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Institute of Nuclear Material Management, 36th Annual Meeting
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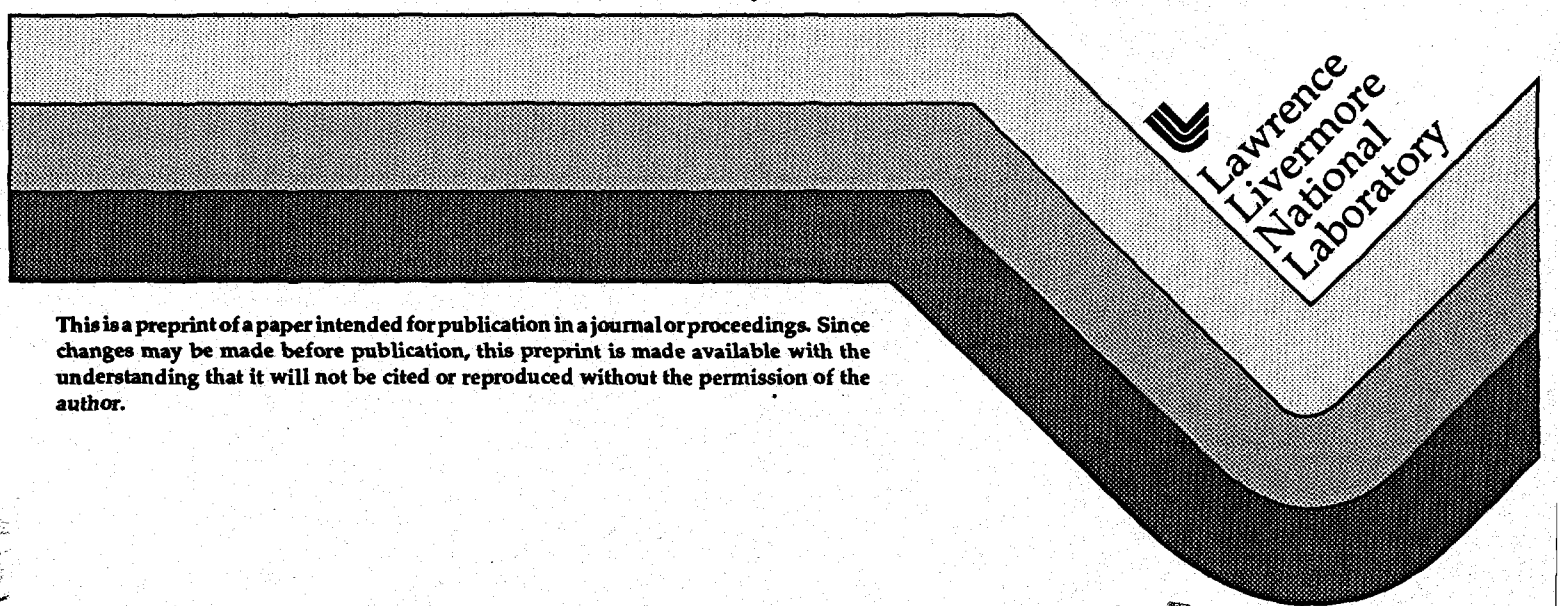

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US./Russian Laboratory-to-Laboratory MPC&A Program at the VNIITF Institute, Chelyabinsk-70

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ABSTRACT

The All Russian Institute of Technical Physics (VNIITF) is one of the major sites in the nuclear weapons complex in Russia. The site contains a number of research facilities which use nuclear material as well as facilities active in disassembly and disposition of nuclear weapons. Chelyabinsk-70 (C-70) also has ties to the major nuclear materials production facilities in the Urals region of Russia.

Under the U.S./Russian Laboratory - to - Laboratory cooperative program, enhanced safeguards systems are being implemented, initially at a reactor test area that contains two pulse reactors and a nuclear material storage facility.

C-70 is developing an extensive computerized system that integrates the physical security alarm station with elements of the nuclear material control system. Under the Lab-to-Lab program, the existing systems will be augmented with Russian and US technologies.

The integrated MPC&A system for the test facilities will be demonstrated to US and Russian audiences when completed and follow-on work at additional C-70 facilities will be identified.

This paper will describe the on-going activities and describe the cooperative effort between the Lawrence Livermore, Los Alamos, Sandia, Oak Ridge, Pacific Northwest, and Brookhaven US Department of Energy National Laboratories in support of VNIITF.

INTRODUCTION

The work described in this paper is part of a larger effort called the Laboratory-to-Laboratory Nuclear Materials Protection, Control, and Accounting Program which was created in response to a DOE directive to the national laboratories to develop a cooperative program between the US. and Russian institutes in the area of nuclear materials non-proliferation. The objective of the program is to accelerate progress toward a common goal: to reduce the risks of nuclear proliferation by strengthening systems of MPC&A in both countries. The program is being carried out by Russian institutes and US laboratories mutually developing and implementing a collaborative program for the improvement of nuclear MPC&A systems at Russian facilities. More specifically the lab-to-lab MPC&A program is

attempting to make rapid improvements in the protection, control, and accounting of nuclear material, especially weapons-grade materials such as separated plutonium and highly enriched uranium, by working directly and cooperatively with each other.

This paper describes that portion of the lab-to-lab MPC&A program that is tailored specifically to the needs of the Russian Federal Nuclear Center: Institute for Technical Physics (VNIITF), Chelyabinsk-70, adjacent to the town of Snezhinsk. VNIITF was established in 1955 as a second nuclear weapons design institute for competition and peer review of the initial Russian nuclear design institute at Arzamas-16. Chelyabinsk-70 is located in the Ural mountains, approximately 2000 km east of Moscow.

HISTORICAL BACKGROUND OF VNIITF SECURITY

The physical security program at VNIITF was designed at a time when the former Soviet Union emphasized strict control systems such as enforcement of personnel passport controls. Russia is now in a very different situation, where their diversification activities are resulting in an influx of business and industrial people whose reliability cannot be guaranteed through personnel screening. VNIITF is therefore evolving its security systems to apply to this different situation.

VNIITF began modernizing its security system in 1993, at the direction of MinAtom. At that time, a specific program was created with emphasis on MPC&A. People from separate laboratories within VNIITF were brought together to work on the enhanced MPC&A program. The program was approved by MinAtom, however, VNIITF has not received any additional money to implement this program. Lack of money has therefore limited the rate of progress.

SELECTION OF A DEMONSTRATION SITE

VNIITF proposed that the enhanced MPC&A systems be implemented for demonstration at a "real" nuclear material site, and has selected the Pulse Reactor Facility, Complex 711, 712, and 713 in Site 20.

There are 5 different nuclear facilities in the Urals. VNIITF has historically had very close relations with them, so it is hoped that these facilities would be ready to implement the system once it is developed for the above site at VNIITF. The VNIITF site system would be used as a demonstration system.

MPC&A TECHNOLOGIES AND STRATEGY

Items, rather than bulk material, are involved in 90% of the VNIITF activities. VNIITF is very interested in a passportization system and would also like to measure the gamma field within the storage facility itself, using sensors mounted within the facility which could be periodically queried for data. The process of taking gamma field portraits is a central component of the VNIITF integrated MPC&A system.

Most of the VNIITF gamma spectroscopy instruments are not yet commercially produced, but are one-of-a kind laboratory prototypes. Equipment also currently requires operation by highly trained personnel. VNIITF and the US laboratories would like instrumentation that is already developed to be used such as that which the US labs have already transferred to industry.

US ASSISTANCE IN SUPPORT OF THE VNIITF MPC&A SYSTEM

Several collaboration tasks required to implement a comprehensive enhanced MPC&A system at VNIITF have been approved by the Joint Russian–US MPC&A Steering Group. The tasks have been prioritized to form a planned approach beginning with a site characterization study and quantitative analysis of the existing system followed by system design and installation.

Facility Characterization for the Pulse Reactor Facility at VNIITF

The objective of this joint LLNL-VNIITF effort is to provide a facility characterization for the VNIITF (C-70) Pulse Reactor Facility, Complex 711, 712, and 713, to assist in the design of a Physical Protection (PP) and a Material Control and Accounting (MC&A) system, to examine the facility to determine where PP and MC&A should be implemented or where existing PP and MC&A should be increased and to provide immediate short term fixes based on the survey.

Analysis of US and Russian Integrated Safeguards and Security Planning and Analysis Techniques

The objective of this effort is for US and Russian personnel to share safeguards and security vulnerability assessment techniques and approaches to obtain some early results by actually applying them to the Pulse Reactor Facility at VNIITF and to study and analyze changes which need to be made to the analytic tools and procedures for their use in Russia. It included a two week vulnerability assessment workshop to be conducted jointly by LLNL and SNL at VNIITF. A continuous process of improving the techniques and applying them to increasing numbers of Russian nuclear facilities is anticipated.

Vulnerability assessment (VA) is an analytical process that is used to evaluate risks and to determine cost-effective physical protection improvements using defined threats and the characteristics of the facility being evaluated. Lawrence Livermore National Laboratory and Sandia National Laboratories have developed vulnerability assessment tools in use throughout the US. Department of Energy complex for the insider and outsider threats and for cost-benefit analysis of physical protection upgrades.

Conceptual Design of a Physical Protection System for the Pulse Reactor Facility at VNIITF

The objective of this effort is to develop a conceptual design for a Physical Protection System (PPS) for the VNIITF Pulse Reactor Facility, Complex 711, 712, and 713. This conceptual design will use the

facility characterization (site survey) performed earlier. The conceptual design is expected to become the Master Plan for the facility PPS. The PPS plan will include a prioritization of tasks (modules) to be implemented to support possible modular implementation. VNIITF and the US laboratories will prioritize the items which should be implemented first.

These modules should include:

a. Exterior sensor system.
b. Interior Sensor system.
c. Alarm Assessment System.
d. Alarm communication and Display System.
e. Entry Control System.
f. Access Delay System
g. Communications.

A plan will also be provided for the system integration of all modules and a description of the PPS operation. A second plan will provide for the integration of the PPS with the Material Control & Accounting (MC&A) system.

Upon completion of the conceptual designs for the MC&A and PP systems , the original Vulnerability Assessments (VA) report will be revised to show the benefits resulting from the implementation of the integrated MC&A and PP conceptual designs.

Conceptual Design of a Material Control and Accounting System for the Pulse Reactor Facility at VNIITF (C-70)

The objective of this effort is to develop a conceptual design for the MC&A System for VNIITF Complex 711, 712, and 713. This conceptual design will use the facility characterization (site survey) performed earlier.

The conceptual design is expected to become the Master Plan for the facility MC&A system. The MC&A plan will also include a prioritization of tasks (modules) to be implemented to support possible modular implementation. VNIITF and the US laboratories will prioritize the items which should be implemented first.

The modules will include a Basic Requirements module containing a description of the organization and management structure, training requirements, internal review and assessment program and an independent system assurance function; a Material Accounting module and a Material Control System module.

Radiation Measurements

The objective of this work is to implement off-the-shelf nuclear material identification technology in Russian institutes with direct-use nuclear materials such as plutonium and highly-enriched uranium, and to enhance nuclear material measurements to improve nuclear material accountability. Desirable attributes of the deployed measurement system will be rapid detection and identification of fissile inventory in variable background environments, without opening the storage container.

Additionally, identity information will be archived in multiple locations to facilitate shipper/ receiver tracking. A large number of storage containers will require rapid processing. This work will focus on

the production aspects of a signature logging device to prepare for certification and distribution through the commercial infrastructure in Russia.

Test and Evaluation of Nuclear Material Portal Monitors using Plastic Scintillators and of Handheld Radiation Detectors

The purpose of this effort is to test and evaluate nuclear material portal monitoring methods and equipment at Russian nuclear facilities. A pedestrian portal monitor and handheld monitors supplied by LANL will be evaluated to determine their suitability and practicality for near-term application in Russian nuclear facilities. This task is part of a larger MPC&A multilab effort, which includes a workshop on integrated portal entry control technology and an evaluation of methods for monitoring vehicles to detect concealed nuclear materials. The scope of this task includes methods for monitoring personnel, packages, or containers to detect nuclear materials.

Test and Evaluation of Computerized Nuclear Material Accounting Methods

The purpose of this effort is to test and evaluate methods for computerized nuclear materials accounting. The scope includes:

* System requirements and specifications that incorporate the data acquisition, record keeping, reporting, and other requirements for nuclear materials control and accounting;
* Computer security requirements; and
* Prototype computer hardware and software demonstration network.

A range of hardware and software options will be evaluated to determine their suitability and practicality for near-term application at VNIITF.

Next Steps

It is anticipated that follow-on activities will involve the implementation of components of the physical protection and MC&A conceptual designs, as prioritized and approved by the joint U.S./Russian Steering Group. Quick fixes of a critical nature will be considered for immediate implementation. Additional efforts involving other aspects of MPC&A and other facilities at VNIITF will also be considered for implementation by the Joint Steering Group.

CONCLUSION

Through increased cooperation it is hoped that the lab-to-lab MPC&A program effort at VNIITF will make rapid improvements in the protection, control, and accounting of nuclear material, especially weapons-grade materials such as separated plutonium and highly enriched uranium, by working directly and cooperatively with each other. The US National Laboratories, hope to continue contracting directly with VNIITF to carry out MPC&A improvements and provide support, technical assistance, and equipment as needed to further the

objectives of the program. VNIITF has taken the primary responsibility to provide the effort needed to improve their MPC&A system based upon their requirements. Our mutual long range goal is for the VNIITF to institutionalize the improvements and transfer them to other facilities and organizations where the US may not be able to go, because of sensitivity or other reasons.

ACKNOWLEDGMENTS

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