
Domestic Nuclear Material Control & Accountability

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Y-12 National Security Complex
December 16, 2008



Establishment of MC&A Programs

- National Agencies
 - Nuclear Regulatory Commission
 - Private enterprise or university study
 - Fuel fabrication
 - Power/research reactors
 - Department of Energy / National Nuclear Security Administration
 - Government owned materials
- International Atomic Energy Agency (IAEA) as applicable

Purpose of MC&A

- To deter and/or detect theft or diversion by maintaining an accurate inventory of nuclear materials
 - Theft: unauthorized removal of nuclear material from a facility
 - Diversion: unauthorized removal of nuclear material from its approved use or authorized location

MC&A Program Elements

- MC&A Plan
- Graded Safeguards
- Accounting
- Measurements
- Material Containment
- Material Surveillance
- Physical Inventory
- Control Indicators
- Performance Evaluation

MC&A Policy Flowdown

- Governed by DOE M 470.4-6, *Manual for Control and Accountability of Nuclear Materials* or 10 CFR Part 74, *Material Control and Accounting of Special Nuclear Material*
- Materials Control and Accountability (MC&A) Plan or Fundamental Nuclear Material Control (FNMC) Plan
- Plant level procedures

Graded Safeguards

- Applying the most controls and resources to the most attractive materials
 - Attractiveness level - determined by the ease of converting the raw materials to a nuclear explosive device.
 - Category - determined by the amount of material for a specific attractiveness level
 - Roll-up - smaller quantities of less attractive materials accumulating to an amount that makes it a higher attractiveness level
- Safeguards Termination

Accounting

- Material Balance Areas
 - defined geographical boundaries used to identify the location of nuclear materials processing or storage
 - isolate inventory differences
 - track/control material transfers
 - Site specific MBA Custodian duties
- Accounting System
 - MBA tracking structure
 - Data collection process for item level information
 - Routine and emergency reporting requirements
 - Inventory reconciliation structure

Measurements

- Net Weight
 - Scales
 - Volume/density
- Element Weight and Isotope Weight
 - Destructive analysis (DA) is a process which alters the material form through sampling or dissolution
 - Non-destructive analysis (NDA) uses a monitoring instrument to determine the isotope weights without altering the material

Measurement Control

- Calibration on an established frequency
- Certified reference material to ensure instrument performance
- Control charts to monitor instrument performance
- Random and systematic error to support measurement discrepancy evaluations

Material Containment

- Material Containment
 - Defined physical security boundaries based on graded safeguards
 - Daily Administrative Checks
 - Authorized location based on security or processing needs
 - Access controls based on need-to-know, security clearance, training

Material Surveillance

- Methods used to detect unauthorized activities or anomalous conditions when material is not in locked and alarmed storage
- Examples
 - Cameras
 - Tamper-indicating devices
 - Local or centralized alarms
 - Two-person Rule

Inventory Monitoring

- Item Monitoring
 - Location of items in storage
- Process Monitoring
 - Balance of input to output
 - Net weight, element weight or isotope weight
 - Key measurement points

Physical Inventory

- Preparation
 - Salvage processing
 - Established date and frequency
 - Training
- Item reconciliation
- Quantity reconciliation
- Propagation of Variance

Control Indicators

- Transfer checks
- Inventory difference evaluation
- Shipper/receiver difference evaluation

Anomaly Resolution

- Graded safeguards
- Contribution to program effectiveness
- Established procedures for resolution steps, issue owner designation, and notification requirements

Performance Evaluation

- Performance Testing
- Comprehensive Assessments
- Independent Assessments
- Internal (Self) Assessments
- Effectiveness Model

Effectiveness Model

- Allows detailed analysis of each program element
- Identifies strengths and weaknesses
- Graded safeguards approach based on contribution of the element
- Examples
 - Comprehensive Analysis of Safeguards Strategies (COMPASS)
 - MC&A System Effectiveness Tool (MSET)

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