Enhancing global preparedness against nuclear and radiological terrorism: strategies for strengthening nuclear security and expectations for nuclear forensics

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Nuclear security: a national responsibility

Nuclear security focuses on the prevention and detection of, and response to, criminal or intentional unauthorized acts involving or directed at nuclear material, other radioactive material, associated facilities or associated activities

The responsibility for nuclear security within a State rests entirely with that State

The IAEA’s role in nuclear security

The IAEA:

- implements specific activities outlined in the Nuclear Security Plans
- supports States, upon request, in their efforts to establish and maintain effective nuclear security through assistance in capacity building, guidance or standards, human resources development and risk reduction
- facilitates adherence to implementation of international legal instruments related to nuclear security

Examples of potential nuclear security events

- Theft or unauthorized removal of nuclear or other radioactive material, or
- Sabotage of facilities or transports with nuclear material

With intent to:

- Construct an improvised nuclear device
- Construct a radiological dispersal device (RDD) or radiological exposure device (RED)
- Commit other malicious or unlawful acts

POTENTIAL CONSEQUENCES

- Health
- Environmental
- Economic
- Societal

Nuclear security – the reality

IAEA's Incident and Trafficking Database (ITDB) Factsheet 2025

Group I: incidents that are, or are likely to be, connected with trafficking or malicious use

Group II: incidents of undetermined intent

Group III: incidents that are not, or are unlikely to be, connected with trafficking or malicious use

4390
confirmed incidents

353
Group I

1065
Group II

2972
Group III

How nuclear forensics contributes to strengthening nuclear security

Nuclear Security Recommendations on Nuclear and Other Radioactive Material out of Regulatory Control

A State should be able to…

1. Notify the competent authorities
2. Assess the validity and potential consequences of the nuclear security event
3. Locate, identify, **categorize and characterize** nuclear and other radioactive material
4. Secure such material and apply other response measures appropriate to the nuclear security event, such as neutralization of the device
5. Recover, detain, and/or seize and place such material under regulatory control
6. Collect, preserve, store, transport and **analyze evidence, including the application of nuclear forensics measures**, related to a criminal act, or an unauthorized act, with nuclear security implications that involve such material
7. Apprehend and subsequently prosecute or extradite alleged offenders

Recommendations from IAEA Nuclear Security Series No. 15

The role of nuclear forensics in nuclear security

Nuclear forensics

The **examination of nuclear or other radioactive material**, or of evidence that is contaminated with radionuclides, in the context of legal proceedings under international or national law related to nuclear security

- Primarily a **laboratory-based** capability, but usually with an **in-field component**
- Usually performed by **technical/scientific personnel**, overseen by the State investigative authority

Nuclear forensics allows States to

- **Prosecute and convict** criminal smugglers and traffickers of nuclear and other radioactive material
- **Deter potential acts** by malicious actors through a credible mechanism of determining accountability
- **Identify gaps and weaknesses** in a State's nuclear security regime

In-field responders

Laboratory scientists

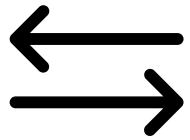
The deterrent effect of nuclear forensics

Nuclear forensics can be used by a State to assist determination of whether the nuclear or radiological material came from a State's materials holdings or not

If **from** the State's own materials holdings

- Nuclear forensics can be used to determine from which facility in the State from which it escaped regulatory control
- Nuclear forensic data can also aid criminal aspects of the investigation

If **not from** the State's own materials holdings



- Nuclear forensics can be used to indicate that its origin might lie outside of the State
- Could indicate cross-border smuggling of nuclear or radioactive material

How the IAEA assists States in the development of nuclear forensics capabilities

International cooperation and the development of human resources

Goal

To ensure that States have a nuclear forensic and radiological crime scene management (RCSM) capability commensurate with their nuclear security needs and requirements

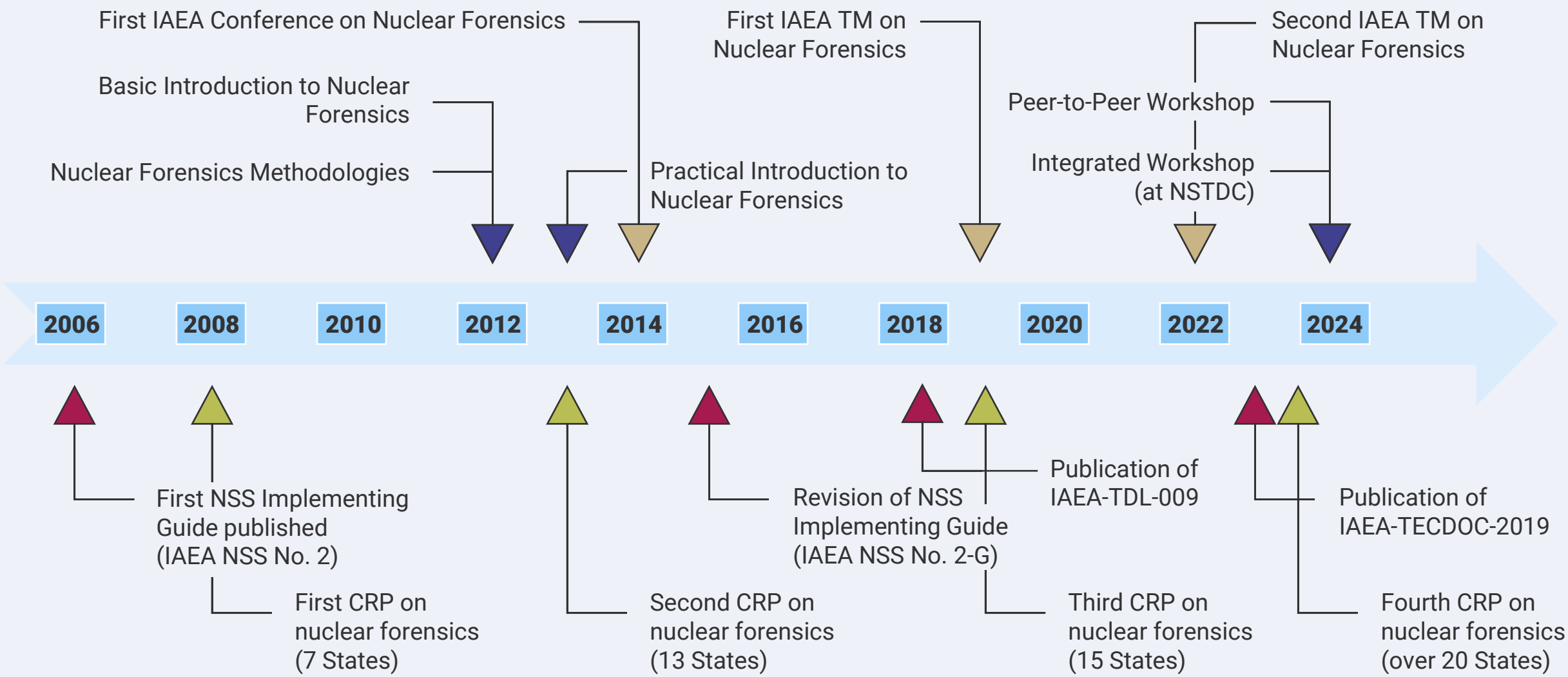
Objectives

To assist States in developing and sustaining the technical and associated capabilities necessary to perform RCSM and nuclear forensic examinations in support of investigations into criminal or intentional unauthorized or suspected acts involving nuclear or other radioactive material

To develop nuclear forensics and RCSM nationally, regionally and globally through collaboration with Member States and international organizations engaged in capacity building efforts in this area

NSNS's programme of Member State assistance in nuclear forensics

A very brief history



Publications

NSS No. 22-G

Radiological Crime Scene Management

NSS No. 2-G

Nuclear Forensics in Support of Investigations

Member state consensus publications

TECDOC publications (not Member State guidance)

Technical information on nuclear forensics

IAEA-TECDOC-2019

Establishing a Nuclear Forensic Capability: Application of Analytical Techniques

IAEA-TDL-009

Development of a National Nuclear Forensics Library

Information from technical meetings

IAEA-TECDOC-1896

Nuclear Forensics: Beyond the Science

Results from Member State CRP projects

Coming soon!

New TECDOC

Applying Nuclear Forensic Science to Respond to a Nuclear Security Event

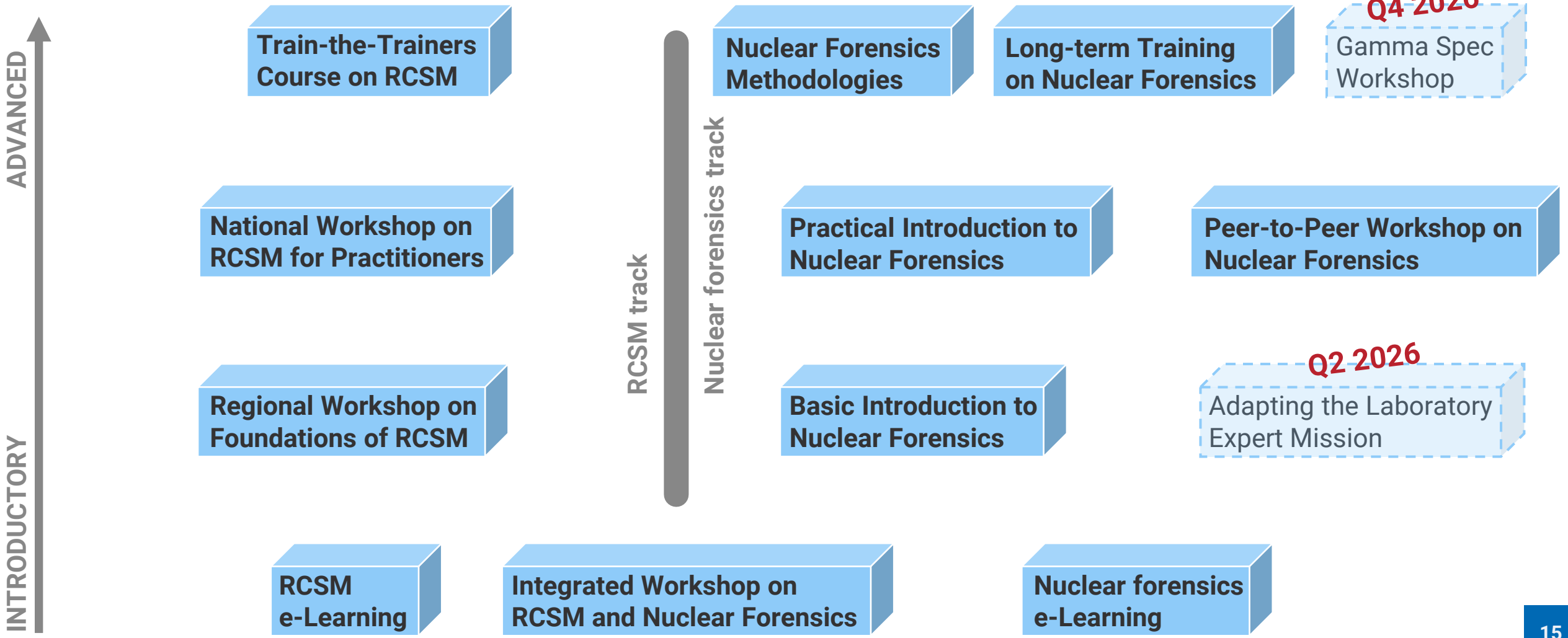
IAEA-TECDOC-1820

Identification of High Confidence Nuclear Forensic Signatures

IAEA-TECDOC-1730

Application of Nuclear Forensics in Combating Illicit Trafficking of Nuclear and Other Radioactive Material

IAEA training programme in nuclear forensics (and radiological crime scene management)



Example #1

The Integrated Workshop on Radiological Crime Scene Management and Nuclear Forensics

- Hosted at the IAEA's Nuclear Security Training and Demonstration Centre

- Designed for experts in nuclear forensics and radiological crime scene management to learn from each other and to practice key methods

Example #2

The Long-term Training Programme in Nuclear Forensics

A placement programme

Technical and scientific personnel, identified by the recipient Member State through official channels and selected by the IAEA, travels to a host Member State for a period of three or more months

In the host Member State, technical personnel will:

- Complete a scientific project focused on a specialization in MORC
- Learn the means by which nuclear security activities are conducted in the host Member State more generally

An opportunity to collaborate

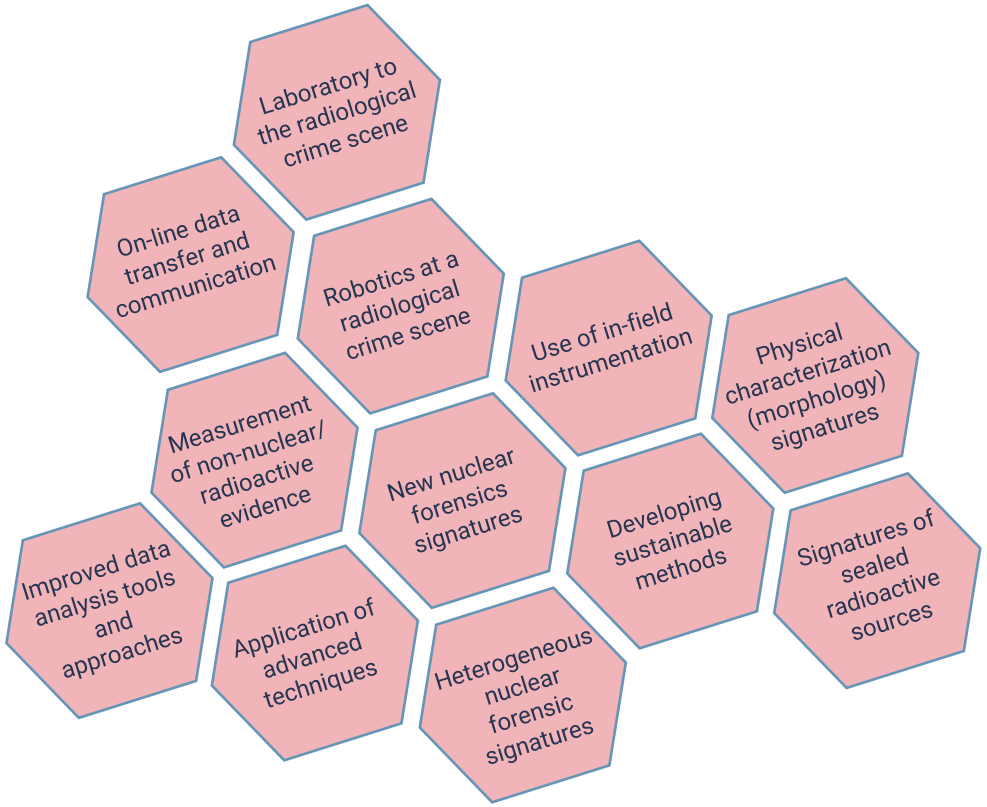
In addition to learning how to conduct key nuclear security activities from experienced personnel, the host and recipient Member States can build the foundation of a lasting collaboration

The output of a Nuclear Security Fellowship not only benefits the recipient Member State, but also the host Member State

Current CRP – J02020

Nuclear Forensics Science to Bridge the Radiological Crime Scene to the Nuclear Forensics Laboratory

- ✓ 19 participating Member States
- ✓ Set to run until 1 October 2026
- ✓ 12 “specific objectives” in RCSM and nuclear forensics targeted



Previous CRP – J02001

Application of Nuclear Forensics in Illicit Trafficking of Nuclear and other Radioactive Materials

Previous CRP – J02003

Identification of High Confidence Nuclear Forensics Signatures for the Development of National Nuclear Forensics Libraries

Previous CRP – J02013

Applying Nuclear Forensic Signatures to Respond to a Nuclear Security Event

Strengthening nuclear security resilience

The role of nuclear forensics

We must remain ever vigilant to the misuse of nuclear and radioactive materials

- Malicious actors continue to seek nuclear and radioactive material with the potential to be used in the construction of radiological dispersal devices and improvised nuclear devices

- The continued growth and expansion of nuclear power globally requires the international community to deploy all means at our disposal to minimize this risk

Nuclear forensics remains an essential tool for States to investigate incidents of material out of regulatory control that occur within their borders

States require nuclear forensic capabilities commensurate with their needs and requirements

- Not all States require advanced capabilities in nuclear forensics, though States with nuclear facilities usually do
- International cooperation is necessary for States to develop sustainable and resilient nuclear forensics capabilities
- States with advanced nuclear forensic capabilities have a leadership role to play, assisting newcomer States

The IAEA stands ready to assist all States in the development of nuclear forensics capabilities commensurate with their needs and requirements

Thank you!