Twenty Five Years of Nuclear Forensics: The Path Forward

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1 – 2 May 2018

prepared for

Institute of Nuclear Materials Management (INMM)

Workshop on Nuclear Materials Science, Processing, and Signature Discovery

Pacific Northwest National Laboratory
The nations of the world have – to date – avoided the terrorist consequence of material out of regulatory control (MORC) – Why?

- It’s largely a material problem involving robust signatures
- A majority of States and the international community take their nuclear security responsibilities seriously
- National laws and international legal instruments manifest expectations
- States have tools, experts and confidence to implement their nuclear security responsibilities
- A nuclear security community – to include nuclear forensic practitioners – has proven effective in the fight

The challenge: we always must remain vigilant and prepared; terrorist acquisition of nuclear or radioactive material persists as an international threat
Nuclear security (and nuclear forensics) is not a contingency plan.....

IAEA’s Incident and Trafficking Database
Total incidents: 3257

Materials

- Nuclear: 59%
- Radioactive: 26%
- Other/RCM: 15%

Incidents

- Group I: 63%
- Group II: 28%
- Group III: 9%
Building nuclear security (and nuclear forensics) awareness has been an international priority the past decade

1) Prague Speech of 2009 by the US President
3) 10 Year Anniversary of Global Initiative to Combat Nuclear Terrorism (GICNT) led by the United States and Russian Federation (The Hague - June 2016)
4) More that 20 annual meetings – and strong growth - of the Nuclear Forensics International Technical Working Group (ITWG)
5) Two IAEA Ministerial Conferences on Nuclear Security (2013, 2016)
6) One IAEA International Conference of Nuclear Forensics (2014)
7) Entry into force on 8 May 2016 of State Parties to the Amendment to the Convention on the Physical Protection of Nuclear Material (A/CPPNM)

All: policy informed, law enforcement enabled, science implemented
Words matter at the IAEA ….. what is nuclear forensics??

Nuclear forensics is the examination of nuclear or other radioactive materials, or of evidence contaminated with radionuclides, in the context of legal proceedings under international or national law related to nuclear security.

- Support criminalization through nuclear forensic confidence in findings that enables admissibility of evidence.
- Use information on the ‘origin and history’ of nuclear and other radioactive materials to identify and correct vulnerabilities in the nuclear security regime.

The IAEA does not conduct nuclear forensics examinations; however the IAEA prepares States for its application.
Steady growth and progress of nuclear forensics but more remains…..

- Awareness and understanding of nuclear forensics continues with guidance; consistent implementation is key

- Reinforcing technical partnerships with law enforcement and nuclear security responders

- Focus on the science building upon national and international legal instruments

- Promoting international cooperation both bi-laterally and multi-laterally to prevent and respond

Over the past twenty five years, the steady growth of nuclear forensics has helped States meet their nuclear security responsibilities
The challenge: consistent implementation

- Awareness and understanding of nuclear forensics through published IAEA guidance and augmented by ITWG technical guidelines and GICNT fundamentals

- The nuclear forensics ‘model action plan’ has been published in the IAEA’s Nuclear Security Series as ‘Nuclear Forensics in Support of Investigations’ (2015)

- Widely adopted by Member States

An array of forensic evidence can be examined
The challenge: working with law enforcement and responders at the site of a nuclear security event.....

**Similarities**

- Scene control
- Perform common hazards risk assessment
- Forensics evidence management to include collections and chain of custody
- Release of scene
- After action review

**Differences**

- **Time** - personnel must manage time spent on scene to minimize dose of radiation received – *Time Constrained!*
- **Distance** - personnel typically must be *as far as possible* from items contaminated or potentially contaminated with radioactive material
- **Shielding** - personnel must use *physical measures to shield* themselves and others from any radioactivity

The link between radiological crime scene management and nuclear forensics enables response
The challenge: nuclear forensic science to meet the threat as well as legal admissibility of evidence.

IAEA Coordinated Research Activities….
Recent perspectives on scientific research from the Nuclear Forensics International Technical Working Group (ITWG)..... and endorsed by the IAEA

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Nuclear forensics is still an emerging science; INMM Signatures Workshop this week in Richland helps answers these vital questions
The challenge: building nuclear forensics internationally through effective partnerships

• A hallmark of nuclear forensics since its inception has been international coordination and cooperation

• Of interest: i) expansion of nuclear power has shifted from Europe and North America to Asia and ii) developing countries are contemplating or embarking on nuclear power

• Despite political turbulence, nuclear forensics remains a ‘common language’ in Vienna
How do we sustain nuclear forensics in the out years – it’s in a State’s interest…..

• ‘Hooks’ that rely on nuclear forensic science to provide nuclear security solutions
  - A/CPPNM
  - INFCIRC 917
• Use research to attract young scientists, validate techniques, and ensure the discipline is available when necessary
• Bridge with responders; encourage the right decisions at the onset of an examination
• Encourage developing States become the developed States
• Focus on indigenous national capabilities; emphasize categorization using non destructive analysis
• Continue to position nuclear forensics in the technical and policy mainstream (IAEA, ITWG, INMM, AAAS, ACS, ICI)
• Use nuclear forensics to quantify national holdings of nuclear and other radioactive materials

States need to own sustainability of nuclear forensics
1) **Develop and sustain** – cross disciplinary training, knowledge transfer, career development

2) **Promote** existing national nuclear science in the context of nuclear forensics

3) **Evaluate and adapt** existing national response frameworks to include nuclear forensics

4) **Advance and mature** nuclear forensics expertise in other countries

Prepared by Australia, and also endorsed by Argentina, Armenia, Canada, Chile, Czech Republic, France, Finland, Georgia, Germany, Hungary, Israel, Indonesia, Italy, Japan, Kazakhstan, Mexico, Morocco, Netherlands, Nigeria, Norway, Philippines, Singapore, Spain, Sweden, Switzerland, Republic of Korea, Thailand, the United Kingdom and the United States of America, and requesting the Secretariat to bring the communication and its attachment to the attention of all IAEA Member States.

As requested, the communication and its attachment are herewith circulated for the information of all Member States.
And let’s take a look: Convention on the Physical Protection of Nuclear Material and its Amendment......May 2016

Physical Protection

Nuclear material in international transport

Offences

Unauthorised use of, or threat to use, nuclear material, to cause death, personal injury or property damage

Theft of nuclear material

Ancillary Offences (attempt to commit a listed offence and participation therein)

International Cooperation

Cooperation and assistance in connection with criminal proceedings and physical protection systems,

Information exchange to protect or recover unlawfully taken material

in addition

Nuclear facilities, and nuclear material in domestic use, storage and transport

Physical protection regime (legislative and regulatory framework, competent authority, etc)

Smuggling of nuclear material

Sabotage of nuclear facilities

Coverage of “substantial damage to the environment”

New ancillary offences (organisation or direction of others to commit a listed offence)

in addition

in addition

Expanded cooperation, assistance and information sharing to locate and recover stolen material and in case of sabotage

NEW
IAEA perspectives – a path forward for nuclear forensics implementation

• New partners to include those in Africa, the Gulf region, Southeast Asia and Latin America

• Strong commitment to science through coordinated research; new IAEA nuclear forensics CRP J02013 approved in February 2018

• Expert missions to focus on evidence collection, categorization, characterization, and interpretation; utilization of Nuclear Security Support Centres

• Planning for IAEA Technical Meeting in Nuclear Forensics in Q2 2019 in advance of next Ministerial Conference
“The history of science is rich in example of the fruitfulness of bringing two sets of techniques, two sets of ideas, developed in separate contexts for the pursuit of new truth, into touch with one another”

J. Robert Oppenheimer (1904 – 1967)

The IAEA’s need for innovation to meet the needs of peaceful uses of atomic energy as well as stay ‘one step ahead’ of determined adversaries who threaten nuclear security globally has never been greater