PROGRESS IN MPC&A UPGRADES AT LUCH

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Abstract

Luch, a MINATOM facility, has been engaged in both scientific research and uranium processing for fifty years. Since the spring of 1996, Luch has participated in a program of U.S./Russia Cooperation in Nuclear MPC&A Upgrades. The program began with planning for immediate upgrades in MPC&A, with an emphasis on physical protection. In addition, U.S. and Luch experts exchanged technical data during a number of workshops, to establish a common understanding of available MPC&A tools and equipment. Site characterizations and vulnerability assessments were then prepared by Luch, to form the basis for the current program of methodical upgrades in all areas of MPC&A. Access control, alarms and alarm communications are being improved as part of this program. Control of nuclear material is being enhanced through improvements in material monitoring and in transportation security when nuclear material is moved between buildings on the

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Luch site. A comprehensive, site-wide computer network for Luch was designed during a recent workshop. Acquiring and installing this computer system, complete with COREMAS software, is currently in progress. Nuclear material analysis will be improved through NDA techniques using Canberra InSpector systems. The planned upgrades in nuclear MPC&A will reinforce safeguards over large quantities of HEU at Luch.

Introduction

The State Science and Technology Institute which is part of the Luch Research and Production Association — a MinAtom facility — has been involved for over 50 years in research and development of HEU fuel compositions and fuel rods, as well as with pilot and small scale production of those products; in addition the Institute has also been reprocessing HEU scrap.

Recent changes in the structure of HEU operations at Luch resulted in a contraction of pilot
production of fuel compositions and fuel rods, with a parallel increase in scrap reprocessing. The latter reflects the need to consolidate HEU materials from various facilities to assure their physical security, as well as to facilitate their further reprocessing into low-enriched uranium for use in the fuel cycle.

Luch has been working with nuclear materials (NM) for a long time, resulting in large amounts of uranium with varying degrees of enrichment accumulating at the Luch site. At the same time, Luch has been receiving HEU scrap with varying degrees of purity; which is then reprocessed and shipped from Luch.

In 1996 Luch was added to the list of MinAtom facilities eligible for Gov-to-Gov cooperation programs. In early 1996 BNL and Luch signed a Framework Agreement. Intensive efforts to upgrade the MC&A and the Physical Protection systems at Luch started in the spring of 1996 when 33 contracts were signed with BNL for various tasks to cover all aspects of nuclear material accounting, control and physical protection at three of the Luch facilities: the Central Storage Facility (CSF); Building 34 (HEU reprocessing); and Building 2 (development and fabrication of experimental fuel rods for the Topaz reactor).

Working together, U.S. and Luch experts identified as the initial, high-priority tasks, upgrades in access control in the CSF, Building 34 and Building 2, requiring door hardening, installation of high security locks, brick the windows and providing access control guard rooms. Implementation of these plans combined with upgrade of the alarm system will assure significant improvements of the nuclear material security system in the buildings both from potential outsider and insider threats.

Applying procedures and using the ASSESS software package provided by the U.S. during a workshop at Luch in May, 1996, Luch specialists trained at that workshop assessed vulnerability of the three Luch facilities. They examined both the existing physical protection systems as well as the systems which will result after the immediate planned upgrades are implemented. This assessment indicated that the identified areas of major improvements were correct and urgently needed.

![Fig. 2. Bricked-up Windows in the Central Storage Facility](image)

In carrying out tasks related to facilities characterization, and developing elements of the MPC&A system for Luch, U.S. and Luch specialists jointly identified the following tasks as priorities:

- Upgrading the procedures for nuclear material control by introducing the use of portal and hand-held nuclear material detectors including instructions for their use in access control;
- Implementation of a TID program using TIDs with unique identification numbers and applying a multiple-person rule;
- Application of NDA instrumentation such as gamma-spectrometry for physical inventory taking, for measuring components in the nuclear material streams, and in nuclear material transfers.

The results of the vulnerability assessment conducted by Luch confirmed that the selected upgrades and the priority in which they were

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1 Brookhaven National Laboratory (BNL) is the lead laboratory for the U.S. Luch Project Team, which includes MPC&A specialists from BNL, LANL, LLNL, ORNL, SNL, and PNNL.
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planned to be implemented were correct from the point of view of assuring immediate detection of discrepancies in the amounts of nuclear materials.

In the process of upgrading measuring instrumentation and procedures to meet the MC&A and material balance needs, Luch, with U.S. support, reviewed the existing measuring instrumentation, methods and procedures. During this review Luch specialists evaluated systematic and random errors for the measuring methods currently employed, and this became the basis for evaluating the inventory difference (or detection thresholds) for closing material balances at production facilities. The data obtained provided the first opportunity to employ statistical methods in the area of nuclear materials safeguard, and allowed Luch to validate the selected approaches and the technologies to be used in upgrading measuring instrumentation and procedures for MC&A needs.

Progress Review of the Joint MPC&A Upgrade Program at Luch Facilities in 1996 and 1997

The agreed-upon scope of work for the 1996 FY at Luch required completion of 33 task orders. The distribution of work within specific areas was as follows:

- Site characterization for separate Luch facilities, including identification of near-term and long-term upgrades and their prioritization;
- Upgrading components of the physical protection system at Luch facilities, including access control, delay components, detection and alarm systems, communication, and assuring security of NM during transportation;
- Upgrading components of NM controls, including implementation of access control and use of TIDs with unique identification numbers;
- Upgrading the instrumentation, methods, and procedures for measuring NM streams and for establishing material balance including computerization of accounting;
- Vulnerability assessment of the three Luch facilities.

Luch specialists, using approaches delineated in materials provided by the U.S. (BNL, Los Alamos), completed 17 tasks within this period, including:

- Complete characterization of the three Luch facilities, with identification of short-term and long-term upgrades;
- Vulnerability assessment using the ASSESS software package provided by the U.S.;
- Design of the local area network structure and development of LAN hardware specifications for each of the three facilities, as well as a Luch site-wide area network for MC&A needs;
- NM consolidation efforts have been successfully completed, resulting in improved physical protection of NM;
- NM security has been increased during NM transportation between various facilities within the Luch site.

Work done under different Task Orders allowed us to complete development of specifications and
layout plans for the equipment to be installed as part of the initial, first-priority upgrades. In addition we have developed and are now implementing upgraded procedures for NM control, including access control to the areas where the target material is located, as well as the use of TIDs with unique identification numbers.

Having completed development of equipment requirements, equipment specifications, and layout plans as part of the effort to upgrade MC&A and Physical Protection systems, Luch, with U.S. support, moved to implementing the plans, following the assigned task priorities and priorities of the three facilities. These projects are successfully moving ahead and are close to completion.

We have replaced the existing wooden doors to the areas where the target material is stored in the Central Storage Facility with hardened metal doors equipped with high security locks. Of the 13 doors identified as needing replacement in the Central Storage Facility, 10 have been replaced with metal doors. Figure 3 shows a typical door before and after replacement.

One of the most important accomplishments of the work done in 1996 was work toward consolidation of nuclear materials. Luch had started NM consolidation four years ago with the objective of consolidating all nuclear materials that are not used in the production process into the Central Storage Facility. U.S. financial and technical assistance extended to us in 1996 allowed us to achieve significant progress in this area. During the 4 years of these efforts nuclear materials were consolidated from 40 locations. This includes consolidation from 18 locations in 1996 alone, as part of the program to upgrade NM physical protection at the Luch site where this protection was deemed to be inadequate. These materials were moved to the Central Storage Facility into an additional storage room that was specially equipped for this purpose.

In Building 34 a priority task to establish a building access control guard post is close to completion. In a rather short period of time Luch specialists developed installation plans to locate a portal monitor in a planned man-trap area in Building 34, as well as developing the wiring diagrams which would permit the use of alarm signals to interlock both doors of the man-trap. Construction and installation have been completed at the entrance to the building, of both the access control guard post and the man-trap. Procedures to control access to the building have been developed, personnel have been identified, Luch has signed a contract with 5 employees who will perform access control functions, and the procedures are now being implemented.

Fig. 4. Building 34 Guard Post

We are continuing construction in Building 2 to build and equip an access control guard post similar to the one for Building 34.

Since TIDs play a key role in the system to control access to NM accounted as units, a program was developed at Luch which will allow us to move to TIDs with unique identification numbers replacing
seals previously used on which the ID numbers were repeated. Luch is in the process of replacing those seals with highly reliable TIDs provided by the U.S., each of which carries a unique identification number.

When the task of assuring secure transportation of NM between buildings within the Luch site was completed, we developed and implemented procedures for NM movement which now require NM escort by Luch forces during such transportation.

Equipment Deliveries

After the types of equipment were identified to meet the needs of the immediate and priority upgrades of the MC&A and Physical Protection systems at Luch, the USLPT arranged for delivery to Luch of the following equipment:

- Four portal monitors to be installed at the access control points to detect unauthorized movement of materials by personnel;
- Three Canberra Inspectors for direct measurements of material enrichment without the need to unseal the containers; this would allow us to carry out confirmatory measurements on arriving materials, as well as to perform measurements during physical inventory taking and to make control measurements during material transfer;
- 12 Hand-held NM detectors to be used at access control points, as well as to detect unauthorized movement of NM;
- 4 Portable Multichannel Analyzers mMCA-430 for identification of NM when an alarm is triggered at a portal monitor, or if the presence of NM is detected with a hand-held PRM-470 NM detector.
- Equipment and computers for use in personnel training and for enhanced communications.

Currently Luch personnel, with U.S. expert support, are expediting installation and commissioning of this equipment as part of the MPC&A upgrading program.

Personnel Training

Personnel training was the area that was identified as the one having the highest priority for joint U.S.-Russian efforts for the MC&A and Physical Protection system upgrade.

The high priority that was assigned to this area was in recognition of the fact that it would not be possible to implement the system-wide upgrades without properly trained personnel; the second reason was the need to change the psychology and the attitude of a significant number of employees among those who have access to NM, as well as those in management positions.

![Lecture and practical workshop](image)

Fig. 5. Lecture and Practical Workshop

At the initial stage of the program only a few of the Luch employees embraced the major concepts of the MC&A system and had an understanding of the strategy and tactics of implementing MPC&A
upgrades. Currently, thanks to a series of training courses and workshops conducted both in the U.S. and in Russia, the number of personnel at Luch who have attended lectures and skill development workshops covering state-of-the-art MC&A technologies and procedures grew to several dozens.

We would particularly like to note the following courses and workshops:

- Vulnerability assessment based on application of the ASSESS software package, conducted at Luch;
- Nuclear materials accounting and control, conducted at Luch;
- TIDs and their role in the NM control system, conducted at Luch;
- NM accounting and control, conducted at IPPE;
- NM physical protection, conducted at IPPE;
- NM access control systems, conducted at IPPE;
- Software for NM accounting, conducted at Los Alamos;
- NM Accounting and Control, and NDA and its role in NM accounting and control, conducted at Los Alamos;
- Computerization of the NM accounting system at Luch, conducted at PNNL.

The number of personnel that have been trained at these and other courses covering various aspects of a modern system-wide transition to MPC&A exceeds 50 members of the Luch staff.

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Thanks in large measure to the knowledge and skills developed at these courses and in the process of implementing the MPC&A tasks at Luch, a number of Luch specialists were able to start in-house training programs for a broad spectrum of Luch personnel including:

- Personnel who operate the access control posts;
- Personnel who transport NM within Luch site;
- Personnel authorized to perform various operations with TIDs.

The number of personnel trained during courses conducted by Luch specialists exceeds 60 members of the Luch staff.

The dynamics of Luch personnel training indicate that Luch has established a foundation for continuous personnel training in the area of modern technologies for nuclear material accounting, control and physical protection, in support of NM nonproliferation and safeguards.

Conclusions and Acknowledgments

Nuclear material control, accounting, and physical protection have improved rapidly at Luch as a result of participation in the program of cooperative upgrades sponsored by the U.S. Luch is now entering the second stage of these improvements: a stage that is slower, more substantial, and more serious. This program benefits from strong administrative and logistical support, and excellent communication between Luch and U.S. specialists, and the strength of the Luch program lies in this team of specialists who share the approach of systematic development of MPC&A upgrades, and who share their experience at both U.S. and Russian nuclear facilities. Luch and all the participants in this program appreciate sponsorship of this vital work by the U.S. Defense Special Weapons Agency and by the U.S. Department of Energy.

Reference: