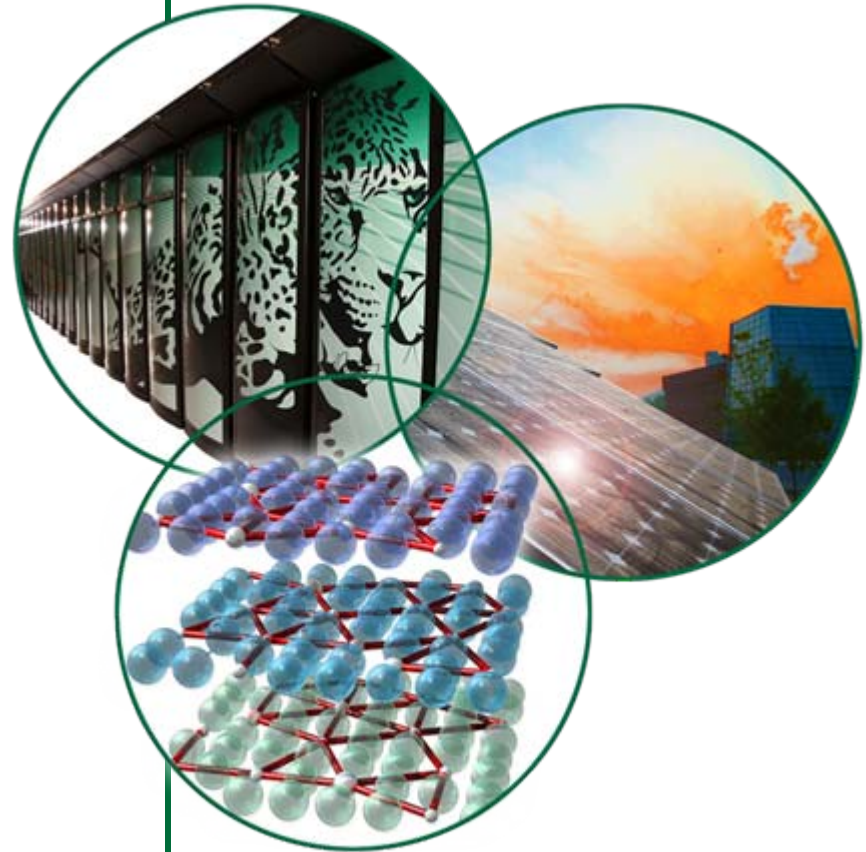


Global Identification and Monitoring of UF₆ Cylinders

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Overview

- **Context for UF₆ Cylinder Monitoring**
- **UF₆ Cylinder Monitoring via Department of Energy (DOE) and Next Generation Safeguards Initiative (NGSI)**
- **Previous work**
 - **Discuss Concepts for Cylinder Registration and Identification**
 - **Design Concepts for Global Monitoring**
 - **Identify Cylinder Stakeholders**
- **Current work**
 - **Develop Five-year Roadmap**
 - **Collaborate with URENCO Initiative**
 - **Examine Revision of Cylinder Standards**
- **Future work**

Context: Nuclear Renaissance

- Nuclear power renaissance → increased nuclear fuel cycle requirements
- Larger, globalized fuel cycle → more nuclear material at sites and in transport



Context: New Fuel Cycle Facilities

- **Licensed large-scale Gas Centrifuge Enrichment Plants (GCEPs) (under construction or planned)**
 - **Advanced Centrifuge Plant in U.S. (USEC) – 3,800 t-SWU**
 - **URENCO USA (URENCO) – 5,900 t-SWU**
 - **George Besse II in France (Areva) – 7,500 t-SWU**
 - **Eagle Rock in U.S. (Areva) – 3,300 t-SWU**



New and expanded GCEPs worldwide



UF₆ Cylinders in Global Commerce

Traditional safeguards focusing on nuclear material do not always require reporting to safeguards systems of all actual cylinder movements and location (e.g., empty cylinders).

Two models of cylinders predominantly used: 48Y and 30B



48Y: natural and depleted uranium (feed and tails)



30B: reactor-grade uranium up to 5% enriched (product)

Context: Increased Threat of Material Loss in Transport and Cylinder Misuse

- Increased nuclear material in commerce → increased threat of theft/diversion/mishandling
- U.S. DOE/National Nuclear Security Administration (NNSA) (NA-24) formed a multi-laboratory team to focus on universal UF₆ cylinder identification and global monitoring



NGSI and UF₆ Cylinder Monitoring

NNSA's NGSI → develop advanced safeguards approach, technologies, equipment, and expertise to meet proliferation challenges



Previous Work

Concepts for UF₆ Cylinder Identification and Registration

- Babcock/Whitaker/Murphy/Oakberg – INMM 2008 – *Benefits of an International Database for UF₆ Cylinders*
- Friend/Lockwood/Hurt – INMM 2009 – *A Concept for a World-wide System of Identification of UF₆ Cylinders*
- URENCO → approaching industry to form a working group



Universal Cylinder ID

Current

- ID labels are not consistent across manufacturers.
- They become difficult to read when subjected to harsh industrial and environmental conditions.
- Inspectors must individually locate and visually read each cylinder.



Proposed

- A unique ID label: standardized labels and locations for the labels.
- A unique label would further facilitate the shift to a more functional (e.g., automated) tracking system.
- Inspectors' time could be used more effectively.



Previous UF₆ Cylinder Work Under NGSII

Concepts for Global UF₆ Cylinder Monitoring

Multi-laboratory team → focus on UF₆ cylinder identification and global monitoring

- Ensuring proper processing, shipment, and delivery of all cylinders
- Improving safeguards and industrial efficiency by automating inventory taking and transit matching
- Enhancing safeguards effectiveness through more timely detection of potential cylinder misuse and diversion
- Discouraging the use of unregistered cylinders to conceal undeclared production or diversion of UF₆
- Supporting IAEA state-level assessments and global information analysis to verify nuclear material commerce and cylinder shipments between states

NNSA Report – Six Recommendations

- 1. Initiate discussions with industry, the International Atomic Energy Agency (IAEA), and other stakeholders to identify and negotiate a preferred structure for a global UF₆ cylinder monitoring system**
- 2. Begin limited cylinder monitoring projects to identify gaps and limitations to monitoring; provide recommendations for design and implementation of monitoring technologies**
- 3. Work with industry and stakeholders to develop and implement a cylinder registry system with a tamper-indicating unique cylinder identifier incorporating tracking and data storage technology**

Eccleston, et al., “Monitoring of UF₆ Cylinders,” ORNL/TM-2009/128, June 2009.

NNSA Report – Six Recommendations (continued)

- 4. Develop and demonstrate a prototype monitoring and registration database with capabilities to receive/send cylinder identity, location, movements, use, and material quantity**
- 5. Review monitoring options and develop and demonstrate secure methods to identify, locate, and track cylinders and to transmit this information to a monitoring database**
- 6. Pursue further analysis to review the best ways to (a) use UF₆ cylinder monitoring to improve the effectiveness and efficiency of IAEA safeguards and (b) to optimize the system to provide benefits to industry, safeguards, and counterterrorism organizations**

Eccleston, et al., “Monitoring of UF₆ Cylinders,” ORNL/TM-2009/128, June 2009.

Next Steps Following 2009 Report

Policy initiatives bring stakeholders together	Reach consensus on universal identification and importance of cylinder monitoring
Deeper investigation of the concepts involved	Publication of papers and technical reports
Technology assessments and field trials	Enable development of theoretical concepts into practical approaches



Concept Development Under NGSII

Concepts for global UF_6 cylinder monitoring:

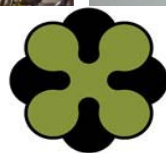
- White/Laughter/Whitaker – PNIC 2010 – *Next Steps in Global UF_6 Cylinder Monitoring*
- Strohmeyer/Hanks/Refalo – INMM 2010 – *Global Monitoring of Uranium Hexafluoride (UF_6) Cylinders: Next Steps in Development of Action Plan*



SRNL
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UF₆ Cylinder Stakeholders

- List of cylinder stakeholders → ensures that all interested parties are informed of the effort and can contribute to the working group
- Oak Ridge National Laboratory (ORNL) → identify companies that manufactured cylinders



SOTRALENTZ

White, et al., "Stakeholders in Global Monitoring of UF₆ Cylinders," ORNL/TM-2010/170, September 2010.

UF₆ Cylinder Stakeholders (continued)

Researchers at ORNL have identified more than 30 companies to date in the “UF₆ users” category.

- There are three active UF₆ cylinder manufacturers → **Plaatijzerindustrie B.V.** in the Netherlands, **Sotralentz** in France, and **Westerman** in the United States.
- Other manufacturers contacted do not make cylinders but have the ability to do so.



- **Difficulty** → Limiting the scope to those directly involved with UF₆ cylinders
- **Question** → Examples: stakeholders or not?

Roadmap Development

- Meeting held at Savannah River National Laboratory (SRNL) in May 2010
- Participants divided into three groups:
- Group 1:
 - Stakeholder interests
- Group 2:
 - Monitoring technology/tracking devices
- Group 3:
 - Development of registration database



By the end of the meeting, the groups had drafted a five-year plan for development prior to the proof-of-concept stage.

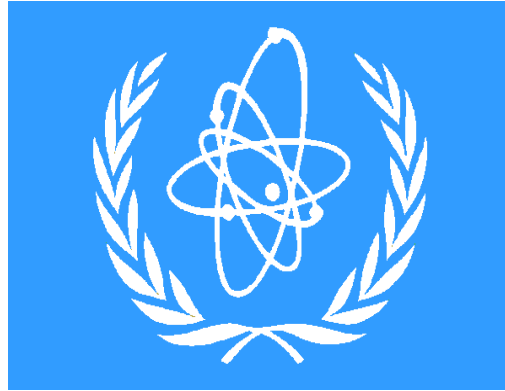
URENCO's Initiative

- Implementing an intermediate solution at facilities
- Possibly serving as a stepping-stone model for a future industry-wide system
- URENCO is organizing an evening meeting during the PATRAM week for all parties interested in the subject. If you wish to attend, you may contact Rudi Valley from URENCO Nederland BV at the PATRAM meeting or by phone (+31 651 207 912) for more information.



Process for Modifying UF₆ Cylinder Standards

- IAEA safety standard TS-R-1 and Nuclear Regulatory Commission (NRC) regulation 10 CFR Part 71 → guidelines for safe nuclear material transport



- ISO-7195 and ANSI N14.1 → require each cylinder to have an attached nameplate



Process for Modifying UF₆ Cylinder Standards (continued)

Other standards that may be affected by modifications:

- **ASTM A516 and EN 10028-3** → standards for steel used in pressure vessels
- **ANSI N15.8 or 10 CFR Part 74** → standards related to nuclear material control and accounting

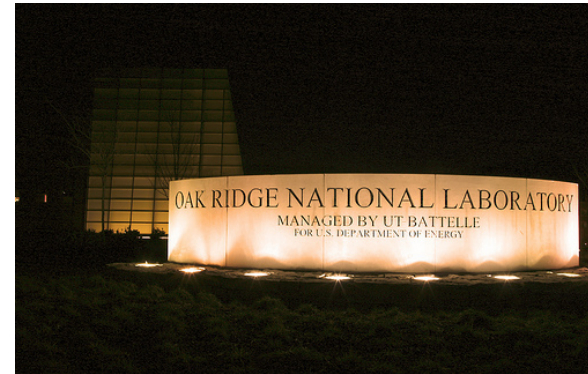


- **ASTM C787 and ASTM C996** → standards for UF₆



Future Work

- **NNSA is developing a comprehensive strategy for moving towards an eventual implementation of a universal cylinder monitoring system.**
- **Frequent engagement will continue with industry on universal identification and registration of cylinders.**
- **More support from NNSA via NGSF will continue the development of related theoretical concepts, technology assessments, and field trials.**



Summary

- DOE recognizes that industry involvement and leadership is essential for universal acceptance.
- A monitoring system would provide locations, movements, and uses of UF₆ cylinders in nuclear commerce and could reduce the *risk* of loss or misuse of UF₆ cylinders.
- Responses received from industry and regulators on the concept have been very positive.
- Some features of the monitoring system (e.g., unique IDs) could be introduced at creation (e.g., cylinder fabrication) to minimize or avoid retrofitting expenses (i.e., safeguards by design).



Thank You!

