

UPGRADE OF THE NUCLEAR MATERIAL PROTECTION, CONTROL AND ACCOUNTING SYSTEM AT THE VNIIEF INDUSTRIAL ZONE

Surinder Paul Singh
Oak Ridge National Laboratory*
P. O. Box 2008, MS 6306
Oak Ridge, TN 37831-6306

Joel C. Lewis
Oak Ridge National Laboratory
P. O. Box 2008, MS 6306
Oak Ridge, TN 37831-6306

Viktor Maltsev
RFNC/VNIIEF
37 Mira Avenue
Sarov, 607190, Russia
Nizhnii Novogorod Region

ABSTRACT

The Industrial Zone at the Russian Federal Nuclear Center/ All-Russian Scientific Research Institute of Experimental Physics (RFNC/VNIIEF) consists of ten guarded areas with twenty two material balance areas (MBAs). The type of facilities in the Industrial Zone include storage sites, machine shops, research facilities and training facilities. Modernization of the Material Protection, Control and Accounting (MPC&A) System at the Industrial Zone started in 1997. This paper provides a description of the methodology/strategy used in the upgrade of the MPC&A system.

INTRODUCTION

The RFNC/VNIIEF is one of the two main nuclear weapons design laboratories in Russia. The laboratory has its origin in the initial Soviet Union effort to develop the nuclear bomb. The past mission of the laboratory included weapon design and fabrication of prototype warheads. Since the collapse of the Soviet Union, the laboratory has been trying to diversify the mission to include research into such areas as safety of commercial nuclear power reactor, mathematical modeling, and elimination of chemical weapons and waste¹. Due to the past and current mission in nuclear weapon development, the laboratory has significant quantities of sensitive nuclear material (SNM) at various locations.

In 1994, discussions began between the United States Department of Energy National Laboratories and

RFNC/VNIIEF on upgrading the existing MPC&A System. The initial funded projects dealt with evaluation of Russian and U.S. safeguards technologies. The purpose of these projects was to introduce the VNIIEF personnel to U.S. technologies and also to provide the U.S. team with data on Russian developed technologies. The actual implementation of the MPC&A upgrades began in 1996 with two sites that were named the Reactor Site and Production Site. The acceptance testing of the upgraded MPC&A System at these sites was completed in the Spring of 1997 and trial operation began during the Summer of 1997.

In the fall of 1997 at a joint U.S./Russian project team meeting in Oak Ridge, the VNIIEF team presented to the U.S. team a plan for the upgrading the MPC&A system at the entire VNIIEF Complex. For the implementation of this plan, the VNIIEF Complex was divided into two large entities called the Scientific Zone and the Industrial Zone. This delineation is based upon the management responsibility and functional responsibility rather than physical location. This paper presents the status of the MPC&A upgrades at the Industrial Zone.

DESCRIPTION OF INDUSTRIAL ZONE

A diagram of the closed territory of Sarov is shown in Figure 1. The closed territory is divided into three sections for the implementation of the MPC&A System. These three parts include the residential section, the Scientific Zone, and the Industrial Zone.

*Operated by Lockheed Martin Energy Research Corp. for the U. S. Department of Energy under Contract No. DE-AC05-96OR22464.

Although these three sections are shown to be distinct in Figure 1, the actual demarcation often does not exist. For example, several sections of the Scientific and Industrial Zones are actually located very close or in the residential areas. In addition, VNIIEF is considered a sensitive site due to the weapon related mission thus the access to actual areas is very limited for the US MPC&A team members.

The Industrial Zone at VNIIEF is made up of ten guarded areas as shown in Figure 2. An individual guarded area consists of number of buildings that contain nuclear materials. Each guarded area is further subdivided into MBAs for accounting purposes. The MBAs are classified into storage sites, research sites, production areas and training sites. The quantity and type of material within each MBA is considered classified information. Material transfers can occur within MBAs of a particular guarded area and also between MBAs located in different guarded areas.

An underlining assumption made in the upgrade of the MPC&A system at the Industrial Zone was that the existing MPC&A system only needed to be modernized and not replaced. The modernization would include implementation of additional delay elements, computerized control/accounting system, non-destructive assay equipment, closed circuit television system and an automated access control system.

SYSTEM DESIGN

A contract was placed between the Oak Ridge National Laboratory (ORNL) and VNIIEF in 1997 to develop a conceptual design for the MPC&A system upgrade at the Industrial Zone. The conceptual design was to include schematics of the different MBAs with an overall equipment list. Due to the sensitive nature of some of the MBAs, the information in the conceptual design document was scarce and the US team felt uncomfortable with commitment of funds based upon the information provided in this document. The information provided in the conceptual design document lead the US team to believe that a fiber optic network was required for transfer of information between the different guarded areas. This fiber optic network would connect not only the guarded areas of the Industrial Zone, but also of the guarded areas of the Scientific Zone.

The information in the conceptual design document also indicated the need to prioritize the work since the project would be a multi-year project. The implementation of the MPC&A system was divided into the following categories: installation of delay elements across the entire Industrial Zone, installation of Material Control & Accounting (MC&A) system by guarded areas, installation of video assessment system by guarded areas, installation of access control system by guarded areas, and installation of an automated physical protection system (APPS) by guarded areas.

For fiscal years 1998 and 1999, guarded areas 3, 5, 6 and 7 were targeted for implementation of the MC&A system. A detailed design was performed for these guarded areas which resulted in a list of equipment needed for the system. The equipment list included communication racks for the network, data base servers, work stations, bar code equipment, scales, pedestrian monitors, and intrusion detection equipment.

SOFTWARE DEVELOPMENT AND MODIFICATIONS

Software for the MC&A System was developed for small sites at VNIIEF under a Los Alamos National Laboratory task in 1996 and 1997. Due to the complexity of the Industrial Zone, the software required modifications prior to implementation at this site. The modification of the software required significant effort from VNIIEF in determining the needs or requirements of each MBA in the Industrial Zone. These needs were determined from conversations with material custodians, operators, facility managers, division managers and guarded area managers. This information was used to develop specifications necessary to implement MC&A at each MBA of the Industrial Zone. A part of this task also included the development of a detailed test plan that would include sample data description, loading criteria, user instruction and performance criteria. Based upon the needs/specifications, VNIIEF will modify the existing software as required.

Figure 1. Sarov Closed Territory

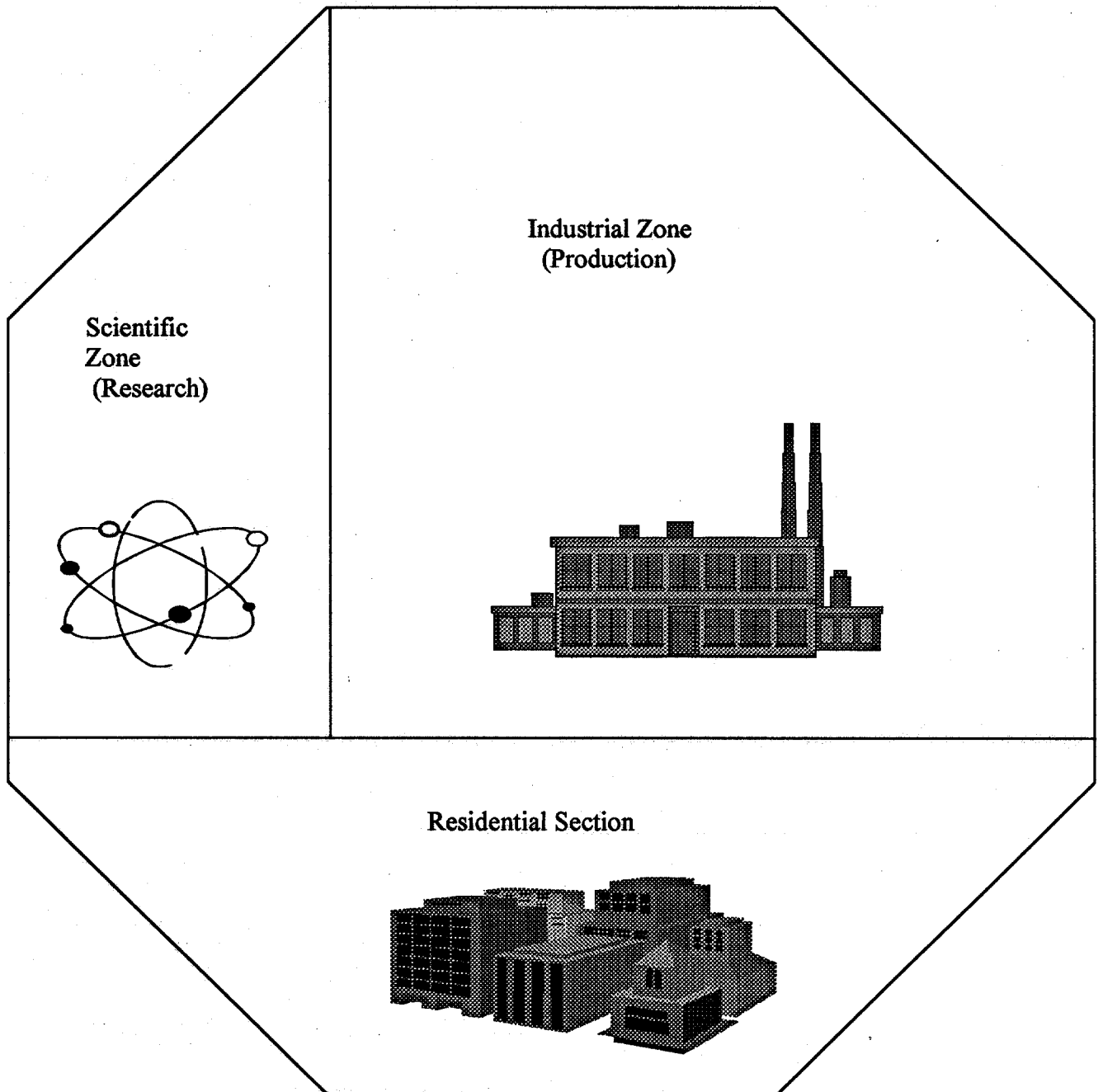
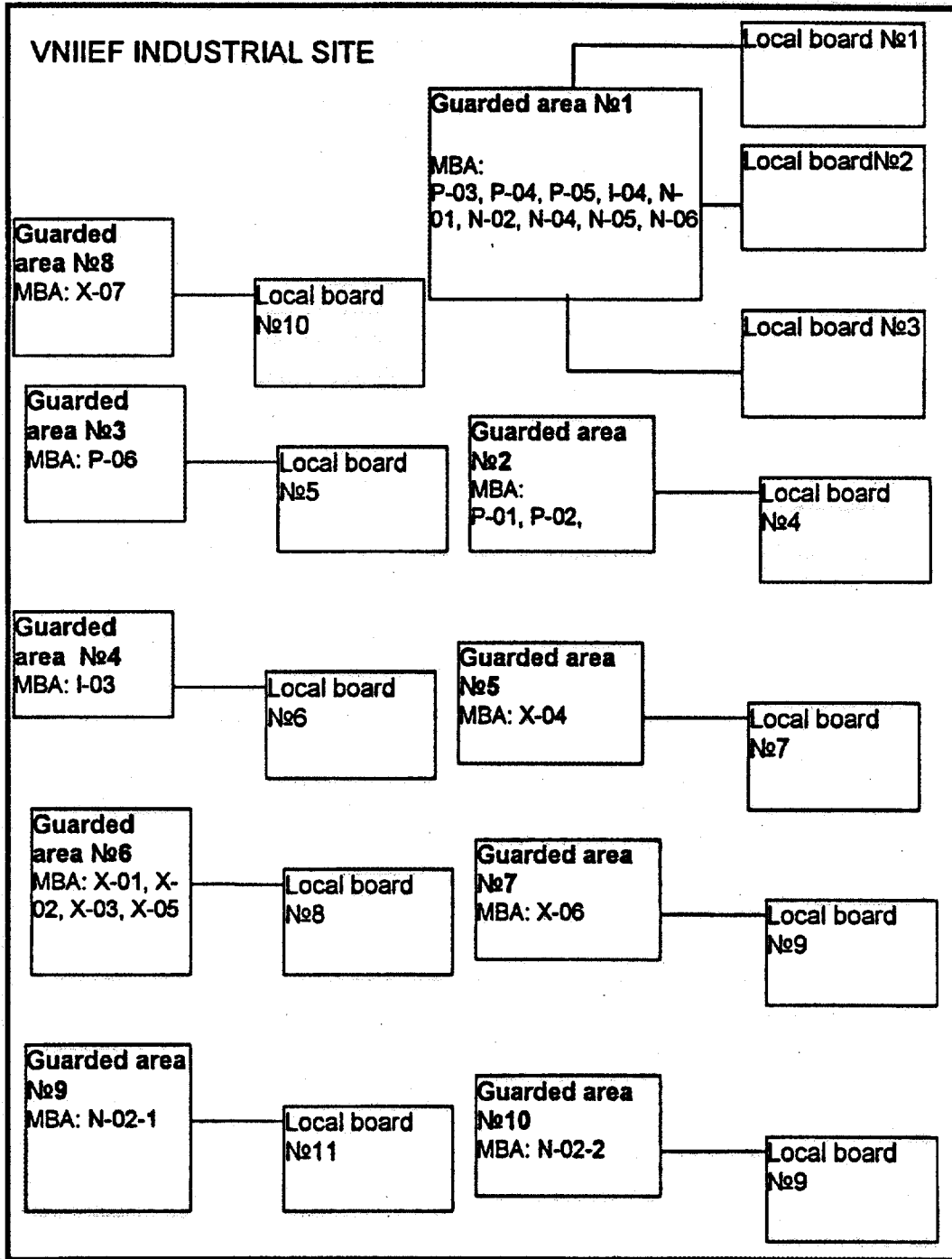


Figure 2. Industrial Zone



ACCOMPLISHMENT

VNIIEF has made significant progress in modernization of the MPC&A system at the Industrial Zone. The work that has been completed to date includes:

1. Installation of fiber optic cable in all the Guarded Areas.
2. Design and fabrication of security doors. Two doors have been fabricated and are undergoing certification process.
3. Detailed design and equipment specification for MC&A system for Guarded Areas 3, 5, 6 and 7. Workstations and scales have already been received by VNIIEF. The bar code equipment and the data base servers should be received in October 1999.
4. Detailed design and equipment specifications for the communication racks. The equipment has already been procured.
5. MC&A Software need/requirements have been determined for each MBA.
6. Detailed design and equipment specifications for the video system for Guarded Areas 3, 5, 6 and 7.
7. Fabrication of eleven pedestrian monitors for Guarded Area 6.

The rate of progress is expected to increase significantly in the future as the equipment is received

and installed at the MBAs. The goal for FY2000 is to have the MC&A under pilot operation at the four guarded areas (3, 5, 6 and 7), complete installation of all the barrier elements, install video system at GA6, and install APPS at Guarded Area 6.

SUMMARY

The modernization of the MPC&A system at the VNIIEF Industrial Zone began in 1997. The modernization includes implementation of a fiber optic network, installation of additional delay elements, installation of computerized MC&A system, installation of video system, and implementation of an automated access control system. The design and implementation has presented some challenges to both the US and Russian team in that the foreign access to most of the sites is not permitted. Even under these constraints, considerable progress has been made with pilot operation of the modernized MPC&A system expected to start at four guarded areas.

REFERENCES

1. Cochran, T. B., R. S. Norris and O. A. Bukharin, *Making of the Russian Bomb: From Stalin to Yeltsin*, p. 39, Westview Press, Boulder, Colorado (1995).