Niowave’s Domestic Production of Mo-99 and other Fission Products without a Nuclear Reactor

NRC Pre-Application Meeting
Design
August 3, 2022
Open Session
Outline

• Conceptual Design
• Licensing Status
• Leveraged Experience
• Location
• Next Steps
Mo-99 Commercial Facility

**Uranium Target Assembly (UTA)**
- \( k_{\text{eff}} \leq 0.95 \)
- LEU Fuel Mass: XX kgU
- NU Target Mass: 54 kgU
- LEU Fission Power: \(~250\ kW\)
- NU Fission Power: 50 kW
- Mo-99 Activity Produced: \(2\ k\text{Ci/week}\) (5% US Demand)

**Lead-Bismuth Eutectic (LBE) Neutron Source (2 per UTA)**
- Electron Energy: 40 MeV
- Accelerator Power: 200 kW
- \( T_{\text{max, LBE}} \): 500 °C
- \( V_{\text{max, LBE}} \): 2 m/s
- Neutron Source Intensity: \(~2.0 \times 10^{15} n/s\)
NRC Licensing Achievements

✓ License to process NU
  • Close-loop uranium cycle
  • Extract and purify fission products
✓ Irradiate subcritical assembly of LEU and NU
✓ License to process radium
  • Isolate and handle radon and radium
  • Irradiate to produce Ac-225
✓ License to process Sr-90
  • Extract Y-90 from Sr-90
✓ Emergency Plan, Part 30.32(i)
  • Reviewed and Recommended by NRC Nuclear Security and Incident Response
✓ Category 2 Byproduct Security, Part 37
  • Partnering with the Office of Radiological Security
Leveraged Experience [1]

✓ National Lab and University Partners
✓ MSU Facility for Rare Isotope Beams (FRIB)
  • Submitted an Environmental Report to DOE
  • DOE published an Environmental Assessment
✓ Construction Partner
  • Christman Constructors, Inc.
✓ Niowave Regulatory Experience
  • NSIR Recommended Emergency Plan
  • Cat 2 Byproduct Security Plan
  • State of Michigan License
  • DOT and IATA Trained
  • NRC Region III SNM materials license
Leveraged Experience [2]

✓ Niowave’s FDA-Compliant Quality System
  • Process Failure Mode and Effects Analysis (PFMEA)
  • Management Measures (toward compliance with 70.61)
  • Document Control

✓ Niowave IT Department
  • Cyber Security
  • Redundant Data Recovery
  • Controls
National Lab & University Partners

ANL – UREX, Mo-99 Chemistry
LANL – LBE Target
ORNL – Neutronics and Shielding Calculations
PNNL – Dissolution & Gas Extraction
SRNL – UREX
Y-12 – Uranium Recovery and LEU

UNLV – UREX, Mo-99 Chemistry, Other Isotopes
MSU – Other Isotopes, Radiopharmaceuticals
Christman Constructors, Inc. (CCI) was awarded the cast-in-place concrete, carpentry and general trades work for the Facility for Rare Isotope Beams (FRIB), a new nuclear science facility at Michigan State University.

The project included:

- 42,000 cubic yards of concrete
- The use of high density 250 P.C.F. concrete
- Largest monolithic wall pour, 48’ tall, 7’ wide, and 650 cubic yards
Quality System

- Implemented 21 CFR 820 / ISO 13485 Quality System
- 200+ Documents released and trained
- ISO 13485 certified

- Passed multiple customer & certified body audits with zero findings within the last year
- FDA qualified supplier of Y-90 for clinical use
Mo-99 Commercial Facility
Mo-99 Commercial Facility

Office
Assembly
Shipping
Accelerator
UTA
Accelerator
Target Fab
Chemistry
Accelerator
UTA
Accelerator
Target Fab
Chemistry
Accelerator
UTA
Accelerator
Target Fab
Chemistry
Accelerator
UTA
Accelerator
Target Fab
Chemistry

500 feet

NIOWAVE
Accelerating the Fight Against Cancer
Airport Location

1 mile radius centered at Niowave’s Airport Facility

Facilities not in flight path
Next Steps

- Continue design development for commercial facility
- Move forward with leasing land
- Start building during review (if NEPA Cat Ex)
- Perform hazard and consequence analyses
- Prepare ISA summary and supporting documentation
- Prepare a license application following NUREG-1520 (informed, as appropriate by the ISG to NUREG-1537)
Next Meetings

• NEPA Categorical Exclusion Determination
• Security, Structural, Fire Safety, Emergency Management
• Management Measures QA, Cyber security, MCA, DFP
• Mechanical, Human Factors, Instrumentation & Controls
• Neutronics, Thermal Hydraulics, Shielding
• Radiochem, Waste
• ISA, Rad Protection, Crit Safety
Thank You