HEU Minimization Challenges in the US and Russia:
Political, Technical, and Economic Issues

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Nuclear Proliferation Prevention Project (NPPP)

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The NPPP engages in research, debate, and public education to ensure that civilian applications of nuclear technology do not foster the spread of nuclear weapons to states or terrorist groups.

Latest News

Public Health and Nuclear Experts Warn Against Importing Russian Medical Isotopes

January 18, 2012

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Problem #1: HEU Still Used at Facilities <u>Within</u> the Traditional Scope of RERTR

- Research reactors that use the most HEU have not yet converted:

	USA	Europe	Russia et al.
	ATR	HFR-ILL	SM-3
	HFIR	FRM-II	MIR.M1
	MURR	BR-2	WWR-M
	NBSR	Orphee	IVV-2M
	MIT		Etc.
HEU (kg/yr)	***250***	***130***	***300+***

- 90% of Mo-99 still made with HEU targets.

Problem #2: HEU in Non-Weapons Activities <u>Outside</u> the Traditional Scope of RERTR

- Critical assemblies
- Pulsed reactors
- Naval propulsion
- Ice-breaking ship propulsion
- Floating reactors (potential)
- Space reactors (potential)

Most Non-Weapons HEU Use Continues

Nuclear Activity	**Kgs Used per Year**	**Kgs in Lifetime Cores**
Research Reactors	750	100s
Medical Isotope Targets	50	
Naval Propulsion	3,000	
Icebreaker Ship Propulsion	~150	
Critical Assemblies		~10,000
Pulsed Reactors		~2,000
TOTAL	**~4,000**	**~12,000**
Amount in Traditional Scope of RERTR	***800***	
Previously Reduced by Conversion	***280***	***10s***
Previously Reduced by Shutdown	***450***	***~1000s***

HEUphaseout.org

Global HEU Phaseout

NPPP POLICY RESEARCH PROJECT - UNIVERSITY OF TEXAS AT AUSTIN

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This year-long Nuclear Proliferation Prevention Project research project — led by Prof. Alan J. Kuperman and involving 14 University of Texas at Austin graduate students in nuclear engineering and global policy studies explores the technical and political prospects and challenges of reducing worldwide non-weapons usage of highly enriched uranium (HEU). Most previous research and policy initiatives in this area have focused on the use of HEU as fuel for nuclear research reactors and as targets for production of medical isotopes. Our project updates and broadens the scope of past research to cover all remaining non-weapons usage of HEU, including the following: naval propulsion, ice-breaking ship reactors, floating reactors, critical assemblies, pulsed reactors, research reactors, and isotope production.

The research project is funded by the Nuclear Threat Initiative

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Field Research in 11 Countries

- Argentina
- Belgium
- Canada
- China
- France
- Germany
- Netherlands
- Norway
- Russia
- South Africa
- USA

13 Research Projects

Past Successes

- **Argentina**: Medical Isotope Production
- **South Africa**: Reactor Fuel and Medical Isotope Production

Continued Progress

- **USA and Europe**: High-Power Research Reactors
- **Germany**: The FRM-II Reactor
- **Russia**: Icebreaker Ships and Floating Reactors
- **China**: Reactors and Naval Propulsion

Ongoing Civilian HEU Use

- **Canada and Russia**: Medical Isotope Production
- **Belgium and the Netherlands**: Medical Isotope Production
- **Russia**: Research Reactors
- **Russia**: Critical Assemblies and Pulsed Reactors

Ongoing Military (non-weapons) HEU Use

- **USA and France**: Naval Propulsion
- **Russia**: Naval Propulsion

Future Applications

- **Space Reactors**

Russia:
Icebreaker Ships and Floating Reactors

- Floating reactor prototype is LEU.
- Next generation icebreakers plan to use LEU.
- [Both due to global norm against HEU exports.]
- No plans to convert existing icebreakers.

Russia:
Critical Assemblies and Pulsed Reactors

- Still 30 HEU critical assemblies.
  - By contrast, Europe has only one.
- Main obstacles to shut down or conversion of critical facilities:
  - Economic.
  - Traditional reliance on experiments, not codes.
- Military pulsed reactors off table – for now.

USA & Russia: High-Power Research Reactors

- **USA:** All 5 scheduled for conversion by 2020.
  - One per year, starting 2016.

- **Russia:** Conversion feasibility studies started on 6 reactors (& 1 critical assembly), under Dec. 2010 bilateral agreement.
  - No feasibility studies on 11 other HEU reactors.
  - No formal commitment to actual conversion.

Russia:
Medical Isotopes

- Expansion of subsidized production using HEU fuel and HEU targets undermines:
  - Norm against HEU;
  - Norm of full-cost recovery;
  - Conversion progress in Netherlands and Belgium;
  - Creation of U.S. production without HEU.
- Jan 18, 2012: U.S. medical and nuclear experts urge Congress to restrict import of Russian, HEU-based medical isotopes.

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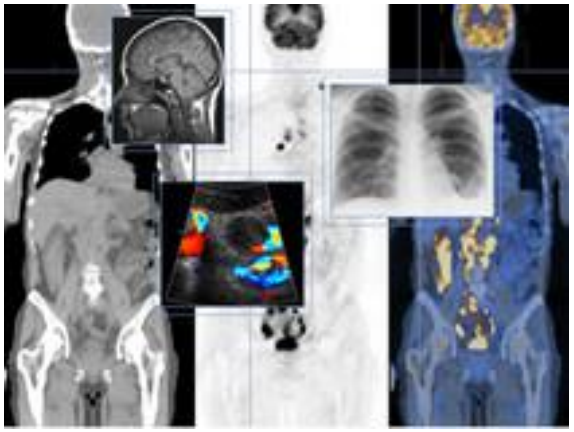

Letter urges Congress not to import Russian medical isotopes

By Deborah Shlian,
Miami Health Care Examiner
January 18, 2012

In November, 2011, the US Senate passed S. 99, the American Medical Isotopes Production Act of 2011, after public health, medical and nuclear experts successfully lobbied Congress to end its dependence on foreign manufacture of Molybdenum 99 (Mo-99) the critical precursor for most medical isotopes used nuclear diagnostic procedures. S99 allows for domestic production using low-enriched uranium (LEU) rather than highly enriched, bomb-grade uranium (HEU) used by foreign producers in Canada and the Netherlands.

Today that same group led by Dr. Alan J. Kuperman, Director, Nuclear Proliferation Prevention Program, Robert S. Strauss Center for International Security and Law, University of Texas at Austin, sent a letter to Representatives Fortenberry, Upton, and Markey asking for an amendment to that bill that would block the use of imported Russian medical isotopes produced with bomb-grade uranium completely within about five years.

USA:
Naval Propulsion

- ***Insight from France's conversion of naval propulsion***: Naval reactors improve even as enrichment reduced, currently to 7% LEU.

- ***USA***: Technical challenges of conversion to LEU probably could be overcome for next generation of submarines, if R&D started now.

Russia:
Naval Propulsion

- Conversion of next generation of submarines to LEU is feasible because they will use the new RHYTM-200 – the same reactor that will use LEU in next generation of icebreakers.

- But the current plan is that this reactor will use HEU fuel in submarines.

R_x for Completing RERTR and Expanding to Global HEU Phase-Out

- Preferential Procurement
- Conditional HEU Supply
- Conditional Take-Back of Spent Fuel
- Publicize Outliers
- Subsidize Conversion and Shutdown
- Technical Assistance
- Feasibility Studies
- Conditional Commitment on US Naval Reactors
- Expand FMCT