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Submitted to: INMM, Naples, FL, July 1996

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IMPLEMENTATION OF MPC&A SYSTEMS AT THE VNIIEF RESEARCH (REACTOR) SITE

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ABSTRACT

As part of the US-Russian Lab-to-Lab program for strengthening nuclear material protection, control, and accounting (MPC&A), an integrated MPC&A system is being installed at a large site within the VNIIEF complex to upgrade safeguards on the nuclear material stored and used at this site. In addition to storage facilities, the site houses a number of critical facilities at which nuclear physics research is conducted.

The design of the MPC&A system is based on the test bed work presented earlier and provides the functions of nondestructive measurements for plutonium and highly enriched uranium, item control, personnel access control, radiation portal monitoring, and computerized on-line accounting. The system controls, monitors, and accounts for nuclear material and people as the material moves through three material balance areas, a measurement room, and a number of control points. It also assists with physical inventory taking. The instrumentation used to implement these functions will include US commercial equipment as well as Russian-designed and -fabricated items.

INTRODUCTION

Building on the experience gained from the construction and evaluation of the test bed facility that was reported on last year (1), the VNIIEF, in collaboration with the DOE US-Russian Lab-to-Lab Program for Nuclear Material Protection, Control, and Accounting (MPC&A), has begun the installation of an enhanced safeguards system at the Research (Reactor) Site located at the Russian Federal Nuclear Center, All Russia Institute of Experimental Physics (RFNC-VNIIEF), Sarov, Russia.

This system will include personnel and vehicle access control functions at the personnel and vehicle entrances to the site; control and accounting functions for nuclear material located in the critical assemblies and reactor buildings (including associated storage vaults); and monitoring functions for material transfers between buildings within the site. The system will communicate MPC&A information between the three material balance areas (MBAs) and central control points via a local area network, which is part of the computerized accounting and control system. Data will be evaluated at these control points, and if alarm conditions are detected, the system will notify appropriate organizations to respond.
To accomplish the above goals, the system is being organized around an accounting structure that includes three MBAs for the three buildings that house nuclear materials, a site-wide (global) MBA, a location designated for measurement of items, and control panels that display status information and alarm conditions. A typical MBA design is shown in Figure 2. The building that is covered by this MBA is used for short- and long-term storage of nuclear material and as the shipping/receiving area. It also houses the measurement room, which is schematically represented in Figure 3. Note that personnel access control equipment for this MBA includes radiation portal monitors (both Russian and US design), metal detectors, badge identifiers, bar code readers, and TV surveillance cameras. A work station is connected to the computerized accounting system for data entry and report requests. Bar code readers will also be used to enter data, e.g., during physical inventories. Some of the storage locations will be equipped with sensors for remote monitoring of the items they contain.

The enhanced system will build on the present system and will:

- improve timeliness and accuracy of data on all FM types and the movement of material within the site,
- tighten personnel access measures,
- develop mechanisms that respond promptly and appropriately to unauthorized actions with FM (causing the system to sound an alarm),
- reduce personnel radiation exposure by shortening the time necessary to conduct periodic physical inventories, and
- create a basic MPC&A system that can be adapted for use at other VNIIEF sites and facilities.

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The special room for measurements will have neutron, gamma-ray, and weighing instruments for periodic verification of FM mass, isotopic composition, and radiation passportization signatures for selected items and for confirmation of items received from outside the site.

There are three centrally located control panels (terminals), which perform the following functions:

- a central panel for monitoring the site physical protection system, which operates round-the-clock and is connected to the VNIIEF central alarm station,
- an accounting system panel that displays information regarding FM movements and FM amounts by location, and
- the site central dispatcher's panel (CDP) for supervising the FM handling procedures and granting permission for access to nuclear material.

The site also has an "aid station," where site personnel who are responsible for potentially hazardous operations undergo daily medical examinations. The results of the medical examinations are entered into the MPC&A system and used to determine whether a given worker may continue to conduct those operations.

The network connections that maintain communication between the various elements of the MPC&A system are shown in Figure 4.

PROJECT STATUS

VNIIEF is responsible for the design of the system, installation of the hardware, programming of the software, and operation of the system. As part of this responsibility, VNIIEF must assure that the performance of the overall system meets Russian national MPC&A requirements. Currently, there are between 150 and 200 Russian staff working on the project. The US laboratories and the Pantex facility are providing technical support on the basis of experience at DOE facilities. A design review meeting was held in June 1996, with all participating organizations present. The work is proceeding on schedule.

This project represents an important step in implementation of enhanced MPC&A, not only at the Research Site but at other sites within VNIIEF and within other Russian facilities.

The design of a system for a second VNIIEF site, at which operations to change the physical form of nuclear materials are performed, is already in progress. Because the activities at this site are considerably different from those at the Research Site, additional features will have to be added to the MPC&A design. However, much of the basic software and hardware already designed will be equally applicable to the Operations Site.

To encourage the participation of other Russian facilities, VNIIEF has invited them to send representatives to review the design and observe the installation and eventual operation of the Research Site system.

Through projects such as the MPC&A system at the VNIIEF Research Site, the US-Russian MPC&A Lab-to-Lab Program is making substantive progress towards its goal of widespread enhancement of nuclear material safeguards at the major facilities of the Russian nuclear complex.
REFERENCES


2. M.I. Kuvshinov, A.M. Voinov, V.G. Zagrafov, Russian Federal Nuclear Center - All Russian Scientific Research Institute of Experimental Physics, "The History of Works on Nuclear Criticality Safety in RFNC-VNIIEF."

Fig. 1. Schematic layout of the VNIIEF research site.
Fig. 2. MBA 1 rooms and equipment (Building 1).
Fig. 3. Rooms and equipment of the measuring room (Building 1).
Fig. 4. Diagram of the system computer network.