NMMSS and the verification of nuclear disarmament

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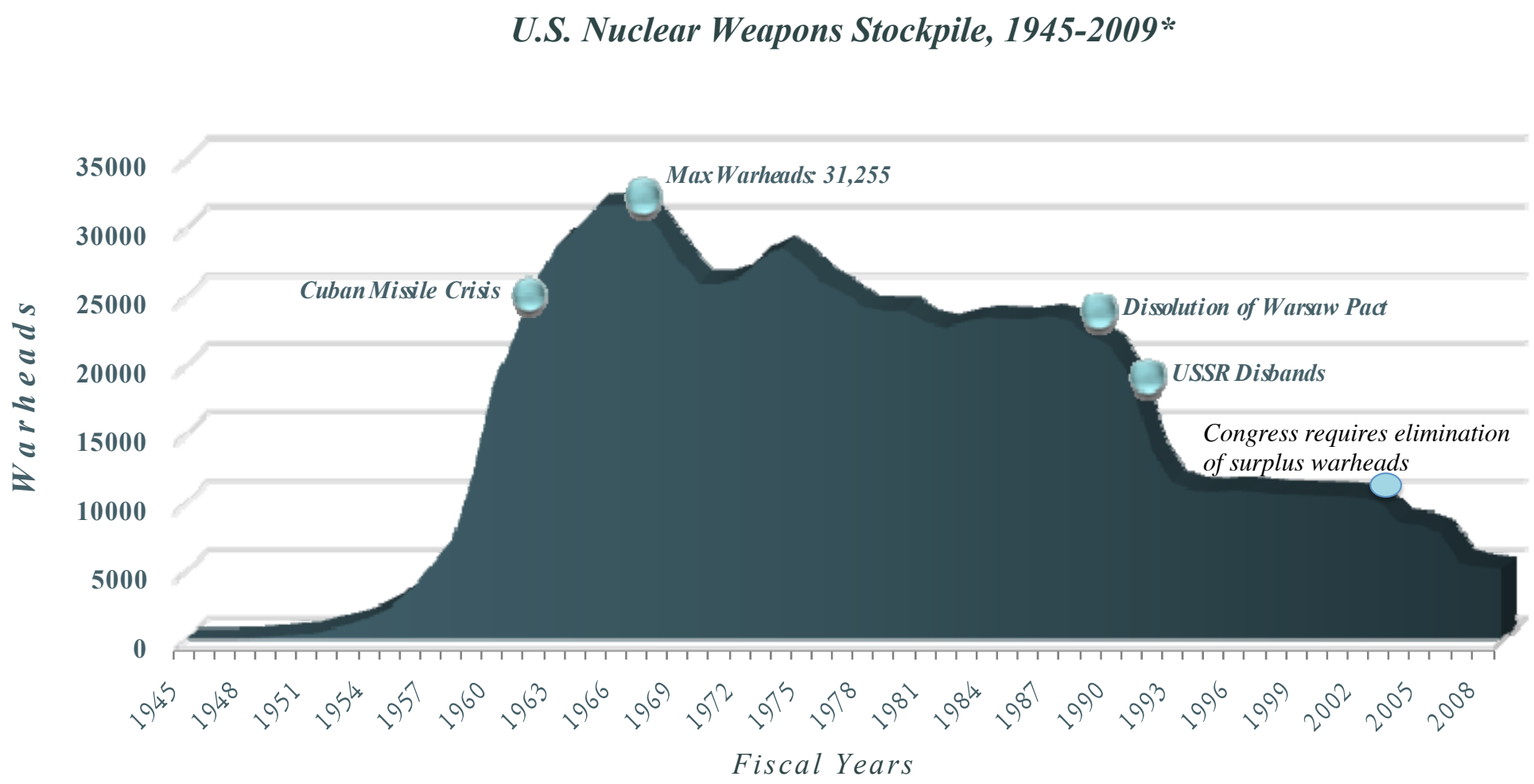
Progress in reducing U.S. nuclear weapons



*Includes active and inactive warheads. Several thousand additional nuclear warheads are retired and awaiting dismantlement.

IPFM
INTERNATIONAL PANEL
ON FISSILE MATERIALS

Global Fissile Material Report 2009

A Path to Nuclear Disarmament

www.fissilematerials.org

Disarmament from a fissile-material perspective

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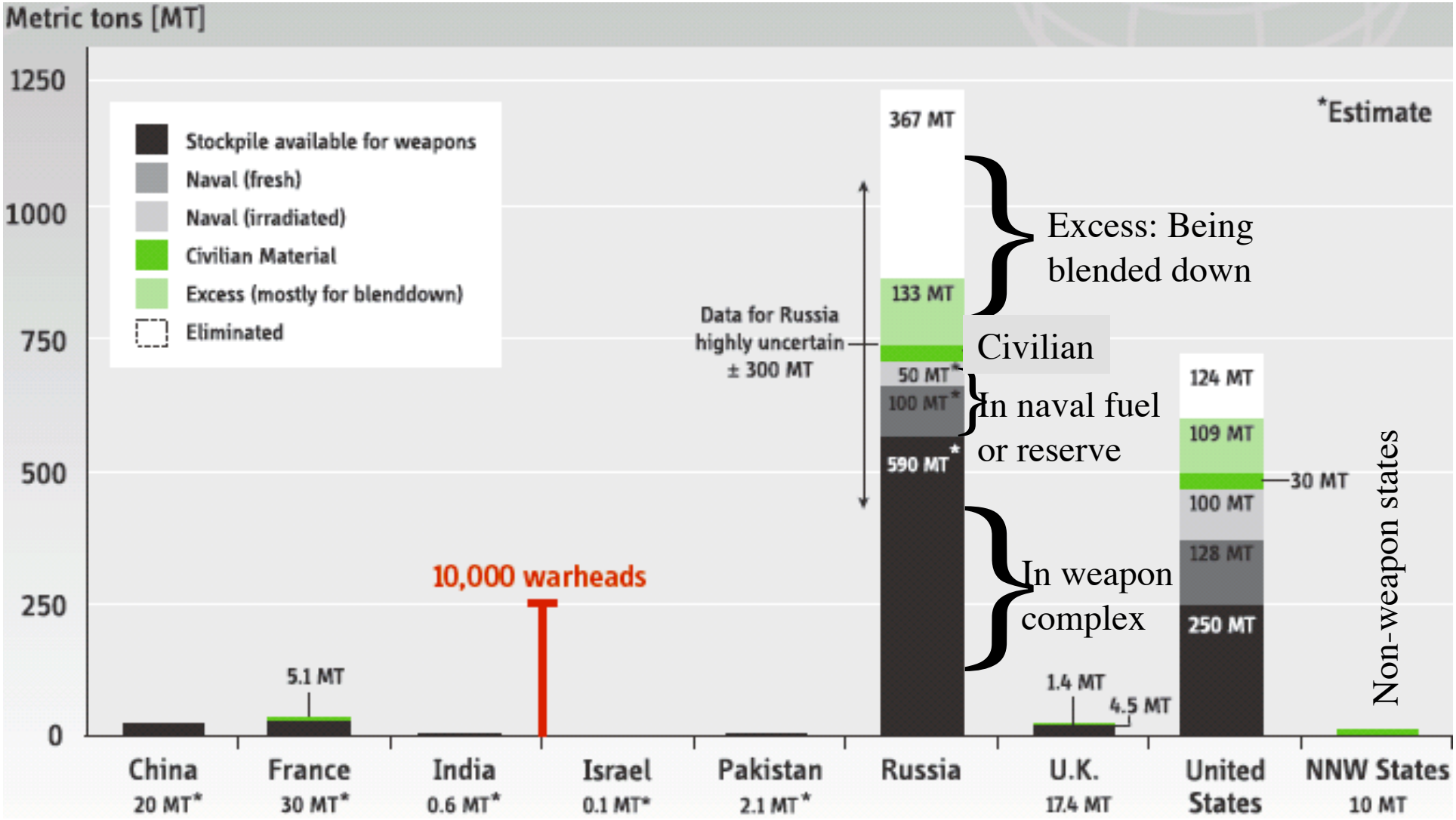
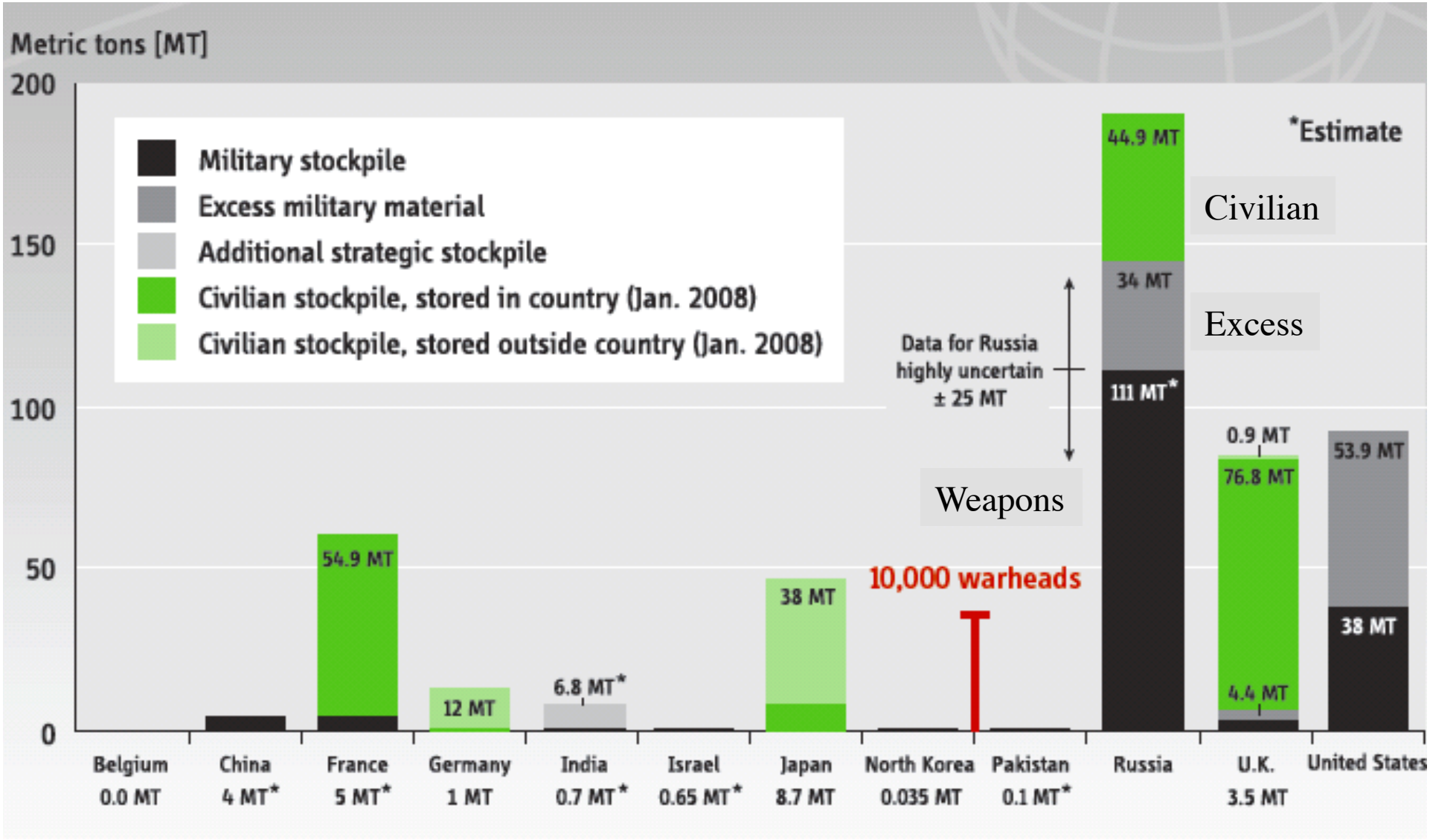
Global HEU Stockpiles, 2009 – mostly Cold War legacy

US, UK, French civilian HEU and NNW states based on government declarations (IPFM).
Other stockpiles non-governmental estimates.



Global stockpiles of separated plutonium, 2009 – Legacy of the Cold War *and* plutonium breeder reactor programs

US, UK, French civilian and NNW states based on government declarations (IPFM).
Other stockpiles non-governmental estimates. (IPFM)



U.S. numbers based on NMMSS

Plutonium:
The First 50 Years

DOE/DP-0137
U.S. Department of Energy
February 1996

United States plutonium production, acquisition, and utilization from 1944 through 1994

Through 1994,

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HIGHLY ENRICHED URANIUM: STRIKING A BALANCE

A HISTORICAL REPORT ON THE UNITED STATES HIGHLY ENRICHED URANIUM PRODUCTION, ACQUISITION, AND UTILIZATION ACTIVITIES FROM 1945 THROUGH SEPTEMBER 30, 1996

U.S. DEPARTMENT OF ENERGY
NATIONAL NUCLEAR SECURITY ADMINISTRATION
OFFICE OF THE DEPUTY ADMINISTRATOR
FOR DEFENSE PROGRAMS

JANUARY 2001

REVISION 1

Through FY 1996,

OFFICIAL USE ONLY
Contains information which may be exempt from public release under the Freedom of Information Act (5 U.S.C. 552), exemption number 2. Approval by the Department of Energy prior to public release is required.
Reviewed by: Bill Benton Date: 2/7/06

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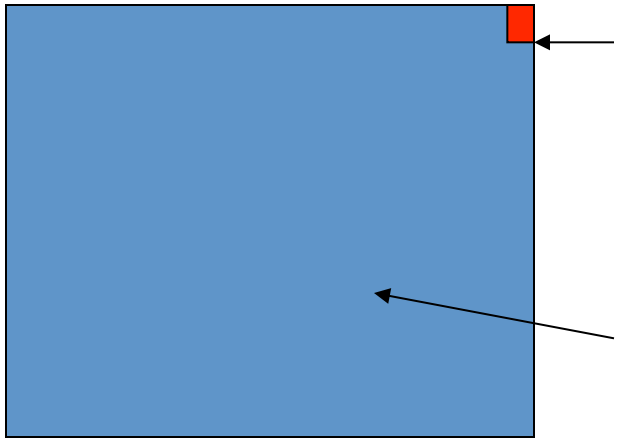
Natural uranium: 2 isotopes, 2 routes to the bomb



U-235 (--0.7% 92 protons, 143 neutrons) will sustain a fission chain reaction *if separated*

U-238 (99.3%, 92 protons, 146 neutrons) does not chain react but, turns into chain-reacting plutonium-239 *if you add a neutron*,

US government bought natural uranium containing 1750 tons of U-235	
Extracted into highly enriched uranium	750 tons
Fissioned to produce 67 tons of plutonium with Hanford reactors	≅ 87 tons
Left in depleted uranium tails	≅680 tons
Sold in U_n or LEU (+DU)	≅ 91 tons

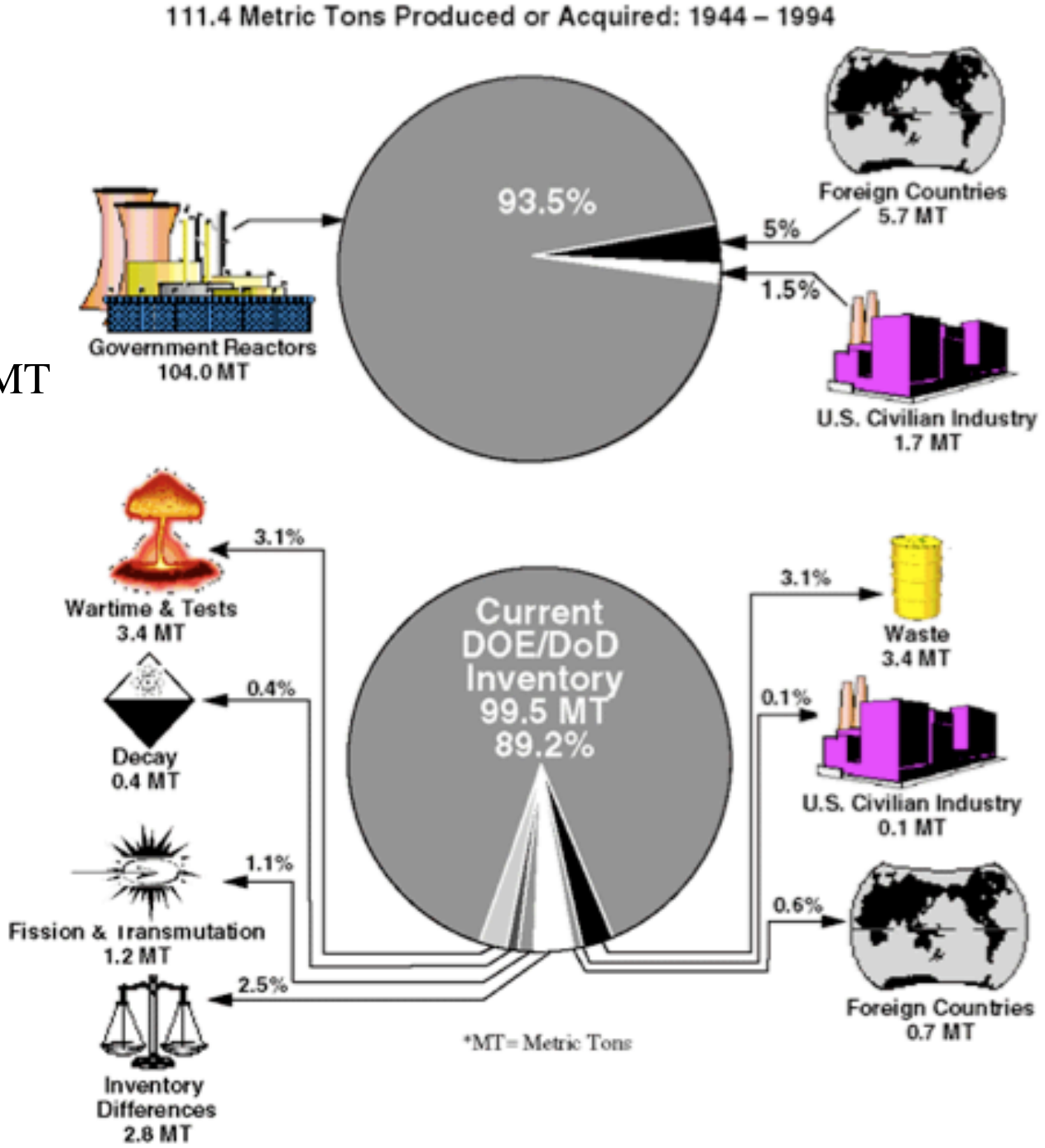
Plutonium Summary

(DOE, 1996)

Produced & acquired 111.4 MT
Remaining stock 99.5 Mt

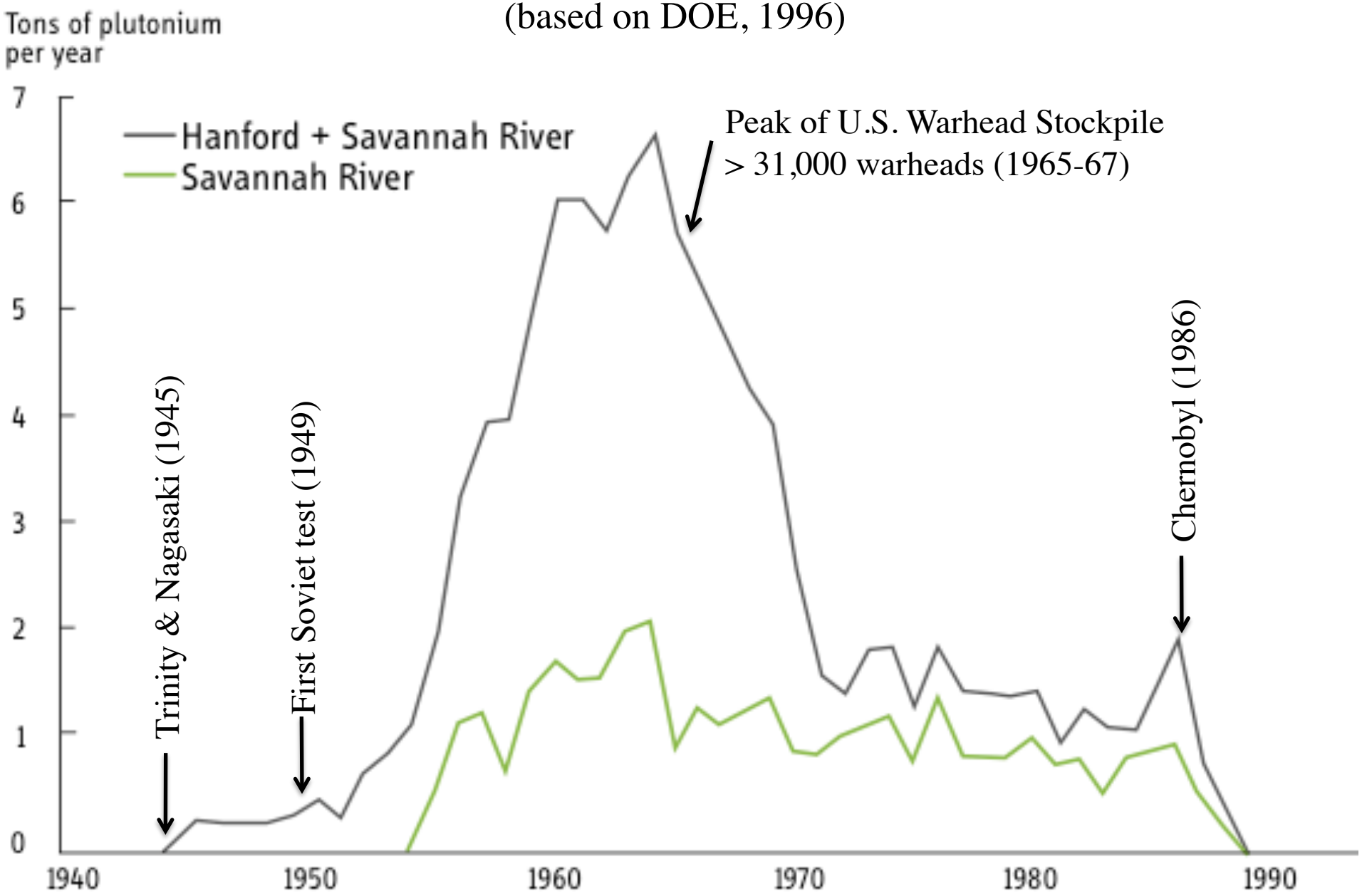
<u>Where did the 12 tons go?</u>

- Nuclear explosions 3.4
- Waste 3.4
- Fission and transmutation 1.2
- Exports 0.7
- Decay 0.4
- Civilian industry 0.1
- *Inventory differences 2.8*



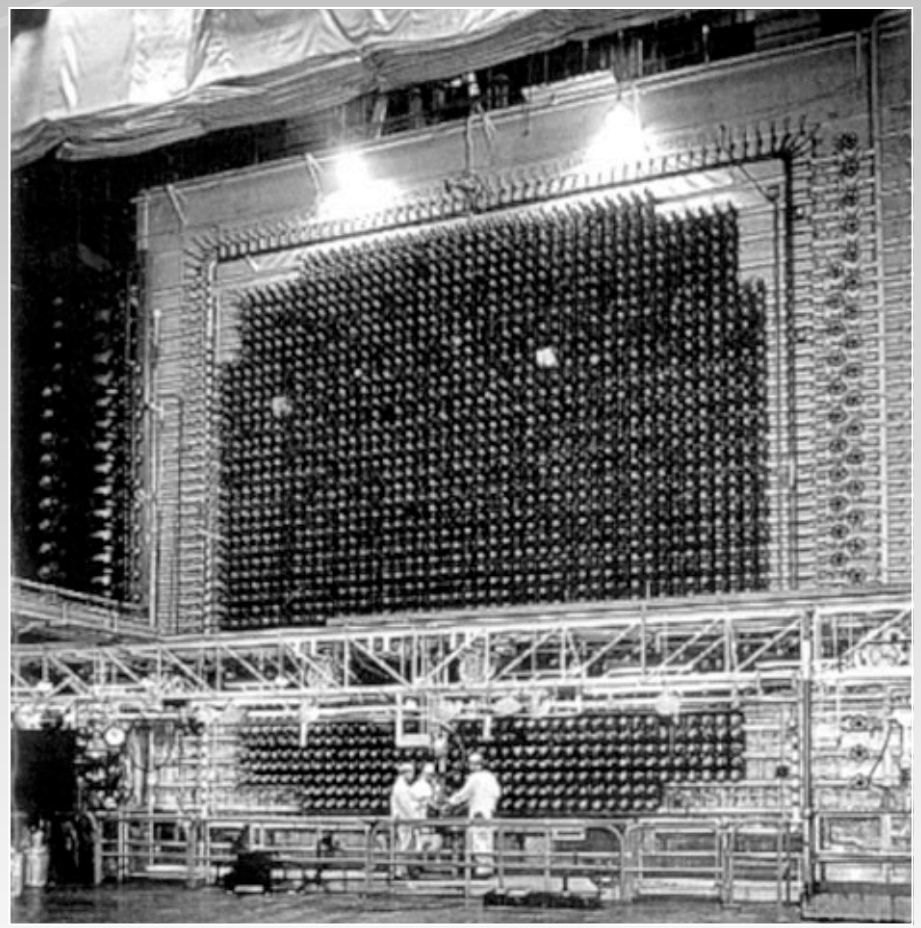
Year-by-year production by Site

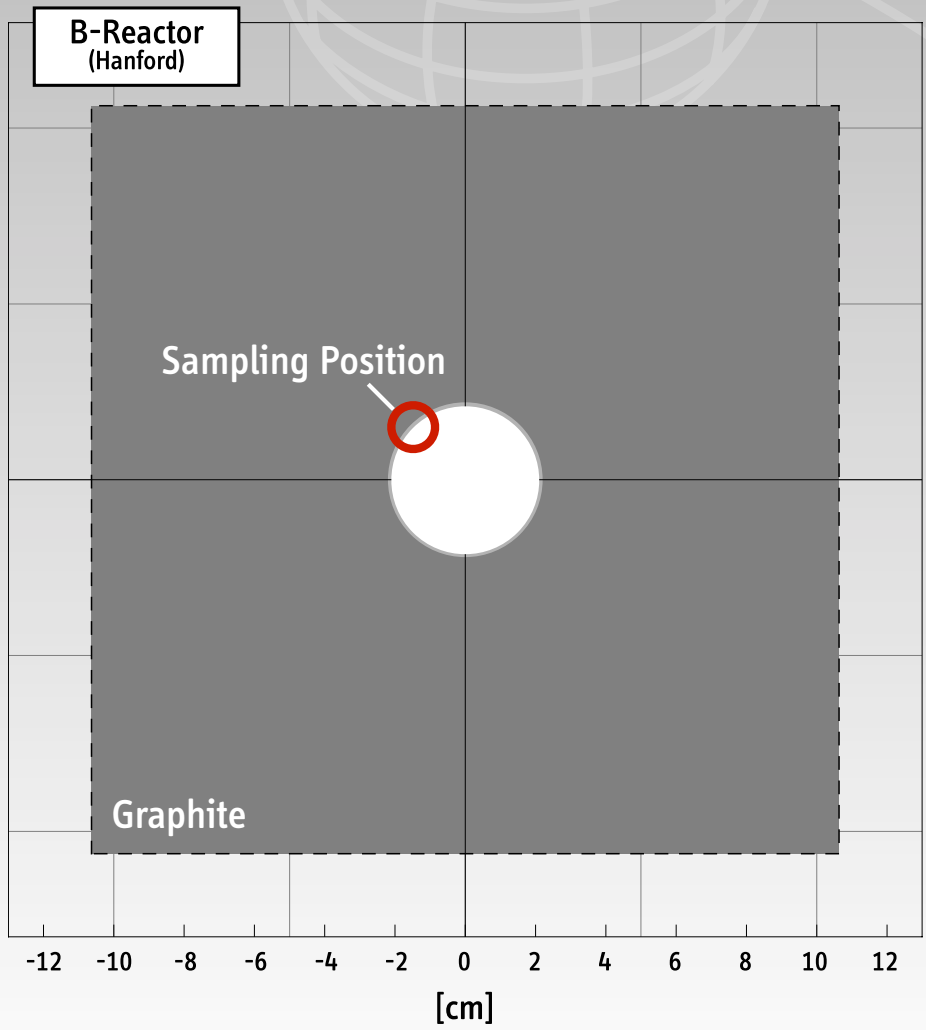
(based on DOE, 1996)



Nuclear Archaeology for Plutonium

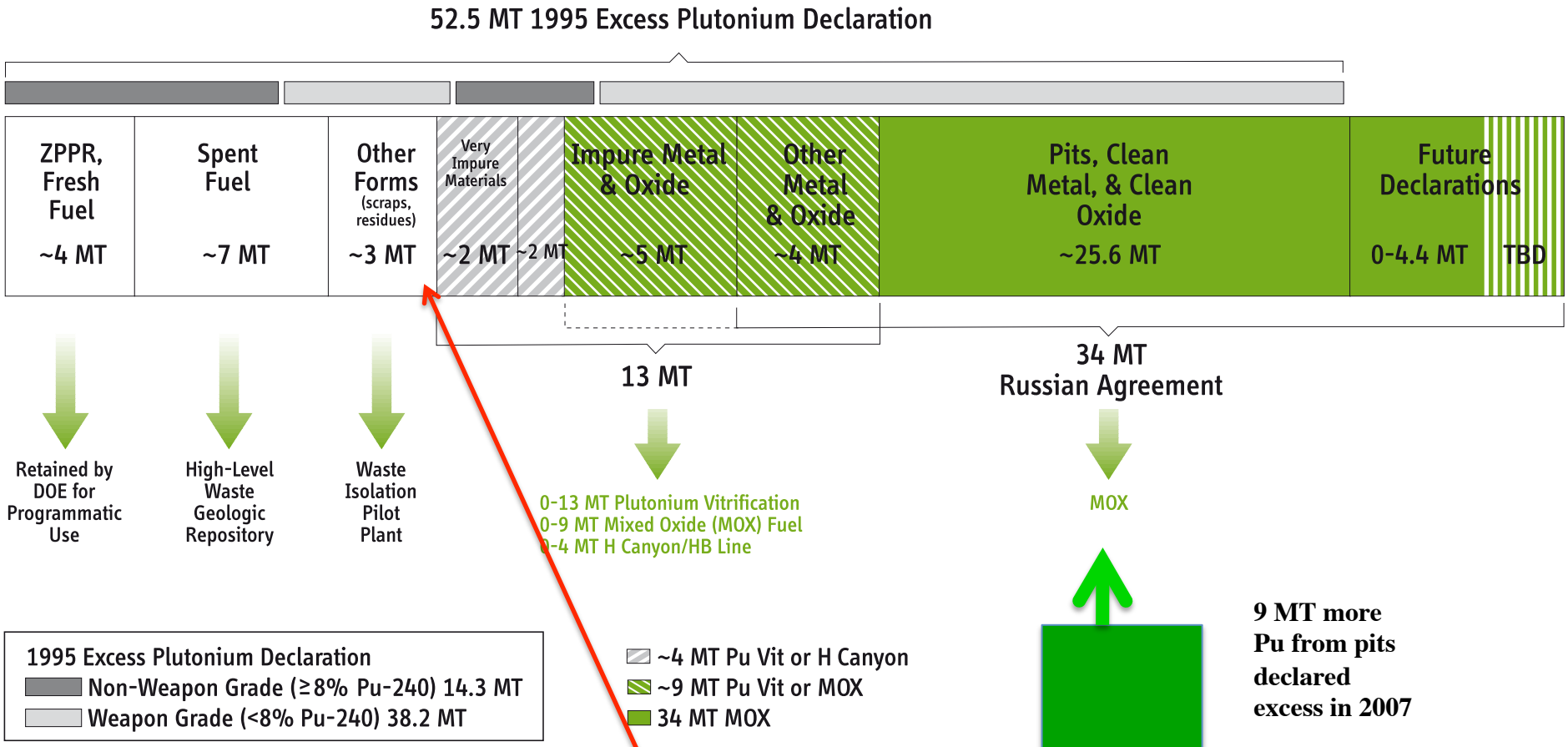
(U.S. Hanford B Reactor, 1944-1968)





Transmutation of boron 10 and other trace isotopes in graphite samples would reveal cumulative neutron flux through the graphite and hence amount of plutonium produced.

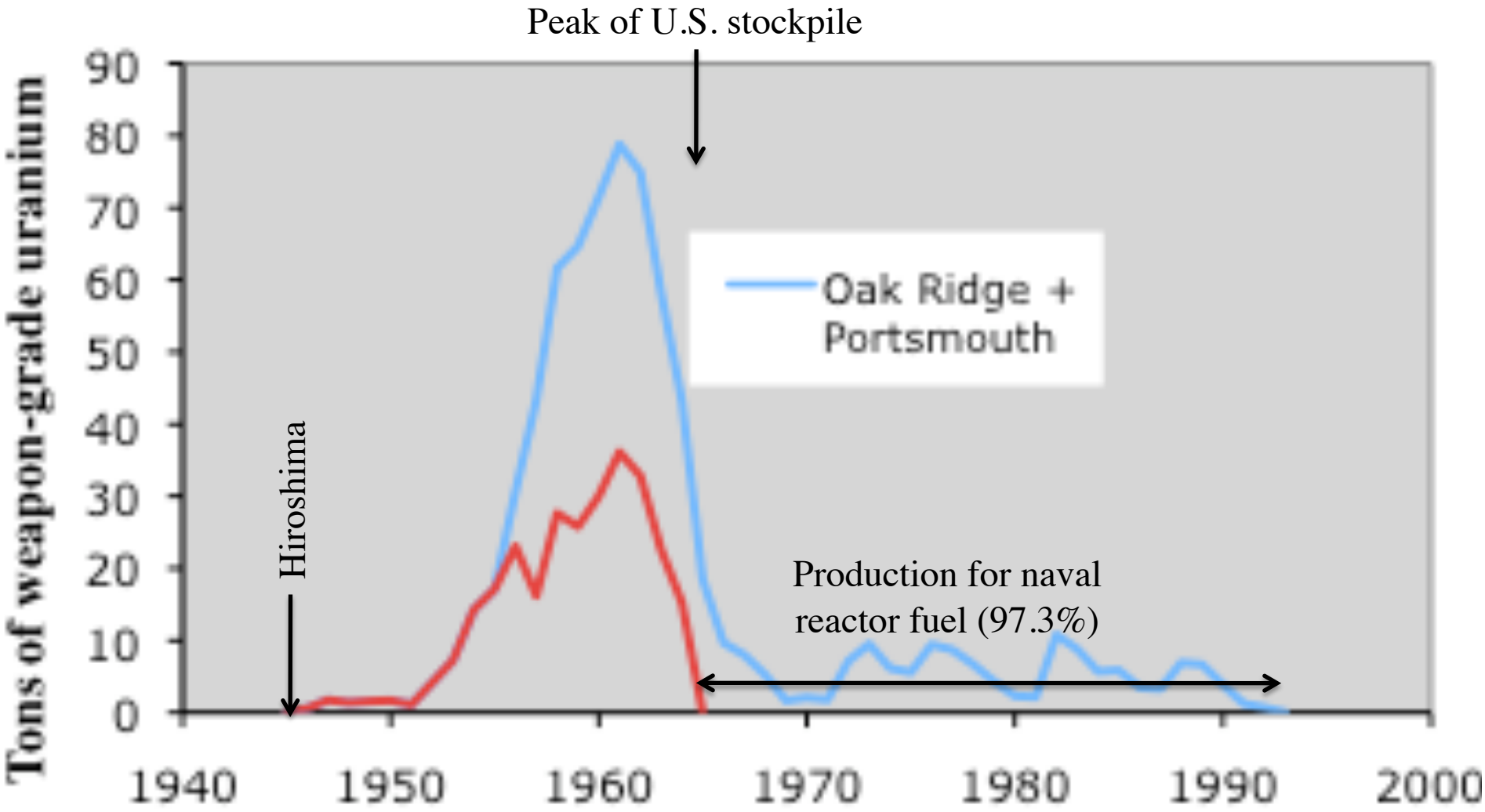
62% of U.S. plutonium has been declared excess for weapons



Should we have the IAEA verify the amount of plutonium we have put in WIPP before we close it up?

U.S. HEU Production

(based on DOE 2001)

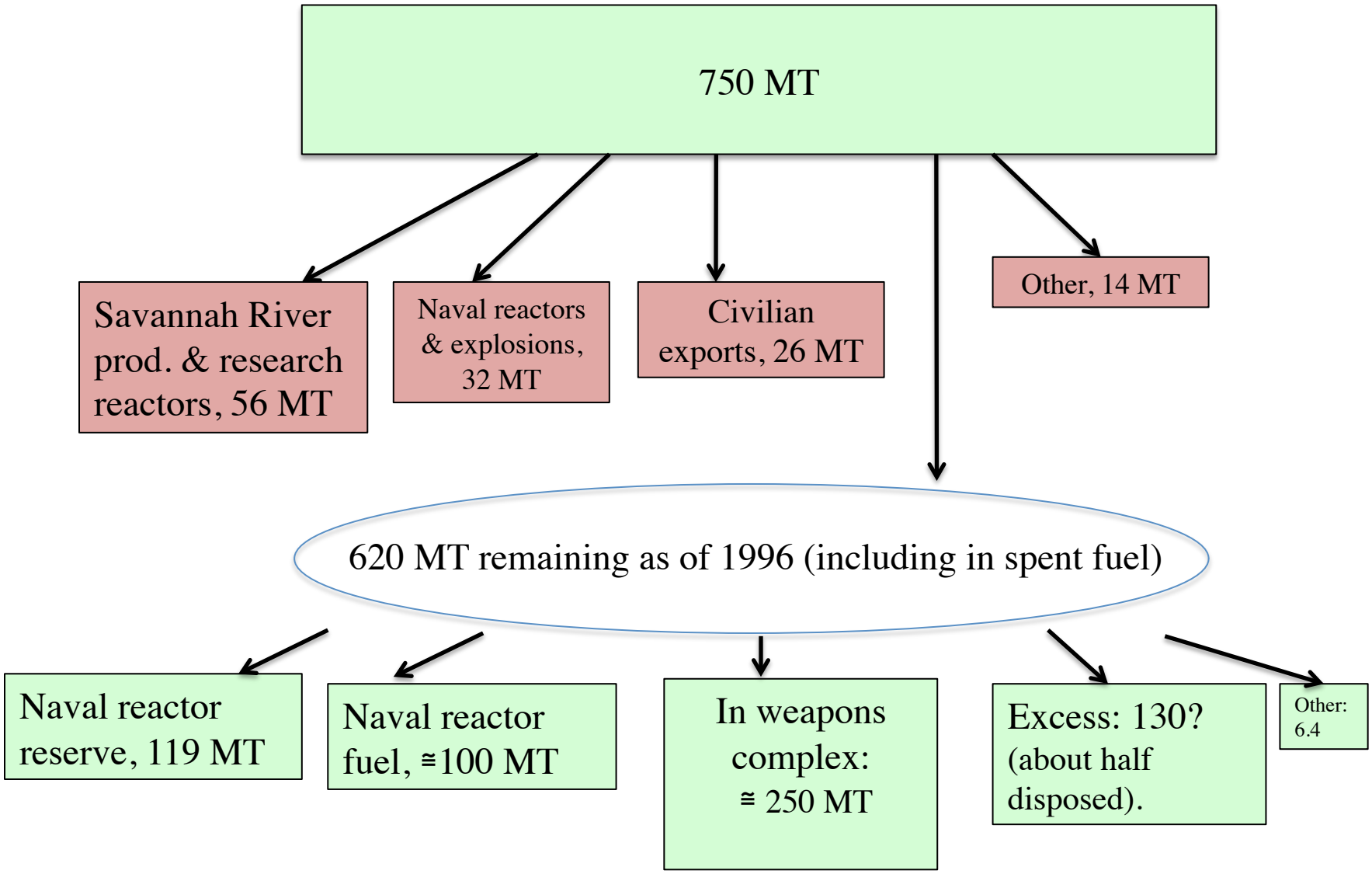


Nuclear Archaeology for Uranium Enrichment

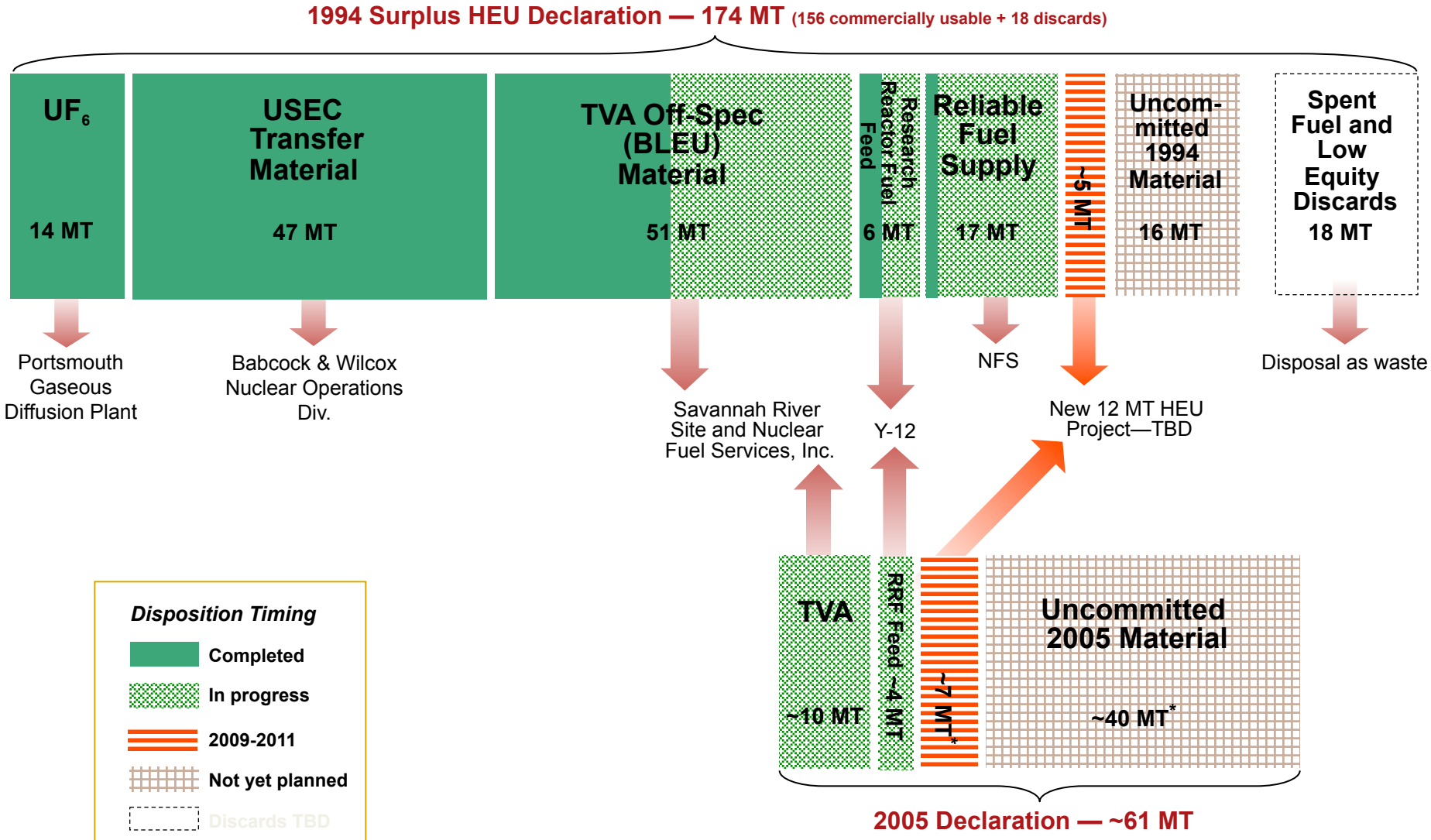
(Storage area for cylinders of depleted uranium in 2001 at K-25 Site, Oak Ridge, TN)

Can date, determine whether the associated product was HEU or LEU, and whether or not the uranium was irradiated in a plutonium-production reactor before enrichment.

U-235 in U.S. HEU (DOE 2001 and 2009)



Disposition plans for 235 tons of excess U.S. HEU (DOE, 2009)



* This ~51 MT of HEU is part of the 200 MT additional HEU removed from use as fissile material in weapons in Fall 2005; it consists of 20 MT designated for downblending plus an estimated 31 MT (out of 160 MT) that is expected to be rejected for use by Naval Reactors.

Revised 5/12/08

What do we (and hopefully the world) learn from all this?

1. ***NMMSS is a model for other nuclear-weapon states.***
2. No damage to U.S. national security from making public the sizes and histories of our fissile material stocks.
3. Tons of HEU and plutonium (hundreds of nuclear weapon equivalents) in waste and uncertainty. But also opportunities for measurements and consistency checks to increase international confidence. ***It is important to preserve records, production reactors, depleted uranium, etc. until international verification can be carried out.***
4. "a comprehensive national research and development program to support continued progress toward a world free of nuclear weapons, including expanded work on verification technologies and the development of transparency measures."– Nuclear Posture Review

   Should be done cooperatively with other countries, starting with Russia.
5. ***This perspective may also suggest ways to strengthen NMMSS***.