

## Implementation of U.S. Department of Energy Physical Protection Upgrades in Lithuania and Uzbekistan\*

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### Abstract

Since 1994, the U.S. Department of Energy (DOE) has provided cooperative assistance to the non-nuclear weapons states of the Former Soviet Union. This effort, within DOE's program of Material Protection, Control, and Accounting (MPC&A), identified the Institute of Nuclear Physics (INP) in Uzbekistan and the Ignalina Nuclear Power Plant (INPP) in Lithuania as sites for cooperative MPC&A projects. The INP, located just outside of Tashkent, is the site of a 10-megawatt WWR-SM research reactor. This reactor is expected to remain operational as a major nuclear research and isotope production reactor for Central Asia. The INPP, located 100 kilometers northeast of the capital city of Vilnius, consists of two Russian-made RBMK reactors with a combined power output of 3,000 megawatts (electric). This power plant has been the subject of international safety and security concerns, which prompted DOE's cooperative assistance effort.

This paper describes U.S. progress in a multinational effort directed at implementing physical protection upgrades in Lithuania and Uzbekistan. The upgrades agreed upon between DOE and the INP and between DOE and the INPP have been designed to interface with upgrades being implemented by other donor countries. DOE/INPP upgrade projects include providing training on U.S.

approaches to physical protection, access control through the main vehicle portal, a hardened central alarm station, and improved guard force communications. DOE/INP upgrade projects in Uzbekistan include an access control system, a hardened fresh fuel storage vault, an interior intrusion detection and assessment system, and an integrated alarm display and assessment system.

### Introduction

In 1993, umbrella and implementing agreements for the Nunn-Lugar funded Cooperative Threat Reduction Program were signed with the Russian Federation, the Republic of Ukraine, and the Republic of Kazakhstan. Subsequently, in 1995, similar umbrella and implementing agreements were signed with the Republic of Belarus. As a result of the agreements, cooperative work on improving the Material Protection, Control and Accounting (MPC&A) systems for nuclear materials within the signatory countries was started. In a parallel effort, similar cooperative assistance was initiated with the non-nuclear weapons states of Latvia, Lithuania, Uzbekistan, and Georgia. Cooperative projects within the non-nuclear weapons states are funded by the Department of Energy (DOE), while projects within the four nuclear weapons states are jointly funded by DOE and the Department of Defense (DoD).

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Other donor countries, working primarily with non-Russian countries of the Former Soviet Union, have cooperative programs similar to the MPC&A program. These international efforts have been coordinated within the framework of the International Atomic Energy Agency's (IAEA) Newly Independent States (NIS) Support Program. The charter of this program is to coordinate activities among the donor countries that wish to provide support to the NIS.

Under the auspices of IAEA's NIS Support Program, the U.S. and other donor countries were invited to send specialists to the non-nuclear weapons states of Latvia, Lithuania, and Uzbekistan to make initial assessments at nuclear facilities in these countries. These visits began in July 1994 with a visit to Latvia, followed by a February 1995 visit to Lithuania, then a June 1995 visit to Uzbekistan. DOE's MPC&A upgrades were started in Latvia in May 1995 and were completed in March 1996. Similar DOE efforts were started in Lithuania in October 1995 and in Uzbekistan in September 1995 and are expected to be completed later this year.

## Work Approach

In a process similar to that used for other MPC&A projects, DOE efforts in both Lithuania and Uzbekistan began with detailed site surveys at the INPP and the INP. The surveys provided Sandia system designers with the details necessary to evaluate the extent of the project and develop system concepts and designs for presentation to the respective facilities. Once the designs had been further developed with input from facility personnel, contracts were written between Sandia and the facilities to implement portions of the design that could be performed by facility personnel. For example, facility personnel are responsible for modifying structural features to accommodate the overall design. When necessary, contracts were written with other organizations to implement those portions of the design requiring more specialized skills or equipment, such as alarm display and assessment consoles.

Sandia system designers used U.S. approaches to physical protection system design, but developed

designs according to internationally recognized guidelines established in INFCIRC/225/Rev. 3, *The Physical Protection of Nuclear Material*. Complete physical protection systems were not implemented; rather, only portions of a system were implemented that would either complement existing systems or complement portions implemented by other donor countries.

## Upgrades in Lithuania

Following dissolution of the Soviet Union, Lithuania became the possessor of one of the world's largest nuclear power plants, the Ignalina Nuclear Power Plant (INPP). The INPP consists of two RBMK, graphite moderated reactors (Fig. 1), which are similar in design to those at Chernobyl in the Ukraine. The RBMKs have a combined power output of 3,000 megawatts (electric). In addition to the plant's general operating conditions, several incidents prompted international concerns for safety and security: (1) the January 1993 disappearance of a fresh fuel assembly from the power plant and (2) November 1994 bomb threats that forced a temporary shutdown of the reactors.

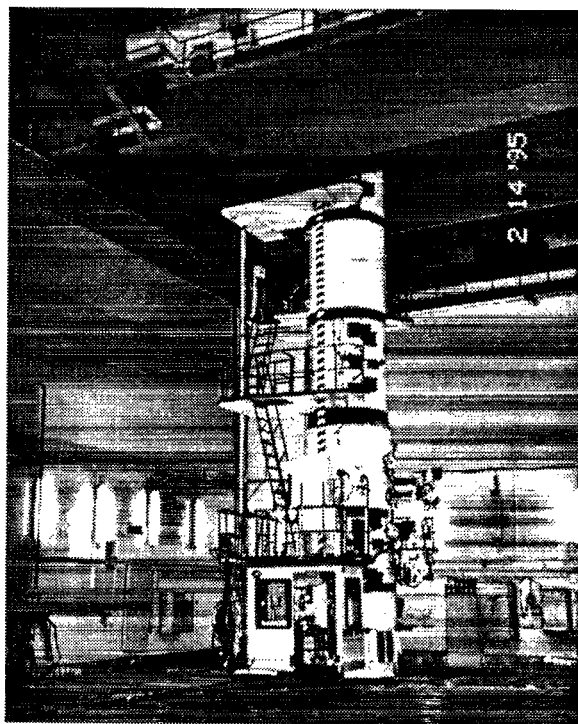


Figure 1. RBMK Reactor Face

In recognition of these concerns, Sweden has been involved in providing bilateral assistance to Lithuania in the area of safety and physical protection upgrades. Sweden has identified several areas of physical protection upgrades at the INPP, including the outer perimeter and access controls to the facility, fresh and spent fuel storage area, reactor hall, and other vital areas, and is working on improving the INPP's system of material control and accounting. Through the IAEA's NIS Support Program, Sweden was able to attract the interest of other countries in providing bilateral assistance to INPP through their respective programs.

### **Objective and Work Scope**

The objective of DOE physical protection upgrades for the INPP focuses on deterring acts of sabotage leading to radiological release. Although this objective is outside of the nonproliferation goals of the MPC&A program, international concerns for the safety and security of the RBMK reactors outweigh this deviation.

To accomplish this objective and to meet budget and scheduling limitations, Sandia limited the scope of its physical protection work to four activities:

- *Training:* Provide a basic physical protection training course to illustrate U.S. approaches and methodology to physical security system design and analysis.
- *Communications:* Provide improved communication equipment to INPP's battalion and security personnel.
- *Central Alarm Station:* Provide analysis, recommendations, training, and assistance for upgrading the Central Alarm Station (CAS).
- *Main Vehicle Portal:* Provide analysis, recommendations, training, and assistance for improving facility access through the main vehicle portal.

### **Training**

To establish a common understanding and build mutual trust and confidence among Sandia designers and facility personnel, Sandia provided training on U.S. approaches and methodologies to

physical protection system design and analysis. This training, which covered the fundamentals of detection, delay, and response, was intended only to be introductory in nature. Topics covered in the methodology included: threat definition, target identification, intrusion detection, alarm assessment, alarm communications and display, entry control, access delay, response force, and response force communications. The training effort, completed in January 1996, was provided to 42 participants from the INPP, government ministries, and other local law enforcement agencies.

### **Communications**

Good communication equipment for INPP's battalion is necessary to coordinate response force activities. Originally, the battalion was using old, unreliable radios. Repair parts were difficult to find and a frequency coordination problem existed among different sets of radios.

The communications system designed for INPP security personnel will not only supply communication within this group, but also be a backbone for expansion and communications with four other operational units: fire brigade, border patrol, external response force, and local police. Efforts in these other areas of communication will be supported by Sweden. The security function of the communications system will be completed in August 1996.

### **Central Alarm Station**

The Central Alarm Station (CAS) contains all the alarm display and assessment capabilities for the INPP and houses on-site response force personnel. Sandia initiated several security modifications to the building designed to harden the CAS against attempts at forced entry. These modifications include upgrading or replacing the main entrance door and adding automated entry control, hardening other doors in the building, hardening the windows, and making provisions for the existing air-conditioning system. New lighting and ventilation also have been provided. Access control equipment for entry into the CAS will be integrated into the site-wide access control system provided by Sweden. Sandia modifications to the CAS are nearly complete.

### **Main Vehicle Portal**

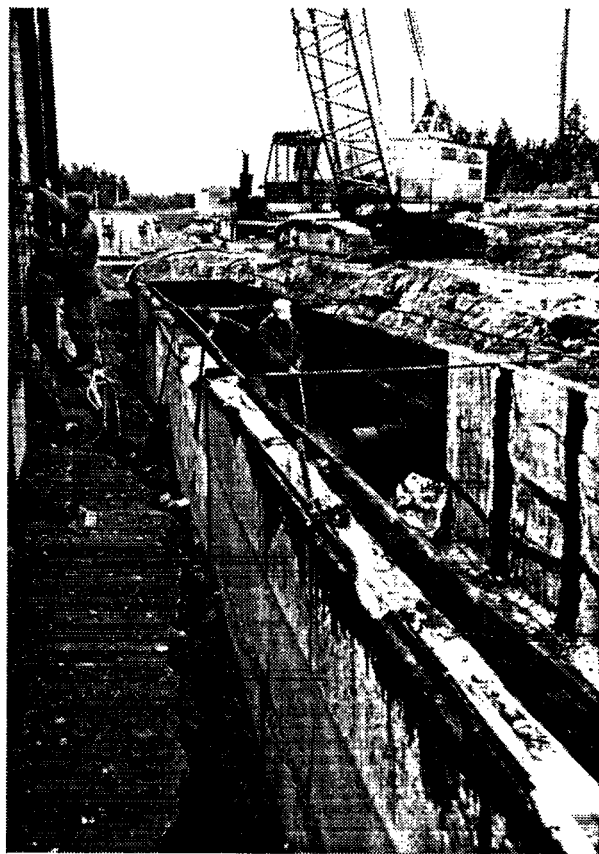
Controlling access to the facility has been identified as a high-priority task. Sandia contracted with the INPP to design and install a new main vehicle portal to better control vehicular access. Sweden initiated a separate task to upgrade the personnel access control system. The vehicle portal, which will be integrated into the upgraded perimeter system, will entrap a vehicle during inspection and also will deter attempts by vehicles to crash through the perimeter.

The new vehicle portal will consist of a new building for personnel, vehicle entrapment gating, and inspection pits (Fig. 2), video surveillance equipment for inspection and recording of personnel activities, a vehicle authorization access control system, microwave sensors for integration into the perimeter intrusion detection system, and a nuclear material detector. Upgrades to the vehicle portal will be completed in August 1996.

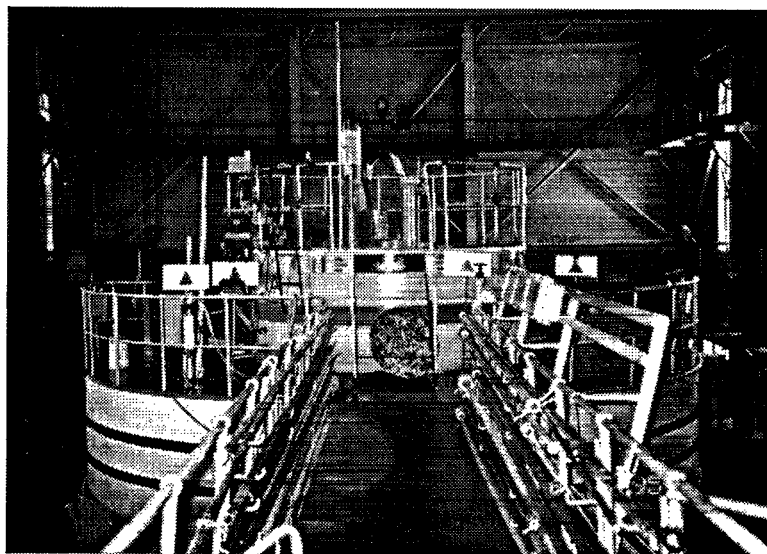
### **Upgrades in Uzbekistan**

The Uzbekistan Institute of Nuclear Physics (INP), located 30 km outside the capital city of Tashkent, employs 1,700 people. It is the site of an operational 10-megawatt WWR-SM (water-water) pool-type research reactor (Fig. 3). The INP is the largest such facility in Central Asia and has plans for expanding its programs. The reactor, which is celebrating its fortieth year of operation this fall, is typical of Russian-built research

reactors. In addition to its nuclear research programs, the INP is pursuing an ambitious commercial isotope production program



*Fig. 2. Vehicle Portal Inspection Pit*



*Fig. 3. WWR-SM Reactor*

Because of the INP's use and storage of highly enriched uranium fuel for its research reactor, the IAEA's NIS Support Program is concerned for the protection of proliferation-sensitive nuclear material. In June 1995, the IAEA convened material control and accounting and physical protection specialists from Australia, Sweden, the United Kingdom, and the U.S. to review facility needs. Australia and Sweden agreed to provide assistance in the areas of material control and accounting, while the U.K. and the U.S. agreed to undertake upgrades to the INP's system of physical protection. As a result of this initial visit, the U.S., represented by the DOE, defined a scope of work to include upgrades to inner areas, the central alarm station, and access control.

### ***Objective and Work Scope***

Since the INP stores and uses highly enriched uranium fuel for its nuclear research and isotope production programs, nonproliferation concerns are addressed in the context of DOE's MPC&A Program. To help fulfill this objective at the INP, physical protection upgrades are limited to those activities that will deter the theft or unauthorized removal of proliferation-sensitive nuclear material from the facility. Physical protection upgrades to protect against radiological sabotage are not specifically addressed; however, the upgrades designed to deter theft also will provide some associated protection against sabotage.

The scope of work, developed in cooperation with INP personnel, is limited to upgrades to interior intrusion detection, access control, alarm display and assessment, and fresh fuel storage. These upgrades are intended to include the fundamental components of detection, delay, and response. Since the INP has an ambitious program of expanding its role as the primary nuclear research and isotope production facility for Central Asia, these upgrades are considered vital to the continued operation of the INP for years to come. In addition to making the appropriate facility modifications and installing the necessary hardware, training was provided to ensure that facility personnel are fully capable of operating and maintaining the upgraded physical protection system. The INP, located at a remote, wooded environment, is surrounded by a 5-kilometer perimeter

fence that encompasses the entire facility. Funding and schedule constraints did not permit upgrades to be made along this perimeter. Physical protection upgrades are limited to interior portions of the INP.

### ***Detection***

Interior intrusion detection sensors are being installed at all doors designated as primary access points. These doors include exterior personnel and vehicle access doors and interior doors. Volumetric and surface penetration sensors are included to detect unauthorized attempts to access the fresh fuel storage vault. Movement through the controlled access points requires a card swipe/key pad combination. In addition, a hand geometry biometric identification system controls access to the fresh fuel. To enforce the two-person rule, valid hand geometry identification from two individuals is required. A new central alarm station is being installed for alarm display and assessment. Finally, hand-held and walk-through metal detectors and hand-held nuclear material detectors have been supplied to allow INP guards to conduct searches on personnel entering or leaving critical areas (Fig. 4).



***Fig. 4. Walk-through Metal Detector at Entrance to Reactor Building***

## **Delay**

At the INP, many delay barriers, such as thick walls and ceilings, already exist. Site preparation was directed at enhancing the performance of these existing barriers. In order to restrict and delay movements around and within critical areas of the INP, stronger doors have been added where needed and windows have been reinforced. In addition, the fresh fuel storage vault was reconfigured as a room-within-room, requiring two authorized personnel to be present before the magnetically locked door can be opened. Bullet-resistant glass and hardened doors have been installed to resist unauthorized access to the CAS.

## **Response**

A guard force communications system was developed with modern radios supplied by the United Kingdom. These radios will be used for communications among INP guard force members and also for communications to an off-site response force.

## **Summary**

Significant physical protection upgrades have been started and will be completed by the end of 1996 at a nuclear power plant in Lithuania and at a nuclear research center in Uzbekistan. These upgrades, designed and implemented in cooperation with the facility operators, will complement existing physical protection systems or upgrades implemented by other donor countries. Other donor countries also have taken on the responsibility of improving systems for material control and accounting. The design of these upgrades was accomplished using U.S. methodologies to physical protection system design, but following internationally recognized physical protection guidelines. Since facilities are fully operational and are expected to continue in operation for years to come, the upgrades are timely in light of perceived threats of sabotage against nuclear facilities and theft of nuclear material.

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