

U.S. DEPARTMENT OF ENERGY **ENERGY** **NNSA**  
 National Nuclear Security Administration  
 Defense Nuclear Security Organization

**NNSA OFFICE OF CONVERSION:  
 RESEARCH REACTOR CONVERSION AND MO-99 PROGRAM  
 UPDATES**

**PRESENTATION TO THE REGULATORY INFORMATION CONFERENCE**

**MARCH 12, 2015 - BETHESDA, MD**

OFFICE OF MATERIALS MANAGEMENT AND MINIMIZATION  
 U.S. DEPARTMENT OF ENERGY – NATIONAL NUCLEAR SECURITY ADMINISTRATION

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**Material Management and Minimization**  
 Achieving Permanent Threat Reduction by Managing and Minimizing Nuclear Materials

 <p align="center"><b>Convert</b></p> <p>Convert research reactors and isotope production facilities to non-weapons-usable nuclear material both domestically and abroad</p> <ul style="list-style-type: none"> <li>• Research Reactor Conversion</li> <li>• Mo-99 Production</li> </ul>	 <p align="center"><b>Remove</b></p> <p>Remove or confirm the disposition of excess weapons-usable nuclear material at civilian facilities across the globe and consolidate those materials that remain</p> <ul style="list-style-type: none"> <li>• International Nuclear Material Removal and Consolidation</li> <li>• International Nuclear Material Down-blending</li> </ul>	 <p align="center"><b>Dispose</b></p> <p>Dispose of and manage excess weapons-usable nuclear material from both domestic stockpiles and material returned from abroad, and implement the Plutonium Management Disposition Agreement (PMDA) with Russia</p> <ul style="list-style-type: none"> <li>• HEU and Plutonium Disposition</li> <li>• Uranium Supply for Peaceful Uses</li> </ul>
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**Program Elements**

NNSA's Office of Conversion consists of two programs:

- 1. Reactor Conversion**
  - Converting HEU research reactors worldwide to the use of LEU fuel.
  - High-density LEU fuel qualification and fabrication for high-performance research reactors in the United States.
  - Technical support for European and Russian high-density LEU fuel qualification.
- 2. Mo-99 Production**
  - Support domestic commercial partners to develop new non-HEU-based Mo-99 production.
  - Support foreign partners to convert existing Mo-99 production from HEU to LEU targets



*Kazakhstan's VVR-K Critical Assembly was converted to LEU fuel in 2012*



*NNSA is working on a new high-density LEU fuel that will enable the conversion of the Missouri University Research Reactor (MURR)*

**92 HEU Facilities Converted or Verified as Shut Down**

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### Domestic Reactor Conversion Status

**Target:** 28 U.S. reactors  
**Status:** 20 addressed (71% completed)


- The 20 U.S. HEU-fueled research reactors that could convert with existing and qualified LEU fuels have all been successfully converted to the use of LEU fuel.

**Since 2004:**

- Converted seven domestic research reactors from HEU to LEU; one-time removals resulted in 80 kg HEU eliminated (~3 nuclear weapons worth of material)
- Remaining Scope:
  - Six U.S. High Performance Research Reactors (USHPRRs) require High Density Fuel
 

• ATR	• MITR
• ATR Critical Assembly	• MURR
• HFIR	• NBSR

Preparing HEU for removal from a research reactor core to allow for conversion to LEU



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### Key Areas of International Collaboration

**Miniature Neutron Source Reactors (MNSR)**

- May 2005 Technical Meeting - all participating MNSR operators indicated their desire to convert to LEU fuel
- Initial collaboration between US and China has resulted in the completion of the ZPTF (Zero Power test Facility) at CIAE to prepare and test the LEU cores and to validate conversion analyses.
- China will convert the first MNSR in 2015 followed by Ghana in 2016, then Nigeria and others

**European High Flux Reactors**

- Long term collaboration with Belgium, France, and Germany to develop high density LEU fuel to convert European high-performance research reactors
- Bilateral collaborations are also continuing in support of the conversion analysis for the BR-2 (Belgium) and RHF (France) reactors

**Kazakhstan**

- Efforts to convert the WWR-K reactor continue:
  - Conversion planned for FY 16
- Studies continue for the conversion of the IVG-1M and IGR reactors
  - Technical feasibility studies were completed and safety analyses initiated
  - Fuel test acceptance criteria need to be defined

**Russian domestic research reactor conversion**

- First Russian reactor converted in 2014, feasibility studies were completed on five others

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### Key Regulatory Framework

- U.S. NRC has played a key role in U.S. research reactor conversion activities. NRC has adopted a number of NUREGs to guide the fuel qualification and conversion process:
  - NUREG-1537:** NUREG for Research Reactor Conversion Process  
*"Guidelines for Preparing and Reviewing Applications for the Licensing Applications of Non-Power Reactors"*
  - NUREG-1282:** NUREG for LEU TRIGA reactor fuel  
*"Safety Evaluation of High Uranium Content Low Enriched Uranium Zirconium Hydride Fuel for TRIGA Reactor"*
  - NUREG-1313:** NUREG for LEU Silicide Fuel.  
*"Safety Evaluation Report related to the Evaluation of Low Enriched Uranium Silicide Aluminum Dispersion Fuel for Use in Non-Power Reactors".*
- U.S. NRC also plays an enabling role providing consultation and lessons learned to foreign regulatory bodies for the conversion of foreign research reactors

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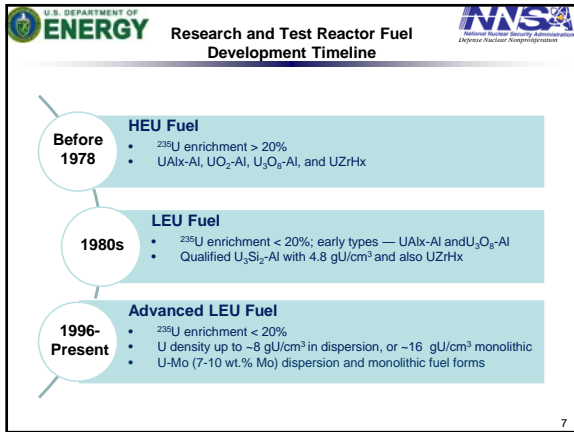
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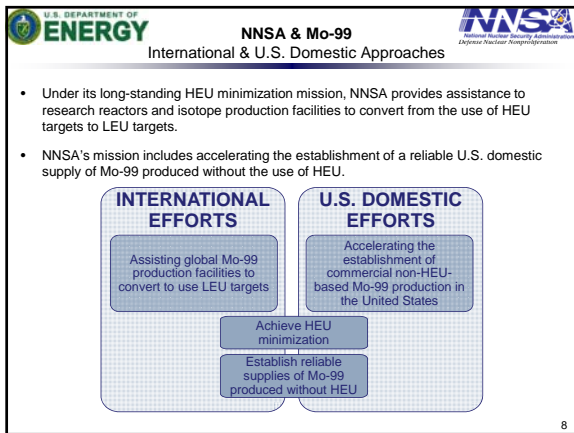
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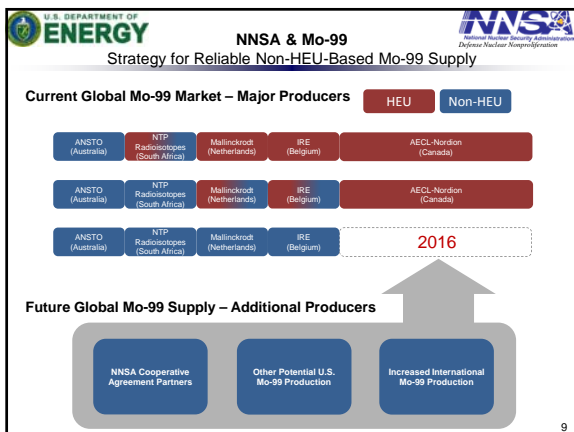
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