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Minimizing the Use of HEU in Medical Isotope Production

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National Nuclear Security Administration
Mo-99 Topical Meeting
Santa Fe, NM
December 5, 2011

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Background Issues for Production of Mo-99

- **Short Mo-99 half-life - continuous production is needed**
- **Mo-99 produced largely at 40+ year-old nuclear reactors**
  - Age occasionally leads to equipment failures and outages
  - Reactors not designed or funded for Mo99 production
- **Mo-99 is produced at only 5 processing facilities worldwide, in cooperation with 8 research reactor facilities.**
  - 3 of the 5 processing facilities use HEU targets to produce Mo-99, one utilizes LEU targets, and one (South Africa) is in the process of converting to LEU.
  - 3 of the 8 research reactors use HEU fuel
- **HEU use in Mo-99 production**
  - Proliferation risk
  - HEU becoming less available
  - Many countries have committed not to use HEU for civilian applications

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The Schumer Amendment
Energy Policy Act of 1992

- **Requires that foreign producers who receive HEU from the United States cooperate in converting to LEU-based production by imposing the following restrictions:**

- **Allows the NRC to issue a license for the export of HEU to be used as a fuel or target only if the Commission determines that**
  - **there is no alternative nuclear reactor fuel or target enriched in the isotope 235 to a lesser percent than the proposed export that can be used in the reactor;**
  - **the proposed recipient has provided assurances that, whenever an alternative nuclear reactor fuel or target can be used in that reactor, it will use that alternative in lieu of HEU; and**
  - **the United States Government is actively developing an alternative fuel or target that can be used in that reactor.**

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The Burr Amendment
Energy Policy Act of 2005

- **Exempts certain HEU recipient countries, specifically Belgium, Canada, France, Germany, and the Netherlands, from some provisions of the Schumer Amendment.**

- **The NRC may issue an export license (including shipment to and use at intermediate and the ultimate consignees) to a recipient country for HEU for medical isotope production if the Commission determines that**
  - **A recipient country has supplied a letter to the U.S. assuring that any intermediate and the ultimate consignees will use the HEU solely to produce medical isotopes.**
  - **This HEU will be irradiated only in a reactor in the recipient country that—**
    - **uses an alternative nuclear reactor fuel; or**
    - **is the subject of an agreement with the U.S. to convert to an alternative nuclear reactor fuel when such fuel can be used in the reactor.**

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Personal Involvement
Senate Staff

- The Schumer and Burr approaches presented well-intentioned extremes
  - Non-proliferation vs. cancer patient care
- Several small suppliers were progressing with use of LEU
- AECL claimed that use of LEU would produce too much waste and that large-scale production with LEU was not feasible.
- Canadian authorities had testified to the NRC in the early 1990s that conversion to LEU would be accomplished by 2000.
- Lobbying was extremely intense on all sides.
- Working with other Office staff, a “compromise” was developed that eventually became Section 630 of EPACT ‘05.
  - This compromise was sharply attacked at the time.

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Energy Policy Act of 2005
Section 630, Subsection b.(4)

The National Academy of Sciences shall conduct a study for the Department of Energy (DOE) on production of medical isotopes without HEU to determine:

1. The feasibility of adequately supplying medical isotopes from commercial sources that do not use HEU.

2. The current and projected domestic demand and availability of medical isotopes.

3. The progress being made by the DOE and others to eliminate all use of HEU in medical isotope production facilities.

4. The potential cost differential in medical isotope production if the products were derived from production systems that do not involve use of HEU.

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Energy Policy Act of 2005
Section 630, Subsection b.(4c, 5-7)

- **The Secretary of Energy must submit a report* to Congress within 5 years containing the findings of the NAS study and disclosing commercial commitments to provide U.S. domestic requirements for medical isotopes without HEU. *Completed August, 2010**
- **If the NAS study determines that it is feasible to procure the supplies of medical isotopes from non-HEU sources and the Secretary is unable to report the existence of commitments, the Secretary shall submit a report to Congress that describes options for developing domestic supplies of medical isotopes in quantities that are adequate to meet domestic demand without the use of HEU.**
- **When commercial facilities can meet domestic requirements for medical isotopes without using HEU (while staying within a 10% cost increase and without impairing the reliable supply of medical isotopes for domestic utilization), the Secretary shall submit to Congress a certification to that effect.**
- **After the Secretary submits this certification, the NRC shall terminate its review of export license applications**

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NAS Study Findings (Paraphrased)

- **Charge #1 – Feasibility**
  - LEU targets useful for large-scale production of Mo-99 have been developed and demonstrated and could be used to produce large quantities of medical isotopes for the U.S. market.
  - At present time, insufficient quantities available to meet domestic needs.
- **Charge #2 – Demand and Availability**
  - Reliable availability of Mo-99 is impacting patient care.
  - Conversion to LEU systems would remove policy uncertainties.
  - Current suppliers utilize reactors built largely at government expense.
  - Private companies might not compete without government assistance.
- **Charge #3 – Progress**
  - Substantial progress made through GTRI, but many challenges remain.
- **Charge #4 -- Cost Differential**
  - Cost increase to convert is <10% for at least 3 large producers.

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Personal Involvement
Nuclear Regulatory Commission

- **Visits to Australian and South African LEU-based facilities**
- **Visit to Chalk River to review**
  - NRU situation
  - HEU storage facility
  - Progress on new processing facility
  - MAPLE reactor progress
- **Regulatory Issues- News Headlines**
  - Toronto Star: “PM blasted for firing of nuclear watchdog”
  - Ottawa Citizen: “Harper government fires Linda Keen over isotope crisis”
  - CBC News: “Nuclear watchdog head fired for ‘lack of leadership’: Minister [Gary Lunn]”

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Major Global Mo-99 Producers Current/Transition/Future

HEU | Non-HEU

NTP Radioisotopes (South Africa)	ANSTO (Australia)	Covidien (Netherlands)	IRE (Belgium)	AECL-Nordion (Canada)
NTP Radioisotopes (South Africa)	ANSTO (Australia)	Covidien (Netherlands)	IRE (Belgium)	AECL-Nordion (Canada)
NTP Radioisotopes (South Africa)	ANSTO (Australia)	Covidien (Netherlands)	IRE (Belgium)	

U.S. Domestic Mo-99 Projects

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Letter from NNSA Administrator D'Agostino to Representatives Fortenberry and Markey*

United States policy to:

- **Minimize use of HEU in Mo-99 production.**
- **Develop non-HEU production in the United States.**
- **Transition Mo-99 market to full cost recovery.**
- **Establish U.S. supplies of Mo-99 without HEU within 5 years:**
  - **Encourage the current international Mo-99 supply chain to transition away from the use of HEU as rapidly as possible.**
  - **Support U.S. companies to accelerate existing projects to produce Mo-99 without HEU.**
  - **Support procurement of non HEU based Mo-99 by taking into account that current major international Mo-99 producers should be able to phase out the use of HEU within 5 years.**
  - **Counter the existing foreign subsidies for HEU- based production.**

*** Dated September 28, 2011**

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The American Medical Isotopes Production Act of 2011 (S.99)

- The *American Medical Isotopes Production Act of 2011* (S.99) - introduced by Senator Bingaman, January 2011 (H.R. 3276 in the last Congress).
- Directs DOE to establish a technology-neutral program:
  - To evaluate and support projects for the non-HEU-based U.S. production of Mo-99,
    - in cooperation with non-Federal entities,
    - under a cost share arrangement.
- Directs DOE to make leased LEU available for Mo-99 production and retain responsibility for the final disposition of the leased uranium and radioactive wastes created by the processes that do not have a commercial disposition pathway.
  - Of GTRI's domestic Mo-99 cooperative agreement partners, this would apply to B&W and Morgridge Institute for Research.
- Conditions and phases out the export of HEU for medical isotope production in 7-13 years.

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CONCLUSIONS

- Global Production of Mo-99 without HEU is closer to reality.
- The National Academy Report played a key role in enabling progress.
- Non-Proliferation goals are enhanced with this progress.
- The Secretary of Energy may soon be able to certify, as required in EPACT'05 , Sec. 630, Para. (7), that the Commission shall terminate its review of HEU export license applications.