



# **NRC Perspectives on the Radiation Source Use and Replacement Study**

**Presented To The National Academies  
By**

**Dr. Brian Sheron, Director  
Office of Nuclear Regulatory Research**

***BWS@nrc.gov***

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## 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 EPAAct 4**



# 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  $\geq 1,000$  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)

CODE OF CONDUCT ON  
THE SAFETY AND SECURITY OF  
RADIOACTIVE SOURCES

放射源安全和保安行为准则

CODE DE CONDUITE SUR  
LA SÛRETÉ ET LA SÉCURITÉ  
DES SOURCES RADIOACTIVES

КОДЕКС ПОВЕДЕНИЯ ПО  
ОБЕСПЕЧЕНИЮ БЕЗОПАСНОСТИ И  
СОХРАННОСТИ РАДИОАКТИВНЫХ  
ИСТОЧНИКОВ

CÓDIGO DE CONDUCTA  
SOBRE SEGURIDAD TECNOLÓGICA  
Y FÍSICA DE LAS FUENTES  
RADIATIVAS

مدونة قواعد السلوك بشأن أمن المصادر  
المشعة وأمنها



Radionuclide	Category 1		Category 2		Category 3	
	1000 x D		10 x D		D	
	(TBq)	(Ci) <sup>a</sup>	(TBq)	(Ci) <sup>a</sup>	(TBq)	(Ci) <sup>a</sup>
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 <sup>b</sup> /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**
- **NRC contact: Tony Huffert, CHP  
Office of Nuclear Regulatory Research  
301.415.6416  
AMH1@ nrc.gov**