U.S. CHINA RADIOLOGICAL SECURITY COOPERATION IN PREPARATION FOR THE 2008 BEIJING OLYMPIC GAMES

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ABSTRACT

Under the U.S. China Peaceful Uses of Nuclear Technology Agreement, the National Nuclear Security Administration's Global Threat Reduction Initiative, the Chinese Atomic Energy Authority, and the China State Environmental Protection Administration, cooperation has been implemented on a joint effort to secure and remove radioactive sources in Beijing, Tianjin and Qingdao in preparation for the 2008 Beijing Olympic Games. To date, cooperation has included joint site vulnerability assessments and subsequent physical protection upgrades at facilities near Olympic venues with International Atomic Energy Agency Category 1 sources, and removal of high-activity beta/gamma and neutron sources to regional interim storage sites within China. This paper outlines the accomplishments of this joint effort and planned future cooperation.

INTRODUCTION

In November 2006, the Global Threat Reduction Initiative (GTRI) of the U.S. Department of Energy (DOE) National Nuclear Security Administration (NNSA) and the Chinese Atomic Energy Authority (CAEA) initiated a joint cooperation program on radiological security under the auspice of the 1998 U.S. China Peaceful Uses of Nuclear Technology Agreement (PUNT). The initial scope of cooperation in radiological security was focused on securing potentially vulnerable radiological sources in the run-up to the 2008 Beijing Olympic Games. Participants included, Los Alamos National Laboratory (LANL), Sandia National Laboratory (SNL), and Oak Ridge National Laboratory (ORNL) from the U.S. and the State Environmental Protection Agency (SEPA), China Institute of Atomic Energy (CIAE), and other associated provincial government agencies from China.

COOPERATIVE FRAMEWORK

In 1985, an agreement[1] was signed initiating nuclear cooperation between the United States and China. The agreement allowed for the transfer of radiological sources, for medical and similar purposes, and outlined requirements for nuclear energy cooperation. In 1998, the DOE and the China State Development Planning Commission signed another agreement (PUNT), which focused on detailing areas of expanded cooperation.

In 2004, a Statement of Intent (SOI) was signed under the umbrella of the PUNT agreement. The SOI, for the first time, outlined cooperation on radiological security as an additional area of collaboration, reiterated statements from past agreements supporting the physical protection of nuclear materials and tied the cooperation to counterterrorism efforts. The SOI, supported by the preceding agreements, enabled the implementation of joint projects on radioactive source recovery, transport security, and physical protection efforts.

RADIOLOGICAL SECURITY PILOT PROJECT

The GTRI and CAEA discussed potential radiological security projects during a November 2006 meeting in Beijing. After a review of past GTRI-IAEA (International Atomic Energy Agency) efforts to protect the 2004 Athens Olympic Games, both sides agreed to address radiological security issues for the 2008 Beijing Olympic Games. A pilot project was developed to demonstrate that China and the US could successfully cooperate on recovering and protecting radioactive sources. The pilot project included the enhancement of physical security and the removal of disused sources at several sites in Beijing.

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[1] The formal name of the 1985, 1998 and 2004 agreements are: (1985) *Agreement for Cooperation between the Government of the United States of America and the Government of the People's Republic of China Concerning Peaceful Uses of Nuclear Energy; (1998) Agreement between the Department of Energy of the United States of America and the State Development Planning Commission of The People's Republic of China on Cooperation Concerning Peaceful Uses of Nuclear Technologies; (2004) Statement of Intent between DOE and the China Atomic Energy Authority Concerning Cooperation in the Fields of Peaceful Use of Nuclear Energy and Nuclear Non-Proliferation and Counterterrorism.*

After establishment of the pilot project, both sides agreed to initiate the GTRI-CAEA radiological security cooperation under the existing PUNT Joint Coordinating Committee and to establish two technical working groups; one for physical security, and the other for source removal.

1. ***Development of Technical Working Groups***

In January 2007, experts from DOE/NNSA, Los Alamos, Sandia, and Oak Ridge National Laboratories along with CAEA, and other Chinese government agencies, convened the first working group meeting of the pilot project on radiological security in Beijing, China. The IAEA and the Beijing Organizing Committee for the Olympic Games (BOCOG) participated in the bilateral meetings as observers. The purpose of the meeting was to establish two technical working groups (WGs) and develop their roles and responsibilities.

- Working Group I (WG I) scope included the implementation of physical protection upgrades of IAEA Category 1 radiological sources in-use or in storage. WGII was jointly chaired by SNL and the CIAE.

- Working Group II (WG II) scope included the removal of disused high activity transuranic and beta/gamma sources to secure storage. WG II's task included oversight of the recovery, packaging, and secured transport of the recovered sources to a repository. This technical working group was jointly chaired by LANL and the SEPA and included representation from ORNL.

With the establishment of the working group structure, points of contacts, and their roles and responsibilities, the WGs jointly identified the criteria that would be used in selecting sites in Beijing for the pilot project. The criteria for selection of the sites included proximity to Olympic venues and the activity of sources.

2. ***Implementation of Pilot Project by Technical Working Groups***

WG I: WG I agreed to conduct physical protection upgrades at one source manufacturing site with three facilities and a second site, which was an irradiation facility. These three facilities at the first site consisted of two manufacturing facilities and one storage facility. U.S. and Chinese experts jointly assessed the government-owned facilities and prioritized the sites for physical protection upgrades. The assessments were then modeled and analyzed by WGI to identify additional security measures required to improve system effectiveness in order to mitigate vulnerabilities identified by the Design Basis Threat (DBT) analysis. The analysis results were then used to develop individual security plans for upgrades at each facility. WGI and CIAE experts agreed to use the contracting company that was used in past PUNT cooperation on physical protection upgrades.

In Beijing, an introductory course, jointly developed with the IAEA, was provided to the Chinese on international guidelines as well as the fundamentals of performance-based physical protection upgrades. As part of the performance-based approach, training was

provided on the development of the DBT. The DBT training resulted in a threat characterization that would be used for all performance based analysis related to the physical protection upgrades.

WG II: WG II identified seven recovery sites and 165 sources, which included both transuranic and beta/gamma sources. To enhance efficiency, the China team consolidated sources from several sites to allow for the packaging and removal of sources at one facility. LANL provided to SEPA containers that are currently in use by the U.S. Off-Site Source Recovery Project (OSRP) to remove disused transuranic sources in the United States. Beta gamma sources were packaged in the containers in which the materials were initially delivered. The actinide/neutron sources were packaged in 12" pipe over-pack containers that contained high density polyethylene for neutron shielding. Upon early completion of the initial seven sites, WG II added a second removal campaign that included two additional sites with 120 additional sources, one of which was an abandoned hospital with a teletherapy head.

In May 2007, WG II presented the first training workshop on *Security of Radioactive Material during Transport* in Beijing for preparation of future shipments of IAEA Category 1 and 2 radiological sources. This course was developed in cooperation with the IAEA and highlighted the need for security during transport, identified recommended international guidance, and addressed the application of security approaches to be used for transporting sources. The course also emphasized the importance of using a transport security plan to ensure proper communications and to establish that security measures are in place to reduce security risks. In addition, training was provided on actinide source packaging, which included practical demonstrations on use of pipe-overpack containers and special form capsules. Attendees included representatives from China's SEPA, Beijing Environmental Protection Bureau (EPB), Tianjin EPB, China National Nuclear Corporation, and the Beijing Counter-Terrorism Office.

The pilot project achieved many results including: 1. upgrades to physical protection systems at two sites (a source manufacturing facility and an industrial irradiator facility); 2. the recovery and packaging of 285 sources from nine facilities including two IAEA Category 2 ^{241}Am/Be (Americium/Beryllium) sources and a Category 1 teletheraphy head; and, 3. the secure transportation of those sources to a storage facility away from Beijing's Olympic venues.

Upon the successful completion of the pilot project, LANL and SNL hosted physical protection and radiological source, packaging, transport, and disposal workshops in the U.S. for Chinese experts from government agencies responsible for radiological sources. The purpose of the workshops was to demonstrate best practices used in radiological security in the United States.

RADIOLOGICAL SECURITY EXPANDED COOPERATION

The successful completion of the pilot project led to an agreement by both sides in September 2007 to expand cooperation to additional sites with Olympic venues including Qingdao and

Tianjin. The new project scope included physical upgrades to seven sites and source removals at 13 facilities in Beijing, Tianjin, and Qingdao. An agreement was also made to expand physical protection upgrades to commercial sites. This shift to commercial sites resulted in the inclusion of SEPA, the national regulatory body responsible for radiological sources, as co-chair of WGI in the implementation of physical protection at commercial sites.

1. ***Working Group I: Physical Protection Upgrades***

WG I continued its efforts to secure sources in preparation for the Olympic Games and transitioned from upgrades at government-owned facilities to commercial facilities in Beijing, Tianjin, and Qingdao. As the regulator, SEPA worked with CAEA to identify and jointly prioritize commercial sites.

In October 2007, WG I and SEPA visited selected facilities in Beijing for physical protection upgrades identified in the expanded project scope. The facilities identified ranged from industrial and research irradiators to temporary storage sites. Before contracting for upgrades, WG I performed site visits to collect data in order to characterize the performance of system components as they related to detection, delay, and response. Security plans and procedures were reviewed and suggestions for improvements were outlined.

Two of the Beijing facilities visited were already in the process of installing basic upgrades. These upgrades were in response to new regulatory requirements issued by the Chinese Ministry of Public Security in June 2007. The requirements, entitled, *Requirements for Safety and Security*, outlined a series of prescriptive upgrade requirements based upon facility type. The new local requirements were timely in that facilities were more willing to participate in this joint radiological security effort. In addition to the prescriptive requirement in the local regulations, WG I and SEPA applied performance-based upgrades and designs in all facilities.

In May 2008, WG I completed the identified project scope at the expanded cooperation with upgrades at seven facilities located at six sites. Upgrades were made to enhance detection, delay and response capabilities. Potential examples of these types of upgrades include infrared sensors, duress alarms, intrusion detection switches on doors and windows, volumetric sensors, new alarm panels, and access control technologies. The installed upgrades provided substantial enhancement to each facility's detection delay and response elements.

2. ***Working Group II: Radiological Source Removal***

With the successful completion of removal of disused sources in Beijing during the pilot project, WG II continued its efforts to remove additional sources in preparation for the Olympic Games in Beijing, Tianjin and Qingdao. As part of the expanded scope both sides agreed to complete additional joint recoveries. LANL and SEPA along with other local government agencies were able to remove eight IAEA Category 1 and 44 Category 2 ^{60}Co sources from two irradiator facilities and two teletherapy heads from hospitals as well as many thousands of small sources from 13 sites in Beijing, Tianjin and Qingdao.

3. ***Transportation/Storage***

As part of each source recovery, WG II worked with the Beijing Public Security Bureau to provide training on security plans for transportation and assisted in the implementation of best practices for transport security. This training followed newly developed draft IAEA *Security of Radioactive Material during Transport: Implementing Guidelines* on the secure transport of radioactive nuclear materials. In addition, a second Transport Security Training Workshop was conducted in Tianjin in December 2008. Attendees for this course included representatives from SEPA, Tianjin EPB, Shanghai EPB, Everclean Environmental Engineering, HTA Company, Beijing Radioisotope Technology Company, and Tianjin BoAn Company.

Sources that were removed were transported to interim storage facilities maintained by Provincial Environmental Protection Bureaus. Interim storage facilities are used for the temporary storage of disused radiological sources until these materials are moved to a long-term storage facility. The implementation of the WG II project scope required extensive coordination amongst local and state Chinese government authorities including local security bureaus.

CONCLUSION

As part of the U.S. and China's bilateral nonproliferation cooperation efforts, both sides worked rapidly and effectively to enhance the security of radioactive materials near Beijing Olympic sites. This joint cooperation between the U.S. and China resulted in physical protection upgrades at 11 facilities at eight sites totaling over 7,000,000 curies. It also resulted in the removal of a large amount of disused sources from 22 sites totaling over 32,000 curies. The workshops provided demonstrated best industry practices for physical protection of facilities, safe packaging of high-activity transuranic sources, and the secure transport of radioactive materials. These workshops provided the knowledge for continued implementation of radiological security following the Olympic Games. With the completion of Olympics-related radiological security cooperation, the GTRI, CAEA, and SEPA plan to continue additional cooperative efforts under existing bilateral agreements.