Title: Target Elimination by Inventory Configuration Management

Author(s): Michael Kaufman, NMT-4, Los Alamos National Laboratory
Pamela Dawson, S-4, Los Alamos National Laboratory
Dennis Wilkey, NIS-7, Los Alamos National Laboratory
Steven Croney, S-4, Los Alamos National Laboratory
Dennis Brandt, NMT-4, Los Alamos National Laboratory

Submitted to: Institute of Nuclear Materials Management
DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, make any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.
DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.
Target Elimination by Inventory Configuration Management

Providing Adequate Safeguards and Security for a Facility Consisting of Multiple Category III and IV Material Balance Areas

This paper describes the Inventory Configuration Management (ICM) system implemented at Los Alamos National Laboratory to address the problem of providing safeguards and security for a facility consisting of multiple category III and IV material balance areas (MBAs). DOE regulations require protection against theft of a category I quantity of special nuclear material (SNM) by rollup (i.e., acquisition of a goal quantity from multiple MBAs). Protection against the rollup theft scenario by an insider adversary requires a clear knowledge of inventory quantities, item stratification, and throughput. Implementation of the ICM system provides the necessary information to maintain inventories at levels consistent with the existing safeguards and security (S&S) system, or to indicate when proposed changes in operations may require changes in S&S. The goal of this system is to provide timely data for managing inventory at both the MBA and facility level. The purpose of this system is to provide assurance that the item-quantity stratification of SNM within the facility remains within limits that are consistent with vulnerability assessment assumptions.

Facility Overview

The CMR facility located at Technical Area 3 (TA-3) is a non-reactor nuclear facility, owned by the DOE and operated by the University Of California. The Nuclear Materials Technology (NMT) Division is responsible for oversight and operation of CMR facility. Constructed in 1952 to house analytical chemistry; plutonium and uranium chemistry and metallurgy; as well as engineering and support functions, the CMR Bldg. is divided into 7 wings. Each of the wings are connected by spinal corridors each spanning three floors. With the addition of Wing 9 in 1980, the total square footage of the facility increased to 550,000 square feet, or 11.5 acres. Most experimental and programmatic activities occur on the main floor of each wing. Currently, the CMR facility contains category I, III, and IV MBAs. Though once considered a state-of-the-art facility, the CMR facility is now nearing the end of its original design lifetime. CMR is currently undergoing a major infrastructure upgrade that will extend the life
of CMR through FY 2010. Another important change taking place is the reduction of the SNM inventories in the category I MBA to category III levels.

**Process Overview**

The Inventory Configuration Management (ICM) system is being developed and implemented at the Los Alamos National Laboratory (LANL), Chemistry and Metallurgy Research (CMR) facility. This system is necessary in order to address the problem of ensuring that adequate safeguards and security measures exist for a facility that consists of multiple category III and IV material balance areas (MBAs). Department of Energy (DOE) Manual 474.1-1, 1. g. states that “For all facilities for which roll-up (i.e., the accumulation of smaller quantities of SNM) to a category I quantity is credible, the safeguards and security system must provide graded protection sufficient to ensure that the failure or defeat of a single component will not increase the level of risk for the system above an acceptable level.” Protection against the roll-up theft scenario by an insider adversary requires a clear knowledge of inventory quantities, item stratification, and material throughput. The ICM system is being designed to provide the information necessary to maintain the configuration of the special nuclear material (SNM) inventories within the CMR facility in a way that is consistent with the existing safeguards and security system. In addition, the ICM system also indicates when proposed changes in facility operations will require changes in the safeguards and security posture for the facility.

**Purpose**

The purpose of the ICM system is to provide assurance that the inventory within the category III and IV MBA’s is in a configuration where roll-up of a category I quantity of SNM from these MBA’s remains incredible.

**Scope**

The ICM system applies only to the category III and IV MBA’s within the CMR facility. The ICM system considers summary material type 20 (highly enriched uranium) items greater than 10 grams and summary material type 50 (plutonium) items greater than 5 grams.
Maintaining the configuration of the SNM inventories within the CMR facility such that roll-up was not possible presented a considerable challenge. There are multiple MBA’s, hundreds of items, various material types and forms, as well as different operating organizations with divergent priorities all within a single facility. A vulnerability analysis (VA) showed that roll-up was incredible as long as the inventory remained in the configuration analyzed, predominately a large number of small items. However, it was not possible to quantify how much the inventory could change due to operational needs and yet remain in a satisfactory configuration without constant re-analysis. Having a dynamic inventory is crucial to the continued operation of the CMR facility but the performance of VA after VA was out of the question. The optimum solution to the problem consisted of a 2-phased approach. The first phase was to initially control the category III and IV MBA inventories such that the combined quantity did not exceed $B_{eff} = \text{category I}$. By itself, this solved most of the technical and managerial problems. To begin with, if a category I quantity does not exist within the facility, there is by definition, no roll-up scenario. Secondly, it eliminates any need to consider the configuration of the inventory from an item/quantity perspective. Recall that in order to calculate the $B_{eff}$ quantity assuming that the quantity of attractiveness level B material is a category III quantity or greater, the following equation is used:

$$B_{eff} = B + CX$$

Where:

- $B_{eff}$ = Effective quantity of attractiveness level B material.
- $B$ = Quantity of attractiveness level B material.
- $C$ = Quantity of attractiveness level C material.
- $X = \frac{1}{4}$ for uranium, neptunium and americium, or
- $X = \frac{1}{3}$ for plutonium and U-233.

Since the equation for $B_{eff}$ does not consider the number of items involved in order to calculate its value, the number of items and therefore the item/quantity stratification becomes irrelevant. The accountability system used by LANL, the Materials Accountability and Safeguards System (MASS) is currently set up to calculate the combined inventories of any combination of Laboratory MBA’s. At the same time, MASS produces a $B_{eff}$ quantity based on that combination.

Now that a viable method for managing the facility inventories existed, only one problem remained to be solved. Very few people within the facility have access to all of the inventory information for the entire facility. However, many individuals have the ability to move material in and out of the building. In order to manage the inventories in a way that ensures
prevention of an unacceptable roll-up condition, these two situations had to be resolved. Clearly, the only workable solution was to limit the number of individuals that could authorize the movement of SNM into and out of the facility. It was determined that the materials control and accountability (MC&A) Coordinator’s office for the CMR facility was the logical focal point for managing the configuration of the inventories including authorizing all SNM shipments into and out of the building.

Currently, the shipping/receiving controls that are in place are administrative in nature. The transportation personnel must receive authorization from the MC&A Coordinator’s office before movement of accountable quantities of SNM will occur. For obvious reasons, transfers of SNM out of the facility do not receive as detailed a review as incoming shipments. Before authorizing an incoming shipment the MC&A Coordinator’s office obtains a current B_{eff} quantity for the facility from the MASS database. This listing is printed and a calculation of the B_{eff} quantity resulting from the shipment occurs. The new value for B_{eff} is verified to be less than category I quantity. The individual performing the calculations signs, dates and puts the listing in the appropriate file. Following this, transportation personnel receive authorization to perform the transfer. When the incoming shipment arrives at the facility, a representative from the MC&A Coordinator’s office verifies that the actual shipment quantity matches the quantity authorized. If they agree, the representative signs the shipping documentation and releases the contents of the shipment to the receiving MBA Custodian.

The Future...

A significant change that is occurring at the CMR facility right now is the removal of SNM from the category I vault to the point where it will become a category III MBA. The intent is to reduce the security costs associated with operating the facility. Once this happens, creation of a shipping/receiving MBA controlled by the MC&A Coordinator’s office will occur. From then on, personnel in the MC&A Coordinator’s office alone will possess the ability to perform transactions across the facility boundaries that are located at the CMR Bldg.

LANL personnel are also developing criteria whereby SNM that previously contributed to the B_{eff} quantity is no longer considered.

Finally, the feasibility of creating additional MBA’s within the facility is under evaluation.