Joint US-China Integrated Nuclear Materials Management Technology Demonstration Workshop

October 18-21, 2004
Beijing, People's Republic of China

US Participants:

DOE/NNSA: NA-243 and NA-25
Los Alamos National Laboratory
Lawrence Livermore National Laboratory
Sandia National Laboratories
Oak Ridge National Laboratory

U.S. Presentation Title:

Overview of Nuclear Materials Safeguards Methodologies and Technologies

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Technology Demonstration Workshop

- **Purpose:**
  - **To demonstrate applications of current technologies and methods for the integration of the protection, control, and accountability of nuclear materials**

Basic Components of MC&A System

- **Material Control**
  - Access Controls
  - Material Surveillance
  - Material Containment
  - Detection/Assessment
- **Material Accountability**
  - Accounting Systems
  - Physical Inventories
  - Measurement and Measurement Control
  - Nuclear Material Transfers
  - Material Control Indicators

Basic Assumptions for Workshop

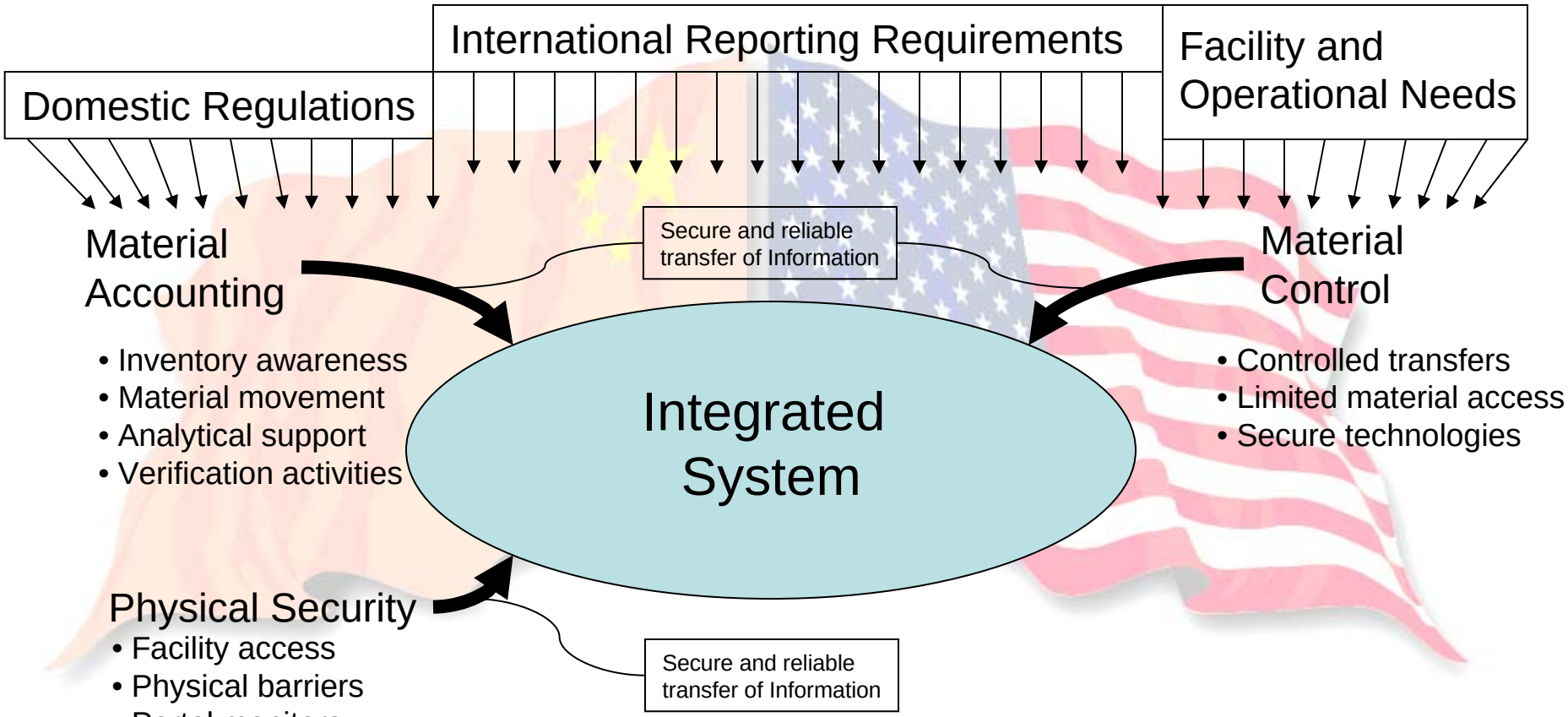
- China and U.S. have
  - Similar regulatory requirements
  - Similar components found at sites
  - Similar threats for design basis
  - Similar goals for detection and response
  - Similar goals for performance and improvement in today's world

Information Collection

- **Collected information and integrated needs defined by:**
  - **International reporting requirements**
  - **Domestic regulations**
  - **Facility and operational needs**

Integrated Nuclear Material Management System

Collected information and integrated needs defined by:



Key Systems

- **Material control systems**
  - **Material containment and location**
  - **Control and limit access to materials**
  - **Surveillance and detection**
- **Material accountability systems**
  - **Inventory and transfer of materials**
  - **Measurements and statistical analyses**

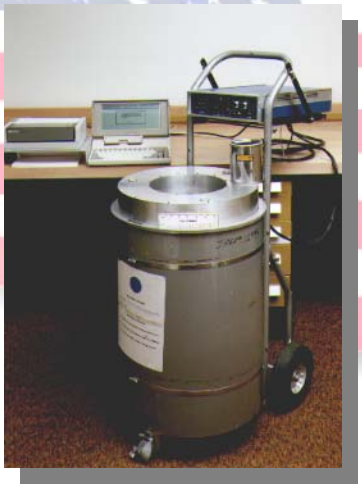
Existing DOE Applications

- At most DOE facilities, such as:
  - Pantex
  - Savannah River Site
  - Y-12 National Security Complex
  - Los Alamos National Laboratory

- Similar degrees of automated, near-real-time accounting at various locales
- Various automated data input systems (barcodes, scales, DA & NDA results, etc.)
- Transactions with Nuclear Materials Managements Safeguards System (NMMSS) – national inventory system
- Accounting subset for IAEA safeguarded materials

Analytical Methods and Systems

- **Nondestructive assay (NDA) instruments are used in many material control and accounting systems**
  - **Gamma-ray spectroscopy**
  - **Scales**
  - **Neutron counting**
  - **Calorimetry**



*Equipment and related technology depicted in presentation may be subject to export control.

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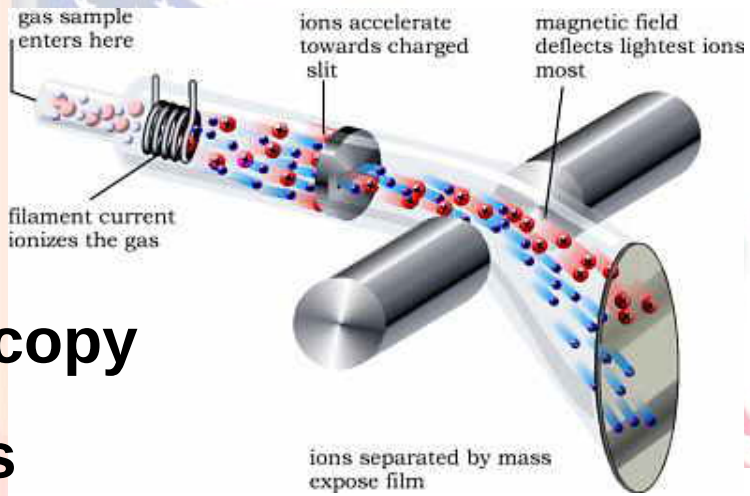
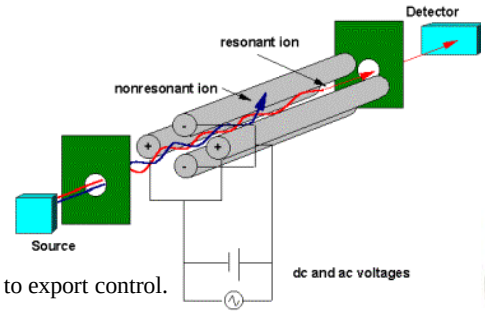
Analytical Methods and Systems

- **Destructive Analysis (DA) is a key ingredient to an effective material control and accountability program (MC&A)**
  - **Atomic absorption**
  - **Mass spectrometry**
  - **Gamma-ray spectroscopy**
  - **Davies-Gray titrations**
  - **UV spectrometry**
  - **Traceable Standards**





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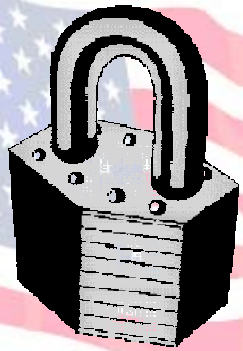
Administrative Controls

- Regulations and Procedures
  - Security Plans
    - Vulnerability assessments
      - Effective modeling scenarios
    - Physical barriers
    - Sensors
    - Self-assessments
- Nuclear Material Control Plans
  - Routine inventory
  - Material movements are procedurally controlled
  - Effective analytical support
  - Database management

Networks and Communications

- Data transfers between components must be
  - Secure,
  - Reliable, and
  - Cost effective.



- Can operate in unattended modes

U.S. Demonstration Working Group Presentations

Topic	Presenter
Domestic Regulations and International Requirements	Michael O'Brien – Lawrence Livermore National Laboratory
Materials Control and Accountability Systems and Methods	Wayne Ruhter – Lawrence Livermore National Laboratory
Nondestructive Assay (NDA) Systems and Methods	T.K. Li – Los Alamos National Laboratory
Secure Communications and Unattended and Remote Monitoring Systems	Don Glidewell – Sandia National Laboratory

Technology Demonstration Working Group

- **Mission:**
  - **To establish a technical demonstration of the application of current technologies for less intrusive and more effective implementation of an integrated system of nuclear material control and accounting at Chinese nuclear facilities.**

Questions Addressed by Joint Working Group

- Define the intended audience
- Specify the central theme/message to be communicated
- Determine how interactive (hands-on) the demonstration will be
- What instrumentation can be provided by each country
- Identify expected outcome

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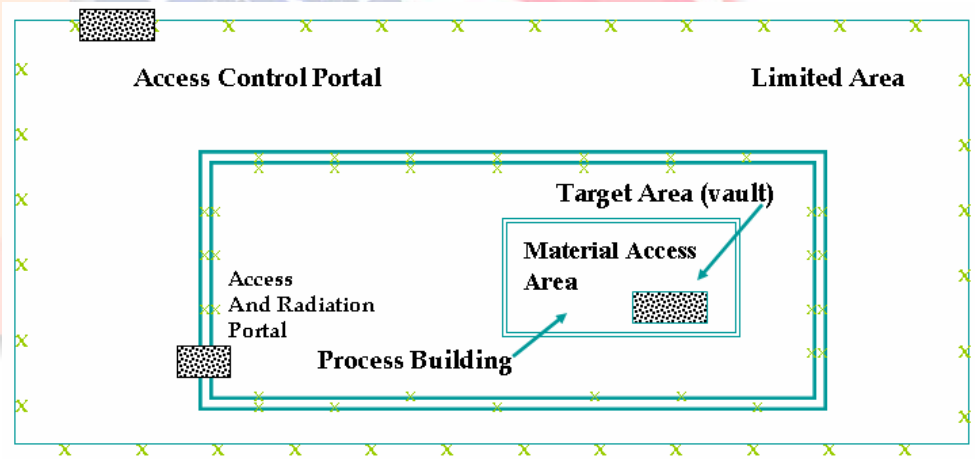
Potential Demonstration Idea

- Create an actual item storage material balance area (MBA)
  - Each item (e.g., canister) has unique attributes
    - Established nuclear material accounting values
    - Identification number
    - Slight radiation signature
      - (e.g., from source)
    - Weight
  - There is an inventory of items
    - (e.g., 20-50 canisters)
  - There are receipts and shipments
    - (e.g., 5-10 transactions per time period)



Potential Demonstration Idea (cont.)

- **Define domestic and international reporting requirements**

- **Define several credible threat scenarios**
  - **Outsider threat (e.g., theft)**
  - **Insider threat (e.g., substitution)**

Potential Demonstration Idea (cont.)

- **Define representative (non-integrated) systems, components, and processes**
  - **Physical protection**
  - **Access control**
  - **Accounting**
    - **Measurement**
    - **Inventory**
    - **Confirmation of shipments & receipts**

Potential Demonstration Idea (cont.)

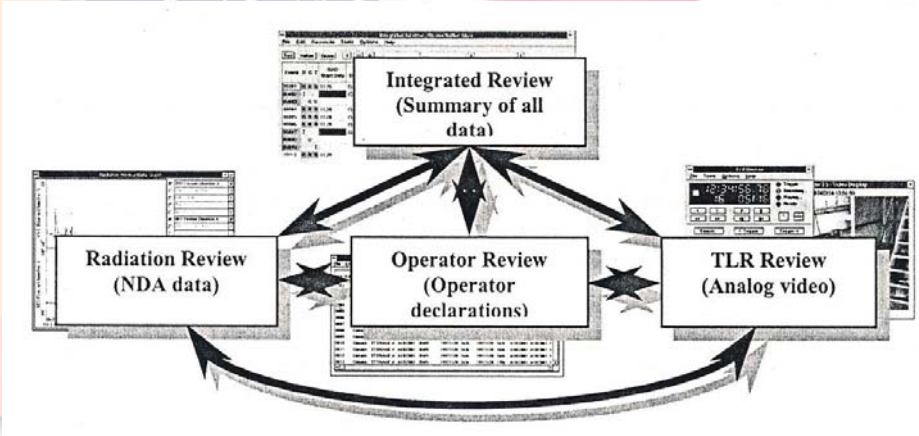
- **Demonstrate system performance**
  - **Amount of effort**
  - **Timeliness**
  - **Accuracy/effectiveness**
- **Demonstrate response to threat scenarios**
  - **Signals generated**
  - **Detection capabilities**

Potential Demonstration Idea (cont.)

- **Describe how an integrated management system could be applied to the same material storage area**

- **Integration of several components**
  - **Physical security**
  - **MC&A**
  - **Program management**
  - **Etc.**

- **Compare and contrast**
  - **Effort**
  - **Timeliness**
  - **Accuracy/effectiveness**
  - **Detection**



Tasks of Joint Working Group

- Specify demonstration message
- Develop work scope
- Establish schedule with intermediate milestones
- Assign roles & responsibilities
- Perform work

Thank you

Questions or Comments?

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