



Information Sheet: Radiation Source Use and Replacement Study

Background

Radiation sources are used extensively in the United States for industrial applications, research, and medical diagnosis and treatment. The Energy Policy Act of 2005 (EPA) has several provisions for the Federal Government to evaluate alternative technologies for replacing radiation sources that may pose a national security risk. One of these provisions, EPA Section 651(d), directs the U.S. Nuclear Regulatory Commission (NRC) to work with the National Academies (NA) to review current industrial, research, and commercial uses of radiation sources and identify technically and economically feasible replacements for these sources. Concerns about the safety and security of radioactive sources that could be used in a radiological dispersal device (RDD) and radiological exposure device (RED) prompted Congress to direct this study.

Overview

The security of radiation sources is a top priority for the NRC. The NRC's efforts have been effective, keeping incidents involving radiation sources and radioactive materials to a minimum and the probability of their consequences low. Most lost or stolen sources are quickly recovered, resulting in minimal or no radiation exposures or contamination. The NRC works with domestic and international organizations on a variety of initiatives to make risk-significant radiation sources more secure and less vulnerable to terrorists.

The regulatory programs of NRC and the Agreement States have served the Nation well, with little need for any major changes before September 11, 2001. In response to the increased terrorist threat since the attacks on that date, the NRC in concert with the Agreement States has strengthened the safety and security program for radiation sources to reduce the potential threat from an RDD or radiological exposure device. The NRC conducted security assessments to identify additional safety measures that can practically be implemented to further enhance the safety and security of radiation sources. These safety measures have been implemented for risk-significant sources.

Approach

Alternative technologies to radiation sources may include the replacement of a radiation source with an equivalent (or improved) process that does not require the use of radionuclides. Another approach is to replace a radiation source with a different radiation source that poses a lower risk to public health and safety if it were involved in an accident or used in a terrorist attack.

The NA is evaluating these options for risk-significant sources defined as Category 1 and 2 sources by the International Atomic Energy Agency's *Code of Conduct on the Safety and Security of Radiation Sources*¹. The majority of these sources use cobalt-60, cesium-137, or iridium-192 in medical applications, such as gamma knives and blood irradiators, and industrial and research applications, such as radiography cameras, well logging, and industrial and research irradiators. In the United States, about 2000 licensees regulated by the NRC and the Agreement States possess Category 1 and 2 sources.



Radiography camera



Blood irradiator

The NRC will provide Congress with the recommendations of the NA on alternative technologies to radiation sources. The agency will consider the NA recommendations within its jurisdiction, as well as recommendations of the Department of Energy and the Radiation Source Protection and Security Task Force, which are also evaluating alternative technologies to radiation sources in accordance with the EPA.

The NRC welcomes recommendations to enhance the safety and security of radiation sources and lower the potential risk of terrorist use of radiation sources. Alternative technologies to radiation sources may be one approach to accomplishing this goal. However, the NRC bases its licensing decisions on whether its requirements have been met, without evaluating whether other technologies could have been used. Traditionally, market forces have driven demand for the use of radiation sources and their alternatives in devices.

The NA began this study in July 2006, and the study committee has provided an open forum for discussion of alternative technologies with a wide range of stakeholders. The NA issued the committee's report in February 2008.

¹See http://www-pub.iaea.org/MTCD/publications/PDF/Code-2004_web.pdf

Visit the NA Web site at <http://www8.nationalacademies.org/cp>



National Academies' Radiation Source Use and Replacement Study

- **NRC has strengthened its security program for risk-significant radiation sources to reduce the potential threat from a radiological dispersal device or radiological exposure device since 9/11**
- **NRC works closely with its domestic and international partners to make risk-significant radiation sources more secure and less vulnerable to terrorists**

The National Academies evaluated the uses of risk-significant sources that could be replaced with an equivalent process or that would pose a lower risk if an accident or attack occurs

- The Energy Policy Act of 2005 section 651(d) mandated this study
- The study began in July 2006 and the report will be released in February 2008
- The National Academies' recommends considering the feasibility of replacing risk-significant radiation sources with alternative technologies that could increase public health and safety and security

NRC welcomes this study and others on alternative technologies or source security and will consider all recommendations as it evaluates how to further improve security and while meeting its Strategic Goals

- The Energy Policy Act of 2005 provisions include studies by the Radiation Source Protection and Security Task Force (August 2006) and the Department of Energy (DOE) (August 2006). The Environmental Protection Agency (EPA), DOE, and the Department of Homeland Security (DHS) are also studying alternative technologies to certain radiation sources (ongoing).
- The Radiation Source Protection and Security Task Force subgroups on Cesium Chloride and Alternative Technologies are expected to issue reports within the next year
- The Independent External Review Panel examining licensing practices and security is expected to issue their report in April 2008
- The Defense Sciences Board is expected to release a report with recommendations related to Cesium Chloride in 2008

NRC will use the Radiation Source Protection and Security Task Force to coordinate its responses with other Federal and State Agencies

- The Radiation Source Protection and Security Task Force was established by the Energy Policy Act of 2005 to provide continuing input to the President and Congress. Its next report is due in 2010.
- The National Academies' report recommends replacing sources with caution to ensure that essential functions performed by the sources are preserved.
- NRC is working to develop a quantitative analysis and review of economic and environmental impacts in order to support a technical basis for regulatory decision-making.
- Accomplishment of some of the recommendations will require the assistance of other Federal agencies, the Agreement States, and possibly Congress.

Security of radiation sources is a top priority for the NRC

NATIONAL ACADEMY OF SCIENCES REPORT “RADIATION SOURCE USE AND REPLACEMENT STUDY”

The National Academies study significantly advanced the NRC’s knowledge of alternative technologies to radiation sources and addressed the Congressional mandate in Section 651(d) of the Energy Policy Act of 2005 (EPAct). This report, in combination with two other studies mandated by EPAct, provides technical information and independent insights that are useful to the NRC and its Federal and State partners that are working to further enhance security of radiation sources and prevent misuse of those sources by terrorists. Specifically, the NA report reviewed the current industrial, research, commercial and medical uses of radiation sources and identified approaches for replacing such sources with lower risk alternatives. It provides an overview of the technical and economic feasibility and risks to workers from such replacements, and recommends options for implementing the identified replacements.

The U.S Environmental Protection Agency, the U.S Department of Energy, and the Radiation Source Protection and Security Task Force (Task Force) have active programs on alternative technologies to radiation sources that will benefit from this report. Federal and State representatives plan to review this report and identify areas that require further analysis to support their alternative technology programs. For example, the Task Force plans to systematically advance the information contained in the NA report for decision making and identification of long-term solutions, with the goal of submitting a report to Congress in 2010. To meet this goal, the Task Force plans to supplement information in the NA report regarding worker risks, economic costs, implementation methods and schedules, and viable research and development programs on alternative technologies. As part of this effort, the Task Force may consider the following topics described in the NA report:

- International collaboration for enhancing security of radiation sources
- Disposition options for existing radiation sources
- Incentives for replacement technologies
- Federal definition of a radiological dispersal device
- Hazard and risk assessments for replacement technologies
- Regulatory changes and effects
- Role of vendor upgrades to enhance security of and radiation sources and devices

As these actions demonstrate, the NRC is dedicated to ensuring the security of these radiation sources. The NRC welcomes recommendations from all collaborative efforts on alternative technologies to enhance security while meeting its Strategic Goals.

The NRC’s Advisory Committee on the Medical Uses of Isotopes, or the ACMUI, provided comments on the NA report to the NRC staff. The ACMUI was established in 1958 under the authority of the Federal Advisory Committee Act. The ACMUI membership includes professionals from various disciplines serving in a part time capacity. The ACMUI charter defines its purpose as providing advice on policy and technical issues that arise in regulating the medical use of byproduct material for diagnosis and therapy. The advice provided by the ACMUI helps the staff create medical regulations that are useful, realistic, practical, not overly burdensome, and not inappropriately intrusive in the practice of medicine. A copy of their comments is attached.

February 20, 2008

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Dear Mr. Lewis

The Advisory Committee on the Medical Use of Isotopes (ACMUI) appreciates the opportunity to comment on the report entitled "Radiation Source Use and Replacement" prepared by National Academy of Science (NAS). The report represents the results of a study, conducted by NAS under Section 651 of the Energy Policy Act of 2005, of the industrial, research, and commercial (including medical) uses of Category 1 and 2 radioactive sources to identify technically and economically feasible replacements for sources that pose a high risk to public health and safety in an accident or terrorist attack. The purpose of the ACMUI is to provide advice to NRC on policy and technical issues that arise in regulating the medical use of byproduct materials for diagnosis and therapy, and, in that capacity, our review of the NAS report was focused on the impact of its recommendations on the practice of medicine.

The ACMUI recognizes and appreciates the efforts put forth by NAS in preparing this report. The ACMUI, however, has several concerns and comments regarding the report and its recommendations:

1. The report has suggested alternative replacements for CsCl, e.g., x-ray blood irradiators. However, the report does not address the efficacy of these alternative replacements for CsCl. Further study will need to be carried out on the alternatives to assure that these alternative replacements have the capacity for producing the desired result or effect and to identify any impacts. For example, a linac could be used to irradiate blood in the evening (when it is not being used to treat patients), but the hemotologists need the blood irradiated immediately before use, which is generally in the daytime, not in the evenings.
2. The report does not address increased or enhanced security methods as an alternative. Enhanced security features would provide a more cost effective means of providing security.
3. Terrorist threat exist worldwide. Elimination of CsCl needs to have a global solution, otherwise, the refurbished CsCl irradiator equipment will be sent to underdeveloped countries where the environment is potentially less secure, thus increasing the overall threat risk.
4. The report does not acknowledge the fact that the cost of replacement, decommissioning, and disposal of current CsCl technology, as well as, the

increased operating cost of the Xray alternatives will likely be passed on to patients, thereby increasing the already high cost of medical care. One estimate suggests that implementation of the x-ray alternative could increase costs by 177% in comparison to Cs while being less reliable.

5. The report does not address the fact that the tax incentives to replace CsCl technology would not work for most hospitals, which are generally not-for-profit.
6. The report does not adequately distinguish between Cs-131 and Cs-137. Cs-131 is a new and useful isotope which does not have the dispersal potential of Cs-137. However, both isotopes may be viewed as having the same threat risk by the public due to the word "Cesium". By not distinguishing between these two isotopes of Cesium, any action on CsCl based on this report could potentially deny the useful medical treatment of Cs-131 to the public.
7. The NAS report appears to have a bias against Gamma Knife Radiosurgery. The Gamma Knife has proven medical benefit. This technology provides very rapid, focused treatment versus the non-radioactive alternatives. However, the NAS report places the Gamma Knife in a negative light compared to the Linac xray alternatives. The successful Gamma Knife treatment method should not be eliminated as it would deny needed medical treatment to patients.
8. ACMUI agrees with the NRC staff observation that there are significant environmental and worker risk of using Ethylene Oxide technology. These risks were the reason that Ethylene Oxide technology was eliminated and hence returning to the Ethylene Oxide technology would be a step backward. Further, Ethylene Oxide is used for sterilizing equipment and not for sterilizing blood.

ACMUI would be happy to elaborate on the above concerns, and any additional observations, resulting from our review with you, NAS, or Congress, at your convenience.

Sincerely



Dr. Subir Nag
ACMUI