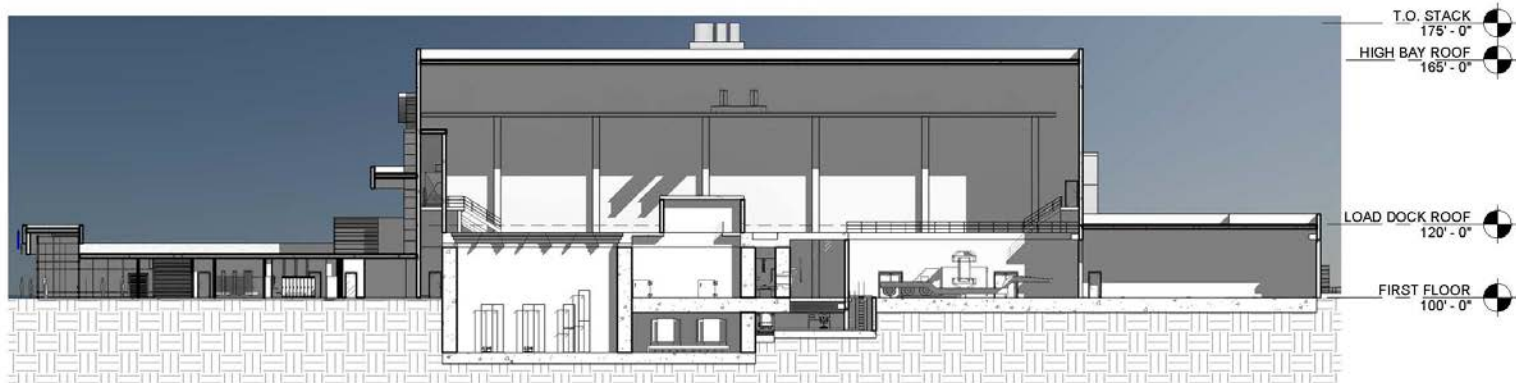
- First level footprint ~52,000 ft<sup>2</sup>
  - Target fabrication area
  - Hot cell processing area (dissolution, <sup>99</sup>Mo, and <sup>235</sup>U recovery)
  - Waste management, laboratory and utility areas
- Basement ~2,000 ft<sup>2</sup> (tank hot cell, decay vault)
- Second level ~17,000 ft<sup>2</sup> (utility, ventilation, offgas equipment)
- Waste Management Building ~1,200 ft<sup>2</sup>
- Administration Building (outside of 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



# Facility Cross-Sections



1 Building Section



2 Building Section

# NWMI Project Status

- Site selection completed – Discovery Ridge Research Park (Columbia, MO)
- RPF preliminary design and associated Integrated Design Report completed
- Construction Permit Application submitted and responded to all requests for additional information (RAI) to date
  - Preconstruction activities have been initiated
  - NRC and local regulatory authorities to be completed by late summer 2017
  - Construction to be initiated immediately after approval of NRC Construction Permit Application
- Re-evaluated all physics modeling at all University reactors and updated entire process mass and activity balances
- RPF final design initiated and will be completed in 1<sup>st</sup> Q 2017
- Initiated development of Operating License Application (Completed – Summer 2017)
- General preconstruction/construction selected; activities have been initiated
- Final stages of completing ULTB contracts with DOE
- R&D activities
  - Completed 12 irradiation/processing tests (10-20 Ci/test) to date and met all required Tc generator incoming requirements (e.g., US pharmacopeia requirements)
  - Next 3-6 Months Activities
    - Produce ~500 Ci of Mo-99 on up to 8 process tests
    - Complete additional quality related generator tests (e.g., 1 – 20 Ci)
    - Fabricate and irradiate full-scale LEU target at Oregon State University



# NWMI Team

## Commercial Irradiation Services University Reactors



## Radioisotope Production Facility

### Engineering Design



### Criticality, Shielding, and Safety Analysis

# ATKINS

### Preconstruction/Construction



### Environmental Assessments and Permitting



## Technology Demonstration



Narodowe Centrum Badań Jądrowych  
National Centre for Nuclear Research  
Świerk

