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# NNSA Activities with experimental and commercial irradiation

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# Office of Radiological Security

**MISSION: The Office of Radiological Security enhances global security by preventing high activity radioactive materials from use in acts of terrorism.**

| PROTECT | REMOVE | REDUCE |
|---|---|---|
| PROTECT radioactive sources used for vital medical, research, and commercial purposes | REMOVE and dispose of disused radioactive sources | REDUCE the global reliance on radioactive sources through replacement with viable non-isotopic alternative technologies |
|  |  |  |

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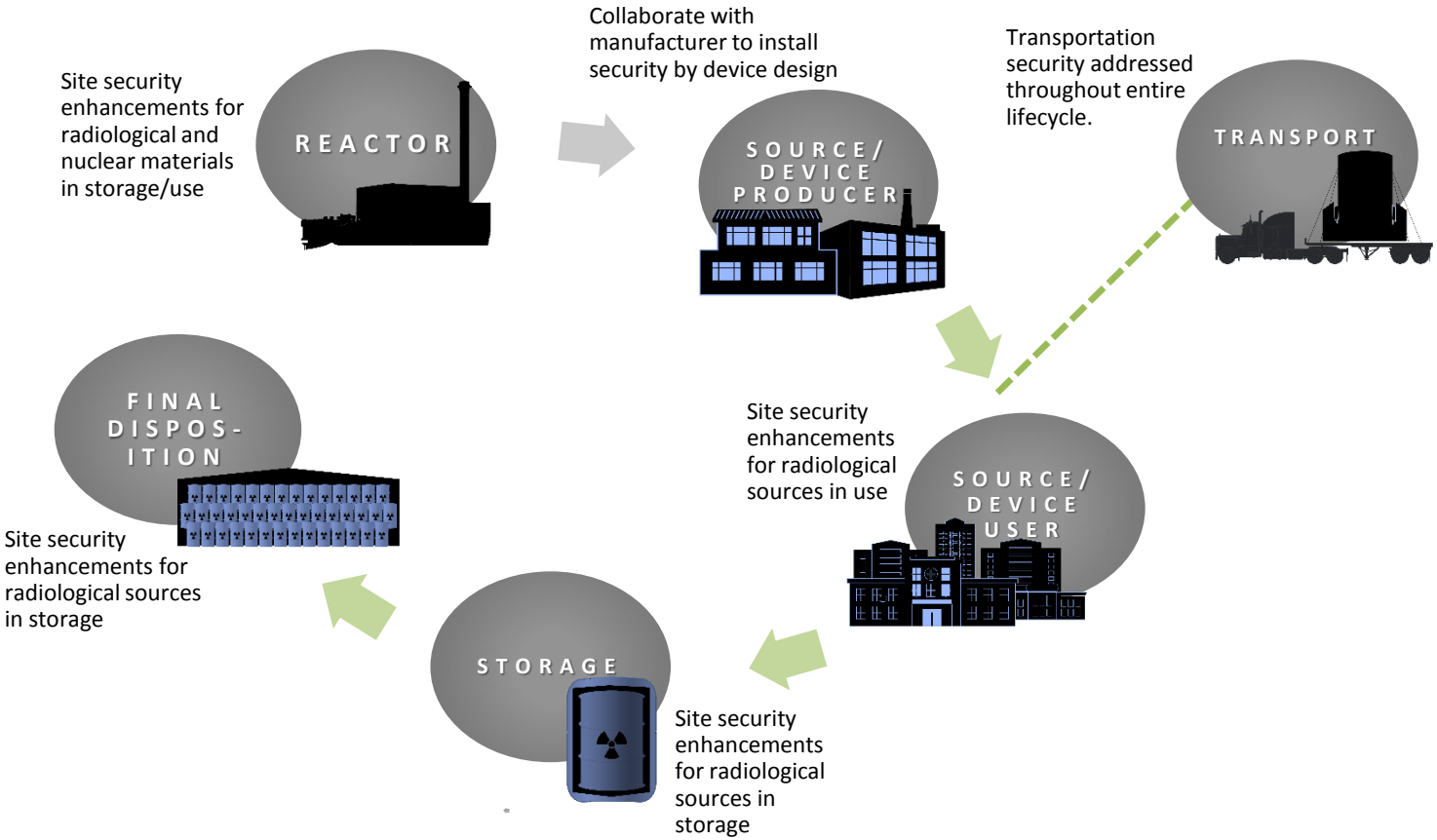
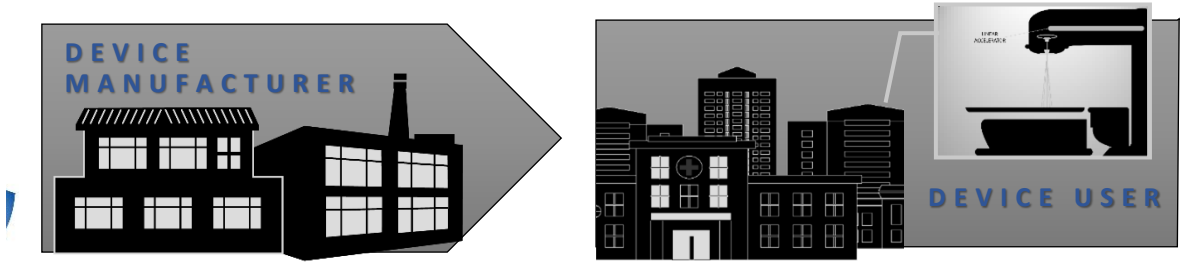
# Holistic Approach to Source Security

## SOURCE LIFE CYCLE




## ALTERNATIVE NON-ISOTOPIC TECHNOLOGIES

The use of non-isotopic technologies negates the need for security and disposal requirements and eliminates the risk that radioactive sources will become orphaned



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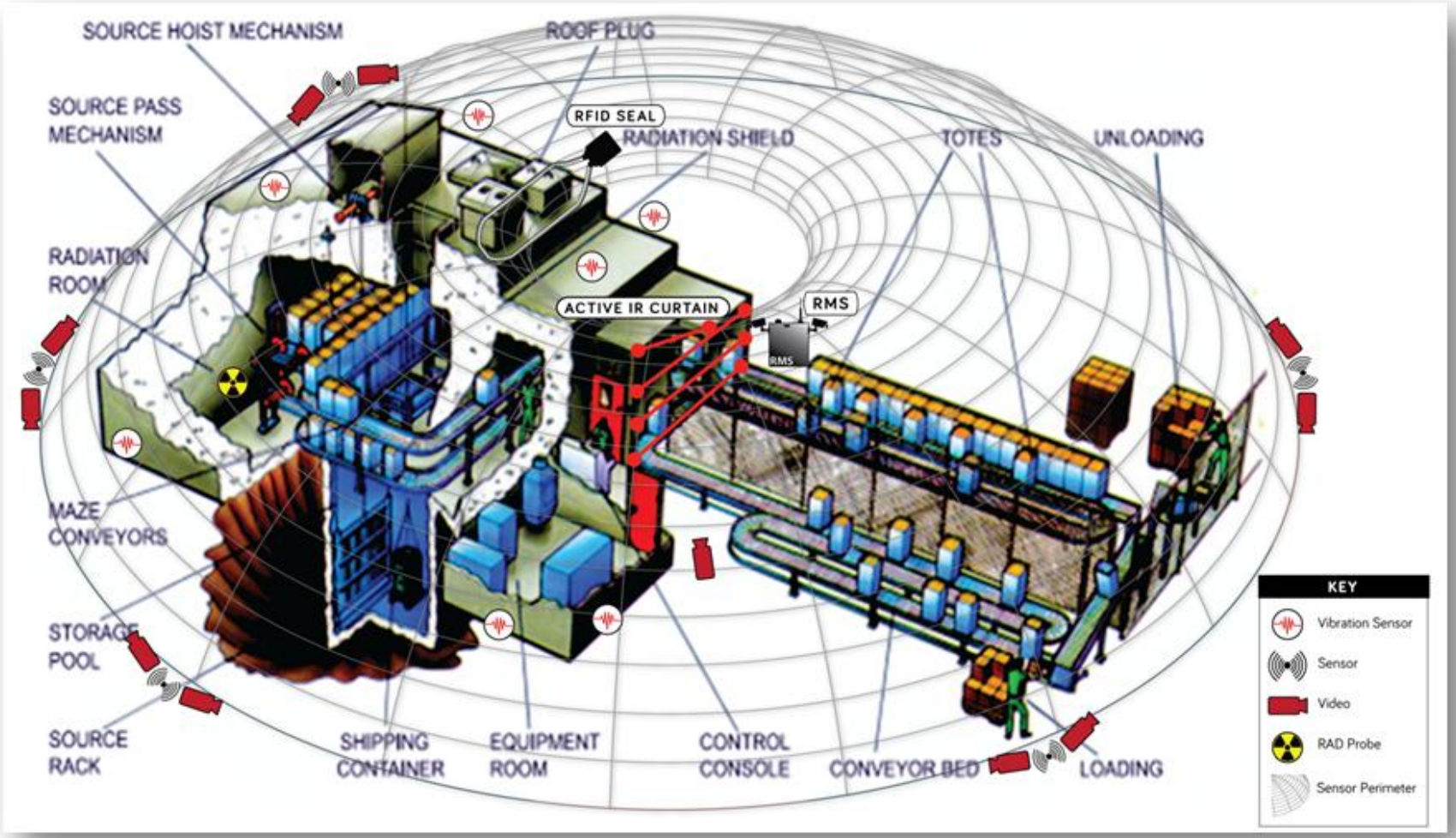
# Virtual Perimeter for Gamma Facilities




**Virtual perimeter alarms would be treated conceptually like a RFID seal providing tamper detection around the "device"**

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# Typical Recommended Security Upgrades

- Automated access controls to facility
  - Two Person Rule
- Radiation detectors outside bunker
- Siren/strobe
- Training
- Plans and Procedures
- Remote monitoring of alarms
- Secure and alarm handling tools
- Lock out on bridge cranes
- Local law enforcement response awareness
- **Insider threat measures to detect unauthorized access to the sources in the pool**

- Intrusion detection systems focused on irradiator
- Control Room
- Duress
- Labyrinth door
- Sensors on loading plug
- Conveyor openings
- Motion sensors  in labyrinth
- Motion sensors around bunker
- CCTV
- Interior of warehouse focused on irradiator
- Exterior if needed
- Labyrinth
- Barriers/covers for pools

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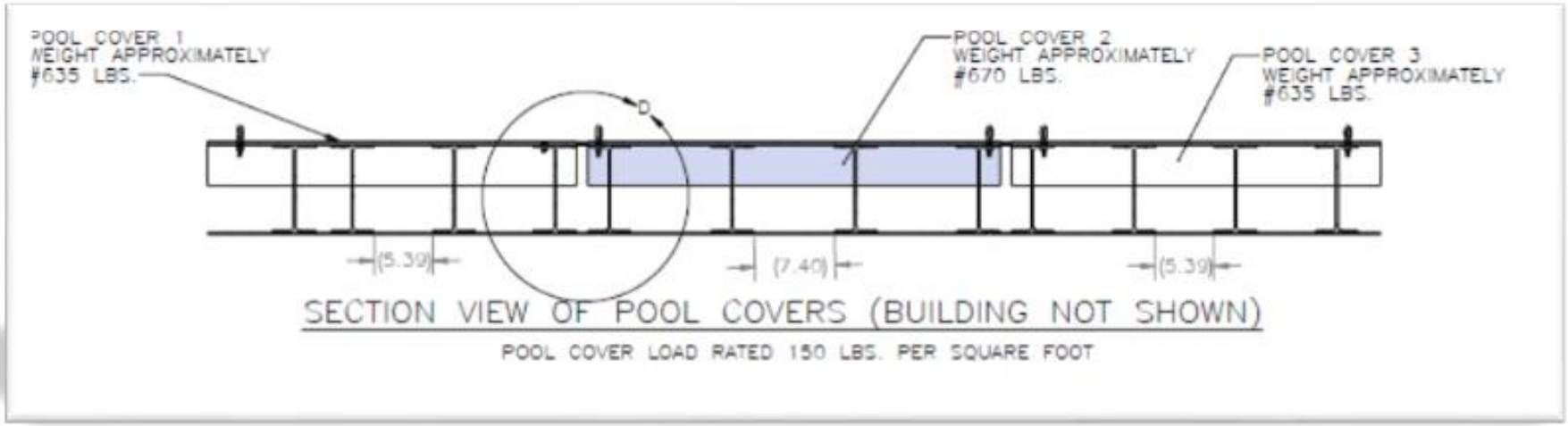
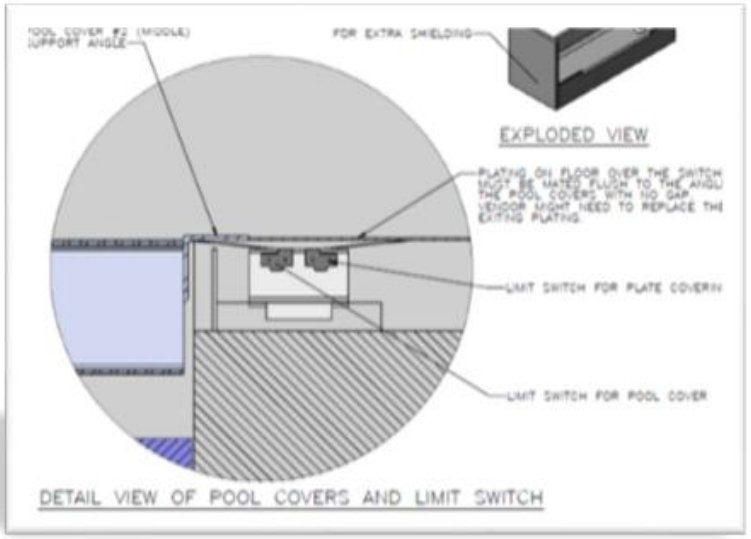
# Pilot Pool Cover Concept




Protection measures for the pool:

- Steel pool covers
- Alarms tied to Remote Monitoring System

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# Security By Design

***2014 Nuclear Security Summit House Gift:*** The United States plans to work with international manufacturers of high-activity sealed source devices to perform **voluntary assessments of the vulnerability of their machines** (to source theft).

- Worked to set a standard for in-device delay and detection measures on newly fabricated high activity devices.
  - Safety Act certification has been approved for in-device delay systems to help promote their inclusion as the security star standard.
  - If device hardening is performed at manufacturing, it reduces retrofitting costs and immediately improves device security.

- Continues to work with manufacturers in the domestic market to strengthen partnerships and support device hardening.
  - Manufacturers are now marketing their hardened devices internationally.
  - **NNSA is interested in working with international device manufacturers to enhance delay and detection capabilities before devices come to the market.**

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# Advanced Technologies

"The US plans to establish an international research effort on the feasibility of **replacing high-activity radiological sources with non-isotopic replacement technologies**, with the goal of producing a global alternative by 2016."

- NNSA will continue to work to develop alternatives where no commercially available alternative exists (e.g., well logging). NNSA is also working to develop a strategic roadmap on the maturity of global technology development.
- Domestically, NNSA will provide incentives to replace devices that use the most attractive materials (Cs-137 Irradiators) with commercially available replacements (e.g., X-Ray in U.S.)
- Internationally, NNSA will collaborate with the IAEA and donor countries to consider what replacement technologies are available worldwide. NNSA will also collaborate with the World Institute for Nuclear Security (WINS) to share best practices regarding alternative technology with the industry.

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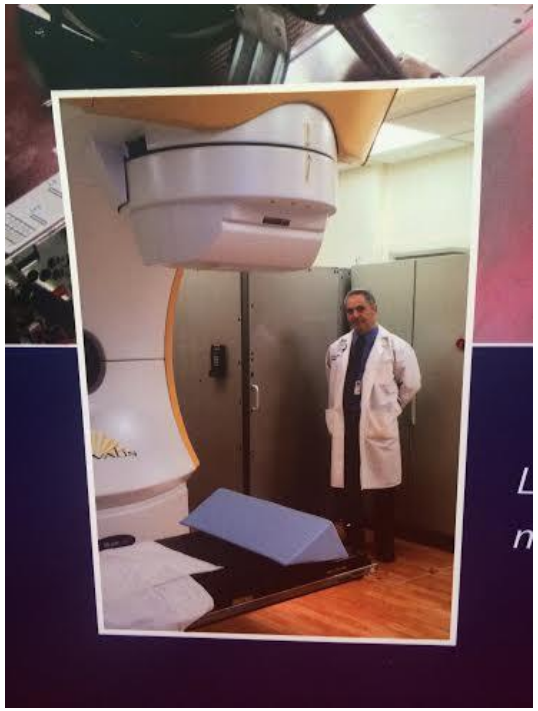
# 2014 IAEA General Conference

Statement by U.S. DOE Secretary Ernest Moniz before the IAEA General Assembly:

"In the area of radiological security, the United States has committed to work jointly with France, the Netherlands and Germany to establish a roadmap of actions over the next two years to strengthen the international framework, support alternatives for radioactive sources, and enhance efforts of source suppliers countries.

This statement was developed by the French and is the premise of their 2016 Nuclear Security Summit Gift Basket

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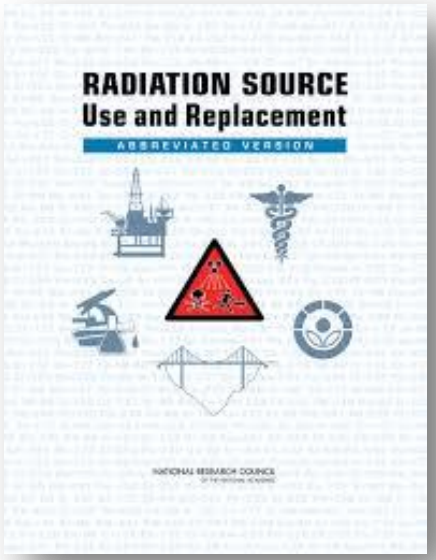
# Gaining Momentum Worldwide

**Momentum is building globally towards non-isotopic replacement technologies.**

- Some countries (e.g., Morocco, Zimbabwe, and Malaysia) are shifting from **Co-60 teletherapy** units to **linear accelerators**
- Some countries (e.g., France, Norway, and Japan) are phasing out **cesium-137 blood irradiation** in favor of **x-ray technology or other available methods**
- Many countries have expressed interest in **international efforts to advance** alternative technologies.

*Linear Accelerator is an alternative to Cobalt Teletherapy*

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# Ad Hoc Group on Alternative Technology

- On April 24th, 2015 a number of countries met on the margins of the IAEA's Radiological Source Security Working Group (RSSWG) meeting to discuss technological alternatives to high-activity radiological sources
- Participants included: France, Germany, Japan, Malaysia, the Netherlands, Norway, United Kingdom, United States, Uruguay
- Discussions focused on recent NGO workshops, domestic approaches to alternative technologies, international approaches, challenges, constraints and next steps
- The meeting results were briefed at the RSSWG
- The group plans to meet annually, next years meeting will focus on lessons learned and recent developments in regulations, R&D, policies and programs. Licensees that have transitioned might be brought in to present on their experience. The meeting would also focus on outreach to the IAEA and other countries.

Topics may vary from year to year, but may include:

- Policy and/or regulatory decisions on alternative technology
- Feedback from States that have adopted policy regarding alternative technologies
- Research and Development in progress and gaps for future development
- Proposals for drafting, updating and reviewing documents referring to technological alternatives
- Criteria for assessment of different applications
- Considerations for assistance programs
- Opportunities to engage user community
- Opportunities for outreach with the IAEA and other countries interested in this issue
- End of life of radioactive sources as it pertains to transitions to alternatives

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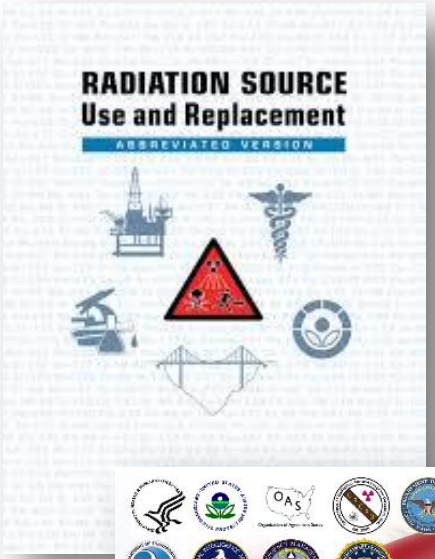
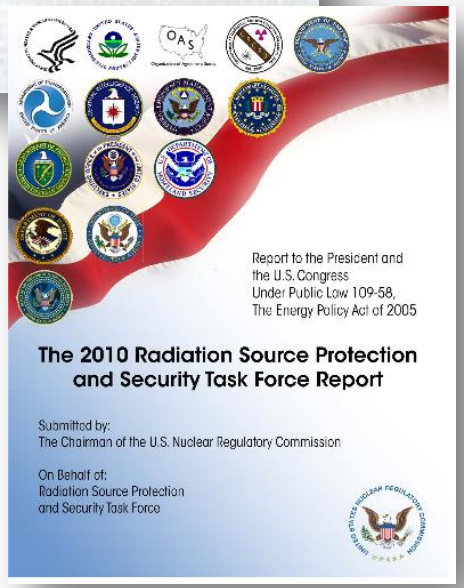
# NNSA Domestic Activities

- **2008 National Academies of Science Report Recommendation:**
  - In addition to actions related to radioactive cesium chloride, the U.S. government should adopt policies that provide incentives (market, regulatory, or certification) to facilitate the introduction of replacements and reduce the attractiveness and availability of high-risk radionuclide sources.
- **2010 Task Force Report Recommendation 10:**
  - The Task Force recommends that the U.S. Government, contingent upon the availability of alternative technologies and taking into consideration the availability of disposal pathways for disused sources, investigate options such as a voluntary prioritized, Government-incentivized program for the replacement of Category 1 and 2 sources with effective alternatives, with an initial focus on sources containing Cs-137.
- **2014 Task Force Report Recommendation*:***
  - The Task Force recommends that the U.S. Government, as appropriate, investigate options such as voluntary, prioritized, incentivized, programs for the replacement of Category 1 and 2 radioactive sources with effective alternatives. The Task Force further recommends that U.S. Government agencies, where appropriate, lead by example in the consideration of and transition to alternative technologies that meet technical, operational, and cost requirements.

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# Additional NNSA Activities

- New Developments
  - NNSA is researching other alternative technologies in use around the world and their applicability for widespread use in the U.S.
- Roadmap
  - NNSA is in the process of developing a strategic roadmap to identify gaps, short and long term R&D needs and establish an agreed upon path forward for the development and implementation of alternative technologies.
- DHS-led Interagency Working Group on Alternative Technologies
- Nuclear Security Education Seminar on Alternative Technologies organized by Massachusetts Institute of Technology
- Health Physics Society Task Force on Alternative Technologies –
  - This group will bring together users of high activity radiological sources to discuss opportunities and acceptance of alternative technologies.
- National Science and Technology Council Working Group
  - Aimed at looking at what U.S. Federal Agencies can do to support the adoption of alternative technologies

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# NNSA International Activities

- NNSA is researching what activities it could support internationally to promote the adoption of alternative technologies, both bilaterally, multilaterally and through the IAEA
- In the past, NNSA has funded IAEA Technical Cooperation projects focused on training medical professionals on advanced equipment (e.g. LINACs)
- NNSA is partnering with the World Institute for Nuclear Security (WINS) to survey what other high income economy countries are doing to convert/phase out the use of ionizing and isotopic based technologies and what, from their experience, can be applied in the U.S. and worldwide.

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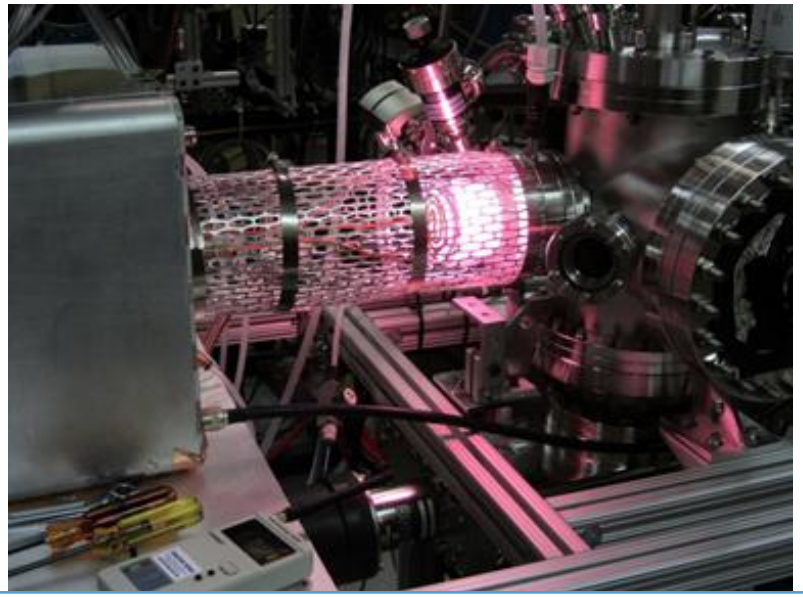
# NNSA's Office of Research and Development

**Collaborative efforts with NNSA's Office of Research and Development include:**

- Superconducting LINAC X-ray source (commercial irradiator)
- Flat panel X-ray sources (blood and research irradiation)
- Field Emission X-ray source (blood irradiation)
- Fusion Gamma sources (radiography and medical therapy)
- Dense Plasma Focus (well logging)



This new technology is a compact deuterium source with a deuterium target (a D-D source) with a negative ion source. The prototype has a goal of 10 to the 8th neutrons per second in flux once a tritium target is used. With a deuterium-tritium (D-T) accelerator and an alpha detector, the technique used is called associated particle imaging. The imaging can be used for radiography. The glow in the photo is the testing of the ion source (no radiation is emitted).

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# Questions?

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