Recent Activities of the International Atomic Energy Agency to Combat Illicit Trafficking of Nuclear and Other Radioactive Material

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Office of Nuclear Security

prepared for the International Workshop on Nuclear Forensics following on Nuclear Security Summit

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Events involving nuclear and radioactive material outside of regulatory control persist in 2010

- In March of 2010, Georgian authorities halt the sale of ~14 grams of highly enriched uranium.
- In July of 2010, ~1700 grams of depleted uranium was confiscated by law enforcement officials in Moldova.
- In February 2009, Argentina authorities recovered a 74 GBq (~2.5 Ci) 137Cs well-logging source stolen at gunpoint from a storage facility.
- In 2009 and 2010, uranium - with variable enrichment - is detected in European metal scrap yards.

From July 2009 to June 2010, 222 incidents were confirmed to the IAEA. 21 involved illegal possession; 61 involved thefts; and 140 involved other unauthorized activities. Of these, 5 involved HEU or plutonium.
Introducing the IAEA’s Illicit Trafficking Database

- Established in 1995
- Unique network of points of contact
- As of 1 September 2010, 111 states participate in the ITDB Programme
- Information collected from official sources supplemented by open-source reports
- ITDB information is restricted to State POCs; no public dissemination
Goals of the Illicit Trafficking Database.....

• To facilitate exchange of authoritative information among States on incidents of illicit trafficking and other related unauthorized activities involving nuclear and other radioactive materials

• To collect, maintain and analyse information on such incidents with a view to identifying common threats, trends, and patterns; use this information for internal planning and prioritisation and provide this information to Member States

• To provide a reliable source of basic information on such incidents to the media, when appropriate
International Atomic Energy Agency

Scope of the ITDB information

• ITDB includes incidents involving illegal trade and movement of nuclear or other radioactive material across national borders

• Scope also covers the unauthorized acquisition (theft), provision, possession, use, transfer or disposal of nuclear and other radioactive materials - intentional or unintentional - with or without crossing international borders

• ITDB also compiles unsuccessful or thwarted acts, the loss of materials, and the discovery of uncontrolled materials
Why does the ITDB have such a broad scope?

**Threat related:**
- Availability of materials
- Material characteristics
- Quantities
- Organizational aspects
- Motives, intentions and threats
- Destinations
- Supply/demand relationship (black market)

**Protection related:**
- Origins
- Vulnerabilities and weaknesses in protection and control
- Stealing techniques and means of defeating security systems
- Insider involvement

**Detection related:**
- Trafficking routes
- Smuggling techniques
- Weaknesses in detection systems and technologies
- Means of defeating detection systems
- Vulnerabilities at borders and other nodal points
From January 1993 to December 2009, 1773 incidents were reported to the ITDB

- 351 incidents involved unauthorized possession and related criminal activity (illegal possession, movement, or attempts to illegally trade in or use nuclear or radioactive sources) - **Group 1**
  - 15 of the 351 incidents involved highly enriched uranium or plutonium
- 500 incidents were reported involving the theft or loss of nuclear and other radioactive material - **Group 2**
- 870 incidents involved other unauthorized activities including unauthorized disposal of radioactive materials or discovery of uncontrolled sources - **Group 3**
Some Conclusions from the ITDB.....

• The availability of unsecured nuclear and other radioactive material persists
• Effective border control measures help detect illicit trafficking, although effective control is not implemented at all international border points
• Individuals, and groups, are prepared to engage in trafficking this material
• Deployment of detection and monitoring equipment by States in increasing - higher reporting of Group 3 incidents
• Regional cooperation to address the problem is improving
The link between nuclear trafficking and nuclear forensics......

• Nuclear forensics supports the three pillars of nuclear security – prevention, detection, and response

• All incidents of illicit trafficking must be pursued vigorously by States; “zero tolerance” is the only message

• By returning information on the origin, history, age, and the source of radioactive material outside of regulatory control, nuclear forensics allows quantitative insights into illicit trafficking

• Nuclear forensics enables informed response
The IAEA program in nuclear forensics was endorsed at the April, 2010 Nuclear Security Summit

“….. Participating States will explore ways to work together to develop national capacities for nuclear forensics, such as the creation of national libraries and an international directory of points of contact, to facilitate and encourage cooperation between States in combating illicit nuclear trafficking, including relevant IAEA activities in this area…”

47 States attended the April, 2010 Nuclear Security Summit plus delegations from the European Union, IAEA, and United Nations
The CY2010 – CY2011 IAEA program in nuclear forensics

1) Training: “Introduction to Radiological Crime Scenes and Nuclear Forensics”

2) Coordinated Research Project: “Application of Nuclear Forensics in Illicit Trafficking of Nuclear and Other Radioactive Material”

3) Assist in the development of State's national nuclear forensics libraries and an international directory with ITWG and GICNT partners
Promoting nuclear forensics through training

• In 2009 the IAEA developed a comprehensive, 5-day training workshop entitled “Introduction to Radiological Crime Scenes and Nuclear Forensics”

• The course covers fundamentals of crime scene management, techniques for forensic examinations, and best laboratory practices using a combination of lectures, case studies, and exercises

• Courses can be either national, regional or international

• Expert faculty from leading international nuclear forensics institutes

• Courses held in Singapore, India, and Canada in 2009 and Argentina and Canada in 2010

A key outcome is the ability of law enforcement, response, and atomic energy experts to work together
## IAEA nuclear forensics workshop curricula

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<td>IAEA and Nuclear Security</td>
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<td>Radiation Fundamentals</td>
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<td>Threat Overview</td>
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<td>Traditional Forensics on Contaminated Evidence</td>
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<td>Radiation Instrumentation</td>
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<td>Processing a Radiological Crime Scene</td>
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<td>Nuclear Forensic Case Studies (Part I)</td>
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<td>Radiological Evidence Sampling and Transport</td>
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<td>Table – Top Exercise</td>
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<td>Ionizing Radiation and Nuclear Forensic Evidence</td>
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<td></td>
<td>International Agreements for Nuclear Forensics</td>
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<tr>
<td></td>
<td>Nuclear Forensic Case Studies (Part II)</td>
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<tr>
<td></td>
<td>Table – Top Exercise</td>
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<td>Nuclear Forensic Case Studies (National Experience)</td>
<td>International Developments</td>
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<td>Table – Top Exercise</td>
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<td>National Perspectives</td>
<td>Table – Top Exercise Conclusion</td>
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<td></td>
<td>Course Evaluation and Conclusion</td>
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</table>
Confidence building through a table-top exercise

- To raise participants' awareness of issues that will likely arise during an event involving a crime involving radioactive materials:
  - traditional forensic investigation procedures requiring examination of radiologically-contaminated evidence
  - the need to perform an analysis of the radiological material(s) involved
  - enhancing the understanding of first responders, forensic examiners, and law enforcement of each other's missions, responsibilities, and requirements
  - the ability of the players to make decisions based on limited information and under time pressure
Addressing nuclear forensic needs of Member States: Coordinated Research Project (CRP)

- IAEA Coordinated Research Projects (CRPs) offer a mechanism for collaborative research and development through international team building
- CRPs are developed in relation to a well defined research topic
- Over 100 CRPs are now active: http://cra.iaea.org/
- Research contracts and agreements are placed with qualified institutes in Member States
- A CRP is planned normally over 3 years; this CRP is in its 2nd year

Each CRP is a network of 5 - 15 national research institutions which work within an operational framework with a similar goal using nuclear technology
## CRP contracts and agreements currently in place

<table>
<thead>
<tr>
<th>Member-State</th>
<th>PI</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>M. Colella</td>
<td>Exploiting Critical Evidence Contaminated with Alpha-Emitting Radionuclides</td>
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<tr>
<td>Brazil</td>
<td>J. De Souza Sarkis</td>
<td>Establishment of Procedures and Techniques for Nuclear Forensic Investigations Part II – Workshop on Nuclear Forensics</td>
</tr>
<tr>
<td>Germany (European Commission)</td>
<td>M. Wallenius</td>
<td>Procedures and Techniques for Nuclear Forensic Investigations</td>
</tr>
<tr>
<td>Germany</td>
<td>H.R. Doerfel</td>
<td>Identification, Localization, and Categorization of RDD</td>
</tr>
<tr>
<td>Greece</td>
<td>G. Nikolaou</td>
<td>Determination of the Origin of Unknown Nuclear Material Through an Isotopic Fingerprinting Method</td>
</tr>
<tr>
<td>Hungary</td>
<td>L. Lakosi</td>
<td>Development of Nuclear Forensics Methods and Techniques for Combating Illicit Trafficking of Nuclear and Other Radioactive Material</td>
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<tr>
<td>Republic of Korea</td>
<td>S.K. Kim</td>
<td>The Development of IT-Based In-Situ Mobile Response Supporting System for Deterring Illicit Trafficking of Nuclear and Radioactive Materials</td>
</tr>
</tbody>
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Nuclear forensics requires a library to enable analysis of comparative signatures

Nuclear forensics collections

Analytical measurements

Analytical data

$^{235}\text{U}/^{238}\text{U}$

$^{240}\text{Pu}/^{239}\text{Pu}$

$^{137}\text{Cs}$, $^{125}\text{Sb}$, $^{90}\text{Sr}$

$\text{Al, Zr, Si, REEs}$

physical size

grain shape

Uranium ores

U ore concentrates

Enrichment

Fuels

Pu

Rad Sources

Nuclear fuel cycle

National Nuclear Forensics Library
A critical need to is begin to structure nuclear forensics libraries agreeable to States

<table>
<thead>
<tr>
<th>Uranium Ore</th>
<th>Ore Concentrate</th>
<th>UF4 UF6</th>
<th>Nuclear Fuel</th>
<th>Spent Fuel</th>
<th>Plutonium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isotopes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>235U/238U</td>
<td>234U/238U</td>
<td>235U</td>
<td>235U/238U, 18O/16O</td>
<td>232U, 236U, fission products</td>
<td>239Pu/240Pu, 241Pu/241Am, age, fission products</td>
</tr>
<tr>
<td>Trace Elements</td>
<td>REEs</td>
<td>Ca, Fe, Al, K</td>
<td>Pu, U</td>
<td>Al, Zr, cladding</td>
<td>Pu, U</td>
</tr>
<tr>
<td>87Sr/86Sr, 207Pb/204Pb, 143Nd/144Nd, 235U/238U, age</td>
<td>Cl, S, Br, anions</td>
<td>UO2/U3O8</td>
<td>color</td>
<td>UO2, dimension grain size, grain shape</td>
<td>spent fuel assemblies</td>
</tr>
<tr>
<td>Physical</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>mineralogy</td>
<td>UO2/U3O8</td>
<td>color</td>
<td></td>
<td>spent fuel assemblies</td>
<td>Rod and plate particles</td>
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IAEA is working with Member-States to develop national nuclear forensics libraries

- National nuclear forensics libraries requires States to identify their own holdings of nuclear and radioactive materials across the nuclear fuel cycle (as applicable)
  - Catalogue nuclear and radioactive materials
  - Collect and assess information supporting a national library
  - Identify a point of contact to represent this library data internationally

The importance of a nuclear forensics libraries framework is recognized by then Senator Joe Biden (2007), AAAS/APS, the Nuclear Forensics and Attribution Act (2010), the 2010 Nuclear Security Summit, the IAEA General Conference and many others........
Considerations affecting the structure of national nuclear forensics libraries and an international directory

- Other information on the location, completeness & gaps, accuracy & precision, information restrictions of data and availability of subject matter experts are essential to the national library construct.

States will administer and control their own national libraries.
The expectations for nuclear forensics and the IAEA continue to grow

- The international nuclear forensics community needs to look outwards since all States - large and small - are affected by illicit trafficking.
- IAEA training, research, leadership in nuclear forensics libraries, and publications are helping Member States develop national response plans.
- The partnership of the International Atomic Energy Agency (IAEA), the Nuclear Forensics International Technical Working Group (ITWG), and Global Initiative to Combat Nuclear Terrorism (GICNT) provides international access, technical best practice, and political impetus necessary to meet these expectations.
Thank You!!