REDUCING THE USE OF HIGHLY ENRICHED URANIUM IN CIVILIAN RESEARCH REACTORS

SUMMARY OF RECOMMENDATIONS FROM A STUDY BY THE NATIONAL ACADEMIES

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Revision 2

DISCLAIMER

VIEWS ARE MY OWN

(AND ARE NOT NECESSARILY THOSE OF THE COMMITTEE)

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STATEMENT OF TASK

The committee will review the current status of and progress toward eliminating highly enriched uranium (HEU) use in fuel for civilian research and test reactors. This study will provide:

1. A list of civilian research and test reactors that operate using HEU fuel.

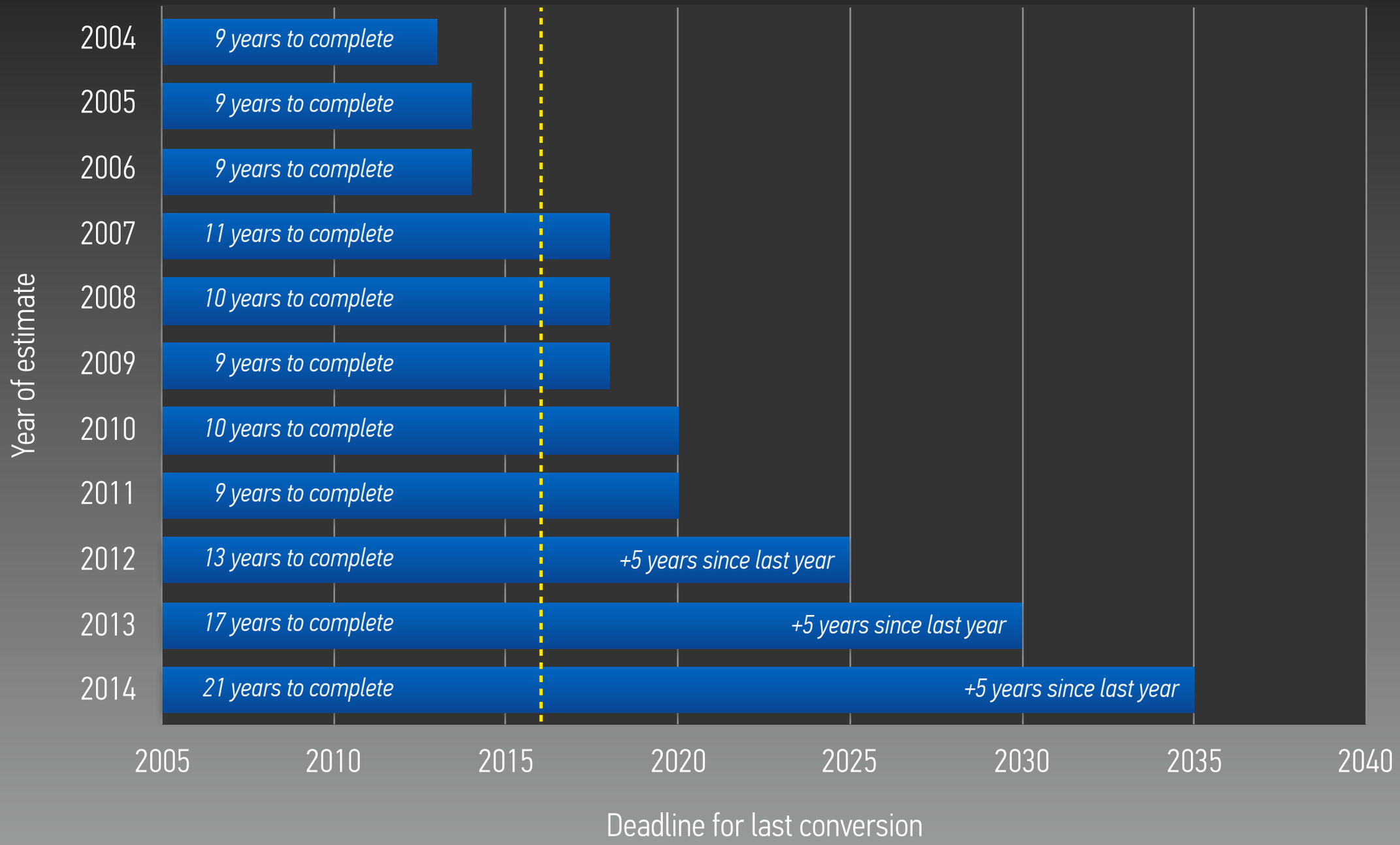
2. A review of civilian research and test reactor conversion status over the past five years.

3. An assessment of the progress being made by the Department of Energy and others to eliminate worldwide use of HEU in fuel for civilian research and test reactors. This assessment should **identify key technical and nontechnical factors and obstacles** to conversion; key obstacles to converting the remaining HEU-fueled reactors; and **steps that could be taken to overcome the identified obstacles**.

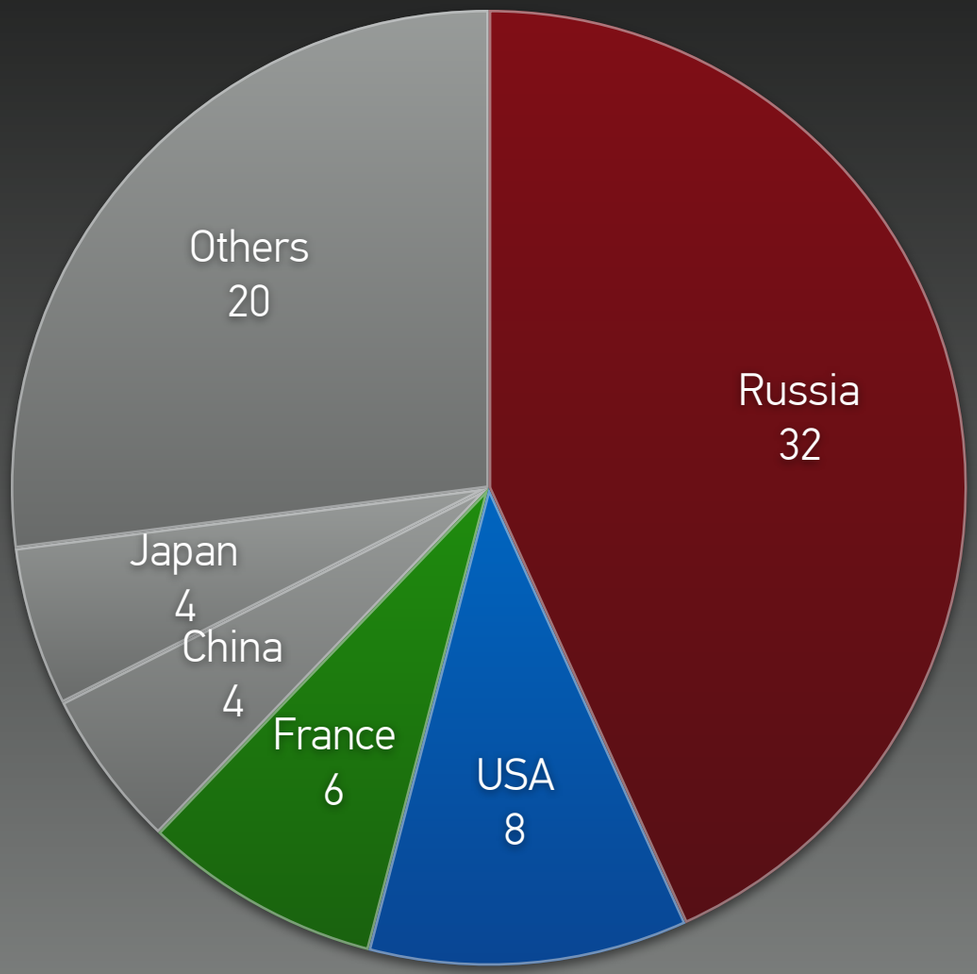
SEVEN RECOMMENDATIONS

1. Develop a 50-year interagency strategy and roadmap for neutron needs
2. Continue the development of very high-density LEU fuels for research reactors
3. Monitor the development of dispersion-type fuels as a backup for U.S. research reactors
4. Pursue an interim solution for conversion of high-performance research reactors
5. Engage Russia in conversion efforts through periodic workshops and scientific exchanges
6. Augment the annual progress reports of the M^3 program
7. Conduct independent technical review for robust project and risk management

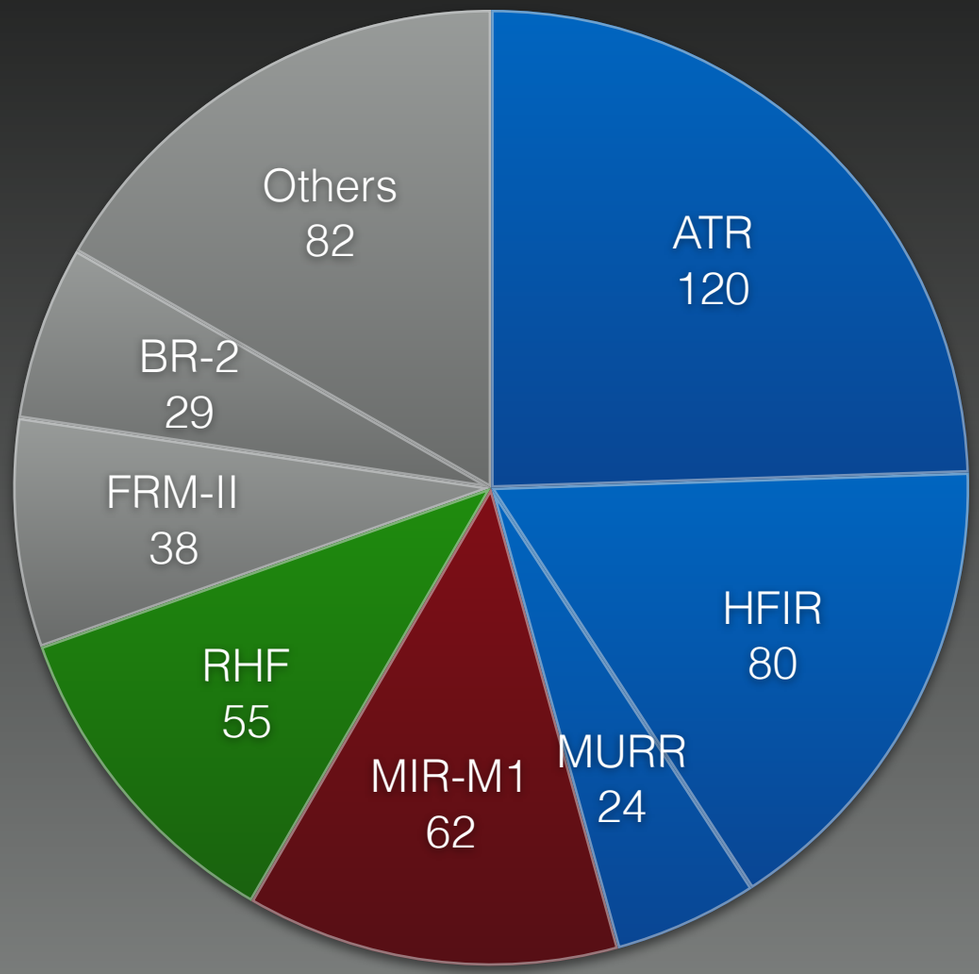
TIMELINES HAVE EXPANDED (A LOT)



WHERE HEU IS USED TODAY



Number of HEU-fueled
civilian research reactors (74)



Approximate annual
HEU consumption (490 kg)

Data from M. K. Meyer, A Global Overview of High Density U-Mo Fuel Development Efforts, *International Symposium on Minimization of Highly Enriched Uranium (HEU) in the Civilian Nuclear Sector: The Way Ahead,* Oslo, Norway, June 17-20, 2006

ASSESSMENT OF AVAILABILITY OF SELECTED HIGH-DENSITY FUELS

	U_3Si_2 4.8 gU/cm^3	U_3Si_2 5.8 gU/cm^3	UMo (Dispersion) Low Power Density (<17 kW/cm^3)	UMo (Dispersion) High Power Density (>17 kW/cm^3)	UMo (Monolithic)
Fuel qualification: Has the LEU fuel been qualified under irradiation? Y = yes, N = no	Y	N	[a]	N	N
Manufacturing qualification: Has the manufacturing process for the LEU fuel been qualified? Y = yes, N = no	Y	[b]	N	N	N
Commercial availability: Is the LEU fuel commercially available? Y = yes, N = no	Y	N	N	N	N
Fuel Availability: How many years to deliver LEU fuel? Rough estimate of number of years provided	< 5	5–10	5–10	15–20	15–20
Uncertainty: What is the uncertainty in the estimate of years?	Low	Medium	Medium	Medium-High	High

Only uranium-silicide fuel at 4.8 g(U)/cc would be immediately available
(and make possible a conversion on the order of 5 years or less)

INTERIM REDUCTION OF ENRICHMENT LEVEL AND DOWNBLENDING OF STOCKS

Recommendation 4: To achieve the goal of using as little highly enriched uranium as possible during the many years that it will take to design and qualify appropriate low enriched uranium (LEU) fuel, the United States should pursue an interim solution that reduces the civilian use of weapon-grade material.

a. During this interim period, high performance research reactors should use dispersion silicide fuel enriched to the lowest practical level, which can be produced with technologies already known to be reliable. The precise enrichment level can be quickly determined by a focused, small-scale study.

b. The United States should downblend the remaining 20 metric tons of highly enriched uranium (HEU) designated for civilian research reactor use to this lowest practical enrichment level as soon as it has been determined.

c. The interim solution should be pursued in a way that does not compromise the long-term goal of eliminating HEU usage in civilian applications.

WHAT AN INTERIM CONVERSION COULD ACCOMPLISH

Avoid the use of up to 3.4 tons of weapon-grade HEU

between now and 2035

Demonstrate U.S. commitment to international conversion efforts

by maintaining an active domestic program and sustaining the technical expertise in the area

Attract scientists and engineers to work on reactor conversions and fuel development

(who would otherwise find projects with a twenty-year time horizon of little interest)

If down-blending is pursued: Reduce the global stockpile of weapon-grade uranium

Ideally, this material could also be offered for IAEA safeguards

Note: the proposition of an interim conversion step is not new. Both the U.S. RERTR Program and the IAEA International Nuclear Fuel Cycle Evaluation considered 45% as an interim step toward 20% enrichment when adequate fuel for a direct conversion was not available.