NRC Perspectives on the Radiation Source Use and Replacement Study

Presented To The National Academies

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July 10, 2006

Background on NRC Licensing of Radiation Sources

- NRC regulatory authorities
  - Atomic Energy Act of 1954 (as amended)
  - Energy Reorganization Act of 1974
  - Energy Policy Act of 2005
- NRC and Agreement States regulate the manufacturing, distribution, and use of radiation sources and devices
- Increased regulatory focus on radiation source security since September 11, 2001

Energy Policy Act of 2005

NRC actions for radiation sources include:

- New requirements for import, export, sale and transfer of radiation sources
- National source tracking system
- Fingerprinting and criminal history checks
- Assume regulatory authority over some naturally-occurring radioactive materials
- Interagency Task Force on Radiation Source Protection and Security

Energy Policy Act of 2005
(continued)

Provisions for evaluating alternative technologies:

- Develop recommendations for regulations and incentives
  - Task Force on Radiation Source Protection and Security
- Conduct survey of industrial sources and establish a research and development program to develop alternative technologies
  - U.S. Department of Energy report
- Determine whether technically and economically feasible replacements exist for sources that pose a high risk to human health or safety
  - National Academies study

U.S. Environmental Protection Agency activities

- Radioactive Device Alternatives Program independent of EPAct

Radiation Source Use and Replacement Study

Review the current industrial, research, and commercial (including medical) uses of radiation sources for which:

- The radiation source can be replaced with an equivalent (or improved) process that does not require the use of radionuclides; or
- The radiation source can be replaced with another radiation source that poses a lower risk to public health and safety if it is involved in an accident or used in a terrorist attack.

Study Scope

- Focus primarily on sealed sources because of pervasive availability and use
  - May also examine unsealed sources
- Limited to most risk-significant radiation sources
  - International Atomic Energy Agency (IAEA) Category 1 and 2 sources

IAEA's *Code of Conduct On The Safety and Security of Radioactive Sources*

26 radionuclides and threshold activity levels

- **Category 1 sources**
  - **Activity ≥ 1,000 x "D"**
  - **Death in minutes**
- **Category 2 sources**
  - **Activity between 10 X "D" and 1,000 X "D"**
  - **Serious harm in minutes to hours and possibly death**

IAEA's *Code of Conduct On The Safety and Security of Radioactive Sources* (continued)

Radionuclide	Category 1		Category 2		Category 3	
	1000 x D		10 x D		D	
	(TBq)	(Ci)[a]	(TBq)	(Ci)[a]	(TBq)	(Ci)[a]
Am-241	6.E+01	2.E+03	6.E-01	2.E+01	6.E-02	2.E+00
Am-241/Be	6.E+01	2.E+03	6.E-01	2.E+01	6.E-02	2.E+00
Cf-252	2.E+01	5.E+02	2.E-01	5.E-00	2.E-02	5.E-01
Cm-244	5.E+01	1.E+03	5.E-01	1.E+01	5.E-02	1.E+00
Co-60	3.E+01	8.E+02	3.E-01	8.E+00	3.E-02	8.E-01
Cs-137	1.E+02	3.E+03	1.E+00	3.E+01	1.E-01	3.E+00
Gd-153	1.E+03	3.E+04	1.E+01	3.E+02	1.E+00	3.E+01
Ir-192	8.E+01	2.E+03	8.E-01	2.E+01	8.E-02	2.E+00
Pm-147	4.E+04	1.E+06	4.E+02	1.E+04	4.E+01	1.E+03
Pu-238	6.E+01	2.E+03	6.E-01	2.E+01	6.E-02	2.E+00
Pu-239[b]/Be	6.E+01	2.E+03	6.E-01	2.E+01	6.E-02	2.E+00
Ra-226	4.E+01	1.E+03	4.E-01	1.E+01	4.E-02	1.E+00
Se-75	2.E+02	5.E+03	2.E+00	5.E+01	2.E-01	5.E+00
Sr-90 (Y-90)	1.E+03	3.E+04	1.E+01	3.E+02	1.E+00	3.E+01
Tm-170	2.E+04	5.E+05	2.E+02	5.E+03	2.E+01	5.E+02
Yb-169	3.E+02	8.E+03	3.E+00	8.E+01	3.E-01	8.E+00
Au-198*	2.E+02	5.E+03	2.E+00	5.E+01	2.E-01	5.E+00
Cd-109*	2.E+04	5.E+05	2.E+02	5.E+03	2.E+01	5.E+02
Co-57*	7.E+02	2.E+04	7.E+00	2.E+02	7.E-01	2.E+01
Fe-55*	8.E+05	2.E+07	8.E+03	2.E+05	8.E+02	2.E+04
Ge-68*	7.E+02	2.E+04	7.E+00	2.E+02	7.E-01	2.E+01
Ni-63*	6.E+04	2.E+06	6.E+02	2.E+04	6.E+01	2.E+03
Pd-103*	9.E+04	2.E+06	9.E+02	2.E+04	9.E+01	2.E+03
Po-210*	6.E+01	2.E+03	6.E-01	2.E+01	6.E-02	2.E+00
Ru-106 (Rh-106)*	3.E+02	8.E+03	3.E+00	8.E+01	3.E-01	8.E+00
Tl-204*	2.E+04	5.E+05	2.E+02	5.E+03	2.E+01	5.E+02

Study Scope
(continued)

- Example IAEA Category 1 sources and devices
  - Radioisotope thermoelectric generators
  - Irradiators
  - Teletherapy devices
  - Co-60, Cs-137, Sr-90
- Example IAEA Category 2 sources and devices
  - Industrial gamma radiography
  - Gamma knives
  - Am-241, Co-60, Cs-137, Sr-90, Ir-192

Study Scope
(continued)

- Evaluate and prepare recommendations on the technical and economic feasibility and risks to workers from alternative technology replacements

- Several types of replacements may be feasible
  - Non-radioactive processes
  - Machine-produced radiation
  - Radionuclides with lower activities, shorter half-lives or less dispersible form

Study Scope
(continued)

Example radiation source: cesium-137

- **Produced in other countries and used domestically in a wide range of applications**
- **Typical chemical form: cesium chloride**
- **Technical and economic feasibility**
  - **Availability and cost of alternative technologies**
  - **Risk to workers**
  - **International considerations**

Classified, Safeguards and Sensitive Information

- NRC and National Academies to provide appropriate protections to prevent improper or inadvertent public release of information that is exempted from release under FOIA
- NRC afforded 14 calendar days to review proposed public version of report for information security review
- National Academies shall remove any information from public version of report that is Classified, Safeguards, and other Sensitive Official Use Only Information

Study Schedule

- NRC issued grant to National Academies in January 2006

- Report due to Congress by August 7, 2007
  - EPAct states "not later than 2 years after the date of enactment of [the Energy Policy Act] the Commission shall submit to Congress the results of the study…"

Conclusions

- NRC has worked aggressively to enhance the security of risk significant radiation sources by strengthening the systems for security and control sources
- NRC is looking forward to working with the National Academies to complete the study on schedule
- NRC will provide necessary technical support throughout this study
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