



HEALTH PHYSICS SOCIETY

“Specialists in Radiation Safety”

September 8, 2005

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**RE: Actions Needed to Better Secure Vulnerable Radioactive Sources:
A Contemporary Report Prepared by a Working Group of the
Health Physics Society – Public Release**

As President of the Health Physics Society, I am making available a report that provides a review and assessment by a Working Group of the Health Physics Society (HPS) of the current status of institutional controls and programs for the security of vulnerable radioactive sources.

HPS President Raymond A. Guilmette chartered a Working Group of experts in June 2005 to prepare a report and recommendations to the HPS Scientific and Public Issues Committee (S&PIC) for its use in evaluating the need to either update or create new HPS position statements regarding security of radioactive sources. Since the Working Group had not completed its task at the time I assumed the position of HPS President in July 2005, I extended the Presidential charter of the Working Group so it could complete its assignment. On September 1, 2005, the Working Group Chair, J. Scott Kirk, forwarded me the completed report.

The report consists of a **background report and assessment** of the current status of actions directed at improving control over radioactive sources that are vulnerable to being obtained for malicious use, and an **appendix** with specific Working Group recommendations for the S&PIC's consideration based upon the background report and assessment. The Rules of the HPS assign the S&PIC the responsibility “for the preparation of impartial scientific and technical statements as it deems necessary.” The rules further require that “[d]ocuments and position statements and drafts thereof” not be released outside the Society (even for peer review) without certain actions by the Board of Directors. However, as President, I have the responsibility for directing the distribution of Society materials.

Having reviewed the report of the Working Group, I consider the background report and assessment to be an excellent document that contains factual information about the current status of the control of radioactive sources, but it does not contain any specific recommendations or positions that can be taken as positions of the HPS. I also consider this information is of immediate interest and use to legislative and regulatory decision makers. Therefore, I am authorizing the public distribution of the background report without the separate appendix that contains specific recommendations and positions. The appendix has been transmitted to the S&PIC for its consideration and action in accordance with the Rules of the HPS.

Since this report is the work of a group of experts that did it as a voluntary effort, it is not presented as a complete compilation of all actions that have been taken related to security of radioactive sources, but rather as a compilation of those things within the experts' purview that they considered important to the HPS S&PIC. In addition, this is a very rapidly changing area with actions completed and others started on an almost daily basis. Therefore, this report represents the status of the items discussed as known to the members of the Working Group on the date of the report, i.e., September 1, 2005.

My sincere thanks to the members of the Working Group for volunteering their time and effort to complete this report. Copies of the report will be available on the HPS Web site, hps.org, as a "[Discussion Paper](#)" until such time as the HPS President deems it no longer necessary.

Sincerely,

A handwritten signature in cursive script that reads "Ruth E. McBurney".

Ruth E. McBurney, CHP

**Actions Needed to Better Secure Vulnerable
Radioactive Sources: A Contemporary
Report**

*Prepared by
A Working Group of the Health Physics Society*

September 1, 2005

Executive Summary

The Health Physics Society (HPS) Position Statement, *State and Federal Action Is Needed For Better Control of Orphan Sources*, was issued in April 2002 to convey the Society's view that "the orphan source problem is a radiation safety issue of high priority needing national and international attention." Although publication of the position statement followed the events of September 11, 2001, by only six months, the document was not specifically focused on the potential for malevolent use of radioactive sources. The position statement more broadly addresses improvements to institutional systems and infrastructure needed to recapture orphan sources and to prevent sources from becoming orphaned.

In June 2005, the HPS president chartered a Working Group (WG) of experts to review the position statement for possible updating, taking into consideration relevant developments that have occurred since publication of the position statement. This report contains the results of the WG's assessment of the current situation. Specific recommendations from the WG based on this report are being provided to the HPS Scientific and Public Issues Committee (S&PIC) in a separate appendix for its consideration and incorporation into Society position statements as it see fit.

Major developments since publication of the position statement include the following:

- Issuance of a major revision to the International Atomic Energy Agency's (IAEA) *Code of Conduct on the Safety and Security of Radioactive Sources (Code of Conduct)* and supporting guidance relating to the safety and security of sealed sources.
- Issuance of a Nuclear Regulatory Commission (NRC) rule that implements the IAEA *Code of Conduct* provisions and guidance on the export and import of radioactive materials.
- Issuance of orders by the NRC requiring safety and security enhancements for transport of radioactive materials and the manufacturing and distribution of sources.
- Actions by the NRC and the Agreement States to develop an inventory of radioactive sources currently possessed by licensees.
- Publication of an NRC proposed rule to create a national tracking system for radioactive sources.
- Restructuring of the Off-site Source Recovery Program by the Department of Energy (DOE) with support from the Congress.
- Drafting by the Department of Homeland Security (DHS) of a nuclear sector-specific plan covering protection of nuclear reactors, radioactive materials, and radioactive waste (as input to the National Infrastructure Protection Plan).
- Establishment within DHS of the Domestic Nuclear Detection Office.
- Enactment of the *Energy Policy Act of 2005*, containing specific provisions for radioactive source protection.

Remaining barriers to, and areas for improvement in, the security of radioactive materials that have been identified in this report include the following.

- Incorporating the evaluation of alternative technologies into the radioactive source licensing process, where appropriate.
- Incorporating naturally occurring and accelerator produced radioactive materials (NARM) into the import/export rule now that NRC has the authority and responsibility to regulate “discrete sources” of ^{226}Ra , accelerator-produced radioactive materials, and naturally occurring radioactive materials.
- Evaluating the inclusion of Category 3 sources in the proposed National Source Tracking System with a specific interest in identifying aggregation of these sources.
- Establishing financial surety requirements in the licensing and procurement of high-risk sources, which would serve to move towards implementation of such provisions contained in *Code of Conduct*.
- Maintaining a federal registry of manufacturer’s special form testing documentation that is available to any source holder for purposes of transporting special form materials.
- Reauthorizing and approving the 6M and 20WC specification packagings as Type B shipping containers.
- Ensuring accessible and safe options are available for dispositioning sealed sources and Class B/C low-level radioactive waste (LLRW).
- Reducing the current backlog of sources and devices awaiting recovery and subsequent disposal by providing a waste disposition pathway for materials recovered as a national security activity at the appropriate DOE facility for the type of materials involved (Waste Isolation Pilot Plant (WIPP) for transuranic waste (TRU) and the Nevada Test Site (NTS) for LLRW).
- Seeking ways to access the vast disposal capacities at uranium mill tailings impoundments for commercial and government owned sources of non-11e.(2) by-product material in a risk-informed manner.

Introduction

On June 3, 2005, Ray Guilmette, President of the HPS, convened a Working Group (WG)¹ of appropriate experts and instructed them to take a fresh look at the HPS Position Statement titled *State And Federal Action Is Needed For Better Control Of Orphan Sources* issued in April 2002. The WG was charged with reviewing actions that have been undertaken by national and international organizations responsible for securing radioactive materials that could be used for malevolent purposes. Furthermore, President Guilmette instructed the WG to prepare a report of its findings and recommendations for review by the S&PIC. Shortly thereafter, the WG embarked on this assignment and prepared a contemporary report on this subject. Since the final report was not completed prior to the end of President Guilmette's term in office, President Ruth McBurney asked the WG to continue its work and provide the report to her.

In the aftermath of the terrorist attacks in the United States on September 11, 2001, the international community has risen to the task of promoting uniform policies for securing certain radioactive materials. Important initiatives are also underway to reacquire fissile materials and other high-risk radioactive sources to prevent their use as an improvised nuclear, radiological exposure, or dispersal device² (IND, RED and RDD, respectively). In the United States, security measures have recently been greatly enhanced at commercial and government-owned nuclear facilities, thus reducing the potential of these facilities for targeting by terrorists. While many of the actions have already been undertaken by federal governmental agencies, the United States Congress has enacted legislation that would duplicate many of their efforts. Therefore, we have highlighted several statutory provisions that have since been overcome by events.

Since issuance of the HPS position statement on actions needed to better control orphan sources, many of the recommendations have been implemented within the United States and abroad. In the United States, a national tracking system has been initiated by the NRC and Agreement States (AS) with the purpose of maintaining an inventory of certain sealed sources. In addition, the federal government has established a source recovery program to collect and safely store certain disused sources across the United States. Nevertheless, significant efforts are still required to address many of the existing barriers to further the protection of national security. As such, the WG has highlighted specific areas needing attention to improve the efficacy of existing federal programs.

The content of the WG's report is intended to contemporarily reflect, as of the date of the report, the status of actions that have been taken since September 11, 2001 to improve the security of radioactive materials that could be used for malevolent purposes. We intend for our insights to provide a basis for the HPS to effectively communicate needed actions with other stakeholders and decision makers on this important subject. Specific

¹ The Working Group was comprised of Ralph Andersen, Keith Dinger, Brian Dodd, Barbara Hamrick, Joel Lubenau, Michael Pearson, J. Andrew Tompkins, and Jim Tripodes. J. Scott Kirk served as chair of the Working Group.

² Radiological Dispersal Devices are typically referred to as "Dirty Bombs".

recommendations from the WG based on this report are being provided to the HPS Scientific and Public Issues Committee (S&PIC) in a separate appendix, which is not intended for public release, for the S&PIC's consideration and incorporation into position statements as it sees fit. In this appendix, the WG calls out what Congressional and regulatory actions it feels are needed to break down barriers and ensure safe and secure disposal pathways for all radioactive sources.

The Energy Policy Act of 2005

The President of the United States has signed legislation enacted by Congress titled the *Energy Policy Act of 2005* (the *Act*). The *Act* contains provisions to strengthen the security of radioactive materials that could be used to make a dirty bomb. These provisions were previously contained in the *Nuclear Security Act of 2005*, which was approved by a Senate committee and was awaiting action on the Senate floor. The *Nuclear Security Act of 2005* adopted many of the provisions from the Clinton/Markey *Dirty Bomb Prevention Act*.

In a press release³ on this matter, Senator Clinton stated that this legislation was intended to fill gaps in our current dirty bomb prevention efforts and believed that it will improve the security over radioactive materials by ensuring that they do not fall into the hands of those who wish to do us harm. As stated in the press release, radioactive sources are numerous in the United States and not all radioactive materials are subject to federal oversight. The Nuclear Regulatory Commission (NRC) reports that about 157,000 general and specific licenses have been issued authorizing the use of radioactive materials for industrial, medical, and other uses. About two million devices containing radioactive sources have been distributed under these licenses. A report from the General Accountability Office in 2003 found that since 1998, there have been more than 1,300 incidents where radioactive sources were lost, stolen or abandoned. While few of these sources and incidents present potential dirty bomb threats, it is clear evidence that we need to improve oversight of radioactive materials.

Specific sections of the *Act* aim to correct deficiencies in security by taking immediate action⁴ to close gaps in the control and oversight of these materials. This legislation gives the NRC the authority to provide oversight of ²²⁶Ra and other naturally occurring and accelerator-produced radioactive materials (NARM) that have historically remained outside of federal control. The Department of Energy (DOE) considers ²²⁶Ra one of the top ten isotopes of concern for use in a dirty bomb, and it is on the list of radioactive sources that the United States has agreed to control as part of adhering to the IAEA's *Code of Conduct*.

³ See Senator Hillary Rodham Clinton's press release titled, *Senate Panel Approves Clinton Legislation to Help Prevent a Dirty Bomb Attack*, issued June 7, 2005, <http://clinton.senate.gov/news/statements/details.cfm?id=239876&&>

⁴ See Title VI - *Nuclear Matters*, Subtitle D - *Nuclear Security* of the *Energy Policy Act of 2005*.

The legislation would also require the NRC within six months to enact a "cradle to grave" tracking system to ensure that the location of all radioactive sources of concern is known at all times. The bill also requires the establishment of "import and export controls" for certain radioactive sources to provide a better understanding of what is coming into and leaving our country as part of our efforts to control these materials.

In addition, the *Act* directs the National Academy of Sciences (NAS) to conduct an assessment of whether some current industrial uses of radiation could be replaced with non-radioactive or less dangerous radioactive materials, and it creates an interagency Task Force on Radiation Source Protection and Security that will provide recommendations to Congress and the NRC on the safety and security of radioactive sources. The assessment of alternative technologies is consistent with the HPS position statement on orphan sources, which calls for "potential users [to] examine alternative technologies 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 radiation/radioactivity." While the NAS is tasked with a "current usage" assessment, the HPS position calls for the evaluation of alternative technologies to be a part of the licensing of new sources in the future.

Providing for the Security of Radioactive Sources Adds a New Paradigm to Radiation Safety

The HPS has not developed a position on actions needed to better ensure the security of radioactive sources that are in the regulatory system (i.e., not orphan). However, over the course of the past year significant progress has been made at home and abroad to establish a unified system for categorizing radioactive sources that could pose a significant risk to national security. Various governmental agencies have differing and competing objectives regarding national security resulting in differing thresholds for the types of radioactive sources needing additional security controls.

Adequate regulatory controls have been in place to prevent theft and diversion of fissile materials for decades. However, the recognized potential for use of other radioactive materials in ways affecting large populations, impeding access to public and private property, and impacting our local and national economy adds a national security dimension that is new to existing regulators. As such, the WG has addressed recent initiatives that have been developed to establish international/national security protocols needed to enhance the security of certain radioactive sources that could pose significant adverse consequences to our society's public, economic and environmental health.

International Atomic Energy Agency's Code of Conduct on the Safety and Security of Radioactive Sources

In response to the terrorist attacks in the United States on September 11, 2001, the national and international communities undertook a review of the laws and guidance affecting the control of radioactive sources, including international transfers. As a result of these efforts, in September 2003, the Board of Governors of the IAEA approved a

major revision to the *Code of Conduct*. Guidance supporting the *Code of Conduct*, specifically relating to the export and import of sealed radioactive sources, was subsequently approved in September 2004. A major purpose of the *Code of Conduct* is to guide IAEA member states in the development and harmonization of policies and regulations for improving the control of certain radioactive sources.

The *Code of Conduct* outlines broad measures that countries should implement to ensure that certain radioactive sources are adequately controlled to protect public health and the environment. Amongst other things, specific guidelines are provided calling for member states to at least establish a national registry for Category 1 and 2 (Annex I) radioactive sources and to provide between countries using established IAEA protocol or other mechanisms information concerning the loss of control of radioactive sources from any incident with potential transboundary effects. The *Code of Conduct* also includes seven provisions related to controlling the import/export of Category 1 and 2 radioactive sources. For Category 3 sources, member states recognized the need for proper security of such sources, but concluded that security measures could be adequately addressed by a combination of domestic safety/security oversight and by recognizing the overall competence of the industry involved with using the radioactive materials.

The *Code of Conduct*, Table 1, provides a categorization by activity levels for radionuclides that are commonly used. These are based on the activities of various radionuclides (D-values) that define a “dangerous source” (i.e., a sealed source) that could, if not under control, give rise to exposure sufficient to cause severe deterministic effects. A more complete listing of radionuclides and associated activity levels corresponding to each of the five categories, and a fuller explanation of the derivation of the D-values, may be found in IAEA, *Categorization of Radioactive Sources*, Safety Standards Series, RS-G-1.9, IAEA, Vienna (2005). This document also provides the underlying methodology that could be applied to radionuclides not listed.

Differing Views for Categorizing High Risk Sources

Recently, NRC declined a request from the DOE National Nuclear Security Administration (NNSA) to work to modify the threshold values in the *Code of Conduct*. These discussions stem from NNSA’s decision to adopt some different thresholds needed to guide work conducted by its *Global Threat Reduction Initiative* (GTRI) responsible for identifying and securing radioactive materials posing a security threat to the United States. The criteria⁵ used by NNSA were based on detonation of an RDD that would cause sufficient economic and social impacts to threaten the United States’ interest due to contamination of land areas and buildings, whereas the *Code of Conduct* thresholds are based on acute health effects. As such, threshold criteria for Category 1 materials cited in the *Code of Conduct* are generally much higher than the GTRI values, while the Category 2 levels are lower. Furthermore, GTRI’s threshold values for ²⁴¹Am and ²³⁸Pu are much lower since resuspension of these radionuclides can readily exceed the Environmental

⁵ NNSA criteria are based on a reference dose of 2 rem/year consistent with the EPA’s Protective Action Guide for relocation of persons following a nuclear/radiological incident.

Protection Agency's (EPA) Protective Action Guides (PAGs) at small levels of radioactivity.

The NRC stated⁶ that it continues to believe that the GTRI's use of a different set of radionuclides than that contained in the *Code of Conduct* will be confusing to other countries, but also recognized NNSA's decision to proceed forward based on different priorities. In fact, the technical basis of IAEA Category 1 and 2 thresholds was developed from consequence analyses that account for radionuclide dispersion, but do not account for the economic and social impacts that would ensue in the event of a terrorist attack involving the use of radioactive materials. While differences in the programmatic objectives of these two agencies exists, the NRC has stated that it is committed to work with NNSA and other federal agencies to converge on the use of a common set of thresholds needed to provide "a consistent national regulatory framework that all agencies can use to achieve their respective goals." NRC reiterated its position that federal agencies need to support the unified position of the United States on the security of radioactive sources and to help the international community implement unified guidance.

In an RDD attack radiation injuries and deaths will be relatively small compared to psychosocial and economic damage. Significant psychosocial effects were observed in the aftermath of the Goiania, Brazil radioactive contamination accident. With respect to economic damage, the cost for a contaminated steel mill to shut down and clean up after accidentally melting a radioactive source has been as high as \$23 million and has averaged \$12 million per event, even though the contamination is confined to specific pathways within mill property. Further, only one of the 22 accidents of this type in the United States involved a source exceeding IAEA Category 1 or 2 criteria. The economic consequences of radioactive contamination caused by similar radioactive sources dispersed by an RDD into a public area would be far greater.

As required by the *Act*, efforts by the NAS to evaluate alternative technologies and the work of the newly formed Task Force on Radiation Source Protection and Security that was established under this legislation should be helpful to determine if additional thresholds should be established to better control certain radioactive materials and to prioritize the reacquisition of sources that pose unacceptable risks to national security, public health and the environment.

Import/Export Rulemaking for High-Risk Sources

In June 2004, the United States committed at the Group of Eight Industrial Nations (G-8) meeting on Sea Island, GA to implement the import/export provisions of the *Code of Conduct* by December 2005. The NRC participated in the development of the guidance supporting the *Code of Conduct*, and the major elements of this guidance are reflected in the NRC's revision of Title 10, Code of Federal Regulations (CFR), Part 110 titled *Export and Import of Nuclear Equipment and Material* issued on July 1, 2005. The

⁶ See Letter from Nils Diaz to Linton Brooks, dated May 24, 2005 (ADAMS Accession Number ML050740487).

United States became the first country⁷ to implement the import/export provisions of the *Code of Conduct* when it issued the final rule⁸ on July 1, 2005. This rule becomes effective on December 28, 2005.

Prior to issuance of the final rule, exports from, and imports to the United States, of special nuclear, source and byproduct material, had been completed pursuant to general licenses offered (for exports) in 10 CFR 110.21, 10 CFR 110.22, and 10 CFR 110.23, respectively (with respect to the type of material), and (for imports) in 10 CFR 110.27 (for all three types of material). Although the previous rule contained restrictions on the form and activity of certain materials, the restrictions were not consistent with the *Code of Conduct*, and did not require specific notification of the recipient government for these shipments.

The final rule currently requires a specific license for the export or import of radioactive materials exceeding the Category 2 threshold in Table 1 of the *Code of Conduct* with the exception of ²²⁶Ra, which the NRC did not have authority to regulate pursuant to the Atomic Energy Act of 1954, as amended (AEA) at the time of promulgating the final rule. (The inclusion of ²²⁶Ra in the rule is expected to be part of the implementation of the provisions in the *Act* that reclassify ²²⁶Ra as a by-product material under the control of the NRC.) The rule also requires specific government-to-government communication and consent for the export from, or import into, the United States of radioactive materials exceeding the Category 1 threshold in Table 1 of the *Code of Conduct*. In addition, unlike the *Code of Conduct*, the rule applies to bulk radioactive material exports and imports, and not just sealed source exports and imports.

A survey conducted by NRC⁹ indicated that this rule will have the largest impact on companies in the United States that export threshold quantities of ²⁴¹Am, ⁶⁰Co, ¹⁹²Ir, and ¹³⁷Cs. For 2003, NRC reported 740 export shipments of these four radionuclides, and of these approximately 700, or more than 95 percent involved Category 2 amounts of ¹⁹²Ir by two companies in the United States. The export of ¹⁹²Ir was made to 30 different countries, with about 500 shipments made to five countries: South Korea, Malaysia, Canada, Mexico and Singapore. The only transfer of Category 1 sources involved about 10 shipments by seven different companies to Canada of ⁶⁰Co, with activities ranging from 1 to 999 kilocuries. The NRC reported that in 2003 there were approximately 20 exports of Category 2 quantities of ²⁴¹Am by three companies, and only one export of ¹³⁷Cs (40 Curies) to Singapore. With respect to ²²⁶Ra, NRC noted that no sources exceeding the Category 1 or 2 thresholds were identified during their survey.

⁷ Of the countries that have agreed to implement the import/export provisions of the *Code of Conduct*, only Canada and Australia, in addition to the United States have committed to do so by the beginning of 2006.

⁸ See Federal Register, *Export and Import of Radioactive Materials: Security Policy*, Vol. 70, No. 126, published July 1, 2005.

⁹ See NRC Final Rule, *Export/Import of Nuclear Equipment and Radioactive Materials: Security Policies*, Regulatory Analysis (ADAMS Accession No. ML051430150).

The NRC plans to implement the new rule in a flexible manner, evaluating the needs of the prospective licensees and their proposed activities on a case-by-case basis. In addition, the NRC also recognizes that this rulemaking may potentially place companies inside the United States at a competitive disadvantage over industries located in other countries that have yet to ratify the import/export provisions of the *Code of Conduct*. Licenses may be issued for single shipments where, for example, the proposed recipient country has limited experience with its regulatory infrastructure. On the other hand, a broad export license may be issued, covering multiple shipments and radionuclides, where the recipient country has a mature regulatory infrastructure, and the proposed recipients are known and competent. A similar evaluation will be made with respect to import licenses.

As previously reported, the *Act* contains provisions that would require a rulemaking by NRC (within 18 months from enacting this legislation) to include discrete sources of NARM. This legislation requires NRC to define a “discrete source” of NARM and solicit stakeholder input in the development of this rule, as a revision to 10 CFR Part 110.

Under this legislation, NRC is required to establish a rule that covers all sources of accelerator-produced radioactive materials and sources of naturally occurring radioactive materials (NORM) that poses a similar risk as that posed by a discrete source of ^{226}Ra . However, since a specific benchmark has yet to be established for determining what levels of risk to public health and/or national security (e.g., Category 1-5 or 2 rem/year EPA PAG for relocation) would be posed by a “discrete source of ^{226}Ra ,” the scope of this rulemaking may be far reaching. In addition, the NRC is required to seek consultation with the State agencies and use “Consensus State Standards¹⁰” to the extent practical while developing rulemakings needed to implement this legislation. To move forward within the 18-month period, it is expected the NRC will plan to conduct several workshops in the coming months to begin implementation of this rulemaking.

Important points regarding this rule include:

- The rule requires a specific license for the export from, or import into the United States of radioactive material exceeding the Category 2 threshold in Table 1 of the *Code of Conduct*, and prior notification to the importing government authority of such shipments.
- The rule requires government-to-government communication and consent from the recipient government for the export from, or import into the United States of radioactive material exceeding the Category 1 threshold in Table 1 of the *Code of Conduct*.
- The rule expands control relative to the *Code of Conduct* to include exports and imports involving bulk radioactive materials, rather than only sealed sources.
- The rule provides flexibility in the licensing process based on the history of the prospective licensees, their proposed activities, and the status of the regulatory

¹⁰ See Conference of Radiation Control Program Directors (CRCPD), Suggested State Regulations (SSRs), http://www.crcpd.org/SSRCRs/TOC_4-2004-on-line.pdf

infrastructure in the countries affected by exports from, and imports into the United States, under the proposed license.

Developments in Homeland Security

On October 8, 2001, the President signed an executive order to establish the Office of Homeland Security with a mission to develop and coordinate the implementation of a comprehensive national strategy to secure the United States from terrorist threats or attacks. Specifically, the Office was tasked to work with executive departments and agencies, state and local governments, and private entities to ensure the adequacy of a national strategy “for detecting, preparing for, preventing, protecting against, responding to, and recovering from terrorist threats or attacks within the United States.”

On July 16, 2002, the Office of Homeland Security produced the *National Strategy for Homeland Security* (National Strategy). The National Strategy aligns and focuses homeland security into six critical mission areas, including: (a) intelligence and warning, (b) border and transportation security, (c) domestic counterterrorism, (d) protecting critical infrastructure and key assets, (e) defending against catastrophic threats, and (f) emergency preparedness and response.

Among the critical mission areas, the National Strategy highlights several tasks that are germane to national efforts to better secure vulnerable radioactive sources, including the following:

- Prevent terrorists from using transportation conveyances or systems to deliver implements of destruction.
- Enable effective partnership with state and local governments and the private sector to develop a national infrastructure protection plan – including protection of the nuclear sector of the national infrastructure.
- Prevent terrorist use of radiological and nuclear weapons through better sensors and procedures.

The Homeland Security Act of 2002 established the Department of Homeland Security (DHS) as an executive department within the United States government. On January 23, 2003, the President issued an executive order to establish the DHS with a primary mission to:

- (a) prevent terrorist attacks within the United States ;
- (b) reduce the vulnerability of the United States to terrorism; and
- (c) minimize the damage and assist in the recovery from terrorist attacks that do occur within the United States

Responsibility for implementing the National Strategy carried over from the Office of Homeland Security to the Department of Homeland Security. Under the DHS, there have been several developments that specifically address aspects of national efforts to better secure radioactive sources. These developments are described in more detail below.

Nuclear Sector Coordinating Council – Radioisotopes Subgroup

As part of implementation of the National Strategy, on December 17, 2003, the President issued Homeland Security Presidential Directive 7 (HSPD-7), *Critical Infrastructure Identification, Prioritization, and Protection*. HSPD-7 directs the DHS and other federal agencies responsible for infrastructure protection to collaborate with appropriate private sector entities to identify, prioritize and coordinate the protection of critical infrastructure and key resources and to facilitate sharing of information about physical and cyber threats, vulnerabilities, incidents, potential protective measures and best practices. Seventeen critical infrastructure/key asset sectors were identified, including the nuclear sector.

As part of carrying out HSPD 7, DHS approached the nuclear sector to establish a Nuclear Sector Coordinating Council (NSCC) to provide primary liaison between the government and the nuclear industry on homeland security matters. Although the initial focus of the NSCC was on nuclear power reactors, test, research, and educational reactors, and fuel cycle facilities, it was recognized the scope should be expanded to include the broader industry that manufactures, imports, exports, distributes, utilizes, transports, and disposes of radioactive materials.

In early 2005, the NSCC-radioisotopes subgroup was established to develop and implement strategies that will enhance the physical security and emergency preparedness of the radioisotopes sector under the auspices of the National Infrastructure Protection Plan. Specifically, the NSCC-radioisotopes will voluntarily collaborate with the Nuclear Sector Government Coordinating Council (made up of the DHS and sector-related government agencies) to identify and implement measures to prevent radioisotopes of concern from being stolen, diverted and used in RDDs or REDs. The HPS is represented on the NSCC-radioisotopes.

National Infrastructure Protection Plan – Sector-Specific Plan for Nuclear Reactors, Materials, and Waste

Under HPSD-7, the DHS is collaborating with the sector-related government agencies and the private sector (through the NSCC and NSCC-radioisotopes) to develop a sector-specific plan for nuclear reactors, waste, and materials to serve as an input to the National Infrastructure Protection Plan, which describes the necessary activities to identify critical infrastructure/key resources assets and reduce their vulnerability to terrorist attacks, as well as to facilitate coordination of protection measures and information-sharing. Among the goals and objectives being considered in the draft plan is a goal to “prevent nuclear and radioactive material from being used for malevolent purposes.” The objectives for the goal cover material entering or leaving the United States, as well as material within

the United States. The final draft of the nuclear sector-specific plan is expected to be completed by the end of September 2005.

Domestic Nuclear Detection Office

The Domestic Nuclear Detection Office (DNDO) was established in April 2005 to consolidate efforts within the DHS and establish linkages across federal agencies for the deployment of a national nuclear detection system to identify and report attempts to import or transport a nuclear device or fissile or radioactive materials intended for illicit use. Among its primary responsibilities, the DNDO will:

- conduct an extensive research and development (R&D) program to improve detection capabilities;
- enhance effective information and intelligence sharing related to nuclear detection;
- enhance the nuclear detection capabilities of Federal, State, and local governments and the private sector to ensure a coordinated response; and,
- establish standards, response protocols, and training across Federal, State, and local levels to ensure that detection leads to timely response actions.

Regulatory Actions to Implement a National Tracking System

The HPS Position Statement titled *State And Federal Action Is Needed For Better Control Of Orphan Sources* contains a specific recommendation to develop a confidential national tracking system of radioactive sources in the United States. To date, progress has been made to implement this recommendation and the recently enacted *Act* directs the NRC to establish regulations requiring development and use of such a tracking system.

The *Code of Conduct* directs regulatory agencies to establish a national registry for at least Category 1 and 2 radioactive sources. Since the United States has made a non-legally binding commitment to adhere to the *Code of Conduct*, the NRC has initiated work to develop a national source tracking system. The NRC began work to develop a national source tracking system reflecting the inventory of high-risk sources (*Code of Conduct*, Category 1 and 2 radioactive sources) present in the United States in 2003. However, since current regulations do not require reporting of source inventories, NRC and the AS only know the quantities a given licensee has been authorized to use, not what a licensee has at a given moment. Therefore, the first step that was taken was the creation of an interim inventory -- a "snapshot" of the existing sources. The interim inventory is necessary to provide NRC and the AS with greater detail on the source population, to plan the development of the final source tracking system.

From October 2003 to September 2004, it was reported¹¹ that the NRC and the AS contacted over 2600 licensees authorized to possess quantities of radionuclides that could exceed the thresholds in aggregate. The inventory asked for details of the sources, additional data such as the number of locations of sources under the license, disposition plans, and import/export aspects. Approximately 99.8 percent of the licensees contacted provided responses. Until a national tracking system is established, NRC will annually contact all licensees authorized to possess quantities of radionuclides that could exceed IAEA thresholds and will ask for the details on exceeding the thresholds.

The second round of the interim inventory began in December 2004. Approximately 25 percent of the licensee population will be contacted each quarter until a national source tracking system is established. Although participation is currently voluntary, licensees are encouraged to provide the information when requested and will be provided the information currently in the database and requested to update it. Licensees can update the information either on-line or by mail.

On July 28, 2005, NRC issued a proposed rulemaking¹² titled *National Source Tracking of Sealed Sources* (10 CFR Part 20) that will require licensees to use the National Source Tracking System for at least Category 1 and 2 sealed sources. In developing the *Code of Conduct* provision for a source tracking system, the IAEA concluded that Category 3 sources carried a potential risk of harm that warrants inclusion in a tracking system. However, participating Member States did not want to make inclusion of Category 3 sources in the national registry a requirement because the large number of such sources and the economic cost for tracking them could be overly burdensome. In their proposed rulemaking, the NRC requests specific information regarding whether or not the rulemaking should also apply to Category 3 sealed sources. At this time, the NRC does not plan to include aggregate quantities of sealed sources to determine the applicability of this rule. The overall goal is to create a working tracking system by the end of 2006.

NRC Issues Additional Security Orders

Since the events of September 11, 2001, the NRC has issued numerous Advisories and Orders to NRC and Agreement State radioactive materials licensees, instructing these licensees to take a number of additional actions to further enhance security. Some of the measures implemented by the licensees in response to the Advisories included augmented security forces and capabilities, installation of additional physical barriers, enhanced coordination with law enforcement, and more restrictive site access controls. The Orders include specific compensatory measures to protect against an insider terrorist attack, and generally include requirements to attain goals similar to those addressed by the Advisories for those licensees in possession of certain high-risk sources.

¹¹ See NRC publication, NMSS Quarterly Newsletter, No. 04-04, December 2004, <http://www.nrc.gov/reading-rm/doc-collections/nuregs/brochures/br0117/04-4.pdf>.

¹² See Federal Register, Volume 70, Number 144, published on July 28, 2005.

The specific compensatory measures, which include Safeguards Information, were sent as attachments to the Orders. These measures have not been released to the public; however, redacted versions of the Orders are available at the NRC's web-site¹³. These additional actions by the NRC serve to further enhance the security of high-risk radioactive sources.

Issues Affecting the Off-Site Source Recovery & Barriers Preventing the Timely Disposition of Disused Sources

The HPS Position Statement titled *State And Federal Action Is Needed For Better Control Of Orphan Sources* contained specific recommendations for restructuring the present system for the possession, transfer and disposal of unwanted radioactive sources. We also recommended creating temporary repositories where such sources could be stored until viable waste dispositioning pathways had been established. Since issuance of our position statement, the DOE's Off-site Source Recovery Program (OSRP) has achieved great successes. However, the WG reports below on barriers that inhibit the timely disposal of sources controlled by DOE and commercial facilities located across the nation. As such, Congressional and federal regulatory agency actions are needed to address shortfalls related to transportation regulations and radioactive waste management which are obstructing the full realization of the mission of safely securing radioactive materials that pose a threat to national security and public health.

Off-Site Source Recovery Program

In 1999, DOE began to sponsor the OSRP that intended to eliminate excess and unwanted radioactive sealed sources from the environment that have no path to permanent disposal. The OSRP, operated by Los Alamos National Laboratory in Los Alamos, New Mexico, was initially tasked with recovering the known backlog of certain excess and unwanted radioactive sealed sources awaiting recovery and subsequent disposal that contain actinides in quantities exceeding the Greater than Class C concentrations established in 10 CFR Part 61 from licensees across the United States. Initially, the OSRP scope of work included recovering sources containing ²³⁸Pu, ²⁴¹Am, and ²³⁹Pu, while pursuing solutions for recovery and storage of other isotopes. This included sources from the commercial sector and sources from state agencies that were holding at-risk sources accepted from licensees.

The OSRP addresses homeland security by providing DOE with a means to aggressively remove from the environment radioactive materials which could pose a terrorist threat if improperly acquired. As of mid-summer 2004, more than 10,000 radioactive sources had been collected under OSRP. This total included a limited number of sources containing additional nuclides collected under an expanded mission defined in 2004 to include the ten nuclides identified in joint NRC/DOE agreements. Thousands of additional radioactive sources, including high-risk sources, are registered on OSRP's database awaiting recovery. It is estimated that over 18,000 such sources will become excess and

¹³ See <http://www.nrc.gov/reading-rm/doc-collections/enforcement/security/index.html>.

disused over the first decade of the 21st century, requiring recovery and secure management.

Despite the success of OSRP, the program has been subject to repeated funding cuts¹⁴. However, in late 2003, the program's prospects substantially improved. First, Congress restored cuts by adding supplemental funding to the fiscal year (FY) 2004 budget. Second, also in late 2003, DOE's leadership moved the program from the Environmental Management division, which did not consider the program a high priority, to NNSA, which considers the program an important national security endeavor. Because the program exceeded expectations in recovering disused sources, it ran out of money in early 2004. Wanting to keep the program moving forward, NNSA asked for and received permission to reprogram funds from other parts of DOE to the OSRP.

With the assignment to NNSA, and the importance of the project being recognized as a part of global threat reduction, the funding picture through FY 2006, as it is known now, appears to be adequate to support OSRP operations. Continued funding to support the expanded mission will be critical to continued OSRP success.

A related issue affecting the viability of disposal options is the absence of a requirement that potential users of radioactive sources prepay or otherwise provide financial surety for disposal costs as recommended by the Society in its position *State and Federal Action is Needed for Better Control of Orphan Sources*. As a result, licensees are usually uninformed of the costs and are unprepared to pay them when their sources reach the end of their service lives. Options such as return to the manufacturer are not necessarily cost-free and may not be available if the manufacturer discontinues business, as has already happened with some major manufacturers. Establishing such requirements would serve to more completely move toward implementation of the *Code of Conduct*.

Transportation Regulations – Barriers to Source Recovery

One barrier to vulnerable source recovery is a transportation issue related to the characterization and documentation of sealed sources as special form¹⁵ 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 Department of Transportation (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

¹⁴ See Center for Nonproliferation Studies, *Security of Radioactive Sources in the United States*, J.O. Lubenau and C.D. Ferguson, July 2004 (http://cns.miis.edu/pubs/nisexcon/pdfs/ob_0407e.pdf.)

¹⁵ A special form of radioactive materials is defined (see 10 CFR 71.4), in part, as either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule.

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.

The DOT and NRC recently initiated rulemakings to harmonize the transportation of radioactive materials in the United States with international standards endorsed by IAEA. In doing this, the transportation regulations issued by DOT and NRC did not provide provisions to maintain the availability of 6M and 20WC specification packaging for domestic use. The 6M and 20WC packagings are the most cost effective and simplest Type B packaging currently available. Many devices and sources are designed to be safely shipped in these packaging. With the implementation of HM-230¹⁶ the DOT discontinued their regulation of 6M and 20WC packaging and acceded to NRC's desire to phase these out of use by October 2008. NRC's singular statement on the topic was that the packaging no longer met the regulatory requirements for materials QA, testing, or a single complete Safety Assessment. The fact that the Transportation Branch of NRC was stranding devices was not deemed to be an important issue. Without the ability to freely and cost effectively ship sealed sources, a barrier against any affordable movement or disposition of the sources has been raised. The two specification packaging may be resubmitted for a new Certificate of Compliance, but only if private enterprise deems the investment of \$500,000 - \$1,000,000 to be worthwhile.

Generally, the WG cautions that any reduction in risk obtained through modification of transportation regulations must be balanced with the risk inherent in allowing excess, unwanted, or orphaned sources to remain prolonged in the environment as a result of impediments to recovery and management propagated by regulatory change. While it is necessary to have harmonization with international standards on radioactive material transportation requirements for international trade, it is not clear why allowance for other acceptable transportation methods can not continue to be used for domestic use.

Waste Disposal

One of the most significant root-causes currently affecting the ability to safely disposition sources that could be vulnerable to loss or theft is the lack of availability of disposal sites and the high cost of waste disposal. Consequently, sources under the control of the

¹⁶ Rulemaking that required changes to 49 CFR Parts 171,172,173, 174, 175, 176, 177 and 178, (Docket No. RSPA-99-6283 (HM-230). The purpose of this rulemaking initiative is to harmonize requirements of the HMR with the IAEA publication, entitled "IAEA Safety Standards Series: Regulations for the Safe Transport of Radioactive Material, 1996 Edition, Requirements, No. ST-1."

OSRP and commercial industry have no other choice but to elect “safe storage” of the sealed sources in their possession.

This national problem is exacerbated by existing legislation that impedes disposal of certain types of radioactive materials. The HPS has recently provided congressional testimony to the Senate Energy and Natural Resources Committee and informational materials to the Government Accountability Office (GAO) on issues related to low-level radioactive waste (LLRW) disposal. In the testimony and GAO materials, the HPS recommends a new regulatory framework for management and disposal of LLRW. These materials call for fundamental changes to allow general access for disposal of LLRW. The changes include a complete rework of the regulatory framework such that the classification of waste is based on the risk posed to human health and safety, not its origin or legislative stature. The HPS materials also call for amending or replacing the Low-Level Radioactive Waste Policy Act of 1985, as amended (LLRWPA) to:

- (1) allow non-DOE waste generators access to all existing licensed and permitted disposal facilities;
- (2) allow non-DOE waste generators access to existing DOE disposal facilities; and,
- (3) provide a new waste disposal capacity for all classes of LLRW at new facilities located on DOE sites, other government property, or privately owned land.

Changes to the manner in which LLRW is dispositioned is urgently needed, given that approximately two million devices¹⁴ containing licensed radioactive materials were estimated to be present in the United States as of 1998. While the majority of the two million sealed sources present in the United States could be disposed of at a waste disposal site licensed under 10 CFR Part 61, other higher activity sources (Greater Than Class C (GTCC)) may not be well suited for shallow land burial. It is estimated that of the two million sources in the United States, 20,000 to 250,000 might be considered GTCC waste once they reach the end of their useful life. The NRC has estimated this number to be around 27,000 GTCC sources. However, without a working national source database, it is unknown exactly how many sources will end up in the GTCC category. Of these, it is uncertain how many would be considered Category 1 or 2 under the *Code of Conduct*.

For commercially generated waste (i.e., non-DOE generated LLRW), as defined under the LLRWPA, waste generators that do not belong to a host Regional Compact can be prohibited from access to a disposal site. Currently, only three waste disposal sites accept commercially generated LLRW: (1) US Ecology, Richland WA, (2) Chem Nuclear Systems (CNS), Barnwell, SC, and (3) Envirocare of Utah, Clive, UT. Of these three sites, only CNS accepts sealed sources from generators located in non-compact member states. However, since South Carolina recently passed legislation to prohibit access to

the CNS facility by non-compact member states on July 1, 2008, licensees in 36 States¹⁷ will have no other choice but “safe-storage” of all sealed sources that otherwise could be dispositioned. Congressional action is required to ensure accessible and safe options are available for dispositioning sealed sources and Class B/C LLRW.

As stated above, the HPS believes that the current system for classifying wastes should be commensurate with the risk posed to public health and safety, not its origin and legislative stature. Commercially generated LLRW must be classified into one of four classes in accordance with regulatory requirements as specified in 10 CFR Part 61: Class A, B, C and GTCC. In 1981 this classification scheme was developed to support the Part 61 rulemaking for disposal of LLRW in near surface disposal facilities. Criteria are specified in §61.55 for short and long-lived radionuclides.¹⁸ For DOE generated wastes, the Performance Objectives¹⁹ specified in DOE Order 435.1 titled *Radioactive Waste Management* serve as the regulatory basis for determining whether or not a waste stream is suitable for burial at any one of the existing disposal facilities owned by DOE (e.g., Oak Ridge Reservation or Nevada Test Site (NTS)). While the Performance Objectives set forth in DOE Order 435.1 are similarly protective of public health, the waste classification criteria are separate and uniquely applicable to commercial waste generators. In fact, any commercial facilities that possess or generate GTCC wastes are prohibited from disposing of such sources at a Part 61 licensed facility. However, ⁹⁰Sr sources in excess of 60,000 curies used in radioisotope thermal-electric generators and some non-defense related, transuranic (TRU) wastes generated by DOE (that would be classified as GTCC²⁰ waste under §61.55) are currently being disposed of at sites under DOE control in accordance with Order 435.1.

Since DOE is required under the LLRWPA to take the responsibility for disposal of GTCC waste generated by non-DOE entities, it would seem only prudent to take a hard look at addressing these self-imposed barriers that are preventing disposal of certain sealed sources that have outlived the desired purpose²¹. Language in the LLRWPA

¹⁷ Only waste generators in the 14 states located in the Rocky Mountain, Northwest and Atlantic Regional Compacts will have access to dispose of Class B/C LLRW after July 1, 2008.

¹⁸ These criteria were selected, in part, to ensure compliance with the §61.41 annual doses limits to the general public to 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any organ.

¹⁹ DOE Performance Objectives specified in Order 435.1 limit annual doses to members of the public to 25 mrems from all exposure pathways (excluding radon), includes a separate limit of 10 mrems/y via airborne releases, radon limits of 20 pCi/m²/s at the surface of the disposal facility and site boundary of 0.5 pCi/L.

²⁰ As discussed in DOE Order 435.1, the reason for this distinction is that waste generated by DOE nuclear activities are much more variable than commercially generated waste. The distribution of radionuclides and their concentrations in DOE-generated wastes is almost continuous, with no natural breakdowns into specific waste classes or concentrations. However, commercially generated wastes have been demonstrated to segregate relatively easily into the waste classes set forth in §61.55.

²¹ On May 11, 2005, DOE issued an advanced notice of intent to prepare an Environmental Impact Statement for disposal of GTCC wastes (See Federal Register, Vol. 70, No. 90). The NRC has also set

requires that GTCC sources recovered from the commercial sector that is not DOE owned material be disposed of in an NRC licensed facility. Since there are no currently licensed NRC disposal facilities accepting GTCC wastes, this legislation places DOE in the position of holding, in storage, thousands of sources with no disposal pathway. In the next few years, the OSRP will confront this hurdle. It will need to find a permanent repository for the disused sources now in interim storage. However, funds for developing a permanent disposal plan for these materials have yet to be provided. Moreover, additional funding will likely be required to pay for a needed expansion of the OSRP beyond the GTCC mandate. In particular, many other unwanted sources that do not fit the narrow GTCC definition could pose a high risk for use in an RDD. The OSRP has been recovering some of those sources on a case-by-case basis, but a more systematic approach is needed to more effectively disposition these radioactive materials. This approach must facilitate transferring legal ownership of the sources/devices to DOE in a way that satisfies the requirements for commercial disposal of non-DOE materials recovered from the commercial sector.

Under the *Act*, disposal of discrete sources of NARM will be allowed for facilities licensed by the NRC, at facilities regulated by EPA under Subtitle C of the Resource Conservation and Recovery Act, and at facilities that ensures the protection of public health. While the legislation did not specifically include language of equivalency between the definition of 11e.(2) and 11e.(3)/11e.(4) by-product material it would allow disposal of discrete sources of NARM at uranium mill tailing impoundments. The aforementioned statement of equivalencies contained in the draft legislation on NARM that was proposed by HPS was intended to not only allow such disposal, but also to require DOE to take title of these sites in perpetuity as required under the Uranium Mill Tailing Radiation Control Act (UMTRCA). Considering that the *Act* requires use of State Consensus Standards, which support such disposal practices, federal governmental agencies could enter into a Memorandum of Understanding on the types of radioactive materials that could be permissible for disposal in a uranium mill tailing site and to which DOE would agree to take title of a site under UMTRCA.

forth a plan to weigh the options for such disposals (see SECY-05-0104), dated June 13, 2005. Lastly, the *ACT* addresses the DOE's responsibilities related to disposal of GTCC (See Section 631 of the *Act*).