Report to the President and the U.S. Congress
Under Public Law 109-58, The Energy Policy Act of 2005

The Radiation Source Protection and Security Task Force Report

Submitted by:
The Chairman of the
U.S. Nuclear Regulatory Commission

On Behalf of:
Radiation Source Protection
and Security Task Force

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Introduction

The terrorist attacks of September 11, 2001, heightened the nation's concerns regarding the potential use of radioactive material for a malevolent act. Preventing a terrorist attack involving a radiological dispersal device (RDD) or radiological exposure device (RED) has been a top priority for the Bush administration. As described further below, the United States Government, with the strong support of the President, has been aggressively involved in efforts to address this concern for the past several years. In August 2005, sharing the Administration's concern, the Congress amended the Atomic Energy Act to create the Task Force on Radiation Source Protection and Security. This is the first report of the Task Force.

Members of the Task Force

- *Chairman of the Nuclear Regulatory Commission (Chair)*
- *Secretary of Homeland Security*
- *Secretary of Defense*
- *Secretary of Energy*
- *Secretary of Transportation*
- *Attorney General*
- *Secretary of State*
- *Director of National Intelligence*
- *Director of the Central Intelligence Agency*
- *Director of the Federal Emergency Management Agency*
- *Director of the Federal Bureau of Investigation*
- *Administrator of the Environmental Protection Agency*

Other Invited Agencies

- *Department of Health and Human Services*
- *Office of Science and Technology Policy*
- *Organization of Agreement States and Conference of Radiation Control Program Directors (non-voting member)*

This executive summary is divided into three parts. Part 1 provides an introduction, a list of key accomplishments of the U.S. Government related to the security of radioactive materials in use, storage, or transport, the formation of a task force pursuant to the Energy Policy Act (EPAct) of 2005, (Public Law 109-58), and the International Atomic Energy Agency (IAEA) Code of Conduct on the Safety and Security of Radioactive Sources (Code of Conduct). Part 2 presents a summary of the individual chapters contained in the body of the report, and Part 3 summarizes the major conclusions and the recommendations and actions proposed by the Task Force.

A task group of federal agencies and a state representative reviewed the status of programs related to the protection and security of radiation sources and concluded that since September 11, 2001, Federal Agencies have implemented or are in the process of implementing actions to increase security. While implementation of some of these activities is still in progress, the actions taken to date have substantially enhanced security. Nevertheless, completion of the ongoing activities should continue to be a high priority.

Background

Although the U.S. Government has long been involved in efforts to address radioactive source protection and security, the events of September 11, 2001, heightened the nation's concerns regarding the use of risk-significant radioactive materials in a malevolent act. Such an attack

has been of particular concern because of the widespread use of radioactive materials (often contained in sealed sources) in the United States and abroad by industry, hospitals, and academic institutions. Loss or theft of such materials, in risk-significant quantities, could lead to their diversion for malicious use in an RDD or an RED. An RDD is a device or mechanism that is intended to spread radioactive material from the detonation of conventional explosives or other means. RDDs are considered weapons of mass disruption; few deaths would occur due to the radioactive nature of the event, however, significant social and economic impacts could result from public panic, decontamination costs, and denial of access to infrastructure and property for extended periods of time. An RED is a device whose purpose is to expose people to radiation, rather than to disperse radioactive material into the air, as would an RDD.

The U.S. Government, in coordination with the Agreement States, has completed a number of activities to enhance the security of radioactive materials in use, storage, or transport. This report discusses many of these activities. Key accomplishments are highlighted below.

- In June 2002, the Secretary of Energy and the Nuclear Regulatory Commission (NRC) Chairman met to discuss the adequate protection of inventories of nuclear materials that could be used in an RDD. At the June meeting, the Secretary of Energy and the NRC Chairman agreed to convene an Interagency Working Group on Radiological Dispersal Devices to address security concerns. In May 2003, the NRC and Department of Energy (DOE) issued a joint report entitled, “Radiological Dispersal Devices: An Initial Study to Identify Radioactive Materials of Greatest Concern and Approaches to Their Tracking, Tagging, and Disposition,” hereafter called the DOE/NRC RDD Report or RDD Report. This study contained a number of recommendations to provide a higher level of protection for radioactive materials.

- On March 17, 2003, the NRC, in cooperation with the Agreement States, issued advisories to licensees to enhance security measures, consistent with the launch of Operation LIBERTY SHIELD.

- During 2002–2003, the U.S. Government and the international community worked to establish international guidelines for the safety and security of radioactive sources. These efforts resulted in a major revision of the IAEA “Code of Conduct on the Safety and Security of Radioactive Sources,” hereafter called the Code or Code of Conduct. The Code of Conduct contains non-binding international guidance for effective life-cycle control of radioactive sources used in non-military applications.

- The Department of State (DOS) has led international negotiations on the IAEA Code of Conduct and IAEA import/export guidance and has built political momentum for widespread international acceptance of the Code and the Guidance by gaining high-level political commitments in forums such as the IAEA G-8, APEC, OSCE, and SPP, as well as national commitments from over 83 countries to follow the Code. DOS has also been effective in strengthening international assistance programs that support sustainable radioactive source control globally.

- In 2004, the Department of Homeland Security (DHS), with DOE and NRC participation, conducted a radiological pilot project, to assess security at nine medical facilities in New York and New Jersey.

- The NRC, with the assistance of Sandia National Laboratories, has conducted security assessments on selected representative facilities possessing Category 1 and 2 quantities of radioactive material.

- In April 2005, a Presidential Directive created the Domestic Nuclear Detection Office (DNDO) within DHS to coordinate efforts to detect and report instances of illicit trafficking.

- The NRC, in coordination with the Executive Branch, has issued a final rule amending the export and import regulations to impose more stringent controls over the Category 1 and 2 materials defined by the IAEA Code of Conduct. This rule reflects a key element of the Code of Conduct and its import/export guidance by increasing licensing requirements, as well as notice and consent requirements. The United States was one of the first countries to implement the export/import provisions of the Code of Conduct.

- The NRC is working closely with DOE, Agreement States, DHS, the Environmental Protection Agency (EPA), the Department of Transportation (DOT), DOS, the Department of Commerce, the Department of Defense (DOD), and the Federal Bureau of Investigation (FBI) to develop a National Source Tracking System (NSTS) to track risk-significant radioactive sources.

- The NRC has developed and is maintaining an interim inventory of Category 1 and 2 radioactive sources for both NRC and Agreement State licensees until completion of the NSTS.

- DOE issued a data call and collected information on Category 1 and 2 sources at DOE sites.

- The NRC has required security enhancements for various classes of NRC and Agreement State materials licensees, including independent spent fuel storage installations, fuel cycle facilities, large irradiators, and manufacturers and distributors of radioactive material. The NRC and Agreement States have issued orders or legally binding requirements to all NRC and Agreement State materials licensees that are authorized to possess Category 1 or 2 quantities of radioactive material. These include licensees in the medical, academic, and industrial fields (e.g., blood irradiators, gamma-knives, and radiographers).

- The NRC has issued security orders governing the transportation of spent nuclear fuel and other radioactive materials in Category 1 quantities. In addition, the NRC has implemented the Homeland Security Advisory System for NRC and Agreement State licensees.

- DOE has accelerated the collection of high-risk radioactive sources that pose a potential safety or security risk through its Offsite Source Recovery Program. From 1999-2005, this DOE program has recovered over 12,000 sources from approximately 400 locations in the United States.

- DOT has issued regulations that require a security plan for transport of hazardous materials, including highway route-controlled quantities (HRCQ) of radioactive material.

- DHS/Transportation Security Administration (TAS) has issued regulations requiring Federal fingerprint-based criminal history checks of various transport personnel, including aircraft flight crew members, persons with authority to perform checked baggage or cargo functions, and drivers for land transport of hazardous materials (including HRCQ of radioactive material).

- The DOE International Threat Reduction Program seeks to accelerate securing and/or removing vulnerable radiological material throughout the world by performing physical security upgrades at vulnerable sites possessing high-risk radioactive sources.

The Energy Policy Act Task Force

The EPAct established the Task Force under the leadership of the NRC to evaluate and provide recommendations to the President and Congress relating to the security of radiation sources in the United States from terrorist threats, including acts of sabotage, theft, or use of a radiation source in a RDD.

The Task Force comprises representatives from the NRC (chair), DHS, DOD, DOE, DOT, Department of Justice (DOJ), DOS, Office of the Director of National Intelligence (ODNI), Central Intelligence Agency (CIA), Federal Emergency Management Agency (FEMA), FBI, EPA, Office of Science and Technology Policy (OSTP), and Department of Health and Human Services (HHS). The Task Force includes a nonvoting member representing the Organization of Agreement States (OAS) and the Conference of Radiation Control Program Directors (CRCPD).

The Task Force members represent agencies with broad authority over radioactive sources of all categories, including regulatory, security, and intelligence, in addition to international activities. The Task Force reviewed existing programs and planned near-term activities and summarized the current practice or programs, as well as the planned activities, at the various agencies. Based on this information, the Task Force made a number of recommendations to further enhance security. These recommendations are the major findings of the Task Force. In addition, the Task Force noted a number of ongoing actions that the agencies plan to complete, but which do not rise to the level of a recommendation. These actions are related to activities that are underway or planned for the near term.

The EPAct defines the term “radiation sources” (hereinafter referred to as radioactive sources) as a Category 1 or a Category 2 source, as defined by the IAEA Code of Conduct, and any other material that poses a threat requiring protection and security, as determined by the Commission, other than spent nuclear fuel and special nuclear materials.

The IAEA Code of Conduct

The IAEA Code of Conduct contains non-binding international guidance for effective life-cycle control of radioactive sources used in nonmilitary applications. The U.S. Government played a leading role in negotiating the Code of Conduct and has encouraged broad international commitment to the Code. The President, in hosting the G-8 Summit at Sea Island, Georgia, in 2004, made a strong push for prompt G-8 action.

The U.S. Government has formally notified the Director General of the IAEA of its strong support for the current Code of Conduct. The U.S. Government has made a nonlegally binding

political commitment to work towards following the guidance in the Code of Conduct. The Code contains basic principles that the IAEA believes are necessary for the safe and secure use of radioactive materials. It also includes guidelines for effective cradle-to-grave control of sealed radioactive sources used in nonmilitary applications for use by countries on a national basis. Specifically, the Code states the following:

> The objectives of this Code, through the development, harmonization and implementation of national policies, laws and regulations, and through the fostering of international co-operation, to:
>
> (i) achieve and maintain a high level of safety and security of radioactive sources;
> (ii) prevent unauthorized access or damage to, and loss, theft or unauthorized transfer of, radioactive sources, so as to reduce the likelihood of accidental harmful exposure to such sources or the malicious use of such sources to cause harm to individuals, society or the environment; and
> (iii) mitigate or minimize the radiological consequences of any accident or malicious act involving a radioactive source

The United States continues to work actively to encourage other countries to reflect the Code in their national law and has succeeded in achieving political commitments to work towards following the Code from 83 countries and by leaders of the G-8 (2003 Evian Summit, 2004 Sea Island Summit, and 2005 Gleneagles Summit), European Union (EU) (2004 U.S.-EU Shannon Summit), Asia Pacific Economic Cooperation (APEC) (2005 APEC Leaders Statement), Organization on Security Cooperation in Europe (OSCE) (2005 OSCE Plenary Meeting); and three North American leaders in the Security and Prosperity Partnership. Such attention by world leaders reinforces the value of the Code as an international standard.

The specific categorization of radioactive sources described below is one of the essential features of the IAEA Code of Conduct. This categorization provides a foundation upon which countries worldwide can base their national regulatory infrastructures to control radioactive sources. In addition, the categorization provides the basis for international exchanges of radioactive sources with an international framework for export control. Furthermore, the IAEA is likely to incorporate the categorization into new international transportation guidance that it is developing.

The IAEA Code of Conduct lists 26 radionuclides and identifies three threshold activity levels for each, referred to as Categories 1, 2, and 3. Sixteen of these radionuclides are commonly used in radioactive sources; the other 10 are unlikely to be used in individual sealed sources with activity levels that would place them within Categories 1-3. The categorization is based on a definition of a dangerous source. Such a source could, if not under control, give rise to exposure sufficient to cause severe deterministic effects (i.e., fatal or life threatening) or a permanent injury. The IAEA Safety Guide No. RS-G-1.9, “Categorization of Radioactive Sources,” details the underlying methodology for the categorization. The Code of Conduct only applies to the first three categories shown below, whereas, RS-G-1.9 covers all five categories.

> Category 1 sources, if not safely managed or securely protected would be likely to cause permanent injury to a person who handled them, or were otherwise in contact with them, for more than a few minutes. It would probably be fatal to be close to this amount of unshielded material for a period of a few minutes to an hour. These sources are typically used in practices such as radiothermal

generators, irradiators and radiation teletherapy.

Category 2 sources, if not safely managed or securely protected, could cause permanent injury to a person who handled them, or were otherwise in contact with them, for a short time (minutes to hours). It could possibly be fatal to be close to this amount of unshielded radioactive material for a period of hours to days. These sources are typically used in practices such as industrial gamma radiography, high dose rate brachytherapy and medium dose rate brachytherapy.

Category 3 sources, if not safely managed or securely protected, could cause permanent injury to a person who handled them, or were otherwise in contact with them, for some hours. It could possibly—although it is unlikely—be fatal to be close to this amount of unshielded radioactive material for a period of days to weeks. These sources are typically used in practices such as fixed industrial gauges involving high activity sources (for example, level gauges, dredger gauges, conveyor gauges, and spinning pipe gauges) and well logging devices.

Category 4 sources, are very unlikely to permanently injure anyone. However, this amount of unshielded radioactive material, if not safely managed or securely protected, could possibly – although it would be unlikely – temporarily injure someone who handled it or who was otherwise in contact with it for many hours, or who was close to it for a period of many weeks.

Category 5 sources, could not permanently injure anyone. [1]

The Task Force, consistent with U.S. policy, has looked to the Code of Conduct in its review of the U.S. programs. The Code defines levels of risk for various sources and appropriate actions to provide for their secure use.

Unless otherwise noted, throughout this report the terms Category 1 and Category 2 sources refer to the 16 radionuclides listed in Annex I of the Code of Conduct at or above the Category 1 or Category 2 threshold, respectively. Category 1 or Category 2 quantities of radioactive material refers to aggregated radioactive material that meets or exceeds the Category 1 or Category 2 thresholds in the Code of Conduct. The aggregated material may include sources smaller than Category 2. The term risk-significant sources refers to Category 1 and Category 2 sources, while the term risk-significant quantities of radioactive material refers to aggregated radioactive material that meets or exceeds the Category 1 or Category 2 thresholds in the Code of Conduct.

Radioactive sources provide critical capabilities in the oil and gas, electrical power, construction, and food industries. They are used to treat millions of patients each year in diagnostic and therapeutic procedures and are also used in a variety of military applications. In addition, academic, government, and private institutions use radioactive sources in technology research and development. These materials are as diverse in geographical location as they are in functional use.

In the United States, there are millions of sources of radioactive material and tens of thousands of authorized users (licensees). The amount of radioactive material authorized for these licensees ranges from one-millionth of a curie (i.e., sources used in gauges) to millions of curies

1 This statement does not take into account possible delayed health effects.

(i.e., sources used in large irradiators). The majority of sources is either Category 4 or Category 5 and poses little risk for use in an RDD. Only a small fraction (approximately 44,000) of these sources, possessed by approximately 1,400 NRC and Agreement State licensees, are Category 1 or 2 sources. DOE controls approximately 2300 additional risk-significant sources in 25 locations. In general, sources with small quantities of radioactive material present lower risk to public health and safety and to common defense and security and are more widely used than sources with large quantities of radioactive material.

Part 2

This section of the report provides a summary of the Task Force's deliberations on each topic the EPAct mandates. The following table lists these topics and provides a pointer to the report chapter that discusses each.

Table ES.1 Energy Policy Act Topics

Topic	Chapter Number
The list of sources requiring security, based on potential attractiveness of the source to terrorists and criminals and the extent of the threat to public health and safety	3
The national system for recovery of lost or stolen sources	8
Storage of radioactive sources	7
The National Source Tracking System	11
A national system (including user fees and other methods) to provide for proper disposal of sources	9
Import[2] and export controls on sources to ensure that foreign and U.S. recipients of sources are able and willing to adequately control them	10
Alternative technologies available that may perform some or all of the functions performed by devices or processes that employ radioactive sources and appropriate regulations and incentives for the replacement of the devices and processes with alternative technologies or with sources that would pose a lower risk to public health and safety	12
Procedures for improving the security of use, transportation, and storage	4 (security and

2 The EPAct only requires the Task Force to address the export of radioactive sources. The Task Force decided to also address import.

of sources, including the inspection program; security measures; fines and background checks for individuals with access to radioactive sources; exchange of information on background checks; physical security of facilities that contain radioactive sources; and the screening of shipments to facilities to ensure that the shipments do not contain explosives	control) 5 (transportation) 6 (background checks) 7 (storage)

Radioactive Source Lists (Chapter 3)

Many agencies have developed lists of radionuclides (and associated thresholds) for various purposes in order to implement their programs. Some of the lists identify the sources that are required to be secured based on the potential attractiveness of the sources for malevolent use and the extent of the threat to public health and safety.

The Task Force reviewed available information on lists of radioactive sources that Government agencies have established for security or safety-related purposes. The Task Force reviewed the following programs and accompanying lists:

- IAEA Code of Conduct
- DOE Radiological Threat Reduction Program
- DOE/NRC Radiological Dispersal Devices Report
- U.S. import/export controls
- National Source Tracking System
- NRC security orders
- NRC standards for protection against radiation
- DOE occupational radiation protection regulations
- transportation rules

The Task Force concludes that agencies are protecting the appropriate radioactive sources (i.e., those sources requiring security based on the potential attractiveness of the source to terrorists and the extent of the threat to public health and safety). At this time, the Task Force does not recommend that additional radionuclides be added to the list of risk-significant sources. The Task Force notes that the source lists are tailored to the specific program and objectives to which it applies. The one list of radionuclides that is different from the Code of Conduct categorization of sources is used in transportation security. The Task Force encourages the U.S. Government to continue the efforts underway internationally to better align transportation guidance with the Code of Conduct. Overall the programs appropriately address the sources consistent with the Code of Conduct.

The Code of Conduct serves as an appropriate framework for considering which sources may warrant additional protection. The Code of Conduct considers that a country should “define its domestic threat, and assess its vulnerability with respect to this threat for the variety of sources used within its territory, based on the potential for loss of control and malicious acts involving one or more radioactive source.” In general, the U.S. programs adhere to this philosophy. However, the threat environment is not static, but is continually changing. Therefore, it is good practice to occasionally reevaluate the potential attractiveness of the radioactive sources. The Task Force recommends that the U.S. Government periodically reevaluate the list of radioactive sources that may warrant additional security and protection. This reevaluation should be coordinated within the Federal family and can be performed as part of the Task Force activities

every 4 years. If the reevaluation determines that the list of sources should be expanded, the U.S. Government will work to revise our national requirements and, if appropriate, will work with the international community to revise the Code of Conduct, as appropriate.

Security and Control of Radioactive Sources (Chapter 4)

The U.S. framework for security and control of radioactive sources requires multijurisdictional coordination. Several U.S. Governmental agencies have authority, sometimes overlapping authorities, to regulate radioactive materials. Reducing the risk of the malevolent use of radioactive material involves many crosscutting activities and issues. Protection of these risk-significant sources is important in preventing RDD and RED proliferation.

The basic principles of the IAEA Code of Conduct state that, "every State should define its domestic threat, and assess its vulnerability with respect to this threat for the variety of sources used within its territory, based on the potential for loss of control and malicious acts involving one or more radioactive sources." Both the NRC and DOE, in conjunction with other Federal and State entities are responsible for establishing and overseeing security measures for the civilian and certain defense nuclear facilities and materials users, respectively. These agencies regularly coordinate with the intelligence community and Federal law enforcement organizations to review and assess threat information and incorporate a graded threat concept into their security programs. The NRC and DOE share and coordinate assessments of threat information and strive for comparable protection for comparable material. One of the key steps in the DHS National Infrastructure Protection Program (NIPP) project is to identify and assess the vulnerability of key assets, utilizing to a large extent the work that has been completed by NRC and DOE, and to analyze the potential risks based on threats and consequences. Similar to the NIPP method for risk analysis and management of critical assets protection, vulnerability and security assessments determine where additional security and control measures or mitigating strategies are needed for risk-significant radioactive material. The Chemical and Nuclear Preparedness and Protection Division within DHS has the responsibility for implementing the NIPP framework for the Nuclear Reactors, Materials, and Waste Sector.

Consistent with the threat analysis and potential consequences of malevolent use, and the objectives of the Code of Conduct, the purpose of the U.S. security and control programs is to achieve and maintain a high level of safety and security of radioactive sources to prevent radioactive material from being used for malevolent purposes. This is accomplished by (1) preventing radioactive material within the United States from being redirected for malevolent purposes and (2) preventing radioactive material intended for malevolent use from entering into the United States. The following actions achieve this goal:

- assuring that authorized users have adequate security and controls for risk-significant radioactive materials to enhance deterrence, detection, and defense in response to the current threat

- coordinating with law enforcement agencies to develop tactics to deter and prevent terrorist attacks on fixed nuclear facilities and material in transport

- detecting radioactive materials at key U.S. entry points where these materials either enter the United States or pass through before being transported to other countries

- detecting unauthorized shipments of radioactive materials within the United States

- tracking legitimate shipments of risk-significant radioactive materials into or through the United States

- assuring that the interim database, the import/export database, and eventually the NSTS database include all risk-significant radioactive sources used legitimately in the United States

A recent Government Accountability Office (GAO) report revealed that its investigators were able to enter the United States with radioactive sources using a counterfeit NRC document. In addressing these concerns, the NRC has worked with DHS Customs and Border Protection, and a program is in place to verify the legitimacy of shipments of licensed radioactive material entering the United States through established ports of entry. This information has included (1) 24/7 contact information for each Agreement State, as well as information on their various capabilities, (2) copies of all active import/export licenses and the import/export database, (3) information from the NRC License Tracking System database (used to track the NRC byproduct, source, and special nuclear material licenses), and (4) information from the interim database. The NRC provides updates to the databases every 2 weeks. Furthermore, the agency will continue to work with Customs staff to improve upon existing procedures and to meet future needs.

Based on its evaluations, including the security assessments and the DHS Radiological Pilot Project results, the NRC has taken additional steps to heighten the security posture for Category 1 and 2 quantities of radioactive material. The NRC and Agreement States have imposed enhanced security and control requirements on licensees authorized to possess Category 1 and 2 quantities of radioactive material. The enhanced security measures and controls are implemented only if the licensee possesses the material. The measures are subject to inspection and enforcement actions by the NRC and the Agreement States.

The regulatory programs of the NRC, Agreement States, and DOE provide controls for the production, use, transportation, storage, and disposal of radioactive sources. After September 11, 2001, many of these controls were augmented by additional legally binding requirements. These requirements strengthened measures that were primarily for public health and safety to enable them to address the national security vulnerabilities raised by the RDD and radiological sabotage threats. The Task Force found that the regulatory controls strengthened by the additional measures reduce the vulnerabilities to national security. Most licensees have just implemented the new requirements and are still adjusting to the requirements, which were effective May 2006. The additional actions planned or underway (i.e., fingerprinting, verification of license, inspections) will further strengthen the regulatory controls.

The Task Force found no significant gaps that are not already being addressed. The Task Force believes that the combination of direct regulations concerning source security and control, personnel protection regulations, guidance, and the recently issued orders, along with the inspection and enforcement program, provides reasonable assurance that Category 1 and 2 sources in use and storage at NRC- and Agreement State-licensed facilities and at DOE facilities are safe and secure. Additional training of both responders and the public is desirable and will improve the response function. Finally, a need exists for continued coordination and communication of ongoing activities by various agencies to obtain the best results without duplication of effort.

Transportation (Chapter 5)

Historically, the transport regulations for radioactive material have focused on protecting persons, property, and the environment from the radiation, criticality, and thermal hazards associated with transport of radioactive material. Because of the international nature of the nuclear industry, international packaging and transport safety standards are needed to support the transport of industrial, medical, research, and fuel cycle material. The IAEA develops these international standards and published them as, "Regulations for the Safe Transport of Radioactive Material, TS-R-1," in September 2005. To ensure international standards are consistent with the transportation requirements in the United States, DOS has designated DOT and the NRC as the U.S. representatives in the IAEA transportation standards development program. To date, these efforts have resulted in complementary international transport standards that afford seamless transport into, out of, through, and within the United States.

In response to the events of 9/11, and changing attitudes in the world, safety standards that do not include security measures were no longer considered adequate in all circumstances. Accordingly, all Federal agencies involved with the transport of radioactive materials initiated programs to improve the security of hazardous materials in our Nation's transportation system.

The current memorandum of understanding (MOU) between DOT and the NRC has served as the foundation of cooperation and consultation for the transportation safety program for transportation subject to their jurisdiction. However, it does not cover transportation security. TSA is primarily involved in transportation security and it was not a signatory to the existing MOU. Because of the importance of transportation security, there should be a similar MOU that addresses security. Therefore, the Task Force recommends that an MOU for transportation security of risk-significant sources be developed. This agreement, similar to the one for transport safety, would clarify the roles and responsibilities of each agency, forge a spirit of cooperation and awareness among the participants, reduce duplication of efforts, and most importantly ensure development of a comprehensive and consistent transport security program.

DOT requires that persons who offer for transport, or transport, hazardous materials (including HRCQ of radioactive material) develop and implement security plans. These plans must include an assessment of the possible transport security risks and appropriate measures to address the identified risks. Plans must also allow that specific security measures may vary with the level of threat at a particular time. At a minimum, DOT requires a security plan to address personnel security (i.e., confirmation of information provided by employees and job applicants), unauthorized access (i.e., risk associated with unauthorized access to hazardous materials) and en route security (i.e., security risks from point of origin to point of destination). Security plans must be in writing and must be retained for as long as they remain in effect. A copy of the security plan or applicable section must be available to the employees who are responsible for implementing it. Companies must revise and update their security plans as necessary to reflect changing circumstances.

The NRC issued orders to NRC and Agreement State licensees that are known to be transporters of Code of Conduct Category 1 materials requiring the implementation of additional security measures during the transport of radioactive material. These measures provide for enhanced transportation security measures beyond current regulations and enhanced security in preplanning and coordination of shipments, advance notification of shipments to both the NRC and the States through which the shipment will pass, control and monitoring of shipments that are underway, trustworthiness and reliability of personnel, and information security

considerations. The NRC provides information to government agencies on a daily basis regarding the Category 1 radioactive material in transit.

The NRC and the Agreement States issued legally binding requirements for increased controls for radioactive materials licensees that use and transport Code of Conduct Category 2 quantities of radioactive material. For the transport of Code of Conduct Category 2 radioactive material, these enhancements provide increased controls beyond current regulations for preplanning and coordination of shipments, use of carriers that control and track shipments, trustworthiness of personnel, and information protection. These legally binding requirements are now in effect.

In addition to the issuance of the orders, legally binding requirements, and standing advisories, the NRC has also routinely adjusted the security measures for shipments to reflect changes in the Homeland Security Advisory System threat level. For example, during national special security events, as defined by DHS, the NRC has issued safeguards advisories to alert licensees to avoid shipping through geographical areas of concern.

Internationally, IAEA has developed the Code of Conduct and the Guidance on Import and Export of Radioactive Sources (Guidance), which supplements the Code. These documents address notification and consent provisions for imports and exports of Category 1 and 2 sources. They do not include notification and consent provisions or provisions relating to security of sources during transit (no conveyance change) or transshipment (involving conveyance change) of radioactive sources that do not have an origination or final destination point within a given country, but are transported through the country. During the development of the Code of Conduct and the Guidance, there was an acknowledged need for further consideration of the transit and transshipment portions of transportation, including how to define transit and transshipment. It is also an area that the Task Force recognizes it cannot solve on its own; the resolution will require international cooperation to develop enhanced security measures for inclusion in international transportation standards. The Transit and Transshipment Security Interagency Working Group was formed to specifically evaluate this area and to develop a U.S. position that can be used in international negotiations on this issue. Not only should these efforts continue, they should be accelerated.

The Task Force recommends that the NRC, DOT, DOS, and other interested Federal agencies continue to work with IAEA to develop international transport security guidance material for risk-significant sources, consistent with international law. The participating agencies should work to harmonize the IAEA program with the existing U.S. requirements and ensure that the guidance on security measures is incorporated into national laws and regulations in the United States at the earliest possible opportunity.

Given the current level of technology, tracking of packages, shipments, and conveyances is possible and would improve security. Although not a fatal flaw in the tracking of hazardous materials, the rapid growth of technology available to track packages, shipments, and conveyances may offer the transport community good benefit at marginal costs. To take full advantage of this technology, transport security officials need to research the technology, including cost-benefit, to determine where it should be applied.

Background Checks (Chapter 6)

Most Federal agencies require some background investigations for their employees. Some agencies require background checks and investigations for licensees and others covered by

their regulations; these checks may include criminal history checks or identity verification for foreign nationals. Background checks involve different types of investigations and/or analysis that may include all or some of the following elements: verification of true identity, trustworthy and reliability check, character and reputation check, credit history check, employment history check, personal history questionnaire, local agency criminal history check, FBI criminal history check, psychological assessment, and a demographic data check. Some of these elements require fingerprinting. Licensees conduct only some of these checks; law enforcement agencies do others. This report discusses the various agencies' background check programs as they relate to radioactive sources.

The EPAct expands the NRC's fingerprinting authority for Federal criminal history check purposes to a broader class of persons. The legislation expands the class of entities covered by the authority for fingerprinting to include individuals or entities that (1) are licensed or certified to engage in an activity subject to NRC regulation, (2) have filed an application for a license or certificate to engage in an activity subject to NRC regulation, or (3) have notified the Commission in writing of an intent to file an application for licensing, certification, permitting, or approval of a product or activity subject to NRC regulation. The legislation provides the Commission with flexibility to establish procedures for fingerprinting and the use of criminal history information, while ensuring the privacy of those fingerprinted.

The NRC is in the process of implementing its new fingerprinting authority provided by the EPAct. The agency has several rulemakings either planned or already underway to implement various fingerprint-related provisions of the EPAct. NRC is planning to issue orders or legally binding requirements for fingerprinting until rulemaking is completed.

The Task Force encourages the NRC to require fingerprinting for Federal criminal history checks on any individual that has access to Category 1 or 2 quantities of radioactive material. Additionally, the Task Force suggests that the NRC consider imposing the requirement on applicants for a license, as well as on licensees. Screening the fingerprints of license applicants would provide assurance that persons with malevolent intent would be detected, thereby reducing the risk of radioactive material being diverted or used for malicious purposes. The Task Force encourages the NRC to expeditiously complete its implementation of the fingerprinting provisions of the EPAct for licensees with, or license applicants for, Category 1 and 2 quantities of radioactive material.

Storage of Radioactive Sources (Chapter 7)

The EPAct specified that the Task Force examine "the storage of radiation sources that are not used in a safe and secure …." When considering the legal possession of sources, they are in one of four basic conditions, in transit, in use, short-term storage between usage, and long-term storage. The transportation section of the report considers the in-transit (and storage-in-transit) condition for sources. Therefore, the NRC interpreted the EPAct to mean that the Task Force was to examine sources in storage only and not to examine sources that are in use "in a safe and secure manner." In other words, the Task Force need not examine sources that are in active use in accordance with applicable regulations.

The Task Force believes that the combination of direct regulations concerning source storage, personnel protection regulations, guidance, and the recently issued orders and legally binding requirements, along with the inspection and enforcement program, provide reasonable assurance that the Category 1 and 2 sources in storage at NRC and Agreement State licensed facilities and at DOE facilities are safe and secure. The new security and control measures will enhance the security of storage situations.

The Task Force did note that some sources in long-term storage are being held for eventual disposal. Either a lack of a legal disposal path or high costs because of a lack of adequate disposal options is causing some licensees to store their unused or unwanted sources until the disposal situation improves. Providing adequate disposal for these sources will have a much greater effect on reducing the total risk of long-term storage (by reducing the number of sources in long-term storage) than any additional changes to storage requirements.

Recovery of Lost or Stolen Sources (Chapter 8)

The national system for recovery of lost and stolen sources is a cooperative and well-coordinated effort between the Federal Government, States, and private sector. It includes licensees authorized to possess and use radioactive sources; regulatory agencies, such as Agreement State radiation control programs and the NRC; response agencies, including DOE, DHS, and EPA, and Federal, State, and local law enforcement agencies.

The system and its capabilities are founded on the principle of protecting public health and safety and national security. Programs are not designed to deal only with lost and stolen sources. Rather, the Federal and State capabilities address a wide range of situations involving excess and unwanted sealed sources, as well as lost, stolen, abandoned, and missing sealed sources. These materials are commonly referred to as “orphan” sources. Additionally, these programs address the full range of concerns for radioactive materials management and are not limited to threats posed only by Category 1 and 2 sealed sources. A number of Federal agencies have resources available to support local emergency operations when orphan radioactive sources are found.

Most reports of lost or stolen material involve small or short-lived radioactive sources that are not a significant risk to public health or useful for terrorist purposes. There is no trend in incidents of loss or theft that would suggest a pattern of collecting such sources for criminal uses. As a result, most reports of lost or stolen sources do not result in emergency response efforts.

A review of NRC and Agreement State data regarding the lost and stolen Category 1 and 2 sources between 1994 and 2005 indicates that there were 60 events involving loss or theft of risk-significant sources (70 percent were lost sources and 30 percent were stolen). This is an average of about 5 lost or stolen risk-significant sources per year. In approximately 80 percent of the events for the 12-year period, the sources were recovered. This results in an average of about one unrecovered source per year. Ninety-five percent of these lost and stolen sources were Ir-192 sources in radiography cameras that were lost/stolen primarily because of the licensee’s failure to meet requirements. Because of the short half-life of Ir-192 (74 days), these sources quickly decayed, and the current risk posed by these sources is negligible. NRC has established a performance goal of zero unrecovered risk-significant sources in any calendar year and NRC met that goal in 2005.

Although the number of risk-significant lost and stolen radioactive sources is very low, NRC takes each of these events very seriously. The NRC, in partnership with the Agreement State regulators, have enhanced the security and control measures for these sources, as a means of further reducing the number of lost and stolen sources. These measures have been put in place for all licensees throughout the United States. The NRC and the Agreement States are inspecting those licensees to verify compliance with these requirements.

The U.S. regulatory approach emphasizes accountability of the licensees in possession of the radioactive material, including radioactive sources defined under the EPAct. This regulatory approach is aimed at protecting public health and safety and national security. The existing regulatory framework requires licensees to secure and control radioactive material at all times to prevent or reduce the potential for lost or stolen sources. This framework also requires routine inventory checks to ensure early discovery of lost or stolen sources. Timely reporting is also required for lost or stolen sources so that recovery operations may be initiated as soon as possible. Federal, State, and local governments have always worked together to investigate and recover lost or stolen sources.

In addition, Federal agencies, by working cooperatively with States, have the capability to address a wide range of situations, including recovering excess or unwanted sealed sources of all categories, as well as addressing issues related to lost, stolen, abandoned, and missing sealed sources. Recovery of excess or unwanted sources is extremely important to the overall protection of public health and safety and the reduction of potential security threats. These programs address the full range of concerns for radioactive materials management and are not limited to risk-significant sources.

From 1999–2005, the DOE OSRP recovered 12,024 sealed sources comprised of six principal isotopes. Each year since 2002, the OSRP has recovered between 1,200 and 3,200 radioactive sources from the licensed sector. Very few of the sources requiring recovery are Category 1 or 2 sources. Approximately 2,000 sources are registered for recovery annually. The owners vary from individuals, small firms, or colleges having one source to large firms possessing hundreds of sources. The OSRP forecasts that it will recover 1960 sources in FY 2006.

The Task Force believes that the current recovery programs for lost or stolen radioactive sources of all categories are effective in protecting public health and safety and providing for security of these sources. Federal, States, local law enforcement, and the private sector should continue to work cooperatively and to communicate effectively in the recovery of lost or stolen sources.

Disposal (Chapter 9)

Disposition of risk-significant radioactive sources that have reached the end of their useful service lives and have no economic value to their current owner (or for various reasons do not have a readily identifiable owner) is an important consideration in ensuring the protection and security of this material. Current disposition programs cover a range of options, including storage, recycling, reconstitution, resale, and, as a final option, disposal as radioactive waste.

The ability to dispose of disused risk-significant radioactive sources in the United States depends on whether the source is a DOE source or sources resulting from certain Federal activities or if it is a commercial source subject to regulation by the NRC or Agreement States. DOE sources can be disposed of at certain DOE radioactive waste disposal facilities in

accordance with DOE policies and orders. Commercial sources (discrete radium and accelerator-produced isotope sources are included in this group) may face a somewhat more complex path to disposal. Three major factors affecting the disposal of commercial sources are (1) restrictions associated with the Low-Level Radioactive Waste Policy Amendments Act (LLRWPAA) of 1985, (2) waste classification requirements, and (3) cost.

The Task Force concludes that a number of challenges are associated with the disposal of commercial sources of all categories because of the limited number of available disposal facilities, the lack of options to dispose of all types of radioactive waste, and the high disposal costs. The GAO report to Congress entitled, "Low-Level Radioactive Waste Disposal Availability Adequate in the Short Term, but Oversight Needed to Identify Any Future Short Falls," issued June 2004 (GAO-04-604), addressed the potential shortfall in commercial low-level radioactive waste (LLRW) disposal capacity. The GAO report noted that the limitations imposed under the LLRWPAA further complicate the disposal issue and that legislative options may be necessary. The Task Force did not identify any immediate security concerns related to disposal of Category 1 and 2 sources that warrant revisiting the LLRWPAA. Disposal options for Category 1 and 2 sources are part of the bigger disposal picture. Since many of the risk-significant sources would be considered to be greater-than-Class C (GTCC) waste if disposed of, completion of DOE responsibilities for GTCC waste under the LLWRPAA will provide a disposal pathway for these sources.

Because not all Category 1 and 2 sealed sources are subject to current NRC financial assurance requirements and to ensure sufficient funds are set aside to properly disposition these sources at the end of their useful service, the Task Force recommends that NRC evaluate alternative financial assurance options. The evaluation should include a broadening of the financial assurance thresholds in 10 CFR Part 30.35, a source-specific surcharge for disposal, and a universal disposal surcharge on all licensees. The evaluation should consider impacts to the regulated community and implementation approaches (e.g., the need for legislation and regulation development), and it should involve stakeholders.

Import and Export Controls for Radioactive Sources (Chapter 10)

A key success for the United States in 2004 was adoption by the IAEA, of the nonlegally binding Guidance on the Import and Export of Radioactive Sources. The IAEA Guidance, which is supplemental to the nonlegally binding Code of Conduct, represents the first international guidance on controlling imports and exports of radioactive sources and an important step forward in preventing accidental use of sources or theft and diversion of materials potentially usable in a "dirty bomb." The United States played a leading role in developing, negotiating, and generating political momentum for the Guidance.

The United States not only took a leadership role in the development and wide acceptance of this international guidance, but it is also among the first countries to take these recommendations into account. In light of new concerns in the security environment after September 11, 2001, the United States has worked quickly to strengthen its controls on the import and export of risk-significant radioactive sources, taking into account the Code and the Guidance. The NRC, which maintains regulatory jurisdiction over the vast majority of commercial U.S. radioactive source transactions, has amended its 10 CFR Part 110, "Export and Import of Nuclear Equipment and Material," regulations to require specific import and export licenses for Category 1 and 2 quantities of radioactive material. The new rule requires notification of all Category 1 and 2 shipments, and the receipt of consent from the recipient country for Category 1 sources. It also requires licensees to verify that foreign companies

receiving their exports are authorized to use the source. Finally, it requires the NRC, in consultation with the Executive Branch, to consider whether the recipient country has adequate controls to safely and securely manage the sources. DOE has undertaken similar internal policy formulation to update its radioactive source import and export procedures. Both agencies will periodically review these policies and procedures to ensure appropriate and efficient implementation. These actions are consistent with the U.S. political commitment to the nonlegally binding Code of Conduct and serve as an example for other States working toward reflecting the Code and Guidance in their national law and regulations. The NRC and DOE will continue to work with other U.S. government agencies to ensure the responsible import and export of risk-significant radioactive sources, while not unduly burdening international commerce in these vital radioactive sources.

The National Source Tracking System (Chapter 11)

There is clearly broad U.S. Government and international interest in tracking risk-significant sources to improve accountability and control. The Task Force considers national source tracking to be part of a comprehensive radioactive source control program for risk-significant radioactive sources. Although a national source tracking system alone cannot guarantee the physical protection of radioactive sources, it can provide greater source accountability, which should foster increased control by licensees. A national source tracking system, in conjunction with other controls, will result in improved security and control for risk-significant radioactive sources.

The NRC, in conjunction with the States and DOE, is developing the NSTS to track IAEA Category 1 and 2 sources, plus three additional radionuclides of interest to DOE. In addition, NRC worked with other Federal agencies to develop the high level requirements for the NSTS. The system will provide information on source inventory and transaction tracking of source movement over the life cycle of that source. This information will support the Federal family in various activities (e.g., Customs and Border Patrol access to information on import/exports). This standardized, centralized information will assist Federal agencies and the States in monitoring the use and movement of risk-significant sources, in prioritizing and conducting inspections or investigations, in effective communication among the various agencies, in verifying legitimate ownership, and in analyzing potential hazards and security risks.

The NSTS is designed to be flexible and easily expanded to support the evolving needs of the U.S. Government. The NRC will publish the final rule establishing the regulatory foundation for the NSTS in August 2006. The agency expects to deploy the system in spring 2007.

Alternative Technologies (Chapter 12)

The use of alternative technologies can eliminate the use of a risk-significant source entirely, make it less dangerous as an RDD or RED source, or reduce the likelihood of its theft. For a number of applications, alternative technologies exist or are in development that could reduce the risk or impact of an accidental or terrorist use involving a radioactive source. In addition, future research in this area could yield even more viable alternative technologies. However, the ultimate success of all such efforts is unclear until a number of critical concerns are addressed. These concerns include incentives for adoption of alternatives, collaboration between Federal agencies, and disposition of displaced sources.

Section 651 of the EPAct requires that the NRC enter into an arrangement with the National Academy of Sciences (NAS) through which NAS will study industrial, research, and commercial

(including medical) uses of radioactive sources and will 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 NAS study will be available in 2007.

Additional effort is necessary before the Task Force can make an informed decision and make specific recommendations on which alternatives should be pursued, what type of incentives should be made available, etc. Therefore, the Task Force recommends that further study be conducted by the Alternative Technologies Subgroup to evaluate financial incentives, research needs for both alternative technologies and alternative designs, including financial support; and the cost versus the benefit of potential alternatives for Category 1 and 2 radioactive sources. These topics will be addressed in the next Task Force report.

A specific area of concern is the widespread use of cesium chloride (CsCl) in a highly dispersible form in certain devices. The Task Force recommends that high priority be given to conducting a study within 2 years to assess the feasibility of phasing out the use of CsCl in a highly dispersible form. This study should include consideration of the availability of alternative technologies for the scope of current uses, safe and secure disposal of existing material, and international safety and security implications. Any plan to phase out these sources should involve industry and consider not only alternatives for uses of these materials, but also how to compensate owners of these sources so that they do not find their way into environments where less rigorous controls are in place.

Conclusions, Recommendations, and Actions

The U.S. Government has been instrumental in working with other countries to develop international guidance on the safety and security of risk-significant radioactive sources. These efforts resulted in a major revision of the IAEA Code of Conduct and development of the Guidance on the Import and Export of Radioactive Sources, approved by the IAEA Board of Governors in 2003 and 2004, respectively. The U.S. Government has made a nonlegally binding political commitment to work toward following the Code and the Guidance.

The United States is actively working to achieve widespread implementation of the Code and Guidance, and has succeeded in obtaining political commitments from 83 countries and by Leaders of the G-8 (2003 Evian Summit, 2004 Sea Island Summit, and 2005 Gleneagles Summit), EU (2004 U.S.-EU Shannon Summit), Asia-Pacific Economic Cooperation (2005 APEC Leaders Statement), Organization for Security and Cooperation in Europe (2005 OSCE Plenary Meeting), and the three North American leaders in the Security and Prosperity Partnership. Such attention by world leaders reinforces the value of the Code and Guidance as international standards.

The Task Force found no significant gaps that are not already being addressed. However, the Task Force believes that the efforts underway in the international transport security area should be given a higher priority. The Task Force believes that the combination of direct regulations concerning source security and control, personnel protection regulations, guidance, orders, and inspection and enforcement provides reasonable assurance that the Category 1 and 2 sources in use and storage at NRC and Agreement State licensed facilities and at DOE facilities are safe and secure. The NRC and Agreement States will be conducting inspection of their licenses to verify compliance with the requirements. The additional near-term actions planned or underway (i.e., fingerprinting, verification of licenses, etc.) will further strengthen the regulatory controls. In

addition, the Task Force has made several recommendations that will enhance the overall security of risk-significant radioactive materials.

The Task Force found the review of programs and activities to be beneficial, providing a convenient means of sharing information that may not have been widely distributed. It provided an opportunity for members to better understand the activities being conducted by other agencies. It is important that this spirit of cooperation and coordination continue into the future. The Task Force has made a recommendation to continue the coordination of activities between interested stakeholders. To assist in this coordination effort, the Task Force plans to meet periodically to discuss topics of interest, receive updates on activities being conducted by the other agencies, and obtain status reports on the implementation of the recommendations and the actions listed in this report.

Summary of Recommendations and Actions

Tables ES.2 and ES.3 present the Task Force recommendations. The Task Force has made no effort to prioritize these actions. Instead, the tables divide the recommendations by type of action necessary to implement the recommendation—regulatory changes and other. Table ES.2 lists those recommendations that would require a policy, rule, or procedure change or development in order to implement. Table ES.3 includes recommendations that involve additional evaluation or study before a final recommendation can be made, as well as miscellaneous actions. At this time, the Task Force is not recommending any legislative changes that would require Congressional action to implement.

Table ES.2 Regulatory Change Recommendations

Recommendation 5-1	The Task Force recommends development of a Transport Security Memorandum of Understanding to serve as the foundation for cooperation in the establishment of a comprehensive and consistent transport security program for risk-significant sources.
Recommendation 5-3	The Task Force recommends that the U.S. Government immediately develop a strategy and take actions to address the security of international shipments of Category 1 and 2 radioactive sources that transit or are transshipped through the land territory of the United States.
Recommendation 9-2	The Task Force recommends that the NRC evaluate the financial assurance required for possession of Category 1 and 2 radioactive sources to assure that funding is available for final disposition of the sources.

Table ES.3 Other Recommendations

Recommendation 3-1	The Task Force recommends that the U.S. Government periodically reevaluate the list of radioactive sources that warrant enhanced security and protection to assess their adequacy in light of the evolving threat environment.
Recommendation 4-1	The Task Force recommends that there be a coordinated public education campaign (Federal, State, and industry)

	to reduce fears of radioactivity, diminish the impact of a radiological attack if one were to occur, and provide a deterrent to attackers considering the use of radiological materials.
Recommendation 4-2	The Task Force recommends that the Federal agencies and States continue efforts to improve coordination and communication of their ongoing activities in the area of radiation protection and security for Category 1 and 2 sources.
Recommendation 5-2	The Task Force recommends that the U.S. Government evaluate the feasibility of using new and existing technologies to detect and discourage the theft of risk-significant radioactive material during transport. The evaluation should include the findings of operational testing of existing technologies offering enhanced security of motor carrier shipments of hazardous material; shipment tracking, including communication systems; radiofrequency identification; vehicle disabling technologies; and mobile and stationary radiation detection systems.
Recommendation 9-1	The Task Force recommends that the U.S. Government further evaluate the waste disposal options as outlined in the GAO reports on LLRW.
Recommendation 12-1	The Task Force recommends that the Alternatives Technology Subgroup evaluate financial incentives; research needs for both alternative technologies and alternative designs, including financial support; and the cost-benefit of potential alternatives for Category 1 and 2 radioactive sources.
Recommendation 12-2	The Task Force recommends that high priority be given to conducting a study within 2 years to assess the feasibility of phasing out the use of CsCl in a highly dispersible form. This study should consider the availability of alternative technologies for the scope of current uses, safe and secure disposal of existing material, and international safety and security implications.

Various agencies also have a number of actions that are underway or planned in the near term. In addition, adequate information was not yet available to make a final conclusion or recommendation regarding certain areas. While it is important to complete these items, they do not rise to the level of a recommendation. The issues are already being addressed and should be completed and implemented before further changes are introduced. The agencies conducting the actions are encouraged to expeditiously complete them. Table ES.4 summarizes these actions.

Table ES.4 Actions

Action 3-1	The NRC should evaluate the need to reissue the Orders to the Manufacturing and Distribution Licensees to make sure no security

	issues have been introduced from the use of different units of radioactivity.
Action 3-2	The DOT should examine the use of the Code of Conduct Category 1 and 2 thresholds in domestic transportation regulations.
Action 4-1	The NRC should consider imposing additional measures to verify the validity of licenses, before transfer of risk-significant radioactive sources, on all licensees authorized to possess Category 1 and 2 quantities of radioactive material.
Action 5-1	The Transportation Security Subgroup should review the findings and conclusions of all research conducted on securing “high hazard” hazardous materials transport to determine if any of the measures should be applied to transport of risk-significant radioactive sources.
Action 5-2	DOT should evaluate the best practices from the high threat urban area corridor assessments to determine whether it should incorporate any of the best practices into the requirements for security plans for high-risk radioactive material. DOT should also evaluate whether transport of lower risk radioactive material warrants a security plan or whether the transport could be exempted from some of the requirements.
Action 6-1	The NRC should expeditiously complete its implementation of the fingerprinting provisions of the EPAct for those applicants for and licensees with Category 1 and 2 quantities of radioactive material. The NRC should place a high priority on completing the EPAct Section 652 rulemaking. As part of the rulemaking, the NRC should require fingerprinting for any individual who could have access to Category 2 or above quantities of radioactive materials. The NRC should also require periodic reinvestigations of such persons.
Action 6-2	The NRC should evaluate the feasibility of establishing a national database for materials licensees that would contain information on pending applications and information on individuals cleared for unescorted access.
Action 6-3	The NRC and DHS should enter into a memorandum of understanding to cover access to the SAVE database for materials licensees.
Action 7-1	The NRC should evaluate requiring licensees to review and document the reasons for storage of risk-significant sources longer than 24 months and the feasibility of establishing a maximum time limit on the long-term storage of risk-significant sources not in use.
Action 9-1	The DOE should continue its ongoing efforts to develop GTCC disposal capability.
Action 10-1	The U.S. Government should continue the efforts to promote international harmonization of import and export controls for Category 1 and 2 radioactive sources.
Action 10-2	The U.S. Government should encourage suppliers to provide arrangements for the return of disused sources and examine means to reduce regulatory impediments that currently make this option unavailable.
Action 10-3	The Task Force suggests the use of education and creation of incentives to discourage the export of used Category 1 and 2 radioactive sources as an alternative to disposal.

Action 10-4	The U.S. Government should improve interagency evaluation of recipient authorization and recipient country controls to prevent fraudulent acquisition of risk-significant sources exported from the United States.
Action 10-5	The NRC should consider reevaluating the need for a specific import license to allow the import of Category 1 and 2 radioactive sources to a U.S.-licensed user.
Action 11-1	The Task Force encourages the NSTS Interagency Coordinating Committee to develop a procedure/policy with guidelines on how to handle both Government and non-Government requests for information in the NSTS.
Action 11-2	The NRC should consider programming the NSTS to provide automatic daily information to Customs on import/export shipment notifications.
Action 11-3	The Task Force suggests that a comprehensive analysis be conducted on the inclusion of Category 3 sources in the NSTS.

Each agency on the Task Force will prepare an action (implementation) plan, as appropriate, addressing the recommendations and actions contained in this report that are within the purview of that agency, and present that plan to the Task Force for inclusion in an overall implementation plan. Action plans should include development of timelines for completion and address resources for implementation.

1 Introduction

The Energy Policy Act of 2005, hereafter called the EPAct, requires establishment of an interagency task force on radiation source protection and security under the lead of the U.S. Nuclear Regulatory Commission (NRC). The Task Force is to evaluate and provide recommendations to the President and Congress relating to the security of radiation sources in the United States from potential terrorist threats, including acts of sabotage, theft, or use of a radiation source in a radiological dispersal device (RDD). The EPAct named 12 Federal agencies to the Task Force and named the NRC Chairman (or his designee) as its chair.

The Task Force was to evaluate and make recommendations for possible regulatory and legislative changes on several specific topics related to the protection and security of radiation sources. For the purposes of the Task Force, the EPAct defines a radiation source as a "Category 1 Source or a Category 2 Source as defined in the Code of Conduct[3] and any other material that poses a threat such that the material is subject to this section, as determined by the Commission, by regulation, other than spent nuclear fuel and special nuclear material." Although the EPAct refers to radiation sources, the rest of this report uses the more common term radioactive sources to avoid confusion with electronic sources of radiation.

The Task Force is required to submit its reports to Congress and the President. The first report is to be submitted no later than August 8, 2006, with subsequent reports to be submitted not less than once every 4 years. The reports will update current Federal actions and recommendations for future actions to better protect and control radioactive sources.

1.1 Background

1.1.1 Understanding the Need to Protect and Secure Radioactive Sources

The events of September 11, 2001, heightened the Nation's concerns regarding the use of radioactive materials in a malevolent act. Such an attack has been of particular concern because of the widespread use of radioactive materials (often contained in sealed sources) in the United States and abroad by industry, hospitals, and academic institutions. Loss or theft of such materials could lead to their diversion for malicious use in an RDD or a radiological exposure device (RED). An RED is a device whose purpose is to expose people to radiation, rather than to disperse radioactive material into the air, as would an RDD. An RDD is a device or mechanism that is intended to spread radioactive material from the detonation of conventional explosives or other means. RDDs are considered weapons of mass disruption; few deaths would immediately occur from the event, but the resultant contamination could play on the public's fears and create mass panic. In addition, clean up of the contaminated area could take months with substantial economic impact. REDs may result in a few deaths, but would not cause widespread contamination.

In June 2002, the Secretary of Energy and the NRC Chairman met to discuss the adequate protection of inventories of nuclear materials that could be used in an RDD. At the June meeting, the Secretary of Energy and the NRC Chairman agreed to convene an Interagency

3 "Code of Conduct on the Safety and Security of Radioactive Sources," approved by the Board of Governors of the International Atomic Energy Agency and published January 2004.

Working Group on Radiological Dispersal Devices to address security concerns. In May 2003, the Department of Energy (DOE) and the NRC issued a joint report entitled, "Radiological Dispersal Devices: An Initial Study to Identify Radioactive Materials of Greatest Concern and Approaches to Their Tracking, Tagging, and Disposition," hereafter called the DOE/NRC RDD Report or RDD Report. This study contained a number of recommendations to provide a higher level of protection for radioactive materials. The NRC and DOE have been taking steps to implement the various recommendations contained in the report.

Even before September 11, 2001, the U.S. Government was involved in efforts to establish international guidance for the safety and security of radioactive sources. The International Atomic Energy Agency (IAEA) revised its nonlegally binding "Code of Conduct on the Safety and Security of Radioactive Sources," hereafter called the Code or Code of Conduct, during a series of international negotiations in 2002–2003 to better address security concerns and to enhance its effectiveness to prevent terrorists from obtaining radioactive material for malicious purposes, such as creating a "dirty bomb." The United States was a key player in these negotiations and in the development of the revised Code and was instrumental in revising the Code's categorization of sources to better align it with the threshold values provided in the DOE/NRC RDD report. In 2003, the IAEA Board of Governors approved the revised code, which was then unanimously endorsed by the General Conference.

The United States is actively working to encourage other countries worldwide to commit to following the guidance in the Code, and has succeeded in achieving political commitments from 83 countries, leaders of the G-8 (2003 Evian Summit, 2004 Sea Island Summit, and 2005 Gleneagles Summit), European Union (EU) (2004 U.S.-EU Shannon Summit), Asia Pacific Economic Cooperation (APEC) (2005 APEC Leaders Statement), Organization on Security Cooperation in Europe (OSCE) (2005 OSCE Plenary Meeting), and the three North American leaders in the Security and Prosperity Partnership. Such attention by world leaders reinforces the value of the Code as an international standard.

The U.S. Government has formally notified the Director General of the IAEA of its strong support for the current Code of Conduct. The U.S. Government has made a nonlegally binding political commitment to work toward following the guidance contained in the Code of Conduct. The Code contains basic principles that the IAEA believes are necessary for the safe and secure use of radioactive materials. It includes a set of guidelines, to be applied on a national basis, for effective cradle-to-grave control of sealed radioactive sources used in nonmilitary applications. Specifically, the Code states the following:

> The objectives of this Code, through the development, harmonization and implementation of national policies, laws and regulations, and through the fostering of international co-operation, to:
>
> (i) achieve and maintain a high level of safety and security of radioactive sources;
> (ii) prevent unauthorized access or damage to, and loss, theft or unauthorized transfer of, radioactive sources, so as to reduce the likelihood of accidental harmful exposure to such sources or the malicious use of such sources to cause harm to individuals, society or the environment; and
> (iii) mitigate or minimize the radiological consequences of any accident or malicious act involving a radioactive source

1.1.2 Understanding the Regulatory Framework for Radioactive Materials

Code of Conduct

One of the essential features of the Code of Conduct is the categorization of radioactive sources contained in Annex I of the Code. This categorization provides a recommended framework or methodology upon which countries worldwide may base their national regulatory infrastructures for radioactive sources. The Code of Conduct categorization lists 26 radionuclides and identifies three threshold activity levels for each, referred to as Categories 1, 2, and 3. Sixteen of these nuclides are commonly used in radioactive sources; the other 10 are unlikely to be used in individual sealed sources at Category 1 or Category 2 levels. The categorization is based on D-values that define a dangerous source (a source that could, if not under control, give rise to exposure sufficient to cause severe deterministic effects (i.e., an effect that is fatal or life threatening or results in a permanent injury that reduces the quality of life)). Category 1 and Category 2 sources are considered to be risk-significant sources. IAEA Safety Guide No. RS-G-1.9, "Categorization of Radioactive Sources," issued August 2005, details the underlying methodology for the categorization. While the Safety Guide contains five categories, the Code of Conduct focuses on three. The Code of Conduct defines Category 1, 2, and 3 sources as follows:

> Category 1 sources, if not safely managed or securely protected would be likely to cause permanent injury to a person who handled them, or were otherwise in contact with them, for more than a few minutes. It would probably be fatal to be close to this amount of unshielded material for a period of a few minutes to an hour. These sources are typically used in practices such as radiothermal generators, irradiators and radiation teletherapy.
>
> Category 2 sources, if not safely managed or securely protected, could cause permanent injury to a person who handled them, or were otherwise in contact with them, for a short time (minutes to hours). It could possibly be fatal to be close to this amount of unshielded radioactive material for a period of hours to days. These sources are typically used in practices such as industrial gamma radiography, high dose rate brachytherapy and medium dose rate brachytherapy.
>
> Category 3 sources, if not safely managed or securely protected, could cause permanent injury to a person who handled them, or were otherwise in contact with them, for some hours. It could possibly—although it is unlikely—be fatal to be close to this amount of unshielded radioactive material for a period of days to weeks. These sources are typically used in practices such as fixed industrial gauges involving high activity sources (for example, level gauges, dredger gauges, conveyor gauges, and spinning pipe gauges) and well logging devices.

The Code encourages countries to devote appropriate attention to the regulation of other potentially harmful radioactive sources. The Code also encourages countries to give appropriate attention to radioactive sources they consider to have the potential to cause unacceptable consequences if employed for malicious purposes and to aggregations of lower activity sources that require management under the principles of the Code.

The U.S. Government has been working towards following the Code of Conduct. Within the United States, the Code of Conduct categorization is substantially consistent with the DOE/NRC RDD Report and is being utilized as the basis for the following activities:

- the national tracking of risk-significant radioactive sources
- national export controls for radioactive sources
- NRC security orders issued to risk-significant radioactive source licensees
- A national strategy for orphan source recovery

Unless otherwise noted, throughout this report the terms Category 1 and Category 2 sources refer to the 16 radionuclides listed in Annex I of the Code of Conduct at or above the Category 1 or Category 2 threshold, respectively. Category 1 or Category 2 quantities of radioactive material refers to aggregated radioactive material that meets or exceeds the Category 1 or Category 2 thresholds in the Code of Conduct. The aggregated material may include sources smaller than Category 2. The term risk-significant sources refers to Category 1 and Category 2 sources, while the term risk-significant quantities of radioactive material refers to aggregated radioactive material that meets or exceeds the Category 1 or Category 2 thresholds in the Code of Conduct.

Regulatory Structure

The Atomic Energy Act (AEA) of 1954, as amended, gives responsibility and authority for the control of special nuclear material, source material, and byproduct material to the NRC and DOE. Commercial applications of radioactive materials are regulated by the NRC directly or by Agreement State regulating authorities.

The AEA provides the NRC with the authority to enter into agreements with the States to regulate radioactive material. Section 274b of the AEA allows the Commission to discontinue its exercise of Federal authority over certain radioactive materials (including Category 1 and Category 2 sources) and certain activities in a State if three conditions are met. First, the State must have laws, regulations, and safety standards compatible with those of the NRC. Second, the State must have a regulatory program that provides a comparable degree of protection to the public health and safety as does the NRC program. Third, the Governor, on behalf of the State, must enter into a formal agreement with the NRC to assume regulatory responsibility over the materials. Those States that enter these formal agreements are known as Agreement States. Through the Agreement State Program, 34 States have signed formal agreements with the NRC, thereby assuming regulatory responsibility over certain byproduct, source, and small quantities of special nuclear material. Note that under the agreement, a State does not enforce Federal requirements on behalf of the NRC; rather, the State regulates the materials under its own authority. The NRC retains authority over the export of materials from and import of materials into the United States and matters related to common defense and security.

The NRC and Agreement States regulate radioactive material through the issuance of general or specific licenses to receive title to, own, acquire, deliver, receive, possess, use, export (NRC only), import (NRC only), or transfer such material. Certain concentrations and quantities of radioactive material are exempt from the regulations and do not require a license to possess. A general license grants authority to a person for certain activities involving a device containing byproduct material without filing an application for a specific license. The particular general license may require registration with the NRC or an Agreement State. A generally licensed device usually consists of radioactive material contained in a sealed source within a shielded device. The design of the device incorporates inherent radiation safety features so persons with

no radiation training or experience can use it. The general license simplifies the licensing process of each user and eliminates the need for a case-by-case determination of the adequacy of the radiation training or experience of each user. The NRC evaluates the adequacy of generally licensed products. All other uses of radioactive material require the issuance of a specific license. A company that wishes to obtain a license to use nuclear materials must submit an application that demonstrates how the use of these materials will meet the safety and security requirements in the regulations. Applicants must provide information on the type, form, and intended quantity of material, available facilities, qualifications of users, and radiation protection programs. The NRC or the Agreement State reviews the application according to procedures and criteria. If the NRC or the Agreement State approves the application, it issues a license. The license may contain additional conditions.

The NRC and Agreement State regulatory programs are designed to assure that licensees safely use radioactive materials and do not endanger public health and safety, cause damage to the environment, or endanger the common defense and security. Both the NRC and the Agreement States issue regulations that establish the requirements licensees must meet to obtain or retain a license or certificate to use radioactive materials or operate a nuclear facility. Both the NRC and the Agreement States have oversight programs that include inspections of licensee activities to ensure that licensees meet regulatory requirements. Both NRC and the Agreement States can issue enforcement actions when they identify violations of requirements. Enforcement may include notices of violation, monetary fines (called civil penalties), or orders to modify, suspend, or revoke a license. When this report references an NRC regulation, it is intended to include the NRC and equivalent Agreement State regulation.

DOE regulates activities undertaken by it or on its behalf. In addition, DOE is responsible for promoting common defense and security, conducting research and development, and other activities to support the use of byproduct, source, and special nuclear materials for medical, biological, health, and other uses in assuring public health and safety in accordance with Section 102(13) of the DOE Organization Act, as amended. The Environmental Protection Agency (EPA) regulates orphan radioactive material of unknown origin, unlicensed radioactive material, or material for which the current or former license holder is not financially viable or otherwise unable to control the material. The Department of Transportation (DOT) and the NRC share oversight responsibility for the transportation of radioactive material subject to their jurisdiction. Other regulating agencies include the U.S. Coast Guard (USCG), which has regulatory oversight for radioactive sources that are shipped as hazardous material in U.S. waters.

The Department of Homeland Security (DHS) implements the national critical infrastructure protection program to protect the Nation's critical infrastructure/key resources. Homeland Security Presidential Directive 7 (HSPD-7), "Critical Infrastructure Identification, Prioritization, and Protection," issued December 2003, provides overall guidance for developing and implementing this national program. HSPD-7 requires the development of the National Infrastructure Protection Plan (NIPP) to provide an overall framework for infrastructure protection. The NIPP partitions the critical infrastructure and key assets into areas of national concern and requires demonstration of compliance through the development of sector-specific plans. The sector-specific plans contain a detailed description of the specific processes used to identify, assess, prioritize, and protect critical infrastructure/key resources; processes used to measure effectiveness; the plans for implementing these processes, and the status of any efforts being conducted to support the effort.

HSPD-7 also assigned responsibility for the protection of critical infrastructure and key resources within each sector to Sector-Specific Agencies. DHS is the Sector-Specific Agency for the Nuclear Reactors, Materials, and Waste Sector. Within DHS, the Chemical and Nuclear Preparedness and Protection Division has been assigned the responsibilities for critical infrastructure/key resources protection of the Nuclear Sector. The Nuclear Reactor, Materials and Waste Site Specific Plan is currently in development and includes the activities to protect against the theft of certain risk-significant sources used in the medical and industrial fields that could lead to the production and terrorist use of RDDs and REDs. The Secretary of DHS is working with the NRC and DOE to ensure the necessary protection of the assets described in this sector, including nuclear reactors, materials, and wastes. This Nuclear Sector Specific Plan also describes the interrelationships of the entities in the nuclear sector that have a role in reducing the risk of an RDD event. Along with DHS, DOE, and the NRC, other Federal agencies, including DOT, the Department of Health and Human Services (HHS), the Department of Justice (DOJ), the Federal Bureau of Investigation (FBI), the Department of State (DOS), EPA, the Food and Drug Administration (FDA), the Occupational Safety and Health Administration (OSHA), DOD, and the intelligence community carry out cooperative interagency activities.

As noted above, several U.S. Government agencies have authority, sometimes overlapping authorities, to regulate radioactive materials. The U.S. Government, States, and the private and public sectors are working to address a broad range of issues for reducing the risk from the malevolent uses of radioactive material. The challenge is to reduce the risk in a consistent manner, across multijurisdictional authorities. Both the NRC and DOE establish and oversee security measures for the civilian and certain defense nuclear facilities and materials users, respectively. These agencies regularly coordinate with the intelligence community and Federal law enforcement organizations to review and assess threat information and incorporate a graded threat concept into their security programs.

The Task Force will build on these domestic and international activities as it responds to specific topics the EPAct mandates. Table 1.1 provides a pointer to the chapter that discusses each topic.

The report recommends additional protection strategies for radioactive sources. The report also includes a number of items for agency action that do not warrant a recommendation at this time. These include actions that the specified agency can implement on its own or activities that are underway or planned and need to be implemented before further change is suggested.

Table 1.1 Energy Policy Act Topics

Topic	Chapter Number
The list of sources requiring security based on potential attractiveness of the source to terrorists and criminals and the extent of the threat to public health and safety	3
The national system for recovery of lost or stolen sources	8
Storage of radioactive sources	7
The National Source Tracking System	11
A national system (including user fees and other methods) to provide for the proper disposal of sources	9
Import[4] and export controls on sources to ensure that foreign and U.S. recipients of sources are able and willing to adequately control sources	10
Alternative technologies available that may perform some or all of the functions performed by devices or processes that employ radioactive sources and appropriate regulations and incentives for the replacement of the devices and processes with alternative technologies or with sources that would pose a lower risk to public health and safety	12
Procedures for improving the security of use, transportation, and storage of sources, including the inspection program; security measures; fines, background checks for individuals with access to radioactive sources; exchange of information on background checks; physical security of facilities that contain radioactive sources; and the screening of shipments to facilities to ensure that the shipments do not contain explosives	4 (security and control) 5 (transportation) 6 (background checks) 7 (storage)

1.2 Overview of Task Force Activities

As Chair of the Task Force, the NRC sent invitation letters in early October 2005 to the various agencies named in the EPAct. The NRC also invited HHS and the Office of Science and Technology Policy (OSTP) to participate on the Task Force. The Task Force held its first meeting on November 30, 2005. The Task Force developed a charter (Appendix C to this report) and a schedule for the first report and determined the scope of the effort for the first report. To complete the activities required by the EPAct, the Task Force formed subgroups to evaluate each of the topics specified in the EPAct. The subgroups evaluated the various subjects and reported back to the Task Force.

4 The EPAct only requires the Task Force to address the export of radioactive sources. The Task Force decided to also address import.

The Task Force comprises representatives of the NRC, DHS, DOD, DOE, DOT, DOJ, DOS, Office of the Director of National Intelligence (ODNI), Central Intelligence Agency (CIA), Federal Emergency Management Agency (FEMA), FBI, EPA, OSTP, HHS, and FDA. The Task Force also has a nonvoting member representing the Organization of Agreement States/Conference of Radiation Control Program Directors (OAS/CRCPD). Appendix C provides current membership for the Task Force and each of the subgroups.

1.3 Stakeholder Interactions

During the evaluation of the programs, the EPAct requires the Task Force to consult with Federal, State, and local agencies; the CRCPD; and the OAS. The EPAct also requires the Task Force to provide public notice of its activities, as well as an opportunity for public comment.

The Task Force issued a notice in the *Federal Register* (FR) to solicit public comment on its activities. The notice, which was published on January 10, 2006 (71 FR 1776), provided a 30-day comment period. The agency received 22 comment letters; Appendix E summarizes the comments. As part of its consultation process, the Task Force also held a facilitated, closed meeting on January 31, 2006, with selected stakeholders to discuss and solicit input on the major issues related to the protection and security of sources. Stakeholders included representatives of CRCPD, OAS, the California Department of Homeland Security, and the Los Angeles Police Department.

An OAS/CRCPD representative participated in the Task Force meetings as a nonvoting member, and each subgroup was assigned a State representative as a nonvoting member. Each chapter of this report discusses additional stakeholder interactions, as appropriate.

1.4 Report Layout

This report addresses the broad areas defined in the EPAct. Chapter 2 provides information on radioactive source use. The other chapters correspond to a topic specified in the EPAct. Each chapter summarizes the current practice or program related to the topic, along with any recommendations or actions for enhancement. The recommendations are the major findings of the Task Force. Adequate information to make a final conclusion or recommendation was not yet available for some areas; in these instances, the Task Force recommends further evaluation. The actions are related to activities that are underway or planned for the near term. While it is important that these items be completed, they do not rise to the level of a recommendation at this time. The issues are already being addressed and should be completed and implemented before further changes are introduced. Chapter 13 of this report summarizes the Task Force's recommendations and actions.

2 Radiation Source Usage

Radioactive sources provide critical capabilities in the oil and gas, electrical power, construction, and food industries. They are used to treat millions of patients each year in diagnostic and therapeutic procedures and are also used in a variety of military applications. In addition, academic, government, and private institutions use radioactive sources in technology research and development. These materials are as diverse in geographical location as they are in functional use.

There are millions of radioactive sources in the United States and tens of thousands of authorized users (licensees). The amount of radioactive material authorized for use varies from one one-millionth of a curie to millions of curies (i.e., sources used in large irradiators). However, only a small fraction (approximately 44,000) of these radioactive materials possessed by approximately 1,400 NRC and Agreement State licensees are considered risk significant (i.e., Category 1 or 2 sources) for security and control reasons. Category 1 and 2 sources are typically used in devices. DOE controls approximately 2300 risk-significant sources at 25 locations. The following sections identify the major uses of risk-significant radioactive sources based on an analysis of the NRC Fiscal Year (FY) 2005 Interim Inventory (hereafter referred to as the Interim Inventory) and the DOE 2005 Data Call[5].

2.1 IAEA Code of Conduct Use Categories

The Code of Conduct categorization lists 26 radionuclides and identifies three threshold activity levels for each, referred to as Categories 1, 2, and 3. IAEA Safety Guide, RS-G-1.9 provides the basis for determining the categories for each radionuclide and was used in the preparation of the Code of Conduct. RS-G-1.9 has five categories of material; the Code of Conduct only addresses the first three. Table 2.1 lists major uses in the order of typical radioactivity. RS-G-1.9 assigns a category to each use; however, the actual category assignment for the use depends on the actual radioactivity of the source within the device. The table is divided roughly in thirds to show where the IAEA divisions occur. Table 2.1 also lists the part of the *Code of Federal Regulations* (CFR) by which the NRC regulates the use in commercial and non-DOE Federal facilities and the approximate number of devices reported to the NRC in the Interim Inventory of Category 1 and 2 sources.

The Task Force organized the description of uses by their assigned use. The Task Force and the Interim Inventory focus on Category 1 and 2 sources. If a use is known to generally employ Category 3 sources, it is listed in the table, but is not discussed further.

5 The NRC and DOE have surveyed the owners of Category 1 or 2 sources to understand the number, models, and uses of sources. The Task Force analyzed the 2005 survey, known as the Interim Inventory for NRC and the Data Call for DOE, in developing this report.

Table 2.1 IAEA Category 1–3 Common Uses

	Use Type	10 CFR Part	Device Count	Comment
Category 1	Sterilization Irradiator Co-60	36	52	
	Sterilization Irradiator Cs-137	36	1	
	Self-Shielded Irradiator Co-60	36	139	
	Gamma-Knife Co-60	35	85	
	Self-Shielded Irradiator Cs-137	35	462	
	Teletherapy Co-60	35	70	
	Blood Irradiator Co-60	35	21	
	Blood Irradiator Cs-137	35	415	
	Radioisotope Thermoelectric Generator Sr-90	30	34	
	Teletherapy Cs-137	35	2	
	Radioisotope Thermoelectric Generator Pu-238	70	0	Only used by NASA, built as needed.
Category 2	Individual Radiography Co-60	34	228	
	Individual Radiography Ir-192	34	1884	
	Calibration source Co-60	30	0	None reported in the U.S.
	Calibration source Cs-137	30	0	None reported in the U.S.
	Individual Radiography Se-75	34	4	
	H/M Dose Rate Brachytherapy Co-60	35	0	Typically Category 3 in the U.S.
	H/M Dose Rate Brachytherapy Ir-192	35	0	Typically Category 3 in the U.S.
	H/M Dose Rate Brachytherapy Cs-137	35	0	Typically Category 3 in the U.S.
	Individual Radiography Yb-169	34	0	None reported in the U.S.
	Individual Radiography Tm-170	34	0	None reported in the U.S.
	Individual Radiography Cs-137 (added to list)	34	13	
Category 3	Well Logging Am-241/Be	39	285	
	Level Gauges Co-60	30	n/a	Typically Category 3 in the U.S.
	Calibration Source Am-241	30	3	
	Level Gauges Cs-137	30	n/a	Typically Category 3 in the U.S.
	Pacemakers Pu-238	35/70	n/a	Typically Category 3 in the U.S.
	Calibration Source Pu-239/Be	30/70	1	

	Use Type	10 CFR Part	Device Count	Comment
	Blast Furnace Gauges Co-60	30	n/a	Typically Category 3 in the U.S.
	Research Reactor Startup Sources Am-241/Be	50	5	Typically Category 3 in the U.S.
	Conveyor Gauges Cs-137	30	n/a	Typically Category 3 in the U.S.
	Dredger Gauges Co-60	30	n/a	Typically Category 3 in the U.S.
	Dredger Gauges Cs-137	30	n/a	Typically Category 3 in the U.S.
	Spinning Pipe Gauges Cs-137	30	n/a	Typically Category 3 in the U.S.
	Well Logging Cs-137	39	n/a	Typically Category 3 in the U.S.
	H/M Dose Rate Brachytherapy Co-60	35	0	Typically Category 3 in the U.S.
	H/M Dose Rate Brachytherapy Ir-192	35	0	Typically Category 3 in the U.S.
	H/M Dose Rate Brachytherapy Cs-137	35	0	Typically Category 3 in the U.S.

2.2 Panoramic and Underwater Irradiator

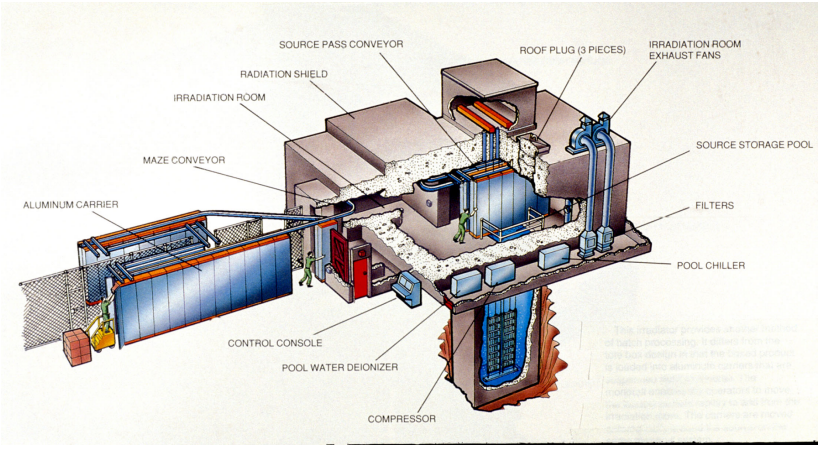

Figure 2.1 Commercial Irradiator

These facilities irradiate medical items, spices, consumer goods, scientific laboratory equipment, or food items. By definition, a panoramic irradiator is large enough that the volume being irradiated can accommodate an individual. They typically have large quantities of sources in order to minimize irradiation times. To provide adequate shielding, most panoramic irradiators store their sources in a water pool and have large concrete walls. The walls form a labyrinth of access paths to the irradiated volume to avoid direct exposure to the source by streaming. The product to be irradiated also follows an elaborate path to the irradiation volume. As a result, these irradiators occupy a full building. The shielding pool is about 18–20 feet deep and approximately 6–8 feet across. Because the sources are stored in a pool, these facilities are referred to as wet, panoramic irradiators. Fifty-two wet, panoramic irradiators exist In the United States, all of which use cobalt (Co)-60. There is also one dry, panoramic irradiator that uses cesium (Cs)-137. A review of the Interim Inventory indicates that the range of reported total activity present at these types of facilities is from 9,000 to 18,000,000 curies (Ci). Because of the relatively short half-life of Co-60, owners of these facilities replace a fraction of the sources on a regular schedule.

The Co-60 is contained in individual pencils that can vary in activity depending on the age of the pencil. Some new pencils may have an activity as high as 14,000 to 17,000 Ci and are considered Category 1 sources. Source racks located in the shielding pond contain the pencils. The shielding pool is about 18–20 feet deep and approximately 6–8 feet across.

Typical irradiators use a conveyor system. The product arrives already packaged for distribution. Workers place these boxes in carriers and then place the carriers onto the conveyor. The conveyor system carries the product into the chamber for the specified irradiation time. The source racks are lifted from the pool to irradiate the items. A plant processes around 1,000 totes per day. A specific computer code, which depends on the product to be irradiated, controls the radiation dose. The bar code reader will shut the system down if a product code does not match or if the box weight is not consistent with the programmed data. Some designs leave the sources in the pool. In these facilities, workers load the product into a watertight bell that is lowered into the pool to irradiate the items.

2.3 Self-Shielded Irradiators

This group includes all dry, self-shielded irradiators. Blood and tissue irradiators generally use Co-60 or Cs-137 sources. The Cs-137 sources typically range in strength from 100 to 12,000 Ci. The Co-60 sources typically range from 200 to 24,000 Ci. These activities cross the Category 2 to Category 1 range. A review of the Interim Inventory suggests that the reported amounts of radioactive material for the majority of self-shielded irradiators (including blood and tissue irradiators) range from 1,000 to 10,000 Ci, with a maximum of 13,000 Ci.

Figure 2.2 Self-Shielded Irradiator

The irradiator weighs approximately 2,500 to 6,000 pounds and is about the size of a medium-sized home refrigerator. The source is sealed inside the machine and can be replaced if returned to the manufacturer, though this is rarely necessary for Cs-137 sources.

<u>Calibration Irradiator</u>
This irradiator typically weighs approximately 1,800 pounds and contains a Cs-137 source of about 400 to 2,000 Ci. These are Category 2 sources. The irradiator is about the size of a family water heater and is used to provide an accurate, uniform delivery of a well-quantified dose to the target. The primary targets are radiation dosimeters that must be exposed to known radiation levels and checked to ensure accuracy.

2.4 Gamma-Knives

A gamma-knife unit is used for stereotactic radiosurgery in the treatment of brain anomalies, including cancer. The unit has 201 double-encapsulated stationary Co-60 pencils (approximately 30 to 33 Ci each (Category 2 sources), with a total of 6,000 to 6,600 Ci) located

in a hemispherical central shield body. The gamma-knife allows the technician to aim the individual radiation beams so that they converge on a single point, concentrating the radiation damage on the target and causing minimal damage to the surrounding tissue. The 201 Co-60 pencils must be replaced every 5 to 8 years. There are 85 gamma-knives in the United States, and all use Co-60.

The Co-60 pencils are enclosed within a hemispherical shield body that weighs approximately 20 tons. The shield enclosure is a cube of about 5 feet per edge. The pencils can be removed if the shield body is disassembled. There is a shield door at the front of the machine that opens while the machine is in operation. The patient is slid onto the table automatically when the machine is put into operation, and the shield doors rise to allow patient exposure. The Co-60 pencils cannot be physically removed from the unit through this path.

Figure 2.3 Gamma-Knife Device

2.5 Teletherapy

Teletherapy devices are used in cancer treatment for both humans and animals. The physical dimensions of the source are relatively small, with a cylindrical (a few centimeters in diameter by several centimeters long) shape. They typically use either Co-60 or Cs-137. The range of Co-60 source strengths is typically from 1,000 to 15,000 Ci (Category 1 source), and the Cs-137 source strengths range from 500 to 1,500 Ci (Category 2 source). The device is about 6 to 7 feet tall, 6 feet deep, and 4 feet wide and weighs several thousand pounds. A shielded head section weighing several hundred pounds can be removed for source changeout.

2.6 Radioisotope Thermoelectric Generators

Radioisotope thermoelectric generators (RTGs) are used as power sources in remote or inaccessible areas. Thermoelectric converters convert heat generated by the radioactive decay of the high activity sources to electricity. These devices are used primarily for military purposes and space exploration. Only the U.S. Navy and Air Force have licenses to possess RTGs. These RTGs are approximately cube shaped, with edges about 4 to 5 feet in length, and weigh thousands of pounds. They all use strontium (Sr)-90 and range in activity from 3,000 Ci (Category 2) to 100,000 Ci (Category 1).

NASA uses RTGs containing plutonium (Pu)-238 in space missions. Pu-238 requires less shielding (weight) and provides the greater power density needed for long-range space flight. A DOE laboratory built the most recently used RTGs and delivered them to NASA shortly before the mission. These RTGs, which are now in space, are about 4 feet long, less than 2 feet in diameter, and weigh about 150 pounds. They contain about 24 pounds (180,000 Ci or Category 1) of Pu-238.

2.7 Radiography

Industrial radiography sources and devices (most often called cameras) are generally small in terms of physical size, although the devices are usually heavy because of the shielding contained in them. The sources themselves are very small, less than 1 centimeter in diameter and only a few centimeters long, and are usually attached to specially designed cables for their proper operation. In the United States, industrial radiography devices generally use iridium (Ir)-192, Co-60, Cs-137, or selenium (Se)-75 sources, all of which are at the Category 2 level. The most common individual device uses an Ir-192 source with a typical strength in the range of 20 to 150 Ci, but the strength of the source can be as high as 240 to 500 Ci. These cameras are about the size of a personal tool box and weigh about 55 pounds. Co-60 source strengths range from 11 to 200 Ci. Cobalt cameras are the size of a small foot locker and weigh several hundred pounds.

Figure 2-4 Radiography Camera

A review of the NRC licenses involving multiple cameras indicates that the total licensed amounts of Ir-192 range from approximately 100 to 14,000 Ci. The amount of Co-60 ranges from approximately 30 to 3,000 Ci and the amount of Cs-137 is generally less than 500 Ci. Radiography licensees range from small operations with a single camera to large facilities with multiple cameras. They may conduct field operations or in-house exposure operations.

2.8 Well-Logging

Well-logging sources and devices are generally found in areas where exploration for minerals, such as coal, oil, or natural gas, is occurring. The typical well-logging licensee using Category 2 sources conducts cased-hole well-logging and tracer operations at temporary field sites throughout its business area. A well logger may have one to several well-logging sources. Sources are about 4 to 5 inches long and 1 inch in diameter. The sources are usually contained in long (1 to 2 meters), but thin (less than 10 centimeters in diameter) devices that also contain detectors and various electronic components. The actual size of the sources inside the

Figure 2.5 Well-Logging Source and its Pressure Vessel

devices is generally small. The devices are heavy because of the ruggedness needed for the environments in which they are used. The individual source strengths typically range from 270 millicuries (mCi) to 23 Ci. Typically, a facility will not receive new sources very often because of the long half-life of americium (Am)-241. (Am-241 is the primary radioactive source for tools. Other smaller sources and tracer isotopes are also used.)

Well-logging facilities using Am-241/beryllium (Be) are licensed to possess between 50 mCi to 650 Ci of Am-241. The majority of the licensees have less than 10 Ci of material. Only sources of at least 16 Ci are Category 2, thus only a fraction of well loggers have a risk-significant source. However, newer well-logging techniques require sources of higher activities, resulting in a shift in the industry from Category 3 and 4 sources to Category 2 sources.

2.9 Source Manufacture

Foreign countries produce most radioactive sources, which are then imported into the United States. For example, MDS Nordion in Canada produces approximately 80 percent of the world's supply of cobalt for use in medical devices and the food industry. Gamma irradiation is used to destroy harmful microorganisms in medical supplies, consumer goods, and some foods. REVISS (Russian/English Venture in Isotope Supply Services) produces Co-60, Cs-137, and Sr-90 sources for industrial radiation processing, bulk radioisotopes for radiochemical research, and sealed radioactive sources for applications in the broader business of radiation technology, including cancer therapy, imaging, spectroscopy, oil well-logging, industrial gauging, and nondestructive testing. Argentina, Australia, Germany, Hungary, India, Russia, South Africa, and the United Kingdom also have source manufacturing programs.

However, radioactive sources are manufactured and distributed in the United States. Fewer than 80 manufacturing and distribution licensees in the United States possess Category 1 or 2 quantities of radioactive materials. Facilities can vary greatly in size and complexity of operations and are highly dependent on the type of sources and devices involved in the business. Many other licensees, as well as the licensees in this group, manufacture and distribute sources containing less than Category 2 sources.

The NRC licensing database indicates that the licensed amount of Cs-137 and Am-241 at manufacturing facilities ranges from less than 1 to 54,000 Ci. The majority of the facilities are licensed for less than 1000 Ci. The five radionuclides most commonly distributed in the United States are Co-60, Cs-137, Ir-192, Am-241, and Sr-90. However, Sr-90 is usually distributed in very small quantities and rarely is there a Category 2 quantity. The manufacturers and distributors of the remaining four radionuclides distribute to the licensees discussed in this chapter. For example, well-logging facilities typically use Cs-137 and Am-241/Be sources. The individual source strengths typically range from 270 mCi to 23 Ci. The source strengths for industrial gauges of many designs are generally small (1 mCi to 50 Ci) of Am-241 or Cs-137. Cs-137 is also the primary radionuclide used in self-shielded irradiators, including blood irradiators, with typical strengths from 27 to 47,000 Ci. Co-60 is primarily produced for gamma-knife and large, pool irradiators, with some radiography or teletherapy use production. These sources can range from 10 to 15,000 Ci. Ir-192 is produced for radiography use with source strengths from 22 to 150 Ci.

DOE provides radioactive and stable isotope products and associated services to many domestic and international customers. Most stable isotopes DOE distributes are sold from existing inventories. Radioisotopes are either domestically produced at reactor and accelerator

facilities located at the national laboratories or imported from abroad for additional chemical processing and distribution. Research facilities and industry use these radioisotopes for a variety of purposes, such as tungsten (W)-188 for cancer research, germanium (Ge)-68 for equipment calibration, californium (Cf)-252 for reactor start-up fuel, and nickel (Ni)-63 for explosives detection.

3 Radioactive Source Lists

3.1 Background

Many agencies have developed lists of radionuclides (and associated thresholds) for various purposes in order to implement their programs. Some of the lists identify the sources that require security based on their potential attractiveness for malevolent use and the extent of the threat to public health and safety. The Task Force has gathered those source lists for evaluation and comparison to determine whether agencies are being consistent in their approaches to protecting these sources or if change may be warranted. To determine whether new sources should be included or others excluded, the Task Force considered the radioactive source activity levels, radioactive half-life, dispersibility, chemical and physical form, the availability of the sources to physicians and patients for medical treatment, and international guidance.

The United States has made a political commitment to work toward following the Code of Conduct and its non-binding set of national guidelines for effective cradle-to-grave control of sealed radioactive sources used in nonmilitary applications. Consequently, the Task Force used the Code of Conduct as its base document in evaluating the source lists.

3.2 Radioactive Source Lists

The Task Force reviewed available information on lists of radioactive sources that have been established by Government agencies for security or safety-related purposes. The following sections discuss the various programs and lists, along with their purpose.

3.2.1 IAEA Code of Conduct

The Code of Conduct categorization lists 26 radionuclides and identifies three threshold activity levels for each, referred to as Categories 1, 2, and 3. Table 3.1 contains the Code of Conduct list of radionuclides. Sixteen of these nuclides are identified as those commonly used in radioactive sources; the other 10 are unlikely to be used in individual sealed sources at Category 1 or 2 levels. The categorization is based on D-values, which define a dangerous source (a source that could, if not under control, give rise to exposure sufficient to cause severe deterministic effects (i.e., an effect that is fatal or life threatening or results in a permanent injury that reduces the quality of life)).

The Code of Conduct lists isotopes and threshold quantities for a narrow subset of isotopes based on their potential to cause injury or be employed for malicious use. In developing the Code of Conduct, IAEA aimed to achieve and maintain a high level of safety and security of radioactive sources by preventing unauthorized access or damage to, and loss, theft, or unauthorized transfer of, radioactive sources. The Code provisions are designed to reduce the likelihood of accidental harmful exposure to such sources or the malicious use of such sources to cause harm to individuals, society, or the environment.

Table 3.1 Code of Conduct Sources (Annex I of the Code)

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/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+02	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

* These radionuclides are very unlikely to be used in individual radioactive sources with activity levels that would place them within Categories 1, 2, or 3 and would therefore not be subject to the paragraph relating to national registries (11) or the paragraphs relating to import and export control (23 to 26).
a. The primary values to be used are given in terrabecquerels (TBq). Curie values are provided for practical usefulness and are rounded after conversion.

The U.S. Government has made a political commitment to work toward following the guidance contained in the Code of Conduct. Therefore, the Task Force compared the source list for each Federal program against the 16 radionuclides in the Code of Conduct list at the Category 1 and Category 2 levels.

3.2.2 DOE Radiological Threat Reduction Program

For international radiological threat reduction (RTR) purposes, DOE has developed a list of sources of concern. The DOE National Nuclear Security Administration (NNSA), International Radiological Threat Reduction Program (IRTR), seeks to accelerate securing and/or removing vulnerable radiological material throughout the world by performing physical security upgrades at vulnerable sites possessing high-risk radioactive sources. IRTR also supports international partners in developing the national infrastructure to institutionalize maintenance and continued operation of upgraded systems.

The NNSA identified 10 radionuclides of concern (i.e., those suitable for use in an RDD) to target as part of its IRTR program and assigned action and assessment levels to each. Radioactive sources with activities above the action level receive priority for security upgrades; radioactive sources with activities above the assessment level require evaluation by the implementation team as to whether security upgrades are pertinent.

NNSA developed its list of radionuclides by identifying those radioactive materials that are in widespread distribution in significant quantities and have long half-lives, such that an RDD using these materials could cause damage sufficient to result in the use of an area being denied for an extended period of time or until remediation is completed. The IRTR program does not consider RED scenarios. As part of this evaluation, the IRTR program developed RDD-specific scenarios and chose a dose criterion to reflect the potential impact that a radiological dispersal event might have as an area denial weapon. This scenario used a defined area and a dose criterion of 2 rem in the first year (i.e., the EPA and recently-issued DHS protective action guidance would require public relocation from areas that exceed this dose criterion).

The Code of Conduct covers five radionuclides that the IRTR program does not—gadolinium (Gd)-153, promethium (Pm)-147, Se-75, thulium (Tm)-170, and ytterbium (Yb)-169. However, the practical effect of limiting the radionuclides to 10 in the IRTR program is negligible because these 10 radionuclides capture the majority of the large sources that are used internationally, which is the main focus of the IRTR program.

Because the IRTR program used different methodologies than those used by the Code of Conduct to determine threshold levels some differences between the values exist. Table 3.2 provides a comparison of the IRTR action level thresholds and the Code of Conduct Category 2 thresholds for the 10 radionuclides covered by the program. The domestic RTR program uses the same thresholds as the Code of Conduct.

Threshold values for most of the radionuclides listed in Table 3.2 are comparable (generally within a factor of 4), with the exception of Co-60, Ir-192, and Cs-137, which are gamma emitters. In these three cases, IRTR threshold values range from 30 to 120 times higher than Code of Conduct values. These differences are significant and arise because NNSA methodology is focused on its programmatic international mission of identifying and securing nuclear and radiological materials and is based on land contamination from a RDD. The Code of Conduct methodology also considered direct exposure, for example, from carrying a source

in the hand or a pocket or from an RED. The Code of Conduct and the IRTR program used different methodologies because the programs have different missions. The Code provides guidance for the national regulation of radioactive sources to promote national safety and security with the intent of preventing severe deterministic health effects to persons. The IRTR program mission is to increase the security of radioactive sources in light of the existing terrorist

Table 3.2 IRTR/Code of Conduct Comparison

Radionuclide	NNSA IRTR Action Threshold (International Activities)		Code of Conduct IAEA Category 2 Threshold (RTR Domestic Activities)	
	(Ci)	(TBq)	(Ci)	(TBq)
Am-241	20	0.74	20	0.6
Cf-252	20	0.74	5	0.2
Cm-244	20	0.74	10	0.5
Pu-238	20	0.74	20	0.6
Pu-239	20	0.74	20	0.6
Sr-90	1000	37	300	10
Co-60	1000	37	8	0.3
Ir-192	1000	37	20	0.8
Cs-137	1000	37	30	1
Ra-226	100	3.7	10	0.4

threat internationally and is specifically focused on reducing the threat from an RDD. The U.S. Government's position on appropriate threshold values for the control and management of sealed radioactive sources nationally supports the thresholds provided in the Code of Conduct. Certain U.S. programs, including the IRTR program, have missions that require consideration of additional criteria in order to prioritize the use of limited resources and address specific security concerns. The Code specifically acknowledges that "States should give appropriate attention to radioactive sources considered by them to have the potential to cause unacceptable consequences if employed for malicious purposes …." Thus, the IRTR program's use of different radioactive source thresholds is not inconsistent with the Code. Rather these programs are conducted in support of the Code and its enhanced focus on security and can be considered complementary.

In addition, the NNSA domestic offsite source recovery program addresses threats posed by high-risk radioactive sources. The list of sources in Table 3.2 includes the 10 radionuclides considered to present the highest risks to health and security. However, the program will also address other sealed sources of radiological concern that warrant Federal recovery action. This includes virtually all sealed sources containing significant quantities of actinides like Am-241 or plutonium. It also includes relatively large sources containing nonactinides like Cs-137 and Sr-90. Chapter 8 of this report provides further details on this program.

3.2.3 DOE/NRC Radiological Dispersal Devices Report

The NRC and DOE released the RDD Report in 2003 with an aim to identify radioactive materials of greatest concern for potential use in an RDD. The RDD Report is based on an analysis prepared by Sandia National Laboratories. The analysis included radionuclides at facilities licensed by the NRC, as well as those controlled and managed by the DOE. The RDD Report did not include DOE strategic nuclear materials and commercial radioactive materials contained at nuclear power plants and at licensees within Agreement States. However, it is important to note that Agreement States have the same type of licensees as the NRC and those licensees possess the same types of radioactive materials.

The analysis broadly evaluated radioactive materials by applying a systematic approach considering potential dose impacts and material attractiveness (the ability to obtain a given material at a given location). The analysis was intended to provide a relative rather than absolute indication of materials of concern and to offer a defensible basis upon which initial decisionmaking could be made by each agency and other Federal and State entities. The computational methodology combined two factors, a Material Index (relative dose impacts) and an Attractiveness Index (relative attractiveness for access to the material) to yield a Hazards Index for each use type or class of radioactive sealed source. The Material Index considers the potential dispersion of these materials. The Attractiveness Index considers the quantity of each material possessed at each location or by each facility, the number of locations with such quantity, and the relative material protection (based upon type and use).

The RDD Report recognized that, historically, the U.S. Government established exposure limits based on safety-based accidents, including inadvertent exposure. Because of changes in the global threat environment after the terrorist attacks of September 11, 2001, the U.S. Government reevaluated these same materials/devices for their potential malevolent uses.

The RDD Report contains a table that provides the radionuclides and their associated near-term action thresholds (in curies) to which the recommendations in the report apply. The public version of the RDD Report does not include the table, which is considered to be Official Use Only.

The RDD Report was released before IAEA had finalized the Code of Conduct categorization. When significant differences between the RDD Report and the Code of Conduct categorizations were identified, the United States was instrumental, during IAEA negotiations, in revising the Code categorization to better align it with the RDD Report's threshold values. For this reason, the differences between the RDD Report and the Code of Conduct categorization are insignificant.

The RDD Report includes radionuclides (plutonium (Pu)-236, Pu-240, thorium (Th)-228, Th-229, and actinium (Ac)-227) that are not included in the Code. The Code specifically excludes nuclear material as defined in the Convention on the Physical Protection of Nuclear Material, except for Pu-239. The Code includes the radionuclides, Pm-147, Se-75, Tm-170 and Yb-169, which are not included in the RDD Report. These radionuclides are used internationally, but are not as common in sealed source form in significant quantities in the United States. For all other

radionuclides, Category 2 threshold values and RDD Report near-term action thresholds are within a factor of 3, which the Task Force considers reasonable, given the different consequence assumptions and uncertainties in the modeling.

The RDD Report, although generally overtaken by the Code of Conduct, can be used as background information and is consistent with the U.S. commitment to the Code of Conduct.

3.2.4 U.S. Import/Export Controls

The U.S. Government made a political commitment to the IAEA to act in accordance with the nonlegally binding Guidance on the Import and Export of Radioactive Sources beginning December 31, 2005. The NRC issued a rule in July 2005 reflecting this U.S. commitment, which provides guidance to increase export and import control of radioactive sources. The rule also includes a list of radioactive material to which the requirements apply (Appendix P, "Category 1 and 2 Radioactive Material," to 10 CFR Part 110, "Export and Import of Nuclear Equipment and Material"). These new controls are consistent with the IAEA Guidance on the Import and Export of Radioactive Sources, which is supplementary to the Code. The NRC controls the majority of commercial radioactive source imports and exports.

The NRC based the radionuclides and thresholds in Appendix P to 10 CFR Part 110 on the Code of Conduct Category 1 and 2 thresholds. There are two differences between Appendix P and the Code of Conduct. First, the NRC did not include radium (Ra)-226 in the import/export final rule mentioned above. When the NRC issued the final import/export rule, the agency did not have authority to regulate Ra-226. The Department of Commerce (DOC) regulated the export of Ra-226. With the issuance of the EPAct, the NRC gained authority over discrete sources of Ra-226. The NRC issued a final rule to add Ra-226 to 10 CFR Part 110 in April 2006. This rule is effective on August 7, 2006. Second, while the Code of Conduct only applies to sealed sources, the NRC rule includes bulk material and considers aggregation and thus is more encompassing than the Code.

DOE has independent authority to regulate imports to it and certain exports by it. DOE expects to finalize a proposed directive on imports and exports in a timely manner. This proposed directive will be consistent with the export and import provisions of the Code in terms of the specific radioactive material and quantities covered. Chapter 10 provides further discussion on U.S. import and export controls for radioactive sources.

3.2.5 National Source Tracking System

The NRC is developing the National Source Tracking System (NSTS) for use in tracking Category 1 and 2 sources by the U.S. Government and the 34 Agreement States. The NRC published a proposed rule for public comment in July 2005 (70 FR 43646, July 28, 2005). The NRC expects to publish the final rule in August 2006. The NSTS will track 20 radionuclides at the Category 1 and 2 levels. The radionuclides are from the Code of Conduct and the DOE/NRC RDD Report.

The NSTS and Code of Conduct categorization are identical, with the exception of four additional radionuclides included from the DOE/NRC RDD Report. The four additional radionuclides are Ac-227, polonium (Po)-210, Th-228, and Th-229. Po-210 is listed in the larger list of 26 radionuclides in the Code. The NRC and DOE used the same methodology to develop the thresholds for these four radionuclides as that used in the Code of Conduct.

The NRC's proposed rule listed three plutonium isotopes that the NRC will not include in the final rule (Pu-236, Pu-239, and Pu-240). The DOE/NRC-RDD Report identified the additional plutonium isotopes as isotopes of concern; therefore, the NRC included them in the proposed rule. The EPAct defines a radioactive source as a Category 1 or Category 2 source, as defined in the Code of Conduct, and any other material that poses a threat as determined by the Commission, other than spent nuclear fuel and special nuclear material. The EPAct requires the NRC to issue regulations for a source tracking system for radioactive sources. The NRC will not include the three plutonium isotopes in the final rule on national source tracking because these isotopes are not "radioactive sources" within the meaning of the EPAct.

The NRC has not made a final decision on whether Category 3 sources should be included in the NSTS. Chapter 11 provides further discussion on the NSTS.

3.2.6 NRC Security Orders

The NRC has issued several orders that contain increased security and control requirements for radioactive materials. In general, the agency issued these orders to licensees that could possess Category 1 or 2 quantities of radioactive materials. The specifics of how each of the four groups of orders compare to the Code of Conduct is discussed below.

The NRC issued the June 6, 2003, Orders to Panoramic and Underwater Irradiators to both NRC and Agreement State licensees that were authorized to possess greater than 370 TBq (10,000 Ci) of byproduct material in the form of sealed sources (68 FR 35458; June 13, 2003). The irradiators are made up of Category 1 and 2 radioactive sources.

The NRC issued the January 12, 2004, Orders to Manufacturing and Distribution Licensees to both NRC and Agreement State licensees (69 FR 3397; January 23, 2004). The orders are based on the Code of Conduct Category 2 threshold values. However, the quantities are specified in curies, at one significant figure, instead of TBq. The orders also included six additional radionuclides based on the DOE/NRC RDD Report. The NRC used IAEA methods to determine the quantity of concern at the Category 2 threshold for the six additional radionuclides. Although at the time the orders were issued, the NRC did not have regulatory authority over Ra-226, it was included for consistency with the IAEA Code of Conduct and because Agreement States have regulatory authority over Ra-226. The EPAct gave the NRC authority over discrete sources of Ra-226.

The NRC issued the July 19, 2005, NRC Transportation Orders to NRC and Agreement State licensees to cover shipments of Category 1 quantities of radioactive material (70 FR 44407; August 2, 2005). The orders are based on the IAEA Code of Conduct Category 1 threshold values. The NRC included Ra-226 for consistency with the IAEA Code of Conduct with a footnote indicating that the NRC does not regulate Ra-226 and that it is included for information only.

The NRC issued the Increased Controls Orders to NRC materials licensees that could possess Category 2 quantities of radioactive material (70 FR 72128; December 1, 2005). The agency issued the majority of these orders on November 14, 2005, with the rest issued in December 2005 and January 2006. Agreement States issued legally binding requirements to their licensees in the same time frame. The orders and legally binding requirements are based on the IAEA Code of Conduct Category 2 threshold values. The NRC issued these Orders after the EPAct provided the NRC authority over Ra-226. However, the agency did not include

Ra-226 in these orders because it had not yet developed a regulatory oversight program to reflect the authority over Ra-226 provided in the EPAct.

As noted above, there are some inconsistencies between the orders and the Code of Conduct. The Task Force does not consider these differences to be significant. These differences are discussed further below.

Although Ra-226 was included in some of the orders, it was provided for information only because the NRC did not have regulatory authority over Ra-226 at the time of issuance. The NRC is currently developing its regulatory program for Ra-226. The NRC will publish the proposed rule for comment in summer 2006. Any company or individual that possesses Ra-226 will need to either amend an existing NRC license or apply for a new license, if not covered by an Agreement State license. During the review of those license applications, the NRC will evaluate whether the licensee will be authorized to possess risk-significant quantities of Ra-226 and will address security accordingly. The NRC will begin licensing Ra-226 in 2007.

The NRC was inconsistent in the use of TBq and curie units in its early orders. This inconsistency could cause some confusion for licensees. It could potentially result in the enhanced security measures not being implemented for some Category 2 sources. The NRC should evaluate whether the use of curie values rounded to one significant figure, as used in the Orders to the Manufacturing and Distribution Licensees, presents any security concerns that need to be addressed. Based on the results of the evaluation, the NRC may want to reissue those orders.

Action 3-1: The NRC should evaluate the need to reissue the Orders to the Manufacturing and Distribution Licensees to make sure no security issues have been introduced from the use of different units of radioactivity.

3.2.7 NRC Standards for Protection against Radiation

NRC regulations for the protection against radiation are contained in 10 CFR Part 20, “Standards for Protection against Radiation.” These regulations contain two primary lists of radionuclides and associated quantities—Appendix B, “Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage,” and Appendix C, “Quantities of Licensed Material Requiring Labeling.” Appendix C is derived from Appendix B, so Appendix B is actually the primary list in 10 CFR Part 20. Appendix B contains annual limits on intake (in microcuries) and concentration limits (in microcuries per milliliter) derived from those annual limits on intake.

Requirements in 10 CFR Part 20 that are based on Appendix B and Appendix C include dose, concentration, and exposure limits; 10 CFR 20.1801, “Security of Stored Material,” and 10 CFR 20.1802, “Control of Material Not in Storage”; 10 CFR 20.1902, “Posting Requirements”; 10 CFR 20.1904, “Labeling Containers,” and 10 CFR 20.1905, “Exemptions to Labeling Requirements”; 10 CFR 20.2003, “Disposal by Release into Sanitary Sewerage”; and 10 CFR 20.2201, “Reports of Theft or Loss of Licensed Material,” and 10 CFR 20.2202, “Notification of Incidents.”

The basis for Appendix B to 10 CFR Part 20 is health risk, determined by potential radiation doses from exposures. These radiation protection standards are applicable under ordinary or accident conditions when the radioactive material is used for its intended purpose. There is no

consideration of the potential causes of exposures, potential malevolent acts, accessibility, attractiveness, or the relative availability of the radionuclide. In fact, many of the radionuclides listed in Appendix B do not exist in significant quantities.

Both the Appendix B and the Code of Conduct lists of radionuclides address the same fundamental concern—relative health and safety risk from exposures. Appendix B to 10 CFR Part 20 is intended for general radiological health purposes for a wide variety of applications, while the Code is intended to address safety and security related to potential significant incidents, including malevolent attacks. It is appropriate that 10 CFR Part 20 uses different radionuclides and thresholds.

The NRC regulations at 10 CFR Part 71, "Packaging and Transportation of Radioactive Material," also contain a list of radionuclides for determining applicable requirements. Because the NRC transportation requirements are identical to the DOT requirements in 49 CFR Part 172, "Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements," and 49 CFR Part 173, "Shippers—General Requirements for Shipments and Packagings," the list is the same as the DOT list (see Section 3.2.9 of this report).

3.2.8 DOE Occupational Radiation Protection

DOE regulations on occupational radiation protection are contained in 10 CFR Part 835, "Occupational Radiation Protection." This regulation lists radionuclides to which certain inventory and control requirements apply for occupational radiation protection (Appendix E, "Monitoring in the Workplace"). Appendix E lists isotopes and the threshold quantities (in curies) above which the accountability and control requirements apply. Appendix E specifies threshold quantities for approximately 200 isotopes. In addition, Appendix E includes default values for isotopes not included in the appendix. Any alpha-emitting radionuclide not listed and mixtures of alpha emitters of unknown composition have a value of 10 microcuries (mCi). Any radionuclide other than alpha-emitting radionuclides not listed and mixtures of beta emitters of unknown composition have a value of 100 mCi.

The threshold quantities in Appendix E are significantly lower than the quantities used in the Code of Conduct (5 to 6 orders of magnitude for some of the major isotopes of concern). This is because the 10 CFR Part 835 values were derived based on a low-level workplace exposure scenario. The 10 CFR Part 835 threshold values are based on the more limiting of the quantity of radioactive material which results in either an external or internal whole body dose, from either inhalation or ingestion, of 100 millirem. The external exposure scenario assumes a photon exposure for 12 hours a day for 365 days with the distance from the source being 1 meter. The internal exposure scenario assumes an instantaneous intake of 0.001 percent of the material by an individual.

It is appropriate that Appendix E to 10 CFR Part 835 contain more radionuclides and different thresholds than the Code of Conduct.

3.2.9 DOT Transportation Rules

DOT regulations in 49 CFR Part 172 and 49 CFR Part 173 specify requirements for transportation of radioactive material. DOT safety and security requirements are based on A_1 and A_2 activity values provided in 49 CFR 173.435. In addition, 49 CFR 173.435, "Table of A_1

and A_2 Values for Radionuclides," contains a list of radionuclides for determining applicable requirements. The A_1 and A_2 values in 49 CFR 173.435 are the same values used internationally as provided in IAEA Safety Standards Series No. TS-R-1, "Regulations for the Safe Transport of Radioactive Material," published September 2005. Appendix I, "The Q System for the Calculation and Application of A_1 and A_2 Values," to IAEA Safety Standards Series No. TS-G-1.1 (ST-2), "Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material Safety Guide," published July 2002, discusses the development of A_1 and A_2 values. IAEA developed the A_1 and A_2 values based on various accident consequences. A_1 means the maximum activity of special form radioactive material permitted in a Type A package. A_2 means the maximum activity of radioactive material, other than special form material, low-specific activity, and surface-contaminated object material, permitted in a Type A package. Most sealed sources would be considered special form material; therefore, the A_1 values would apply.

As required by 49 CFR 172.800, "Purpose and Applicability," each person who offers for transportation in commerce or transports in commerce a highway route-controlled quantity (HRCQ) of a Class 7 (radioactive) material in a motor vehicle, rail car, or freight container must develop and adhere to a security plan. An HRCQ means a quantity of radioactive material within a single package that exceeds (1) 3,000 times the A_1 value of the radionuclides as specified in 49 CFR 173.435 for special form radioactive material, (2) 3,000 times the A_2 value of the radionuclides as specified in 10 CFR 173.435 for normal form radioactive material, or (3) 1,000 TBq (27,000 Ci), whichever is least. These definitions, found in 49 CFR 173.403, "Definitions," are based on a table in 49 CFR 173.435. Table 3.3 in this report compares the HRCQ value for those radionuclides in the Code of Conduct with the IAEA Category 1 and 2 threshold quantities. In most cases, the HRCQ values are higher than the Category 1 threshold. Thus, the requirement for security plans would not apply to many Category 1 and 2 radioactive source shipments.

The Code of Conduct values are universally understood and implemented. Using different values for transportation security requirements may cause confusion in the user community. DOT should reconsider the use of highway route controlled quantities of radioactive material as the baseline for development of a transport security plan or requirement to incorporate additional security measures. Given the international nature of transport and the international community and other U.S. agency's acceptance of the Code of Conduct Category 1 and 2 levels, DOT should examine using the Category 1 and 2 thresholds in domestic regulations. In addition, the U.S. Government is working with the IAEA to revise the transportation guidance to better align with the Code of Conduct values. This effort should be continued. See Chapter 5 for further discussion on transportation security.

Action 3-2: The DOT should examine the use of the Code of Conduct Category 1 and 2 thresholds in domestic transportation regulations.

Table 3.3 Code of Conduct High-Risk Radionuclides for Domestic Shipments Comparison

IAEA Code of Conduct			HRCQ		
High-Risk Radionuclides	**Cat 2 Threshold Quantity (TBq)**	**Cat 1 Threshold Quantity (TBq)**	**A_1 Value (TBq)**	**3000 x A_1 Value (TBq) or 1,000 TBq, whichever is least**	**3000 x A_2 Value (TBq) or 1,000 TBq, whichever is least**
Am-241	0.6	60	10.0	1000	3
Am-241/Be	0.6	60	10.0	1000	3
Cf-252	0.2	20	0.1	150	9
Cm-244	0.5	50	20.0	1000	6
Co-60	0.3	30	0.4	1000	1000
Cs-137	1.0	100	2.0	1000	1000
Gd-153	10.0	1000	10.0	1000	1000
Ir-192	0.8	80	1.0	1000	1000
Pm-147	400.0	40000	40.0	1000	1000
Po-210	20.0	60	40.0	1000	1000
Pu-238	0.6	60	1.0	1000	3
Pu-239/Be	0.6	60	1.0	1000	3
Ra-226	0.4	40	0.2	600	9
Se-75	2.0	200	3.0	1000	1000
Sr-90 (Y-90)	10.0	1000	0.3	900	900
Tm-170	200.0	20000	3.0	1000	1000
Yb-169	3.0	300	4.0	1000	1000

3.3 Conclusions

The Task Force concludes that agencies are protecting the appropriate radioactive sources (i.e., those sources requiring security based on the potential attractiveness of the source to terrorists and the extent of the threat to public health and safety). At this time, the Task Force does not recommend that additional radionuclides be added to the list of risk-significant sources. The Task Force notes that the source lists are tailored to the specific programs and objectives to which they apply. The only program area that uses a categorization that is different from the Code of Conduct categorization is transportation security. Categorization of international and

domestic transportation regulations is based on preexisting criteria for determining nuclide risk. The Task Force encourages the U.S. Government to continue the efforts underway internationally to better align transportation guidance with the Code of Conduct categorization. In general, the programs appropriately address the sources consistent with the Code of Conduct.

The Code of Conduct serves as an appropriate framework for considering which sources warrant additional protection. The Code of Conduct considers that a country should "define its domestic threat, and assess its vulnerability with respect to this threat for the variety of sources used within its territory, based on the potential for loss of control and malicious acts involving one or more radioactive source." In general, the U.S. programs adhere to this philosophy. However, the threat environment is not static, but is continually changing. Therefore, it is good practice to occasionally reevaluate the potential attractiveness of the radioactive sources. The Task Force recommends that the U.S. Government periodically reevaluate the list of radioactive sources that warrant additional security and protection. This reevaluation should be coordinated within the Federal family and can be performed as part of the Task Force activities every 4 years. If the reevaluation determines that the list of sources should be expanded, the U.S. Government should consider appropriate revisions to our national requirements and work with the international community to revise the Code of Conduct, as appropriate.

Recommendation 3-1	The Task Force recommends that the U.S. Government periodically reevaluate the list of radioactive sources that warrant enhanced security and protection to assess their adequacy in light of the evolving threat environment.

3.4 Summary of Recommendations

The Task Force is making one recommendation in the area of radiation source lists. The recommendation is discussed above and is summarized below.

Recommendation 3-1	The Task Force recommends that the U.S. Government periodically reevaluate the list of radioactive sources that warrant enhanced security and protection to assess their adequacy in light of the evolving threat environment.

4 Security and Control of Radioactive Sources

4.1 Introduction

The NRC and DOE are responsible for establishing and overseeing security measures for radioactive sources in civilian use and involved in activities by or on behalf of DOE, respectively. They regularly coordinate with the intelligence community and Federal law enforcement agencies to review and assess threat information and incorporate a graded threat concept in their security programs. For facilities using Code of Conduct Category 1 and 2 quantities of radioactive material, the NRC uses a deterministic approach and specifies protection requirements either through regulations or orders that are based on an implicit referenced threat. DOE uses a deterministic approach employing both performance and compliance elements to establish protection requirements for radioactive materials security. Because the NRC and DOE regulate and oversee different types of facilities and materials, differences in the respective threat documents and protection requirements do exist. However, the NRC and DOE have a longstanding working relationship pursuant to a Memorandum of Understanding (MOU), and they cooperatively share and coordinate assessments of threat information and strive for comparable protection for comparable material.

Consistent with the threat analysis and potential consequences of malevolent use, and the objectives of the Code of Conduct, the purposes of the U.S. security and control programs are to achieve and maintain a high level of safety and security of radioactive sources and to deter the use of radioactive material for malevolent purposes by (1) preventing radioactive material within the United States from being redirected for malevolent purposes and (2) preventing radioactive material intended for malevolent use from entering the country. Actions to accomplish these goals include the following:

- assuring that authorized users have adequate security and controls for risk-significant radioactive materials to enhance deterrence, detection, and defense in response to the current threat

- coordinating with law enforcement agencies to develop tactics to deter and prevent terrorist attacks on fixed nuclear facilities and material in transport

- detecting radioactive materials at key U.S. entry points where these materials either enter the country or pass through before being transported to other countries

- detecting unauthorized shipments of radioactive materials within the United States

- tracking legitimate shipments of risk-significant radioactive materials into or through the United States

- assuring that all risk-significant radioactive sources that are in legitimate use within the United States are included in the NSTS database.

Consistent with the objectives of the Code of Conduct, an important control component of a protective strategy to reduce risk is to “mitigate or minimize the radiological consequences of any accident or malicious act involving” Code of Conduct Category 1 and 2 quantities of

radioactive material. These controls could include, but are not limited to, those needed for response activities such as the following:

- promptly searching for lost, stolen, or missing sources and securing found sources
- rapidly intervening in the event of an accident or malicious act involving a risk-significant radioactive source
- training law enforcement agencies and emergency services organizations.

Institutional controls and technology may also provide important means for reducing risks by minimizing the likelihood of a loss of control and lowering potential consequences. These may include the following measures:

- a national register of risk-significant radioactive sources
- reuse or recycling of disused risk-significant radioactive sources
- adequate financial provisions for disposal
- adequate disposal capabilities
- development of alternative technologies that decrease or eliminate use of risk-significant radioactive sources.

4.2 Current Programs for Security and Control of Radioactive Material

The U.S. framework requires multijurisdictional coordination. Several U.S. Government agencies have regulatory authority over radioactive materials, and these authorities sometimes overlap. Reducing the risk of the malevolent use of radioactive material involves many cross-agency activities and issues. Protection of these risk-significant sources is important in preventing RDD and RED proliferation. This section primarily describes the current DOE and NRC regulatory programs for security and control of radioactive materials, including Code of Conduct Category 1 and 2 quantities. This section also briefly describes some DHS, DOD, FBI, and DOT programs.

Both the NRC and DOE have graded regulatory approaches to safety and security that are generally consistent with potential radiation risk. Historically, oversight of regulated radioactive materials focused on the level of risk to workers and to the public that the materials pose under ordinary or accident conditions, when used for their intended purposes. However, since September 11, 2001, and consistent with the U.S. Government's political commitment to work toward following the guidance in the Code of Conduct, these risk-significant sources require additional security measures (ASMs) and increased controls (ICs) to enhance their protection from theft or sabotage. Enhancing the security and control of these radioactive materials relies on assessments of the threat and potential consequences. The following sections discuss the various agencies' approaches to security and control of radioactive materials. Included, where applicable, are the methods for applying threat assessments and consequences of concern, identifying and assessing the vulnerabilities, developing protection and mitigation strategies, and the enhanced security and control requirements.

4.2.1 Nuclear Regulatory Commission Program

Approach to Security and Control of Radioactive Material

The NRC and the Agreement States have regulatory programs to protect the public health and safety and the environment from the effects of radiation from radioactive materials. The NRC also regulates these materials and facilities to promote the common defense and security. The NRC and Agreement States carry out their missions through regulations, licensing, orders, and oversight. Regulations impose requirements that licensees must meet to obtain or retain a license or certificate to use nuclear materials or operate a nuclear facility. These regulations govern the transportation of materials; the use of materials at such nuclear facilities as power plants, research reactors, uranium mills, fuel facilities, and waste repositories; and the use of materials for medical, industrial, and academic purposes. The NRC licenses the possession, use, processing, exporting, importing, and certain aspects of transporting nuclear materials and waste.

By ensuring that licensees meet the regulatory requirements, inspections play an important role in the oversight program of the NRC and Agreement States. The NRC and Agreement States periodically inspect licensed radioactive materials activities and operations. The NRC conducts about 2000 inspections of nuclear material licensees a year, and the Agreement States about 8000. These inspections cover areas such as training of personnel who use materials, radiation protection programs, radiation patient dose records, transportation, and security of radioactive materials. Also as part of the oversight process, the NRC and Agreement States issue sanctions called enforcement actions to licensees who violate the regulations. These sanctions may include notices of violation, monetary fines, or orders to modify, suspend, or revoke a license or require specific actions because of a public health and safety or security issue.

The NRC determined that in the terrorist threat environment following September 11, 2001, it should review the existing regulations regarding security and storage and, if necessary, issue orders to close any gaps found in the safety and security of risk-significant sources during use, storage, and transport. This reevaluation placed emphasis on the prevention of the use of materials that present higher risks to public health and safety if deployed in an RDD. By adopting the Code of Conduct Category 1 and 2 thresholds, the NRC also factors REDs into its reevaluation. The NRC established the Materials Security Working Group (MSWG) to review existing regulations and propose compensatory measures accompanied by new guidance, inspection procedures, licensing procedures, and enforcement policy. In essence, the MSWG compared existing requirements and conditions with the intent of improving storage conditions, as well as other security concerns. In its deliberations, the MSWG considered the results from a DHS Radiological Pilot Project conducted at nine sites in New York and New Jersey to assess security. The MSWG effort produced a series of actions to enhance security and control of risk-significant radioactive material for licensees that could possess these radioactive materials.

Threat Assessment

The NRC safeguards and security program uses a graded approach, in which the security interests and activities whose loss, theft, compromise, and/or unauthorized use would seriously affect the national security, the environment, and public health and safety receive the highest levels of protection. The NRC has regulatory requirements (some performance based and some deterministically based) for nuclear power reactors and fuel facilities possessing strategic special nuclear material. For other facilities and radioactive materials, such as risk-significant sources, the NRC establishes specific protection requirements (deterministic approach) either through regulations or orders that are based on an implicit referenced threat

Consequences of Concern

The potential deterministic health effects from risk-significant sources are the consequences of concern that form the basis of the NRC safeguards and security program for protecting against malevolent events. While the security and control requirements focus on protecting against these severe immediate or short-term health consequences, they also provide some protection against latent radiological consequences, physical and social disruption, and economic consequences. Changes in consequences of concern requiring protection would necessitate a reevaluation of the protection and mitigation strategies and the corresponding security and control measures. Changes in the consequences of concern would be evaluated as part of the NIPP to provide a consistent level of protection with other sectors in the Critical Infrastructure Plan.

Security Assessments

The NRC uses a security assessment decisionmaking framework that provides a process and criteria for evaluating results of security assessments for a broad range of activities subject to the NRC's regulatory authority. The security assessments analyze the risk of sabotage and malevolent use of stolen material. Consistent with the NRC's overall approach, security assessments continue to be performed for licensed users possessing risk-significant quantities of radioactive material. Because of the great number and diversity of users, the assessments target representative facilities. The NRC performs security assessments on a range of threat scenarios for the transportation and licensed uses of Category 1 and 2 sources. Remote or speculative scenarios and scenarios with insignificant consequences are initially screened out based on threat assessments and engineering evaluations. The assessment evaluates asset attractiveness using factors that consider the target's iconic value, complexity of planning, resources needed, execution risk, and protective measures for the safety of the public. Attractiveness factors are valued and averaged to give an overall ranking expressed as an "attractiveness category." Effects are expressed, by order of magnitude, as a "consequence category." The attractiveness category and the consequence category are then applied to a decision matrix to assess the need for additional mitigating strategies.

Security and Controls for Radioactive Material

Based on its evaluations, including the security assessments and the DHS Radiological Pilot Project results, the NRC has taken additional steps to heighten the security posture for Category 1 and 2 quantities of radioactive material. The NRC and Agreement States have imposed enhanced security and control requirements on licensees authorized to possess Category 1 and 2 quantities of radioactive material. The enhanced security measures and controls are implemented only if the licensee possesses the material. The measures are subject to inspection and enforcement actions by the NRC and the Agreement States. The NRC has issued the following orders:

- In June 2003 (68 FR 35458; June 13, 2003), the NRC issued orders imposing compensatory measures to 60 NRC and Agreement State licensees authorized to possess at least 10,000 Ci in panoramic or underwater irradiators. The orders imposed a series of requirements to supplement the existing regulations. Of the 60 licensees, 48 are implementing the provisions of the orders. The other 12 licensees either did not possess enough material to meet the requirements or have terminated their licenses. The intent of the orders is to provide reasonable assurance that the public health and safety and common defense and security continue to be adequately protected in the current environment. The orders remain in effect until the NRC rescinds them. The orders imposed new requirements regarding the security of and access to these sources. The actual requirements are considered to be safeguards information (SGI).

- In January 2004 (69 FR 3397; January 23, 2004), the NRC issued orders for additional security measures to 61 NRC and Agreement State licensees authorized to manufacture or distribute radioactive materials. The 26 licensees that possess radioactive material in quantities greater than or equal to Category 2 have implemented these measures. These measures will remain in effect until rescinded by the NRC. The orders imposed new requirements regarding the security of and access to these sources. The actual requirements are considered to be SGI.

- In July 2005 (70 FR 44407; August 2, 2005), the NRC issued orders for shipments of Code of Conduct Category 1 quantities of radioactive material to 90 NRC and Agreement State licensees. The 48 licensees that ship Category 1 quantities of radioactive material are implementing the orders. The orders contained new measures to protect certain regulated transportation activities. The measures address preshipment notification to States and to the NRC, in-transit shipment communications capabilities, shipment tracking, and escorts. These measures will remain in effect until rescinded by the NRC. The actual requirements are considered to be SGI.

- In November and December of 2005 (70 FR 72128; December 1, 2005), the remaining NRC licensees (1032) authorized to possess at least Category 2 quantities of radioactive material were issued orders that required strengthening of the measures regarding the control over use and storage of these sources. The Agreement States issued compatible, legally binding requirements to approximately 1800 of their licensees. About 1680 of the licensees are implementing the increased controls; the remaining licensees do not possess Category 2 quantities of radioactive material. The requirements also involve enhanced measures for the transportation of Category 2 quantities of radioactive material. Licensees completed implementation of these increased controls in May 2006. The increased controls will remain in effect until the Commission incorporates similar measures into its regulations and Agreement States adopt compatible regulations.

Licensees were required to verify in writing that they were in receipt of the Orders. Implementation of the measures is subject to inspection and enforcement.

The NRC regulations require licensees to secure radioactive materials (including risk-significant sources) that are stored, maintain constant surveillance of the materials when in use, and immediately report to the NRC when they discover that materials are lost, stolen, or missing. To enhance prompt discovery of lost, stolen, or missing risk-significant radioactive material, the new security and control measures require each licensee possessing Category 1 and 2 quantities of radioactive material to have a program to monitor and immediately detect, assess, and respond to unauthorized access to radioactive material and the devices that contain the material. The licensee's immediate response to any actual or attempted theft, sabotage, or diversion of the radioactive material is to call the local law enforcement agency (LLEA).

For highway and rail shipments of Category 2 quantities of radioactive material, shippers must use carriers that implement similar security and control requirements to those specified in the orders and legally binding requirements, use methods to track shipments of radioactive materials, implement methods to assure trustworthiness and reliability of drivers, maintain constant control and/or surveillance during transit, and have the capability for immediate communication to summon appropriate response or assistance. Licensees must also verify the timely receipt of radioactive material shipments by their customers and initiate an investigation with the carrier to determine the location of the licensed material if the shipment does not arrive

at or about the expected arrival time. If the shipment location is promptly determined to be still under the carrier's control, then the licensee must establish a new expected delivery time. Based on the graded regulatory approach to safety and security, the new controls for shipments of Category 1 quantities of radioactive materials require similar but more rigorous tracking and communication controls.

Authorization to Receive and Use Radioactive Material

For a person to possess a Code of Conduct Category 1 or 2 quantity of radioactive material, the NRC's regulations in 10 CFR 30.3, "Activities Requiring License," require that "no person shall manufacture, produce, transfer, receive, acquire, own, possess, or use byproduct material except as authorized in a specific or general license issued pursuant to the regulations …." Additionally, 10 CFR Part 110 requires a specific license to import or export the risk- significant quantities of radioactive material. Furthermore, 10 CFR 30.41, "Transfer of Byproduct Material," prohibits the transfer of these risk-significant radioactive materials to anyone not licensed by the NRC or an Agreement State or to DOE. The licensee transferring the material must verify that the transferee's license authorizes the receipt of the type, form, and quantity of byproduct material to be transferred. The regulations allow a copy of the purchaser's license to be faxed to the seller as verification of a valid license. The orders to manufacturing and distribution licensees supplement the existing regulations to require licensees to take specific measures to verify the validity of a new customer's license or when significant changes occur in a regular customer's purchasing pattern or delivery location.

A person with malevolent intent could apply for and obtain a legitimate license and then use it to purchase radioactive material from a distributor. In response to this concern, the NRC and Agreement States developed prelicensing guidance and implemented a modified process of issuing specific licenses to ensure that risk-significant quantities of radioactive material cannot be purchased before determining with reasonable assurance, through inspection or other means, that the materials will be used as intended.

Throughout, the NRC regulations require that individual users of radioactive materials (including Category 1 and 2 sources), under a specific license, must be appropriately trained in radiation safety, in the use of the devices containing the radioactive material, and in emergency procedures.

Security Plan

For the Category 1 and 2 quantities of material and the types of practices that would use such sources, there are no NRC regulations that require a licensee to submit a security plan or have a security plan. However, the new security and control requirements require each licensee to have a documented program to monitor and immediately detect, assess, and respond to unauthorized access to radioactive material quantities of concern and devices. Licensees must also retain other documentation, for inspections, that demonstrates compliance with all the new security and control requirements.

Access Controls

Some of the NRC's regulations for radiation safety also provide a level of security access control. The NRC's primary controls for radiation safety are in 10 CFR Part 20. The regulation in 10 CFR 20.1801, "Security of Stored Material," requires the licensee to secure against unauthorized removal or access licensed materials that are stored in controlled or unrestricted areas. When the radioactive material is not in storage but in use, 10 CFR 20.1802, "Control of Material Not in Storage," requires the licensee to control and maintain constant surveillance of licensed material. For higher hazard areas, 10 CFR 20.1601, "Control of Access to High

Radiation Areas," and 10 CFR 20.1602, "Control of Access to Very High Radiation Areas," require additional controls. Licensees must control worker and public access to radiation areas to assure that the radiation protection requirements in 10 CFR Part 20 are achieved. Hence, access to restricted areas is location- and time-limited, based on meeting dose limits for workers and members of the public. Additional controls for a particular type of use that are applicable to the Code of Conduct Category 1 and 2 quantities of radioactive material appear throughout NRC regulations. Examples of radiation safety access controls appear in 10 CFR 34.51, "Surveillance"; 10 CFR 36.23, "Access Control"; and 10 CFR 39.71, "Security."

The NRC regulations do not specify escorted or unescorted access controls for byproduct material licensing. Rather, as discussed above, restricting someone's access to an area is dependent on the radiation levels and procedures required to limit the stay times to meet occupational and public dose limits. Licensees must develop, implement, and maintain written procedures for restricting access to assure compliance with dose limits. Licensees must limit the use of the radioactive material to individuals who are trained in radiation safety, in the use of the devices containing the radioactive material, and in emergency procedures.

The new security and control orders require licensees to limit access to the risk-significant radioactive material and devices to only approved individuals who require access to perform their duties. For those individuals approved for unescorted access, the licensee must conduct a background investigation and make a determination of the individual's trustworthiness and reliability. An approved individual must escort other individuals requiring access. The NRC is in the process of implementing the provisions of the EPAct that authorize fingerprinting, for criminal history check purposes, for individuals or entities that have unescorted access to radioactive material. See Chapter 6 of this document for further discussion of the requirements for background investigations.

Event Reporting

For Code of Conduct Category 1 and 2 sources, 10 CFR 20.2201, "Reports of Theft of Loss of Licensed Material," requires licensees to report any lost, stolen, or missing licensed material, by telephone, immediately after the licensee learns of the occurrence. The reporting requirements in 10 CFR 30.50 specify that "an immediate report notify the NRC as soon as possible but not later than 4 hours after the discovery of an event … that could exceed regulatory limits (events may include fires, explosions, toxic gas releases, etc.)." In addition, the NRC collects and assesses data on the security of licensed facilities and radioactive materials. These reports are tracked in databases maintained by the NRC.

To enhance prompt discovery of lost, stolen, or missing risk-significant radioactive material, the new security and control measures require each licensee possessing Category 1 and 2 quantities of radioactive material to have a program to monitor and immediately detect, assess, and respond to unauthorized access to radioactive material and the devices that contain the material. The licensee's immediate response to any actual or attempted theft, sabotage, or diversion of the radioactive material is to call the LLEA. After calling the LLEA, the licensee is to call the NRC and/or the appropriate Agreement State.

For shipments of Code of Conduct Category 2 quantities of radioactive material, when an investigation determines that the shipment has become lost, stolen, or missing, the licensee shall immediately notify the NRC and/or the appropriate Agreement State. If, after 24 hours of investigating, the material still cannot be located, the radioactive material is considered missing, and the licensee immediately notifies the NRC. For shipments of IAEA Code of Conduct Category 1 quantities of radioactive materials, licensees should notify the NRC more quickly.

Emergency/Security Event Planning and Response

The byproduct material licensing requirements for emergency response plans in 10 CFR 30.32(i)(1) apply to accidental release of radioactive material only in unsealed form, on foils or plated sources, or sealed in glass. Schedule C, "Quantities of Radioactive Materials Requiring Consideration of the Need for an Emergency Plan for Responding to a Release," of 10 CFR 30.72 provides the quantities of material requiring consideration of an emergency plan. This requirement does not apply to sealed sources. Table 4.1 compares the Code of Conduct Category 2 thresholds and the 10 CFR 30.72, Schedule C, values for those radionuclides in both the Code of Conduct and Schedule C. Licensees possessing risk-significant sealed sources must maintain and implement procedures for responding to accidental emergency situations but, in most cases, are not required to have an emergency plan.

In addition, the ASMs and ICs require licensees with Category 1 and 2 quantities of radioactive material to coordinate with LLEA to develop a plan for responding quickly to alarms to thwart the theft or provide a pursuit to prevent malevolent use. Licensees are to give the police information about potential malevolent radiological consequences and facility security information needed to preplan for an event response. The preplanning is important for establishing points of contact for source recovery and radiation protection education.

Table 4.1 Comparison of Category 2 Threshold and 10 CFR 30.72, Schedule C Values

Radionuclide	IAEA Category 2 Threshold (Ci)	10 CFR 30.72 Schedule C (Ci)
Am-241	16	2
Am-241/Be	16	2
Cf-252	5.4	9
Cm-244	14	4
Co-60	8.1	5,000
Cs-137	27	3,000
Gd-153	270	5,000
Ir-192	22	40,000
Pm-147	11,000	4,000
Pu-238	16	2
Pu-239/Be	16	2
Ra-226	10	100
Se-75	54	10,000
Sr-90 (Y-90)	270	90
Tm-170	5,400	4,000
Yb-169	81	-

Source Tracking and Inventories

The NRC and Agreement State licensing programs require specific licensees to keep track of the radioactive material they possess. Licensees must keep records of receipts, transfers, and disposal of radioactive material and maintain inventory records to demonstrate compliance with

the licensed possession limits. Requirements for leak testing sealed sources and business practices oblige the licensee to periodically inventory its radioactive materials.

The NRC and Agreement States also keep track of certain radioactive sources distributed to general licensees. Radioactive sources in generally licensed devices are usually below Category 2 amounts for those radionuclides listed in the Code of Conduct. Manufacturing and distribution licensees are required by 10 CFR 32.52, "Material Transfer for Reports and Records," to submit quarterly material transfer reports and records of all transfers of such devices to persons for use under a general license. As required by 10 CFR 31.5, "Certain Detecting, Measuring, Gauging, or Controlling Devices and Certain Devices for Producing Light or an Ionized Atmosphere," general licensees must register certain devices annually. The requirement to register is based on protection of property.

The security and control measures impose new requirements for licensees to track the shipments of risk-significant radioactive material.

In 2004, the NRC initiated an interim inventory of Category 1 and Category 2 sources (also included were seven additional radionuclides from the DOE/NRC RDD report). The interim inventory, which is a voluntary survey, is updated annually. The NSTS will replace the interim inventory in 2007. See Chapter 11 of this report for information on the NSTS.

Information Security

Protecting the information about the security of these radioactive materials is as important as protecting the material itself. Sensitive security-related information that can reasonably be foreseen to harm the public interest must be controlled to protect it from loss, misuse, modification, or unauthorized access.

The AEA gives the Commission authority to prescribe regulations or issue orders, as necessary to prohibit the unauthorized disclosure of SGI which specifically identifies a licensee's or applicant's detailed security measures (including security plans, procedures, and equipment) for the physical protection of byproduct material. Only those persons who have established their need-to-know the information and are considered trustworthy and reliable have access to SGI. The NRC's requirements for protecting SGI are in 10 CFR Part 73, "Physical Protection of Plants and Materials."

The Commission's regulation in 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding," considers correspondence and reports to or from the NRC which contain information or records concerning a licensee's or applicant's physical protection, not otherwise designated as SGI or classified as national security information or restricted data, to be commercial or financial information and therefore exempt from public disclosure.

The NRC has expanded the type of information that it considers SGI. Orders were issued to the panoramic and underwater irradiator licensees, to the manufacturing and distribution licensees, and to licensees shipping Category 1 quantities of radioactive material. The orders declared that the new compensatory measures and additional security measures contain SGI. They impose specific requirements to ensure proper handling and protection of SGI to avoid unauthorized disclosure of the information. The NRC is in the process of codifying those new requirements (70 FR 7196; February 11, 2005). Additionally, the EPAct requires an FBI criminal history check of anyone with access to SGI. The NRC is also in the process of codifying this new requirement.

The increased controls imposed by the NRC and Agreement States on all other material licensees authorized to possess Code of Conduct Category 1 and 2 quantities of radioactive material also included general requirements for licensees to protect their detailed security-related information from unauthorized disclosure. These information protection requirements are not at the level of those for SGI. They are similar to measures used in managing company proprietary, confidential commercial, or financial information, personal identification information, and individual financial information.

Inspection and Enforcement

Inspections and enforcement are important elements of NRC's oversight of its licenses. NRC conducts inspections on a periodic schedule based on risk to ensure that licenses meet NRC's regulatory requirements. Inspectors follow guidance in the NRC Inspection Manual, which contains objectives and procedures to use for each type of inspection. If an inspection shows that a licensee is not conducting an activity or operating the facility in accordance with regulatory requirements, the NRC informs the licensee of any problems that were found and ensure that they are addressed.

As part of the oversight process, NRC issues sanctions called enforcement actions to licensees who violate the regulations. These sanctions may include notices of violation, monetary fines, or orders to modify, suspend, or revoke a license or require specific actions because of a public health issue or a national security issue. All violations are subject to civil enforcement action and may also be subject to criminal prosecution. Enforcement action is used as a deterrent to emphasize the importance of compliance with regulatory requirements and to encourage prompt identification and prompt, comprehensive correction of violations.

The security and control measures have now been put in place for all licensees throughout the United States. The NRC and Agreement States are inspecting these licensees to verify the compliance with the new requirements. If violations are discovered, the licensees will be subject to enforcement sanctions. Both NRC and Agreement State inspectors have received specific training on how to inspect against the new measures.

The NRC's enforcement jurisdiction is drawn from the AEA and the Energy Reorganization Act of 1974, as amended. Subpart B of 10 CFR Part 2 of NRC's regulations set forth the procedures the NRC uses in exercising its enforcement authority. The AEA provides for penalties of up to $100,000 per violation per day; the amount has been adjusted by the Debt Collection Improvement Act of 1996 to be $130,000. The authority and limit for accessing fines for violations of regulations is adequate for enforcing the security and safety measures applicable to licenses that possess risk-significant sources.

4.2.2 Department of Energy Program

Approach to Security and Control of Radioactive Material

DOE is responsible for safeguards and security with respect to activities by or on behalf of DOE. DOE safeguards and security policy utilizes a graded approach, in which security interests and activities whose loss, theft, compromise, and/or unauthorized use would seriously affect the national security, the environment, departmental programs, and/or the health and safety of the public or employees receive the highest levels of protection. Safeguards and security protection programs are based on the results of vulnerability and risk assessments, which the agency uses to design and provide graded protection in accordance with an asset's importance or the impact of its loss, destruction, or misuse.

Threat Assessment

DOE has an established radiological sabotage policy defined under DOE Order 470.3A, Design Basis Threat (DBT) Policy, which delineates appropriate levels of protection based on clearly defined thresholds for radioactive materials. The DOE DBT mandates specific safeguards and security measures relative to these documented thresholds. The DBT defines a combination of prevention and mitigation measures and calls for their implementation depending on the results of the radiological sabotage analysis.

DOE has an established radiological sabotage vulnerability assessment process. The process evaluates specific nuclear and radiological materials to determine if the application of threats, as defined in the DBT policy, can potentially cause a release of material that would result in an unacceptable consequence to the public, employees, or environment. A fundamental assumption is the deliberate dispersal of radioactive materials by malevolent act (security), not by accidental release (safety). The vulnerability assessment process considers several elements including the defined departmental and local threat, adversary characteristics, the vulnerability of the potential target, and the potential consequences of the radiological sabotage event (adversarial act). The assessment considers the aggregation of radiological materials and their proximity to other accountable nuclear materials. The DBT radiological sabotage policy provides for a performance-based protection strategy with compliance components. The highest equity assets are afforded the highest combined levels of access control, surveillance measures, physical barriers/alarms, entry inspections, etc. The agency develops security plans for facilities possibly facing radiological, chemical, or biological sabotage threats. The DBT and radiological sabotage policy encompass security and control policy for the Category 1 and 2 radioactive sealed sources.

The DOE safeguards and security program establishes control and protection measures for DOE assets exceeding defined thresholds based on the results of the radiological sabotage and vulnerability assessment analysis results. This is addressed under the DOE DBT policy stated above and the DOE 470.4 order series.

Since the terrorist incidents on September 11, 2001, DOE has revised the DBT policy. The document reflects the most comprehensive and sophisticated threat policy revision in the history of the Department. DOE is currently implementing the DBT requirements, which will result in protective forces and associated security strategies to address the following:

- significantly increased adversary numbers, capabilities, and threats based on current intelligence and real-world events
- consideration of vehicle-borne improvised explosive devices
- consideration of commercial aircraft
- a graded threat scale based on the asset being protected and the potential consequences of the loss of control of an asset
- via an unclassified DBT, the protection of those Department assets not directly related to traditional national security missions
- new graded radiological sabotage criteria based on “prompt dose”

- new graded biological sabotage criteria based on safety requirements of the Centers for Disease Control and Prevention

Risk Assessment

DOE has an established safeguards and security risk management program codified under DOE Order 470.4. Site safeguards and security plans and site security plans document the risk assessments. The security plans are required for all DOE-owned and -leased sites and facilities and for covered contractor-owned and -leased facilities that (1) have certain quantities of special nuclear materials; (2) face a radiological/chemical/ biological sabotage threat that would cause an unacceptable impact on the national security or the health and safety of employees, the public, or the environment; (3) face an industrial sabotage threat that would cause an unacceptable impact to those DOE programs supporting national defense and security; (4) are engaged in intra-site transportation of special nuclear materials; (5) possess classified matter; (6) are engaged in the protection of government property; or (7) heads of DOE elements have deemed appropriate.

DOE conducts safeguards and security vulnerability assessments for national security assets per DOE Manual470.4-1. The vulnerability assessments conform to the tenets of the DOE DBT policy.

The Department reviews and updates the Site Safeguards and Security Plans and the associated risk/vulnerability assessments on an annual basis for accuracy and currency. The annual updates are designed to address changes in emerging threats and associated safeguards and security programs and systems. The plans and associated risk/vulnerability assessments are verified through annual force-on-force exercises, periodic systems and protective force performance testing, and simulation modeling of emerging threats and safeguards and security protection systems and operations.

Risk Management

Risk management is an essential element of the DOE safeguards and security strategy. Risk management arises from an analysis of the combination of a target's attractiveness and the potential consequences associated with the unauthorized use of that target. The goal of safeguards and security risk management encompasses the fielding and operation of appropriate, cost-effective protection systems to protect sensitive programs and facilities against threats, with special emphasis on the threat of terrorism.

Risk management consists of deterrence, assessment, prevention, and mitigation. A key element of risk assessment is analyzing security systems against the DBT. Risk prevention and risk mitigation to address the terrorist threat are accomplished through the vulnerability assessment process. This analysis, coupled with the implementation and continued validation of measures to prevent or mitigate risk to acceptable levels, constitutes the fundamental approach of the Department's risk management program.

Because of the incomplete knowledge inherent in any threat definition, it is impossible to precisely tailor a protective system to defend against all threats. The challenge presented to safeguards and security program managers lies in developing systems sufficiently effective to defend against the threats as defined in the DBT while taking into account local conditions. Management must then balance these systems against technological, resource, and fiscal constraints.

The protection of radiological materials in DOE consists of performance-based elements and compliance-based elements. The relative consequence that could result from the misuse of the asset in question determines the applicable elements. All radiological materials have varying levels of compliance-based requirements (i.e., access controls, material control and accountability policies, detection and assessment systems, protective force responses, etc.). The requirements depend on the categorization of the radiological material (both as individual items and as the aggregate of the items to a greater category). As the result of vulnerability assessments that delineate the relative potential consequences caused by deliberate misuse of the assets, performance-based elements may supplement the compliance elements. The performance elements range from simple protective force patrols to an aggressive denial strategy for the assets.

Site Safeguards and Security Plans

Site Safeguards and Security Plans, developed cooperatively by site and Headquarters personnel, provide the basis and justification for safeguards and security program development, budget, and staffing requirements. The process examines, describes, and documents safeguards and security programs, at both site and facility levels; establishes safeguards and security program improvement priorities; describes site and facility protection philosophy and strategy; and estimates the resources required to make improvements.

Vulnerability Assessment Process

The six steps in vulnerability assessments, which form the basis for the safeguards and security planning process, are (1) threat and target identification, (2) facility characterization, (3) protective force and systems characterization, (4) risk determination, (5) risk validation and verification, and (6) vulnerability assessment approval and concurrence.

To accomplish threat and target identification, the DBT is applied, through the use of scenarios, against targets prioritized based on nuclear material category and attractiveness. Analysts use an Adversary Capability List to explicitly detail the equipment, weapons, ammunition, technical capability, and transportation modes that a potential adversary might employ. While development of the DBT is the responsibility of the DOE Office of Security and Safety Performance Assurance, its application for vulnerability assessments is the responsibility of the DOE Headquarters program, the cognizant field, and the site's primary contractor. Target identification is accomplished through a comprehensive onsite evaluation and characterization of assets. The assets are then prioritized relative to the resources available. Target identification is primarily the responsibility of field offices and primary site contractors.

Facility characterization is a process that models a facility to determine material, system, and protective force dispositions. The model relies heavily on personnel from site operations, maintenance, and the protective force for accurate information. In recent years, computer-based tools have developed symbolic and topological models detailing the physical and operational safeguards and security features. The models detail the physical parameters of walls, security barriers, doors, fences, portals, roofs, floors, and other physical features. This function is mainly the responsibility of primary site contractors, with strong protective force involvement.

Protective force and systems characterizations determine, model, and quantify the systems' operations, capabilities, and performance as applied against potential adversaries. Analysts use performance tests, force-on-force exercises, and observation in the characterization. As with facility characterization, protective force and systems characterization relies on computer-based tools. The models detail the physical parameters of safeguards and security sensors

(e.g., detection probability, detection parameters, delay times), protective force operations (e.g., response times, deployment positions, tactical plans, equipment and weapons), and access control systems (e.g., delay times, identification probabilities, two-person control).

As the basis for the characterization of the protective forces and systems, performance tests and force-on-force exercises test the terrorist threat capabilities to quantify and verify the operational effectiveness of the safeguards and security systems and protective force against a threat, consistent with postulated adversary actions and capabilities. The force-on-force exercises evaluate the protective force responses and capabilities against the postulated adversaries' actions, capabilities, and equipment. Both performance tests and force-on-force exercises use statistical methods to determine the performance values. Field offices and primary site contractors have responsibility for this step.

Risk determination is the process of quantifying and evaluating the aggregate protection afforded the targets based on the protective force and systems characterization. The DOE vulnerability assessment process relies on a path analysis technique. Symbolic and topological models allow multi-path analyses to be conducted simultaneously to identify single-point failures or weaknesses that could potentially be exploited. Analysts develop a bounding scenario, which postulates an event that traverses an adversary's most advantageous credible path. Analysts then apply associated safeguards and security protection elements (such as motion detectors, metal detectors, perimeter sensors, etc.) to ensure that adequate safeguards and security systems and programs are present regardless of the path the adversary takes or the path-elements attacked. The risk is then assessed to ensure that all targets are protected appropriately and cost effectively. Field offices have primary responsibility for final risk determination, and primary site contractors have responsibility for the intermediate evaluations.

Risk validation and verification involve performance tests, operational reviews, and protection systems evaluations. Validation is the hands-on assessment of the capabilities and performance characteristics of the protection systems. Validation primarily focuses on systems or operations that are identified either as being on the adversary path in the bounding scenario, or performing at a lower level than other comparable systems and therefore being more susceptible to defeat or compromise. Verification is a review of the validation to ensure that the analysis has addressed all safeguards and security interests. The verification relies on the results of validation exercises, selected performance tests, and a representative series of force-on-force exercises. The focus of the verification is to ensure that the analysis has considered all potential threats, including terrorist threats, as characterized by the DBT, and that an acceptable level of performance is demonstrated. Field offices are responsible for validation, and DOE Headquarters elements complete the verification.

Approval and concurrence represent the acceptance of the Site Safeguards and Security Plan or the Site Security Plan and the supporting Vulnerability Assessment Report as an accurate depiction of a facility's protection posture, philosophy, and operations. Field offices approve the plans, while DOE Headquarters program offices concur on Site Safeguards and Security Plans. The Office of Security and Safety Performance Assurance provides review and comment.

Reporting and Tracking

DOE is currently drafting a policy for reporting selected radioactive sealed sources to a centralized repository (database) in conjunction with the development of the NSTS. This policy will address, at a minimum, the Code of Conduct Category 1 and 2 sources.

Incident Reporting
The DOE Incidents of Security Concern Program sets forth requirements, including timely identification and notification, response, inquiry, reporting, and closure actions for incidents of security concern. The suspected incident is categorized by an Impact Measurement Index number (IMI-1 to IMI-4), which determines further actions required. Locally developed procedures are established, documented, approved by the DOE departmental element, and disseminated to ensure the identification, reporting, root cause analysis, and resolution of incidents of security concern. These procedures identify guidelines for corrective actions and documentation of time and funds expended on incidents. Corrective actions are taken for each incident of security concern to reduce the likelihood of recurrence of the incident. These actions may include review and/or revision of applicable safeguards and security plans and procedures.

The DOE Occurrence Reporting and Processing System also addresses the DOE requirements for incident reporting related to radioactive material (including Category 1 and 2 radioactive sources).

Radiological Worker Protection
The DOE radiological worker protection program defines DOE safety and health requirements for sealed source accountability and control as specified in 10 CFR Part 835, “Occupational Radiation Protection.” This regulation establishes requirements for 6-month inventory and leak testing of accountable sealed sources. (An accountable sealed radioactive source is defined as a sealed radioactive source having a half-life equal to or greater than 30 days and an isotopic activity equal to or greater than the corresponding value provided in Appendix E to 10 CFR Part 835.) Some of the DOE requirements for radiological worker protection and safety also provide a level of control and security for monitoring, detecting, assessing, and responding to unauthorized access to radioactive sealed sources. For example, the DOE radiological worker protection program designates custodial responsibilities and storage and inventory-recording requirements for sealed radioactive sources.

4.2.3 Department of Defense Program

DOD consists of three primary military services—the U.S. Air Force, the U.S. Army, and the U.S. Navy (which includes the Marine Corps).

Installations of DOD use sources of ionizing radiation and support radiation protection programs for the control of these radioactive materials. As a Federal agency, DOD complies with all applicable environmental regulations under the Federal Facilities Compliance Act of 1992. Specific instructions include DOD Instruction 6055.8, "Occupational Radiation Protection Program," dated March 31, 1989 (administratively reissued May 6, 1996), and DOD Instruction 6055.1, "DOD Occupational Safety and Health Program," dated August 19, 1998.

DOD Sources of Ionizing Radiation
The DOD list of radioactive material includes the following:

- special nuclear material such as plutonium or enriched uranium
- source material such as uranium or thorium
- byproduct material such as any radioactive material yielded in or made radioactive by exposure to radiation incident to the process of producing special nuclear material

- naturally occurring or accelerator-produced radioactive material (NARM), such as radium, not classified as source material

- materials containing induced or deposited radioactivity

- devices that produce ionizing radiation (examples of electronic devices capable of emitting ionizing radiation include linear accelerators, cyclotrons, radiofrequency generators that use klystrons or magnetrons, and other electron tubes that produce X-rays; these devices may have components that contain radioactive material or they may induce radioactivity in certain other materials)

Commodities Containing Radioactive Material

DOD uses a variety of manufactured items (commodities) incorporating in whole or in part both sealed and unsealed radioactive material. Ionizing radiation is used directly in DOD systems as calibration and check sources for RADIAC or other survey-type instruments, as a source of radioluminescence in meters and gauges, as an ionization source in various devices, and as radiographic sources. Indirectly, ionizing radiation may be emitted from a DOD material system as natural radioactivity or induced radioactivity incorporated into material or a component of the system. Specific examples of commodities include instrument calibration sources, luminescent compasses and exit signs, certain electron tubes and spark gaps, depleted uranium counterweights, armor and munitions, and magnesium-thorium aircraft components.

Licensed Radioactive Material

Licensed radioactive material is source, special nuclear, or byproduct material received, stored, possessed, used, or transferred under a specific or general license issued by the NRC. The individual military services license or control radioactive material.

The NRC, through the issuance of a Master Materials License, has designated to the Department of the Air Force regulatory authority for the receipt, possession, distribution, use, transportation, transfer, and disposal of radioactive material at Air Force activities. The Air Force Radioisotope Committee provides administrative control of all radioactive material used in the Air Force except for reactors and associated radioactivity, nuclear weapons, and certain components of weapons delivery systems. Air Force Radioactive Material Permits are used to maintain this control.

The Department of the Army does not have a Master Materials License. The NRC regulates its activities through the issuance of specific licenses to Army installations and activity commanders. In addition, within the Department of the Army, radioactive material classified as NARM may be used under a Department of the Army Radioactive Material Authorization issued by major army commands. A Department of the Army Radiation Permit is required for use, storage, possession, and disposal of radioactive sources by non-Army agencies (including contractors) on Army installations.

Through the issuance of a Master Materials License, the NRC has designated the Department of the Navy to have regulatory authority for the receipt, possession, distribution, use, transportation, transfer, and disposal of radioactive material at Navy and Marine Corps activities. The Navy Radiation Safety Committee has administrative control over all radioactive material used in the Navy and Marine Corps except for nuclear propulsion reactors and

associated radioactivity, nuclear weapons, and certain components of weapons delivery systems. The Navy uses Radioactive Material Permits to maintain this control.

4.2.4 Department of Homeland Security Program

DHS has numerous responsibilities in its role as the focal point for leading, integrating, and coordinating the overall national effort to enhance critical infrastructure/key resources protection. The Chemical and Nuclear Preparedness and Protection Division within DHS will plan a significant role in enhancing protection in the Nuclear Sector. Some of the responsibilities that the Chemical and Nuclear Preparedness and Protection Division will manage are:

- Coordinating, facilitating, and supporting the overall process for building security partnerships and leveraging sector-specific security expertise, relationships, and resources across critical infrastructure/key resources sectors, including oversight and support of the sector partnership model
- Cooperating with State, local, and tribal security partners and collaborating with the DOE to reach out to foreign countries and international organizations to strengthen the protection of the U.S. critical infrastructure/key resources
- Facilitating the sharing of critical infrastructure/key resources protection best practices and processes, and risk assessment methodologies and tools across sectors and jurisdictions
- Coordinating multi-agency efforts to optimize the use of resources and avoid duplicative activities
- Sponsoring critical infrastructure/key resources protection-related research and development, demonstration projects, and pilot programs
- Promoting national-level critical infrastructure/key resources protection education, training, and awareness through State, local, tribal, and private sector partners.

Security controls for radioactive sources required by regulatory agencies provide one aspect of source security. These controls reduce the threat of malicious use of domestic radioactive sources. Another threat is the illicit trafficking of radioactive sources with malevolent intent. To reduce this threat, systems of radiation detection have been or are in the process of being deployed both internationally and domestically. The Megaports Initiative and Second Line of Defense (both programs are under DOE) and the Customs and Border Patrol Radiation Portal Monitoring Project are the major systems that have been partially deployed. The first two systems are intended to screen either shipments near sources of the radioactive material or shipments intended for U.S. ports. The Customs and Border Patrol system screens traffic coming through legal U.S. ports of entry. A domestic system or architecture is being developed and deployed to provide another layer of detection for illicit trafficking and a means to intercept lost or stolen domestic sources. In April 2005, a Presidential directive created the Domestic Nuclear Detection Office (DNDO) within DHS with the intent of coordinating these and other efforts to detect and report instances of illicit trafficking. According to the directive, “DNDO will be a jointly-staffed, national office established to develop, acquire, and support the deployment of a domestic system to detect and report attempts to import or transport a nuclear device or fissile or radiological material intended for illicit use.”

DNDO is coordinating these detection efforts and providing an information-sharing infrastructure through its Joint Analysis Center. These efforts will increase the ability of law enforcement officials to detect licensed material in shipments and provide a means to intercept lost or stolen domestic sources or illegal shipments along major highway routes. Radiation detectors installed in portals can detect very small quantities of licensed material in shipments. Detectors in the field, supported by offsite technical assistance, also have considerable capability in identifying specific radionuclides. However, the current technology has limitations. Isotope identification can be a slow process. Also, because sources may be shielded in various configurations, it is beyond the capability of the existing detectors to measure quantity even within an order of magnitude (i.e., a radiation detector cannot distinguish a Category 3 source from a Category 1 source in a transportation package). Screening of shipments with radiation detectors provides reasonable assurance of detecting illicit trafficking of radioactive sources that are intended for malevolent use. However, this process can be slow and affects the timely arrival of time-sensitive shipments (i.e., short half-life sources), thus impacting beneficial uses.

DNDO coordinates efforts to resolve detector alarms and review and disseminate reports of lost or stolen radioactive sources and intelligence reports that identify cases of illicit trafficking. If those efforts identify a possible malevolent intent, the appropriate agency will assume an operational lead for the incident. Examples include the FBI Joint Terrorist Task Force for domestic cases working with state and local law enforcement, Customs and Border Protection and Immigration and Customs Enforcement for border incidents, the Maritime Operational Threat Response for maritime threats, and the Nuclear Trafficking Response Group for all other threats outside the borders of the United States. These groups will identify options using all available law enforcement, diplomatic, and military means to address the identified threat. Those options will be reviewed at the appropriate level for policy coordination and execution to resolve the potential threat. DNDO is conducting or funding research, testing, and evaluation to improve the system's capability to rapidly verify the radionuclide and its activity in a shipment so as not to adversely impede commerce. The Task Force encourages DNDO to continue these efforts.

The domestic system being deployed consists of handheld and portal radiation monitors purchased by State and local entities (typically, law enforcement and fire departments) either through DHS grant programs or other means. DNDO has tested most of the available detection equipment and has made the results available to participating State and local organizations to help inform the purchase of equipment. DNDO is developing and will provide training for the State and local entities that participate in the domestic detection architecture. The training will consist of hands-on instruction using the instruments purchased and guidance on the protocols and procedures for integrating these detection activities into a coordinated national system to detect illicit trafficking of nuclear or radioactive material.

The duties of DNDO also include the coordination, collection, and analysis of the various databases for detectors, detector performance, lost or stolen reports, and transportation information. Transportation information includes types and quantities of radioactive materials, carriers, routes, etc. DNDO will share insights gained from these analyses with stakeholders.

DNDO is also responsible for testing all aspects of the architecture through drills, exercises, and red team efforts to penetrate the system and test transportation security. The red team mission is to look at vulnerabilities in the system and see if they can be exploited. If the red team efforts are successful, then a weakness has been identified and corrective actions are warranted to reduce or eliminate the vulnerability. The Office will share lessons learned from these activities with stakeholders to help improve the overall performance of the detection architecture.

4.2.5 Federal Bureau of Investigations Program

Pursuant to 28 U.S.C. (U.S. Code) 533, and Presidential Decision Directives 39 and 62, the FBI is authorized to coordinate a law enforcement investigative and operational response to terrorism. In doing so, the mission of the National Joint Terrorism Task Force is to enhance communication, coordination, and cooperation between Federal, State, and local government agencies representing the intelligence, law enforcement, defense, diplomatic, public safety, and homeland security community by providing a point of fusion for terrorism intelligence and by supporting the field element (the Joint Terrorism Task Forces). Positioned regionally throughout the United States, the Joint Terrorism Task Forces (at present, there are 101) comprise multiagency representatives and are charged with the critical task of conducting counterterrorism activities by identifying threats and preventing, stopping, and responding to terrorism incidents.

4.2.6 Department of Transportation Program

Packages of radioactive material are shipped throughout the United States by rail, air, and sea and over roads. Many packages contain small quantities of radioactive material typically used in industry and medicine. These packages are designed to provide a safe and economical means of transporting less hazardous material. The regulations prescribe limits on the maximum amounts of radioactivity that can be transported in these packages, such that radiological doses from any accidents involving these packages will have no substantial health risks. Regulations of the NRC set forth safety standards for the packaging of more hazardous radioactive material. Package design requirements provide reasonable assurance that packages will withstand serious transportation accidents. The NRC must issue an approval certificate for the design before a package can be used for the domestic transport of more hazardous radioactive material, such as the risk-significant sources used in panoramic irradiators. DOT, in consultation with the NRC, revalidates foreign certificates for packages used in international shipments. The DOT hazardous materials security requirements appear in 49 CFR 172.800. Class 7 (radioactive) material that bears a Yellow-III label, or meets the definition of a “highway route controlled quantity” (HRCQ) as defined in 49 CFR 173.403, is covered by the security requirements. Under the provisions of 49 CFR 172.802, “Components of a Security Plan,” those who offer or transport such quantities for commerce are required to have a security plan which includes an assessment of possible security risks. The security plan must address (1) personnel security, (2) unauthorized access, and (3) en route security. For additional information on transportation security programs, see Chapter 5 of this document.

Common and contract carriers, freight forwarders, warehousemen, and the U.S. Postal Service are exempt from the regulations in 10 CFR Part 30 and 10 CFR Parts 31 through 36 and 39 and the requirements for a license set forth in Section 81 of the AEA to the extent that they transport or store byproduct material in the regular course of carriage for another or storage that occurs during transport.

4.3 Discussion

The descriptions of the NRC/Agreement State and DOE programs (Sections 4.2.1 and 4.2.2) show that those programs provide many of the same elements for the security of sources. These include a license or other authorization to possess the material, some degree of access control, security requirements, trustworthiness determinations, event reporting, tracking and inventory requirements, etc.

While these programs offer the same elements, there are some differences in the degrees of control over these elements given to the licensees or permittees regulated by each agency. This is primarily because DOE regulates the use of radioactive material involved in activities by or on behalf of DOE. An additional level of security exists because the sources are used on Federal reservations or facilities. This minimizes the use of DOE sources in areas where the general public would have free access to the reservation or facility since access is controlled for national security reasons. With the exceptions of military licensees and other Federal agencies possessing NRC licenses, the NRC and Agreement State licensees generally cannot provide the same level of access control. Trustworthiness is a similar element; in this case, DOE and DOD have background check requirements for national security reasons that are more stringent than the requirements that the NRC can impose on authorized users.

The primary security concern for risk-significant radioactive material is the theft or diversion of that material for malevolent purpose. There are three primary means to obtain risk-significant radioactive material domestically. The first is to obtain the material using a legitimate license or a forged license. The second method is theft, and the third method is obtaining an orphaned or abandoned source.

Historically, the license review process for new applications included a prelicensing visit only for certain categories of licensees. Inspections to verify that the radioactive material was being used safely and as intended typically occurred after the license was issued. A person with malevolent intent could receive a legitimate license, use it to obtain radioactive material, and divert or maliciously use the material before being inspected. A Government Accountability Office (GAO) report recommended that the NRC modify its procedure of issuing specific licenses to ensure that sealed sources cannot be purchased before NRC verification that the materials will be used as intended. Currently, the NRC and Agreement States have screening processes for license applications to provide some assurance that the radioactive material will be used as intended. Screening of license applicants, as part of the license application process, should provide reasonable assurance that a person with malevolent intent will not obtain a legitimate license.

The Code of Conduct recommends that "[e]very State should ensure that the regulatory body established by its legislation has the authority to" issue authorizations and that these authorizations are conditional on "measures to determine, as appropriate, the trustworthiness of individuals involved in the management of radioactive sources." The EPAct gives the NRC new authority to require fingerprinting for Federal criminal history checks for persons with access to SGI and radioactive material that the Commission determines to be of significance to the public health and safety or the common defense and security. The security orders and increased controls require current licensees to determine the trustworthiness and reliability (based on a background check) of persons who have unescorted access to risk-significant radioactive materials. The screening of fingerprints against the Federal terrorist watch list should reduce the risk of radioactive material being used for malevolent purposes. The NRC is in the process of implementing the new authority provided by the EPAct with regards to fingerprinting and is developing orders that will require fingerprinting for certain licensees. Several rulemakings are either planned or already underway to implement various provisions of the EPAct. The NRC should expeditiously complete those actions necessary to implement the fingerprinting provisions of the EPAct. For additional information on background checks, see Chapter 6 of this document.

With the Internet and photocopy technology, forging a license is relatively easy. Existing regulations require the licensee transferring the material to verify that the intended recipient's license authorizes the receipt of the type, form, and quantity of byproduct material to be transferred. The regulations allow a copy of the purchaser's license to be faxed to the seller as verification of a valid license to receive the type, form, and quantity of byproduct. A person with malevolent intent could forge a license to obtain byproduct material. The orders to manufacturing and distribution licensees (the initial suppliers of approved sources and devices) require them to take specific measures to verify the validity of the purchaser's license. However, these sources and devices can be subsequently transferred to other licensees without the additional verification requirement. The specific measure to verify the validity of the purchaser's license (or some other mechanism) must be implemented uniformly to reduce the risk that a forged license will be used to obtain risk-significant quantities of radioactive material. The NRC should consider imposing additional measures to verify the validity of licenses, before the transfer of risk-significant radioactive sources, on all licensees authorized to possess Category 1 and 2 quantities of radioactive material.

Action 4-1: The NRC should consider imposing additional measures to verify the validity of licenses, before transfer of risk-significant radioactive sources, on all licensees authorized to possess Category 1 and 2 quantities of radioactive material.

A recent GAO report revealed that, using a counterfeit NRC document, its investigators were able to enter the United States with radioactive sources. In addressing these concerns, the NRC has worked with DHS Customs and Border Protection to create a process to verify the legitimacy of shipments of licensed radioactive material entering the United States through established ports of entry. The NRC has shared information with Customs and Border Protection to help verify the legitimacy of shipments. This information has included (1) 24/7 contact information for all Agreement States, as well as information on their various capabilities; (2) copies of all active import/export licenses and the import/export database; (3) information from the NRC License Tracking System database, which contains information on all NRC issued materials licenses; and (4) information from the interim database. The NRC provides updates from the databases every 2 weeks. In addition, the NRC has created a Source Data Team that is available 24/7 to respond to any issues that are not resolved by Customs and Border Protection staff or the NRC Headquarters operation officers who receive the incoming calls from Customs. The NRC conducted hands-on training sessions for Customs and Border Protection staff, NRC Headquarters operations officers, and the Source Data Team on the databases. The NRC will continue to work with Customs staff to improve existing procedures and to meet future needs.

The second means to obtain radioactive domestic material is to steal the material from a licensee or during shipment. Someone within the company (an insider) or an outside group could commit the theft. In part, the trustworthiness determination requirements in the increased controls address the insider scenario. However, the background checks element of the trustworthiness determinations may not provide adequate assurance. For detecting persons with malevolent terrorist intent, fingerprint checks are better. As discussed elsewhere, the NRC has not completed its implementation of the EPAct provisions for fingerprinting. Once completed, the requirement for fingerprinting those with access to risk-significant material will further reduce the insider threat.

One of the vulnerabilities of a risk-significant radioactive source is loss or theft occurring during transportation. Consequently, the NRC has recently implemented new security measures and coordination for risk-significant shipments. The objective of these requirements is to ensure

timely detection of any loss or diversion of shipments containing Category 1 (or greater) quantities of radioactive material. When licensees use contract carriers, they are required to seek reasonable assurance that the carrier meets certain additional security requirements. If the carrier has a security plan that the DOT requires for shipments of highway route quantities of radioactive material, the licensee shall verify and document that the carrier's security plan also meets each of the requirements of the NRC, or the carrier must provide written confirmation that it will implement these provisions. Licensees are required to notify the NRC Operations Center in advance of shipment dates for all Category 1 quantities. The NRC receives daily shipping and tracking information on all Category 1 shipments, including the isotopes and quantities, consignees and consignors, routes, carriers, schedules, and points of contacts. The NRC treats this information as sensitive and shares it with other agencies and authorities on a "need to know" basis.

While DOT does have fingerprinting and background check requirements, the requirements do not apply to all transportation carriers of risk-significant radioactive sources. The requirements apply only to HRCQ, which has higher thresholds than the Code of Conduct; therefore, not all risk-significant shipments are covered. The Task Force encourages DOT to consider adopting the Code of Conduct values. (See Action 3-2 in Chapter 3 for further discussion.) After the NRC has completed its determination on fingerprinting, it should work with DOT and TSA to reevaluate the requirements for fingerprinting of transportation carriers to determine if there are any gaps in coverage and how to address those gaps.

Theft of radioactive material from a licensee by a determined outside group is nearly impossible to prevent. The broad spectrum of uses and types of licensees makes prescribing physical security measures difficult. Portable devices such as radiography cameras are used to check structural integrity of welds in buildings and pipes where only the radiographers control access. Life-saving cancer therapy devices and blood irradiators located in hospitals must be accessible. While increased physical security may delay attempted thefts, it would offer very little deterrence to determined individuals. In these scenarios, success in preventing malevolent use depends on prompt detection of the attempt and a law enforcement response that will either thwart the theft, provide a pursuit to prevent the malevolent use, and/or promptly initiate actions to mitigate potential consequences. The security and control requirements include coordination with LLEAs for such a response. There are also regulatory requirements for licensees to maintain emergency plans and procedures.

The third means to obtain risk-significant radioactive material in the United States is to take possession of an orphaned or abandoned source. By definition, these sources escape the regulatory requirements since no licensee or regulatory agency controls them. When orphaned risk-significant radioactive sources are found, they must be promptly recovered and secured. Programs are in place for that purpose. See Chapter 8 of this document for discussion of the recovery program.

Smuggling radioactive material into the United States is another means of obtaining risk-significant radioactive material for use in an RDD or RED. Thus, another facet of the U.S. security and control program is to prevent radioactive material intended for malevolent use from entering the country. To reduce this threat of illicit trafficking of radioactive sources, systems of radiation detection have been or are in the process of being deployed both internationally and domestically. Radiation detectors are set up at key U.S. entry points where these materials either enter the United States or pass through before being transported to other countries. The U.S. Government is developing and deploying a domestic system of detectors to provide

another layer of detection for illicit trafficking along major transportation routes. Section 4.2.4 of this chapter discusses this program in more detail.

A radiological sabotage event may result in damaged equipment and shielding that could present a radiation hazard to first responders. The Code of Conduct, Basic Principles, states, "Every State should ensure that adequate arrangements are in place for the appropriate training of the staff of its regulatory body, its law enforcement agencies and its emergency services organizations." The stakeholder meeting and comments from members of the public revealed that communication and training for response to these types of events would benefit from additional inter- and intra-agency coordination. CRCPD has developed training material, and DNDO has a program to train first responders. DOE has a security assistance program education campaign for first responders. In addition to providing best security practices, the training for first responders should cover (1) physical security measures for radioactive material, (2) the types of licensees who possess these radioactive materials, (3) the security and control requirements for risk-significant radioactive material, and (4) response needs and capabilities, including how to respond to radiological sabotage and the need for prompt response to mitigate potentially severe consequences of an RDD event. Better coordination of Government effort will enhance the knowledge of first responders about radiological sabotage and potential RDD events, appropriate responses, and potential risks. Educating the first responders will ensure that they have a consistent understanding of the potential consequences and lead to better coordination across different jurisdictions. Trained first responders will respond more effectively to radiological sabotage and RDD events. The efforts to train first responders should continue.

Another important aspect of response training is public education. Proactively educating the public about the radiation risks of an RDD may reduce the public's anxiety and ameliorate the psychological impacts in the event of RDD attack and thereby mitigate some of the physical and social disruption consequences caused by fear and panic. Agencies should coordinate this effort to avoid duplication of effort and ensure the consistency of the intended message. Therefore, the Task Force recommends that there be a coordinated interagency (Federal and State) campaign, which would work with industry groups, to educate the public on the effects of and response to an RDD event.

Recommendation 4-1	The Task Force recommends that there be a coordinated public education campaign (Federal, State, and industry) to reduce fears of radioactivity, diminish the impact of a radiological attack if one were to occur, and provide a deterrent to attackers considering the use of radiological materials.

Federal and State agencies are implementing many activities and programs related to radioactive source protection and security, descriptions of which appear in this and other chapters of this report. These activities and programs require coordination and cooperation between the interested stakeholders to ensure that their approaches do not conflict and avoid duplication of effort. While coordination and communication of efforts does occur, improvement is always possible and helps to improve the programs. Therefore, the Task Force recommends that the Federal agencies and States continue efforts to improve coordination and communication of their ongoing activities in the area of radiation protection and security for Category 1 and 2 radioactive sources. This Task Force is one mechanism for improving coordination.

Recommendation 4-2	The Task Force recommends that the Federal agencies and States continue efforts to improve coordination and communication of their ongoing activities in the area of radiation protection and security for Category 1 and 2 sources.

4.4 Conclusions

The Basic Principles of the IAEA Code of Conduct state, "Every State should define its domestic threat, and assess its vulnerability with respect to this threat for the variety of sources used within its territory, based on the potential for loss of control and malicious acts involving one or more radioactive sources." The NRC and DOE are responsible for establishing and overseeing security measures for the civilian program and activities by or on behalf of DOE, respectively. They regularly coordinate with the intelligence community and Federal law enforcement agencies to review and assess threat information and incorporate a graded threat concept in their security programs. DOE and the NRC cooperatively share and coordinate assessments of threat information and strive for comparable protection for comparable material. One of the key steps in the NIPP project being conducted by DHS is to identify and assess the vulnerability of key assets and to analyze the potential risks based on threats and consequences. Similar to the NIPP method for risk analysis and management of critical assets protection, vulnerability and security assessments determine where additional security and control measures or mitigating strategies are needed for risk-significant radioactive material.

Historically, the regulatory programs of the NRC, Agreement States, and DOE have controlled the production, use, transportation, storage, and disposal of radioactive sources. After September 11, 2001, many of these controls were strengthened by additional legally binding requirements to enhance measures that primarily protected public health and safety in view of the national security vulnerabilities raised by the RDD and radiological sabotage threats. The Task Force review found that the regulatory controls strengthened by the additional measures reduce the vulnerabilities of national security. The NRC and the Agreement States will inspect and enforce regulations related to the actual implementation of the new security and control measures to make sure that licensees properly implement the measures. Most licensees have just implemented the new requirements. Those licensees are still adjusting to the requirements, which became effective in May 2006. The additional actions planned or underway (i.e. fingerprinting, verification of license, etc.) will further strengthen the regulatory controls.

The Task Force found no significant gaps that are not already being addressed. The Task Force believes that the combination of direct regulations concerning source security and control, personnel protection regulations, guidance, and the recently issued orders, along with the inspection and enforcement program, provides reasonable assurance that the Category 1 and 2 sources in use and storage at facilities licensed by the NRC and Agreement States and at DOE facilities are safe and secure.

Additional training of both responders and the public is desirable and will improve the response function. Finally, the there is a need to continue to improve coordination of ongoing activities by various agencies in order to obtain the best results without duplication of effort.

4.5 Summary of Recommendations

The Task Force recommends the following actions in the area of security and control:

Recommendation 4-1	The Task Force recommends that there be a coordinated public education campaign (Federal, State, and industry) to reduce fears of radioactivity, diminish the impact of a radiological attack if one were to occur, and provide a deterrent to attackers considering the use of radiological materials.
Recommendation 4-2	The Task Force recommends that the Federal agencies and States continue efforts to improve coordination and communication of their ongoing activities in the area of radiation protection and security for Category 1 and 2 sources.

5 Transportation Security of Radioactive Sources

5.1 Overview of Radioactive Material Transport Safety Program

5.1.1 Overview of the Domestic Transport Safety Program

The NRC, DOT, and DOE all have significant roles in the safe and secure transport of radioactive material into, out of, and within the United States. DOT regulations appear in 49 CFR Parts 171 to 180; the NRC regulations appear in 10 CFR Part 71 and 10 CFR Part 73. DOE Orders, including 460.1B, 460.2A, 461.1A, and 470.4, regulate transportation by DOE and DOE contractors and include provisions that require the transportation of radioactive material by or on behalf of DOE to be in accordance with relevant NRC and DOT requirements. These regulations have established safety standards that provide an acceptable level of control of the radiation, criticality, and thermal hazards to persons, property, and the environment that are associated with the transport of radioactive material.

To ensure the development and implementation of consistent and comprehensive transport regulations, the NRC and DOT entered into an MOU that delineated their respective responsibilities and authorities, with respect to activities subject to their jurisdiction. Generally, the roles and responsibilities of the two agencies are as follows:

- DOT is responsible for developing the standards for the definition of radioactive material and each subcategory of radioactive material; the design and performance specifications for packages containing small amounts (Type A and below) of radioactive material, low concentrations of radioactive material (low specific activity material), and nonradioactive objects that have surface contamination (surface-contaminated objects); the maximum radiation levels from packages and vehicles in transport; the communications standards (shipping papers, marking, labeling, and placarding) for packages and vehicles; the mechanical conditions, construction requirements, and tie-down requirements of carrier equipment; the qualifications of carrier personnel; the procedures for loading, unloading, handling, and storage in transit; and any special transport controls necessary for radiation safety during carriage.

- The NRC is responsible for developing the design and performance specifications for packages containing large quantities of radioactive material (Type B, Type C) and/or fissile materials. The NRC regulates and approves the design, fabrication, use, and maintenance of shipping packages. It also regulates the physical protection of licensed radioactive material, including commercial spent fuel and special nuclear material, in transit against sabotage or other malicious acts.

Although the agencies have not modified the MOU since it was signed in 1979, the foundation of cooperation and consultation it established allows the transport regulatory program to expand to include new program elements and address emerging safety technologies. Some recently added program elements that are now a valuable part of the safety program include quality assurance programs (NRC lead); shipper and carrier training (DOT lead); emergency response coordination, training, and communication (DHS lead, DOT and NRC participation); inspection and enforcement programs (dual responsibility); and security (dual responsibility).

5.1.2 Overview of the International Transport Safety Program

Because of the global nature of the nuclear industry, international packaging and transport safety standards are needed to support the transport of industrial, medical, research, and fuel cycle material. Developed by IAEA, these standards appear in "Regulations for the Safe Transport of Radioactive Material, TS-R-1." Numerous organizations (most importantly, the United Nations (UN), the International Civil Aviation Organization, and the International Maritime Organization) have adopted and implemented these standards.

To ensure that international standards are comprehensive and are consistent with the requirements of the United States, the State Department has designated DOT and the NRC as the U.S. representatives in the IAEA standards development program. To date, these efforts have resulted in complementary international transport standards that afford seamless transport into, out of, through, and within the United States.

5.2 Overview of Federal Radioactive Material Transport Security Programs

Historically, transport regulations for radioactive material have focused on protecting persons, property, and the environment from the radiation, criticality, and thermal hazards associated with transport of radioactive material. Titles 10 and 49 of the *Code of Federal Regulations*, the IAEA standard "Regulations for the Safe Transport of Radioactive Material," and the UN report "Recommendations on the Transport of Dangerous Goods" are just a few examples of these safety standards.

Because of recent events and changing attitudes in the world, safety standards that do not include security measures are no longer considered adequate in all situations. Accordingly, all Federal agencies involved with the transport of radioactive materials initiated programs to improve the security of hazardous materials in the Nation's transportation system. The following briefly describes the major transport security programs of the U.S. Government.

5.2.1 DOT Pipeline and Hazardous Materials Safety Administration Transport Security Program

The Pipeline and Hazardous Materials Safety Administration (PHMSA) is the agency within DOT responsible for formulating, issuing, and maintaining the Hazardous Materials Regulations under the Federal Hazardous Materials Transportation Law. The Hazardous Materials Regulations cover hazardous materials definitions and classifications, hazard communications, shipper and carrier operations, training and security requirements, and packaging and container specifications.

In furthering its transport security program, PHMSA has consulted with hazardous materials shippers and carriers, transport industry trade associations, packaging manufacturers, and Federal, State, and local government agencies to improve the security of hazardous materials in the Nation's transportation system. The two strategies that PHMSA views as critical to managing transportation security risks are (1) the development and implementation of security plans and (2) training to ensure that all employees who handle and transport hazardous materials recognize and react to potential security problems. As discussed below, PHMSA has established regulatory requirements to ensure the use of these strategies.

PHMSA Security Plans

After assessing the security risks associated with the transport of different classes and quantities of hazardous materials, PHMSA concluded that the most significant security risks involve the transportation of certain types and quantities of hazardous materials. Based on this risk assessment, PHMSA requires (in 49 CFR 172.800) that persons who offer for transport or transport certain hazardous materials develop and implement security plans. These hazardous materials include an HRCQ of radioactive material; more than 55 pounds of a division 1.1, 1.2, or 1.3 explosive material; more than 1 liter per package of a material poisonous by inhalation; a shipment of any hazardous material in bulk packaging with a capacity equal to or greater than 3500 gallons of liquids or gases or greater than 468 cubic feet of solids; a shipment other than bulk packaging of one class of hazardous materials for which placarding of the conveyances is required; infectious substances listed as select agents by the Centers for Disease Control and Prevention; and shipments that require placarding. As noted in Chapter 3 of this document, the HRCQs for radioactive material are set at a higher threshold than the Code of Conduct Category 2 threshold.

Because of the diversity of both the hazardous materials addressed and the methods to transport the material, PHMSA security plan requirements are not prescriptive in nature. PHMSA requires that each plan include an assessment of the possible transport security risks and appropriate measures to address the identified risks and allows that specific security measures put into place by the plan may vary with the level of threat at a particular time. At a minimum, PHMSA requires a security plan to address the elements of personnel security (confirmation of information provided by employees and job applicants); unauthorized access (complete treatment of risks associated with unauthorized access to hazardous materials); and en route security (consideration of security risks from point of origin to point of destination).

Although PHMSA does not maintain or approve security plans (a general template is available), security plans must be in writing and must be retained for as long as they remain in effect. A copy of the security plan or applicable section must be available to the employees who are responsible for implementing it. The security plan must be revised and updated as necessary to reflect changing circumstances.

PHMSA Training Requirements

So that security plans are properly implemented, PHMSA requires that all hazardous materials employees receive basic training on the security risks associated with hazardous materials transportation and methods to enhance transport security. This training must also include a component that covers how to recognize and respond to possible security threats. Employees responsible for implementing a company's security plan should receive additional training on the topics of company security objectives, specific security procedures, employee responsibilities, actions to take in the event of a security breach, and organizational security structure.

5.2.2 DOT Federal Motor Carrier Safety Administration Transport Security Program

The Federal Motor Carrier Safety Administration (FMCSA) is the agency within DOT responsible for improving truck and bus safety on U.S. highways. In terms of hazardous material safety, the agency's goal is to reduce the number of serious hazardous material transportation incidents 20 percent by 2010 as compared to fiscal year 2000. In terms of hazardous material security, FMCSA is conducting research, implementing programs, and drafting regulations to reduce

hazardous material security risks that could potentially harm the public and environment. The following is a summary of the agency's recent security initiatives and programs.

Following the terrorist attacks of September 11, 2001, FMCSA began conducting security sensitivity visits to motor carriers involved in the transportation of hazardous material. A security sensitivity visit is a set of security-related questions asked in conjunction with a Hazardous Material Compliance Review. Security sensitivity visits are nonratable reviews intended to educate the motor carrier and not intended to initiate enforcement.

On February 27, 2003, FMCSA instituted the Security Contact Review (SCR) Program. An SCR is a stand-alone visit to a transportation entity for the purpose of evaluating that company's security posture. The agency designated SCRs to be conducted for motor carriers transporting high-hazard materials, including radioactive material. The SCR can be performed independently or in conjunction with any other type of FMCSA review (Hazardous Material Compliance Review, Cargo Tank Facility Review, or Shipper Review, etc.). SCRs are nonratable reviews but may result in enforcement actions. FMCSA performs SCRs on motor carriers and/or shippers that are required to have a transportation security plan, per Part 172 Subpart I of the Hazardous Material Regulations. To date, FMCSA has conducted approximately 3000 SCRs on motor carriers and shippers of hazardous materials.

On March 25, 2003, the Research and Special Programs Administration, now PHMSA, issued a final rule (68 FR 14509) that required transportation entities to have a written security plan if they transport or cause to be transported hazardous materials in quantities that require placarding. FMCSA modified its SCR Program to incorporate all aspects of required security plans, following the release of this rule.

In an effort to increase industry knowledge about the DOT security plan requirements, FMCSA created the "Guide to Developing an Effective Security Plan for the Highway Transportation of Hazardous Materials." The agency distributed this guide to all its registered hazardous material carriers. The guide continues to be distributed at industry conferences and is available in a downloadable format on the FMCSA Web site.

FMCSA established its Hazardous Materials Safety Permit Program on January 1, 2005. Congress directed FMCSA to implement this program to produce a safe and secure environment for the transport of certain types of highly hazardous materials, including explosives, HRCQ of radioactive materials, toxic by inhalation hazards, and methane. This program requires permitted motor carriers to maintain a security program and establish a system of communication to enable commercial motor vehicle drivers to contact motor carriers during the transportation of these hazardous materials. This safety and security program utilizes the SCR Program to collect specific security information regarding the motor carrier's ability to secure certain type of hazardous materials.

The FMCSA and the Intelligent Transportation Systems Joint Program Office within DOT sponsored a major field operational test to assess the potential enhancement of the safety and security of hazardous materials transportation resulting from the application of various technologies. The agencies conducted the Hazardous Materials Transportation Safety and Security Field Operational Test Program from August 2002 to August 2004. The goal of the program was to demonstrate and assess the effectiveness of certain technological solutions for enhancing the safety and security of hazardous materials transportation by highway.

5.2.3 DOT Federal Railroad Administration Transport Security Program

The Federal Railroad Administration (FRA) is the agency within DOT that is responsible for promoting and regulating safety throughout the Nation's railroad industry. The Hazardous Materials Division of the FRA Office of Safety administers a safety program that oversees the movement of hazardous materials (including dangerous goods), such as petroleum, chemical, and nuclear products, throughout the U.S. rail transportation system, including shipments transported to and from international organizations.

In partnership with the railroad industry and shippers, FRA has undertaken a variety of actions to enhance the safety and security of hazardous materials transported by rail. These include enhanced security planning requirements; inspection of rail carriers' security programs; partnership with other Federal, State, and local agencies, industry, and labor to improve information-sharing and compliance with threat-based security requirements; and development of rail-specific security regulations.

In July 2004, FRA held a meeting with all Class I[6] rail carriers to verify awareness of DOT security plan requirements, as detailed in 49 CFR 172.800 through 49 CFR 172.804, and develop a nationwide plan to ensure compliance. FRA developed special focus inspection teams and performed security inspections at all Class I railroads. The agency performed these security inspections at the railroads' headquarters facilities and inspected the security plan against DOT regulatory requirements. FRA documented the findings from these inspections and performed necessary followup inspections to ensure compliance. For the smaller regional and short-line railroads, FRA hazardous materials inspectors are reviewing compliance with the security plan requirements as part of regularly scheduled hazardous materials compliance inspections.

FRA has taken the lead in coordinating the establishment of the Nation's first organized labor, information security, and coordination working group. In conjunction with the Transportation Trades Division of the AFL/CIO, FRA established the Railroad Labor Security Committee. The objective of the committee is to inform railroad labor representatives and employees about security and to encourage employees to be vigilant and to report hostile surveillance or suspicious activity along the right-of-way to railroad police or appropriate law enforcement agencies.

As part of the railroad intelligence and law enforcement information-sharing network developed by FRA, the agency has funded a railroad special agent assigned full time to the FBI's National Joint Terrorism Task Force. This program provides a direct conduit for sharing intelligence and threat awareness information with railroad industry and security authorities. Additionally, FRA inspectors and railroad police assist each of the FBI's local Joint Terrorism Task Forces.

FRA has participated in a variety of other working groups with Federal agencies and industry representatives to review the security of hazardous materials in transportation. Specific to transportation of radioactive materials, FRA has participated in the DOE Transportation External Coordination Working Groups for Security and Rail Routing and in the NRC Transit and Transshipment Security Working Group.

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6 Class I railroads, as designated by the Surface Transportation Board, are those railroads with operating revenues of $272 million or more.

Building on the lessons learned from both security compliance inspections and the input of other agencies and stakeholders, FRA is developing enhanced security regulations for shipment of certain hazardous materials. The proposed security regulations will require rail carriers to perform specific security checks for signs of tampering or improvised explosive devices before the carrier accepts railcars containing hazardous material for transportation. Additionally, for those materials identified as posing a significant risk in transportation (including radioactive materials identified as HRCQ), the proposed regulations will require rail carriers to analyze the safety and security risks along the rail transportation routes, assess alternative routing options, and make specific routing decisions based on the assessments. FRA is also proposing clarifications of the existing security plan requirements to address en route storage and delays in transit. FRA is developing these regulations jointly with PHMSA and has benefited from consultation and input from TSA.

5.2.4 DOT Federal Aviation Administration Transport Security Program

The Federal Aviation Administration (FAA) is the DOT agency responsible for increasing air transport security by preventing hazardous materials accidents and incidents aboard aircraft. FAA employs over 100 special agents dedicated to enforcement and educational outreach. FAA's internal security works with security specialists assigned to security divisions at each FAA region and center. The security program ensures that FAA complies with public laws, national directives, and DOT policies that influence FAA security practices. It creates an FAA environment that reduces the risks posed by espionage, sabotage, theft, vandalism, terrorism, and other criminal acts.

FAA enforces all DOT hazardous materials regulations and actively investigates shippers and carriers of hazardous materials for development and implementation of security plans, which include an assessment of possible security risks. FAA ensures that the security plan addresses personnel security, unauthorized access, and en route security. For passenger air carriers and <u>some</u> all-cargo air carriers, the security programs required by TSA meet these requirements. These TSA security programs address all three elements of the required security plan.

TSA is responsible for the overall security of air cargo and baggage. Thus, TSA maintains and enforces security regulations that cover air cargo throughout its movement in the air transportation system, starting with its acceptance for transportation by an airline or freight forwarder (also known as an "indirect air carrier") until its departure from the destination airport. These TSA regulations are found in 49 CFR Part 1540, "Civil Aviation Security: General Rules"; 49 CFR Part 1542, "Airport Security"; 49 CFR Part 1544, "Aircraft Operator Security"; 49 CFR Part 1546, "Foreign Air Carrier Security"; and 49 CFR Part 1548, "Indirect Air Carrier Security." For air cargo, there is considerable overlap between the DOT and TSA security regulations. As per 49 CFR 172.804, "Relationship to Other Federal Requirements," many shippers and carriers use TSA-mandated security plans to meet DOT security requirements.

5.2.5 Transportation Security Administration

Whether a part of DOT or DHS, TSA has had only one mission since its inception on November 19, 2001—to protect the Nation's transportation system and to ensure freedom of movement for people and commerce. TSA is developing collaborative relationships with other Federal, State, and local agencies, as well as industry stakeholders and foreign governments and organizations, to delineate specific roles and responsibilities for transportation security information throughout the domains of air, land, and sea. The agency is making innovative use of leading-edge technologies and techniques to collect and manage information regarding

potential threats to persons, cargo, and commerce. Its processes and procedures will effectively disseminate relevant and timely transportation security and intelligence information to the appropriate agencies.

Although a relatively new agency, TSA has numerous programming initiatives and coordinates with other Federal and State agencies on many more. At this time, TSA is focusing on domain awareness (developing threat and vulnerability assessments and developing the Transportation Worker Identification Credential Program); terrorism prevention and protection of transport system (developing standards for security equipment, developing standards for aircraft baggage and cargo operations, and establishing a presence at foreign transport nodes); and incident response (developing rapid response capabilities, developing response plans, and establishing a security operations center).

5.2.6 U.S. Coast Guard Transport Security Program

The Hazardous Materials Standards Division of the USCG develops standards and industry guidance to promote the safety of life and protection of property and the environment during marine transportation of hazardous materials, including radioactive materials. This includes transportation of cargo and hazardous materials used as ships' stores and hazardous materials used for shipboard fumigation of cargo. The division develops and maintains the safety requirements for marine vapor control systems and establishes occupational health and safety program guidance for maritime and Coast Guard personnel. Other specific functions involve the classification of new bulk liquids, gases, and solid hazardous cargoes before their shipment, issuance of special permits for transport of bulk solids, maintenance of chemical hazards and attributes databases, and publication of the Chemical Data Guide for Bulk Shipment by Water. The division represents USCG in fora related to hazardous materials such as the American Bureau of Shipping technical committees, National Fire Protection Association committees, and the Marine Chemist Qualification Board. Internationally, the division represents the United States at meetings of the International Maritime Organization Subcommittee on Bulk Liquids and Gases and the Subcommittee on Dangerous Goods, Solid Cargoes, and Containers, and meetings of the UN Committee of Experts on the Transport of Dangerous Goods.

USCG authority also extends to security requirements for marine terminals. In accordance with the Maritime Transportation Security Act of 2002, USCG develops standards for and approves facility security plans for marine terminals.

In addition to ongoing safety and security programs, USCG has developed or expanded its efforts in identifying, inspecting, and securing dangerous goods. One of the latest efforts involves establishing a list of selected “high hazard” hazardous materials, designated “certain dangerous cargoes.” Ships that carry certain dangerous cargoes, which include large quantities of radioactive material, must report that cargo to USCG as part of its standard notice of arrival. USCG uses this notification as one element in its risk scoring process, which may result in additional security measures being applied to the vessel. This program also applies to barges on inland rivers. This program has allowed USCG to better apply its limited resources to the vessel movements that pose the most risk of being used as weapons (for example, liquefied hazardous gas carriers).

A second USCG initiative is increased container security. Because much of the cargo entering the United States is containerized, expanded container inspection is of vital importance. Under the current inspection program, containers known to hold hazardous materials (placarded containers) are inspected to ensure compliance with all applicable hazardous materials

regulation and for structural safety. Containers with nonhazardous cargoes undergo random inspection to verify that no hazardous materials are present.

Finally, USCG provides security resources and services to protect maritime shipments of materials for other Government agencies upon request.

5.2.7 NRC Transport Security Program

Following the terrorist attacks of September 11, 2001, the NRC immediately issued advisories for licensees to take certain measures to enhance security to further reduce the possibility of malevolent acts using risk-significant sources. These advisories recommended that licensees implement additional security measures during shipments, including enhanced preplanning and coordination with the affected States, additional advance notification of shipments, enhanced control and monitoring of shipments en route, trustworthiness checks for individuals who have access to the shipment or to information about the shipment, and enhanced information security measures for shipment routes and schedules. In general, the industry voluntarily and quickly implemented these advisories and has adhered to their recommendations. The NRC also concluded that these increased controls and additional security measures should be imposed by an order rather than be adopted on a voluntary basis. The objective of this effort is to ensure timely detection of any loss or diversion of shipments so that a licensee can initiate an appropriate investigation and response.

As noted in Chapter 4 of this document, the NRC has issued orders to NRC and Agreement State licensees that are known transporters of Code of Conduct Category 1 byproduct materials. These orders require the implementation of ASMs during the transport of radioactive material in quantities greater than Code of Conduct Category 1. These ASMs provide for enhanced transportation security measures and address security enhancements in the areas of preplanning and coordination of shipments; advance notification of shipments to both the NRC and the States through which the shipment will pass; control and monitoring of shipments that are underway; trustworthiness and reliability of personnel; and information security. In general, these security and control measures include enhanced communications between transport, monitoring stations, and LLEA; requirements for individuals who accompany the shipments; more stringent loss source investigation action and notification time requirements; and expanded trustworthiness and reliability background checks for transportation personnel. The NRC provides information to Government agencies on a daily basis regarding Category 1 radioactive material in transit.

The NRC and the Agreement States issued legally binding requirements for ICs to radioactive materials licensees that use and transport quantities at or greater than Code of Conduct Category 2 levels but less than Category 1 levels. For the transport of Code of Conduct Category 2 byproduct radioactive material, these enhancements provide increased controls beyond current regulations in the areas of preplanning and coordination of shipments, use of carriers that control and track shipments, trustworthiness of personnel, and information protection. These legally binding requirements are now in effect.

The ICs also direct NRC and Agreement State licensees to contact NRC 90 days in advance of a shipment, if they intend to transport Category 1 radioactive material. Upon receiving this notification, the NRC will issue the ASMs to the licensee.

The NRC issues orders requiring ASMs and ICs, as appropriate, to licensees that are importing, exporting, or domestically transporting Code of Conduct Category 1 and 2 byproduct materials

within the United States. The orders will remain in effect until the Commission incorporates similar measures into its regulations.

In addition to the issuance of the orders, legally binding requirements, and standing advisories, the NRC has also routinely adjusted the security measures for shipments to reflect changes in the Homeland Security Advisory System threat level. For example, during "national special security events" as defined by DHS, the NRC has issued safeguards advisories that warn licensees to avoid shipping through geographic areas of concern.

5.3 Discussion

The domestic regulations and international standards governing the safe transport of hazardous materials, including risk-significant radioactive materials, provide a level of protection from the risks associated with the transport of these materials. The safety regulations are widely implemented, and the level of compliance is high. Efforts to include security requirements in these regulations or as companion documents to these regulations have received high priority since 2001 and continue today.

The agencies involved in the transport of hazardous materials, including risk-significant radioactive sources, continue to initiate and develop programs. The range of programs and level of effort are good, but additional effort is necessary. In this context, the following sections discuss possible enhancements to these programs related to transport security.

<u>Incorporation of Hazardous Material Transport Security "Lessons Learned"</u>
Since September 11, 2001, the Federal agencies represented on this task force have researched transport security programs, implemented security initiatives, and codified transport security plan requirements. Because of the limited number of shipments of risk-significant radioactive sources, these initiatives and programs have focused on shipments of hazardous materials of high consequence. Radioactive material transport experts have not always participated in their development and implementation. The security programs for risk-significant radioactive sources may be improved by examining the results, implementing the applicable provisions, and determining the "lessons learned" from hazardous materials security initiatives. Specifically, the Transportation Security of Radiation Sources Subgroup should review the findings and conclusions of all research conducted on securing "high hazard" hazardous materials transport. Although risk-significant radioactive sources pose unique threats, the techniques and technologies used to secure the transport of other hazardous materials of high consequence may also improve security of radioactive source transportation. Given the greater number of nonradioactive hazardous materials shipments, these practices might also suggest new ideas or methods previously deemed too expensive for the relatively small radioactive material transport industry. This Subgroup should pay particular attention to the ongoing DOT studies on securing the transport of toxic by inhalation material, explosive material, and flammable liquids and gases.

Action 5-1: The Transportation Security Subgroup should review the findings and conclusions of all research conducted on securing "high hazard" hazardous materials transport to determine if any of the measures should be applied to transport of risk-significant radioactive sources.

<u>Transportation Security Memorandum of Understanding</u>
The current MOU between DOT and the NRC has served as the foundation of cooperation and consultation for the transportation safety program. However, it does not cover transportation

security. TSA is primarily involved in transportation security and it was not a signatory to the existing MOU. Because of the importance of transportation security, there should be a similar MOU that addresses it. Therefore, the Task Force recommends that an MOU for transportation security of risk-significant sources be developed. This agreement, similar to the one for transport safety, would clarify the roles and responsibilities of each agency, forge a spirit of cooperation and awareness among the participants, reduce duplication of efforts, and most importantly ensure development of a comprehensive and consistent transport security program.

Recommendation 5-1	The Task Force recommends development of a Transport Security Memorandum of Understanding to serve as the foundation for cooperation in the establishment of a comprehensive and consistent transport security program for risk-significant sources.

Improving Existing Security Plans and Programs

In May 2002, PHMSA (then known as the Research and Special Programs Administration) proposed regulations to enhance the security of hazardous materials shipments. Although the proposal included provisions on registration certificates, shipping documentation, and training, the major initiative was the establishment of a new requirement that shippers and carriers of HRCQ of radioactive material, explosive material, poison by inhalation material, and infectious substances have plans to ensure the security of shipments during transportation. Since this rule became final in March 2003, PHMSA and all DOT modal authorities now have some experience with its implementation. The HRCQ addresses other radioactive material and not just those radionuclides in the Code of Conduct. (Chapter 3 of this report addresses thresholds for Code of Conduct radionuclides.) DOT should evaluate whether transport of some of the lower risk radioactive materials warrants a security plan.

As part of the high-threat urban area corridor assessments conducted in 2005, DHS and DOT identified some best practices for the transport of various hazardous materials. DOT should evaluate the security recommendations that emerged from this program and consider them for inclusion, as appropriate, in the security plans for transporting risk-significant radioactive materials.

Action 5-2: DOT should evaluate the best practices from the high-threat urban area corridor assessments to determine whether it should incorporate any of the best practices into the requirements for security plans for high-risk radioactive material. DOT should also evaluate whether transport of lower risk radioactive material warrants a security plan or whether the transport could be exempted from some of the requirements.

Current requirements restrict air transport of radioactive material to material being used for research, medical diagnosis, or medical treatment. As currently written, the requirement is vague and does little to actually restrict the air transport of radioactive materials. In some circumstances, air transport may offer the most secure mode of transport but is prohibited. While not specific to risk-significant radioactive material, this issue should be evaluated. The Task Force will consider examining this topic in the future.

Research and Development of Shipment Tracking Requirements

Given the current level of technology, tracking of packages, shipments, and conveyances is possible and would improve security. Although not a fatal flaw in the tracking of hazardous materials, the rapid growth of technology available to track packages, shipments, and conveyances may offer the transport community good benefit at marginal costs. To take full

advantage of this technology, transport security officials need to research the technology, including cost-benefit, to determine where it should be applied.

EPA and DOE (Oak Ridge National Laboratory) are testing the use of radiofrequency identification to track and monitor the shipment of radioactive materials in commerce. Various radioisotopes, including Sr-90, Cs-137, Co-60, and Cf-252, have been shipped in Type A packaging embedded with these tags. Initial results are very encouraging and indicate that this technology is a viable way to physically track less-than-truckload shipments.

FMCSA has conducted operational tests of existing technologies offering enhanced security of motor carrier shipments of hazardous materials. This 2-year test evaluated the costs, benefits, and operational processes required for wireless communications systems, including GPS tracking and digital telephones; in-vehicle technologies, such as onboard computers, panic buttons, and electronic cargo seals; personal identification systems, including biometrics and a user name/password system; and vehicle tracking, including geofencing and trailer tracking systems. These tests may form the basis of regulation to require vehicle tracking and communications systems and antitheft technologies for motor carriers transporting certain classes and quantities of hazardous materials. The results of this study should be evaluated to see which if any of these technologies should be required for transporting risk-significant radioactive material.

One method to thwart hijackers is to disable the truck carrying the material they wish to obtain. DOT has been evaluating vehicle-disabling technologies, and this effort should continue. Specific aspects to be studied include safety and security testing of these systems, costs and benefits of using industry-standard truck disabling technologies, identification of best practices for safety and security applications of remote vehicle-disabling technologies in trucking operations, and conducting field operational testing of this technology.

As mentioned in Chapter 4 of this document, one way to uncover illicit trafficking is the use of detection devices. The U.S. Government should continue testing and evaluating mobile and stationary radiation detection devices to be used on truck traffic. The testing should evaluate a system's capability to detect loads of radioactive materials and to identify specific isotopes and quantities present in shipments.

The U.S. Government needs to research these technologies, along with their implementation and maintenance costs, to determine the feasibility of applying them to shipments of risk-significant radioactive materials. Factfinding should include interactions with interested stakeholders, such as industry representatives. The Task Force should establish a forum to promote exchange of information and provide a common interest setting that may result in collaboration. To accomplish these objectives, the Task Force recommends that DHS and DOT work with the Transportation Security Subgroup to study shipment tracking options. The group should report back to the Task Force with recommendations on shipment tracking within 2 years.

Recommendation 5-2	The Task Force recommends that the U.S. Government evaluate the feasibility of using new and existing technologies to detect and discourage the theft of risk-significant radioactive material during transport. The evaluation should include the findings of operational testing of existing technologies offering enhanced security of motor carrier shipments of hazardous material; shipment tracking, including communication systems; radio-frequency identification; vehicle disabling technologies; and mobile and stationary radiation detection systems.

Improving Route Security

Since not all routes offer the same level of security, it stands to reason that restricting risk-significant radioactive source transport to those routes with the best security would improve transport security. Identification of such routes and the possibility of restricting transport to these routes should be investigated. Although this effort is in its infancy; no routes have been determined to be unacceptable. DOT should continue its current efforts to identify secure route characteristics and to evaluate and identify the best transport routes for large quantities of hazardous materials, including risk-significant radioactive material.

DOT should also continue to develop regulations requiring rail carriers of risk-significant radioactive material, large quantities of explosives, and toxic by inhalation materials to collect and maintain data on the numbers of these shipments along its routes and to use the data to conduct a safety/security risk analysis of the routes used. Additionally, DOT should require each carrier to identify and analyze the next most commercially practicable alternative route for each of the primary routes analyzed.

DOT should continue its efforts to provide a comprehensive analysis of safety and security concerns related to hazardous materials routing in the United States. DOT should develop guidance documents and tools to identify and mitigate security vulnerabilities in the identified routes.

Transport Facility Security

Although cargo theft from warehouses and intermodal transport facilities is a growing problem facing the entire transport industry, theft of large quantities of radioactive material from such facilities has not been a major issue. The measures implemented to improve transport security for risk-significant radioactive material also improve security of the material in short term storage. Large shipments of radioactive material are made directly with few, if any, stops. It is the opinion of the Task Force that efforts to improve shipment tracking and reporting systems; implement transport security programs; improve local law enforcement expertise in cargo security; and improve cargo security techniques both on the container themselves and on contain handling coupled with improved security requirements for intermodal facility and warehouses adequately address this potential threat.

International Transport, Transit and Transshipments

In response to the potential for their malevolent use, the United States has implemented prescriptive security measures designed to control the domestic transport, import, and export of Category 1 and 2 sources as defined in the Code of Conduct. The U.S. Government is also participating in international efforts to develop similar security standards for international transport of such sources.

Internationally, IAEA has developed the Code of Conduct and the Guidance on Import and Export of Radioactive Sources (Guidance), which supplements the Code. These documents address notification and consent provisions in connection with import or export of Category 1 and 2 sources, but do not include these provisions for transit (no conveyance change) or transshipment (involving conveyance change) of radioactive sources that do not have an origination or final destination point within a given country but are transported through the land territory of the country. Developers of the Code of Conduct and the Guidance acknowledged the need for additional work to define the transit and transshipment portions of transportation, consistent with international law. The Task Force believes that the completion of this effort is vital. The lack of knowledge about these shipments is one of the most significant gaps in transportation security. The Task Force recognizes it cannot resolve this issue on its own, as resolution will require international cooperation to revise international transportation standards to include enhanced security measures. The mission of the Transit and Transshipment Interagency Working Group is to evaluate this specific area and to develop a U.S. position that can be used in international negotiations. This position should be consistent with existing U.S. positions on international transportation of radioactive material, as well as existing international law. These efforts should not only continue, they should be accelerated.

As a practical matter, transshipment requirements can only be imposed and enforced through international cooperation. However, the NRC has worked with several foreign companies for the voluntary submission of information related to transits and transshipments. The NRC shares the information with other regulatory bodies such as Customs and the States through which the material is transiting. In the interim until international transportation security guidance is developed and implemented on a broad basis, the NRC should continue its efforts to obtain this information from shippers making transit or transshipments of radioactive sources through the United States.

To close the international transport security gap, the Task Force recommends that DOT, NRC, DOS, and other interested Federal agencies continue to work with IAEA to develop international transport security guidance material for risk-significant sources. The participating agencies should work to coordinate the IAEA program with the existing U.S. requirements and ensure that the IAEA standards are reflected in U.S. law and regulations as soon as possible. The domestic strategy for controlling Category 1 and 2 source transport consists of increased security transport measures, promulgated by the NRC, which licensees that ship or receive sources will impose on the carriers. Upon issuance of international transport security guidance, the DHS, DOT, NRC, and interested Federal agencies should develop an implementation strategy and schedule to define the transport security requirements for import, export, transit, and transshipments of Category 1 and 2 radioactive sources in the United States.

Recommendation 5-3	The Task Force recommends that the U.S. Government immediately develop a strategy and take actions to address the security of international shipments of Category 1 and 2 radioactive sources that transit or are transshipped through the land territory of the United States.

5.4 Conclusions

The domestic and international regimes governing the safe transport of hazardous materials, including risk-significant radioactive material, provide a level of protection from the risks associated with the transport of these materials. Considerable progress has been made in

enhancing the security provisions in the domestic regime. The international safety standards are widely implemented, and the level of compliance is high. Efforts to include security provisions in these standards or as companion documents have received high priority since 2001 and continue today.

The agencies involved in the transport of hazardous materials, including risk-significant radioactive sources, continue to initiate and develop programs. The range of programs and level of effort among the agencies are good but additional effort is necessary. Therefore, the Task Force has made several recommendations to enhance transportation security.

5.5 Summary of Recommendations

The Task Force is making several recommendations in the area of transport security. The Task Force has not attempted to prioritize these actions.

Recommendation 5-1	The Task Force recommends development of a Transport Security Memorandum of Understanding to serve as the foundation for cooperation in the establishment of a comprehensive and consistent transport security program for risk-significant sources.
Recommendation 5-2	The Task Force recommends that the U.S. Government evaluate the feasibility of using new and existing technologies to detect and discourage the theft of risk-significant radioactive material during transport. The evaluation should include the findings of operational testing of existing technologies offering enhanced security of motor carrier shipments of hazardous material; shipment tracking, including communication systems; radio-frequency identification; vehicle disabling technologies; and mobile and stationary radiation detection systems.
Recommendation 5-3	The Task Force recommends that the U.S. Government immediately develop a strategy and take actions to address the security of international shipments of Category 1 and 2 radioactive sources that transit or are transshipped through the land territory of the United States.

6 Background Checks

6.1 Introduction

Most Federal agencies require some background investigations for their employees. Some agencies require background checks and investigations for licensees and others covered by their regulations; these checks may include criminal history checks or identity verification for foreign nationals. Background checks involve different types of investigations and/or analysis that may include all or some of the following elements: verification of true identity, trustworthy and reliability check, character and reputation check, credit history check, employment history check, personal history questionnaire, local agency criminal history check, FBI criminal history check, psychological assessment, and a demographic data check. Some of these elements require fingerprinting. Licensees conduct only some of these checks; law enforcement agencies do others. This chapter discusses the various agencies' background check programs as they relate to radioactive sources.

6.2 Types of Background Checks and Investigations

The following sections describe the various terms in use by regulatory agencies and industry, background check requirements of different agencies, and characteristics of each type of background check as they pertain to individuals with access to risk-significant radioactive material.

<u>FBI Criminal History Check</u>
In an FBI criminal history check, a Federal agency or LLEA submits the individual's fingerprint cards to the FBI. An individual may request a copy of his or her FBI identification record for personal review or to challenge information on the record. As required by State or Federal law, other requests for a background check for employment or licensing within the United States must come through a State identification bureau, requesting Federal agency, or other authorized channeling agency such as the NRC. The criminal history check provides an overview of the subject's past recorded criminal activities, including affiliations with violent gangs or terrorist activities, associated with a specific set of fingerprints. FBI runs the fingerprints through the Terrorist Screening Center.

<u>Local Criminal History Check</u>
Depending on the jurisdiction, a local criminal history check may involve a fingerprint check by local law enforcement officials. This check only provides information from local criminal justice agency records or local court documents and is limited to cases processed by the agency providing the information. Organizations may need to check several local sources to screen applicants who have moved within counties or States.

<u>NRC Trustworthy and Reliability Check</u>
Typically performed by a licensee, an NRC trustworthy and reliability check does not require fingerprinting. The check involves, at a minimum, an evaluation of employment history, education history, and personal references.

<u>NRC Background Check</u>
An NRC background check includes, at a minimum, verification of identity, employment history, education history, and personal references. It does not include fingerprinting.

NRC Background Investigation
An NRC background investigation seeks to identify past actions that indicate an individual's future reliability. At a minimum, the background investigation must verify an individual's true identity, employment history, education history, credit history, military service, and character and reputation. A background investigation may or may not include fingerprinting.

6.3 Summary of Current Programs

6.3.1 Department of Energy Program

In accordance with Executive Order 12968, "Access to Classified Information;" Section 145 of the AEA; and DOE regulations at 10 CFR Part 710, "Criteria and Procedures for Determining Eligibility for Access to Classified Matter or Special Nuclear Materials," and DOE Directive M 470.4-5, "Personnel Security." DOE issues security clearances to federal and contractor employees for access to classified information (National Security Information and Restricted Data) and special nuclear materials following a determination the employee has a demonstrated "need to know" and a favorable background investigation by either the U.S. Office of Personnel Management or the FBI.

The DOE personnel security program focuses on determining eligibility for access to restricted data, special nuclear material, and national security information. The only background checks DOE obtains for other purposes are those required by the U.S. Office of Personnel Management under 5 CFR Part 731, "Suitability," to determine an individual's eligibility for Federal employment, and those required under HSPD-12, "Policy for a Common Identification Standard for Federal Employees and Contractors," for individuals who require an identification badge to work on DOE-controlled facilities. The DOE does not use these additional background checks, governed by the Privacy and Freedom of Information Acts, to determine eligibility for access to limited areas or to radioactive materials.

6.3.2 Department of Homeland Security Program

Other Federal agencies with separate statutory authority in transportation security have security requirements that include fingerprinting and criminal history checks. TSA has regulations for both civil aviation security and maritime and land transportation security. These include specific requirements for Federal fingerprint-based criminal history checks of various transport personnel, including aircraft flight crew members, persons who perform checked baggage or cargo functions, and hazardous materials drivers. Individuals can be disqualified from performing these functions if the checks indicate potential security risks. Similarly, the USCG has requirements for security at U.S. ports and background checks for maritime personnel.

As part of its Hazmat Threat Assessment Program, TSA issued 49 CFR Part 1570, "Land Transportation Security: General Rules," and 49 CFR Part 1572, "Credentialing and Background Checks for Land Transportation Security." These regulations require the collection of biographical information and fingerprints from applicants seeking a new hazardous materials endorsement on their State-issued commercial driver's license. Individuals who wish to renew or transfer an existing hazardous materials endorsement must follow a similar process. TSA is proposing regulations for the transport worker identification credential under 49 CFR Part 1570 and 49 CFR Part 1572, which would apply a systemwide common credential for use across all transportation modes (air, land, and water).

DHS administers the Systematic Alien Verification for Entitlements (SAVE) web-based computer program. The DHS SAVE program has two databases. One is the Basic Pilot Program, which verifies the identity of citizens and noncitizens. Users can query Social Security Administration and DHS databases by using an automated system to verify the employment authorization of all newly hired employees. Participation in the Basic Pilot Program is voluntary and free to participating employers.

The other database of the DHS SAVE program is the Verification Information System, which verifies the immigration status of noncitizens only. This database queries an immigration database with information on more than 60 million noncitizens. The return time for this query is 3 to 5 seconds, if the information is in the database and there are no discrepancies. If there are discrepancies, the user must initiate a second search following the guidelines of the DHS SAVE program. The return time for this query ranges from 10 to 30 business days. An MOU is necessary for participation in the Verification Information System.

6.3.3 Federal Bureau of Investigation Program

Pursuant to Public Law 92-544, the FBI may conduct criminal history record checks for noncriminal justice purposes. The FBI is empowered to exchange criminal history record information with State and local government officials for employment, licensing, volunteering, and other similar noncriminal justice purposes if authorized by a State statute approved by the U.S. Attorney General.

A criminal history record includes an individual's identifiers (descriptive information and fingerprints) and arrests and subsequent dispositions. The FBI's Criminal Justice Information Services (CJIS) Division posts dispositions to the National Criminal History Record File. Each criminal arrest for which the CJIS Division has a fingerprint submission should have a disposition. The FBI defines a disposition as an action the criminal justice system regards as final. A disposition states that arrest charges have been modified or dropped, or it reports the court's findings. To ensure accuracy and completeness, criminal justice agencies submit dispositions to the CJIS Division, which posts them to the criminal history record. Information on dispositions may come from the following sources:

- State criminal history repositories
- arresting agencies (sheriff's offices, police departments, State police, correctional facilities)
- courts
- Federal agencies (FBI; Drug Enforcement Agency; Bureau of Alcohol, Tobacco and Firearms; U.S. marshals; Immigration and Naturalization Service)

Fingerprints go to the FBI's Integrated Automated Fingerprint Identification System, which is directly linked to the FBI's National Criminal Information Center and updated daily by the Terrorist Screening Center database. The FBI also compares fingerprints to the Violent Gang and Terrorist Organization File.

6.3.4 U.S. Nuclear Regulatory Commission Program

The NRC's fingerprinting authority stems from Section 149 of the AEA. Before enactment of the EPAct, the NRC could only require fingerprint-based FBI criminal history checks for individuals at utilization facilities who had unescorted access to the facility or access to SGI. The NRC submits all fingerprints obtained by licensees to the Attorney General. Licensees use the results from the FBI criminal history check to determine whether unescorted access to the nuclear facility or access to SGI can be granted. The regulations contain guidance on using the information and procedures for processing the fingerprint checks.

As discussed in Chapter 4 of this report, the NRC and Agreement States have imposed additional security and control requirements on certain licensees that are authorized to possess Category 1 or 2 quantities of radioactive materials or have access to SGI. These requirements include background checks for licensee personnel; however, fingerprinting is not required. The requirements emphasize the licensee's determination of the trustworthiness and reliability of individuals who have unescorted access to Category 1 or 2 quantities of radioactive material. At a minimum, the evaluation of information about a person's trustworthiness and reliability should include employment history, education history, and personal references.

Table 6.1 summarizes the current background check elements for approved unescorted access to licensee facilities and SGI.

6.4 Stakeholder Interactions

Throughout the development of the NRC's post-September 11, 2001, measures to enhance the security and control of radioactive materials, the NRC met with affected stakeholders to solicit their input on the proposed security and control requirements. The stakeholder meetings included discussion on background checks and trustworthiness and reliability requirements. In addition, the recent promulgation of the NRC proposed rulemaking to amend 10 CFR Part 73, which includes background check requirements for access to SGI, included a period for public comment. Future rulemakings will also provide for a public comment period on proposed rules.

6.5 Discussion

<u>Background Checks for NRC and Agreement State Licensees</u>
The EPAct expands the NRC's fingerprinting authority for Federal criminal history check purposes to a broader class of persons. The legislation expands the class of entities covered by the authority for fingerprinting to include individuals or entities that (1) are licensed or certified to engage in an activity subject to NRC regulation, (2) have filed an application for a license or certificate to engage in an activity subject to NRC regulation, or (3) have notified the Commission in writing of an intent to file an application for licensing, certification, permitting, or approval of a product or activity subject to NRC regulation. Key employees of these entities would need to submit fingerprints if they have (1) unescorted access to a utilization facility, (2) unescorted access to radioactive material or other property subject to regulation by the Commission that the NRC determines to be of such significance to public health and safety or common defense and security as to warrant fingerprinting and background checks, or (3) access to SGI. The legislation gives the Commission flexibility to establish procedures for fingerprinting and the use of criminal history information, while ensuring the privacy of those fingerprinted.

Table 6.1 Summary of Current Background Check Elements

Program Elements Required to Access a Facility or Material	Power Reactors	Panoramic Irradiators	Manufacturers and Distributors	RAMQC	Research Test Reactors	Decom Reactors	Fuel Facilities	IC Licensees	SGI for Byproduct Material Licensees
Consent	X	X	X	X	X	X	X	X	X
Verification of true identity	X	X	X	X	X	X	X	X	X
Character and reputation check	X	X	X	X	X	X	X	X	X
Credit check	X				X	X	X		
Employment history check	X	X	X	X	X	X		X	X
Personal history questionnaire	X	X	X	X	X	X			
Local agency criminal history check		X	X	X	X	X	X		
FBI criminal history check	X								
Psychological assessment	X								
Behavior observation	X								
Drug and alcohol testing	X								
Reinvestigations	X								
Demographic data check[1]	X				X	X			

[1] This an NRC program that screens applicants by criteria not used in a criminal history check. For research and test reactors and decommissioning reactors, the demographic data check was previously completed only once. All other program elements are the responsibility of the licensee.

The NRC is in the process of implementing its new fingerprinting authority provided by the EPAct. It has several rulemakings either planned or already underway to implement various fingerprint-related provisions of the EPAct. The NRC must determine what radioactive material or other property warrants fingerprinting for unescorted access. This evaluation is currently ongoing and should be completed this summer. The following list describes rulemakings that are either planned or underway:

- Proposed amendment to 10 CFR 73.21 rule for access to SGI by broad class of individuals as mandated by EPAct Section 652(B)(ii). The amendment would require that no person may have access to SGI unless (1) there is need to know; (2) the applicant has undergone an FBI criminal history check; and (3) the licensee has established the person's trustworthiness and reliability based on a background investigation of work history, education history, references, and credit history.

- Proposed amendment to 10 CFR 73.56, "Personnel Access Authorization Requirements for Nuclear Power Plants." The amendment would enhance current requirements for granting unescorted access to nuclear power facilities and codify order requirements.

- Proposed amendments to implement EPAct Section 652(B)(i)(II). This rulemaking would establish the requirements for fingerprinting of individuals with unescorted access to radioactive material or other property that the NRC determines to be of such significance to the public health and safety or the common defense and security as to warrant fingerprinting and background checks.

- Proposed amendments to implement EPAct Section 656, "Secure Transfer of Nuclear Materials." Section 656(a) of the EPAct states that individuals accompanying or receiving transfer of material in the United States, pursuant to an NRC import or export license, will be subject to a security background check. Section 656(c) states that these requirements will become effective on a date established by the Commission. The NRC believes that the most appropriate and comprehensive approach for establishing requirements for security background checks is as part of the broader considerations of NRC's planned rulemaking to implement Section 652 of the EPAct. Consistent with Section 656(b), the staff is proposing to amend NRC's regulations to exempt from the security background check requirements of Section 170I those licensees that have not received NRC orders restricting unescorted access to radioactive materials, based both on background checks for trustworthiness and reliability and on fingerprinting and criminal history record checks. In the future more comprehensive Section 652 rulemaking, the staff will consider whether the exceptions for security background checks should be modified.

As part of implementing its new fingerprinting authority, the NRC may issue orders requiring certain licensees to conduct fingerprint checks for employees with access to radioactive materials at Category 1 or 2 levels and with access to SGI. Because orders can be issued more quickly than a regulation that must go through notice and comment, they would cover the gap until the new rules are issued. The NRC has also asked some applicants and licensees to submit fingerprints in advance of the Orders. The NRC plans to issue orders this summer for any NRC or Agreement State licensee that has access to SGI. The NRC also intends to issue orders to the manufacturing and distribution licensees and large panoramic and underwater irradiator licensees to require fingerprints for any individual who has access to risk-significant quantities of radioactive material. The NRC also plans to order fingerprinting of those licensees

who transport Category 1 quantities of radioactive material. The NRC has not decided whether to order fingerprinting for other licensees that may possess risk-significant quantities of radioactive material or to wait until the rulemaking is complete. The Task Force encourages the NRC to require fingerprinting for Federal criminal history checks on any individual with access to Category 1 or 2 quantities of radioactive material.

The NRC should also consider imposing the requirement on license applicants, as well as licensees. The Task Force believes that individuals should be screened before the NRC grants them a license to obtain risk-significant material. A license application screening process that includes fingerprinting for Federal criminal history checks can detect persons with malevolent intent, thereby reducing the risk of radioactive material being diverted or used for malevolent purposes. Until the regulations are in place to require fingerprinting of applicants before they obtain a license, the NRC should explore methods to close this gap. The Task Force encourages the NRC to expeditiously complete its implementation of the fingerprinting provisions of the EPAct for licensees with Category 1 and 2 quantities of radioactive material and those applying for such licenses. The NRC should also consider requiring that individuals with unescorted access to Category 1 and 2 radioactive materials be subject to periodic reinvestigation. One possible method to address this is the expansion of the NRC's Demographic Data Project. This project is a joint collaborative effort by the NRC and the Terrorist Screening Center to identify individuals who pose a threat to national security and who have access to the protected areas and vital areas of nuclear power plants.

Action 6-1: The NRC should expeditiously complete its implementation of the fingerprinting provisions of the EPAct for those applicants for and licensees with Category 1 and 2 quantities of radioactive material. The NRC should place a high priority on completing the EPAct Section 652 rulemaking. As part of the rulemaking, the NRC should require fingerprinting for any individual who could have access to Category 2 or above quantities of radioactive materials. The NRC should also require periodic reinvestigations of such persons.

While Federal fingerprint checks provide reasonable assurance of detecting persons with a malevolent intent and reduce the risk of radioactive material being used for malevolent purposes, fingerprint checks are not conducted in a vacuum. A fingerprint check does not by itself establish a person's trustworthiness and reliability, but must be accompanied by a background investigation reviewed by an official. This ties the fingerprint check and background investigation together. Licensees cannot make a determination of malevolent intent absent the background investigation process. Both the orders and the rulemaking will address the licensees' vetting process.

There is some concern that an individual could apply for a license application in several different Agreement States and with the NRC. Under the current system, reviewers would not know about multiple applications or if an individual had been refused a license in another jurisdiction. This knowledge can be useful to license reviewers. The Nuclear Energy Institute maintains a database with information on power reactor licensees and individuals with unescorted access to nuclear power plants. This database allows users to track permanent employees and members of the transient workforce who have unescorted access to nuclear power plants and to preclude unauthorized entries. A similar database for material licensees could be useful to both reviewers and industry. The NRC should evaluate the feasibility of establishing a national database with information on pending applications for a specific license and information about individuals cleared for unescorted access. Reviewers in Agreement States and the NRC regional offices would then be aware of all applicants requesting materials from various regulatory agencies. A national database would effectively and efficiently streamline the

information flow of current applications for a specific license and information on the current status of employees at particular sites or who may be trying to enter another facility.

Action 6-2: The NRC should evaluate the feasibility of establishing a national database for materials licensees that would contain information on pending applications and information on individuals cleared for unescorted access.

Because NRC is still developing its policy on fingerprinting for materials licensees, it is not clear what obstacles exist for sharing information with the Agreement States. There are privacy issues that will need to be addressed. States do have authority to submit fingerprints to the FBI. The issue of effective and timely exchanges of information relating to the results of criminal and security background checks between the NRC and the Agreement States will be addressed in the next report.

SAVE Program Access

DHS requires an MOU to access the Verification Information System portion of the SAVE program. The NRC was a signatory to a SAVE-related MOU with DHS executed in August 2003. The MOU established the terms and conditions for the participation of the NRC and, at that time, its power reactor licensees in the SAVE program for verifying the immigration status of alien applicants for unescorted access to NRC-licensed reactor facilities. To use the SAVE program under the current umbrella of the NRC/DHS MOU, each licensee must establish its own MOU with DHS. For materials licensees this would mean 1000 to 2000 individual MOUs. Under a possible revised MOU between the NRC and DHS, an MOU between each licensee and DHS would not be necessary. DHS and the NRC General Counsel are working on language for the revised MOU. The language changes will address the statutes that govern the SAVE program and also allow NRC licensees to use the SAVE database to check the immigration status of individuals. For the purpose of verifying the true identity of foreign nationals and to aid in trustworthiness and reliability determinations, the Task Force encourages DHS and the NRC (including Agreement States) to complete the MOU. The MOU would authorize use of the SAVE program and establish the terms and conditions governing participation.

Action 6-3: The NRC and DHS should enter into a memorandum of understanding to cover access to the SAVE database for materials licensees.

6.6 Conclusions

The EPAct provides the NRC the authority to fingerprint for criminal history check purposes a broader class of persons. The NRC needs to complete its implementation of the EPAct, including the determination of which uses are of such significance to the public health and safety or the common defense and security as to warrant fingerprinting and background checks. The Task Force encourages the NRC to complete these actions as expeditiously as possible. The Task Force believes that the submittal of fingerprints for FBI criminal history checks would provide additional assurance for detecting persons with malevolent intent and thereby reduce the risk of radioactive materials being diverted or used for malevolent purposes.

6.7 Summary of Recommendations

The Task Force is not making any recommendations in the area of background checks at this time.

7 Storage of Radioactive Sources

7.1 Background

Licensees regulated by the NRC and Agreement States, as well as persons regulated by DOE, must meet certain requirements governing the storage of Category 1 and 2 sources. This chapter assumes that the storage is undertaken in accordance with all applicable regulations and requirements. It makes no attempt to speculate on actions outside any legally binding requirement. This means that the source is legally obtained and possessed.

The EPAct specified that the Task Force examine "the storage of radiation sources that are not used in a safe and secure manner." The four basic conditions of legally possessed sources are (1) in transit, (2) in use, (3) short-term storage between usage, and (4) long-term storage. Chapter 5 of this report considers the in-transit condition for sources. Therefore, the Task Force interprets this direction to mean that it is to examine sources in storage only and not to examine sources that are in use "in a safe and secure manner" or, in other words, in active use in accordance with applicable regulations.

This chapter considers the major use of Category 1 and 2 sources, as discussed in Chapter 2 of this report. These uses are further broken down into short- and long-term storage. Short-term storage is typically employed in between active uses and dictated by the type of use, frequency of use, and operator convenience. Long-term storage is typically for sources that are no longer in active use and may be held for future use, for transfer to another licensee, or for disposal. Because short-term storage is a function of active use, this chapter only focuses on the long-term storage as fitting the EPAct's direction to examine "the storage of radiation sources that are not used."

7.2 Summary of Storage Requirements

7.2.1 NRC Requirements Regarding Storage

Title 10, "Energy," of the *Code of Federal Regulations* contains NRC regulations for byproduct materials licensees, broken into major parts. One part, 10 CFR Part 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material," applies to all materials licensees. Other parts applicable to Category 1 or 2 source holders include the following:

- 10 CFR Part 31, "General Domestic Licenses for Byproduct Material"
- 10 CFR Part 32, "Specific Domestic Licenses to Manufacture or Transfer Certain Items Containing Byproduct Material"

- 10 CFR Part 33, “Specific Domestic Licenses of Broad Scope for Byproduct Material”
- 10 CFR Part 34, “Licenses for Industrial Radiography and Radiation Safety Requirements for Industrial Radiographic Operations”
- 10 CFR Part 35, “Medical Use of Byproduct Material”
- 10 CFR Part 36, “License and Radiation Safety Requirements for Irradiators”
- 10 CFR Part 39, “Licenses and Radiation Safety Requirement for Well-Logging”
- 10 CFR Part 40, “Domestic Licensing of Source Material”
- 10 CFR Part 70, “Domestic Licensing of Special Nuclear Material”

Title 10, Part 20, “Standards for Protections against Radiation,” of the *Code of Federal Regulations* contains the primary NRC regulations for material storage. The scope of 10 CFR Part 20 includes licensees under Parts 30–36, 39, 40, and 70. The basic requirements for storage, given in 10 CFR 20.1801 and 10 CFR 20.1802, include the following:

> 20.1801 Security of stored material.
> The licensee shall secure from unauthorized removal or access licensed materials that are stored in controlled or unrestricted areas.
>
> 20.1802 Control of material not in storage.
> The licensee shall control and maintain constant surveillance of licensed material that is in a controlled or unrestricted area and that is not in storage.

In addition to the above, the NRC recently issued an additional regulation, known as the “portable gauge rule,” which does not include radiography and well-logging sources. It addresses lower activity gauges (i.e., below Category 2), such as moisture density gauges used in road building to characterize the soil.

No other regulations directly state storage requirements for Category 1 or 2 sources. However, in several locations, NRC regulations provide or imply a maximum period of storage for sources and devices not in use. In 10 CFR 31.5(c)(15), regarding generally licensed devices, it states that a general licensee “may not hold devices that are not in use for longer than 2 years …. Devices kept in standby for future use are excluded from the two-year time limit if the general licensee performs quarterly physical inventories of these devices while they are in standby.” Title 10, Section 30.36(d), of the *Code of Federal Regulations* gives requirements for licensee action in the cases in which “(3) No principal activities under the license have been conducted for period of 24 months; or (4) No principal activities have been conducted for a period of 24 months in any separate building or outdoor area that contains residual radioactivity ….” Pursuant to 10 CFR 30.36(h), licensees that are decommissioning a site must “request license termination as soon as practicable but no later than 24 months following the initiation of decommissioning.” Although there is no absolute maximum time limit for storage of sources not in use by an active licensee, the regulations seem to suggest that licensees should evaluate the potential for future use after 24 months of storage. Choosing to continue storage or work toward disposal of a source is complicated by potential difficulties (availability of a disposal path

and cost) associated with proper disposal of the source. The short-lived nuclides (i.e., Ir-192, Se-75, Tm-170, and Yb-169) are less of a concern.

Certain sections of the regulations seek to protect personnel from unintended radiation exposure. Though not intended as storage requirements, these sections may impose requirements, as a consequence of their implementation, on the storage of Category 1 and 2 sources. These regulations include access controls for irradiators (10 CFR 36.23), alarms for the exposure of sources with personnel in the vicinity (10 CFR 34.33 and 10 CFR 36.21), and control of access to high and very high radiation areas[7] (10 CFR 20.1601 and 10 CFR 20.1602). Effective implementation of these regulations requires establishing controls to prevent uncontrolled access to sources in use or in storage. Because of the high activity of Category 1 and 2 sources, the radiation that the source emits typically falls within the range for which these requirements apply. Therefore, these regulations are, in effect, de facto storage requirements.

Throughout the materials regulations there are additional requirements for inventory (10 CFR 34.29, 10 CFR 35.67, and 10 CFR 39.37) and routine leak-testing (10 CFR 34.27, 10 CFR 35.67, 10 CFR 36.59, and 10 CFR 36.35) for sources at various intervals and for the performance of surveys to verify the presence (or lack of) a source. While these are not storage requirements, they have the effect of heightening the accountability of and improving the storage controls for these sources. In addition, the orders and legally binding requirements for enhanced security and control measures have the effect of improving the storage of sources not in use.

7.2.2 DOE Requirements Regarding Storage

The primary DOE regulation for sealed radioactive source storage is set forth in 10 CFR Part 835.8. Subpart M, "Sealed Radioactive Source Control," of 10 CFR Part 835, has two sections. The first, 10 CFR 835.1201, provides a storage requirement.

> 835.1201 Sealed radioactive source control.
> Sealed radioactive sources shall be used, handled, and stored in a manner commensurate with the hazards associated with operations involving the sources.

Paragraphs (a) through (c) of 10 CFR 835.1202 contain additional requirements that may impact storage.

> 835.1202 Accountable sealed radioactive sources.
> (a) Each accountable sealed radioactive source shall be inventoried at intervals not to exceed six months. This inventory shall:

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7 Under 10 CFR 20.1003, a high radiation area is an area, accessible to individuals, in which radiation levels from radiation sources external to the body could result in an individual receiving a dose equivalent in excess of 0.1 rem (1 millisievert) in 1 hour at 30 centimeters from the radiation source or 30 centimeters from any surface that the radiation penetrates. A very high radiation area is similarly defined as where an individual could receive an absorbed dose in excess of 500 rads (5 grays) in 1 hour at 1 meter. DOE regulations at 10 CFR 835.2 have similar definitions.

8 While the definition of a "sealed radioactive source," as defined in 10 CFR 835.2, "Definitions," specifically excludes RTGs, the NRC and IAEA consider them sources, and they are discussed in this chapter.

(1) Establish the physical location of each accountable sealed radioactive source;
(2) Verify the presence and adequacy of associated postings and labels; and
(3) Establish the adequacy of storage locations, containers, and devices.

(b) Except for sealed radioactive sources consisting solely of gaseous radioactive material or tritium, each accountable sealed radioactive source shall be subject to a source leak test upon receipt, when damage is suspected, and at intervals not to exceed six months ….

(c) Notwithstanding the requirements of paragraph (b) of this section, an accountable sealed radioactive source is not subject to periodic source leak-testing if that source has been removed from service. Such sources shall be stored in a controlled location, subject to periodic inventory as required by paragraph (a) of this section, and subject to source leak testing prior to being returned to service.

DOE regulations have requirements similar to NRC regulations concerning personnel protection. Subpart F, "Entry Control Program," of 10 CFR Part 835 provides the regulations regarding access to radiological areas and high and very high radiation areas. The effect of these personnel protection regulations is to provide additional requirements on the storage of sources.

DOE has published additional guidance to supplement its regulations. DOE G 441.1-13, "Sealed Radioactive Source Accountability and Control Guide," supplements Subpart M of 10 CFR Part 835. The purpose of the guide is to provide a program to control sealed radioactive sources to prevent unplanned exposures and loss of sources. The guide contains general guidance on the location, design, and monitoring of source storage areas or facilities. It specifies that inventories of sources should occur at 6-month intervals. It also specifies leak-testing requirements.

7.3 Descriptions of Storage Conditions

The following sections describe, for the most common types of Category 1 and 2 sources, a description of how the sources are used and stored. The Task Force reviewed data from the DOE 2005 Data Call and the Interim Inventory and considered only those categories in which sources are actually in use in the United States. These include radioisotope thermoelectric generators under DOE control. Chapter 2 of this report provides further description of the devices.

7.3.1 Sterilization (wet, panoramic) Irradiator

A panoramic irradiator has a volume which is undergoing irradiation that is large enough to accommodate a reference man. This volume must be maintained inaccessible, by an entry control system, during use. Source storage may be either dry or wet. In the United States, wet storage is the preferred method. Due to solubility issues, cesium-chloride cannot be used in a wet storage arrangement, so Co-60 is the radionuclide used. There is one cesium-sourced dry, panoramic irradiator in use in research.

In the wet design, sources are typically long and thin, referred to as pencils and are mounted vertically, in a line in racks. There are two basic designs of wet, panoramic irradiators. One

design keeps the sources in a pool of water, and involves lowering of enclosed, internally dry, “bell” containing the material to be irradiated to the source racks. The second, more common design, involves raising the racks out of the pool to irradiate the product which passes by the rack on a conveyor system.

Typically, facilities have only 8 to 12 people trained to operate the irradiator. Only these trained individuals have unescorted access to the irradiator, and the radiation safety officer controls access. Alarms at the access points to the pool areas where the source pencils are located notify personnel when the source is exposed. Built-in interlocks prevent inadvertent entry into the exposure areas when the source is exposed. Control is typically from a control room with a direct view of the conveyors and entry doors to the source pool.

The facilities usually operate continuously. If they cease operation, it is usually for maintenance or source replacement. Most sources are in continuous use in the pool. On occasion, an extra source or rack of sources may be stored in the pool. Because of the very high radiation levels, exposure to a single unshielded source can result in a fatal dose within seconds or minutes. Any source storage is in the pool only. Thus, this source use has no long-term storage and is rarely stored short term. The recently issued security orders increased the security of these facilities during operation and source changeout.

7.3.2 Self-Shielded Irradiator

This group includes all dry, self-shielded irradiators. Blood and tissue irradiators generally use Co-60 or Cs-137 sources. The source is sealed or welded inside the machine and can be replaced if returned to the manufacturer. However, facilities rarely change out these devices because of the long half-life of Cs-137 and the logistics of returning the device. The machine requires a key to operate, and the sample chamber will not open otherwise. The sample chamber rotates clockwise to allow access for loading of the samples. The source cannot be accessed through the sample chamber area.

Only authorized, trained, and approved personnel can operate the blood irradiator. Blood irradiators frequently occupy areas that are continuously staffed. Because of the demand for blood, blood irradiators are constantly in use and are rarely placed in storage.

Research facilities, colleges, and even high schools have used other self-shielded irradiators. In the past 10 years, manufacturers and the Off-Site Source Recovery Project (OSRP) have recovered many self-shielded irradiators.

<u>Calibration Irradiator</u>
The primary use of calibration irradiators is to provide an accurate, uniform delivery of a well-quantified dose to the target. The primary targets are radiation dosimeters, which must be exposed to known radiation levels and checked to ensure accuracy. Calibration of the dosimeter readout equipment is another use of these dosimeters. Calibration irradiators allow dosimeters to reach higher exposure levels more rapidly than a simpler, smaller source arrangement (hours or minutes instead of days of exposure). This allows for more rapid calibration of dosimeters, especially accident dosimeters, which must be exposed to higher levels of radiation.

The irradiator does not require any kind of key to operate. The operator simply plugs it into a power receptacle and sets a timer for the exposure. The material being irradiated goes in a sample chamber that moves into the beam area and then rotates inside the unit for uniform

exposure. The sample chamber does not allow access to the source. Typical interlocks include the requirement of a sample in the chamber to activate the beam and an external door interlock that shuts down the irradiator if the door is opened. Some have battery backups to return the target material to the external access area in the event of a power loss.

Calibration irradiators are in frequent use with the constant cycling of dosimeters through them and are rarely in a long-term storage situation.

7.3.3 Gamma-Knives

Medical professionals use a gamma-knife unit for stereotactic radiosurgery in the treatment of brain anomalies, including cancer. Typically, a unit is located in an outpatient area of the hospital. The room is constructed of thick concrete walls and a concrete ceiling. The room's door is made of wood and remains open and unlocked except during operation of the unit. Safety interlocks on the doors are solely for radiation protection purposes and operate in conjunction with the gamma-knife unit. If the door is inadvertently opened during unit operation, the unit table/patient will be immediately withdrawn and the source shield doors will automatically close. In addition, an alarm will sound in the immediate area, and an emergency light will flash to indicate a problem.

The unit's operator uses a control computer located immediately outside the room. Viewing cameras allow for monitoring the patient and the unit during operation. A patient is never unattended while the machine is in operation.

The manufacturer handles the entire process of re-sourcing the cobalt pencils in the gamma-knife. Re-sourcing takes place within the facility using an automated reload machine. The reload procedure takes about 2 hours to complete. The reload process requires disassembly of the hemispherical shield body. An automated robot, mated to the unit, removes the old pencils and replenishes them with new pencils. The lab does not keep the tools required to disassemble the unit.

7.3.4 Teletherapy

Some cancer treatments involve teletherapy devices. Their use and storage are similar to gamma-knives as described above. Because there is only one source in the unit, source changeout is much simpler and quicker than it is with a gamma-knife.

As the use of accelerators for teletherapy increases in the United States, the use of devices employing radioactive sources for teletherapy has decreased. The end result has been the conversion of these source-based devices to other uses, transfer to other users, placement in storage, or disposal. Other uses include fixed-site radiography, veterinary teletherapy, and research irradiators.

7.3.5 Radioisotope Thermoelectric Generators

The only licensees possessing RTGs are the U.S. Navy and Air Force. Two other nonmilitary licensees shipped all of their RTGs to DOE for storage for eventual disposal.

The Air Force RTGs are currently located in a remote area, stored in a locked building surrounded by a locked, chain-link fence. No accessible public ground transportation routes to the RTGs exist, so access is available by air transport only. The Air Force controls the airspace

over this facility. Unescorted access to the RTGs requires, at a minimum, a Secret security clearance. Personnel without such clearance must have an escort at all times to access the RTGs.

In addition to these security protocols, each RTG connects to two electronic sensor devices that enable 24-hour Air Force Operations Center surveillance through communication lines with the RTGs. If communication with the RTGs is lost, the Air Force conducts a flyover to determine the integrity of the site before dispatching a maintenance team. DOE will take ownership of the Air Force's RTGs upon their passing a performance assessment.

Three of the Navy's RTGs are unrecoverable at the bottom of the Atlantic Ocean under approximately 3,048 meters (10,000 feet) of water. The Navy stores its remaining RTGs in a weapons bunker on a naval base. A lock designed for protection of stored weapons secures the bunker. All individuals with access to the RTGs have military clearances. Base security forces respond to any unauthorized access to the weapons bunker. If necessary, Quick Reaction Forces are also available to respond to an incident.

Both the Air Force and the Navy plan to transfer their RTGs to DOE by the end of FY 2006 for disposal.

7.3.6 Radiography

Radiographic exposure devices are often called cameras. Radiography licensees range from small operations with a single camera to large facilities with multiple cameras. These licensees may conduct field operations or in-house exposure operations. Larger companies usually have a building located in an industrial park with a vault or special cabinet for the storage of radioactive sources. Single camera operations may take place out of almost any location.

Devices are brought back to the facility and locked up overnight, if possible. Occasionally, devices must stay in the field overnight. In accordance with the recently issued ICs, users must secure equipment stored at a temporary jobsite to prevent access by unauthorized personnel.

In the field, licensees must keep all devices within line of sight or secured in accordance with the ICs at all times. Single individuals can check out devices, but there is a two-person rule for actual use of the device. Only certified, qualified radiographers or assistants can check out devices. A survey of the device is completed when the device is pulled out of storage.

Source changing usually occurs at the central facilities, but may be done at the remote field locations, if necessary. The facility receives shipments of new sources via a local trucking company that handles these types of shipments or by Federal Express. An industrial radiography source changer ships with the new source, and the re-sourcing, usually conducted by the radiation safety officer, takes place at the facility. Because of its relatively short half-life (about 2.5 months), radiography devices with Ir-192 sources are typically re-sourced every 3–6 months. The short half-life also means that Ir-192 sources would decay below a usable activity (and below the Category 2 threshold) in a long-term storage situation. Thus, for business reasons, licensees keep, exchange, or dispose of the source.

7.3.7 Well-Logging

The typical well-logging licensee using Category 2 sources conducts cased-hole well-logging and tracer operations at temporary field sites throughout its business area. Licensees take

sources out for field operations. When this occurs, the source is either in the well-logging tool and used down-hole during drilling or secured in the truck. Sources are rarely out overnight. Licensees normally remove sources from the truck and place them into a secure storage container when not in use.

Two trucks convoy to a field site—a wireline truck to perform the well-logging and a standard truck for use by the engineer in charge of the operation. The source stays in a “pig” (shielded transportation package) that is secured in the wireline truck with a chain and padlock during transportation. A typical job takes 1 to 3 days; offshore jobs take longer. Licensees secure the source in the “pig” with the well-logging tools in a skid for transport by boat to the customer’s offshore platform. For overnight jobs, licensees either attend sources during use or secure them in a fenced area at the field site.

A significant number of small well-logging companies, particularly in the Midwest, derive their main revenues from logging operations. Because of the highly volatile nature of the oil industry, well-logging companies frequently find themselves lacking enough work to support the company or sufficient revenues to properly dispose of their sources. As a result, these companies often place their sources in long-term storage at their base of operations or another secure location until either the next ”up” cycle in the oil industry or a disposal option becomes available.

7.3.8 Manufacturers and Distributors

Manufacturers and distributors are the starting point for all sources and are a specific group of licensees. Any review of source licensees must consider them. Fewer than 80 manufacturing and distribution licensees possess Category 1 or 2 quantities of radioactive material. They can vary greatly in size and complexity of operations, which highly depend on the type of sources and devices involved in the business. While these licensees have authorization to possess risk-significant quantities of radioactive material, they frequently manufacture and distribute sources containing less than Category 2 quantities of material.

Manufacturing facilities may have several major source storage locations within the facility. One storage area is often located within or near the source load/unload hot cells of the building. A second may be a storage area located directly outside the source load/unload area used for shipping and receiving. A third may be a storage area for returned or unused sources awaiting disposal. The first two are short-term storage areas for processing source orders, and company business practices maintain strong accounting of these sources. The third area is the only potentially long-term storage area.

7.3.9 Waste Encapsulation and Storage Facility

The Waste Encapsulation and Storage Facility (WESF) at the Hanford Site in Richland, Washington, contains capsules consisting of bulk Cs-137 and Sr-90 that were separated from waste in an adjoining facility and encapsulated for safe storage. WESF stores the capsules in an underwater pool that provides shielding while allowing circulating water to remove the heat generated by radioactive decay. Based on the response to the March 2005 DOE Data Call, there are approximately 1925 source capsules in storage with a total activity of over 58 million Ci. It is the single largest collection of Category 1 and 2 sources within the DOE complex, representing about 82 percent of the DOE Category 1 or 2 sources and 98 percent of the activity. Although included in the DOE 2005 Data Call for completeness, the capsules do not fall under the Code’s definition of radioactive sealed source.

7.3.10 Off-Site Source Recovery Project

DOE created the OSRP at LANL in the 1990s and tasked it with recovering certain excess, abandoned, orphan, and certain other radioactive sealed sources from licensees across the United States that pose potential safety or security risks. This included sources from the commercial sector and from State agencies that were holding sources accepted from licensees. Chapter 8 of this report contains further discussion on the OSRP.

To date, the OSRP has recovered more than 12,000 radioactive sources. The DOE 2005 Data Call reported that only 134 of these sources are Category 2. The OSRP does not currently store any Category 1 sources. The isotopes used in these sources include Am-241, Pu-238, and Sr-90, with a total combined activity under 10,000 Ci.

As part of the project, DOE currently holds six Sr-90 RTGs in an underground storage facility at LANL. The OSRP recovered four of the RTGs from the National Security Space Institute and two from a commercial entity. There are no RTGs in the commercial sector anymore; remaining RTGs are at DOE or DOD sites.

Most recovered sources are packaged for transport and interim storage or disposal in 55-gallon drums, with tamper-indication seals, and stored on site at LANL. The success of OSRP depends on developing and maintaining adequate safe and secure interim storage. Program priorities include maintaining long-term safe and secure storage capability at NNSA facilities, principally at LANL using existing facilities. Contracts exist with a number of firms to provide short-term offsite interim storage facilities for field recovery, sealed source consolidation activities, and efficient storage before sources are packaged and transported to an NNSA facility.

The OSRP manages inventory data in the LANL registry to track sealed source storage inventories, including types, quantities, and locations. Internal audits assess and document whether storage operations meet regulatory, project, and DOE requirements.

7.3.11 Other DOE Facilities

Data from the 2005 data call indicate that DOE uses another 266 Category 1 or 2 sources throughout its complex of facilities. Of these, 237 are either Co-60, Cs-137, or Pu-238. These sources are generally in use, and their storage is in compliance with DOE regulations and orders.

7.3.12 Storage Time Limits

No absolute time limit exists for the long-term storage of sources. Several sections of regulations encourage licensees to evaluate storage situations after 24 months. This period is long enough to allow licensees to set sources aside to meet business purposes. Holding a source in storage longer than 24 months usually indicates the lack of a strategy to use or dispose of the source. The NRC should consider a new requirement for licensees to review and document the reasons for storage of risk-significant sources longer than 24 months. This would consist primarily of an assessment of the costs for transfer or disposal versus the cost of storage and the licensee's expectation of eventually using the source again. Few risk-significant sources are actually stored for 24 months, so this requirement would be invoked only rarely. However, making licensees consider why they are storing a risk-significant source and if it is a good time to get rid of it has several benefits. Such a requirement could make licensees

more aware of the source's existence, trigger an evaluation of the adequacy of storage conditions, and encourage the use of sound business and regulatory principles that would lead to the removal of sources which should not remain in storage. Implementation of a maximum time limit may create a hardship for some licensees if disposal options for greater than Class C (GTCC) waste are not developed. Once disposal options for GTCC exist, the NRC should consider requiring a maximum time limit on the long-term storage of risk-significant sources not in use.

Action 7-1: The NRC should evaluate requiring licensees to review and document the reasons for storage of risk-significant sources longer than 24 months and the feasibility of establishing a maximum time limit on the long-term storage of risk-significant sources not in use.

7.4 Conclusions

The Task Force believes that the combination of direct regulations concerning source storage, personnel protection regulations, guidance, and the recently issued orders and legally binding requirements, along with the inspection and enforcement program, provide reasonable assurance that the Category 1 and 2 sources in storage at NRC and Agreement State licensed facilities and at DOE facilities are safe and secure. The new security and control measures will enhance the security of storage situations.

The Task Force did note that some sources in long-term storage are being held for eventual disposal. Either a lack of a legal disposal path or high costs because of a lack of adequate disposal options is causing some licensees to store their unused or unwanted sources until the disposal situation improves. Providing adequate disposal for these sources will have a much greater effect on reducing the total risk of long-term storage (by reducing the number of sources in long-term storage) than any additional changes to storage requirements. Chapter 9 of this report provides further discussion of disposal.

7.5 Summary of Recommendations

The Task Force is not making any recommendations in the area of source storage at this time.

8 National System for Recovery of Lost and Stolen Sources

8.1 Introduction

The national system for recovery of lost and stolen radioactive sources is a cooperative and well-coordinated effort between the Federal Government, States, and private sector. It includes licensees authorized to possess and use radioactive sources; regulatory agencies such as Agreement State radiation control programs and the NRC; response agencies, including DOE, DHS, and EPA; and Federal, State, and local law enforcement agencies.

The system and its capabilities are founded on the principle of protecting public health and safety and national security. There are no programs designed to deal only with lost and stolen sources. Rather, the Federal and State capabilities address a wide range of situations involving excess and unwanted sealed sources, as well as lost, stolen, abandoned, and missing sealed sources. This range of materials is commonly referred to as orphan sources. In addition, these programs address the full range of concerns for radioactive materials management and are not limited to threats posed by Category 1 and 2 sealed sources. Federal resources are also available in a number of agencies to support local emergency operations when orphan radioactive sources are found.

8.2 Regulatory Framework

8.2.1 Scope of the Problem—Radioactive Source Loss and Theft

Most reports of lost or stolen material involve small or short-lived radioactive sources that are not a significant risk to public health or useful for terrorist purposes. There is no trend in incidents of loss or theft to suggest that there is a pattern of collecting such sources for criminal uses. As a result, most reports of lost or stolen sources do not result in emergency response efforts.

A review of NRC and Agreement State data regarding the lost and stolen Category 1 and 2 sources between 1994 and 2005 indicates that there were 60 events involving loss or theft of risk-significant sources (70 percent were lost sources and 30 percent were stolen). This is an average of about 5 lost or stolen risk-significant sources per year. In approximately 80 percent of the events for the 12-year period, the sources were recovered. This results in an average of about one unrecovered source per year. Ninety-five percent of these lost and stolen sources were Ir-192 sources in radiography cameras that were lost/stolen primarily because of the licensee's failure to meet requirements. One unrecovered Ir-192 source fell overboard in the Gulf of Mexico during transport. Because of the short half-life of Ir-192 (74 days), these sources quickly decayed, and the current risk posed by these sources is negligible. NRC has established a performance goal of zero unrecovered risk-significant sources in any calendar year and NRC met that goal in 2005..

Although the number of risk-significant lost and stolen radioactive sources is very low, NRC takes each of these events very seriously. The NRC, in partnership with the Agreement State regulators, have enhanced the security and control measures for these sources, as a means of further reducing the number of lost and stolen sources. These measures have been put in place for all licensees throughout the United States. The NRC and the Agreement States are inspecting those licensees to verify compliance with these requirements.

8.2.2 Loss and Theft Notification Requirements

The principal goal of radiation safety requirements is to prevent radiation exposure of workers and the public. This goal includes preventing thefts and accidental losses. As mandated in 10 CFR 20.1801 to 10 CFR 20.1802 and the IC requirements, licensees must maintain positive control of all radioactive material exceeding Category 2 quantities. This includes sources that are in use and in storage.

In the event that a risk-significant source is lost or stolen, it is important to know when the loss or theft occurred, commence a search, and notify the appropriate agencies for assistance, as necessary, depending upon the quantity and type of lost or stolen material. Title 10, Section 20.2201, of the *Code of Federal Regulations* provides reporting requirements (Table 8.1) that each licensee must follow for any lost, stolen, or missing licensed material exceeding specified quantities. Licensees make the report to the appropriate regulatory agency (i.e., the NRC or an Agreement State). The reporting thresholds are lower than the Category 2 thresholds.

Table 8.1 Summary of NRC Regulatory Requirements for Radioactive Material Loss and Theft Reports

Requirement	Timeframe	Action Required
10 CFR 20.2201(a)(1)(i)	Immediate	Telephone report for licensed material equal to or greater than 1000 times the quantity specified in Appendix C to 10 CFR Part 20, under such circumstances that an exposure could result to persons in unrestricted areas
10 CFR 20.2201 (a)(1)(ii)	30 days	For any lost, stolen, or missing licensed material in a quantity greater than 10 times the quantity specified in Appendix C to 10 CFR Part 20, that is still missing at the time
10 CFR 20.2201(b)	30 days	Following initial notifications required under 10 CFR 20.2201(a)
10 CFR 20.2201(d)	30 days	Additional substantive information on the loss or theft of the licensed material including notification when reported material is found

The new security and control measures require each licensee possessing Category 1 and 2 quantities of radioactive material to have a program to monitor and immediately detect, assess, and respond to unauthorized access to radioactive material and the devices that contain the material. The licensee's immediate response to any actual or attempted theft, sabotage, or diversion of the radioactive material is to call the LLEA. After calling the LLEA, the licensee must call the NRC and/or the appropriate Agreement State.

When the incident involves Category 1 and 2 sources, the NRC notifies other Federal agencies to take appropriate action to assist in the recovery or to mitigate consequences. In most cases, the licensee, perhaps with the assistance of local law enforcement, conducts the search for the material, and no additional agency action is required. There have been cases, however, involving Federal assistance. In a recent example, the FBI assisted one owner in locating a source shipment from overseas that did not arrive as expected.

8.2.3 Law Enforcement Investigations—Lost or Stolen Sources Involving Terrorism or Criminal Intent

The FBI operates both as a law enforcement and an intelligence agency, and it is the lead investigative agency of the Federal Government. For lost or stolen sources related to terrorism or other criminal intent, the FBI is responsible for coordinating activities related to tracking and recovering radioactive sources. Additionally, the FBI has authority to respond to the use or threat of use of weapons of mass destruction (WMD). The Federal law enforcement response to these threats or incidents involves thorough criminal investigative and intelligence gathering activities that are recognized by other Federal departments and agencies in the National Response Plan. Specific WMD prevention undertakings led by the FBI may include law enforcement activities to disrupt a terrorist attack through tactical preventive actions based on targeted outreach, investigations, or intelligence collection and analysis.

In 1969, 28 CFR 0.85, "General Functions," Subpart P, "Federal Bureau of Investigation," codified FBI responsibility to conduct terrorism investigations. This regulation provides that the Director of the FBI, acting through the U.S. Attorney General, will exercise lead agency responsibility in investigations of all crimes for which it has primary or concurrent jurisdiction and which involve terrorist activities or actions in preparation for terrorist acts within the United States.

The HSPDs—particularly HSPD-5,"Management of Domestic Incidents"—contain similar language. This directive gives the Attorney General lead responsibility for criminal investigations of terrorist acts or terrorist threats by individuals or groups inside the United States or directed at U.S. citizens or institutions abroad, as well as for intelligence collection activities within the United States. HSPD-4, "The National Strategy to Combat Weapons of Mass Destruction," focuses on the acquisition of WMD materials by foreign interests with the potential to inflict massive harm on U.S. interests, domestically or abroad. In addition, HSPD-10, "Biodefense for the 21st Century," outlines the responsibilities of the Attorney General to coordinate the activities of other members of the law enforcement community to detect, prevent, preempt, and disrupt terrorist attacks against the United States involving WMD.

The AEA, as well as Title 18, Section 831, "Prohibited Transactions Involving Nuclear Materials," of the U.S. Code provides the FBI with jurisdiction to conduct investigations into any allegations regarding unlawful use or possession of nuclear and radiological materials and threats to use those materials for criminal or terrorist activities. Title 18 prohibits possession, malicious use, or threats involving radioactive sources and other radioactive materials. It advises FBI field offices that any unauthorized possession of nuclear and radiological material, even without malevolent intentions, is a violation of the AEA and falls within the agency's investigative jurisdiction. This guidance also ensures that FBI field offices notify FBI Headquarters regarding lost, stolen, or missing material.

The FBI WMD units and the NRC Office of Nuclear Security and Incident Response have established a liaison at the Headquarters level. This liaison ensures prompt notification of and response to any allegations involving unlawful use, possession, or terrorist targeting of NRC-licensed nuclear/radiological materials. The FBI WMD Operations Unit will notify the appropriate FBI field office regarding lost, stolen, or missing material. While the FBI WMD units have conducted some outreach efforts with State and local authorities in Agreement States, these efforts have focused primarily on other law enforcement agencies and not on the Agreement State radiation control programs. The FBI should expand its outreach efforts to the

State radiation control programs, which are the appropriate counterpart to the NRC in Agreement States.

8.2.4 Illicit Trafficking Interdiction

A Presidential directive created DNDO within DHS in March 2005. DNDO is to coordinate domestic efforts to detect and report instances of illicit trafficking. In fulfilling this mission, DNDO plays a key role in a national system for the recovery of lost or stolen sources. DNDO coordinates efforts to continue building an international and domestic architecture capable of detecting lost or stolen radioactive sources, including testing existing detectors, fostering development of improved technology for increasing the probability of detection of illicit trafficking in nuclear and radioactive material, and providing a consistent level of training on the use of the detector systems. Another key role is reviewing and disseminating information related to lost and stolen radioactive sources and intelligence reports that identify cases of illicit trafficking and ensuring that the appropriate domestic response protocols are implemented.

These efforts will help identify lost or stolen radioactive sources whether or not they are intended for malevolent use. At legal ports of entry, Customs and Border Protection and Immigration and Customs Enforcement officials will interdict when lost or stolen sources are identified. Within the domestic borders of the United States, the FBI Joint Terrorist Task Force and/or State and local law enforcement will respond. For lost or stolen sources identified in a maritime scenario, the Maritime Operational Threat Response will respond. For lost or stolen sources in an international scenario, the State Department chaired Nuclear Trafficking Response Group will monitor the event to determine if a threat exists for the United States which would trigger further action.

8.2.5 Orphan Radioactive Materials

Situations in which lost or abandoned radioactive material is found require other methods of recovery and disposition of material. In such cases, State radiation control programs, local law enforcement, or EPA can take immediate actions to secure the material. While the NRC cannot take possession of material, it can facilitate disposition efforts to identify the owner. In cases in which the owner cannot be determined, the owner is not licensed to possess the material, or the owner is unable to resume possession, the NRC or the Agreement State radiation control program can request that DOE or EPA recover and disposition the material.

The Nuclear Material Events Database, which includes a record of all reported events, records occurrences of missing material under the jurisdiction of the NRC and Agreement States. Although this database typically contains only events involving AEA material, it was expanded in 1998 to include voluntary reports of non-AEA orphan discrete sources (sources that are found but the owner cannot be identified) and expanded again in 2002 to capture voluntary reports of lost or stolen non-AEA discrete sources. The CRCPD requested these expansions to support its national effort to track lost, stolen, and recovered radioactive material of all types (including non-AEA and unlicensed material) found in both Agreement and non-Agreement States. The database collects data on lost, stolen, and abandoned sources from Agreement and non-Agreement States and, in some cases, non-licensee organizations and members of the public. (The passage of the EPAct brought these sources into the materials regulated under the AEA.) These data are used to allow the NRC and Agreement States to remain aware of the scope and magnitude of the problem and any trends associated with missing material. They can also be used to match recovered material with previously reported missing material.

8.2.6 Additional Controls for Small Quantities

Additional controls and tracking mechanisms govern certain licensees and sources. The NRC General License Tracking System, for example, tracks individual devices and sources. This system allows positive tracking by the NRC of items within its jurisdiction that do not require a specific license, and it also promotes better awareness and control by the users. Most Agreement States have a comparable system in place. These products, which are usually Category 3 and lower, are restricted to low external radiation levels and are robustly constructed to maintain user doses under the public limits when used by individuals with little radiation training.

8.3 Federal Outreach, Training, and Awareness

The EPA sponsors proactive outreach programs to prevent radioactive material losses. This helps prevent unwanted and unregulated radioactive materials from being unintentionally incorporated into consumer products. The EPA is accomplishing the goal of the Clean Materials Program by concentrating its efforts on (1) finding and securing lost sources, (2) maintaining control of existing sources, and (3) preventing future losses.

To accomplish these objectives, the EPA directs its efforts on the national and international fronts, focusing primarily on sources that are vulnerable to loss, theft, and abandonment. Most of the sources targeted by this effort are Category 3 sources or lower. Key programmatic activities are highlighted below:

- The Pilot Radioactive Source Roundup is a 2001 test of the feasibility of implementing a national roundup of orphan radioactive sources. Thirty cesium sources were recovered and returned to a source manufacturer for disposition at a cost of $30,000. This activity continues today nationwide with Federal funds provided to CRCPD to administer the program.

- Training programs increase the capability of the recycling industry to detect, identify, and remove abandoned sources when they are encountered in scrap metal. State radiation control program officials and metal processing facilities worldwide are increasingly implementing this program. The metal processing industries are the last point where lost radioactive materials can be detected and secured before being incorporated into consumer goods. More than 800 domestic demolition contractors have implemented these training materials.

- The Product Stewardship Initiative involves the collaboration of EPA and the Product Stewardship Institute to design a mechanism for shared responsibility with manufacturers, retailers, consumers, and government, focusing on radiation-source industrial gauges and devices. Representatives from various radioactive gauge manufacturers have met to discuss methods for maintaining better control of existing sources and to develop protocols to prevent loss, theft, and abandonment.

- The International Radiation Monitoring Protocol is an effort in which EPA is coordinating with the United Nations Economic Commission for Europe to develop an international radiation monitoring protocol for lost and abandoned radioactive sources. When implemented, countries will have a framework that allows for consistent trade in scrap

metal, while helping to prevent the incorporation of lost, stolen, or abandoned radioactive sources into consumer products.

8.4 Programs for Radioactive Material Recovery

8.4.1 Regulatory Roles

The NRC and the Agreement States' regulations establish a regulatory framework for safe use of radioactive material. They have established sufficient regulatory controls to minimize the likelihood of loss or theft of risk-significant radioactive material. In the event of losses or thefts, however, licensees have the primary responsibility to recover missing material and must provide incident reports to regulators. The recovery of the missing material may involve additional agencies such as local law enforcement, the State radiation control program, the NRC, and the FBI. In most cases, the material is returned to the licensee. However, in cases in which the owner of located material cannot be identified, the NRC or the Agreement State radiation control programs may request assistance from DOE or EPA to recover the material.

8.4.2 Proactive Radioactive Source Recovery

The NNSA conducts international programs to prevent loss and theft of risk-significant radioactive sources that could be used in an RDD. The OSRP accomplishes this mission, in part, by conducting domestic recovery of radioactive sealed sources that pose a security or public health and safety threat in the United States. The OSRP is a key program element of the Office of Global Threat Reduction within the NNSA Office of Defense Nuclear Nonproliferation. On February 2, 2006, Congress received a more detailed report on this program under a separate reporting requirement of the EPAct. The following paragraphs provide a synopsis of pertinent details.

History
DOE instituted the OSRP in the early 1990s. Originally, the OSRP provided recovery and storage on a case-by-case basis, at the request of regulatory agencies. This project was intended to provide storage only for sealed sources that did not have a disposition path and that presented public health and safety concerns because they were vulnerable to loss, theft, or abandonment. Most of these sources exceeded the criteria for Class C LLRW, also known as GTCC waste. Since September 11, 2001, DOE has transferred these activities from its Environmental Program to its Defense Nuclear Nonproliferation Program. In the transfer, the OSRP maintained its responsibility to address management of sealed sources exceeding Class C waste criteria. However, it gained additional responsibilities to address other sealed sources that are considered to be a high risk for theft and misuse by terrorists. DOE has consulted with the NRC to include vulnerability to loss and theft to its factors for prioritizing sealed source recovery.

DOE is responsible for consultation and coordination with the NRC in the development of contingency plans for dealing with threats, thefts, and sabotage from all licensed activities under Section 204(b)(2)(B) of the Energy Reorganization Act, as amended. DOE is authorized to take, requisition, condemn, or otherwise acquire or disposition any special nuclear material, source, or byproduct material pursuant to Sections 55, 66, 81, and 161 of the AEA.

DOE is only responsible for conducting sealed source recovery of radioactive materials used domestically by licensees in situations representing threats to public health and safety and security. In a few instances, DOE has accepted material of U.S. origin from foreign institutions.

This has occurred in response to specific national security threats or in response to a specific request from the IAEA or a foreign government. No national policy currently addresses broader Federal responsibility for radioactive source acceptance from other countries. Public comments on the Task Force activities have expressed concerns that such a broader policy is needed.

Coordination and Prioritization

DOE and the NRC consult and coordinate pursuant to an MOU allowing for information exchanges and related activities that assist in prioritizing, recovering, and storing radioactive sealed sources. The MOU describes the process by which the NRC and DOE interact in situations that are outside the normal operation of the OSRP, when the NRC requests that DOE take certain actions to mitigate or eliminate threats to public health and safety or national security, after other reasonable alternatives have been explored. No MOU exists between DOE and any of the Agreement States; however, DOE does coordinate with the Agreement States' radiation control programs on a case-by-case basis, as necessary.

The OSRP priority is recovering the highest-risk sealed sources to prevent loss and theft. Recovered sources are moved to safe and secure storage or disposal. Owing to public health, safety, or security concerns over potential dirty bomb attacks, this activity currently includes recovering both risk-significant sealed sources lacking a disposition path and other selected sealed sources. The OSRP mission includes the following:

- recovering radioactive sealed sources from the licensed sector that pose a threat to public health, safety, or security, prioritized on the basis of risk
- developing and maintaining short- and long-term secure interim storage capabilities
- recycling and reusing sources and radioactive materials whenever appropriate
- disposing of recovered sources in both DOE and commercial facilities if an appropriate disposal site is available

The OSRP primarily recovers GTCC sources that present public health, safety, or security threats, but also works to provide recovery of other orphaned or abandoned sources. Many of these sources are smaller than Category 1 and 2 sources. Table 8.2 summarizes the types of sources involved.

Table 8.2 Types of Radioactive Sources Recovered and Stored by OSRP

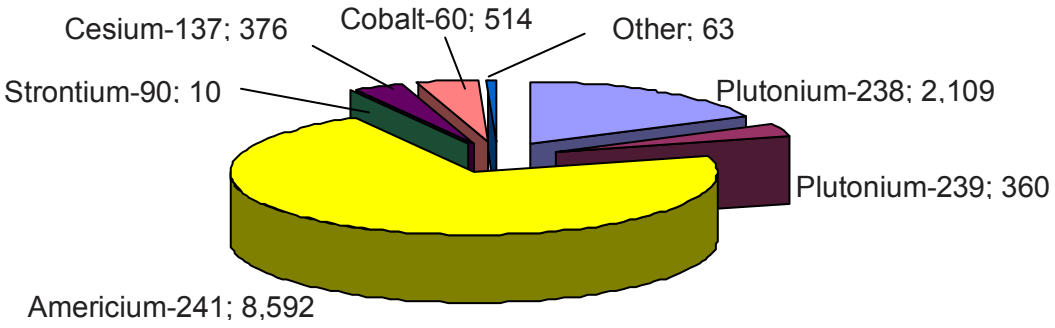
Typical GTCC Sources	Other Category 1 and 2 Sources
Am-241 neutron sources	Co-60 irradiators
Am-241 gauge sources	Ir-192 radiography sources
Pu-238 medical pacemakers sources	Ra-226 sources
Sr-90 thermoelectric generators	
Cs-137 irradiator sources	
Cm-244 alpha radiation sources	
Pu-239 neutron sources	
Cf-252 neutron sources	

Accomplishments

From 1999–2005, the OSRP recovered 12,024 sealed sources comprised of six principal isotopes (Figure 8.1). Each year since 2002, the OSRP has recovered between 1,200 and 3,200 radioactive sources from the licensed sector. Very few of the sources requiring recovery are Category 1 or 2 sources. Approximately 2,000 sources are registered for recovery annually. The owners vary from individuals, small firms, or colleges having one source to large firms possessing hundreds of sources. The OSRP forecasts that it will recover 1960 sources in FY 2006.

Sources recovered for public health and safety or national security purposes are evaluated against the acceptance criteria for both DOE and commercial disposal facilities. If the sources meet waste acceptance criteria, they can be disposed of at these facilities. If the recovered sources do not meet the criteria, they will remain in secured storage until permanent disposal is available.

Figure 8.1 Summary of Radioactive Sealed Sources Recovered by OSRP through Calendar Year 2005



In the history of OSRP, there have been very few incidents where sealed sources required recovery because they were lost or abandoned by licensees. The most significant such activity involved DOE recovery of approximately 480 sources abandoned by a bankrupt Pennsylvania firm in 2004. The aggregate amount of radioactive material in this incident was lower than Category 2.

8.5 Lost and Stolen Sources Response

8.5.1 NRC Emergency Response Protocol to Lost and Stolen Sources

The Nuclear/Radiological Incident Annex of the National Response Plan describes the coordinated response by Federal agencies to incidents involving radioactive material. The scope of this annex applies to nuclear/radiological incidents, including sabotage and terrorist incidents, involving radioactive material that pose an actual or perceived hazard to public health and safety, national security, and/or the environment. This includes lost radioactive sources.

In response to reports of lost or stolen Category 1 or 2 sources, the NRC Headquarters Emergency Response Center follows set procedures for acquiring information and determining the seriousness of the incident. In addition, other Federal and State agencies receive notice during this process. Agreement State radiation control programs must transmit reports of a theft or loss of Category 1 or 2 sources to the NRC within 24 hours of the initial report, but the

Agreement State radiation control programs make their own initial assessments of the seriousness of the incident and the potential need for Federal assistance.

If the lost or stolen source is risk significant, there will be additional operations center response procedures implemented. This response action is to provide information awareness to internal NRC organizations and external agencies that have expertise and authority to take further actions, if deemed necessary.

The owner/licensee of a lost or stolen radioactive source is primarily responsible for mitigating the consequences of the loss of materials control and for providing notification and appropriate protective action recommendations to State, local, and/or tribal government officials to minimize the radiological hazard to the public. The owner/licensee of a lost or stolen radioactive source has primary responsibility for actions within the licensee's facility boundary or work area and may also have responsibilities for response and recovery activities outside the facility or work area boundary under applicable legal obligations. State, local, and tribal governments are responsible for determining and implementing measures to protect life, property, and the environment in those areas outside the materials licensee's facility or work area boundary or incident location.

The NRC also maintains close communications with nuclear regulators in Canada and Mexico as part of a trilateral agreement with these countries. Specifically, Government representatives receive notice of all lost or stolen sources occurring in States contiguous to U.S. international borders with Canada or Mexico.

8.5.2 Federal Radiological Response Assets

The responsibilities of the NRC, EPA, DOE, States, and other Federal agencies often overlap when dealing with lost or stolen sources in both the private and public sectors. This overlap affords a strong partnership allowing each agency to provide resources when responding to a radiological incident. In accordance with the National Response Plan, the NRC is usually the coordinating agency (previously known as the lead Federal agency), with DOE and EPA acting as cooperating agencies for lost or stolen risk-significant sources in non-Agreement States. Agreement State radiation control programs have the lead when responding to reports of lost or stolen material within their State.

The National Response Plan designates the EPA as the coordinating agency for emergency response to incidents involving unknown radiological materials or materials not licensed or owned by a Federal agency or an Agreement State. If the source involved in an incident is traced to an NRC licensee, the NRC is the lead for response. If the source is traced to an Agreement State licensee, the Agreement State radiation control program has the lead. If the source involved in an incident is traced to DOE or DOD ownership, those agencies have the lead for response. In a terrorist event such as an RDD, the FBI would have the initial role as coordinating agency.

Each of these Federal agencies can provide emergency response support to States and municipalities for radiological incidents. Trained teams at a number of DOE sites, EPA laboratories, military bases, and other Government programs and facilities provide the support. Most of the capabilities apply to potential accidental dispersion of radioactive material, especially resulting from transportation accidents. These capabilities are important resources in the event of a deliberate radiological attack. While these are important factors in the overall

mitigating strategy, they are outside the scope of this report. The Task Force will conduct a detailed evaluation of emergency response in the next report.

Most of these response capabilities are not suited to, and would not be employed in, dealing with lost and stolen sources. However, some specific services and capabilities that could be deployed if necessary include the following:

- response coordination and logistics support
- monitoring and assessment
- law enforcement and forensics support
- aerial measurements and detection
- decontamination and waste disposal
- medical and health physics treatment and consultation

The level of Federal response to a specific incident varies based on the ability of State, local, and tribal officials to respond; the type and/or amount of radioactive material involved; and the extent of the impact or potential impact on the public and environment. In situations in which threat analysis indicates that a terrorist incident involving radiological materials could occur, actions are coordinated in accordance with the pre-incident prevention protocols set forth in the base plan of the National Response Plan.

Since September 11, 2001, the NRC has expanded its involvement with the FBI, other Federal intelligence and law enforcement agencies, NRC licensees, and military, State, and local authorities. It has also expanded communications with the DHS, DOD, DOE, and other agencies.

8.6 Conclusions

The national system for recovery of lost and stolen sources is a cooperative and well-coordinated effort between the Federal Government, States, and private sector. The system and its capabilities operate on the principle of protecting public health and safety and national security. The Federal capabilities address a wide range of situations involving excess and unwanted sealed sources, as well as lost, stolen, abandoned, and missing sealed sources. These programs address the full range of concerns for radioactive materials management and are not limited to threats posed only by Category 1 and 2 sealed sources. It is vital that these programs continue. The Task Force believes that the current recovery program for lost and stolen risk-significant sources are effective in protecting public health and safety and providing for the security of the sources.

8.7 Summary of Recommendations

The Task Force is not making any recommendations in the area of the national system for the recovery of lost and stolen sources at this time.

9 National System to Provide for the Proper Disposal of Radioactive Sources

9.1 Introduction

Disposition of risk-significant radioactive sources that have reached the end of their useful service lives and have no economic value to their current owner (or for various reasons do not have a readily identifiable owner) is an important consideration in ensuring the protection and security of this material. Current disposition programs cover a range of options, including storage, recycling, reconstitution, resale, and as a final option, disposal as radioactive waste.

The ability to dispose of disused risk-significant radioactive sources in the United States depends on whether the source is a DOE source or sources resulting from certain Federal activities or if it is a commercial source subject to regulation by the NRC or Agreement States. DOE sources can be disposed of at certain DOE radioactive waste disposal facilities in accordance with DOE policies and orders. Commercial sources (discrete radium and accelerator-produced isotope sources are included in this group) may face a somewhat more complex path to disposal. Three major factors affecting the disposal of commercial sources are restrictions associated with the LLRWPAA, waste classification requirements, and cost.

The LLRWPAA encourages States to form regional compacts to implement the disposal of commercial LLRW, which the Act recognized as a State responsibility. The Act's promulgators envisioned that the regional compact approach would result in the development and operation of a new generation of four or five regional disposal facilities, each of which would handle the LLRW in the compact it served. However, since the passage of the LLRWPAA, no construction of new compact facilities has occurred. The two compact facilities (in Barnwell, South Carolina, and Richland, Washington) that are presently operating were constructed before the passage of the LLRWPAA. Barnwell accepts waste from the Atlantic Compact States (Connecticut, New Jersey, and South Carolina) and from 36 non-Atlantic Compact States. However, in June 2008, the facility will close to the 36 non-Atlantic Compact States based on a South Carolina law. The Richland facility accepts waste from the Northwest and Rocky Mountain Regional Compacts (11 States in all).

Commercial radioactive sources are subject to waste classification requirements defined at 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste." The NRC's waste classification system imposes increased isolation based on the material's toxicity, longevity, and mobility. Waste classified as Class A, B, and C can generally be disposed of at commercial disposal facilities, albeit with increased restrictions associated with increased class. Waste considered GTCC is generally not appropriate for disposal at these facilities. Pursuant to the LLRWPAA, DOE is responsible for the disposal of GTCC LLRW, including GTCC sealed sources. Many of the Category 1 and 2 sources would likely fall under GTCC classification due to their relatively high radioactivity. (DOE does not impose the NRC classification system on waste disposed of at its facilities, but uses a different analysis protocol to ensure safe isolation.)

Disposal cost at commercial facilities is generally based on complex formulas taking into account (among other factors) volume, weight, and radioactivity. Sources are often physically very small with a relatively high radioactivity per unit volume or mass. Disposal criteria often require that small sources be encapsulated in an inert, stable medium such as concrete. This significantly increases disposal weight and volume while radioactivity remains the same. The

end result can be a substantial cost for disposal (several tens of thousands of dollars for a single small source). This high cost can be a significant disincentive to a licensee to properly dispose of disused sources. Figure 9.1 summarizes the available disposal options and associated constraints for disused commercial sealed sources.

9.2 Current Disposal System

This section of the report describes the current disposal system in the United States for radioactive sealed sources, including governing laws, disposal requirements, available disposal options, ongoing disposal initiatives, and financial assurance requirements. This section also identifies associated issues that are more fully discussed in Section 9.3 of this report.

9.2.1 Laws Governing the Disposal of Sealed Sources

A number of laws govern the disposal of sealed sources in the United States, including the AEA, the LLRWPAA, and the Waste Isolation Pilot Plant Land Withdrawal Act of 1992, as amended. These laws establish oversight responsibilities for the disposal of radioactive waste, including sealed sources, as discussed below and summarized in Table 9.1. Tables 9.2-A and 9.2-B provide key radioactive waste definitions that appear throughout this chapter.

<u>NRC and State Responsibilities</u>
Under the LLRWPAA, States must provide disposal capability for commercial Class A, B, and C LLRW (as defined by NRC regulations), including sealed sources, generated within their borders. The Act encouraged the States to enter into compacts that would allow them to dispose of waste at a regional disposal facility and to exclude wastes from States outside that compact. Most States have entered into compacts (Figure 9.2); however, no new disposal facilities have been built pursuant to the Act since it was passed. The two existing commercial LLRW disposal facilities that accept sealed sources (Barnwell and Richland facilities) operate under the restrictions of the State compacts. The NRC or Agreement States are responsible for licensing commercial LLRW disposal facilities.

<u>DOE Responsibilities</u>
Pursuant to the LLRWPAA, DOE is responsible for the disposal of LLRW (including sealed sources) owned or generated by DOE; owned or generated by the U.S. Navy as a result of decommissioning of its vessels; owned or generated by the Federal Government as a result of any research, development, testing, or production of any atomic weapon; and for any other LLRW with concentrations of radionuclides exceeding Class C limits (i.e., GTCC waste) resulting from activities licensed by the NRC. Under Sections 55, 66, 81, and 161 of the AEA, DOE also has authority to take, requisition, condemn, or otherwise acquire or disposition any special nuclear, source, or byproduct material.

Figure 9.1 Summary of Available Disposal Options for Disused Commercial Sealed Sources

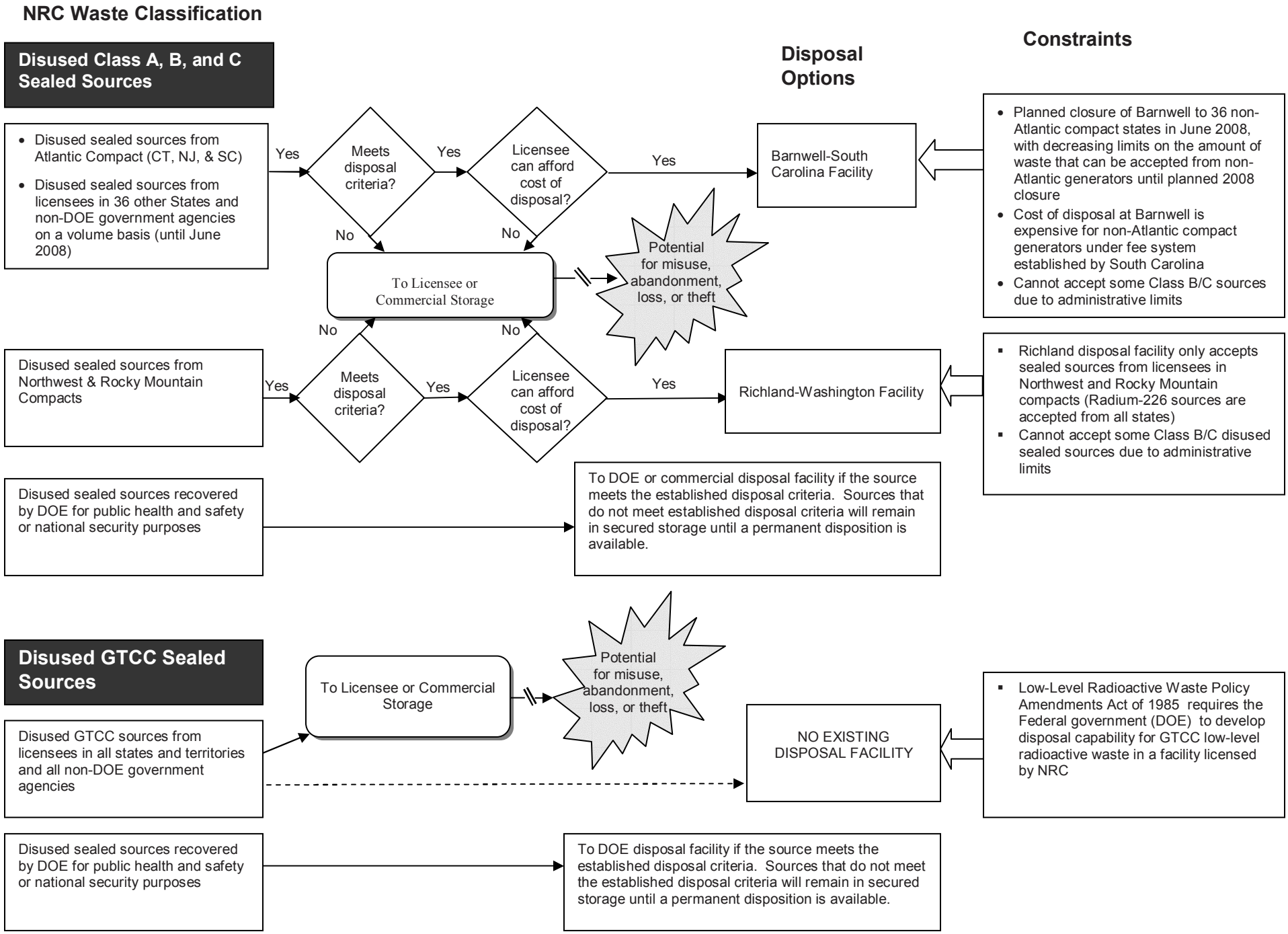


Table 9.1 Key U.S. Laws Concerning Sealed Source Disposal

Atomic Energy Act of 1954, as amended, established the Federal responsibility to regulate activities related to source, special nuclear, and byproduct material, and designated the Atomic Energy Commission (the predecessor to DOE and the NRC) to be responsible for regulating atomic energy production and nuclear material safety in both the Government and commercial sectors. EPA was created under Reorganization Plan No. 3 and has authority to establish generally applicable environmental standards for the protection of the environment from radioactive material.

Energy Reorganization Act of 1974, as amended, established the NRC and the Energy Research and Development Administration (ERDA). The NRC has the Federal responsibility for regulating commercial activities related to source, special nuclear, and byproduct material, including regulation of civilian nuclear reactors. DOE (successor to ERDA) has the Federal responsibility for nuclear energy technology and the nuclear weapons programs, including regulatory authority over most of its own activities related to source, special nuclear, and byproduct material.

Low-Level Radioactive Waste Policy Act of 1980, as amended by the Low-Level Waste Policy Act of 1985, established State rather than Federal responsibility for providing additional disposal capability, either individually or through regional compacts, for LLRW generated in the State that contains Class A, B, or C waste as defined in NRC regulations, codified in 10 CFR 61.55. Waste generated by a commercial licensee that is GTCC, as defined in 10 CFR 61.55, is the responsibility of the Federal Government to dispose of in a facility licensed by the NRC. The Federal Government is responsible for the disposal of LLRW owned or generated by DOE; the U.S. Navy as a result of decommissioning its vessels; and the Federal Government as a result of any research, development, testing, or production of any atomic weapon.

Waste Isolation Pilot Plant Land Withdrawal Act of 1992, as amended, withdraws land from the public domain for the operation of the WIPP, authorized under separate law, for the disposal of transuranic (TRU) waste resulting from atomic energy defense activities of the United States exempt from regulation by the NRC. EPA is responsible for establishing disposal regulations applicable to WIPP and for certifying that those regulations have been met before initial disposal of TRU waste and every 5 years thereafter.

Energy Policy Act of 2005 established a comprehensive set of energy policies and programs. Among other things, the statute contains provisions related to DOE reporting requirements on its plans for disposal of GTCC waste (including GTCC sealed sources); the establishment of accelerator-produced and other radioactive material as byproduct material under the AEA; and the exclusion of such newly defined byproduct material from the definition of LLRW under the LLRWPAA.

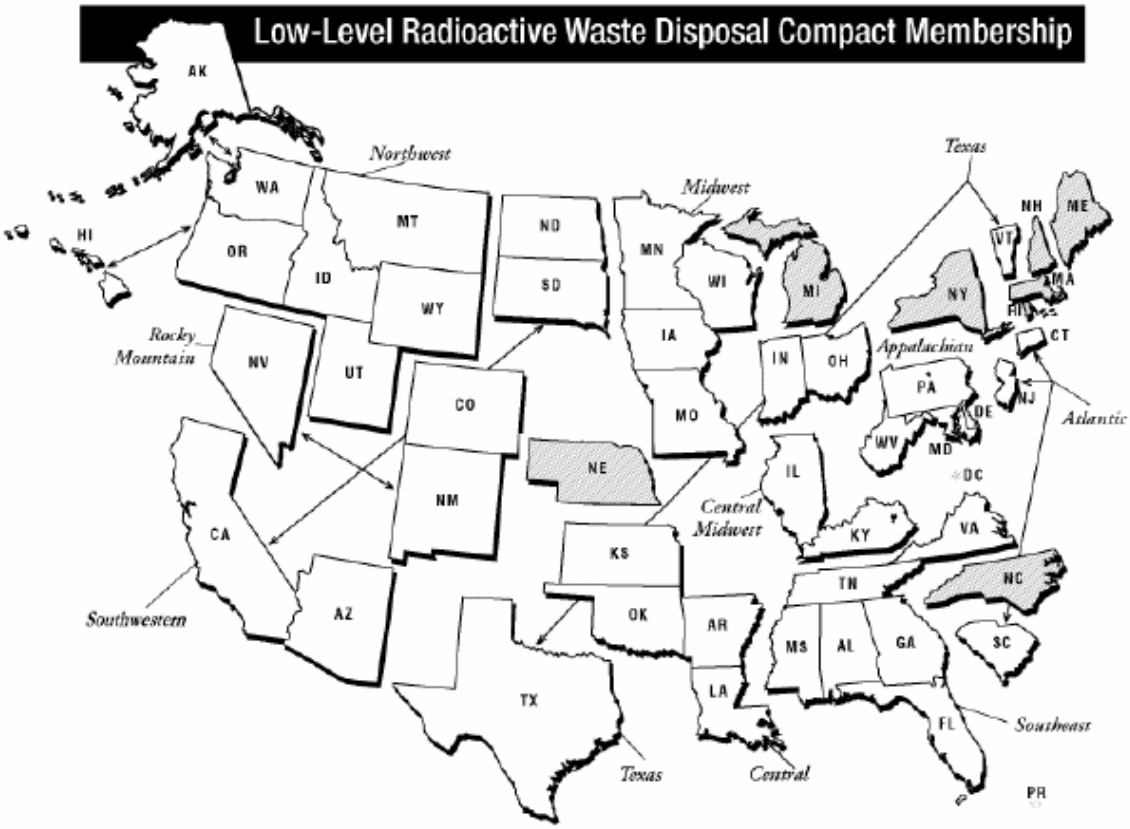
Table 9.2-A U.S. Commercial LLWR Definitions

Class A LLRW is waste in which the physical form and characteristics must meet the minimum requirements in 10 CFR 61.56. Concentration is limited in 10 CFR 61.55 (e.g., to concentration limits in Column 1 of Table 2 (short-lived radionuclides) or 10 percent of limits in Table 1 (long-lived radionuclides)), or combinations thereof by sum of fractions rule.
Class B LLRW is waste that must meet more rigorous requirements on waste form to ensure stability. The physical form and characteristics must meet both the minimum and stability requirements in 10 CFR 61.56. Concentration limits of certain short-lived radionuclides are higher than Class A limits as defined in 10 CFR 61.55, Column 2 of Table 2 (short-lived radionuclides).
Class C LLRW is waste that not only must meet more rigorous requirements on waste form to ensure stability but also requires additional measures at the disposal facility to protect against inadvertent intrusion. It must meet both the minimum and stability requirements in 10 CFR 61.55. Radionuclide concentration per 10 CFR 61.55 falls between 10 percent and 100 percent of values in Table 1 (long-lived radionuclides) or between the values in Column 2 and Column 3 of Table 2 (short-lived radionuclides), with application of the sum-of-fractions rule for isotope mixtures.
Greater than Class C (GTCC) LLRW is waste that is not generally acceptable for near-surface disposal for which form and disposal methods must be different, and in general more stringent, than those specified for Class C waste. Absent specific requirements in 10 CFR Part 61, such waste must be disposed of in a geologic repository as defined in 10 CFR Part 60 or10 CFR Part 63 unless the NRC approves proposals for disposal of such waste in a licensed disposal site regulated under 10 CFR Part 60. Radionuclide concentration (individual or combined isotopes) exceeds the limits set forth in Table 1 (long-lived) or Table 2, Column 3 (short-lived) of 10 CFR 61.55.

Table 9.2-B DOE Radioactive Waste Definitions

Low-level radioactive waste is radioactive waste that is <u>not</u> high-level waste, spent fuel, TRU waste, byproduct material (as defined in Section 11(e)(2) of the AEA), or naturally occurring radioactive material. Reference: DOE M 435.1, citing the Nuclear Waste Policy Act of 1982, as amended.
Transuranic waste is radioactive waste containing more than 3700 becquerels (100 nanocuries (nCi)) of alpha-emitting TRU isotopes per gram of waste, with half-lives greater than 20 years, except for (1) high-level waste, (2) waste that the Secretary of Energy has determined, with the concurrence of the Administrator of EPA, does not need the degree of isolation required by the 40 CFR Part 191 disposal regulations; or (3) waste the NRC has approved for disposal on a case-by-case basis in accordance with 10 CFR Part 61. Reference: DOE M 435.1, citing the Waste Isolation Pilot Plant Land Withdrawal Act of 1992, as amended.

Source: DOE/EM-0654, Rev. 1.



Appalachian Compact
Delaware
Maryland
Pennsylvania
West Virginia

Atlantic Compact
Connecticut
New Jersey
South Carolina

Central Compact
Arkansas
Kansas
Louisiana
Oklahoma

Central Midwest Compact
Illinois
Kentucky

Northwest Compact
Alaska
Hawaii
Idaho
Montana
Oregon
Utah
Washington
Wyoming

Midwest Compact
Indiana
Iowa
Minnesota
Missouri
Ohio
Wisconsin

Rocky Mountain Compact
Colorado
Nevada
New Mexico

Northwest accepts Rocky Mountain waste as agreed between compacts

Southeast Compact
Alabama
Florida
Georgia
Mississippi
Tennessee
Virginia

Southwestern Compact
Arizona
California
North Dakota
South Dakota

Texas Compact
Texas
Vermont

Unaffiliated States
District of Columbia
Maine
Massachusetts
Michigan
Nebraska
New Hampshire
New York
North Carolina
Puerto Rico
Rhode Island

Figure 9.2 Low-Level Radioactive Waste Disposal Compact Membership

DOE manages the use and disposal of DOE sealed sources through procedures comparable to NRC regulations.

Public Law 102-579, the Waste Isolation Pilot Plant Land Withdrawal Act, transferred specific lands, located near Carlsbad, New Mexico, from the Secretary of the Interior to the Secretary of Energy for the construction and operation of the WIPP. EPA authorized DOE to dispose of TRU waste at WIPP in the EPA 1998 Certification Decision. In accordance with the Waste Isolation Pilot Plant Land Withdrawal Act, DOE can dispose of TRU waste (which includes some sealed sources) generated by atomic energy defense activities at WIPP. The Waste Isolation Pilot Plant Land Withdrawal Act requires DOE to operate WIPP in accordance with EPA regulations at 40 CFR Part 191, "Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level Waste, and Transuranic Radioactive Wastes" (developed pursuant to the 1982 Nuclear Waste Policy Act), and 40 CFR Part 194, "Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations."

Section 631 of the EPAct requires DOE to report on activities to identify and analyze disposal options for GTCC LLRW, which would include sealed sources that are GTCC LLRW upon disposition, generated from activities licensed by the NRC.

EPA Responsibilities

Pursuant to its authority under the AEA, EPA issues general environmental protection standards and radiation protection guidelines for some facilities that may be used to dispose of sealed sources. The Waste Isolation Pilot Plant Land Withdrawal Act authorizes EPA to regulate the disposal of TRU waste at the WIPP facility.

9.2.2 Disposal Requirements for Commercial (NRC- or Agreement State-Licensed) Sealed Sources

Commercial disposal of disused risk-significant radioactive sources must be in accordance with the NRC requirements in 10 CFR Part 61 or with compatible Agreement State regulations. The regulations articulate the characterization, design, and construction requirements for new LLRW disposal facilities. The regulations also provide for facility operation, closure, and postclosure monitoring.

These regulations also provide waste classification and minimally acceptable characteristics for the waste and its package. Through the classification system (Classes A, B, C and GTCC), 10 CFR Part 61 establishes increased levels of control for waste with increasing longevity, radiotoxicity, and environmental mobility to ensure continued protection of public health and safety and the environment. Classification for individual radionuclides is based on concentration in terms of radioactivity per unit volume or mass.

Class A, B, or C sealed sources can be disposed of in radioactive waste disposal facilities licensed in accordance with regulations compatible with 10 CFR Part 61, subject to compact restrictions and facility-specific license conditions and waste acceptance criteria. These conditions or criteria may preclude acceptance of some radioactive Class A, B, or C LLRW sources. In some cases, waste acceptance criteria may allow for waste processing to render GTCC waste acceptable for disposal as Class C or less. Under the LLRWPAA, DOE is responsible for disposal of commercial GTCC at an NRC-licensed facility. The NRC regulations

require sources exceeding Class C values to be disposed of in a geologic repository, unless the agency receives and approves a proposal for an alternative disposal method.

9.2.3 Disposal Requirements for DOE Sealed Sources

DOE disposes of its disused sealed sources in DOE facilities in accordance with DOE Directive, DOE O 435.1, "Radioactive Waste Management," and other applicable DOE policies and orders. These sources are classified according to waste type as either LLRW or TRU waste.

DOE does not to use the NRC LLRW classification system for sealed sources disposed of at DOE LLRW facilities. Disposal at DOE facilities involves facility-specific performance assessments and waste acceptance criteria, which ensure that the disposal operations meet radiological performance objectives for protection of workers, the public, and the environment. Like commercial LLRW disposal facilities, DOE LLRW facilities incorporate siting, design, operations, monitoring, closure, and postclosure requirements to protect human health and the environment.

WIPP accepts for disposal TRU sealed sources generated from defense-related activities, if they meet the facility's waste acceptance criteria. Regulations establish disposal facility containment requirements, individual protection requirements (annual radiation dose limits), and groundwater protection requirements, as well as certification and recertification requirements. To be classified as DOE TRU waste, the waste must contain more than 100 nCi per gram of alpha-emitting TRU isotopes per gram of waste, with half-lives greater than 20 years. The NRC does not classify waste as TRU (NRC regulations allow for the disposal of TRU radionuclides in concentrations of less than 100 nCi per gram as Class A or C LLRW, depending on the concentration); the NRC would consider DOE TRU waste to be GTCC under the NRC waste classification system.

9.2.4 Relevance of IAEA Categorizations to NRC Disposal Requirements

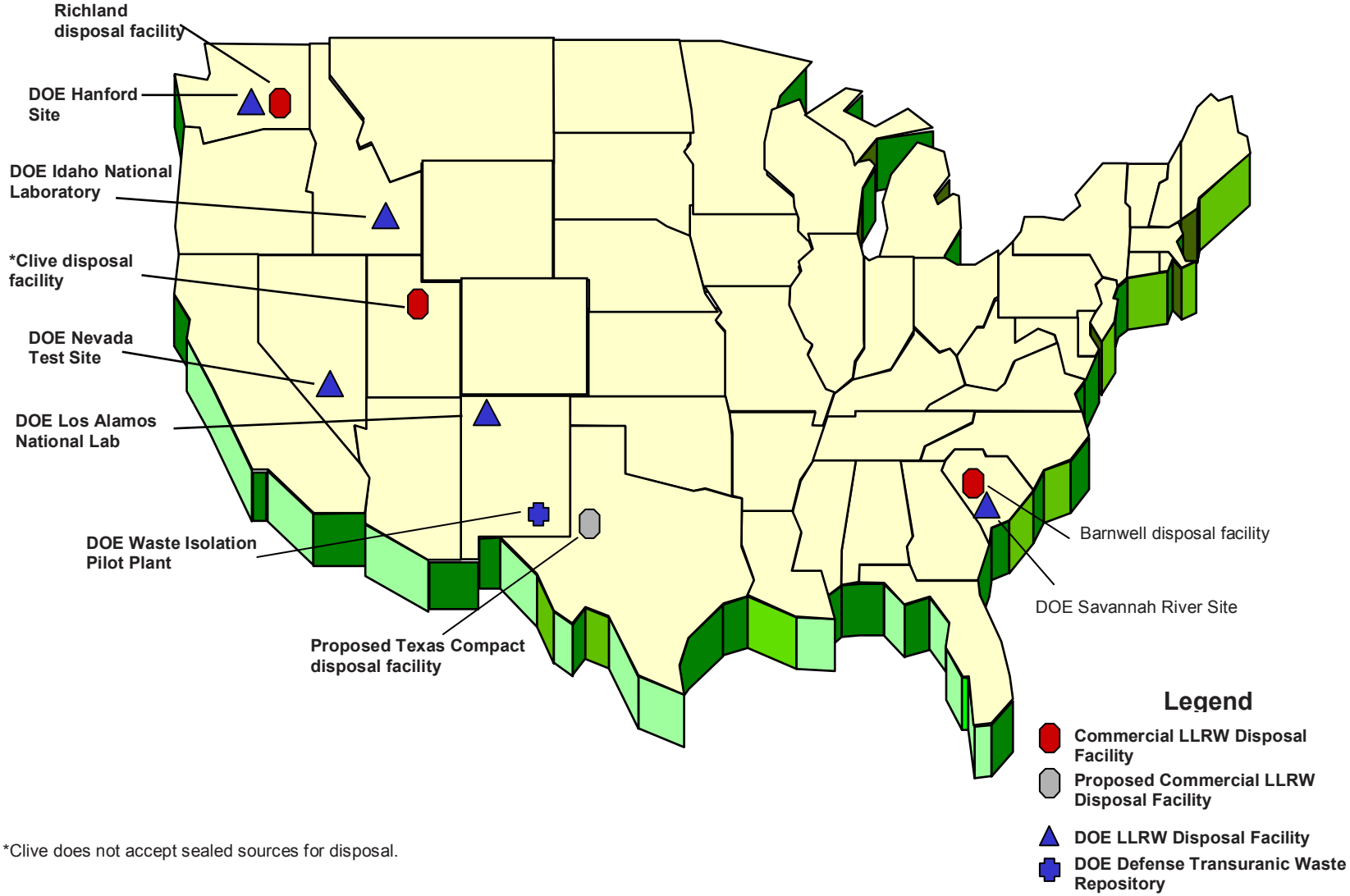
One of the challenges in determining disposal needs for commercial Category 1 and 2 sealed sources is that a direct correlation does not exist between IAEA Code of Conduct categories and the NRC disposal requirements. Sealed sources can be Class A, B, or C or GTCC under the NRC waste classification system. While many Category 1 and 2 sealed sources would equate to GTCC LLRW under the NRC waste classification system, some may be classified as (or have the potential to be processed as) Class A, B, or C LLRW and, subject to other restrictions, these sources would be eligible for disposal as commercial LLRW.

9.2.5 Available Disposal Options

Commercial sealed sources are disposed of in two commercial LLRW disposal facilities. DOE disposes of its sealed sources in certain existing DOE LLRW disposal facilities and WIPP. Disposal options for commercial and DOE sealed sources are further described in this section. Figure 9.3 shows the disposal locations for the commercial and DOE disposal facilities.

<u>Commercial Disposal Facilities</u>
Commercial LLRW disposal has evolved from an essentially free-market system, including six geographically diverse facilities in the 1970s, to a much more constrained and costly system today. Environmental concerns prompted the promulgation of a strict regulatory structure.

Figure 9.3 Location of Commercial LLRW Disposal Facilities, DOE LLRW Disposal Facilities, and DOE Defense Transuranic Waste Disposal Facility



*Clive does not accept sealed sources for disposal.

Political decisions prompted the transformation from six sites, the access to which was open to essentially all generators, to three sites (two of which operate under compact restrictions).

Commercial disposal of LLRW in the United States is provided by three facilities— located in Barnwell, South Carolina; Clive, Utah; and Richland, Washington. License conditions prohibit the Clive facility from accepting any sealed sources for disposal. Both the Barnwell and Richland facilities can accept Class A, B, and C waste, including sealed sources, subject to compact restrictions, license conditions, and waste acceptance criteria, as discussed below. Neither facility can accept GTCC sealed sources. In some circumstances, GTCC sealed sources can be processed to meet commercial facility disposal criteria.

Cost for disposal of sealed sources at these facilities can be prohibitive to some licensees. Key factors that contribute to disposal cost include limited disposal options that impact disposal fees and the cost of waste processing. For example, disposal classification is based on concentration in terms of radioactivity per unit volume or mass. Therefore, the sources themselves, unprocessed, often have an activity-to-mass or activity-to-volume ratio so high that it renders them unacceptable for disposal. The disposal facilities may allow processing of such sources by imbedding them in concrete inside larger drums and other packages. This allows the activity to be averaged over the mass or volume of the entire package (referred to as "concentration averaging"). Because cost is usually based on a number of factors, including volume and radioactivity, the increase in volume resulting from this processing adds significantly to the cost of disposal of an otherwise small object.

Barnwell Disposal Facility—Located in Barnwell, South Carolina, this 235-acre LLRW disposal facility is owned by the State of South Carolina and operated by Chem-Nuclear Systems, LLC, a private company, under a lease agreement with the State. The facility accepts Class A, B, and C LLRW from the Atlantic Compact region and from 36 non-Atlantic Compact States, subject to volumetric limits, license conditions, and waste acceptance criteria. This situation will soon change for the non-Atlantic Compact States. The State of South Carolina is gradually scaling back the availability of Barnwell to generators in all States but the Atlantic Compact. A State law enacted in July 2000 limits access to the Atlantic Compact beginning June 2008. This will eliminate access to the facility for sealed source waste generators in the 36 non-Atlantic Compact States.

Barnwell accepts most Class B/C sealed sources. However, Barnwell cannot accept all Class B/C sources for disposal due to licensing conditions. For example, the facility does not accept sources containing Cs-137 with an activity greater than 10 Ci (Category 3). Class B/C sources that do not meet the waste acceptance criteria may not have a disposal path. The State of South Carolina allows for concentration averaging, but is more restrictive in its concentration averaging requirements than that allowed by NRC guidance. This limits the ability to dispose of some higher activity sources at the facility.

South Carolina law defines the disposal costs for compact and non-Atlantic Compact generators. For non-Atlantic Compact generators, the minimum disposal cost is $1,870 per cubic foot with additional costs based on the mass and density of the disposal package, the activity of the waste, and other variables. Disposal costs for compact States are significantly lower, ranging from $276 to $414 per cubic foot with additional surcharges applied. The surcharges can be significant, especially for high activity sources due to a $0.419/mCi fee. For example, the disposal of a single 300 Ci Co-60 source (Category 2) will cost well over $100,000.

There is no required closure date for the Atlantic Compact operational period of the facility. The remaining capacity of the facility is approximately 2.5 million cubic feet, which State officials indicated is sufficient capacity to meet the long-term disposal needs of the Atlantic Compact States.

Richland Disposal Facility—Located near Richland, Washington, this LLRW disposal facility is within a 100-acre tract on the U.S. DOE Hanford Site. The land is leased to the State of Washington by DOE and subleased to U.S. Ecology, a private company that has operated the facility since 1965. Since 1993, the Richland facility has been the regional compact disposal facility for the Northwest Compact. The facility accepts Class A, B, and C LLRW from the Northwest Compact region (Alaska, Hawaii, Idaho, Montana, Oregon, Utah, Washington, and Wyoming) and from the Rocky Mountain Compact region (Colorado, Nevada, and New Mexico). The facility can also accept radium sealed sources from generators nationwide. The facility does not accept other types of sealed sources from generators outside of the Northwest and Rocky Mountain Compact regions.

Like Barnwell, Richland does not accept all Class B and C sealed sources due to licensing conditions. For example, the facility has denied requests to accept Sr-90 RTGs because of its concern about meeting the Class C LLRW disposal criteria for waste stabilization. Sealed sources that do not meet the facility's waste acceptance criteria may not have an alternative disposal path.

The facility plans to operate until 2056, and there are no identified constraints on physical capacity (there is approximately 45 million cubic feet of unused disposal capacity at the facility). The Washington Utilities and Transportation Commission periodically adjusts disposal costs based on a complex formula that accounts for volume, radioactivity, and dose rate as well as various taxes and surcharges. Because of the relatively high activity per mass, disposal costs for sealed sources can be significant. For example, recent disposal of a 1.16 Ci radium source (Category 3) cost approximately $97,000.

Proposed Texas Disposal Facility—A private company, Waste Control Specialists, is in the licensing process for a new commercial LLRW disposal facility in Andrews County, Texas, to serve the Texas Compact (Texas and Vermont). Texas is not expected to make a licensing decision before December 2007.

<u>DOE Disposal Facilities</u>
DOE has adequate near- and long-term capability to dispose of its disused sealed sources at DOE facilities. These disposal facilities include the following:

- WIPP, an underground repository near Carlsbad, New Mexico

- near-surface LLRW disposal facilities at the Hanford Site in Richland, Washington; Idaho National Laboratory in southeastern Idaho; the Los Alamos National Laboratory in north central New Mexico; the Nevada Test Site in southwestern Nevada; and the Savannah River Site in southeastern South Carolina

The WIPP facility accepts TRU sealed sources generated by defense-related activities. The NRC waste classification system would classify these sources as GTCC LLRW.

The types of sources accepted by the DOE LLRW disposal facilities depend on the radiological properties of the source, waste packaging, facility design, site conditions (e.g., depth to

groundwater), dose-based performance objectives, and disposal authorizations. Except for the Nevada Test Site, most of these facilities can only receive DOE waste from onsite generators. For example, Hanford is currently not accepting waste from other DOE facilities pending completion of an environmental impact statement (EIS) for the Hanford Site.

Sources recovered by DOE for public health and safety or national security purposes are also evaluated against the established acceptance criteria for disposal at DOE or commercial facilities. If the sources meet those criteria, they can be disposed of at the facility. If the recovered sources do not meet the criteria, they will remain in secured storage until a permanent disposition path is available.

The types of sealed sources disposed of at DOE facilities are similar to those employed by commercial industry, such as Am-241, Pu-238, Pu-239, and other actinide sources used for imaging and measurement (e.g., radiography, well logging, and calibration); Co-60, Cs-137, Sr-90, and other beta/gamma sources used for medical or biological applications (e.g., industrial and research irradiators) and in power sources (e.g., radioisotope thermoelectric generators); Pu-238/Be neutron sources used in level gauges and other devices; and Ra-226 and other miscellaneous small sources used to support DOE mission activities.

9.2.6 DOE Initiative to Develop Disposal Capability for GTCC LLRW

The DOE Office of Environmental Management has initiated activities to prepare an EIS to analyze disposal alternatives for GTCC LLRW. The scope of the EIS will include disposal capacity needed for current and projected GTCC LLRW, including GTCC sealed sources, generated by licensees. EPA is participating in the EIS as a cooperating agency. Currently, there are no licensed disposal facilities for GTCC LLRW.

As required by Section 631 of the EPAct, DOE will submit a report to Congress by August 8, 2006, on the estimated cost and proposed schedule to complete the EIS. Section 631 also requires that, upon completion of the EIS, DOE will report to Congress on the disposal alternatives and await congressional action before implementing a decision. The length of time required for constructing and licensing a new facility, or modifying and licensing an existing facility, is unknown. In addition, some alternatives could require legislation to implement. DOE will be in a position to establish a milestone for having a disposal facility operational once the National Environmental Policy Act process is completed and a disposal alternative is selected.

9.2.7 Disposal Initiatives for Lower-Activity Sealed Sources

Other programs, such as the EPA Clean Metals Program, are addressing Category 3, 4, and 5 radioactive sources. The EPA's Clean Materials Program is working with the metal processing and demolition industries to identify and properly dispose of disused radioactive sources in the scrap metal recycling stream. Some States and the CRCPD also administer programs for the recovery and disposal of lower-activity sources.

9.2.8 Financial Assurance to Ensure Proper Disposal of Disused Sealed Sources for Which Recycling, Reuse, or Return Is Not an Option

The NRC regulations at 10 CFR 30.35, "Financial Assurance and Recordkeeping for Decommissioning," require financial assurance or a decommissioning funding plan for radioactive byproduct material licensees who possess byproduct material at activity levels above certain thresholds. For sealed sources, the thresholds are fairly high and only affect

possessors of individual IAEA Category 1 sources or significant quantities of lower-activity sources. As a result, licensees that possess Category 1 and 2 radioactive sources may not need to have financial assurance for decommissioning. Some of these licensees may not have sufficient funds set aside to cover the costs of disposal or other appropriate disposition, potentially resulting in prolonged storage and possible misuse or abandonment.

9.3 Discussion

The Task Force identified several issues affecting the disposal of Category 1 and 2 sealed sources. Each of these issues is discussed below. Some of these issues stem from the problematic nature of commercial LLRW disposal in the United States as an ultimate result of the uneven implementation of the LLRWPAA. The Task Force does not consider these issues reason alone for Congress to revisit the LLRWPAA. If Congress revisits the LLRWPAA for other reasons, the action might remove some of the impediments to the disposal of some Category 1 and 2 sealed sources.

Commercial Disposal Options Are Limited
Only two commercial disposal facilities (Barnwell and Richland) can accept Class A, B, and C sealed sources. The third existing LLRW facility (Clive) does not accept any sealed sources.

Although both the Barnwell and Richland disposal facilities accept most Class B/C sealed sources, much of the country's disused Class A, B, and C sealed sources that cannot be reused or recycled go to the Barnwell facility for disposal. However, license conditions prevent the disposal of some Class B/C sources at either facility. In addition, the Barnwell facility is scheduled to close to the 36 non-Atlantic Compact States in June 2008, leaving sealed source generators in those noncompact States without a disposal option. Consequently, those generators will have to store their disused sources unless other disposition options are identified.

GAO reported to the Senate in June 2004 (GAO-04-604) on LLRW disposal availability. GAO identified three legislative options for addressing a potential shortfall in LLRW disposal availability that still apply to the current situation. These options are briefly summarized below:

(1) Allow the current compact system under existing federal legislation to adapt to the changing LLRW situation (i.e., maintain status quo). GAO concluded that this option "may no longer be tenable if there are no assured safe, reliable, and cost-effective disposal options put forward to address a potential shortfall in disposal availability for class B and C wastes after mid-2008."

(2) Repeal the existing Federal legislation to allow market forces to respond to the changing LLRW situation. GAO stated that this option could "create a national LLRW disposal market that might lead to more competition and lower disposal rates." However, GAO noted that States that host LLRW disposal facilities would likely resist opening their disposal facilities nationally and could take several actions to restrict access (e.g., decide not to renew leases for State-owned land).

(3) Use DOE disposal facilities for commercial waste. GAO identified a number of issues that require resolution and possible legislation concerning the use of DOE facilities for commercial waste including (i) it is not clear whether DOE currently has authority to accept commercially generated LLRW at its disposal sites; (ii) a determination would be

needed as to whom (e.g., generators, States, or DOE) pays for the additional cost for disposing of commercial waste at DOE facilities; and (iii) licensing and regulatory oversight issues would need to be clarified since the NRC and Agreement State regulations that govern commercial facilities do not apply to DOE disposal facilities. GAO further pointed out that use of DOE facilities might have the adverse effect of eliminating the financial viability of commercial disposal facilities and possibly putting DOE disposal facilities in competition with private facilities. It also noted that Nevada and Washington, the host States for the DOE regional disposal facilities, have objected in the past to having to accept a disproportionate burden of LLRW disposal.

The Task Force did not identify any immediate security concerns related to disposal of Category 1 and 2 sources that warrant revisiting the LLRWPAA. As discussed in chapter 7, licensees are required to safely and securely store their radioactive sources and, as discussed in chapter 8, DOE OSRP will collect sources that represent threats to public health and safety and security.

The Task Force identified two other areas that could be explored:

(1) The NRC has statutory authority to override any compact restrictions and allow shipment of waste to a regional or other non-Federal disposal facility under narrowly defined conditions (e.g., common defense and security) identified in 10 CFR Part 62, "Criteria and Procedures for Emergency Access to Non-Federal and Regional Low-Level Radioactive Waste Disposal Facilities".

(2) The NRC could facilitate discussions with host States/compacts of operating commercial LLRW disposal facilities to promote access, on an exigency basis, for disposal of selected sealed sources that, if not disposed, present potential national security concerns. Any such negotiated disposal would be subject to disposal facility site-specific technical considerations.

Recommendation 9-1	The Task Force recommends that the U.S. Government further evaluate the waste disposal options as outlined in the GAO reports on LLRW.

Lack of Disposal Options for GTCC LLRW

Currently, no commercial disposal facility will accept GTCC LLRW. Many of the Category 1 and 2 sources would be considered GTCC waste. DOE has initiated the process to develop disposal capability for GTCC LLRW. Current efforts center on performing the necessary National Environmental Policy Act analyses of potential disposal alternatives, including development of an EIS. As required by Section 631(b)(1) of the EPAct, DOE will submit a report to Congress by August 8, 2006, on the estimated cost and proposed schedule to complete the EIS. Providing disposal options for GTCC waste will have the greatest effect on reducing the total risk of long-term storage for risk-significant radioactive sources. Until disposal options for GTCC LLRW are available, DOE OSRP will recover any source that presents threats to public health and safety and security. The Task Force encourages DOE to continue its ongoing efforts to develop GTCC disposal capability.

Action 9-1: The DOE should continue its ongoing efforts to develop GTCC disposal capability.

High Costs of Disposal

Due to high costs, some licensees do not want to pay or cannot pay to dispose of disused sealed sources, which may be acceptable for disposal at the two existing commercial disposal

facilities. As a result, these sources may remain in storage indefinitely or, in some situations, possibly misused, abandoned, lost, or stolen if there are no other disposition alternatives, such as recycling or reuse.

Disposal cost at commercial facilities is generally based on complex formulas taking into account (among other factors) volume, weight, and radioactivity. Special fees, taxes, and surcharges also add to the cost. Sources are often physically very small with a relatively high radioactivity per unit volume or mass, which is the basis for the NRC waste classification system. Disposal criteria often require that small sources be encapsulated in an inert, stable medium such as concrete. This significantly increases disposal weight and volume, while radioactivity remains the same. The end result can be a substantial cost for disposal (several tens of thousands of dollars for a single small source). This high cost can be a significant disincentive to a licensee to properly dispose of disused sources.

Some members of the radioactive waste community claim that the lack of competition in the commercial disposal industry results in excessive costs to the generators. This issue is rooted in the current compact implementation, as discussed above. They also believe that the high cost can impede the use of nuclear technologies that provide significant benefits to society. Since the State compact systems were established in 1985, no new construction of commercial disposal facilities has occurred within the compact structure. The proposed commercial disposal facility in Andrews County, Texas, if licensed by the State and constructed, would provide an additional disposal capability for the Texas Compact.

The Federal Government has existing programs to recover sealed sources, including Category 1 and 2 sources that are unwanted or orphaned. These programs include the NNSA OSRP and grants to the CRCPD. These national programs have successfully recovered and securely dispositioned sources, and these programs should continue. Chapter 8 of this report discusses the recovery program.

Financial Assurance Requirements

Not all possessors of sealed sources need to have financial assurance to cover the costs of disposal or other appropriate disposition of sources, potentially resulting in prolonged storage and possible misuse, abandonment, loss, or theft. The costs of disposal can often be high, prompting a licensee to delay disposal either by choice or economic necessity. Three options—broadening the NRC financial assurance thresholds, assessing a source-specific surcharge for disposal, or assessing a universal disposal surcharge on all licensees—could help alleviate the above concerns. Implementation of any of these options would require consideration of the economic impacts to the licensee. As an unintended consequence, the options could also discourage beneficial use of the radioactive materials due to the increased financial burden.

Option 1: Broadening the NRC Financial Assurance Thresholds

This option would broaden the requirements of 10 CFR 30.35 by applying a lower threshold of radioactivity for determining financial assurance requirements. It would impose a decommissioning surety requirement on the licensee as a function of cost of disposition of all radioactive material in its possession. Funds would remain secure and inviolate for the exclusive purpose of decommissioning activities associated with the possession of sealed sources and other radioactive material. Disposal cost of sealed sources and other radioactive material would be a subset of these decommissioning activities. This option would ensure that affected licensees set aside adequate funds to properly dispose of sealed sources. However, it would not provide funds to dispose of orphan sources or other sources for which there was not a responsible or financially capable party.

Option 2: Assessing a Source-Specific Surcharge for Disposal
This option would develop a financial assurance system by assessing a source-specific surcharge at the time of acquisition or throughout a source's service life to cover the costs of disposal. The option would provide flexibility to spread the surcharge over the life of the source to minimize financial burden and to not discourage the licensee/service provider from providing a service (e.g., use of sealed sources for medical procedures).

The concept would be to create a sinking fund earmarked for source disposal based on its projected disposal cost at time of acquisition, its service life, and its "salvage value," if any. The fund would include an appropriate surcharge at the time of purchase that would be supplemented periodically with a surcharge on the license fee. A third-party financial institution would hold the fund in an interest-bearing escrow account. The fund would follow the source from licensee to licensee throughout its service life. If the fund exceeded the source's disposal costs, it would be returned, on a pro rata basis, to contributors.

The size of the fund and rate of contribution would depend on a variety of factors, including specific isotope and radioactivity, service life of the source, and salvage value. Licensees could seek relief, in whole or in part, by providing demonstration of an enforceable and fungible "path forward" other than disposal.

The NRC would periodically evaluate (during license renewal) the adequacy of the accumulation of funds in the sinking fund, taking into account increases or decreases in anticipated disposal costs. If, at the time of license termination, the licensee made alternative arrangements for disposition using monies other than those contained in the disposal escrow fund, the NRC would remand the fund to the licensee.

While such a solution would prospectively ensure that individual licensees would be financially responsible for disposal of their sealed sources, it would not address the disposal of orphan sources or other sources for which there is not a responsible or financially capable party.

Option 3: Assessing a Universal Disposal Surcharge on All Licensees
This option would involve assessing a small surcharge on all licensees of radioactive material (i.e., not limited to sealed source licensees) to cover the costs of disposal, similar to a program currently implemented by the State of Texas and other States. The Texas Radiation and Perpetual Care Fund (the Fund) is a State account set up to prevent or mitigate the adverse effects of abandonment of radioactive materials, default on a lawful obligation, insolvency, or other inability by the possessors or users of radioactive material to manage its proper disposition. Monies in the Fund may be used for decontamination, closure, decommissioning, reclamation, surveillance, or other care.

Monies for the Fund come from an additional fee assessed on the State's radioactive materials licensees and administrative penalties collected by the enforcement program (from radioactive materials licensees as well as from the registrants of machine-produced radiation). There is no cap on the amount of penalties accrued in the Fund.

Such a solution would address a broader range of problematic disposition situations (e.g., existing backlog of orphan sources). However, it would have the disadvantage of spreading the cost burden to licensees who would not specifically benefit from the program.

Because not all Category 1 and 2 sealed sources are subject to current NRC financial assurance requirements and to ensure sufficient funds are set aside to properly disposition these sources at the end of their useful service, the NRC should evaluate alternative financial assurance options, including a broadening of the financial assurance thresholds in 10 CFR Part 30.35, a source-specific surcharge for disposal; and a universal disposal surcharge on all licensees. The evaluation should consider impacts to the regulated community and implementation approaches (e.g., the need for legislation and regulation development), and it should involve stakeholders.

Recommendation 9-2	The Task Force recommends that the NRC evaluate the financial assurance required for possession of Category 1 and 2 radioactive sources to assure that funding is available for final disposition of the sources.

9.4 Conclusions

The Task Force recognizes a number of challenges (e.g., limited disposal availability due to compact limitations and high costs of disposal) associated with the commercial disposal of some Category 1 and 2 sources, which equate to NRC Class A, B, and C waste. As noted above, GAO previously reported to Congress (GAO-04-604) legislative options for addressing a potential shortfall in commercial LLRW disposal availability that would apply to those Category 1 and 2 sealed sources that equate to NRC Class A, B, and C waste. However, the Task Force also concludes that the challenges in providing disposal options for this limited category of waste do not in and of themselves warrant revision of the LLRWPAA by Congress. Disposal options for Category 1 and 2 sources are part of the bigger disposal picture. Since many of the risk-significant sources qualify as GTCC, the development of a disposal pathway is covered by the LLWRPAA and section 631 of the EPAct. For many of the Category 1 and 2 sources, there are no requirements for licensees to provide financial assurance for decommissioning. This situation warrants further evaluation by the NRC.

9.5 Summary of Recommendations

The Task Force has made two recommendations in the area of source disposal and financial assurance. These recommendations are discussed above and are summarized below.

Recommendation 9-1	The Task Force recommends that the U.S. Government further evaluate the waste disposal options as outlined in the GAO reports on LLRW.
Recommendation 9-2	The Task Force recommends that the NRC evaluate the financial assurance required for possession of Category 1 and 2 radioactive sources to assure that funding is available for final disposition of the sources.

10 Import and Export Controls for Radioactive Sources

10.1 Background

A key success for the United States in 2004 was the adoption by the IAEA Board of Governors on the nonlegally binding IAEA Guidance on the Import and Export of Radioactive Sources, supplemental to its nonlegally binding Code of Conduct. The Guidance represents the first international guidance on controlling exports and imports of radioactive sources and is an important step toward preventing accidental use of sources or theft and diversion of materials potentially usable in a "dirty bomb." The United States played a leading role in developing, negotiating, and generating political momentum for the Guidance.

The Guidance is the product of numerous IAEA experts meetings in 2003–2004, which included negotiations and consensus by more than 40 Member States. The Guidance provides detailed recommendations concerning the import and export provisions in the Code of Conduct. Member States specifically requested the Guidance so that these multilateral actions can be carried out in a harmonized fashion without undercutting manufacturers in any particular country.

The export control guidance received considerable international political backing in 2004 at the G-8 Sea Island and the U.S.-EU Shannon Summits when leaders endorsed the Guidance and announced their intention to work toward implementing adequate export controls by the end of 2005. The Guidance received further international status when it was approved at the September 2004 Board of Governors meeting and unanimously endorsed by the General Conference. In its resolution, the General Conference "notes that more than 30 countries have made clear their intention to work towards effective import and export controls by 31 December 2005, and encourages States to act in accordance with the Guidance on a harmonized basis…."

Radioactive source manufacturers strongly pressed for a target date that would universally apply to Member States working toward following the Guidance. Such coordinated action will help ensure harmonization and promote a level economic playing field for suppliers worldwide. In addition, action in accordance with the Guidance on a global scale will help to ensure that commercial radioactive materials continue to be used for peaceful purposes.

Specifically, the Guidance applies to Category 1 and 2 sealed sources used in nonmilitary and nondefense applications. Its five major provisions are as follows:

(1) The exporting State should ensure that the recipient is authorized by the importing State to receive and possess the material.

(2) The exporting State authority should assess whether the importing State has adequate controls to safely and securely manage the material.

(3) The exporting State should receive consent from the importing State's authority for shipments of Category 1 sources.

(4) Advance notification should be provided prior to each shipment.

(5) In cases in which the first or second provisions cannot be met, the Guidance provides for exceptional circumstances—specifically, in cases of considerable medical need, of

imminent radiological hazard, or in which the exporting facility maintains control of the sources throughout the period the sources are abroad

To meet the G-8 Summit political commitment of the United States to act in accordance with the export control Guidance by the end of 2005, the two agencies with regulatory authority over the export of radioactive sources, the NRC and DOE, have amended their rules and directives, respectively, as outlined in the following section.

10.2 Summary of Current Programs

10.2.1 NRC Radioactive Source Import/Export Program

In July 2005, the NRC amended its regulations in 10 CFR Part 110 (70 FR 37985; July 1, 2005). The amendment, effective December 28, 2005, implemented changes to the nuclear and radioactive material security policies of both the NRC and the executive branch. The rule change took into account provisions in the Code of Conduct concerning the import and export of radioactive sources and the supplemental Guidance document on internationally harmonized procedures for the import and export of risk-significant radioactive sources. The amended regulations require certain licensees previously operating under general license to file for specific export and import licenses. The regulations also include procedures for advance notification before shipment, verification of the recipient facility's licensing status, and review of the adequacy of the receiving country's controls on Category 1 and 2 radioactive sources. The following is a comprehensive summary of the NRC's current program on the controls for import and export of Category 1 and 2 radioactive sources.

The July 2005 revisions to 10 CFR Part 110 are consistent with the Code's "Import and Exports of Radioactive Sources" section. This Code section guides countries in the development and harmonization of policies and laws on exports and imports of potentially harmful radioactive sources to ensure that such sources are only exported to authorized end users in countries with adequate regulatory controls and that sources are not diverted for illicit use. Under the sections of the Code of Conduct relating to exports and imports of Category 1 and 2 radioactive sources, exports and imports of such radioactive sources should take place with the awareness of the exporting country authority and with the prior notification of the importing country authority. Additionally, exports of Category 1 quantities of such material require the consent of the importing country. While prior notification to the importing government authority may originate from either the exporting licensee or exporting government authority, consents to the import of Category 1 sources must occur on a government-to-government basis. The Code of Conduct provides that, unless there are exceptional circumstances, a country should authorize the import or export of potentially harmful Category 1 and 2 sources only if it is satisfied that the recipient is authorized to receive and possess the radioactive material and the importing country has the necessary technical and administrative capability, resources, and regulatory structure to ensure that the radioactive source will be managed in a manner consistent with the Code provisions.

Appendix P to 10 CFR Part 110 lists the specific radioactive material and quantities that are covered by the July 2005 rule, which are essentially identical to the list of radioactive materials in Category 1 and 2 of the Code of Conduct. While the radionuclides and threshold quantities are the same, Appendix P uses the more encompassing term "radioactive material" rather than "sources." Therefore, unlike the Code of Conduct, 10 CFR Part 110 encompasses the import and export shipments of bulk radioactive material, in addition to sealed sources. With the exception of plutonium, Appendix P radioactive materials are in the category of byproduct material as defined in the AEA. Although the Code of Conduct covers Ra-226, the July 2005

rule does not because the NRC did not have the authority to regulate Ra-226 at the time. The EPAct gives the NRC authority over discrete sources of Ra-226. Therefore, the April 2006 amendments to 10 CFR Part 110 added Ra-226 to Appendix P; the rule will become effective in August 2006 (71 FR 20336; April 20, 2006).

Under the AEA and 10 CFR Part 110, the principal criterion for approving exports of Appendix P materials is a finding that the export is not inimical to the common defense and security of the United States (10 CFR 110.42(a)(8), (c)). The noninimicality finding is relevant to both the nuclear proliferation significance of exports and the related security concerns of potentially harmful radioactive material falling into the hands of nonstate organizations, including terrorist groups. In making its inimicality determination, the NRC will, under the rule, consider whether the importing country has the technical and administrative capability, resources, and regulatory structure to manage the radioactive material in a safe and secure manner (10 CFR 110.42(e)(2)). For proposed exports of Category 1 quantities of Appendix P radioactive materials, the NRC also considers whether the government of the importing country has provided its consent to the import (10 CFR 110.42(e)(3)). For both Category 1 and Category 2 exports, the NRC requires the applicant for an export license to provide the NRC with pertinent documentation demonstrating that the recipient of the radioactive material has the necessary authorization under the laws and regulations of the importing country to import, receive, and possess the material (10 CFR 110.32(g)).

Consistent with the Code of Conduct and the Guidance document, 10 CFR Part 110 provides for the import and export of Appendix P quantities of material in situations in which a potential recipient lacks the necessary authorization to receive and possess the radioactive material, or in which a receiving country lacks the technical and administrative capability, resources, or regulatory structure, under “exceptional circumstances” (10 CFR 110.42(e)(4)). The NRC will consider, as part of its overall inimicality determination, whether the export qualifies as an “exceptional circumstance” as defined in 10 CFR 110.2, “Definitions.” In such cases, the NRC will also consider whether the government of the importing country has provided its consent to the import of Category 1 or 2 amounts of radioactive material (10 CFR 110.42(e)(5)).

In examining these and other factors pertaining to the proposed export’s potential impact on the U.S. common defense and security, the NRC will, as appropriate, seek the advice of the Executive Branch and will take into account information it receives through regular interactions with its foreign regulatory counterparts, the IAEA, and the executive branch. If, after considering the above information, the NRC authorizes the export, then export licensees will need to provide prior notification of individual shipments to the importing country authority and to the NRC (10 CFR 110.50(b)(4)).

For imports, the licensing criteria include noninimicality to the U.S. common defense and security and a finding that the import does not constitute an unreasonable risk to the public health and safety (10 CFR 110.43(a), (b)). Because all U.S. recipients must have proper authorization from the NRC, an Agreement State, or DOE to receive and possess such radioactive material, an NRC import license requires that the recipient licensee provide the following:

- a copy of its authorization to the exporter or exporting country authority (or alternatively the NRC’s confirmation to the exporting country’s authority that the U.S. recipient is authorized to receive and possess the radioactive material)

- prior notification to the NRC of individual shipments (10 CFR 110.50(b)(4))

- pertinent documentation to the NRC that each recipient of the radioactive material has the necessary authorization to possess the material (10 CFR 110.32(h)).

For proposed imports into the United States of Category 1 quantities of Appendix P material, the NRC must provide the necessary formal U.S. Government consent to the export authority of the exporting country (10 CFR 110.45(c)(2)).

Version 2 of the National Source Tracking System database will include the advance notifications and consents required by the import/export final rule. NRC will provide the information to Customs in a timely manner.

10.2.2 DOE Radioactive Source Import/Export Program

DOE has independent legal authority under the AEA to conduct imports and certain exports of radioactive sources without requiring an NRC license. While the vast majority of U.S. commercial radioactive source imports and exports are under the jurisdiction of the NRC, due to these distinct authorities, both the NRC and DOE are listed with the IAEA as points of contacts for U.S. imports and exports of radioactive sources.

Consistent with the United States' political commitment to work toward following the nonlegally binding Code of Conduct and related Guidance, DOE is developing internal policies and procedures to be implemented by DOE and its contractors engaged in activities falling under the scope of the Code and Guidance. These procedures will apply to those specific Category 1 and 2 radioactive materials as listed in Table 1 of the Code of Conduct. These procedures will likely address responsibilities related to prior notification of shipments, recipient government consent procedures, export request evaluations, and imports and exports in exceptional circumstances, consistent with the Guidance document's recommendations.

The United States will carry out its commitments to work toward following the Code and Guidance in accordance with activities furthering nonproliferation, nuclear security, and the avoidance of malicious acts involving risk-significant radioactive sources. Noting that both the Code and Guidance specifically exclude radioactive sources used for defense or military purposes, and the Code's inherent objectives of strengthening nonproliferation and security, internal policy of DOE will instruct staff and its contractors on these Guidance provisions. DOE will continue to work with other executive branch agencies, as appropriate, on procedures and criteria for radioactive source exports and interagency export licensing responsibilities as outlined in 10 CFR Part 110.

DOE continues to work internally to evaluate and implement these import/export recommendations and expects its efforts to be finalized in a timely manner so as to uphold the United States' political commitment to work toward following the Code and the Guidance. The Task Force encourages DOE to finalize its import/export policy expeditiously.

10.2.3 Stakeholder Interactions

The NRC held two public meetings to obtain stakeholder input on the import/export rulemaking and included a 75-day public comment period on the proposed rule.

10.3 Discussion

International

To date, 83 nations have made a political commitment to work toward following the Code of Conduct, as called for in IAEA 2003 General Conference Resolution GC (47)/RES/7.B. However, only 20 of these countries have made a subsequent political commitment to act in accordance with the Guidance document, pursuant to GC (47)/RES/7.B in 2004. This discrepancy may largely be due to Member States' confusion as to why a second commitment is needed. The U.S. Government strongly believes that a second commitment is needed because unlike the Code, whose guidelines are primarily addressed to action on a national basis, the import/export Guidance seeks to harmonize multilateral interactions. To harmonize these interactions, each country needs to commit to act in accordance with the Guidance and set a date by which it anticipates that it will meet this commitment. As part of the G-8 Sea-Island Summit and the U.S.-EU Shannon Summit, 29 nations made a political commitment to work towards having effective export controls, as recommended by the Guidance, by the end of 2005. In addition, leaders of the OSCE and the APEC made similar commitments as part of their summits. However, some of these countries have not submitted their individual letters of commitment to the IAEA Director General. DOS should continue to press countries that have not already done so to make this commitment. In addition, DOS should continue its efforts to promote international harmonization of export and import controls over Category 1 and 2 radioactive sources through multilateral and bilateral forums, conferences, technical meetings, and other meetings to harmonize import/export actions. Finally, the U.S. Government should press for common forms, used in import and export bilateral transactions, to further harmonize implementation of import and export controls.

Action 10-1: The U.S. Government should continue efforts to promote international harmonization of import and export controls for Category 1 and 2 radioactive sources.

Life-cycle management of risk-significant radioactive sources is key to preventing sources from becoming abandoned, lost, or diverted for malicious use. Encouraging suppliers and supplier countries to arrange for the return of risk-significant sources would provide an outlet for sources at the end of their useful lives. Making this option available is particularly important given the limited and high costs of disposal options. Suppliers could receive encouragement to arrange for the return of sources through work with the IAEA, development of a code of practice by suppliers, or other means.

Internationally, the redefinition of sources as "radioactive waste" can impede the return of disused risk-significant sources to manufacturers. Once sources are redefined as waste, they are subject to the regulatory framework that requires rigorous licensing and export/import authorization processes and that makes this source management option unavailable in some cases. In the United States, NRC rules allow for the return of sources without considering the sources to be radioactive waste. Specifically, radioactive waste, as defined in 10 CFR 110.2, does not include radioactive material that is "contained in a sealed source, or device containing a sealed source, that is being returned to any manufacturer qualified to receive and possess the sealed source or the device containing a sealed source." In adding this exclusion to the definition of radioactive waste, the Commission stated, "This exclusion acknowledges that shipment of used sources to a qualified manufacturer should be handled as expeditiously as possible because these types of shipments help to ensure that used sources are handled in a safe and responsible manner." Additionally, the recent changes to 10 CFR Part 110 allow for

broad licenses that can include the return of the disused risk-significant source as part of a combined import/export license. This may still be an impediment in other countries.

Obstacles to the return of Category 1 and 2 radioactive sources also include the loss of Type B packaging status. Many of the Category 1 and 2 sources must be transported in Type B packages. In the United States, many of the Type B packages were designed several decades ago and do not meet new international standards. Internationally, the grandfathering clause for old designs expired in 2001. In the United States, Type B packages do not have to meet the new design standards until October 1, 2008. After that date, many of the existing Type B packages will no longer be in use. While Type B packages that meet the new standards are available, they are expensive to either lease or buy. The Task Force encourages the agencies involved to examine the regulatory landscape that applies to the return of disused sources to suppliers and to identify and address the obstacles that currently make this option unavailable.

Action 10-2: The U.S. Government should encourage suppliers to provide arrangements for the return of disused sources and examine means to reduce regulatory impediments that currently make this option unavailable.

A number of developing countries have voiced concern that facilities in developed nations may export used risk-significant sources and devices, such as teletherapy units, to the developing world as an alternative to disposal. While donation and sale of used sources and devices are legitimate and essential avenues for many countries to acquire life-saving therapy and diagnostic capabilities, these practices can also result in lingering safety and security concerns as the recipient facilities and importing countries may not have the means for proper storage, conditioning, and disposal of high-risk sources at the end of their useful lives. Implementation of the new import/export controls in the United States and other countries will help address this issue. The importing country will need to consent to the import of the risk-significant radioactive material, as many of the devices contain Category 1 levels of radioactive material. Using incentives and education to discourage this practice would also help address this problem. One option would be to support voluntary development of a code of ethics or practice by suppliers to help guide decisions on the resale or donation of used sources, especially to entities in the developing world.

Action 10-3: The Task Force suggests the use of education and creation of incentives to discourage the export of used Category 1 and 2 radioactive sources as an alternative to disposal.

<u>Domestic</u>
Paragraph 25 of the Code of Conduct states the following:

> Every State intending to authorize the export of radioactive sources in Categories 1 and 2 of Annex 1 to this Code should consent to its export only if it can satisfy itself insofar as practicable, that the receiving State has authorized the recipient to receive and possess the source and has the appropriate technical and administrative capability, resources and regulatory structure needed to ensure that the source will be managed in a manner consistent with the provisions of this Code.

In addition, the Guidance document states that, in deciding whether to authorize an export of such a source, the exporting State should consider, based on available information, the following elements:

- whether the recipient has been engaged in clandestine or illegal procurement of radioactive sources

- whether an import or export authorization for radioactive sources has been denied to the recipient or importing State, or whether the recipient or importing State has diverted for purposes inconsistent with the Code any import or export of radioactive sources previously authorized

- the risk of diversion or malicious activities involving radioactive sources (paragraphs 8c and 11c).

Finally, under 10 CFR Part 110, the principal criterion for approving exports of Appendix P material is a finding that the export is not inimical to the common defense and security of the United States. The noninimicality finding is relevant to both the nuclear proliferation significance of exports and the related security concerns of potentially harmful radioactive material being used for malicious purposes.

The NRC, DOE, and DOS are currently conducting the review called for in the above documents. However, additional information gained from leveraging the knowledge and expertise of additional government entities could provide a more comprehensive information base to facilitate the U.S. Government in making a more informed decision on whether to authorize an export.

Currently, the interagency informally makes an evaluation based on a number of criteria, including a country's nonproliferation credentials, whether it is on the embargoed countries list, its export history, and its progress in IAEA assistance programs to the extent information is publicly available or provided by the country. Verifying the legitimacy of some end users is difficult at times, and additional information could be useful in this review process. The decisionmaking process should, where appropriate, take greater advantage of the extensive knowledge base offered by the various agencies. This is particularly important in light of today's security concerns.

Bringing in additional existing expertise and resources could be beneficial. This interagency group could periodically review and share relevant trade, end user, and country information. Agencies involved in the export licensing process should consider any information provided by the working group, but without allowing such information to unduly hamper legitimate trade or unduly lengthen the review process. Specific actions that could be considered include the following:

- Request additional information, as appropriate, from potential recipient governments regarding the safe transport, security, handling, and storage of the exported risk-significant radioactive material in the country.

- Make greater use of existing U.S. Government resources (e.g., working through the DOC, DOE, DOS, and the NRC), as appropriate, to share information regarding potential recipient companies to help ensure that the end user is authentic.

- Make greater use of existing U.S. Government resources (e.g., DOC, DOE, DOS, and the NRC) to better understand the recipient country's security environment, the

adequacy of its regulatory controls, and any potential security concerns that may arise during the transport or at the end-use location

Action 10-4: The U.S. Government should improve interagency evaluation of recipient authorization and recipient country controls to prevent fraudulent acquisition of risk-significant sources exported from the United States.

Most other industrialized countries implementing the import/export Guidance do not require a specific import license. Category 1 and 2 sources are imported under a licensee's site license to use and possess the source, as was previously done in the United States. Licensees suggest that the new import/export rules requiring specific import licenses are a significant and costly administrative burden with little value. Requirements for the licensee to notify the NRC of the import could still be in place without requiring a specific import license. This would ensure that the NRC would know of the import and to whom it is destined. The Task Force suggests that the NRC consider reevaluating the need for a specific import license to allow the import of Category 1 and 2 radioactive sources to a U.S. licensed user.

Action 10-5: The NRC should consider reevaluating the need for a specific import license to allow the import of Category 1 and 2 radioactive sources to a U.S.-licensed user.

10.4 Conclusions

The IAEA Code of Conduct and supplementary Guidance provide a foundation for the nascent international radioactive source import/export control effort. These two documents outline recommendations on the roles and responsibilities of entities engaged in both the import and export of these commercial sources, helping to ensure these risk-significant sources are managed in a safe and secure manner and to prevent their malicious use.

The United States not only took a leadership role in the development and wide acceptance of this international guidance, but it was also among the first countries to take these recommendations into account in national regulations. In light of new concerns in the security environment after September 11, 2001, the United States has worked quickly to strengthen its controls on the import and export of risk-significant radioactive sources, taking into account these international recommendations. The NRC, which maintains regulatory jurisdiction over most commercial U.S. radioactive source transactions, has amended its 10 CFR Part 110 regulations to require specific import and export licenses for Category 1 and 2 quantities of radioactive material. The DOE is undertaking similar internal policy formulation to update its radioactive source import and export procedures. Both agencies will periodically review these policies and procedures to ensure appropriate and efficient implementation. These actions are consistent with the United States' political commitment to work toward following the nonlegally binding Code of Conduct and serve as an example for other states working toward following these international recommendations. The NRC and DOE will continue to work with executive branch agencies to ensure the responsible import and export of risk-significant radioactive sources while not unduly burdening international commerce in these vital radioactive sources.

The recent U.S. regulatory changes outlined in this chapter represent a great step forward in the control of imports and exports of risk-significant radioactive sources used for commercial purposes. Balancing import/export controls and trade concerns requires a continued effort by all parties. The United States should continue to encourage other countries to support and

implement international radioactive source import/export guidance so as to maintain a level economic playing field.

10.5 Summary of Recommendations

The Task Force is not making any recommendations in the area of source import/export at this time.

11 National Source Tracking System

11.1 Background

In July 2002, the NRC and DOE established an RDD working group to investigate how to improve the control of nuclear material and, in particular, risk-significant radioactive sources. One recommendation of the RDD report was to develop a national radioactive source tracking system to better understand and monitor the location and movement of risk-significant radioactive sealed sources. To track risk-significant radioactive source transfers in a timely manner, the RDD working group recommended that the system be Web-based, allowing most radioactive source transfers to be recorded directly by licensees using the Internet.

In addition, the Code of Conduct recommends the establishment of national registers of, at a minimum, Category 1 and Category 2 radioactive sources.

The NRC began activities needed to develop and implement sealed radioactive source tracking regulations and the NSTS in late 2003. The NRC recognized that the NSTS would be a collaborative effort involving multiple Federal and State agencies, as well as approximately 2500 commercial, academic, medical, and Governmental entities that are licensed by the NRC or the Agreement States to possess and transfer risk-significant sources. The NRC established NSTS governance and project structure with representation from the following significant stakeholders:

- The NSTS working group includes representatives from the NRC, DOE, and Agreement States. These agencies are the primary system stakeholders. The NSTS working group is responsible for preparing the system requirements, recommending the necessary regulatory changes, and providing input to the business case, system development, and system implementation efforts.

- The SafeSource steering committee includes representatives from the NRC, DOE, and Agreement States. It oversees the NSTS working group and resolves policy issues.

- The NSTS Interagency Coordinating Committee (ICC) includes representatives from the NRC, DOE, and Agreement States, as well as representatives from DOS, DOT, DOD, DHS (multiple representatives), EPA, DOC, and the FBI. This committee advises the NSTS working group and SafeSource steering committee on Federal interagency requirements for source tracking and developed the high-level requirements for NSTS.

The NRC published a proposed rule on national source tracking of sealed sources for public comment (70 FR 43646; July 28, 2005). The final rule is scheduled for publication in August 2006. OAO Corporation/Lockheed Martin Information Technology is developing the NSTS under a contract with the NRC. The NRC plans to deploy the NSTS no later than mid-2007. Upon deployment, the NSTS will replace the NRC interim inventory.

The President signed the EPAct into law on August 8, 2005. It contains a provision on national source tracking that requires the NRC to issue regulations establishing a mandatory tracking system for certain radioactive sources in the United States. The regulations must be issued no later than 1 year after the date of enactment. The EPAct requires the tracking system to accomplish the following:

- enable the identification of each radioactive source by serial number or other unique identifier
- require reporting within 7 days of any change of possession of a radioactive source
- require reporting within 24 hours of any loss of control of, or accountability for, a radioactive source
- provide for reporting through a secure Internet connection

The EPAct further requires the NRC to coordinate with the Secretary of Transportation to ensure compatibility, to the maximum extent practicable, between the tracking system and any system established by the Secretary of Transportation to track shipments of radioactive sources. The EPAct defines a radioactive source as a Category 1 source or a Category 2 source, as defined in the Code of Conduct, and any other material that poses a threat, as determined by the Commission by regulation, other than spent nuclear fuel and special nuclear materials.

11.1.1 Summary of the NSTS Program

The NRC's final rule will establish the regulatory framework for the NSTS for both the NRC and Agreement State licensees. The final rule will require licensees to report to the NSTS the manufacture, transfer, receipt, disassembly, and disposal of nationally tracked sources. Nationally tracked sources are classified as Category 1 or 2 based on the activity level of the source. Each licensee will be required to report its starting inventory of nationally tracked sources. The final rule will require that licensees report transaction information to the NSTS by the close of the next business day after the transaction occurs. Each licensee will also be required to annually reconcile the information in the NSTS against its onsite inventory. Licensees will be able to provide information online, by electronic batch file, mail, facsimile, or telephone.

The NSTS will also contain other information, including import/export notifications, lost/stolen radioactive source event reports, radioactive source destruction, and radioactive source abandonment in a well (i.e., source is irretrievable). The NRC currently receives reports of these types of information either directly from licensees or through an Agreement State, and the NRC staff will enter this type of information into the NSTS. DOE plans to input information related to selected DOE radioactive sealed sources that are transferred to or from the commercial sector in the NSTS.

Upon full deployment, the system will contain information on risk-significant radioactive sealed sources possessed by the NRC and Agreement State licensees and selected DOE sources. The system will not contain information on DOD sources unless the radioactive sealed sources are possessed under an NRC license.

The NSTS will provide a life history account of each nationally tracked source. The NSTS will not contain information for radioactive sealed source transactions that occurred before the deployment date of the system, but will capture all defined transactions that occur after the deployment date. Therefore, risk-significant radioactive sealed source origins will include manufacture, import, and the starting inventory. Risk-significant radioactive sealed source endpoints will likely include disposal, loss or theft, abandonment (i.e., source is irretrievable),

disassembly, destruction, export, and decay. The system will calculate decay. Once a radioactive sealed source decays below the Category 2 threshold, it will no longer be tracked within the system and will reach its endpoint within the NSTS. The system will also capture possession changes (transfers). The system will be transaction based and will not employ real-time tracking. The NSTS will not track transportation of radioactive sources.

Radioactive sealed source information contained in the system will include the manufacturer, model number, serial number, radionuclides, activity, manufacture date, and source status, as well as information on its owner. Information on who possesses the radioactive source will include the facility name, address, and license number (for NRC and Agreement State licensees only). It will not include detailed information such as a room or building number, as this type of information is more sensitive and would require additional cyber-security protection strategies if collected and would result in the system becoming either SGI or classified.

The system will also contain licensee transaction information such as the parties involved in a transaction, the date of the transaction, estimated arrival dates for shipments, and the name of the individual reporting the transaction.

Data in the NSTS will be accessible only to the appropriate type of user. For example, a licensee will only be able to view and modify the information for its facility; regulatory agencies (NRC, Agreement States, and DOE) will only be able to view and modify facility and radioactive source information of their respective jurisdictions; and other agencies will only be able to view limited information on a need-to-know basis. For example, information on imports and exports will be routinely available to Customs and Border Control, and information on lost or stolen radioactive sources will be available to law enforcement. The NRC, as the system administrator, will be able to view all of the system data. The data will be controlled as “Official Use Only—Security-Related Information” and will not be SGI or classified. Access to the data will be on a need-to-know basis.

The NSTS will have advanced searching capabilities for retrieving and analyzing the system’s data and will include a robust set of online search filters. Some of the filters will be for facility use, such as searching for a particular radioactive source or device that is in its inventory or searching for a pending transaction. Other filters will allow authorized users to see all radioactive source transfers for a given licensee, full history of a radioactive source, current status of a given transfer, all pending transfers, and all overdue transfers. The system will also have advanced reporting capabilities that allow users to retrieve and analyze system data. These will include a set of built-in reports for the most common inquiries and an ability to create, store, and execute ad hoc inquiries. The system will be able to report and analyze data by geographic area (zip code).

The system will provide automated event monitoring and alert notifications to enhance the timely reporting and monitoring of NSTS data. For example, if a shipment of radioactive sources is not received by the expected date, the system will automatically alert the NRC. If a licensee enters information on a transfer to another licensee that is not listed in the system, the system will automatically generate an alert.

All information on nationally tracked sources, transfers, and licensees will remain in the NSTS for the life of the system. The system will not delete source data once a sealed source reaches an endpoint or licensee information when a company goes out of business. In both cases, the status would change but the system would retain the data. At startup, the system will contain information on more than 44,000 Category 1 and 2 sources possessed by approximately 1400

NRC and Agreement State licenses. The system will also contain information on selected Category 1 and 2 sealed radioactive sources possessed by DOE.

The system's design will make it easily expandable for more users, sources, and functions. The system is currently expected to go online in spring 2007. The initial release (Version 1) will only have the basic search and report abilities. The second release (Version 2) will contain the advanced search and reporting abilities and is expected to be released in winter 2007/2008.

The home page for the NSTS will contain links to related Web sites that users may find helpful. These include the NNSA registry for pickup of unwanted radioactive sources and the CRCPD Web site.

11.1.2 Additional Stakeholder Interactions

The NRC held numerous meetings of the NSTS working group, the SafeSource steering committee, and the ICC during development of the NSTS requirements and the proposed rule. For the proposed rule, the NRC held two public meetings to obtain stakeholder input on the source-tracking rulemaking, as well as a 75-day public comment period.

11.2 Discussion

There is broad U.S. Government and international interest in tracking risk-significant radioactive sealed sources to improve accountability and control. The Task Force considers national source tracking to be part of a comprehensive radioactive sealed source control program for risk-significant radioactive materials. Although a national source tracking system cannot guarantee the physical protection of radioactive sealed sources, it can provide greater sealed source accountability, which should foster increased control by licensees. A national source tracking system in conjunction with other controls will result in improved security and control for nationally tracked sources.

The NSTS will be useful for a variety of purposes. This standardized, centralized information will help the NRC, DOE, and Agreement States monitor the movement and use of nationally tracked sources, conduct inspections and investigations, communicate nationally tracked source information to other Government agencies, verify legitimate ownership and use of nationally tracked sources, and further analyze hazards attributable to the possession and use of these radioactive sources.

There are currently no procedures or guidelines in place that would provide criteria for handling requests for access to NSTS information. As it stands now, each request would need to be handled on a case-by-case basis. The NRC has already received inquires for access to various pieces of information that will be in the database. A procedure or policy is needed to process such requests. The development of the procedure or policy should be an interagency effort and should address requests from both Government and non-Government entities. The procedure/policy should address the types of information potential users would need to submit to support a request. The development of such a procedure/policy should not require extensive resources and would likely save resources in the end. Case-by-case reviews generally require more effort to process than those handled according to an established procedure/policy. Case-by-case reviews also leave the agency making the decision open to criticism. The Task Force suggests that the ICC develop the procedure/policy. This committee already exists, will continue to be involved in the NSTS, and is therefore a logical choice to prepare the document.

Action 11-1: The Task Force encourages the NSTS Interagency Coordinating Committee to develop a procedure/policy with guidelines on how to handle both Government and non-Government requests for information in the NSTS.

The NSTS will record more than just the transaction reporting required by NRC's rule on source tracking. It will also record information collected from other reporting requirements. It will capture information reported on lost, stolen, or missing Category 1 and 2 sources. The import/export notifications required by NRC's import/export final rule will be recorded in the NSTS. Other information currently being collected or information that will be required in the future could also be recorded in the NSTS with some modifications to the system. The system's design will allow for easy expansion to accommodate future needs as they are identified. Depending on the need, it is possible that rulemaking would be necessary. SGI or classified information could not be stored in the NSTS without significant and costly modifications.

While the NRC intends to record import/export notifications in the NSTS, the actual requirements for the notifications were not finalized before the NSTS development requirements were completed. The current system requirements do not provide for a daily automatic notification to Customs on shipments of Category 1 or 2 sources that will be entering or exiting the United States. An import/export notification report will be one of the system's routine reports and Customs will receive that information, but Customs will not have direct access to the information through the NSTS. The NRC should consider programming the NSTS to provide an automatic daily notification to Customs with information on any shipments of Category 1 or 2 sources that may be entering or exiting the country within the next 24 hours. An automatic notification would eliminate the human-factor aspects and would ensure that Customs officials receive the information in a timely manner. Development of a program and the report format should not require extensive effort, but will require coordination with Customs officials over the report content and who should receive such notifications. If this cannot be conducted under the current contract for development, the NRC should consider it for inclusion in future modifications.

Action 11-2: The NRC should consider programming the NSTS to provide automatic daily information to Customs on import/export shipment notifications.

The Task Force considered whether Category 3 sealed sources should be included in the NSTS. At this time neither the NRC nor DOE plans to track Category 3 sources; however, the agencies have not made a final decision on this issue. Many of the stakeholders commenting on the Task Force activities and on NRC's proposed rule addressed this issue. Because of the interest in this topic, the inclusion of Category 3 sources in the NSTS should be completely analyzed so that an informed final decision can be made. This analysis should address the cost or burden to licensees, the NRC, DOE, and Agreement States, if tracking of Category 3 sources were to be required; the benefit that would be obtained and by whom if the information were collected; the potential for unintended consequences, such as a negative impact on NSTS operation; the potential impact to the NRC and Agreement State General Licensee Tracking Systems; and the potential alternatives to tracking Category 3 sources, such as inventory reporting (inventory reports could be captured in the NSTS). In conducting the analysis, the NRC should engage industry, States, and Federal agencies. This effort would involve considerable resources to implement, but the Task Force believes the effort may be warranted. Various parties continue to raise this issue. GAO suggested that there may be benefit to the inclusion of Category 3 sources in the NSTS (GAO-05-967). The Health Physics Society has recommended inclusion of Category 3 sources if the cost is not prohibitive (January 2006

Position Statement). The NRC's Office of the Inspector General recommended that NRC staff conduct a comprehensive regulatory analysis to assess expanding the materials tracked in NSTS to include Categories 3, 4, and 5 and bulk material (OIG-06-A-10). Category 3 and lower activity sources comprise a major portion of those voluntarily identified as surplus, excess, or unwanted in the commercial sector and that are being collected by OSRP. Additionally, the U.S. metal recycle industry has indicated that Category 3 radioactive sealed sources are those more commonly misplaced or abandoned in industry, resulting in potential contamination of the metal recycling process with operational and financial impacts. The inclusion of Category 3 sources needs to be comprehensively addressed so that the issue can be resolved. In a June 9, 2006, Staff Requirements Memorandum, the Commission directed the staff to conduct a one-time survey of licensees to obtain information on Category 3 sources and to prepare a proposed rule to include Category 3 data in the National Source Tracking System.

Action 11-3: The Task Force suggests that a comprehensive analysis be conducted on the inclusion of Category 3 sources in the NSTS.

The NRC is currently funding the development and implementation of the NSTS. Over the next 10 years, the system will cost NRC more than $29.3 million for development and implementation (2006 dollars with a 3-percent discount). Licensees will bear almost $4 million for the cost of reporting to the system, staff training, and programming. Agreement States will bear another $0.8 million for regulation development and inspection and enforcement activities. As a fee-recoverable agency, the NRC must recover most of its operational costs by imposing fees on the regulated industry. If the full cost of the NSTS were passed on to those NRC licensees directly impacted by NSTS (about 350 licensees), the additional burden could potentially put smaller licensees out of business. The cost of the system needs to be removed from the NRC fee base (i.e., the portion passed on to licensees). The EPAct permanently removes certain Homeland Security activities from the fee base beginning in fiscal year 2007. Development and operation of the NSTS is one of the activities that will be removed from the fee base; however, inspection- and enforcement-related activities will remain in the fee base. Care should be taken to make sure any future enhancements to the system are fully justified by the expected benefit.

11.3 Conclusions

The Task Force considers national source tracking to be part of a comprehensive radioactive source control program for risk-significant radioactive sources. Although a national source tracking system cannot guarantee the physical protection of radioactive sources, it can provide greater source accountability, which should foster increased control by licensees. The NSTS will provide information on tracking and movement of a source over the life cycle of that source. This information will support the Federal family in various activities (e.g., Customs and Border Control access to information on import/exports). A national source tracking system in conjunction with other controls will support improved security and control for radioactive sources. A flexible design will make the NSTS easily expandable to support the evolving needs of the U.S. Government.

11.4 Summary of Recommendations

The Task Force is not making any recommendations in the area of the NSTS at this time.

12 Alternative Technologies

12.1 Background

There are potential alternatives to using Category I and 2 radioactive sealed sources that can reduce the security and health risks associated with the source. The use of alternative technologies can eliminate the use of a risk-significant source entirely, make it less dangerous as an RDD or RED source, or reduce the likelihood of its theft. The Task Force did not consider alternative technologies for aggregation of lower risk sources.

When evaluating a large source application for an alternative technology, the approaches to consider include the following:

- the replacement of the application with a process that uses nonradioactive materials
- the replacement of the radionuclide with a radionuclide of lower risk
- the reduction of the quantity of radioactive material in the source
- the replacement of the chemical/physical form of a given radionuclide with one that is more dispersion resistant
- the development of equipment designs that prevent or decrease the likelihood of radioactive material theft

In general, under the IAEA criteria for radioactive sources, those that pose the greatest security risk are the Category 1 and 2 radioactive sources, which are intended for use mainly in the industrial and medical sectors. Additional properties that determine the security risk of RDDs include energy and type of radiation, half-life of the radioisotope, amount of material, and dispersibility. The sealed sources of most concern are primarily used in industrial and research irradiators, industrial radiography, medical applications, thermal power sources, and measuring devices.

It is important to balance the additional burden imposed by the use of an alternative with the risk of continuation of the current situation. In the medical community where sources and radioactive material are used in the diagnosis or treatment of illnesses, the alternatives may be available but the physical and economic impact as well as the detriment to quality of patient care may outweigh the perceived benefit of having eliminated the use of risk-significant radioactive sources. In addition, healthcare costs could escalate if the alternative technologies are more expensive.

12.2 Sources and Alternative Technologies

12.2.1 Industrial and Research Irradiators

Large industrial and research irradiators are devices containing radioactive materials that pose a high risk to human health if not managed safely and securely. Many industrial irradiators are used for sterilization applications, with sources ranging from tens of thousands to millions of curies. Industrial irradiators employ Co-60 metal or Cs-137 as cesium chloride (CsCl) in an encapsulated powder form. Research and blood irradiators also employ large amounts of Cs-137 or Co-60.

Alternative technologies for replacing irradiators include X-ray-based irradiation units. However, X-ray-based alternatives involve technical and cost considerations. Presently, the only X-ray substitute for a Cs-137 research irradiator is an X-ray system, which limits the type of sample that can be irradiated and requires special filtering that could compromise the sample. Additionally, the dose delivered to the sample is more consistent with Cs-137 sources than the dose delivered by X-ray-based systems. For blood irradiators, a viable X-ray alternative exists, but the cost for the X-ray version is 50 percent greater than for the Cs-137 based irradiator, and disposition of the existing blood irradiator can be expensive.

12.2.2 Industrial Radiography

Industrial radiography sources and devices are small in size compared to large industrial and research irradiators and pose a lower risk to human health if not managed safely and securely. However, more Category 1 and 2 devices are used in industrial radiography than in any other single application, as indicated in the NRC's FY 2005 interim inventory. Industrial radiography sources typically contain Co-60, ranging from 10 to 200 Ci, or Ir-192, ranging from 5 to 200 Ci. Fixed facilities may use machines that are similar to teletherapy units or small portable devices. The majority of industrial radiography is performed using small devices that are susceptible to loss or theft because of their portability. Alternative technologies to industrial radiography include ultrasonic, infrared, and magnetic resonance techniques, as well as X-ray devices. These technologies are commercially available and are manufactured and marketed widely; Table 12.1 summarizes their advantages and limitations.

Table 12.1 Comparison of Industrial Radiography with Alternative Technologies

Radiography (X-ray)	
Uses	Identification of defects due to change in density, inclusions, and variations in material properties. Identification of foreign objects and placement of parts internal to a structure. In-service inspection for degradation (generally changes in thickness).
Major Advantages	Useful for a wide range of materials and thicknesses; versatile; permanent record generated.
Major Limitations	Radiation safety precautions; expensive; orientation of defect is a factor. Radiographs show discontinuities in two dimensions only. Access to both sides of the subject material is required. Subject material thickness can also preclude the use of radiography. Limit of material penetration depends upon the energy of the X-ray generator.
Industries	Power generation; aerospace; petrochemical; medicine/ pharmaceuticals; nonmetals; law enforcement; food; evaluation of art/ historic objects.
Ultrasonic	
Uses	Identification of defects through changes of acoustic impedance—cracks, inclusions, interface problems, lack of bonding. Typical applications include structural weldments, ship hull thickness, corrosion surveys, weld quality, aircraft wing and tail attach fittings, wheel rim and bead seat areas, gears and shafts, forgings, and some castings.
Major Advantages	Effective for thick materials; excellent for crack detection.
Major Limitations	Requires coupling a probe to the material to be tested; orientation of defect is a factor. Proper surface is essential. Geometry of the item being inspected may preclude the use of ultrasonics. Reliability of an ultrasonic inspection depends greatly on the skill and experience of the technician performing the inspection. Temperatures in excess of approximately 1000 °F for thickness readings, and 400 °F for weld scan, in the material to be tested may affect the ultrasonic sound waves, which may affect the inspection results.
Industries	Component fabrication, aerospace, chemical.
Eddy Current	
Uses	Identification of defects though changes in electrical conductivity—cracks, voids, inclusions, and changes in material properties.
Major Advantages	Moderate cost; easily automated.
Major Limitations	Only useful for magnetically conductive materials; limited by thickness of material. Extremely dependent on operator proficiency. Adequate access to the item is required.
Industries	Aerospace, automotive, component fabrication, nuclear steam generators.

Magnetic Particle	
Uses	Identification of surface defects or near surface defects through leakage of magnetic flux—cracks, voids, inclusions, material or geometry changes. Typical applications include large shafts, rods, gears, forging, castings, broaches, machinery ways, landing gear struts.
Major Advantages	Moderate cost.
Major Limitations	Limited to ferromagnetic material; surface preparation required; de-magnetization may be required.
Industries	Petrochemical, construction, aerospace, automotive, defense, nuclear, transportation, marine.
Liquid Penetrant	
Uses	Identification of surface defects through liquid seeping into crack—cracks, porous regions, seams, or folds. Typical applications include weldments, castings, forgings, turbine housings, airplane parts, and many nonferrous metallic materials.
Major Advantages	Inexpensive; easy to use; portable.
Major Limitations	Limited to surface defects; not useful with porous materials or on rough surfaces. Normally performed at a temperature range of 40 °F to 125 °F, unless special procedures and penetrants are used. The surface must be accessible and capable of being satisfactorily cleaned. Easily affected by surface contaminants or conditions.
Industries	Power generation, petrochemical, marine, aerospace, metalworking, welding.

12.2.3 Medical Uses

Although many radionuclides are used in medical diagnosis, radiotherapy, research, and nuclear medicine, only a few uses involve risk-significant sources. In cancer therapy, teletherapy sources can contain 1,350 to 15,000 Ci of Cs-137 or Co-60. In the United States, linear accelerator technology has replaced most teletherapy units. However, internationally, hospitals and treatment centers still use teletherapy units. At least two major exposure incidents have occurred outside the United States as a result of the loss of control of teletherapy systems, where unknowing victims disassembled the devices and exposed the sources.

Gamma-knife stereotactic radiosurgery has revolutionized the treatment of certain types of inoperable brain anomalies, including cancers. These devices use 201 sources of Co-60 in a large, shielded collimator system to focus intense radiation on a tumor or other tissue deep within the skull, while delivering an acceptable dose to the noncancerous parts of the brain. The procedure may involve hundreds to thousands of curies of Co-60. For larger tumors, surgeons have used linear accelerators, but treatment of medium to small tumors and anomalies still requires the accuracy provided by gamma-knives.

In brachytherapy, surgeons use radiation to treat cancers by placing the source of radiation, such as Ir-192 metallic seeds, within a tumor to deliver a dose. High dose rate afterloading systems use an Ir-192 source of approximately 12 Ci in a 3.5-millimeter by 0.5-millimeter seed attached to a delivery cable. The High dose rate unit is self-shielded and highly mobile. These uses typically involve Category 3 and lower sources. Brachytherapy also involves the use of Cs-137 “needles” and Ir-192 “seed ribbons.” These sources are low activity, on the order of millicuries, and would create a nuisance if employed in an RDD but would be unlikely to create a

significant exposure problem. The medical community uses brachytherapy widely for gynecological and prostatic cancers. Alternative technologies include surgery, external beam therapy, chemotherapy, and, for prostate cancer, permanent iodine (I)-125 seed implantation as a substitute for Ir-192 seed ribbons.

12.2.4 Power Sources

Remote power sources also use radioisotope applications. Generally, equipment requiring power generation is located in remote or inaccessible areas that make it difficult to perform routine service and/or replacement operations, and alternative power technologies such as solar power are not sufficiently reliable. Extended-life power sources are needed to make operation of such remote equipment practical. Plutonium-238 and Sr-90 provide thermal power for these purposes. Remote power applications commonly use RTGs that generally contain 30,000 to 300,000 Ci. The U.S. military and NASA use well-protected RTGs mostly for deep space probes. Users in the United States have already replaced many RTGs with alternative technologies such as batteries and solar cells. However, RTGs in foreign countries present potential risks.

12.2.5 Measuring Devices

Some measuring devices use radioisotope sources for determining the presence, quantity, and density of the material between the source and the detector. Industrial gauges use Am-241, Cs-137, Co-60, or Pu-238. The current technology is mature, and EPA and DHS are investigating various alternatives. Each device uses a relatively small amount of radioactive material, typically at IAEA Category 3 levels or below. However, some of these devices are portable and susceptible to loss or theft.

Geological well-logging operations use sources, such as americium-beryllium and Cs-137, to measure subsurface characteristics. Many of these sources are Category 3 sources; however, some are Category 2. Americium-beryllium and Cs-137 in certain forms are security concerns for potential RDD use because of their dispersibility characteristics. A deuterium-tritium linear accelerator provides an alternative source for americium-beryllium in the well-logging industry. However, the user may find this alternative unattractive as it may not be as efficient or able to withstand a hostile subsurface drilling environment.

Table 12.2 summarizes the industrial, medical, and research uses of radioactive sources in the United States.

Table 12.2 Applications and Numbers of Devices Using NRC-Regulated Radioactive Sources*

Application	Radionuclides	Activity Range	No. of Units	Alt. Tech. Exist
Industrial and Research	Co-60 Cs-137 Ir-192	300 Ci–40,000 Ci/ source 27 Ci–213,000 Ci 22 Ci–330 Ci	550 794 1903	Some
Medical	Co-60 Cs-137 Ir-192	10 Ci–13,000 Ci 27 Ci–12,000 Ci 24 Ci	176 417 1	Yes
Power Sources (RTGs)	Sr-90 Pu-238	3,000 Ci–244,000 Ci 85,000 Ci–570,000 Ci	34 0	Yes No
Measuring Devices	Am-241 Am-Be Pu-238	20 Ci–50 Ci 16 Ci–44 Ci 38 Ci–50 Ci	18 296 7	Some

*According to NRC 2005 Interim Inventory data, the NRC regulates these IAEA Category 1 and 2 sources.

12.3 Summary of Current Programs on Alternative Technologies

12.3.1 Department of Energy

Although DOE does not currently have any research and development activities that explicitly focus on alternatives to radioactive sealed sources, various DOE facilities have either performed or supported research that is highly relevant to the development of alternative technologies. For example, the Lawrence Berkeley National Laboratory has perfected methods for building miniature neutron generators that could replace existing neutron sources for some applications; the DOE Office of Science has funded research at the University of Southern California leading to the development of compact electron accelerators that could be used to produce very high-energy X-rays that might someday replace a variety of industrial and medical irradiators. In addition, in response to Section 957 of the EPAct, DOE is conducting a survey of the current inventory of large radioactive sources used for industrial purposes in the United States, providing information on current domestic and international programs to manage and dispose of radioactive sources, and developing a plan for a research and development program to identify promising alternative technologies that can replace radioactive sources and reduce vulnerabilities associated with those sources. A DOE report in response to Section 957 is due to Congress no later than August 1, 2006.

12.3.2 Department of Health and Human Services

Alternative technologies that use radioactive sources in medical devices fall within the regulatory jurisdiction of the Federal Food, Drug and Cosmetics Act. Sections 531 through 542 of this Act give the radiation control provisions (originally enacted as the Radiation Control for Health and Safety Act of 1968). These provisions apply to any “electronic product,” which is defined as any manufactured or assembled product (or component, part, or accessory of such product) which, when in operation, (i) contain or acts as part of an electronic circuit and (ii) emits

(or in the absence of effective shielding or other controls would emit) electronic product radiation.

The FDA Center for Devices and Radiological Health (CDRH) regulates new medical devices to ensure they are safe and effective for their intended use before marketing. CDRH monitors these devices throughout the product life cycle, including postmarketing surveillance, and assures that radiation-emitting products meet radiation safety standards. In addition, CDRH regulates radiation-emitting electronic products (medical and nonmedical) such as lasers, X-ray systems, radiation therapy and diagnostic devices, ultrasound equipment, and microwave ovens. This list of radiation-emitting electronic products includes possible alternatives to the devices that currently use radioactive sources.

New alternative technology source devices used for medical applications are divided into three regulatory classes as Class I, II, or III devices. Most Class I devices are exempt from Premarket Notification 510(k), most Class II devices require premarket notification, and most Class III devices require premarket approval. If the alternative technology medical device or radiation-emitting electronic product requires the submission of a premarket notification in accordance with 21 CFR Part 807, "Establishment Registration and Device Listing for Manufacturers and Initial Importers of Devices," Subpart E, the manufacturer cannot distribute it commercially until FDA provides a letter of substantial equivalence. A 510(k) premarketing submission must demonstrate that the device to be marketed is substantially equivalent to one legally in commercial distribution in the United States (1) before May 28, 1976, or (2) to a device that FDA has determined to be substantially equivalent.

Products requiring premarket approval in accordance with 21 CFR Part 814, "Premarket Approval of Medical Devices," are Class III devices. Class III devices are high-risk devices that pose a significant risk of illness or injury, or devices that are not found to be substantially equivalent to Class I and II predecessors through the 510(k) process. The premarket approval process is more involved than premarket notification and includes the submission of clinical data to support claims made for the device. Premarket approval involves actual FDA approval of the device.

12.3.3 Department of Homeland Security

DHS/DNDO is developing a domestic system to detect and report attempts to import or transport a nuclear device or fissile or radiological material intended for illicit use. DNDO is seeking alternative technologies to replace current radioactive sources in order to reduce the number of alarms received by its detection system. Reducing the volume of alarms from legitimate trafficking of radioactive sources through alternative technology would improve the performance of the detection system by minimizing the impact on commerce. Each radiation detection event requires resolution. While legitimate shipments of radioactive sources are relatively easy to identify, that shipment is delayed, as are other shipments waiting to be screened, while resolving the alarm. Also, a high volume of alarms desensitizes personnel operating the detection equipment. DNDO intends to seek and promote alternative technology building upon efforts already in progress by other Federal agencies.

12.3.4 Department of State

As part of an overall approach to strengthen controls over radioactive sources, DOS has promoted internationally the examination of alternatives to certain risk-significant radioactive sources and materials. The domestic pursuit of alternatives should be considered in the context

of potentially significant consequences extending well beyond U.S. borders. The exploration of alternative technologies by the United States may benefit from coordination with major importing and exporting countries and key international organizations such as IAEA.

The legitimate export of radioactive sources and associated devices provides many benefits and essential services to people in developing nations, and such legitimate transactions should continue. However, it is extremely important to anticipate potential problems associated with the export of used radioactive sources to countries and recipients that may not have the resources or expertise to inspect, calibrate, maintain, control, and manage them. As was seen with the successful substitution of electron accelerators for high-activity gamma-emitting sources for cancer treatment in the United States, introduction of viable and attractive alternatives will displace the use of radioactive sources for some applications. Some used sources may be transferred to new users domestically; many will be stored or sent for disposal, if available. Where new domestic users cannot be found, a strong incentive may exist to sell or donate these sources to recipients in other countries, especially the developing world. This may be particularly true in those cases where disposal options are prohibitively expensive or not available.

The export of sources and devices is a potential consequence of alternative technology adoption that should be avoided. This practice should be discouraged through adequate oversight, awareness on the part of U.S. licensees, coordination with capable partners such as IAEA and the Pan American Health Organization, and voluntary application of ethics and good business practices. To this end, manufacturers of radioactive sources have formed an international nongovernmental organization, the International Source Suppliers and Producers Association, and are currently developing a voluntary code of practice to provide for adequate management of sources throughout their life cycle.

12.3.5 Environmental Protection Agency

EPA has been pursuing alternative technologies since 2001. It is conducting a comprehensive effort towards the successful implementation of alternative nonnuclear technologies for devices used in industrial applications. EPA is committed to reducing the incidence of radioactive sources falling out of regulatory control and entering the public domain. Because EPA does not have regulatory authority over sealed sources commonly used in industrial devices, it has focused on voluntary approaches oriented to finding and securing sources that have fallen out of control, as well as those that would potentially prevent sources from entering into the economy. The Alternative Technology Initiative grew out of the latter.

The goal of the Alternative Technology Initiative is to reduce the number of sealed sources used in industrial devices and applications by substituting nonnuclear alternatives that are technically and economically advantageous during the entire life cycle. EPA has worked closely with all stakeholders to identify issues with and barriers to the ultimate successful implementation of alternatives in certain industrial applications.

The research conducted by EPA reveals the following:

- In general, user stakeholders would welcome alternative technologies for a variety of reasons, including to minimize the requirements associated with licensing, training, worker safety, and source disposition. User stakeholders are nonetheless concerned about capabilities and validation of alternatives by appropriate authoritative bodies.

- Alternatives are specific to particular applications.

- Although radioactive sources with large activities are inherently more hazardous, smaller activity sources used in certain environments and applications are more susceptible to falling out of regulatory control.

- Large gaps in communication exist between the manufacturers and research institutions developing alternatives and the potential users and other stakeholders. The integration of technical activities needs to be coordinated with all stakeholders to identify and overcome barriers to implementation.

EPA has conducted projects for fixed gauging devices, radiography cameras, and portable moisture density gauges to find nonradioactive alternatives. The efforts to date have included market demonstration projects for devices that are currently or near to entering the marketplace, validation studies, and research and development for concepts requiring future development. Future areas of study will include well-logging devices, among other applications.

All projects have emphasized a cooperative effort, using a product stewardship approach between technical manufacturers, researchers, end users, and other stakeholders to identify and overcome barriers for a successful implementation. Since the transition from devices using sealed sources to nonnuclear alternatives is very application specific and requires communications among all stakeholders, EPA has initiated an integrated approach intended to bridge the gaps that are inhibiting acceptance of the alternative devices into the marketplace.

In 2006, EPA convened an expert panel consisting of representatives from Federal and State governments to provide recommendations to strengthen technology, identify barriers to implementation, offer insights into regulations, and identify technologies and applications that future projects should address. The successful acceptance and implementation of the panel's recommendations will require an integrated approach among all involved parties.

EPA has been conducting life-cycle/materials flows analyses of Cs-137 and Co-60 in an effort to evaluate trends in material use and identify technologies where alternatives should be considered, as well as to serve as a metric of success for the alternatives program.

12.3.6 Nuclear Regulatory Commission

The NRC and Agreement States review information provided by manufacturers pertaining to engineering, radiation safety, and conformance with national standards for all radioactive sealed sources and devices containing sealed sources before adding the sources or devices to the Sealed Source and Device Registry. When sources and devices are used for medical purposes, the NRC also relies on FDA to evaluate the safety and effectiveness of the sources and devices. The NRC authorizes the medical use of radioactive sealed sources pursuant to the requirements in 10 CFR Part 35. Neither the NRC nor FDA evaluates whether an alternative nonradioactive technology is available. The NRC and Agreement States only approve safe uses of radioactive material.

The NRC has conducted research studies on approaches for reducing the dispersibility of materials used in radioactive sources. In November 2002, the NRC held an expert panel workshop with representatives from State and Federal agencies, U.S. national laboratories, and a U.S. sealed source manufacturer to discuss methods for reducing the dispersibility of materials used in radioactive sources. The expert panel recommended that research efforts to

reduce the dispersibility of source materials focus on CsCl and Am-Be compounds. Cesium-chloride poses a significant threat if dispersed. It can be difficult to remove from building material and is used in some applications that have lower security environments.

In April 2003, the NRC presented these recommendations at an IAEA technical meeting that convened the sealed source manufacturers, suppliers, and regulators to discuss ways to make radioactive sources less dispersible and less easy to dismantle. Based on the feedback from the meeting participants and the lack of international research being conducted by manufacturers or regulator groups, the NRC proceeded in October 2003 to conduct technical feasibility studies with Argonne National Laboratory and Ames Laboratory on reducing the dispersibility of CsCl and Am-Be materials. The research at Argonne National Laboratory incorporated nonradioactive CsCl in a proprietary cementitious matrix called Ceramicrete. The ensuing product showed improved strength and enhanced fracture resistance; it was also resistant to shattering and fragmentation by impact load. Research with radioactive CsCl was not pursued due to resource limitations.

The researchers at Ames Laboratory used a compound as a surrogate for Am-Be. They used hot pressing and pressureless sintering, with aluminum as an intermediate liquid phase, to fabricate dense, hard, and strong material that resisted shattering or other means of dispersal. This research also successfully demonstrated the application of surface modification techniques, such as nitriding and deposition of ceramic coatings, to surface-harden stainless steel material, which is used for sealed sources capsules.

These feasibility studies successfully demonstrated that existing CsCl and americium-beryllium material used in radioactive sources might in some cases be replaced with an alternative material that is less dispersible. This research concluded in 2005 and at this time the NRC does not have plans for additional research. However, followup research on these materials could prove to be a viable alternative commercially.

12.3.7 National Academy of Sciences Study

Section 651 of the EPAct requires that the NRC enter into an arrangement with NAS under which NAS will study industrial, research, and commercial (including medical) uses of Category 1 and 2 radioactive sources and will identify technically and economically feasible replacements for sources that pose a high risk to public health and safety in an accident or terrorist attack.

NAS will study IAEA Category 1 and 2 radioactive sources but it will not evaluate sources used in national defense or classified research activities. The NRC signed the grant for NAS in January 2006 and expects to submit the results of the study to Congress by August 2007.

12.4 Discussion

As noted above, for a number of applications, alternative technologies exist or are in development that could reduce the risk or impact of an accidental or terrorist use involving a risk-significant radioactive source. In addition, future research in this area could yield even more viable alternative technologies. However, the ultimate success of all such efforts is unclear until a number of critical concerns are addressed. These concerns, discussed below, include incentives for adoption, collaboration between Federal agencies, and disposition of displaced sources.

Incentives

Application of alternative technologies may not be effective unless economic incentives are established to encourage the adoption of those alternatives. Competition in the U.S. marketplace typically encourages, evaluates, and ultimately determines if nonradioactive technology will take the place of radioactive sources or devices. A good example of the marketplace effect is the speed with which drug-coated stents replaced the Ir-192 and Sr-89 high-dose rate remote afterloader devices used to treat coronary artery restenosis. In other examples, electronically produced X-ray sources have replaced I-125 and Am-241 sources in small, hand-held fluoroscopy units and larger scanning bone mineral analyzers, respectively. However, some alternative technologies in the marketplace have not been sufficiently attractive to replace radioactive sources and devices yet. Thus, even if alternatives are viable, adoption of the alternative in the commercial sector will depend on its feasibility as well as its economic attractiveness.

Incentives that are intended to promote the adoption of alternative technologies through marketplace forces may require several years to take hold. A wide range of incentives may be needed and should be established with stakeholder input. Regulatory mandates or economic incentives such as underwriting the disposal cost or providing tax incentives may be required to encourage use of the alternatives.

As one approach, Federal and State agencies could adopt a licensing policy that would require applicants for new uses of radioactive sources to examine alternative technologies. However, the Task Force does not recommend this approach at this time because of potential licensing complications and regulatory impacts, and the lack of sufficient viable alternative technologies for most radioactive source applications. However, this approach may be more appropriate in the future when alternative technologies are further developed and validated for affected industries, and after cost-benefit and regulatory and statutory analyses have been performed. This approach would also need to be evaluated from a legal and policy standpoint. The marketplace should be allowed to react to the alternatives before proposing additional changes.

Outreach

Stakeholder input leading to the acceptance and ultimate implementation of alternative technologies is essential. Manufacturers, researchers, end users, and validating authorities need to participate in addressing the issues forming barriers for acceptance of an alternative for a given application. Those developing and implementing such alternatives need to include technical and economic criteria as top considerations to ensure that the results are practical. Those involved in developing alternatives must partner with end users to develop these criteria. This cooperation should provide research direction, facilitate information sharing, and avoid duplication of effort.

Collaboration

As discussed above, various Federal agencies have initiated a number of independent efforts on alternative technologies. These initiatives could yield additional viable alternatives to existing sources, pending availability of resources. However, to reduce duplication of effort and to benefit from the synergy resulting from an open exchange of research results, collaboration among Federal agencies is needed.

To facilitate collaboration, the Interagency Steering Committee on Radiation Standards (ISCORS) could be requested to form a new subcommittee with representatives from agencies that are conducting activities related to the research and development of alternative technologies. This subcommittee would meet regularly and report to the ISCORS full

committee. This approach is consistent with the ISCORS charter for coordination on radiation issues among Federal agencies. In addition, Federal agencies should continue to participate in the EPA Alternative Technology Initiative.

Cost-Benefit

Concurrent with research and development, Federal agencies should conduct a comprehensive cost-benefit analysis to gauge the attractiveness and potential impacts to the marketplace of alternative technologies. Federal agencies could also use this analysis to evaluate other potential benefits and impacts from replacing radioactive sources and devices that use radioactive sources with nonradioactive alternatives or replacing them with lower risk sources (different chemical/physical form, lower activity, etc.). This information would be made available to radioactive source users, suppliers, and manufacturers as a way to foster the infrastructure needed to support the use of alternative technologies. This activity should take into consideration the recommendations of the ongoing NAS study, which is expected to consider technical and economic feasibility and risks to workers from such replacements.

Displaced Sources

The replacement of existing risk-significant radioactive sources, by either a nonradioactive process or an RDD-resistant radioactive source, will result in an accumulation of unneeded or displaced radioactive sources. Because the objective of developing alternative technologies is to reduce the number of radioactive sources at risk for malevolent use, the accessibility of unneeded sources must be addressed for alternative technologies to be of benefit. In order to reduce the overall security and safety risks associated with radioactive sources, the displaced sources must either be disposed of or stored in a location that is at least as secure as the ones from which they came. Accordingly, in addition to the efforts expended in promoting the development and adoption of alternative technologies, parallel efforts are needed to ensure that storage and disposal options are available for the disposition of risk-significant radioactive sources displaced by the adoption of alternative technologies.

In those cases in which disposal options are prohibitively expensive or not available, strong incentives may be present to sell or donate these sources to recipients in other countries, especially the developing world. Other countries may have an incentive to purchase the sources because of healthcare needs. Export as an alternative disposal path should be discouraged through adequate oversight, awareness on the part of U.S. licensees, coordination with capable partners such as IAEA and the Pan American Health Organization, and voluntary application of ethics and good business practices. Furthermore, the United States and the international community should coordinate to harmonize the development and use of alternative technologies.

Passive Features

Enhanced security features incorporated in new designs could make it harder for a person with malevolent intent to remove a source from a device. In so doing, the added delay would improve the chances of stopping the malevolent act. Enhanced security features incorporated in new designs could provide additional access controls, alarms, and tracking. This would allow only authorized users to remove or operate the device and trigger an alarm upon unauthorized access.

Additional effort is necessary before the Task Force can make an informed decision and make specific recommendations on which alternatives should be pursued, what type of incentives should be made available, etc. Therefore, the Task Force recommends that further study be conducted by the Alternative Technologies Subgroup to evaluate financial incentives, research needs for both alternative technologies and alternative designs, including financial support; and the cost versus the benefit of potential alternatives for Category 1 and 2 radioactive sources. These topics will be addressed in the next Task Force report. The subgroup should report back to the Task Force within 2 years with its report, including possible recommendations, on alternative technology research, incentives, and related issues. The 2-year timeframe will allow the subgroup to consider the findings of the NAS study and the response to the DOE report to Congress in its deliberations. This effort should address the following activities:

- Provide economic incentives. To complement the creation of research and development programs, consideration could be given to creating financial incentives for manufacturers, distributors, and users of alternative technologies. Incentives could include the following:

  — revision of Federal tax law to provide tax credits or other financial incentives to users that purchase products using approved alternative technologies

  — reduction of the cost of alternative technologies by providing fiscal benefits to the manufacturers and distributors of these technologies

  — authorization for Federal agencies to underwrite the cost of retrieval, storage, and disposal of those specific sources that become displaced when an alternative technology is adopted

- Conduct outreach to affected stakeholders. Federal agencies should promote the adoption of alternative technologies by manufacturers, distributors, and users by conducting educational outreach to affected stakeholders, including licensees and other users that would benefit from use of alternative technologies.

- Promote collaboration. Federal agencies should collaborate with each other and the international community on various issues associated with the development and adoption of alternative technologies. Federal and State agencies should coordinate efforts in evaluating, developing, or implementing alternative technologies.

- Fund research and development efforts. The subgroup should provide suggestions for the level of funding likely to be needed for particular projects related to research and development on alternative technologies for risk-significant radionuclides (IAEA Category 1 and 2 sources), taking into account a realistic envelope for such efforts.

- Conduct cost-benefit analyses. The report should evaluate alternative technologies based on the NAS cost-benefit analysis and also conduct an independent cost-benefit analysis.

- Evaluate storage and disposal options for sources that are replaced or displaced by alternative technologies. Identify safe and secure storage options or permanent disposal of those sources that are displaced because of alternative technologies.

Recommendation 12-1	The Task Force recommends that the Alternatives Technology Subgroup evaluate financial incentives; research needs for both alternative technologies and alternative designs, including financial support; and the cost-benefit of potential alternatives for Category 1 and 2 radioactive sources.

A specific concern is the widespread use of CsCl in a highly dispersible form in certain devices. An accidental release of CsCl in Goiania, Brazil, in 1987 demonstrated that an inadvertent dispersal of one CsCl source can result in significant economic and social impacts. Following the accident, the Goiania region suffered economic and social isolation from the rest of Brazil; 125,000 people were screened for contamination; and more than 120,000 cubic feet of radioactive waste was generated. While alternative technologies exist for certain risk-significant CsCl applications, such as industrial and medical irradiators, not all applications have a readily available alternative at this time.

The Task Force recommends giving high priority to conducting a study within 2 years to assess the feasibility of phasing out the use of CsCl in highly dispersible forms. This study should consider the availability of alternative technologies for the scope of current uses, safe and secure disposal of existing material, and international safety and security implications. The 2-year timeframe would allow the Federal Government to consider the findings of the NAS study in the evaluation. Any phaseout should encourage similar efforts worldwide; coordination and collaboration with international partners will be necessary to most effectively implement a phaseout domestically. A phaseout strategy should take into account the status of disposal options for radioactive sources that may become disused as a result of such a phaseout; the economic feasibility of using alternative radionuclides, physical-chemical forms, or different technologies; the use of incentives or other compensation to current users; and measures to make sure that the displaced sources do not find their way into environments with less rigorous controls in place. Entities having major economic interests in the production, processing, and sale of CsCl must participate in discussions on the phaseout of CsCl in highly dispersible forms.

In order to make near term progress on this issue, a Subgroup of the Task Force with specific interests in this issue will be formed immediately to identify near term actions. This Subgroup will determine the attractiveness of these sources to be used in an illicit manner. It may be possible to identify readily available technology to replace some application of these sources. If such an application is identified, additional work will be needed to ensure disposal capacity for the existing sources and evaluation of the impacts on the affected industry such as the health care and research community. Also, security issues for sources that may become available on the international market must be addressed. This Subgroup will consider information presented in public meetings for the National Academies of Science Study mentioned in the Energy Policy Act of 2005.

Recommendation 12-2	The Task Force recommends that high priority be given to conducting a study within 2 years to assess the feasibility of phasing out the use of CsCl in a highly dispersible form. This study should consider the availability of alternative technologies for the scope of current uses, safe and secure disposal of existing material, and international safety and security implications.

12.5 Conclusions

For a number of applications, alternative technologies exist or are in development that could potentially reduce the risk or impact of an accidental or terrorist use of a risk-significant source. However, additional evaluation is necessary before the Task Force can make specific recommendations for incentives or for further research. The Task Force will await the results of the NAS study and the response to the DOE report to Congress before making any specific recommendations. The next Task Force report will address incentives and possible research needs.

12.6 Summary of Recommendations

The Task Force is making two recommendations, discussed above and summarized below, in the area of alternative technologies.

Recommendation 12-1	The Task Force recommends that the Alternatives Technology Subgroup evaluate financial incentives; research needs for both alternative technologies and alternative designs, including financial support; and the cost-benefit of potential alternatives for Category 1 and 2 radioactive sources.
Recommendation 12-2	The Task Force recommends that high priority be given to conducting a study within 2 years to assess the feasibility of phasing out the use of CsCl in a highly dispersible form. This study should consider the availability of alternative technologies for the scope of current uses, safe and secure disposal of existing material, and international safety and security implications.

13 Conclusions, Recommendations, and Actions

13.1 Conclusions

The U.S. Government has been instrumental in working to develop international guidance for the safety and security of risk-significant radioactive sources. This effort resulted in a major revision of the IAEA Code of Conduct and the development of the IAEA import/export Guidance, approved by the IAEA Board of Governors in September 2003 and 2004, respectively. The U.S. Government has made a nonlegally binding political commitment to work toward following the guidance in the Code and the import/export Guidance.

The United States is actively working to encourage other countries to follow the Code and the Guidance, and has succeeded in obtaining political commitments from 83 countries and by Leaders of the G-8 (2003 Evian Summit, 2004 Sea Island Summit, and 2005 Gleneagles Summit), EU (2004 U.S.-EU Shannon Summit), Asia-Pacific Economic Cooperation (2005 APEC Leaders Statement), Organization for Security and Cooperation in Europe (2005 OSCE Plenary Meeting), and the three North American leaders in the Security and Prosperity Partnership. Such attention by world leaders reinforces the value of the Code and Guidance as international standards.

Within the United States, the Code of Conduct categorization is utilized as the basis for the following:

- the national tracking of risk-significant radioactive sources
- national export controls for risk-significant radioactive sources
- NRC security orders issued to risk-significant radioactive source licensees
- national strategy for orphan source recovery

The Task Force found no significant gaps that are not already being addressed. However, the Task Force believes that the efforts underway in the international transport security area should be given a higher priority. The Task Force believes that the combination of direct regulations concerning source security and control, personnel protection regulations, guidance, orders, and inspection and enforcement provides reasonable assurance that the Category 1 and 2 sources in use and storage at NRC and Agreement State licensed facilities and at DOE facilities are safe and secure. The NRC and Agreement States will be conducting inspections of their licenses to verify compliance with the requirements. The additional near-term actions planned or underway (i.e., fingerprinting, verification of licenses, etc.) will further strengthen the regulatory controls. In addition, the Task Force has made several recommendations that will enhance the overall security of risk-significant radioactive materials.

The Task Force found the review of programs and activities to be beneficial, providing a convenient means of sharing information that may not have been widely distributed. It provided an opportunity for members to better understand the activities being conducted by other agencies. It is important that this spirit of cooperation and coordination continue into the future. The Task Force has made a recommendation to continue the coordination of activities between interested stakeholders. To assist in this coordination effort, the Task Force plans to meet periodically to discuss topics of interest, receive updates on activities being conducted by the other agencies, and obtain status reports on the implementation of the recommendations and the actions listed in this report.

13.2 Summary of Recommendations and Actions

Tables 13.1 and 13.2 present the Task Force recommendations. The Task Force has made no effort to prioritize these actions. Instead, the tables divide the recommendations by type of action necessary to implement the recommendation—regulatory changes and other. Table 13.1 lists those recommendations that would require a policy, rule, or procedure change or development in order to implement. Table 13.2 includes recommendations that involve additional evaluation or study before a final recommendation can be made, as well as miscellaneous actions. At this time, the Task Force is not recommending any legislative changes that would require Congressional action to implement.

Table 13.1 Regulatory Change Recommendations

Recommendation 5-1	The Task Force recommends development of a Transport Security Memorandum of Understanding to serve as the foundation for cooperation in the establishment of a comprehensive and consistent transport security program for risk-significant sources.
Recommendation 5-3	The Task Force recommends that the U.S. Government immediately develop a strategy and take actions to address the security of international shipments of Category 1 and 2 radioactive sources that transit or are transshipped through the land territory of the United States.
Recommendation 9-2	The Task Force recommends that the NRC evaluate the financial assurance required for possession of Category 1 and 2 radioactive sources to assure that funding is available for final disposition of the sources.

Table 13.2 Other Recommendations

Recommendation 3-1	The Task Force recommends that the U.S. Government periodically reevaluate the list of radioactive sources that warrant enhanced security and protection to assess their adequacy in light of the evolving threat environment.
Recommendation 4-1	The Task Force recommends that there be a coordinated public education campaign (Federal, State, and industry) to reduce fears of radioactivity, diminish the impact of a radiological attack if one were to occur, and provide a deterrent to attackers considering the use of radiological materials.
Recommendation 4-2	The Task Force recommends that the Federal agencies and States continue efforts to improve coordination and communication of their ongoing activities in the area of radiation protection and security for Category 1 and 2 sources.
Recommendation 5-2	The Task Force recommends that the U.S. Government evaluate the feasibility of using new and existing technologies to detect and discourage the theft of risk-significant radioactive material during transport. The

	evaluation should include the findings of operational testing of existing technologies offering enhanced security of motor carrier shipments of hazardous material; shipment tracking, including communication systems; radiofrequency identification; vehicle disabling technologies; and mobile and stationary radiation detection systems.
Recommendation 9-1	The Task Force recommends that the U.S. Government further evaluate the waste disposal options as outlined in the GAO reports on LLRW.
Recommendation 12-1	The Task Force recommends that the Alternatives Technology Subgroup evaluate financial incentives; research needs for both alternative technologies and alternative designs, including financial support; and the cost-benefit of potential alternatives for Category 1 and 2 radioactive sources.
Recommendation 12-2	The Task Force recommends that high priority be given to conducting a study within 2 years to assess the feasibility of phasing out the use of CsCl in a highly dispersible form. This study should consider the availability of alternative technologies for the scope of current uses, safe and secure disposal of existing material, and international safety and security implications.

Various agencies also have a number of actions that are underway or planned in the near term. In addition, adequate information was not yet available to make a final conclusion or recommendation regarding certain areas. While it is important to complete these items, they do not rise to the level of a recommendation. The issues are already being addressed and should be completed and implemented before further changes are introduced. The agencies conducting the actions are encouraged to expeditiously complete them. Table 13.3 summarizes these actions.

Table 13.3 Actions

Action 3-1	The NRC should evaluate the need to reissue the Orders to the Manufacturing and Distribution Licensees to make sure no security issues have been introduced from the use of different units of radioactivity.
Action 3-2	The DOT should examine the use of the Code of Conduct Category 1 and 2 thresholds in domestic transportation regulations.
Action 4-1	The NRC should consider imposing additional measures to verify the validity of licenses, before transfer of risk-significant radioactive sources, on all licensees authorized to possess Category 1 and 2 quantities of radioactive material.
Action 5-1	The Transportation Security Subgroup should review the findings and conclusions of all research conducted on securing “high hazard” hazardous materials transport to determine if any of the measures should be applied to transport of risk-significant radioactive sources.
Action 5-2	DOT should evaluate the best practices from the high threat urban area corridor assessments to determine whether it should

	incorporate any of the best practices into the requirements for security plans for high-risk radioactive material. DOT should also evaluate whether transport of lower risk radioactive material warrants a security plan or whether the transport could be exempted from some of the requirements.
Action 6-1	The NRC should expeditiously complete its implementation of the fingerprinting provisions of the EPAct for those applicants for and licensees with Category 1 and 2 quantities of radioactive material. The NRC should place a high priority on completing the EPAct Section 652 rulemaking. As part of the rulemaking, the NRC should require fingerprinting for any individual who could have access to Category 2 or above quantities of radioactive materials. The NRC should also require periodic reinvestigations of such persons.
Action 6-2	The NRC should evaluate the feasibility of establishing a national database for materials licensees that would contain information on pending applications and information on individuals cleared for unescorted access.
Action 6-3	The NRC and DHS should enter into a memorandum of understanding to cover access to the SAVE database for materials licensees.
Action 7-1	The NRC should evaluate requiring licensees to review and document the reasons for storage of risk-significant sources longer than 24 months and the feasibility of establishing a maximum time limit on the long-term storage of risk-significant sources not in use.
Action 9-1	The DOE should continue its ongoing efforts to develop GTCC disposal capability.
Action 10-1	The U.S. Government should continue the efforts to promote international harmonization of import and export controls for Category 1 and 2 radioactive sources.
Action 10-2	The U.S. Government should encourage suppliers to provide arrangements for the return of disused sources and examine means to reduce regulatory impediments that currently make this option unavailable.
Action 10-3	The Task Force suggests the use of education and creation of incentives to discourage the export of used Category 1 and 2 radioactive sources as an alternative to disposal.
Action 10-4	The U.S. Government should improve interagency evaluation of recipient authorization and recipient country controls to prevent fraudulent acquisition of risk-significant sources exported from the United States.
Action 10-5	The NRC should consider reevaluating the need for a specific import license to allow the import of Category 1 and 2 radioactive sources to a U.S.-licensed user.
Action 11-1	The Task Force encourages the NSTS Interagency Coordinating Committee to develop a procedure/policy with guidelines on how to handle both Government and non-Government requests for information in the NSTS.
Action 11-2	The NRC should consider programming the NSTS to provide automatic daily information to Customs on import/export shipment notifications.

Action 11-3	The Task Force suggests that a comprehensive analysis be conducted on the inclusion of Category 3 sources in the NSTS.

Each agency on the Task Force will prepare an action (implementation) plan, as appropriate, addressing the recommendations and actions contained in this report that are within the purview of that agency, and present that plan to the Task Force for inclusion in an overall implementation plan. Action plans should include development of timelines for completion and address resources for implementation.

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Appendix A

Acronyms and Abbreviations

Ac	actinium
AEA	Atomic Energy Act of 1954, as amended
Am	Americium
APEC	Asia-Pacific Economic Cooperation
ASM	additional security measure
Au	gold
Be	beryllium
Bq	Becquerel
Cd	cadmium
CDRH	Center for Devices and Radiological Health
Cf	californium
CFR	*Code of Federal Regulations*
Ci	curies
CIA	Central Intelligence Agency
CJIS	Criminal Justice Information Services
Cm	curium
Co	cobalt
CRCPD	Conference of Radiation Control Program Directors
Cs	cesium
CsCl	cesium chloride
DBT	design-basis threat
DHS	Department of Homeland Security
DNDO	Domestic Nuclear Detection Office
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
DOJ	Department of Justice
DOS	Department of State
DOT	Department of Transportation
EIS	environmental impact statement
EPA	Environmental Protection Agency
EPAct	Energy Policy Act of 2005
ERDA	Energy Research and Development Administration
EU	European Union
FAA	Federal Aviation Administration
FBI	Federal Bureau of Investigation
FDA	Food and Drug Administration
Fe	iron
FEMA	Federal Emergency Management Agency
FMCSA	Federal Motor Carrier Safety Administration
FR	*Federal Register*
FRA	Federal Railroad Administration
GAO	Government Accountability Office

GCC	Government Coordinating Council
Ge	germanium
Gd	gadolinium
GTCC	greater than Class C
HHS	Health and Human Services
HRCQ	highway route control quantities
HSPD	Homeland Security Presidential Directive
I	iodine
IAEA	International Atomic Energy Agency
IC	increased control
ICC	NSTS Interagency Coordinating Committee
IMI	Impact Measurement Index
Ir	iridium
IRTR	International Radiological Threat Reduction Program
ISCORS	Interagency Steering Committee on Radiation Standards
LANL	Los Alamos National Laboratory
LLEA	local law enforcement agency
LLRW	low-level radioactive waste
LLRWPAA	Low-Level Radioactive Waste Policy Amendments Act of 1985
mCi	millicurie
MOU	memorandum of understanding
MSWG	Materials Security Working Group
NARM	naturally occurring or accelerator-produced radioactive material
NAS	National Academy of Sciences
NASA	National Aeronautics and Space Administration
nCi	nanocuries
Ni	nickel
NIPP	National Infrastructure Protection Plan
NNSA	National Nuclear Security Administration
NRC	Nuclear Regulatory Commission
NSTS	National Source Tracking System
OAS	Organization of Agreement States
ODNI	Office of the Director of National Intelligence
OSCE	Organization for Security and Cooperation in Europe
OSHA	Occupational Safety and Health Administration
OSRP	Off-Site Source Recovery Project
OSTP	Office of Science and Technology
Pd	palladium
PHMSA	Pipeline and Hazardous Materials Safety Administration
Pm	promethium
Po	polonium
Pu	plutonium
Pub. L	Public Law
Ra	radium
RAMQC	radioactive material in quantities of concern
RDD	radiological dispersal device

RED	radiological exposure device
Rh	rhodium
RTG	radioactive thermal generator
RTR	radiological threat reduction
Ru	ruthenium
SA	security assessment
SAVE	Systematic Alien Verification for Entitlements
SCR	security contact review
Se	selenium
SGI	safeguards information
Sr	strontium
TBq	terrabecquerel
Th	thorium
Ti	thallium
Tm	thulium
TRU	transuranic
TSA	Transportation Security Administration
UN	United Nations
U.S.	United States
U.S.C.	United States Code
USCG	United States Coast Guard
W	tungsten
WESF	Waste Encapsulation and Storage Facility
WIPP	Waste Isolation Pilot Plant
WMD	weapons of mass destruction
Y	yttrium
Yb	ytterbium

Appendix B

Glossary

A_1
A_1 means the maximum activity of special form radioactive material permitted in a Type A package for transportation.

A_2
A_2 means the maximum activity of radioactive material, other than special form material, low specific activity, and surface contaminated object material, permitted in a Type A package for transportation.

Agreement State
An Agreement State is a State that has signed an agreement with the Nuclear Regulatory Commission under which the State regulates the use of byproduct, source, and small quantities of special nuclear material within that State. There are 34 Agreement States.

Deterministic Effect
A deterministic effect is a health effect of radiation for which a threshold level of dose generally exists above which the severity of the effect is greater for a higher dose. Such an effect is described as a "severe deterministic effect" if it is fatal or life threatening or results in a permanent injury that decreases the quality of life.

Disposal
Disposal is the emplacement of radioactive sources in an appropriate facility without the intention of retrieval.

Disused Source
A disused source is a radioactive source that is no longer used, and is not intended to be used, for the practice for which an authorization has been granted.

General License
A general license grants authority to a person for certain activities involving byproduct material, without filing an application for a specific license. The general license allows the person to receive and use the device. The particular general license may require registration with the NRC.

Greater-Than-Class-C Radioactive Waste
Greater-than-Class-C (GTCC) radioactive waste is defined in the Low-Level Waste Policy Amendments Act of 1985 as low-level waste that exceeds the Class C limits in Title 10, Section 61.55, "Licensing Requirements for Land Disposal of Radioactive Waste," of the *Code of Federal Regulations* (10 CFR 61.55). This section classifies low-level waste as Classes A, B, or C, according to concentration of specific short- and long-lived radionuclides; this section also sets varying requirements on waste forms for disposal. GTCC waste is generally unacceptable for near-surface disposal.

Highway Route Control Quantity
A highway route control quantity means a quantity of radioactive material within a single package which exceeds (1) 3,000 times the A_1 value of the radionuclides as specified in 49 CFR 173.435, "Table of A_1 and A_2 Values for Radionuclides," for special form radioactive material, (2) 3,000 times the A_2 value of the radionuclides as specified in 49 CFR 173.435 for normal form radioactive material, or (3) 1,000 terrabecquerels (27,000 curies), whichever is least.

Inimicality
Non-inimicality to the common defense and security of the United States of an export or import of radioactive material from or into the United States is a principal criterion for the Nuclear Regulatory Commission to determine whether to approve the export or import. "Inimical to" means adverse, detrimental, or unfavorable to.

License
The NRC issues licenses under the regulations of 10 CFR Parts 30 through 36, 39, 40, 50, 60, 61, 63, 70, 72, or 76 or an Agreement State issues a license under its equivalent regulations. The NRC and Agreement States issue about 21,000 specific licenses for medical, academic, and industrial uses of nuclear materials. Reactor-produced radionuclides are used extensively throughout the United States for civilian and military industrial applications, basic and applied research, the manufacture of consumer products, civil defense activities, academic studies, and medical diagnostics, treatment and research. The regulatory programs of the NRC and Agreement States are designed to ensure that licensees safely use these materials and do not endanger public health and safety nor cause damage to the environment.

Long-Term Storage
Long-term storage refers to storage with little or no limits on its duration. This type of disposition mechanism can be used while arrangements are made for final disposition, because of (1) a lack of a final disposal option, (2) a lack of available funds, (3) a need for time to complete an amended or new authorization, (4) a need for time to establish a new disposition pathway, or (5) pending the availability of transportation to a new disposition location. Long-term storage can be an effective mechanism to alleviate a health and safety or security risk posed by a source. However, long-term storage may not permanently alleviate the risk associated with the source.

Orphan Source
An orphan source is a radioactive source that is not under regulatory control, either because it has never been under regulatory control, or because it has been abandoned, lost, misplaced, stolen, or transferred without proper authorization.

Radioactive Source
A radioactive source is radioactive material that is permanently sealed in a capsule or closely bonded, in a solid form, and which is not exempt from regulatory control. It does not mean material encapsulated for disposal, or nuclear material within the nuclear fuel cycles of research and power reactors.

Radiological Exposure Device
A radiological exposure device (RED) is a device whose purpose is to expose people to radiation, rather than to disperse radioactive material into the air, as would a radiological dispersal device (RDD). A person could construct an RED from unshielded or partially shielded radioactive materials in any form placed in any type of container.

Radiological Dispersal Device
An RDD is a device or mechanism that is intended to spread radioactive material from the detonation of conventional explosives or other means.

Risk-Significant Source
Risk-significant source refers to Category 1 and 2 sources from the International Atomic Energy Agency (IAEA) Code of Conduct.

Risk-Significant Quantity
Risk-significant quantity refers to radioactive material that aggregated together meets or exceeds the Category 1 or 2 thresholds from the IAEA Code of Conduct.

Safeguards Information
Safeguards Information means information not otherwise classified as National Security Information or Restricted Data which specifically identifies a licensee's or applicant's detailed, (1) security measures for the physical protection of special nuclear material, or (2) security measures for the physical protection and location of certain plan equipment vital to the safety of production or utilization facilities.

Special Nuclear Material
Special nuclear material means plutonium, uranium-233, and uranium enriched in the isotope uranium-233 or in the isotope uranium-235.

Spent Nuclear Fuel
Spent nuclear fuel means fuel that has been withdrawn from a nuclear reactor following irradiation. It includes the special nuclear material, byproduct material, source material, and other radioactive materials associated with fuel assemblies.

Storage
Storage refers to the holding of radioactive sources in a facility that provides for their containment with the intention of retrieval.

Appendix C

Task Force Charter

TASK FORCE
ON RADIATION SOURCE PROTECTION
AND SECURITY
CHARTER

Background

The Energy Policy Act of 2005 required establishment of an inter-agency task force on radiation source protection and security. The Task Force is being established to evaluate and provide recommendations to the President and Congress relating to the security of radiation sources in the United States from potential terrorist threats, including acts of sabotage, theft, or use of a radiation source in a radiological dispersal device.

The Energy Policy Act of 2005 defines a radiation source as a Category 1 Source or a Category 2 Source as defined in the Code of Conduct[1] and any other material that poses a threat such that the material is subject to Section 170H of the Atomic Energy Act, as determined by the Commission, by regulation, other than spent nuclear fuel and special nuclear materials.

Purpose and Scope

The Task Force shall evaluate and provide recommendations relating to the security of radiation sources in the United States from potential terrorist and criminal threats, including acts of sabotage, theft, or use of a radiation source in a radiological dispersal device.

Specifically, the Task Force will evaluate and make recommendations on the following:

- The list of sources requiring security based on potential attractiveness of the source to terrorists and criminals and the extent of the threat to public health and safety
- The national system for recovery of lost or stolen sources
- Storage of radiation sources that are not used in a safe and secure manner
- The national source tracking system
- A national system (including user fees and other methods) to provide for the proper disposal of sources
- Import and export controls on sources to ensure that foreign and U.S. recipients of sources are able and willing to adequately control sources

1 "Code of Conduct on the Safety and Security of Radioactive Sources," approved by the Board of Governors of the International Atomic Energy Agency and dated September 8, 2003.

- Alternative technologies available that may perform some or all of the functions performed by devices or processes that employ radiation sources

- Appropriate regulations and incentives for the replacement of the devices and processes with alternative technologies or with sources that would pose a lower risk to public health and safety in the event of an accident or attack involving the radiation source

- Procedures for improving the security of use, transportation and storage of sources, including the inspection program; security measures; fines, background checks for individuals with access to radiation sources; exchange of information on background checks; physical security of facilities that contain radiation sources; and the screening of shipments to facilities to ensure that the shipments do not contain explosives

The Task Force may decide to include other pertinent topics in its evaluation.

During the evaluation of the programs, the Task Force shall consult with Federal, State, and local agencies; the Conference of Radiation Control Program Directors; and the Organization of Agreement States. The Task Force shall notice and provide an opportunity for public comment on its activities.

Membership

The Task Force consists of representatives of NRC, Department of Homeland Security (DHS), Department of Defense (DOD), Department of Energy (DOE), Department of Transportation (DOT), Department of Justice (DOJ), Department of State (DOS), Director of National Intelligence (DNI), Central Intelligence Agency (CIA), Federal Emergency Management Agency (FEMA), Federal Bureau of Investigation (FBI), Environmental Protection Agency (EPA), Health and Human Services/Food and Drug Administration (HHS/FDA), and Office of Science and Technology Policy (OSTP). The Committee will be chaired by NRC.

Products

The Task Force is chartered to produce the following:

- An initial report, in unclassified form with a classified annex if necessary, providing recommendations, including recommendations for appropriate regulatory and legislative changes related to the protection and security of radiation sources. The report is to be submitted to Congress and the President.

- Subsequent reports, in unclassified form with a classified annex if necessary, providing recommendations, including recommendations for appropriate regulatory and legislative changes related to the protection and security of radiation sources. The reports are to be submitted to Congress and the President.

Report Content

The first report will document what is currently being done (or planned in the near term), and where appropriate provide rationale for acceptability of the program element in each of the areas discussed above. The report will also identify inconsistencies and apparent weaknesses in these areas. Where possible, the report will identify and recommend specific actions to remediate them. For the second report, the Task Force will conduct a gap analysis and focus on areas and issues where there may not be actions underway or programs in place. The report will include an update on each of the areas discussed in the first Task Force report. Possible topics include emergency response from a local to national perspective.

Concept of Operations

The Task Force may form Subgroups to evaluate specific topics. In evaluating topics, the Subgroup should endeavor to develop consensus findings and recommendations. Consensus does not mean that everyone agrees on every detail, but rather that they have a shared understanding of the issue and a basic level of widespread acceptability of the outcomes. Subgroup members should be allowed an opportunity to express their opinions. The Subgroup should look for alternatives that are acceptable to all participants. In achieving consensus, there should be no major objections or strong concerns related to the finding or recommendation. If the Subgroup cannot achieve consensus, the issue needing resolution should be brought to the attention of the full Task Force. The Subgroup should state the issue as concisely as possible, including possible alternatives for the consideration of the full Task Force. If after consideration the full Task Force cannot reach consensus on the topic, the Task Force may consider the inclusion of a minority view in the Task Force report.

Schedule

The first report is to be submitted to Congress and the President no later than August 8, 2006. Subsequent reports to the Congress and the President are to be submitted not less than once every 4 years. The second report is to be submitted no later than August 8, 2010. Milestones for individual products will be developed on a case-by-case basis.

Level of Effort

Initially, the Task Force and Subgroup meetings are expected to occur on a schedule needed to support development of the recommendations for source protection and security and delivery of the report to Congress and the President no later than August 8, 2006. Member agencies will provide necessary resources to support the Subgroups. Member agencies will provide input to the initial report, comment on the report, and concur on the report consistent with the agreed upon schedule. After the initial report is issued, the Task Force meetings will be convened on a schedule necessary to support delivery of the updated report every 4 years as required by the Act.

Appendix D

Task Force Membership

Task Force Members

Commissioner Jeffrey S. Merrifield, NRC - Task Force Chair acting for NRC Chairman Dale E. Klein

Jack Strosnider, NRC
Joe Rivers, DOE
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Subgroup Members

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Appendix E

Public Comment

The comments received on the Federal Register notice and at the stakeholder meeting are summarized in bullet form by chapter topic below. Under each topic the comments are broken into categories. A brief response is provided at the end of each category.

General

Communication and Collaboration With Other Groups

- The Task Force should collaborate with the Government Coordinating Council (GCC) as part of the effort to establish the Nuclear Sector Infrastructure Protection Plan to ensure that their approaches to enhance security do not conflict and to have access to the same input from the radioisotopes subcouncil of the Nuclear Sector Coordinating Council regarding the assessment of risk from radiation sources in their numerous applications.

- Duplication of effort between agencies and the GCC needs to be avoided.

- Better communication is needed across the board - within States and agencies; among States; among Federal agencies; and between Federal agencies and State and local organizations.

Task Force Response: The Task Force recognizes that improved coordination and communication among those involved in security and control of radioactive material would facilitate activities. The Task Force made a recommendation along those lines.

Chapter 3 - Radiation Sources

Use of International Atomic Energy Agency (IAEA) Code of Conduct As Basis

- Be consistent in the approach to categorization for applicability of source protection and security measures with the IAEA Code of Conduct thresholds for specific radionuclides and activities. Support the IAEA Code of Conduct and its categorization as the basis for establishing thresholds.

- IAEA Code of Conduct is an internationally recognized standard based on the assessment of international experts. The Task Force should not go beyond the Code and should accept and be consistent with the Code.

- There has already been a significant amount of technical assessment as the basis of IAEA standards and regulations, including those of the NRC, that concludes that the scope of applicability for enhanced security measures should be Category 1 and Category 2 sources. The Task Force needs to take the same approach to ensure that the appropriate effort and resources are allocated on a priority basis to these higher risk materials and to be consistent with the established standards and regulations.

- The commitment by the United States (U.S.) to adopt and implement the IAEA Code of Conduct is a step in the right direction. Concern that other Member States are slow adopting and implementing the Code.

- A risk-based approach is needed for the development of a list of isotopes and thresholds used as the basis for security requirements for radioactive materials (other than sources). Extension of the Code of Conduct standard for control of sources to other radioactive material does not give adequate consideration to the different security risks, and potential malevolent uses, posed by sources versus other forms of radioactive material. This approach has created undue expenditure of public and private resources in the application of additional controls to radioactive materials that do not necessarily pose a significant threat.

- The Task Force needs to review the inconsistency between NRC regulations and the IAEA Code of Conduct and determine the significance. The Task Force will then be able to determine if changes in the regulations are appropriate. The Code of Conduct was focused on sealed sources while NRC regulations have not restricted the regulations in the same manner.

- The Task Force should review the regulations imposed by NRC to determine if they are consistent with the Code of Conduct. The Task Force must consider what is being done in other major countries of the world. Regulations designed to protect the American public should not be so restrictive that they isolate the U.S. from the rest of the world. The U.S. imports as well as exports radioactive materials. While it is important to protect the citizens of the U.S., it should not deprive them of the benefits of radioactive materials in the name of security.

Task Force Response: The U.S. has made a political commitment to work toward following the guidance contained in the IAEA Code of Conduct. The Code of Conduct serves as an appropriate basis for determining which sources may warrant additional protection. The Code of Conduct considers that each country should "define its domestic threat, and assess its vulnerability with respect to this threat for the variety of sources used within its territory, based on the potential for loss of control and malicious acts involving one or more radioactive source." The U.S. programs adhere to this philosophy; however, the U.S. cannot dictate how fast other Member States are adopting and implementing the Code of Conduct. The U.S. does not wish to deprive U.S. citizens from the many benefits of radioactive materials. The regulations and programs of the Federal agencies are only meant to enhance security for radioactive sources that may be attractive to terrorists.

Basis

- Regarding security of radiation sources in transport, the Task Force needs to take into consideration the "Security of Radioactive Material during Transport: Specific Guidelines" being developed by the IAEA to ensure consistency with this document.

- The public health and safety considerations for an RDD constructed from well logging sources have been greatly exaggerated.

- Result of deployment of a dirty bomb is only a nuisance requiring some clean-up afterward with little potential for the infliction of injury other than from the blast. Levels of radiation from the dispersal most likely would be minimal, and the prime factor would be the terror instilled in a public uneducated in the realities of ionizing radiation.

- The safety and security of nuclear density gauges need to be increased from its current standing and stricter penalties need to be in place for those found guilty for the theft of one.

- Co-60 sources used in commercial irradiators are not attractive to terrorists because of the nondispersible nature. Inherently high radiation levels make handling virtually impossible, design and operation of irradiators make it extremely difficult for a terrorist to gain access to the Co-60, and operations and regulation make it very difficult for a person or persons with the intent to do harm to be undetected.

Task Force Response: The U.S. Government has made a political commitment to the Code of Conduct. The Code serves as the basis for many of the security programs being implemented. The U.S. Government is working with the international community to develop transportation security guidelines. The Task Force is focusing on Category 1 and 2 sources, nuclear density gauges are below Category 2 and are not being addressed by the Task Force at this time.

Expansion of List

- Do not include Category 3 sources.

- Category 3 should be considered within the scope of infrastructure protection, if warranted, by voluntary measures that may already be in effect or by site-specific license conditions supplemented by existing regulations.

- If other radionuclides or thresholds are determined to be appropriate, the U.S. should take action to recommend those changes to the IAEA Code of Conduct. The security of other materials, such as non-source material and those in Category 3, could be regulated, if warranted, by site-specific license conditions and by existing regulations such as those for sites (10 CFR Part 20, Subpart I), and in transport (49 CFR Part 172). Other materials such as nonsource material and those in Category 3 should be considered within the scope of infrastructure protection, if warranted, by voluntary measures.

- Urge caution in any consideration of including Category 3 in the scope of quantities of concern to ensure that the time-sensitive supply chain of medical radionuclides is not adversely affected. The negative impact on the quality and timeliness of patient care would likely outweigh the benefit of enhanced security measures.

- Opposed to imposing additional controls on radioactive tracer material (I-131 most common). Existing regulations for short half-lived materials are adequate.

- Mo-99 should not be subject to the enhanced security measures required for

Categories 1 and 2. Other medical radioisotope products such as radioiodine therapy products and low activity brachytherapy devices may also be needlessly subjected to enhanced security measures if included as Category 3 materials.

- The inherent low specific activity of materials possessed by nuclear laundries serves to justify a categorical exclusion of nuclear laundries from Increased controls. Alternatively, a concentration of concern thresholds should be established below which there would be no need for increased controls.

Task Force Response: The Task Force concludes that agencies are protecting the appropriate radioactive sources (i.e., those sources requiring security based on the potential attractiveness of the source to terrorists and the extent of the threat to public health and safety). At this time, the Task Force does not recommend that additional radionuclides be added to the list of risk-significant sources. The Task Force notes that the source lists are tailored to the specific program and objectives to which it applies. Overall the programs appropriately address the sources consistent with the Code of Conduct.

Chapter 4 - Security and Control

Current Program

- Current policies, laws, regulations, and controls are adequate. The Working Group on increased controls was very thorough. Need to provide adequate time for implementation and then reevaluate after some experience is obtained.

- Urge caution in imposing unnecessary additional regulatory burdens on the small independent sector of the well logging industry.

- Further security requirements should only be considered in extreme conditions and must be balanced against the socio-economical beneficial use of radionuclides. Further security measures imposed may inadvertently limit or restrict the use of sealed sources and adversely affect patient care, research, and the sterilization industry.

- Many licensee employees exhibit poor judgment when it comes to the safety and security of nuclear moisture density gauges (not carrying the required transport documents to actually leaving the radioactive material unattended in or near construction areas). Need enhanced or sharper penalty schedule for violations. Suggest doubling the fine and confiscating the gauge to make companies hire more responsible individuals.

- Better oversight of sources, stricter controls for well logging sources. Instances of lost sources are usually due to indifferent handling and physically insecure transportation (i.e. falling out of vehicles, source container failure, disgruntled employee).

- Review regulations and orders in place to assure there is no duplication of effort between agencies.

- The security measures imposed by NRC have been ambiguous and have gone beyond

the security measures imposed on other dangerous goods. NRC should reevaluate the risk and measures imposed on radioactive material against the risk posed by other dangerous goods. The security measures should be compatible to those imposed on other dangerous goods with similar risk.

- A process needs to be in place to ensure that high-risk radioactive sources cannot be obtained before verification, through inspection or other means, that the materials will be used as intended. This may affect additional devices.

- Inconsistent format and terminology of Agreement State licenses complicate the process for verification of recipient licenses by manufacturers and distributors of radioactive materials. There is a potential for material to be received by unauthorized individuals.

- There is a wide variety of uses and users, and assuring that proposed changes for improving security in one area may have unexpected consequences in another area.

- NRC should check with local law enforcement to see how they feel about the requirement for licensees to communicate with local law enforcement.

Task Force Response: At this time, the Task Force is not recommending additional security provisions. Further evaluation in some areas is recommended and dependent on the outcome the Task Force may make recommendations in the future. Both NRC and the Agreement States are implementing a pilot program on prelicensing guidance that addresses the concern of obtaining a license before verification.

Need for Guidance Information

- NRC should issue guidance information to the States and licensees on how to implement the security requirements prescribed for the control and use of radiation sources. The implementation of the requirements by various States has resulted in a variety of different compliance expectations. This is difficult to manage and does not allow for fairness of trade and business amongst different States.

- NRC Orders and implementing guidance contain expectations that are ambiguous and in some cases misleading.

- Orders and guidance documents should be revised, specifically in regard to export requirements. For example, none of the language of Section 6 of the Order specifically or clearly states that those regulations apply to import or export of material.

- Need guidance for licensees on how and what to communicate to local law, perhaps develop a form letter that could be used by licensees. Also need guidance on what is expected of the local officials when a call from the licensee is received.

- Consider development of a poster on frequently transported devices and distribute them to local law.

Task Force Response: The Task Force is aware of the tremendous challenges in providing guidance that is transparent, consistent, and likely to yield uniform implementation wherever it is applied. These challenges can be overcome by continued communication and feedback among various members of the regulatory and regulated community. It is necessarily an iterative process. As specific issues manifest themselves and are communicated to and among regulators, necessary guidance and/or clarifications will be developed and deployed. The Task Force is sensitive to communicating with and informing LLEA as to the importance of security and control of radiation sources, appropriate and effective response regarding lost or stolen sources and pre-planning information needed by first responders. The challenge in developing and promulgating such guidance is being as informative as necessary and useful without being alarming. The Task Force agrees with the need to foster a "security culture" whereby licensees, their employees, and local law enforcement have the correct level of awareness of and sensitivity to the need for security and control of radioactive sources. There may be a need for guidance in this area.

Information Security

- There is a major gap that has led to major inconsistencies for the protection of sensitive information. What material does a petitioner with the ASLB have the right to receive? Do they have the right to receive sensitive and/or SGI-M contained within the application? If they do have rights, how is the material to be protected? There is little if no protection for enforcement on nonlicensees for disclosure of sensitive information. The Task Force should address potential rulemaking that would: (1) clearly define what sensitive materials may or may not be made available to a nonlicensee in an ASL adjudication by the presiding officer; (2) if it is deemed that the public has a right to these materials, develop protection and enforcement provisions to protect the sensitive material; and (3) develop rules on the above that would allow the issue of sensitive information to delay the hearing process beyond the time schedules put into effect in the "Changes to Adjudicatory Process: Final Rule" on 2/14/04. It is believed that there is presently no prohibition of the presiding officer of the ASLB to freely hand sensitive or SGI-M material to a member of a terrorist group that petitions for a hearing under his or her rights as a member of the public.

- In the course of doing business, there are instances when there is a need to discuss the requirements of the security order or transportation regulations with other licensee, carrier, or industry trade group. However, the discussion is being inhibited by the controls placed on SGI.

Task Force Response: It should be pointed out that NRC regulations provide for protection of information beyond "Safeguards" information. Party standing in a proceeding does not automatically afford access to information. In fact, there are specific requirements to establish a "need to know" for sensitive information.

The Task Force also discussed this concern in a somewhat broader context. The detailed security programs for nuclear reactors, nuclear fuel cycle facilities, and certain materials licensees are designated as Safeguards Information, and as such, are protected from public disclosure under Section 147 of the Atomic Energy Act. The detailed physical protection information for the materials licensees subject to the increased controls is considered sensitive

information, and licensees were jointly required by both the NRC and the Agreement States to protect the information from unauthorized disclosure. This sensitive information is currently not protected under Federal law. Rather, the protection of such information in the possession of Federal and State agencies is subject to the respective statutes and regulations of the individual agencies.

There was a general stakeholder concern about inhibition of cross communication because of SGI controls. Because the stakeholder did not provide specific examples, it was not possible for the Task Force to address this concern.

Chapter 5 - Transportation Security

Special Form Testing Records and Authorization

- Recommend that special form testing records be maintained in perpetuity and made available online by manufacturers registering their special form testing records with the Department of Transportation (DOT) in a manner that will not identify potential vulnerabilities of the packaging.

- Recommend that DOT extend the authorization for continued domestic use of the specification containers 20WC and 6M as necessary to provide sufficient time for design, testing, and approval of replacement containers with adequate internal volume, gross weights, and cost based on requests for an extension from potential applicants for certification. NRC should expedite the review and approval process for updated replacement containers.

- One barrier to vulnerable source recovery is a transportation issue related to the characterization and documentation of sealed sources as special form radioactive material. The requirements for characterization are delineated in 49 CFR Part 173.469. The issue has been that manufacturers of sealed sources typically tested their sources and maintained records of that testing which was documented via a source certificate. Unless the manufacturer applied to the DOT for a Certificate of Competent Authority (COCA), there was no record held by the regulator of the special form testing. If the manufacturer then went out of business, the records of special form testing were subsequently lost. The failure to maintain a national record of sealed source special form testing frequently means that the material is reclassified as normal form radioactive material for transportation purposes resulting in the fact that the maximum quantity that can be shipped in a Type A package is reduced by a factor of 1,000. This typically means that sources originally shipped during distribution in a Type A package must now be recovered by shipment in a Type B package. Shipments in Type B packages usually require an NRC approved Quality Assurance (QA) program, which is not very common among NRC licensees. To maintain the ability of the licensee to ship the material in a Type A package, all special form testing records would need to be registered with the DOT regardless of whether or not the manufacturer has applied for a COCA.

<u>Task Force Response</u>: DOT maintains design and test records for all special form material approved in the United States. As the records contain proprietary information, it is not available online but is available upon request. DOT does not believe it is possible to require

manufacturers to submit design and test data for special form material that is certified by the manufacturer.

In response to public comment in the rulemaking process, DOT and NRC set a 5-year transition period for 20WC and 6M packages. Public and industry comments stated this was a sufficient transition period.

Regarding source recovery, DOT has recently approved two capsules which may be classified as special form and may be used to recover source capsules.

Transportation Requirements

- Current DOT and State laws, regulations, rules, and policies are already extremely thorough (and burdensome).

- The framework used should be consistent with the Code of Conduct and other relevant regulations, and conflicting regulation must be avoided.

- Procedures to enhance transport security of sources must be effective, and the demand on resources to employ them is warranted by the level of risk posed.

- Co-60 sources for use in commercial irradiators are transported in a safe and secure manner according to guidelines. However, current treatment by State and local agencies create confusion and hand-off coordination concerns that could be eliminated with source to destination inspection reciprocity, neutral transport carrier commercial markings, and elimination of attention attracting escorts. New generation mobile tracking devices and use of cellular communication technology should be advanced to state-of-the-art “best available” status.

- NRC should take a more active role in resolving State discrepancies in the implementation of the security measures imposed by NRC. Inconsistent approaches and requirements among various States make it difficult for carriers to comply and lead to carriers not wanting to transport this material. States should be encouraged to implement the measures as described by NRC and not impose additional measures.

- Another inconsistency is the difference between the radioactive transport security measures in 49 CFR Part 172 that, for example, apply to Yellow-III packages, and those required by NRC regulations. There needs to be consistency in thresholds of applicability regarding quantities of radionuclides and the specific measures to be performed when applicable. The Task Force needs to take into consideration the “Security of Radioactive Material during Transport: Specific Guidelines” being developed by IAEA to ensure consistency with this document.

- The Task Force needs to take into account the difference in transport security requirements imposed by the various agencies with jurisdiction over a single consignment and consider that these inconsistencies have put shippers and carriers in a position of unattainable compliance, and this, along with the complexity of the regulatory landscape, has discouraged some carriers, particularly in the air mode, from accepting

radioactive shipments. This is an issue that has been recognized by the industry as well as some agencies, including IAEA, as a threat to the radiopharmaceutical and medical radioisotope supply chain.

- The biggest issue is the inconsistency among regulations for the security during transport of radioactive materials and the security of other hazardous materials, which have similar levels of risk. For this reason, NRC should return regulation of radioactive materials in transport back to DOT. Security provisions would be better served if they were in DOT regulations versus NRC regulations. Carriers are familiar with DOT regulations and may not be familiar with Title 10. State regulations do not cover common carrier, so requirements must be in DOT regulations.

- Transport security measures imposed by NRC have been ambiguous and have gone beyond the security measures imposed by DOT for other dangerous goods. NRC should reevaluate the security measures imposed on transport of radioactive material and should consider harmonizing the measures with DOT. Additional security measures imposed for the transport of radioactive material are causing difficulty for carriers who may no longer transport this material. NRC must balance these risks against the social and economic benefit gained by the use of Co-60 in the healthcare and other industries. Transport security measures should be compatible with those imposed on other dangerous goods with similar risk.

- Shippers required to develop and implement a Transportation Security Plan in accordance with 49 CFR Part 172 are also required to complete a risk assessment to determine which materials were subject to these requirements and applicable security measures. On May 18, 2004, TSA published an Interim Final Rule that subjects those involved in transportation activities to measures for protecting sensitive security information (SSI), effective June 17, 2004. The rule was unclear as to the extent of applicability, but it could apply to shippers and carriers who have completed a vulnerability assessment. If this is the case, compliance is problematic as the TSA requirements pose conflicts with those of 49 CFR Part 172, particularly related to training and communication of information. TSA and DOT published a technical amendment on January 7, 2005, clarifying that the “need to know” limitations in the rule apply not only to air and maritime transport but to all modes.

- Need to align Category 1 thresholds with highway route control quantities. The current system is confusing.

- Need to require transponders on larger shipments (Category 1 and Category 2).

Task Force Response: DOT is reviewing its designation of high hazard, radioactive material to determine if Category 1 and 2 materials, as defined in the IAEA Code of Conduct, is a more appropriate designation.

In addition, the Task Force recommends that regulatory authorities involved in transportation security of risk-significant sources should develop an MOU for transport security. This agreement, similar to the one for transport safety, would clarify the roles and responsibilities of

each agency, forge a spirit of cooperation and awareness among the participants, reduce duplication of efforts, and most importantly ensure development of a comprehensive and consistent transport security program. Key agencies involved in transportation security should participate in the development and be signatories to the MOU.

Better harmonization and coordination of federal transport security requirements are areas addressed by the Task Force.

NRC RAMQC Orders

- The Orders specify certain notification requirements prior to a shipment of material, but there is no formal mechanism in place that requires NRC or Agreement States to acknowledge that notification. For the sake of security, all submittals and notifications made by a licensee to a regulatory body should be positively acknowledged by the regulatory agency.

- The Orders contain SGI dealing with requirements that the licensees cannot share with uncleared personnel, including the carriers themselves who are being contacted specifically to comply with those requirements. This arrangement inhibits effective communication and is detrimental to security.

- The table of radionuclides of concern provided in USNRC Order EA 03-225 is somewhat different than that provided in USNRC Order EA 05-006. The list of radionuclides of concern in EA03-225 should be revised to be identical to the table provided in Order EA 05-005.

- Licensees are being held responsible to ensure the carrier is meeting the requirements of the RAMQC order; however, licensees do not have the capabilities and must, in many instances rely upon the word of the carrier to meet those requirements. To adequately ensure compliance with the Order NRC should specifically inspect and license carriers who have demonstrated their compliance with the requirements of the Order. Otherwise, return the requirements for transport security back to DOT, who actually has regulatory jurisdiction over carriers.

- NRC should take a collaborative approach with carriers, review their programs, and suggest possible changes and consider alternate methods of meeting the requirements prescribed in the RAMQC Orders.

- The responsibility for ensuring security of sources during the transportation process, outside the control of the licensees, should be the responsibility of the DOT, the authorized transporters, freight forwarders, etc. as opposed to the current situation of placing the onus on the licensees as specified in the NRC Increased Controls.

<u>Task Force Response</u>: NRC does not regulate the carriers. NRC and DOT are working internationally to incorporate transport security provisions into the international guidance. One this is complete, DOT and NRC will revise their regulations to incorporate the new provisions.

Transport of Nuclear Gauges

- NRC and DOT should work more closely together to enforce not only safe operation of nuclear gauges in the field, but also safe vehicle operation while in possession of nuclear sources. This could be accomplished by DOT officers making traffic stops of vehicles, wearing DOT numbers issued by the NRC, that are operated in an unsafe manner on all roads and highways. The ticket bearing the number issued by the NRC, would be sent to the NRC for further enforcement action over and above any moving violation incurred by the driver of the said vehicle.

- The movement of every gauge should be accounted for. Transporting a gauge should be by a registered ground transportation company to ensure that the path of the departure and arrival is via the company's internal tracking system. When transported via a company vehicle, the gauge should be secured via a secondary containment device, and steps should be taken to avoid unnecessary stoppages.

Task Force Response: DOT is not authorized to make traffic stops. DOT can accompany State and local law enforcement and conduct inspections in conjunction with local law enforcement efforts (i.e. DOT can conduct inspections at truck weigh stations).

DOT requires that transport records for Type A quantities and above must be maintained for 3 years after date of shipment and that unnecessary transport delays be avoided. Recent NRC rulemakings require a second security device for gauges transported to, from, and around job sites.

Tracking

- DOE currently has a tracking system (Transcom) that is capable to provide nationwide tracking of commercial carriers transporting material to or from DOE facilities. Since this system is already in place, NRC should investigate the feasibility of expanding the system to track other commercial vehicles.

Task Force Response: The Task Force has made a recommendation for further evaluation of shipment tracking related issues.

Chapter 6 - Background Checks

Single System

- There should be one system that all licensees can follow to eliminate inconsistencies, and the person with authorized access to radioactive material would have the same type of background check no matter what the facility.

- Suggest a single consistent process across different Federal agencies involving background checks. A single process would be more efficient from both a company and Federal perspective. Examples of current NRC, DOT (CDL drivers with Hazardous Material Endorsement) and Bureau of Alcohol, Tobacco, Firearm, and Explosives (Explosive Responsible Persons and Explosive Users).

- Many small, independent well loggers have already been subject to the BATFE FBI explosives licensing security check. Urge that efforts be made to prevent the duplication of efforts with multiple security checks. A good starting place would be if one has passed a BATFE FBI security check, it should be deemed adequate for NRC or Agreement State purposes.

- Encourage NRC to develop, in conjunction with other agencies, one background check that would cover numerous areas. This would lesson both the responsibility of the licensee and the governmental agencies in doing multiple checks by multiple agencies on single individuals.

- If the Federal Government determines that background checks have value, it needs to establish uniform requirements for who falls within this category, and the background checks need to be consistent across all Federal agencies. The Task Force can review the requirements from each Federal agency as well as what needs to be included in the background check. The Task Force can make recommendations for uniform background checks across the Federal government.

- Establish a nationwide NRC clearance process that will facilitate communication between licensees, organizations, and various elements of industry involved with safety and security of radioactive materials.

Task Force Response: The Task Force agrees with the commenters that a single system for background checks is desirable, and that the information should be made available to appropriate Federal and State agencies and licensees. However, there are information sharing issues related to privacy concerns, as well as cost for development and maintenance of such a system. In some cases the information needs may be different.

Need for Background Checks

- Need background checks of individuals applying or who already have a job where use of reportable quantities of radioactive material is part of the job description, including transportation of the material (density gauges).

- Gauge use should warrant an individual background check.

- Background checks have minimal value.

- Additional measures should be limited to Categories 1 and 2.

- Detailed background checks are already in place for operating personnel at commercial irradiators. Fingerprinting would be of questionable added value. Fingerprinting could significantly delay the ability of the licensee to certify new operators required to safely operate an irradiator. The Task Force should perform a cost/benefit analysis on any fingerprinting requirements. If it is determined that there is some advantage to fingerprinting, the fingerprinting should be required within a certain time period after a new person is allowed to perform his or her assigned function. Access to SGI, by

definition, does not require this level of security (fingerprinting). A fingerprint requirement for individuals with access to radiation sources would be inconsistent with fingerprinting for those with access to SGI.

- Safeguard requirements for sensitive information prevents the type of communication between commercial operations that could lead to gaps in security measures. The process to fulfill Section 149 of the Atomic Energy Act needs to be developed as a result of collaboration between agencies with relevant threat assessment requirements to avoid duplication or conflicting requirements. Since most of the personnel threat assessment requirements in existing regulations are limited to those who have access to Category 1 and Category 2 sources, any additional measures should be applicable to these materials. If there are any conflicts or gaps between existing and additional measures, these need to be resolved.

- The best way to get material is to legally apply for a license in several States. There should be a prelicense check and a sharing of information.

- Concern over access to necessary information to conduct a background check. If criminal activity is involved, there may need to be law enforcement to have access to the information. States are concerned that Federal background checks are a backdoor way to bring NRC controls back over the Agreement States. Timing is also an issue; companies cannot wait months and months for the results.

- Need criteria for doing the checks. What within someone's background could disqualify him or her from having access to radioactive materials? What about foreign nationals? This could be a big concern for continuation of teaching and patient services, if there were problems with obtaining the background checks.

Task Force Response: The Task Force agrees that background checks should be limited to Category 1 and Category 2 quantities of material and is not recommending expansion of background checks for Category 3 quantities of material at this time. The Task Force disagrees that background checks provide minimal value. Background checks that include fingerprinting for Federal criminal history checks provide a screening process that can detect persons with malevolent intent, thereby reducing the risk of radioactive material being diverted or used for malevolent purposes. Background check systems should be routinely used and relied upon to assure that Category 1 and Category 2 materials remain secure and are not compromised. A cost/benefit analysis will be conducted during the rulemaking process to add the fingerprinting requirement to the regulations. Without fingerprinting, an individual would only be allowed to perform his or her assigned tasks at a facility, if the individual is escorted under the approved site security plan for that facility.

The Task Force agrees that the safety/security interface will be considered when introducing new requirements for security or for safety programs. Communication is essential for effective commercial operations and regulatory programs. Background checks will be completed with agencies that maintain relevant threat assessment data. The licensing process will be modified to incorporate background checks for individuals who request a specific license for Category 1 and Category 2 materials. The Agreement States will be involved in the development of background check requirements and implementation of the requirements.

Chapter 7- Storage

Additional Security Suggestions

- Use secondary containment boxes in order to prevent the theft of any gauge. All gauges should be required to be locked in either a job type “Gang Box” or through the use of a site “Conex” box.

Task Force Response: The Task Force notes that this issue was considered by the MSWG when drafting the Increased Controls Orders and incorporated to the degree that they determined was necessary.

Increase Enforcement

- NRC and AS regulations are quite clear on what the requirements are. More enforcement may be necessary to correct the behavior of licensees possessing sources that are not used in a safe and secure manner.

Task Force Response: The Task Force agrees that adequate inspection and enforcement of all regulations or Orders is necessary to ensure effectiveness.

Current Program Acceptable

- Current laws, regulations, rules, and policies are adequate for the secure storage of radioactive material.

- Storage requirements for commercial irradiators are well regulated, safe, and secure.

Task Force Response: The Task Force is not recommending additional security measures at this time.

Work with Others

- The Task Force should utilize the GCC and the NSCC-R to review and develop any changes to the current regulations for storage of material when not in use.

- NRC should partner with industrial source manufacturers to develop programs that will facilitate the collection, storage, recycle, reuse, or disposal of disused sources.

Task Force Response: The Task Force agrees that there are many partners to work with when developing changes to regulations. The Task Force agrees that stimulation of the downstream flowpaths away from long-term storage is desirable and should be encouraged.

Chapter 8 - National Recovery

Need for National Policy

- There is a need for a true national system for recovery of lost, stolen, abandoned, or otherwise unwanted sources. The programs under DOE and CRCPD do not have the resources to handle all of the sources that have been currently identified by licensees and State programs.

- No uniform way in which things are handled. Need a national program. IAEA looks at 1) a system in place to look for lost sources or those that are not being used, 2) does that country have a place to store them, and 3) does that country have a place to dispose of those sources. In the U.S., it's very hit and miss; no unified program. Currently, if the budget is good, State may pick up source; tight budget, probably won't.

- No current system to look for sources or store ones found. DOE is a great place. DOE to take GTCC. Sources would not make a dent in to volume of DOE waste.

- Recommend that the Administration establish and implement a national policy aimed at recovering vulnerable and orphan sources of U.S. origin that currently reside outside of U.S. borders instead of the current efforts that involve approval of the recovery of individual sources on a case-by-case basis. Although the OSRP is recovering sources, there is no statement by the Administration that it is the policy of the United States to recover vulnerable and orphan sources of U.S. origin. Such a policy statement would institutionalize the program and form the basis for its existence into future Administrations.

- DOE should, in cooperation with CRCPD, establish a technically competent and responsible recovery system for sources performed by the OSRP. This program is a key component of any plan to secure the nuclear sector and should be provided with the necessary funding and staff to ensure effective operation.

- Congressional action is needed to authorize programs and to continue to appropriate sufficient funds on an ongoing basis to maintain a robust national capability for the recovery and disposition of vulnerable and orphan sources within the U.S. and abroad in order to assure the national defense and security and protection of public health and safety.

Task Force Response: As described in Section 8.1 of the Task Force report, licensees are largely responsible for providing safe and secure management of their sources. These responsibilities include reporting lost and missing sources to regulators and notifying law enforcement officials in the case of theft. Reporting thresholds for these incidents are considerably lower than the Category 1 and Category 2 sources addressed by this report.

Federal Government support for a national capability to deal with orphan sources is reflected by the DOE's Global Threat Reduction initiative and its Offsite Source Recovery Project activity. The Task Force supports the continuation of the existing programs and is not recommending any changes at this time.

OSRP

- OSRP can be considered a key component of any plan to secure the nuclear sector and should be provided with the necessary funding and staff to ensure effective operation.

- Establishment of OSRP has been a step in the right direction to address this issue.

- OSRP is the single most effective thing the government has done in this area. Urge continuation on a no-fee basis.

- Commend NRC, DOE, and CRCPD for their cooperative roles in supporting the establishment of the OSRP. Congressional action is needed to authorize programs and to continue to appropriate sufficient funds on an ongoing basis. to maintain a robust national capability for the recovery and disposition of vulnerable and orphan sources within the U.S. and abroad in order to assure the national defense and security and protection of public health and safety.

- OSRP needs additional resources to ensure that ongoing needs to recover and provide responsible custody of problematic sources are addressed. Alternatively, funding should be used to collaborate with private industry to bridge the gap between OSRP and source owner resources.

- NRC should work to provide funding and collaborate with industrial partners, and DOE under OSRP, to facilitate the rapid securing, storing, packaging, and disposing of orphan or disused sources throughout the U.S.

- OSRP isn't always effective. The types of sources are not inclusive, limited to specific radionuclides. The program has had difficulties with support for the program. The program has been active and inactive since the NRC/DOE MOU of 2000.

- Would like access to sources collected by OSRP. Due to limited source availability and extremely long lead times for certain sources, available access to safe, secure sources is needed with the well servicing industry.

- Urge the government to determine which AmBe sources in OSRP storage meet regulatory requirements and offer these to the well logging industry. Such an effort serves public policy and enhances national security. The only current source of AmBe sources is from Russian Am which is a significant security concern.

Task Force Response: Many commenters noted support for this program, and there are no plans to discontinue it. The Task Force supports the program and encourages continuation.

DOE's OSRP, described in Section 8.4 of the Task Force report, is adequately funded to address certain sources lacking a disposition path which are presenting public health and safety threats and security risks. The Task Force, however, acknowledges that certain Class B or C sources continue to lack a disposition plan. As long as such sources do not present a threat to public health and safety and national security, current radioactive waste regulations and

legislation require that licensees remain responsible for proper management of sources, and State compacts remain responsible for developing disposal capability.

It should be noted that this proactive program is not meant to be inclusive, and is limited to specific nuclides under the law, unless specific requests are made by regulatory agencies for situations presenting public health and safety threats or national security risks.

Reporting Lost/Stolen Material

- Concern that a very conservative approach (in terms of quantity of activity), that some agencies have taken regarding reporting expectations of licensees, has resulted in the needless expenditure of valuable resources to report and investigate on an escalated basis the temporary misplacement of exempt or very small quantities of extremely low risk materials (e.g. packages containing microcurie quantities of short-lived gamma emitters that are not delivered as expected, traced over a 24-hour period, and then accounted for by the carrier a day or two later). There needs to be more reasonable and practical requirements for the reporting of missing material. These need to be consistent across all jurisdictions and with a level of escalated activity that is commensurate with the level of potential risk the material presents. The most rigorous reporting and tracking requirements should be limited to Category 1 and Category 2 sources, and any move to expand this scope should consider the impact on industry.

- The Trilateral Initiative was discussed. What is the status of the numerous portable gauges reported stolen or missing in the southern States? Have there been any successful recoveries of lost materials?

Task Force Response: The NRC does consider the risk when responding to reports of lost/stolen/missing material. The response for risk-significant quantities of radioactive material is more rigorous and would involve notification of law enforcement agencies such as the FBI. There are only a few instances each year that involve a report of lost or stolen Category 1 or 2 materials, most sources are recovered. The Task Force has focused on Category 1 and 2 sources for this report, portable gauges are considered Category 3 or 4 and were not addressed in this report.

Reasons for Source Abandonment

- The Task Force needs to take a look at factors that have contributed to the abandonment of sources in the first place. Most of these have to do with the lack of available options for the disposal of sources, particularly GTCC waste and problematic sources such as those that are leaking, have lost their special form status, or do not meet the authorized configuration of a Type B container. More flexibility regarding containers authorized for greater than Type A shipments needs to be afforded to those transferring sources to responsible storage or disposal sites. Another contributing factor that has made it difficult for sources to be returned to overseas manufacturers has been the regulatory framework in which sources no longer used are defined as “radioactive waste” and are then subject to the rigorous licensing and export/import authorization processes that essentially make this an unworkable option for responsible source management.

- Another significant factor contributing to the inability to ensure responsible source disposition is the lack of an available and cost effective disposable option. In addition, the obligations of the Federal Government to provide for the disposal of GTCC waste have yet to and need to be fulfilled.

Task Force Response: The Task Force agrees that lack of available options for affordable disposal of sources can be a factor in source abandonment. However, this is more a problem with the smaller sources. In the history of the OSRP, there have been very few incidents where sealed sources required recovery because they were lost or abandoned by licensees. The OSRP program has only recovered a few Category 1 and 2 sources.

Miscellaneous

- NRC GLTS isn't accurate.

- Companies should be required to maintain a current serial number list of all sources in their current possession, and fined for any deviation/exclusions to that list. Accountability for all sources ensures that in the event that something is presumed lost or stolen, an inventory list can be references, and exact knowledge of what went missing will help aid in the manner of the recovery of the item.

- Recovery of sources in commercial irradiators is well managed, safe, and secure. The concept that a source could not be lost or stolen without the immediate knowledge of the licensee is highly unlikely.

- The Task Force should work with regulatory agencies in order to provide some flexibility in transporting older sources and packages as they have lost their transport status, i.e. special form or Type B certification.

- Concern that if we move to a program where a lost source will be stored and disposed of, we are moving away from licensee accountability.

- Need an education program. First responders, politicians, general public, schools. Department of Education should not allow anybody to get a high school diploma who can't understand the difference between low-level and high-level waste. Maybe all the Federal agencies need to get together and maybe pool a little money to actually get education going on a nationwide level.

- CRCPD has developed a first responders' guide and is actively exploring ways to get a copy into the turnout gear of every fireman in the U.S. Would help with communication issues across fire departments, etc.

Task Force Response: The Task Force has made a recommendation in regards to public education on RDD related issues. Licensees are required to maintain an inventory list of all radioactive material in their possession and are held accountable.

Chapter 9 - Disposal

Financial Assurance and User Fees

- Favored changing the current framework for financial assurance (including user fees) as it pertains to the cost of sealed source disposal.

- Opposed changing the current framework for financial assurance (including user fees) as it pertains to the cost of sealed source disposal.

- The current NRC requirements in 10 CFR 30.35, *Financial assurance and recordkeeping for decommissioning*, are adequate and should be left as written. The threshold for financial assurance requirements should continue to be based on total authorized possession limits and not on individual sources.

- The current NRC financial assurance requirements in 10 CFR 30.35 are not adequate to ensure that the cost of sealed source disposal is planned for in advance and that the requirements should be revised. Expand the financial assurance requirements to include acquirers of Categories 1, 2, and 3 sources; consider readjusting the financial assurance threshold to the individual source activities; and lower the financial assurance threshold. Suggested an escrow account as a possible financial assurance method.

- The current financial assurance requirements overestimate decommissioning costs because they do not properly account for salvage value.

- The current financial assurance requirements regard sealed sources as a decommissioning liability regardless of their current value.

- The NRC definition of radioactive waste is not clear.

- In favor of the imposition of user fees as a means of financial assurance for sealed source disposal.

- Oppose the imposition of user fees as a means of financial assurance for sealed source disposal.

- As an alternative to the current requirement for financial assurance for disposition of some high activity sealed sources, impose a surcharge on annual fees charged to radioactive material licensees that could be placed into a special account for use by the regulatory agency for disposal of orphan sources and cleanup of accidental contamination caused by a licensee that has gone out of business or that is bankrupt.

- Concern that additional financial assurance requirements could drive small companies, which might not be able to afford the additional costs, out of business.

<u>Task Force Response</u>: The Task Force has considered the public comments on financial assurance and recommends that the NRC evaluate the financial assurance required for Category 1 and 2 radioactive sources to assure that funding is available for disposition of the

sources. A range of options, along with their relative advantages and disadvantages, should be evaluated.

Availability of Disposal Facilities

- Concern regarding the limited availability of commercial disposal facilities and the cost effectiveness of disposal for sealed sources. Recommend providing continued access to existing commercial disposal facilities, providing a disposal option for GTCC sealed sources, completely overhauling the existing national low-level radioactive waste management system through Congressional and regulatory agency actions, providing licensees access to DOE disposal facilities, and ensuring cost effective disposal options.

- As an alternative to a national program, recommend funding for responsible commercial entities in the U.S. to provide disposal services that would ultimately reduce the likelihood of lost, stolen, or abandoned sources.

Task Force Response: The Task Force has considered the public comments regarding the limited availability of disposal facilities and cost effectiveness of disposal for sealed sources. However, the Task Force did not identify any immediate security concerns related to disposal of Category 1 and 2 sources that warrant revisiting the Low Level Waste Policy Act. DOE's ongoing efforts to develop GTCC disposal capability should resolve disposal issues for many Category 1 and Category 2 sealed sources.

Discrete Sources of NARM

- In reference to the expanded definition of byproduct material under the Energy Policy Act of 2005, suggest that Federal Government agencies could enter into a Memorandum of Understanding on the types of radioactive materials that could be permissible for disposal in a uranium mill tailings site and to which DOE would agree to take title of the site, thus allowing for disposal of byproduct material in mill tailings sites without further Congressional action.

Task Force Response: NRC is undertaking a rulemaking on the expanded definition of byproduct material per Section 651(e) of the Energy Policy Act of 2005. The Act mandates that the Commission promulgate a rule no later than 18 months from the date of enactment.

Chapter 10 - Import/Export

Implementation of Code in Other Countries

- Concern that very few countries (11 by the end of 2005) have so far committed to implementing the import/export provisions of the Code. DOS must continue to use all means possible to work with IAEA to get its Member States to adopt and implement the import/export controls and to prevent source transactions with countries that do not have proper source controls.

- The United States needs to work with the rest of the world to get all countries to a common level of exchange.

- Need to address the issue of harmonization of requirements to assure that recipients are authorized to receive sources. This needs to consider the Code of Conduct and the actions that individual countries are taking. Currently, there are many different levels of regulatory control, resulting in potential gaps in the control of sources in some countries.

Task Force Response: The Task Force is aware of the need for harmonized implementation of radioactive source export controls and the disadvantage an uneven playing field will have on U.S. manufacturers. The Task Force is also aware that as one of the first countries to reflect the IAEA import/export guidance in national law or regulations, we forge new ground in this area. As such, the U.S. Government has and continues to use a full range of diplomatic channels, including the G-8, OSCE, APEC, IAEA, and other international bodies, as well as bilateral and multilateral engagements, to press countries to follow the IAEA Code of Conduct and IAEA import/export guidance. The Task Force did not make an additional recommendation on this point, as it is already underway.

Current controls

- No need for additional controls. Rule is adequate. Give time to see if there are any problems.

- Import and Export controls must be effective, and the demand on resources to employ them is warranted. Framework should be consistent with the Code.

- NRC Security Orders to licensees contain provisions for import/export that differ from the controls specified in the export import regulations. Need to examine and resolve the differences between NRC Orders to licensees for safeguards and enhanced security measures and Part 110. NRC should consider deleting contradictory or redundant regulations in the Safeguards Orders that are addressed in the export/import rule. Need to assure the NRC Orders for safeguards and enhanced security measures and the import/export rule are consistent and not duplicative.

- Export/import regulations have not always been consistent with the regulations for transport security or the requirements for the determination if the documents are to be protected as safeguards information.

- There is a lack of consistency by the NRC's determination of which regulations are controlled as Safeguards Information. NRC security regulations for licensees are controlled as SGI while controls for export/import are not.

- NRC should reevaluate the need for a specific import license to allow the importation of a source to a U.S. licensed user. Other countries implementing the import/export requirements from the Code of Conduct do not require the need for a specific import license and include the authorization as part of the site license. The U.S. should adopt this practice as specific import licenses are a significant and cost administrative burden

with little value. Notification of the import would still be sent so NRC would know of the import and to whom it is destined.

- Since other countries have not gone to the extremes of the U.S., this implies that the U.S. regulations may be overconservative. The Task Force should review the U.S.
-
- regulations, and make a determination that the regulations warrant the level of security that is being imposed.

- Concern over verification of authenticity of foreign license and companies. Difficult to figure out if the recipient is indeed authorized to receive the material.

- Question of who is responsible when materials have come into Customs and have been identified as radioactive (contaminated or unintended versus actual radioactive material import). Who is responsible is a question. Who has jurisdiction when material is impounded by Customs? Who has jurisdiction when material on a ship of foreign registry is in U.S. territorial waters.

Task Force Response: The Task Force recognizes that licensees have raised questions regarding the need and benefit of specific import licenses and that many of our counterparts abroad have not taken this approach. As such, the Task Force has suggested that the NRC should consider reevaluating the need for a specific import license to allow the import of sources to a U.S. licensed user. The Task Force also recognizes the difficulty licensees have verifying the authenticity of foreign companies that are requesting sources. Please see the previous response regarding U.S. continued efforts to press others to live up to the IAEA import/export guidance. Finally, the Task Force is aware there has been confusion over jurisdiction of materials arriving into Customs. Customs will have access to the consent and notification information that is provided for Category 1 and 2 imports and exports. The import/export rule and SGI provisions do not appear to be in conflict, however, no specifics were provided.

Return of Sources

- Return of sources, no longer used, to foreign manufacturers of sources is subject to the regulatory framework in which these sources are defined as “radioactive waste” and are then subject to the rigorous licensing and export/import authorization process that makes this option for responsible source management unavailable. There is also a gap between NRC’s Export and Import rule and the need for guidelines on the process and adequate time for affected licensees to make the necessary changes in procedures. Including Category 3 materials in the scope of these regulations should not be considered as it would result in an unwarranted burden on licensees.

- Need to review the regulatory landscape that applies to the return of unused sources to manufacturers to identify and address the obstacles that currently make this responsible option of responsible source disposition unavailable.

Task Force Response: The Task Force recognizes that there are some regulatory impediments surrounding the return of sources to foreign manufacturers. As such, the Task Force

encourages the U.S. Government to examine means to reduce regulatory impediments that currently make the return of disused sources to the manufacturer difficult.

Chapter 11 - National Source Tracking System

Inclusion of Category 3

- Do not include Category 3. Resources should be focused on the source quantities that pose a significant threat. The Code does not recommend a registry for Category 3 quantities. Category 3 sources are only considered a health threat under circumstances of prolonged exposure. Addition of Category 3 sources would significantly increase the number of sources tracked, disproportionate to the threat they pose. Inclusion would create a huge administrative burden for both NRC and licensees (general and specific).

- Inclusion of Category 3 sources will not enhance the system but will hinder the ability of companies in the reporting process by including sources that are of minimal consequence.

- Category 3 does not warrant inclusion because terrorist dispersal of this amount of material is extremely unlikely to cause permanent injury or threaten life and the cost of inclusion would be more burden than is warranted by the risk, especially considering that use, care, and reporting for this amount of material will continue to be governed by existing regulation and license.

- Support source registry for Category 1 and Category 2 sources. Opposed to inclusion of Category 3 sources and expanding requirements to temporary job site reporting.

- Inclusion of Category 3 sources will do nothing to enhance protection or security.

- Because of the potential for unacceptable personal injury, economic, or social consequences from a mismanaged or poorly secured individual, Category 3 sources should be considered for inclusion unless an analysis can demonstrate that the large number of such sources and the economic costs would be overly burdensome. Consider that some types of Category 3 sources could be excluded while others included.

- Any initiative to include all Category 3 sources, at least categorically, in the system must include a risk-benefit analysis and should take into account some of the work being done by the Nuclear Sector and Government Coordinating Councils.

- Need to modify the reporting requirements if Category 3 sources are subject to additional security measures.

- Recommend that the most demanding requirements for tracking sources should be limited to Category 1 and Category 2. If NRC considers the need to expand the scope, it should be done with the input of industry.

Task Force Response: The Task Force is not recommending the inclusion of Category 3 sources at this time. Further study on the impacts of inclusion is necessary before a decision to include Category 3 sources is made. The Commission has recently directed the staff to conduct a one-time survey of licensees to obtain information on Category 3 sources and to prepare a proposed rule to include Category 3 data in the National Source Tracking System.

Harmonization

- Use compatible data formats and transfer protocols for import/export that would allow for electronic simultaneous information flow between the U.S. and Canadian tracking systems.

- Notification for import/export should also act as the input for the national source tracking system to avoid submitting the same information twice.

Task Force Response: Although import/export notification information will be recorded in the NSTS, licensees will not be able to input the information directly. NRC will consider this in future updates to the system.

Transactions

- Manufacturers should maintain a copy of all source numbers and submit these numbers to a government agency anytime a gauge is purchased along with the appropriate information of the purchasing body. The purchaser should also register as an affirmation that they are in possession of the sources.

- Routine transport of well logging sources to and from temporary job sites should be exempt from reporting

Task Force Response: The Task Force is focused on risk-significant sources (Category 1 and Category 2 sources). Lower risk sources are not included at this time. Temporary jobsite reporting is not required by the NSTS.

Timing of reporting

- Close of the next business day is not appropriate for Category 2 sources and does not enhance security and response to thefts and thus is overly burdensome.

- Real-time tracking. From state view not practical or feasible thing to do or necessary. Type of tracking being proposed is appropriate.

- Real time tracking is not practical nor is it required.

Task Force Response: The Task Force is not recommending real-time tracking at this time. The Task Force believes that the timing for reporting is appropriate.

Alternatives to Tracking Category 2

- Licensees be required to maintain a record of the present location of the Category 1 and Category-2 sources they possess;

- Licensees be required to make a monthly report of movement to ensure that the national source registry is maintained;

- Licensees be required to notify the planned recipient licensee whenever a source is sent to them with the information to include the name of the freight carrier, expected ETA, and carrier tracking information; and

- That the reporting requirements of 10 CFR 20.2201 be expanded to require licensees to report within 24 hours Category 1 or 2 sources in transit that cannot be located by the freight carrier.

- Not sure what we're going to accomplish by doing source tracking that can't be done in other ways with improving inventory control and greater emphasis on regulations currently in place.

- Look at subcategories. There may be groups where just because they're in a Category 1 or 2, they might not need to be tracked.

Task Force Response: Licensees are required to maintain inventory of the sources. The intent of the NSTS is to provide up-to-date information to the regulators. Some of the items suggested by the commenters are addressed in the security and control measures imposed by order or legally binding requirements. For most licensees, a monthly reporting requirement would be more burdensome than transaction reporting.

Miscellaneous

- The promulgation of the NRC proposed rule must take place only after sufficient time has been allowed to validate the system and to ensure that it is effective and that the demand on resources to employ the system are warranted by the level of risk posed by the sources. The framework should be consistent with the Code of Conduct.

- System has merit; however, at this point it's only a concept.

- Provisions for Co-60 sources in commercial irradiators are appropriate.

- NRC should take advantage of vendor experience when designing the tracking system. NRC should consult with industry while developing the system and software. The system must be thoroughly tested by prospective users before the implementation date of the regulation.

- See NSTS as providing basic information to accomplish other goals related to how material moves.

- Implementation will be a nightmare; accuracy will be hard to maintain. Major challenge. Going to take a lot of enforcement. Going to be problems with timely reporting for those in field, particularly small companies. System will be fraught with wrong data, frequent changes, fraught with misinformation about things being missing. Will need more than one person at NRC to oversee and make sure it's accurate.

Task Force Response: NRC will not deploy the system until it has been fully tested. NRC views that the cost of the system is justified by the benefit to be gained. NRC plans to hold workshops, have on-line training, and a help desk to assist with implementation. NRC is prepared to address the implementation challenges that are likely to arise.

Chapter 12 - Alternative Technologies

Research

- All relevant Federal agencies should take measures to inspire research and development of nonnuclear construction testing devices.

- An alternative technologies project should be pursued by a Federal agency to explore viable alternatives to the discrete sources being utilized at this time.

- Further work and approval by the DOT/FHWA to utilize Laser Density Measuring Devices on roadway construction projects would eliminate the use of nuclear density gauges all together.

Task Force Response: Although several Federal agencies have conducted research independently on alternative technologies for reducing the risk of radioactive sources, there has not been a coordinated Federal research and development effort to date. The Task Force is recommending that the Alternatives Technology Subgroup evaluate further various aspects pertaining to the development and adoption of alternative technologies. Such aspects include the establishment of incentives, funding for research and development efforts taking into account a realistic budgetary envelope for such efforts, as well as outreach to affected stakeholders. The report of this subgroup would be due to the full Task Force in 2 years.

Regulatory Changes

- Recommend that the Federal and State regulatory agencies adopt, as licensing policy, a requirement that license applicants for a new use of a category 1, 2, or 3 source examine alternative technologies, including but not limited to different source forms that are technically and economically feasible and whose alternative use would result in an equal or greater net benefit than from the use of the source.

- Regulations that would inhibit or prevent the use of certain sealed sources should be balanced against the resultant socio-economic impact of eliminating those sources from practical commercial use.

Task Force Response: The Task Force considered recommending that Federal and State agencies adopt a licensing policy that would require applicants for new uses of radioactive

sources to examine alternative technologies. This approach is not recommended at this time because it is premature given the lack of sufficient viable alternative technologies. This recommendation will be evaluated in the future, after more alternative technologies become available and there has been time for the marketplace to determine the practicality of these new alternative technologies.

The Task Force would need a full evaluation of the impacts from inhibiting or preventing the use of certain sealed sources be conducted before initiating any regulatory or legislative changes. However, because of the concerns associated with certain highly dispersible and soluble isotopes used in sealed sources. The Task Force recommends that the Federal government conduct a study to assess the feasibility of phasing out the use of cesium chloride in highly dispersible forms.

Incentive Program

- In addition to the economic, regulatory, and practical factors driving users away from the use of sources or toward any available alternatives, the development and implementation of positive incentive programs should be considered.

- NRC and other governmental programs need to establish positive incentives for businesses and researchers to explore these alternative technologies. One means of creating this positive incentive is for this topic to become an award basis for Small Business Innovative Research or STTR programs.

Task Force Response: The Task Force is recommending that the Alternatives Technology Subgroup evaluate further various aspects pertaining to the development and adoption of alternative technologies. Such aspects include the establishment of incentives, funding for research and development efforts taking into account a realistic budgetary envelope for such efforts, as well as outreach to affected stakeholders. The report of this subgroup would be due to the full Task Force in 2 years.

Considerations/Miscellaneous

- While we appreciate the intent of the arrangement to have the National Academy of Sciences conduct an analysis of alternative technologies that would replace the use of radiation sources, it is our view that most of the low-hanging fruit may have already been harvested. The increasing economic, regulatory, and practical burdens on applications using radioactive materials have been driving the users of radiation sources to seek alternatives. Where alternatives have become available, it is very likely that these have already been employed. In some areas, particularly in the use of sources and radioactive material in the diagnosis and treatment of illnesses, alternatives may be available, but the physical and economic impact as well as the detriment to quality of patient care may outweigh the perceived benefit of having eliminated the use of radiation sources. In the search for alternative technologies, it is important to ensure that this effort does not present additional burdens on the use of radiation sources in applications where alternatives have not been identified.

- There are numerous applications within the nuclear sector infrastructure that have no

suitable alternatives, and the Task Force needs to consider how these will need to be protected in the context of the NIPP.

- Possible options but only if they are cost effective options to the industry. Alternative technologies must be affordable, available to all members of an industry (not just the large companies that have financial resources). Licensees do not possess the expertise or financial ability to develop their own alternative technologies.

- The concept of alternative technology has little merit for the Task Force. The market provides the best means for the development of alternative technologies. Any action taken by the Task Force or the government in this area needs to be a result of issues of safety and effectiveness and not a result of security activity. Security issues should not drive alternative technologies.

- Moving to a different sterilization technology would be an extremely costly and lengthy process, and would serve to increase healthcare costs. A rapid shift in technologies may even disrupt the supply of sterile medical devices. Many products such as medical devices are specifically designed to use gamma irradiation. Many life saving products would not be on the market today if it were not for gamma irradiation. For many products, gamma irradiation is the only existing technology.

- You must consider the cost/benefits to alternative technologies. In many cases, alternative technologies represent a more plausible security risk than the use of gamma irradiation. Many technologies do not have the safety record.

- A shift to less competitive and effective technologies would accelerate the erosion of the U.S. market share by encouraging manufacturers to move production offshore where gamma continues to be widely accepted. Unilateral shift in technology by the USE does not eliminate worldwide use of the technology. Other countries with potentially less control on radioisotope security may employ the technology.

- Alternative technologies are a grand idea, but alternative technologies are most likely a pipe dream. The fundamental technology behind radiation-based well logging is quite mature, and various alternatives have been investigated.

- Need to watch for unintended consequences. Example teletherapy not in use in the U.S. but went to developing countries that have less security. Result turning up in scrap metal, etc. Other countries may have issues that limit alternatives such as unreliable power supply and lack of expertise for dose calculations. Unless there is agreement from all countries, alternative technologies may cause unintended consequences.

- Need to involve the industry in the discussion as to advantages and disadvantages.

Task Force Response: The Task Force considers the adoption of alternative technologies as an important tool for reducing the risk of sealed sources, as alternatives could eliminate the use of a source entirely, make it less dangerous as an RDD source, or reduce its attractiveness for malicious use. The Task Force is aware of the stakeholders' concerns and briefly discusses them in the Alternative Technologies chapter. These issues are complex and require further analyses to ensure they are properly addressed. The Task Force recommends continued deliberation and studies on the benefits and impacts of promoting and eventually using alternative technologies.