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**ISSM Applied to FB-Line MC&A**Ed Sadowski

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**Abstract**

The paper will employ the Integrated Safeguards & Security Management (ISSM) methodology to analyze previous MC&A failures in the FB-Line at the Savannah River Site (SRS) that led to Marginal and Unsatisfactory ratings on Department of Energy (DOE) Surveys. Each of the core functions of ISSM:

Define the Scope of Work

Analyze the Risks

Develop and Implement Safeguards &amp; Security Measures

Perform Work within Measures

Provide Feedback and Continuous Improvement

will be discussed in the context of the MC&A requirements in the FB-Line, a plutonium processing facility. The two processes that will be explored are measurement of metal ingots and characterization of scrap for the proper disposition path. Recent FB-Line self assessments and Surveys by the DOE have resulted in Satisfactory ratings and identification of Best Business Practices. The remediation of the FB-Line MC&A program into its current state of success will also be discussed in the framework of the ISSM methodology.

**Introduction**

FB-Line is a chemical processing facility at the United States Department of Energy's Savannah River Site (SRS). FB-Line's former mission was to convert plutonium nitrate solution into plutonium metal ingots. This mission concluded in March 2002 and will be discussed below.

FB-Line's current mission is to stabilize plutonium and uranium metal and oxide for long term storage in containers compliant with DOE-STD-3013. This plutonium and uranium was either produced at FB-Line or received from other facilities throughout the DOE Complex. The portion of the process of interest to this paper is the Material Characterization line. In this line, plutonium- and uranium-bearing material, mostly Central Scrap Management Office (CSMO) material from the 1970's and 1980's, is introduced into a glovebox where large chunks and waste materials are separated from finer particles. The chunks and particles are 'characterized' as to their constituents so that the proper disposition path can be determined. The batches in this line are usually Category III, sometimes Category IV, rarely Category II, and never Category I quantities of Special Nuclear Material (SNM).

From April 2001 into February 2003, a series of DOE Surveys yielded ratings of Marginal and Unsatisfactory. The three drivers for these ratings were

- Metal ingots were not measured during the inventory period in which they were produced
- No Limit of Error of the Inventory Difference (LEID) was calculated for the Material Characterization line
- Lack of Oversight by Site MC&A and FB-Line Management

### **Breakdowns in ISSM**

*Metal ingots were not measured during the inventory in which they were produced  
Lack of Oversight by FB-Line Management and Site MC&A*

1. Define the Scope of Work
  - a. The scope of work was well defined as production of plutonium metal ingots.
2. Analyze the Risks
  - a. The risk was diversion of plutonium metal and substitution with non-SNM.
3. Develop and Implement Safeguards & Security Measures
  - a. Physical Security and Access Control around the ingots were compliant with DOE Orders for protection of Category I SNM.
  - b. LEIDs were calculated and evaluated using weight measurements.
  - c. Destructive Analysis or Nondestructive Analysis was not implemented as a safeguard to detect substitution.
4. Perform Work within Measures
  - a. Metal ingots were produced, weighed, and stored in compliance with the measures listed above.
5. Provide Feedback and Continuous Improvement
  - a. FB-Line MC&A entered weight as a measured value without a measurement type identifier in the SRS Material Accounting System, SRSMAS.
  - b. Site MC&A saw a measured value in SRSMAS.
  - c. Self Assessments missed this lack of either Nondestructive Analysis or Destructive Analysis because the FB-Line assessors were the same people that developed and implemented the Safeguards & Security measures, and none of the Site MC&A personnel were told that they needed to assess this part of FB-Line MC&A.

From the above analysis, the two breakdowns were that

- MC&A was not viewed as the final check on the Physical Security system, but as a complement to it. The belief was that if the Physical Security was robust enough, some elements of MC&A could be lessened.

- FB-Line Management did not independently self assess MC&A, and Site MC&A personnel did not perform their oversight role because they were busy performing FB-Line MC&A tasks.

### Current Improved Practices

All items are analyzed via Nondestructive Analysis or Destructive Analysis before closing the inventory period.

1. Define the Scope of Work
  - a. The scope of work is well defined as production of SNM metal and oxide items.
  - b. The expectation that weight alone is not a measurement has been set by MC&A and accepted by Operations and Engineering.
  - c. Nondestructive Analysis and/or Destructive Analysis and evaluation of the results against Limits of Error (LOEs) are now steps in the shipping process recognized by both Operations and Engineering.
2. Analyze the Risks
  - a. The risk is diversion of SNM metal or oxide and substitution with non-SNM.
3. Develop and Implement Safeguards & Security Measures
  - a. Physical Security and Access Control around the SNM are compliant with DOE Orders for protection of Category I SNM.
  - b. The SNM in all items is quantified by Nondestructive Analysis and/or Destructive Analysis before closing the inventory period.
  - c. The items can not move to the next step in the process until they have been measured and the item/batch/inventory period inventory differences are resolved.
4. Perform Work within Measures
  - a. All items are produced, processed, analyzed, stored, and shipped in compliance with the measures listed above.
5. Provide Feedback and Continuous Improvement
  - a. Added additional, independent technical support personnel in FB-Line MC&A whose primary area of responsibility is to perform self assessments.
  - b. Company reorganization clearly defined Site MC&A's role as policy and oversight.
  - c. Company reorganization transferred personnel responsible for FB-Line MC&A into FB-Line organization, reporting to the Facility Manager. FB-Line Management is now compelled to self assess FB-Line MC&A since FB-Line is now responsible for all MC&A in FB-Line.
  - d. The instrument that measured each item is now identified in SRSMAS.

In summary, the SNM in all items is quantified and evaluated against LOEs before the item can proceed in the process and before the inventory period can be closed.

Ownership of FB-Line MC&A is now concentrated in FB-Line. FB-Line self assessments have been identified by the DOE as a Best Business Practice.

*LEIDs were not calculated for Material Characterization  
Lack of Oversight by FB-Line Management and Site MC&A*

1. Define the Scope of Work
  - a. The scopes of work were well defined as sort and characterize SNM-bearing material to determine the disposition path.
2. Analyze the Risks
  - a. The risk was diversion of SNM and substitution with non-SNM.
3. Develop and Implement Safeguards & Security Measures
  - a. Senior personnel partially developed measures like proper sampling and calculating LEIDs, but multiple personnel changes, including senior personnel, in a short period of time, resulted in poor turnover that caused the implementation to fail.
4. Perform Work within Measures
  - a. SNM-bearing material was sorted and characterized.
  - b. LEIDs were not calculated for several years.
5. Provide Feedback and Continuous Improvement
  - a. FB-Line self assessments did not detect this deficiency because calculation of LEIDs was a Site MC&A responsibility.
  - b. Site self assessments did not detect this deficiency because Site MC&A 'checked the box' on the self assessment because they were calculating LEIDs on the old bulk process and the turnover that LEIDs were expected on the new (Category III or IV) Material Characterization process was poor.

From the above analysis, poor turnover during multiple personnel changes caused partially developed Safeguards & Security measures to not be completely developed or implemented in FB-Line. Superficial self assessments caused this deficiency to go unnoticed.

Current Improved Practices

Real Time Process Monitoring by Operations has been implemented, and Near Real Time Process Monitoring (Ref. 1) has been implemented by FB-Line MC&A. LEIDs are now calculated around items, batches, and inventory periods. FB-Line Management self assesses all of FB-Line MC&A.

1. Define the Scope of Work

- b. The scopes of work are well defined as sort and characterize SNM-bearing material to determine the disposition path.
2. Analyze the Risks
    - a. The risk was diversion of SNM and substitution with non-SNM.
  3. Develop and Implement Safeguards & Security Measures
    - a. Site MC&A personnel that were performing FB-Line MC&A tasks have been moved to FB-Line and report to the FB-Line Facility Manager.
    - b. Real Time Process Monitoring by Operations has been implemented.
    - c. Near Real Time Process Monitoring has been implemented by FB-Line MC&A.
    - d. LEIDs are calculated around items, batches, and inventory periods.
  4. Perform Work within Measures
    - a. SNM-bearing material is sorted and characterized in compliance with measures listed above.
  5. Provide Feedback and Continuous Improvement
    - a. FB-Line Management self assesses all of FB-Line MC&A.
    - b. FB-Line self assessments identified by DOE-SR as a Best Business Practice.
    - c. Site self assessments are more robust due to clear definition of oversight role.

In summary, FB-Line has implemented a multi-tiered Process Monitoring regime that results in thorough, timely knowledge of SNM quantities and locations. The company reorganization resulted in a highly developed sense of ownership of FB-Line MC&A by FB-Line Management.

## Summary

Two of the Guiding Principles of ISSM were found to be at the root of past poor performance in FB-Line MC&A:

- Line Management Responsibility for Safeguards & Security
- Clear Roles and Responsibilities

Westinghouse Savannah River Company strengthened implementation of these principles via a company-wide reorganization in January 2003. The purpose of the reorganization was to move all personnel that supported a facility into the facility's line organization. The line organizations now have responsibility for all activities that directly support the mission of the facilities, like Safeguards & Security. The Site central organizations now provide only policy and oversight, so the roles and responsibilities of the line organizations and the Site central organizations are very clear. The strengthening of the implementation of these Guiding Principles of ISSM has caused significant improvements in the application of the core functions of ISSM to FB-Line MC&A. The keys to these improvements are summarized below.

### *Develop and Implement Safeguards & Security Measures*

Due to the flexibility in the DOE MC&A Manual, early buy-in by all stakeholders, as to what constitutes acceptable measures to mitigate risks is essential. These stakeholders consist of at least Management, Operations, Engineering, MC&A, and Oversight.

These measures must be institutionalized through plans, procedures, etc. so as to be independent of personnel changes.

*Perform Work within Measures*

MC&A is a part of operations and works best when integrated as a step in a larger process rather than as an add-on at the end of a process.

*Provide Feedback and Continuous Improvement*

Facility Management needs to be an aggressive assessor and ally to create a healthy MC&A program. If they are apathetic or confrontational toward MC&A, the program will founder.

If the MC&A program supports operations by helping to streamline the MC&A requirements, then the Operations organization will trust the MC&A organization enough to provide feedback when requirements are not being met.

The result of these improvements is that since March 2003, a series of DOE Surveys have yielded ratings of Satisfactory and included notations of Best Business Practices.

**Reference:**

R. Lynn, "Process Monitoring – Measurement Evaluation", Institute of Nuclear Materials Management 45<sup>th</sup> Annual Meeting, July 18 -22, 2004.