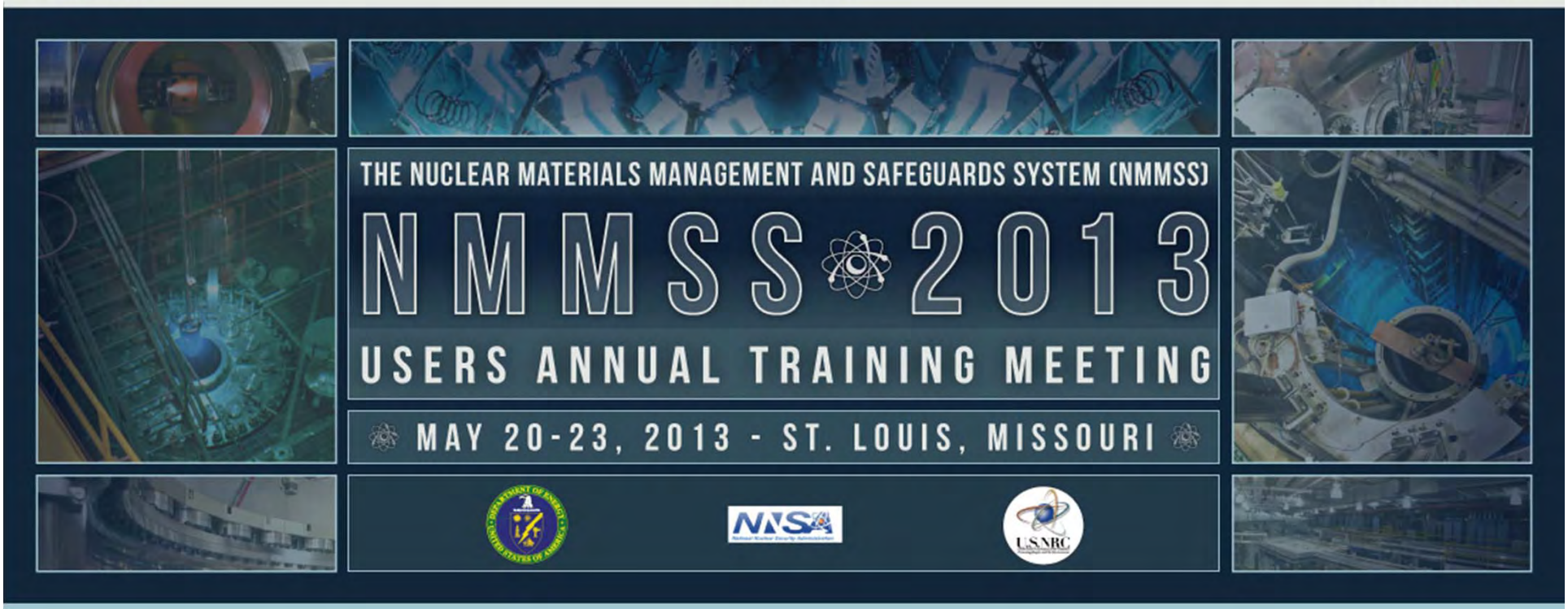
ACCURACY PERFORMANCE ACCOUNTABILITY



Global Monitoring of Uranium Hexafluoride Cylinders

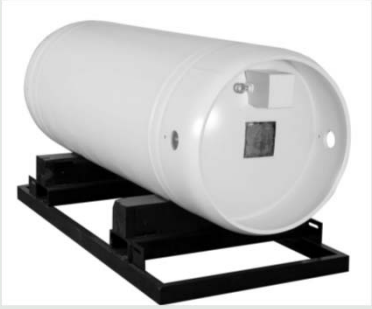
Jessica White-Horton, Oak Ridge National Laboratory

NMMSS Users Annual Training Meeting,

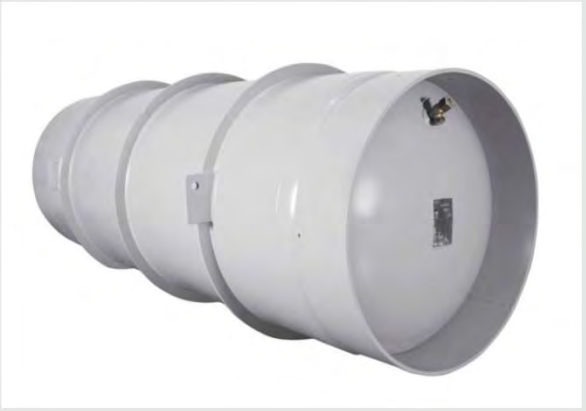
May 21, 2013

Outline

- Project Context & Current Challenges
- NNSA 5-year Program Plan
- Concept of Operations
- Stakeholder Views
- Conclusions and Next Steps



Model 30B cylinder for low-enriched uranium (LEU)



Model 48Y cylinder for natural uranium

Context for NNSA UF_6 Project

- Approximately 20,000 cylinders are in active circulation at any time
  - Each cylinder can contain enough ^{235}U to make two significant quantities (SQs) of HEU
  - No industry-wide standard for uniquely identifying cylinders
  - No single listing of all UF_6 cylinders being used around the world

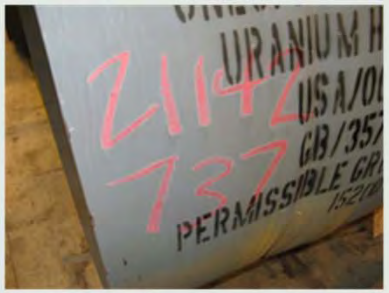
- Not all LEU is under IAEA safeguards when produced & shipped--NWS

- Enrichment capabilities (declared and clandestine) have increased in the last decade

- A small clandestine enrichment facility with a capacity of 10,000 – 25,000 SWU/year could convert:
  - Contents of a 48Y cylinder containing natural UF_6 into an SQ of HEU in ~3 months – 1 year
  - Contents of a 30B cylinder containing LEU (~3-5% enriched) into an SQ of HEU in ~30-90 days

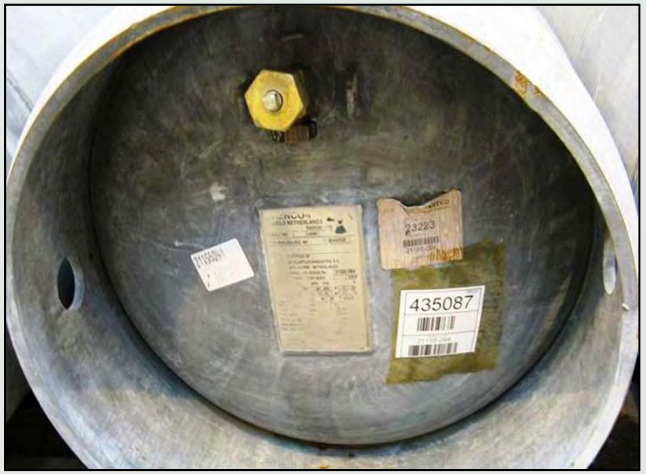
Current Industry Practices

- Each facility has its own system for numbering and marking cylinders
  - No industry-wide standard for numbering
  - No widespread automated system exists



Current Safeguards Challenges

- Safeguards efficiency
  - Inconsistent application of cylinder IDs across industry
    - Increases likelihood of error in reading and recording IDs
    - Limits ability for IAEA to automate on-site inspection tasks and to efficiently match transfers
  - Time to locate and identify cylinders
    - Consumes IAEA inspector time during inspections (Inspection days at larger GCEPs already exceed 100 days/year)
    - Reduces detection probabilities (IAEA resource constraints)



Current Safeguards Challenges (Continued)

- Safeguards effectiveness
  - Detecting diversion before a SQ of HEU can be produced
    - From on-site cylinder inventories
    - During transit
  - Detecting undeclared production pathways (using undeclared cylinders)
  - Detecting clandestine enrichment facilities
  - Transit matching
    - Time delays
    - Manual vs automatic matching

NNSA UF_6 Cylinder Monitoring Project Scope

- Enhance IAEA inspection capabilities to detect diversion and undeclared production in a more effective & efficient manner
- Develop a concept for a global identification and monitoring system for UF_6 cylinders
- Demonstrate at a proof-of-concept level the principal elements of a system that uniquely identifies UF_6 cylinders throughout their life cycle that can be used by both operators and the IAEA

Task 1: Key Findings

- An industry-wide UID must be:
  - Tamper-indicating for use by IAEA
  - Capable to be automatically scanned or read
  - Able to withstand a challenging/harsh environment
  - Capable to be applied during cylinder fabrication or in the field
- The IAEA detection of certain diversion/misuse scenarios could be improved
  - Excess production at a declared facility
  - Diversion in less than a year
  - Production at a clandestine facility
  - Diversion in transit
- Continued engagement with stakeholders is critical

Concept of Operations

- The concept for a global cylinder monitoring system for UF_6 cylinders has 3 principle components:
  - Standardized ***unique identifier*** (UID) for each cylinder
  - Unattended and portable ***UID reader systems*** at IAEA safeguarded facilities
  - Collection of safeguards-relevant cylinder information (e.g., UID, location) into an access-controlled, ***global "registry"***

Unique Identifier

Concept

- Standardized format/design
- Unique across all industry
- Read remotely (by portable or unattended readers)
- Applied during fabrication and/or during recertification
- Usable by both the operator and IAEA
- Tamper-indicating for use by IAEA

Unique Identifier

Benefits

- Improves cylinder identification and reporting to SSAC and IAEA
  - Eliminates reading and transcription errors
  - Eliminates need for operator to apply additional labeling
    - Eliminates potential confusion over ID in reports (nameplate vs labels)
- Tamper-indicating feature increases confidence that nameplates have not been altered.
- Rapid reading of IDs by operator, regulators, and IAEA
  - Reduced inventory times
  - Reduced personnel exposure times in cylinder yards
- Can be integrated into plant systems (operations, safety, MC&A)
  - Potential for shared-use instruments

UID Reader Systems

Concept

- Portable readers can be used to inventory cylinders in storage areas
- Unattended readers can be installed at strategic locations
  - Cylinder receipt and shipment
  - Key operational points (in IAEA safeguarded facilities)

UID Reader Systems

Benefits

- Both operators and IAEA inspectors can improve efficiency in verifying cylinders
  - Reduced PDIs to verify flow and static inventories (~20-40/year or more)
  - Will strengthen effectiveness of unannounced inspections (SNRIs, ELFUAs)
    - Inspectors can redirect site effort to spend more time verifying design and operations
- New capability for IAEA to detect undeclared production pathways
  - Unattended, reader systems can confirm that only declared, registered cylinders are being processed
    - Detect undeclared feed pathways

UID Reader Systems

Benefits (continued)

- Operators can automate cylinder handling activities
- Provides fundamental component for all unattended monitoring systems currently being investigated for IAEA use:
  - Accountancy scale monitoring
  - Feed/withdrawal station monitoring
  - Flow monitoring (coupling on-line enrichment monitors with cylinders connected to process)

Access-Controlled, Global "Registry"

Concept

- Provide listing of all cylinders present in each State
- Collects cylinder-related information from existing sources:
  - Cylinders containing UF_6 at IAEA safeguarded facilities
  - Shipments of UF_6 between IAEA safeguarded facilities
- Collect additional information:
  - Fabrication of new cylinders
  - Cylinder destruction
  - Shipments of empty cylinders
  - Cylinder inventories in NWS

Access-Controlled, Global "Registry"

Benefits

- To IAEA
  - Easily generate a complete listing of all cylinders within each safeguarded country
    - Support acquisition path analyses, annual inspection plans and State evaluations
  - Strengthens ability to reconcile transfers between countries
    - Automated transit matching
    - More timely than current reporting requirements
  - Provides a technical basis for recognizing unregistered (potentially undeclared) cylinders

- To cylinder owners
  - Easily generate list of location of all their cylinders

Phased Implementation

- Initially focuses on cylinders in active circulation
  - 30B and 48Y cylinders
  - Notionally implemented over a 3-5 year period during cylinder recertification
- Long-term, incorporate into cylinder fabrication standards and regulations

Industry Feedback

- Companies seem interested in an industry-wide UID for cylinders
  - Must not present safety hazard (e.g., fall off in steam autoclave)
  - Companies are currently using barcodes, stencils, and markers to label cylinders
  - Resistance to changing from current formats
  - Several companies have (or have investigated) automated ID reader systems (for company applied labels)
  - Some national authorities and companies have registries of cylinders (e.g., CNSC)
- Questions about the UID
  - How much would they cost and who would supply?
  - Who would apply? When and where?
  - What happens if it gets damaged or destroyed during recertification?
- Some concerns about a global “registry”
  - Who would have access? Could it help their competitors?
  - Many objections to “tracking”

Conclusions

- Global UID
  - Would improve reporting to the IAEA
  - Would immediately benefit transit matching process
  - Some in industry are in general agreement, but still have concerns over some aspects

- A tamper-indicating, remotely readable UID
  - Would reduce time for IAEA to conduct on-site inspection activities
  - Is a fundamental component of unattended monitoring systems necessary to detect undeclared production scenarios
    - Must be globally unique
  - Must be designed to be useable by IAEA

Next Steps

- Investigate available technology for UID and reader systems
- Define global “registry” (e.g., data, owner, access, architecture)
- Estimate costs and analyze lifecycle cost benefit
- Continue and expand industry outreach
- Continue to engage the IAEA

Contact

- Jessica White-Horton
- (865) 574-1075
- whitejl@ornl.gov