



National Nuclear Security
Administration (NNSA)

Defense Nuclear
Nonproliferation (DNN)

Office of Material Management
and Minimization (M3)

Molybdenum-99 Program Update

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Overview

- Program mission
- Conversions from highly enriched uranium (HEU) to low enriched uranium (LEU)
- Support for emissions monitoring and control
- Updates on recent Mo-99 developments
- National laboratory technical accomplishments

M3: What We Face

The detonation of a crude nuclear bomb would have catastrophic consequences, potentially including:



Significant fatalities and casualties;



Extensive infrastructure damage and radioactive contamination;



Economic losses worth hundreds of billions of dollars;



Irreparable psychological damage and fear across the globe.

M3: Our Response



Minimize the risk

of hostile states and non-state actors acquiring nuclear material for an improvised nuclear device

by working with partners

to eliminate the need for, presence of, or production of weapons-usable nuclear material.

M3: Our Opportunity



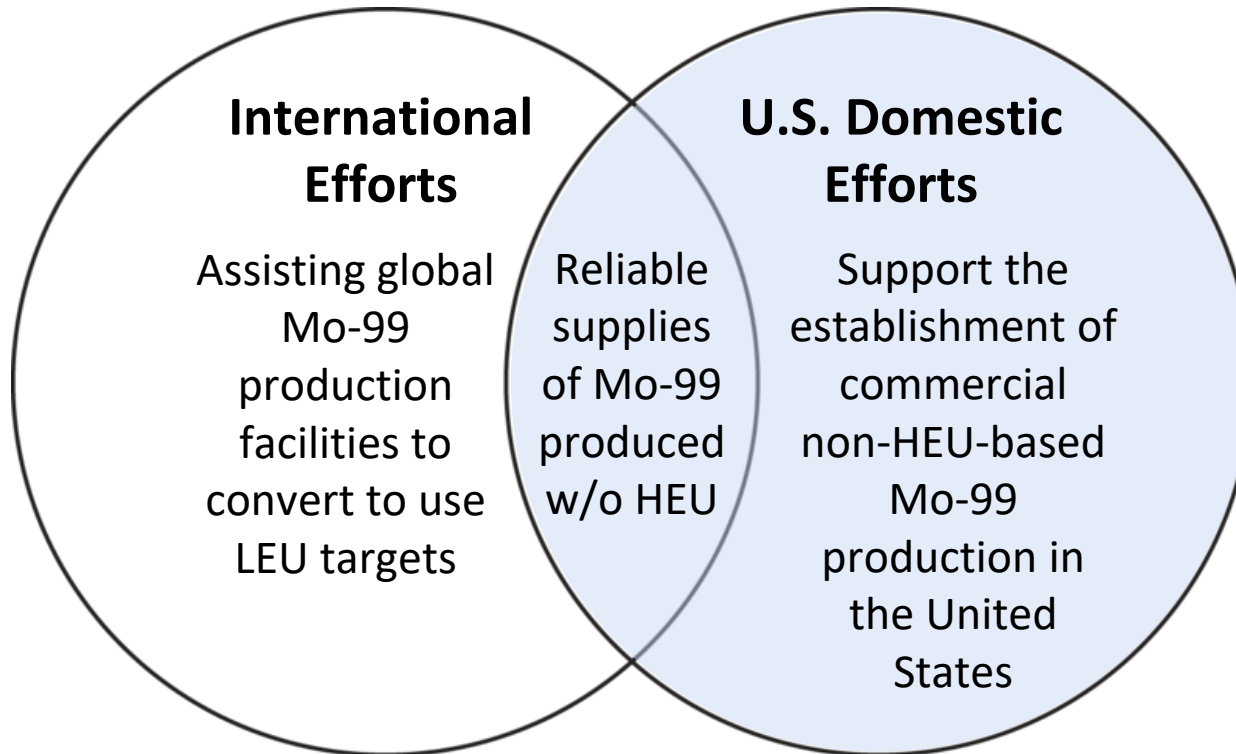
Keep the United States

at the forefront of civil nuclear industry
and nonproliferation leadership

→ **by ensuring our industry and allies**

have access to non-weapons-usable nuclear
material for scientific application and power
production (including High-Assay Low Enriched
Uranium or “HALEU”)

Highly Enriched Uranium (HEU) Minimization with Mo-99





All Major International Producers Now Use LEU Targets!

NTP (South Africa)

Converted to LEU in
2017



Curium (the Netherlands)

Converted to LEU in
2018



IRE (Belgium)

Partially converted
to LEU in 2020
Fully converted in
March 2023



*ANSTO (Australia) has always produced Mo-99 with LEU targets

Support for Emissions Monitoring and Control



U.S. Producers in
STAX



R&D on Emissions
Control



Facilitating Dialogue

All DOE/NNSA cooperative agreement partners that use fission-based processes are planning to participate in the STAX program

Developments on New Mo-99 Production

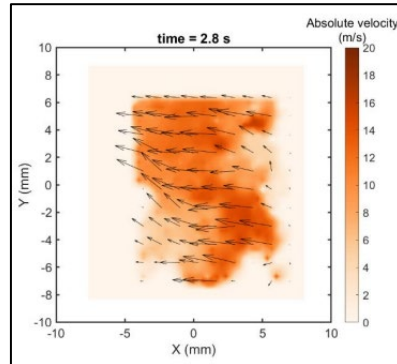
- U.S. Developments
 - NorthStar Medical Radioisotopes indefinitely suspended Mo-99 production.
 - SHINE Technologies continued work on new Mo-99 production facility, reaching milestones on Nuclear Regulatory Commission licensing, fusion accelerator testing, and equipment procurement and qualification.
 - Niowave conducted pre-application meetings with U.S. Nuclear Regulatory Commission.
- International Developments
 - Reactor outage resulted in short-duration Mo-99 shortages in late 2022.
 - BWXT installed and commissioned Mo-99 production equipment at Darlington Nuclear Generating Station.
 - OECD/NEA released new Mo-99 supply and demand report.



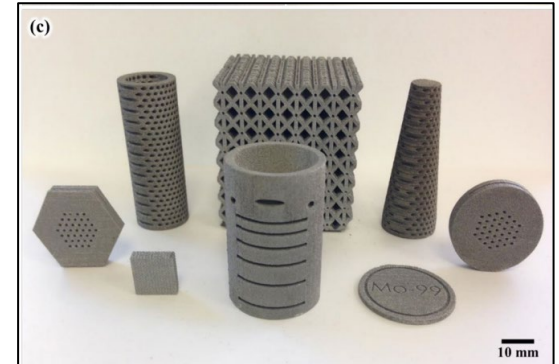
National Laboratory Technical Accomplishments



Argonne National Lab demonstrated changes to an existing process for separating Mo-99 from LEU targets to enable larger batch sizes

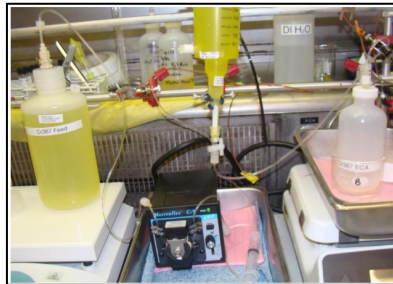


Los Alamos National Lab designed, built, and operated a system for laser-based measurements of helium cooling gas velocity for accelerator-based Mo-99 production



Oak Ridge National Lab published a report on additive manufacturing ("3D printing") of Mo-100 targets for accelerator-based Mo-99 production

Pacific Northwest National Lab developed and shipped for testing a new tool to capture radioxenon emissions from Mo-99 production



Savannah River National Lab demonstrated technology for removing high-activity fission products from Mo-99 waste

Y-12 National Security Complex tested and demonstrated a process for loading uranium fuel rods for Mo-99 production