

Improvement of Safeguards Practices in Armenia Through Implementation of Advanced Software

A.Melkumyan, Armenian Nuclear Regulatory Authority
 A.Amirjanyan, Nuclear and Radiation Safety Center

Abstract

The Agreement between the Republic Armenia (RA) and the International Atomic Energy Agency (IAEA) for the Application of Safeguards in connection with Treaty on the Non-Proliferation of Nuclear Weapons was signed on 23.09.1993 and the Protocol Additional to the Safeguards Agreement was ratified on 28.06.2004. In 2007 the RA invited the IAEA ISSAS mission that made recommendations the majority of which have been implemented. The Law of the RA on Safe Utilization of Atomic Energy for Peaceful Purposes establishes the provisions related to the safeguards implementation on state and facility levels, as well as provisions related to preparation and conduct of SG inspections at nuclear facilities and LOFs, preparation and submission of accounting reports and other. The Armenian Nuclear Regulatory Authority is responsible for the safeguards implementation on the state level. The ANRA also maintains the general ledger for LOFs, prepares the accounting reports and submits them to the IAEA. To improve the SG practices and provide with the efficient and continuous control over the nuclear materials, the Nuclear and Radiation Safety Center (ANRA's TSO) developed an electronic database NUCMAT to maintain an accurate inventory, record all changes and provide recoverable history of all activities related to the nuclear materials present in the RA. The NUCMAT provides with automated access to the information on NM and is aimed to assist in efficient implementation of accounting and control of NM, storing data, generating the accounting reports in the format that meets the IAEA requirements, as well tables and maps and quick access to the data. At present the NUCMAT is in trial use by the ANRA specifically in relation to implementation of the accounting and control of nuclear materials in the LOFs.

1. Introduction

To provide efficient and continuous control over the nuclear materials in the Republic of Armenia NUCMAT software was designed and implemented that maintains accurate nuclear material inventory, records all changes, and provides recoverable history of all activities related to nuclear material disposition and inventory change.

2. Technical Basis of NUCMAT

NUCMAT was developed on the basis of Microsoft Visual Studio 2008. Database part of NUCMAT was designed using Microsoft SQL Express technology. Since Microsoft SQL Express is available for free of charge this allows users to avoid any additional financial burdens for NUCMAT installation and implementation. NUCMAT can be installed and used both on individual computer or on a server with Windows operating system. A user can access the database simply using an Internet Explorer or a similar browser.

3. Versions of NUCMAT

Two versions of NUCMAT were developed:

- State level version,
- Facility level version.

Facility level version of NUCMAT is designed to meet nuclear material accounting and reporting needs at facility level and transferring all necessary information to the state level. State level version of NUCMAT is designed for nuclear material accounting and reporting needs at the state level based on collection of information sent by facility level version of NUCMAT. State level version of NUCMAT allows also performing nuclear material accounting and reporting for locations outside facilities (LOFs).

4. NUCMAT Main Functions

Both versions of NUCMAT are capable to perform following main functions:

- Perform and register all required nuclear materials inventory change operations
- Manage of nuclear materials accountancy infrastructure:
 - ❖ Create, brows and edit MBAs,
 - ❖ Create, brows and edit KMPs,
 - ❖ Create, brows and edit 2D disposition maps of nuclear materials (see for example Fig. 4.1)
 - ❖ Move nuclear materials from one location to other by mouse (see for example Fig. 4.2).
- Generate all required Internal and External Reports
 - ❖ General Ledger,
 - ❖ Physical Inventory Listing (PIL),
 - ❖ Inventory Change Report (ICR),
 - ❖ Material Balance Report (MBR),
 - ❖ List of Inventory Items (LII).
- Create starting point (initial nuclear material inventory loading into NUCMAT database).

5. Key Features of NUCMAT

All required nuclear material data could be entered into NUCMAT database both by manual or automatic operations. Every record could be only modified in accordance with the user's access rights. NUCMAT

- keeps all history of modifications of entered data and provides ability of tracking of all data evolution.
- provides capabilities for validation of data entries wherever applicable (numbers, letters, acceptable ranges etc.).
- prompts the users on necessity to enter mandatory parameters without which the further addition of records is impossible.
- contains drop down lists that offer standard, often used data for users (inventory change codes, isotope codes, material codes, irradiation status etc).

6. Reports

One of the main outcomes of NUCMAT is generation of nuclear materials accounting reports that completely meet the IAEA requirements [1-5]. NUCMAT allows generating following reports to be submitted to IAEA in accordance with the Safeguards Agreement:

- PIL (Physical Inventory Listing)
- ICR (Inventory change report)
- MBR (Material balance report)

Option for generation of PIL, ICR and MBR reports in ASCII format is implemented in NUCMAT.

Additionally LII (List of Itemized Inventory) report is generated as supplementary report for above mentioned reports and for IAEA and Regulatory Authority inspections.

Besides of above mentioned reports NUCMAT generates and permanently maintains General Ledger for each MBA except for foreign MBAs (see Fig. 6.3).

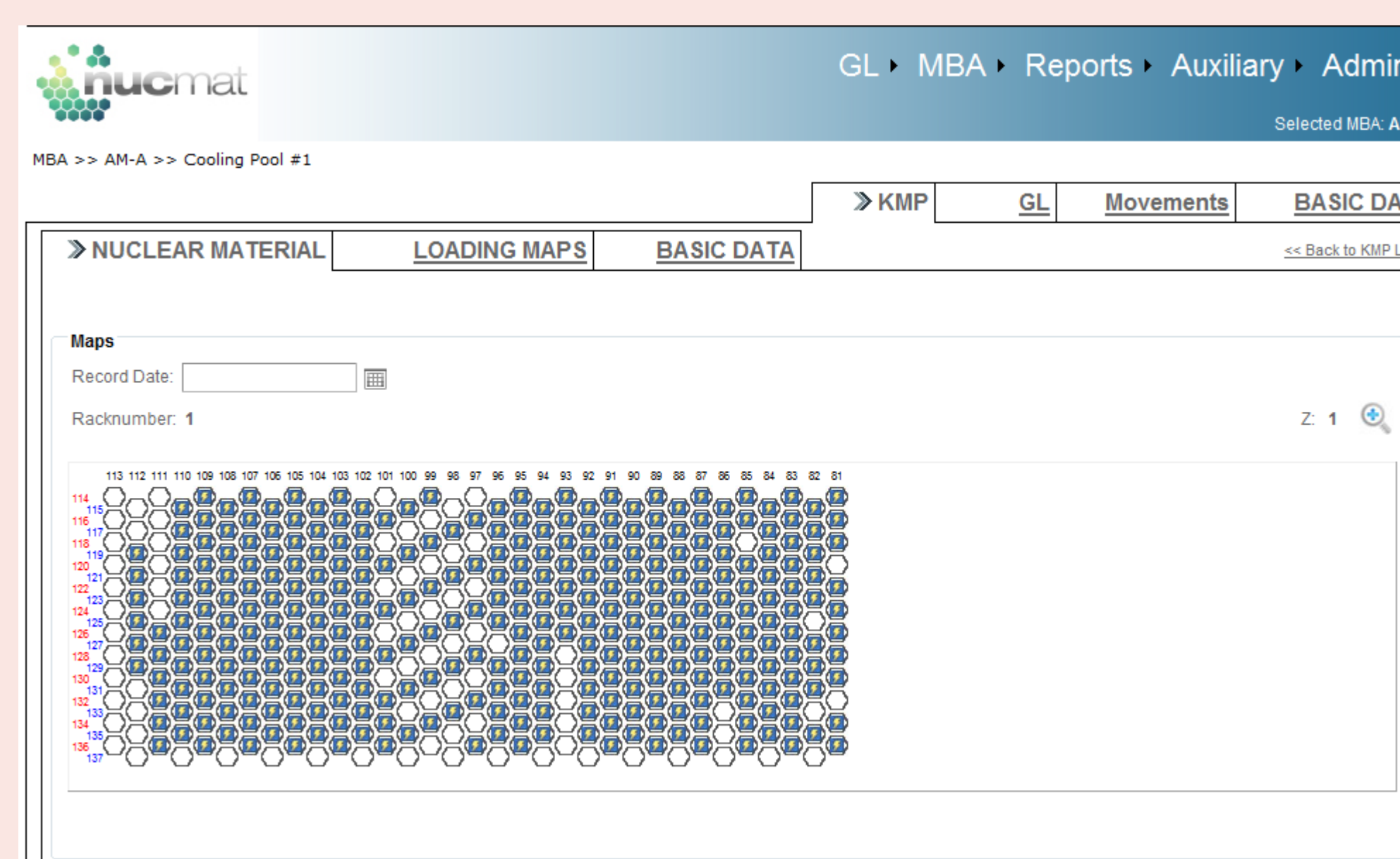


Fig. 4.1 Nuclear materials disposition in KMP inventory

To perform main functions the following possibilities were developed and incorporated into NUCMAT:

- Calculation of isotopic compositions of nuclear materials based on provided tabulated information.
- Calculation of nuclear materials inventory.
- Calculation of nuclear material balance.
- Tracking of nuclear materials histories and providing recoverable history of nuclear materials to users.
- Registration of all actions performed during work with database (Logbook).
- Data entering and validation.
- Automatic input of nuclear materials characteristics into NUCMAT database from special formatted files.
- Backup/Restore of NUCMAT database.
- Provide users with auxiliary capabilities to create nuclear material accountancy infrastructure. For example create and edit preloaded 2D-maps of inventory KMPs and containers.
- Administration of user rights.

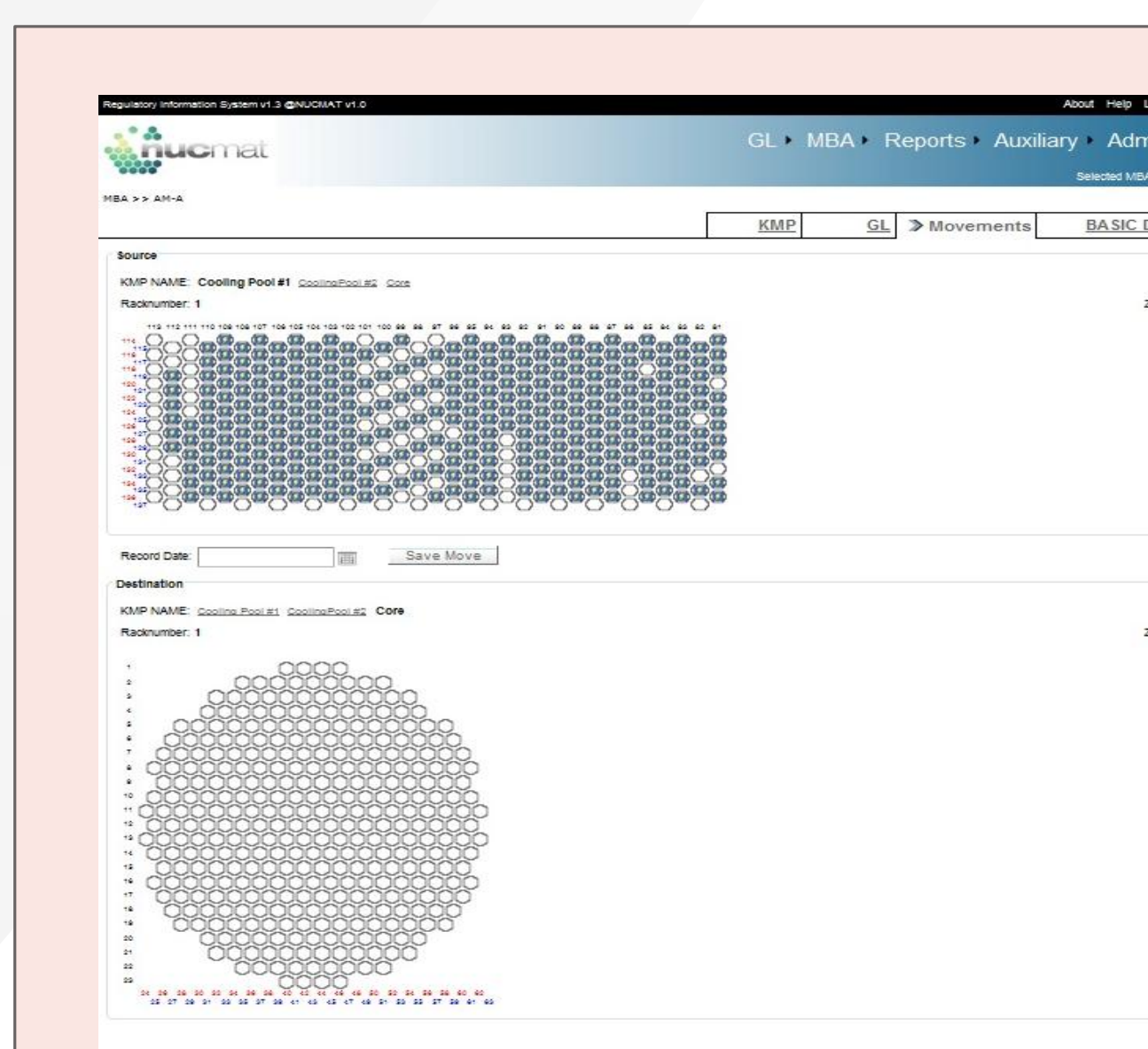


Fig. 4.2. Movement of Nuclear Materials from one Location to Other by Mouse

ENTRY ID	DATE	FACILITY	MATERIAL BALANCE AREA	ISOTOPE	WEIGHT OF ELEMENT	WEIGHT OF FEEDBLE ISOTOPE (UNRADIATED ONLY)	ISOTOPE CODE	IRRADIATION STATUS	REPORT NO.	ENTRY NO.
1	28	E	21488	1	9025	4	1170948	4	270248	1
2	C	E	21488	0	9025	F	49800	4	270248	2
3	C	E	22807	1	9025	E	1108180	4	270248	3
4	C	E	22807	0	9025	F	47480	4	270248	4
5	C	E	10288	1	9025	E	3147540	4	102488	5
6	C	E	10288	0	9025	F	186140	4	102488	6

Fig. 6.1. Example of PIL Report Generated by NUCMAT

Date	ICD Code	No of Items	Receipts	Inventory	No of Items
20100701	BB			0.00	0.00
20100730	SP	1	253.00	253.00	14.50
20100730	SP	1	150.35	403.35	69.95
20100720	SP	1	1500.00	1903.35	1169.95
20100721	ICD.35	LA	1	253.00	1456.35
20100721	ICD.35	LA	1	253.00	1397.35
20100721	ICD.35	LA	1	240.00	1157.35

Fig. 6.3. Example of General Ledger Generated by NUCMAT.