

# **The Threat Posed by HEU, and Legislation to Reduce Bomb- Grade Uranium Commerce**

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*Getting Bomb-Grade Uranium Out of Civilian Hands: Toward the Nuclear Security Summit*  
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# Civilian HEU = Bomb-Grade Uranium

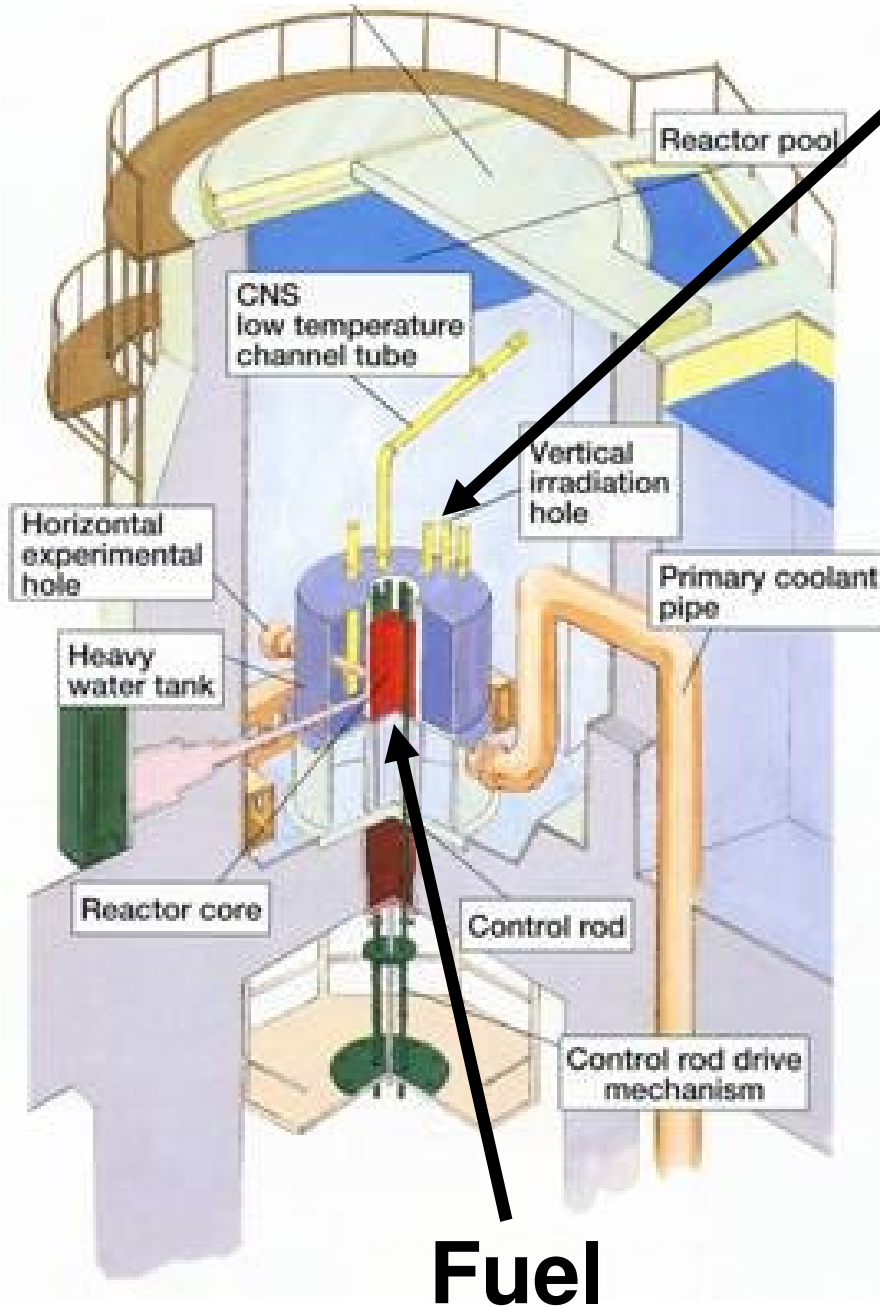
<i>Type of Uranium</i>	<i>Enrichment</i>
Natural	0.7%
LEU fuel for nuclear powerplants	3.5%
Military HEU in nuclear weapons	93.3%
Civilian HEU fuel for research reactors	93.3%
Civilian HEU targets for medical isotope production	93.3%

# Easy to Make a Hiroshima-type Atomic Bomb from HEU

“With modern weapons-grade uranium . . . terrorists, if they had such material, would have a good chance of setting off a high-yield explosion simply by dropping one half of the material onto the other half. . . . Even a high school student could make a bomb in short order.”

-- Luis Alvarez, Manhattan Project Scientist  
*Adventures of a Physicist* (Basic Books, 1987), p. 125

# Reactor



**Targets** briefly inserted into reactor for irradiation, then removed for processing

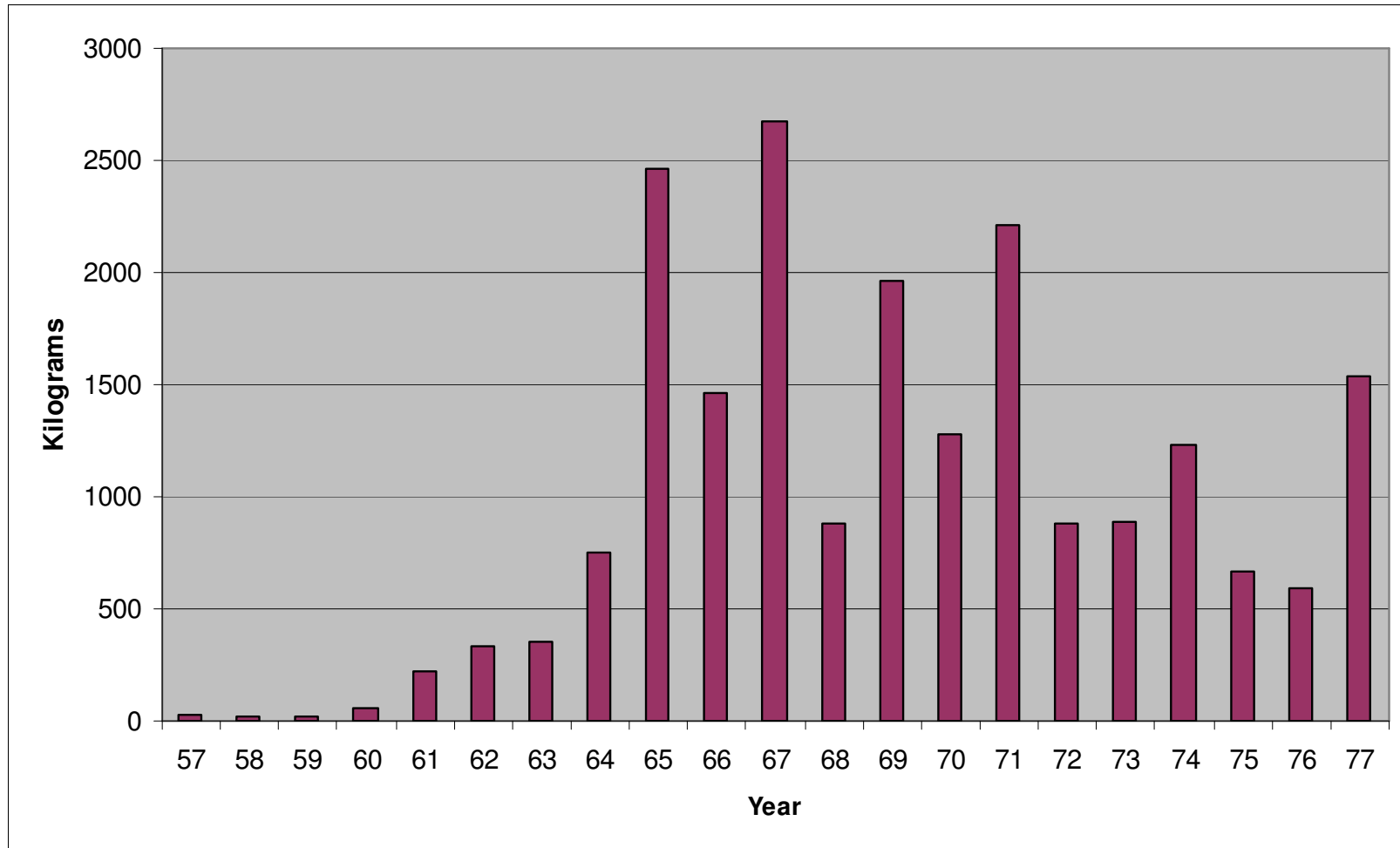


# Processing Facility

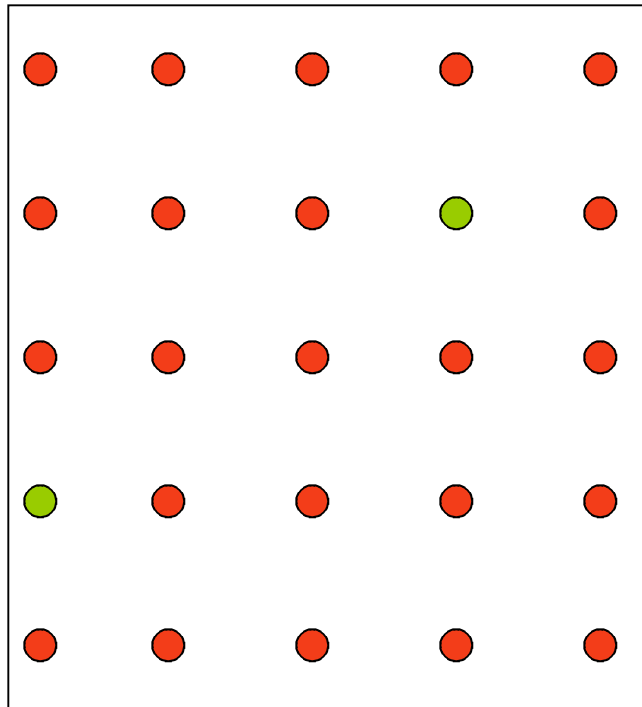
**Mo-99**  
for  
medical  
isotopes

**Waste:**  
uranium  
retains  
enrichment

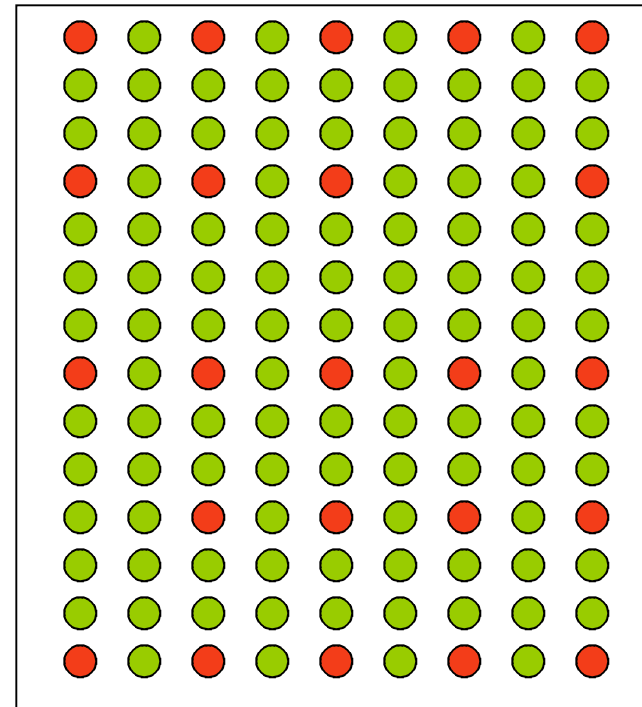
# HEU Exports: 1950s-1970s



# RERTR Converts Fuel and Targets from HEU to LEU: Higher Uranium Density Enables Lower Enrichment



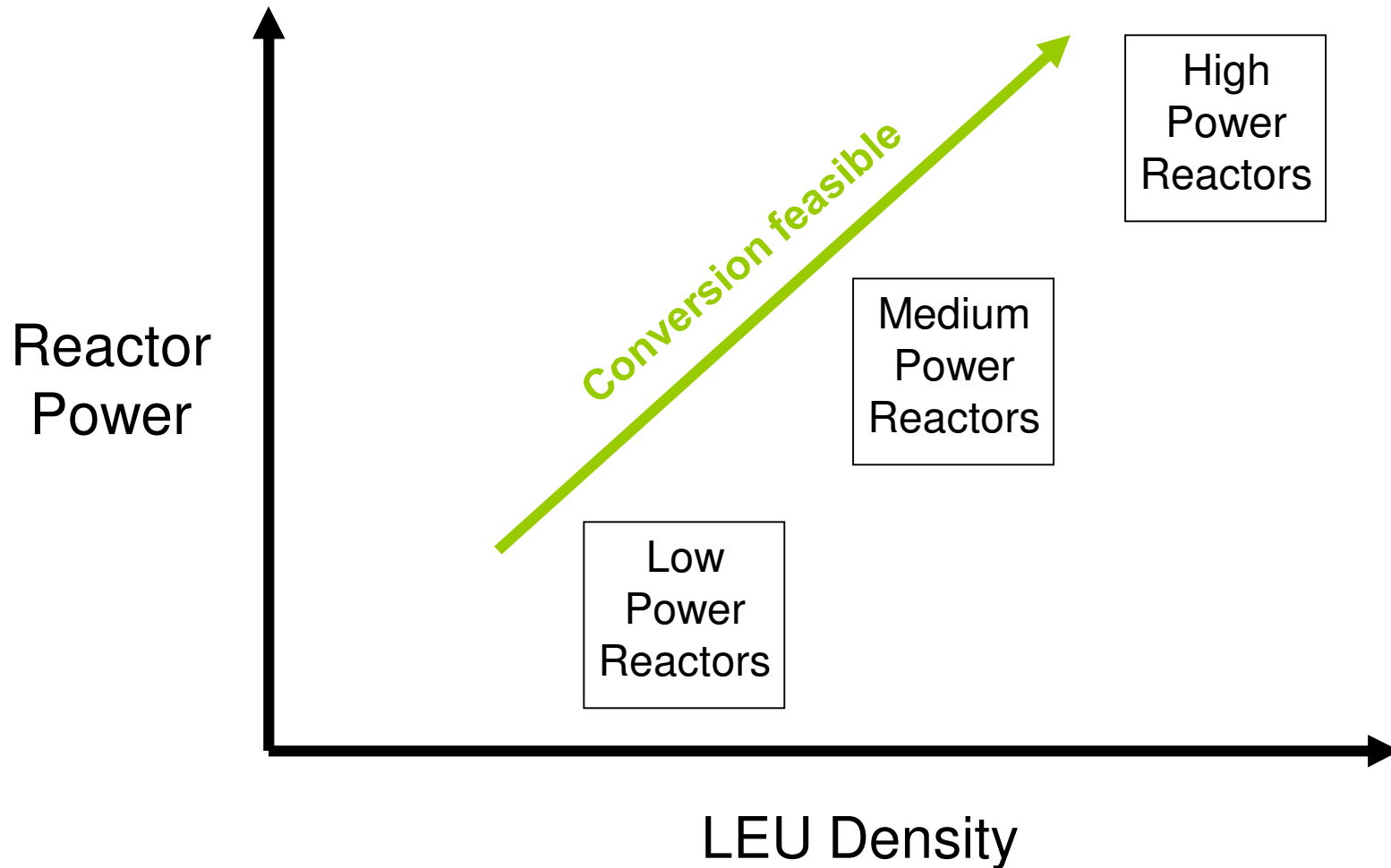
**HEU: 93.3%-enriched**



**LEU: 19.9%-enriched**

**Key:** ● = U-235  
● = U-238

# As RERTR Increases LEU Density, More Reactors Can be Converted



# 1980s: Initial Progress on Conversion

- Many old, low-power reactors converted.
- Most new reactors use low-enriched fuel from the start:

## LEU

Peru	Algeria
Malaysia	Canada
Bangladesh	Egypt
Indonesia	Canada
Japan	Morocco
China	Thailand
China	France
South Korea	China
United States	Taiwan
United States	Canada
	Australia

## HEU

Libya  
USSR  
USSR  
China  
Germany

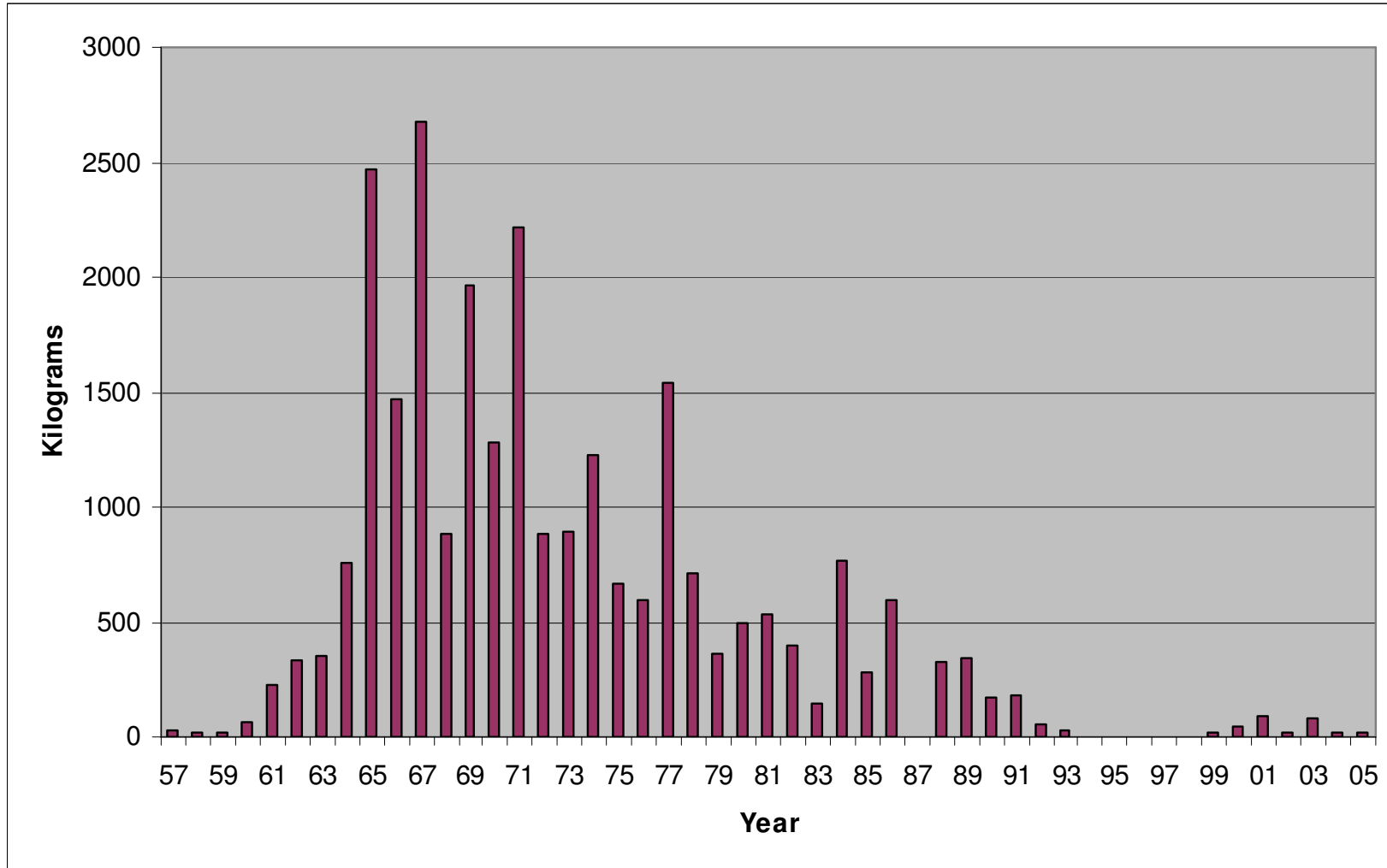


# 1992 Energy Policy Act

**NRC may not license the export of HEU for fuel or targets unless all of 3 conditions are met:**

- 1) There is no LEU fuel or target that can be used by the recipient;
- 2) The recipient has provided assurances that whenever an LEU fuel or target can be used, it will do so; and
- 3) The U.S. Government is actively developing an LEU fuel or target that can be used by the recipient.

# HEU Exports Decline



# 2005 Energy Policy Act

- Eliminates restrictions of 1992 law to allow HEU exports for targets to 3 largest isotope producers without commitment to eventual conversion.
- Consequences:
  - Nordion halts conversion effort;
  - European producers plan new HEU exports from U.S. rather than pursue conversion; and
  - **U.S. HEU exports are projected to increase**, rather than decrease, and to continue for foreseeable future.

# BOMB- GRADE BAZAAR

How industry, lobbyists, and Congress weakened export controls on highly enriched uranium.

By Alan J. Kuperman



# The Energy Bill's Gift to Terrorists

By Alan J. Kuperman

**A**USTIN, Tex. — An obscure provision of the energy bill signed into law this week by President George W. Bush demonstrates how, even in this era of heightened concern about terrorism, narrow commercial considerations can trump national security at the behest of one senator.

Despite widespread opposition — from the Bush administration, a majority of the Senate, leaders of the House Energy Committee, and nuclear regulators from the five preceding presidential administrations — Senator Pete Domenici, Republican of New Mexico and chairman of the Energy Committee, included an amendment that guts restrictions on the export of highly enriched uranium, the same material used in the Hiroshima atomic bomb.

If terrorists obtained enough such uranium they could fashion a full-fledged nuclear weapon, not merely a “dirty bomb” that would scatter radioactive waste. As the late Manhattan Project physicist Luis Alvarez noted in his memoirs: “With modern weapons-grade uranium, the background neutron rate is so low that terrorists, if they had such material, would have a good chance of setting off a high-yield explosion simply by dropping one half of the material onto the other half. . . . Even a high school kid could make a bomb in short order.”

The new law increases the likelihood of that nightmare scenario by allowing exports of bomb-grade uranium to foreign companies to rise to more than 100 pounds annually, thereby multiplying the odds that terrorists could steal enough for a bomb while the uranium is in transit to, or in storage at, foreign facilities.

Why would Senator Domenici favor increasing exports of bomb-grade uranium that could lead to the perfect terrorist weapon? One reason may be that lobbyists claimed that foreign pharmaceutical companies need this type of uranium to produce medical isotopes that are re-imported to diagnose and treat thousands of American patients in the absence of a domestic producer. But in reality, these vital isotopes can be produced just as well with low-enriched uranium, which is not bomb-grade, as facilities in Argentina and Australia already do.

The actual driving factor is money.

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Firms that produce isotopes in Belgium, Canada and the Netherlands for export to the United States want to avoid the expense and inconvenience of converting their production processes to use the safer uranium. But American law had barred export of bomb-grade uranium to them, except on an interim basis if they were in the process of converting to the safer alternative. Rather than responsibly complying with this antiterrorism statute, the foreign producers cynically tried to eliminate it — and succeeded, thanks to Senator Domenici's intervention.

Although President Bush signed the energy bill under the pressure of spiraling gas prices, his Energy Department strongly opposed lifting the export restrictions. Its top official for nuclear nonproliferation, Paul M. Longworth, warned last month that the provision “may undermine support of the U.S. highly enriched uranium minimization policy and nuclear

control system.” Firms that produce isotopes in Belgium, Canada and the Netherlands for export to the United States want to avoid the expense and inconvenience of converting their production processes to use the safer uranium. But American law had barred export of bomb-grade uranium to them, except on an interim basis if they were in the process of converting to the safer alternative. Rather than responsibly complying with this antiterrorism statute, the foreign producers cynically tried to eliminate it — and succeeded, thanks to Senator Domenici's intervention.

This is where Mr. Domenici abused his power as Senate committee chair. He successfully pushed all of the Republicans he appointed to the House-Senate conference on the bill to vote for his provision — against the expressed will of the Senate. He then re-

jected the House's offer to eliminate the provision, thereby strong-arming the provision into law over the bipartisan opposition of executive and legislative branch officials.

Ironically, Mr. Domenici's law also undermines a company in his own state that promised an innovative solution to the whole problem. Albuquerque-based TCI Medical had been trying to raise funds to start producing isotopes domestically using the safer low-enriched uranium — which would enable the United States to halt bomb-grade exports to foreign producers and thereby eliminate the risk of terrorist interception. But because the new law bolsters foreign competitors

by assuring them a steady supply of bomb-grade uranium, venture capitalists are less likely to fund the domestic start-up.

Perhaps Senator Domenici was misinformed and didn't realize that previous statutes enabled both the production of medical isotopes and the phasing out of bomb-grade exports, that the Bush administration opposed his provision on national-security grounds, and that his law would hinder a local company's efforts to reduce the risk of nuclear terror. But now that the facts are on the table, there is no excuse. Congress and the White House should rectify this grievous error — before it is too late. □

## Keep a lid on the export of highly enriched uranium.

export control system.”

The legislation also prompted a bipartisan group of scientists, policy specialists (including myself) and former officials responsible for various aspects of nuclear security under every president since Gerald Ford to send a letter to Senator Domenici pleading with him not “to weaken a major provision of the U.S. nonproliferation law that makes it more difficult for terrorists to obtain material capable of producing a nuclear bomb.”

The ill-advised amendment actually failed the only vote ever held specifically on it by either house of Congress, in the Senate on June 23, 2005, by 52-46. The House of Representa-



## **2009 National Academies Study: *Medical Isotope Production Without HEU***

- “No technical reasons that adequate quantities cannot be produced from LEU targets in the future.”
- “A 7-10 year phase-out period would likely allow enough time for all current HEU-based producers to convert.”
- “Would have a negligible impact on the cost of common diagnostic imaging procedures.”

# 2009: Congress Faces Challenges

- All 4 major foreign producers still use HEU.
- U.S. exports 20 kg HEU to Canada every year, and Europeans may ask for more.
- Risks of supply interruption:
  - In short-term, from unexpected, prolonged outage of a foreign reactor or production facility.
  - In medium-term, from permanent shut down of Canada's aging NRU reactor.
  - **No U.S. producer of Tc-99**

# American Medical Isotopes Production Act of 2009

- House approves (400-17) on Nov 5, 2009.
  - Senate pending.
- Halts HEU exports for isotopes within 7 to 11 years, to promote LEU conversion (waiver to avoid isotope shortage).
- \$163 million over 5 years to develop domestic isotope production w/o HEU. (\$20 million in FY2010 as jump-start.)



# More Legislation Likely

- Simply halting HEU exports could backfire, if it prompted foreign isotope producers to:
  - Seek HEU from Russia; and/or
  - Reprocess spent targets to recycle HEU.  
(Either would increase security risks.)
- Rx 1: Ban U.S. purchase of HEU-produced isotopes, effective when Secretary of Energy certifies that there is an adequate supply of LEU-produced isotopes; and/or
- Rx 2: Impose tariff on import of HEU-produced isotopes.

# Conclusion

Within a decade –

1. US will halt HEU exports for isotope production.
2. US will stop importing HEU-produced isotopes.
3. Foreign isotope producers who fail to convert to LEU will lose their main supplier and market.