SAND97-1809C
SAND--97-1809C

Developing Indigenous Safeguards Capabilities Within the MPC&A Program: A Transition from Near-Term Upgrades to Long-Term Sustainability

CONF-970744--10

Phillip W. Robinson
US Department of Energy
Washington, D.C., USA

Frederick O. Leutters
Sandia National Laboratories, DOE Headquarters,
Albuquerque, New Mexico, USA

Rebecca D. Horton
and Mark S. Soo Hoo
Sandia National Laboratories
Albuquerque, New Mexico, USA

Abstract

Approximately five years ago, the United States and countries of the Former Soviet Union (FSU) started the Cooperative Threat Reduction program. The program's purpose was to accelerate reduction of the risk of nuclear proliferation, including such threats as theft, diversion, and unauthorized possession of nuclear materials. This goal would be accomplished through near-term upgrades to strengthen the nuclear material protection, control, and accounting systems within the FSU countries.

In addition to this near-term goal, a long-term goal of the U.S. Department of Energy's (DOE) Material Protection, Control, and Accounting (MPC&A) program is to promote a new safeguards culture and to support the establishment of a sustaining MPC&A infrastructure in the FSU. This long-term goal is vital to assuring that the near-term upgrades remain effective for safeguarding nuclear material as these countries experience political and social changes. The MPC&A program is managed by DOE's Russia/Newly Independent States (NIS) Nuclear Materials Security Task Force.

A coordinated effort is underway to promote and to help establish a new safeguards culture and a sustaining infrastructure. Elements being implemented at both the national and site levels include system operational performance evaluations, development of MPC&A training, operational procedures, national MPC&A regulations, and adaptation of modern MPC&A methodologies to suit the conditions in the FSU countries. This paper identifies current efforts in several countries that are undergoing transition from near-term upgrades to sustainable MPC&A systems.

Introduction

In response to the risk of nuclear proliferatoin resulting from theft or diversion of nuclear materials, the U.S. and countries of the Former Soviet Union (FSU) have begun a cooperative effort to prevent such occurrences. Umbrella and implementing agreements for the Nunn-Lugar funded Cooperative Threat Reduction Program were signed in 1993 with the Russian Federation, the Republic of Ukraine, and the Republic of Kazakstan, and subsequently in 1995 with the Republic of Belarus. As a result of the agreements, cooperative work began on improving Material Protection, Control, and Accounting (MPC&A) systems for nuclear materials within the signatory countries.

In a parallel effort, DOE initiated similar cooperative assistance efforts with the non-nuclear weapons states of Latvia, Lithuania, Uzbekistan, and Georgia because of the materials present at nuclear reactor sites within these countries.

The DOE established the Russia/Newly Independent States (NIS) Nuclear Materials Security Task Force to manage the MPC&A program. The mission of this program is "to reduce the threat of nuclear proliferation and nuclear terrorism by rapidly improving the security of all weapon-usable nuclear material in Russia, the Newly Independent States (NIS) and the Baltic States." This mission will be accomplished through three program strategies:

1. Secure all weapons-usable nuclear material in forms other than nuclear weapons by entering into agreements of cooperation with government ministries and individual sites;

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under contract DE-AC04-94AL85000.

2. Implement systematic and rapid MPC&A upgrades, and
3. Ensure future nuclear materials security by encouraging the development of a safeguards culture, indigenous site-level capabilities, and by strengthening national-level systems for MPC&A.

This paper examines the third program strategy which is defined as *long-term sustainability* within the Task-Force-managed MPC&A program.

Long-Term Sustainability Requires Infrastructure

Long-term sustainability is addressed at the site level and the national level. Sustainability at the site level is achieved by:

- implementing upgrades that can be maintained by site personnel upon completion of the upgrade project,
- using technology that has demonstrated reliable performance and has accessible maintenance support, and
- creating an MPC&A infrastructure at the site level.

The major elements for a site MPC&A infrastructure include:

- Site MPC&A organization with authority and responsibilities
- MPC&A site plans
- MPC&A system operating procedures
- Site MPC&A response plans
- Ongoing system certification, maintenance, and performance testing
- Guard and response force capabilities
- MPC&A training programs
- International exchanges

Sustainability at the national level is achieved by developing a national MPC&A infrastructure, that is, the foundation or framework for an enduring safeguards culture. This framework is not limited to activities by government agencies, but extends to institutes and commercial entities with key roles in MPC&A.

A national infrastructure includes the following:

- Governmental entities with statutory authority and responsibility for MPC&A
- Regulatory documents (laws, regulations, and guidance)
- Licensing process
- Inspection and enforcement system
- MPC&A plans
- National MPC&A response plans
- Training and education program
- Federal information system for nuclear material accounting
- Nuclear material standards and sources
- MPC&A hardware and software certification process
- Indigenous MPC&A support capability

Within Russia, the MPC&A program addresses long-term sustainability at both the site and national levels. In Ukraine and Kazakstan, the MPC&A program places a larger emphasis on site-level infrastructure development than on the national level, while other countries offering assistance have programs that develop both site- and national-level infrastructures. Within the other NIS and the Baltics, the MPC&A program concentrates almost entirely on site-level infrastructure development. Countries other than the U.S. have also pledged support in national level development for countries other than Russia.

U.S. MPC&A Assistance to the NIS

The MPC&A program has completed near-term upgrades for the nuclear reactor sites identified in Belarus, Latvia, Lithuania, Uzbekistan, and Georgia. (See Figure 1.) This section discusses the MPC&A site-level infrastructure development within those countries. The strategies and activities described below may be used as a model to address site-level, long-term sustainability for Russia, Ukraine, and Kazakstan.

Other donor countries also conduct cooperative programs similar to the DOE MPC&A program and work primarily with the non-Russian countries of the FSU. These international efforts have been coordinated within the framework of the International Atomic Energy Agency (IAEA) NIS Coordinated Technical Support Program. This program is chartered to coordinate activities among the donor countries desiring to provide MPC&A support to the NIS.

Under the auspices of the IAEA NIS Support Program, the U.S and other donor countries were invited to send specialists to Belarus, Latvia, Lithuania, Uzbekistan, and Georgia to make initial assessments at nuclear facilities in these countries.

These assessments began in April 1994 with Belarus and concluded in January 1996 with Georgia. By the end of 1996, DOE and its National Laboratories had completed all identified near-term upgrades at each of these five sites.

In coordination with the IAEA support program, the thrust of the U.S. MPC&A program for these sites has been to support near-term upgrades primarily to secure proliferation-sensitive fissile material (physical protection). The U.S. program also provided some MPC&A assistance to the sites. As a part of the upgrades, site operators received training on U.S. approaches to MPC&A, operational security procedures were developed in conjunction with site personnel, and material accounting, measurement equipment, expert advice, and training was provided. Other donor countries committed to assist with regulatory development, national and site-specific systems of MPC&A, and physical protection. U.S activities for each of these sites is summarized below.

Belarus

The Sosny Scientific and Technical Center (SSTC) is the site of a shut-down Soviet-designed IRT 100 research reactor. As the lead participant in physical protection, DOE reviewed and made recommendations on the initial physical protection design developed by Japan, Sweden, and the facility, and provided some of the physical protection equipment. The MPC&A plan called for the consolidation of nuclear material into one location. DOE also assumed responsibilities for SSTC site preparation and material accounting.

Latvia

The Latvian Academy of Sciences Nuclear Research Center near Riga, Latvia, is the site of a 5 megawatt, Soviet-designed IRT research reactor. Near-term upgrades with U.S. support have included an access control system, an interior intrusion detection system, a video surveillance system, an integrated alarm communications and assessment system, and a material accounting system.

Lithuania

Lithuania possesses one of the world's largest nuclear power plants, the Ignalina Nuclear Power Plant (INPP). The INPP consists of two Chernobyl-type RBMK graphite-moderated reactors. In addition to general plant operating conditions, several incidents had prompted international concerns for safety and security. In recognition of these concerns, the MPC&A program provided near-term upgrades support to control vehicular access to the site, improve the guard force communications system, and upgrade the central alarm station.

Uzbekistan

The Uzbek Institute of Physics is the site of an operating, Soviet-designed, 10 megawatt VVR-SM research and isotope production reactor. It is the largest such nuclear research center in Central Asia. U.S.-supported, near-term upgrades at the site included nuclear material consolidation, improvements to the access control system, nuclear material storage, unauthorized access delays, and intrusion detection and assessment systems.

Georgia

The upgrades in Georgia at the Center of Applied Research in Tbilisi concentrated on the physical protection of nuclear material used for a shut-down IRT-2M research reactor. The near-term upgrades included intrusion detection and barriers to delay access to the nuclear material.

Joint U.S./Donor Country Assistance to the NIS

Much of the U.S. assistance provided to the countries of the NIS has been coordinated with the IAEA Coordinated Technical Support Program. Assistance covered by the IAEA program included regulatory development, as well as national- and site-level systems for physical protection and material control and accounting. Donor countries committed support in the form of expertise, equipment, or funding for each of these areas. Donor country commitments are summarized in Table 1.

While the Coordinated Technical Support Program has different objectives from the DOE MPC&A

program, the major elements for development of a national level infrastructure are addressed and may be sufficient for the relatively smaller nuclear programs within the NIS and Baltic countries.

Table 1. Donor Country Commitments to Non-Nuclear NIS

	Belarus	Latvia	Lithuania	Uzbekistan	Georgia
Regulatory Development	Sweden, Finland, Australia, Norway, IAEA	Sweden, Finland, Australia, Norway	Sweden, Finland, Australia, Norway	Sweden, Finland, Australia, Norway, IAEA	Sweden
National-Level MC&A	Sweden, Japan, IAEA	Finland, Sweden	Sweden, Finland	Australia, Sweden	Sweden, IAEA
Site-Level MC&A	U.S., Japan, Sweden	Finland, Sweden, U.S.	Sweden	U.S., Australia	
Site-Level Physical Protection	U.S., Sweden, Japan	U.S., Sweden	U.S., Sweden	U.S., UK	U.S., UK, Sweden

Transition from Near-Term Upgrades

Identified below are specific transition tasks that ensure that MPC&A upgrades are used, maintained, and further refined and improved as changing needs dictate. The intent of defining routine tasks is to create an MPC&A culture within a facility and ultimately for the operators to take "ownership" of an upgraded MPC&A system.

Development of a Site MPC&A Organization

An organization within the facility is necessary to oversee MPC&A continued operation and maintenance. In the course of implementing near-term upgrades, facilities have developed working groups to interface with the U.S. teams. These work groups form the basis for an ongoing MPC&A organization. The organization should be given the authority to implement any national- and site-imposed regulations and procedures. As a minimum, the organization would be comprised of an MC&A supervisor, nuclear material custodians, the physical protection supervisor, and the head of the on-site guard force.

MPC&A Site Plans

Site MPC&A plans are needed to provide: 1) a functional description of the site MPC&A system; 2) a description of how the MPC&A system will be implemented; and 3) the roles and responsibilities of the on-site MPC&A organization. The MPC&A site plans could be developed in conjunction with the appropriate facility personnel as the MPC&A upgrades are implemented. The facility director is also involved in the development of the plan and gives final approval for its acceptance and use.

MPC&A System Operating Procedures

Written operating procedures, developed by the site MPC&A organization, are needed to execute the site MPC&A plans. The procedures document how to accomplish such routine tasks as transferring nuclear material from one material balance area to another, applying and maintaining a tamper-evident seal program, operating the alarm monitoring station, and establishing access privileges for various protected areas.

Site MPC&A Response Plans

A facility MPC&A plan should be established to provide guidance to facility personnel for accomplishing specific defined objectives in the event of theft or diversion of nuclear material. The response plans should identify possible abnormal events and the procedures and facility resources committed to resolve the events. The planning should also include the measures to be taken to coordinate with off-site responders.

Ongoing System Certification, Maintenance, and Performance Testing

While responsibility for certification of the MPC&A system rests at the national level, the site should adopt it own certification procedures for ensuring that hardware and software meet the functional performance requirements identified in the MPC&A site plan. Routine maintenance and operational performance plans are also needed to test and ensure effective utilization of the MPC&A system. Periodic exercises should also be conducted to demonstrate effectiveness and to provide familiarization and training.

Guard and Response Force Capabilities

An effective, well-integrated, on-site guard force and response force is vital to an MPC&A system. Routine guard force procedures are needed to ensure that the MPC&A system is properly operated. In addition, response force procedures are necessary to resolve abnormal or MPC&A emergency occurrences. Measures should be taken for ensuring that the guard force and response force have a well-defined role in the development and implementation of the site MPC&A plan.

MPC&A Training Programs

Training is another key aspect for an effective MPC&A system. Initial MPC&A upgrade activities should include training specific to MPC&A needs. Additional training is needed to ensure that MPC&A is understood and accepted by all who have access to a site and particularly to those involved with nuclear activities. A training regimen must be a part of the MPC&A system and should be defined within the MPC&A site plan.

International Exchanges

International exchanges help foster the development of a sustaining MPC&A culture. The exchanges can range from information exchanges to the exchange of personnel to participate in training and other activities in host countries. The exchanges can occur bilaterally, as in the case of the MPC&A program or multilaterally as is the case with the IAEA's Coordinated Technical Support Program. For follow-on bilateral exchanges, it is DOE's intention to continue to work and assist these countries in the coming years. The primary interest will remain in MPC&A, but could be expanded to other areas as well. Using the IAEA as a coordinating body, multilateral exchanges can also occur. For physical protection, one example of such an exchange is the newly created IAEA International Physical Protection Advisory Service (IPPAS). The IPPAS objective is to provide advice and assistance to requesting countries to strengthen and enhance the effectiveness of national- and site-level physical protections systems.

Task Implementation and Sequencing

As is done for the other tasks within the MPC&A Program, these transition tasks can be implemented through new contracts with the site operator or could result from previous implementation contracts. Ideally, the transition from near-term upgrades to long-term sustainability would occur as early as possible during the upgrade efforts and should continue beyond completion of the upgrades. The first two tasks, the creation of MPC&A site plans and the development of a site MPC&A organization, should be viewed as key tasks to be accomplished during the early stages of near-term upgrades. The remaining tasks could be developed in succession during the upgrades or as the result of return visits to the facility, and then conclude with periodic international exchanges.

Following the completion of near-term upgrades, DOE made return visits to several recently upgraded sites. The DOE visitors found that the nuclear materials were better safeguarded and facility operators exhibited an intent to use the upgrades appropriately. Also, the DOE recommended additional efforts to continue development of a new safeguards culture. Needs were identified for additional training, maintenance support, system operational procedures, and guard force procedures. While these needs will be addressed, the lack of a strong national-level infrastructure is still apparent. Without such an infrastructure, it will be difficult to attain acceptable safeguards levels with new systems and inexperienced operators.

Subsequent to these visits, additional contracts are being placed to address the immediate needs for developing operational tests and evaluation procedures, guard force procedures, and material accounting procedures. MPC&A system designers plan to return to review and identify deficiencies in the operations at least annually for the first year or two. For maintenance, contracts have been placed with local suppliers to provide for up to two years of extended warranty service. DOE, through its bilateral exchanges and the IAEA, through its IPPAS program, will continue with long-term exchanges at each of these upgraded sites. DOE will continue to work bilaterally with these countries in the coming years and together with support from other donors and IAEA programs such as the IPPAS program, long-term sustainability can be achieved.

Summary

While near-term MPC&A upgrades can be readily implemented to rapidly reduce the risk of proliferation, an acceptable level of long-term safeguarding can only be achieved through promotion of a new safeguards culture and a sustaining MPC&A infrastructure. This new culture and infrastructure should occur at both the site and national levels. In Belarus, Georgia, Latvia, Lithuania, and Uzbekistan, near-term upgrades have been completed. Tasks are under way or planned to encourage the sites to adopt a sense of "ownership" for the MPC&A upgrades which would lead to the continuation of the development of a new site level infrastructure. While the tasks identified above are not all-inclusive, they identify the basic activities that could be pursued in the site-level MPC&A upgrade effort and ensure the transition to long-term sustainability. The transition from near-term upgrades to long-term sustainability will occur once the sites demonstrate many of the key elements for an effective MPC&A system.

For the five countries discussed above, the site-level development is supplemented by the national-level infrastructure as detailed within the IAEA NIS Coordinated Technical Support Program. For countries with a more extensive nuclear program, more substantial national level efforts are warranted to ensure that the site-level efforts are adequately supported.