Science and Security Nuclear Forensics R&D and Professional Capacity Building

- Mission and Perspectives of the Regulatory Body and Expectation for Research institutions

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Nuclear Forensics in Nuclear Security

- NUCLEAR FORENSICS IN SUPPORT OF INVESTIGATION (IAEA NSS No.2 - G)

Nuclear Forensics:

Preventive measure & Mechanism of response

Prevention

- Identifies security weaknesses (materials from secure facilities)
- Deterrence (awareness of capabilities discourages illicit trafficking)

Response

- Complements traditional forensics criminal investigations
- Essential for national response (unregulated materials)

Enhanced nuclear security & deterrence of radiological & nuclear terrorism

Investigative capabilities	Investigative insight	Proactive deterrence
- Understand & mitigate risks - Lessons learned (identify deficiencies) - Targeted improvements (physical protection & procedures)	- Evidence for law enforcement - Determine origin, intended use, physical protection pathway	- Strong deterrent against future illicit activities - Identify & close security gaps - Makes acquisition harder for terrorists

Human resource development and capacity building

01

Nuclear or Radioactive Material Evidence

02

Transport Sample Safety and Securely

03

Examination Plan and Laboratory Analysis

04

Integration using a Comparative Database or Library

05

Linking of Events, People and Materials

06

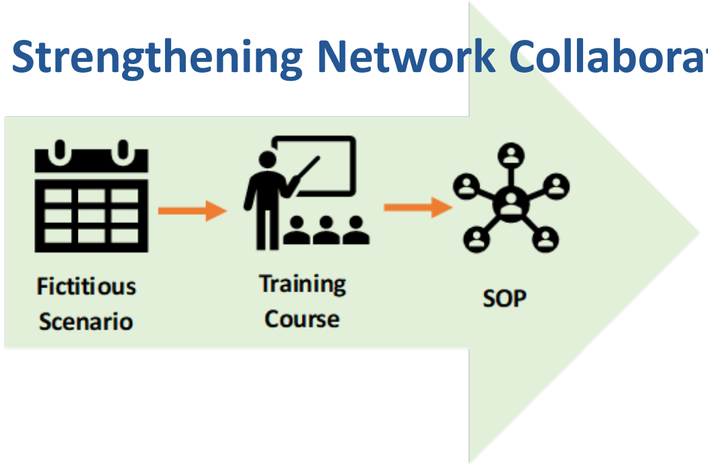
Findings support criminal prosecution

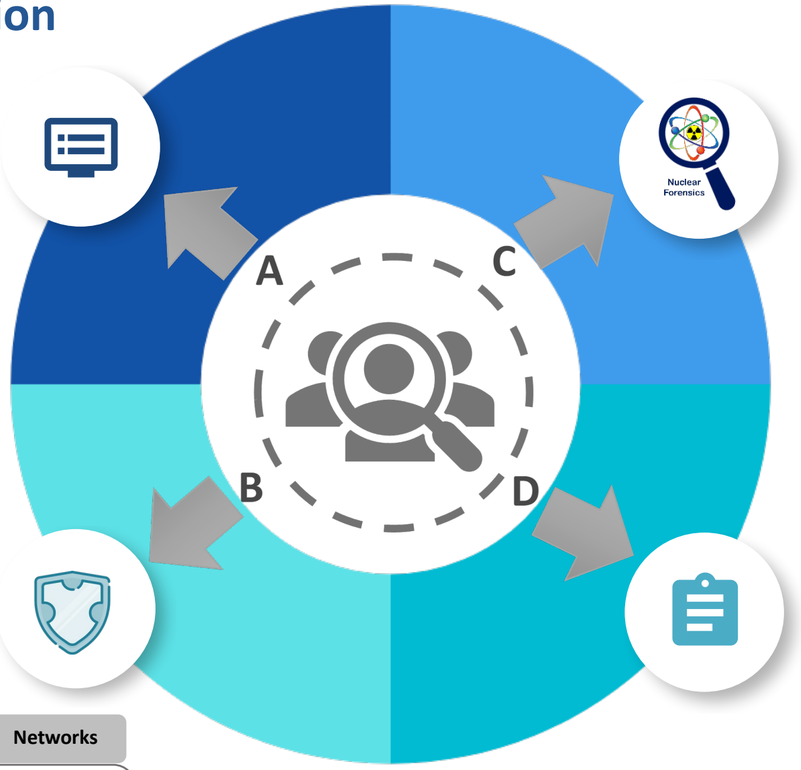
Thailand has hurdles in developing nuclear forensics capability.

- Harmonizing current resources to provide effective nuclear security support.
- Identify the critical factors for nuclear and radioactive use in nuclear security concerns.
- Management allocated a restricted budget for capacity building.

Human resource development and capacity building

A. Strengthening Network Collaboration





B. Radiological Crime Scene Management

Safety
- Typical form
- Properties
- Safety data
- Personal protection
- Symptoms
- Exposure pathways
- Treatments

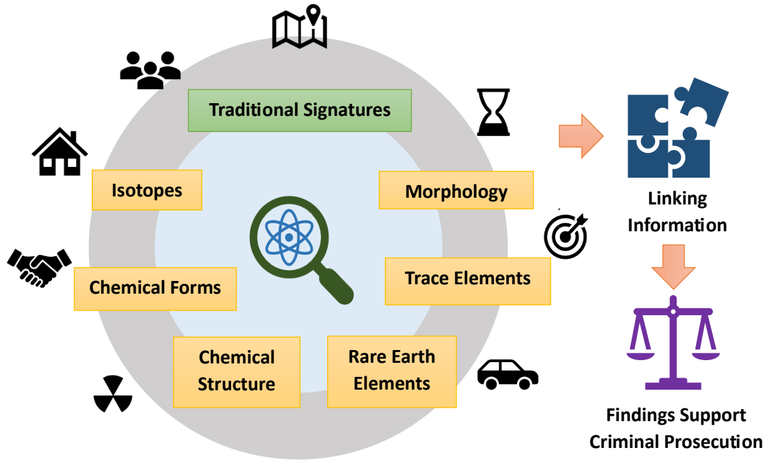
Law & Regulations
- Safety
- Security
- Safeguards

Security
- Nuclear security event
- Malicious activity tendency

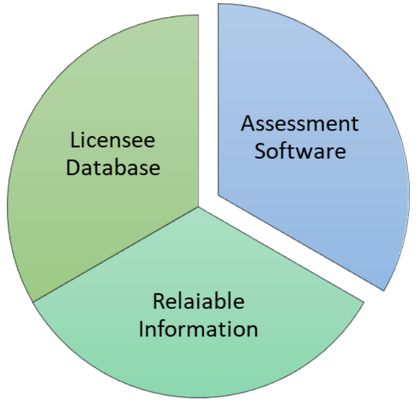
Technical Support
- Technical data
- Laboratory analysis

Networks
- SOP
- Contact information

C. Nuclear Forensics Laboratory

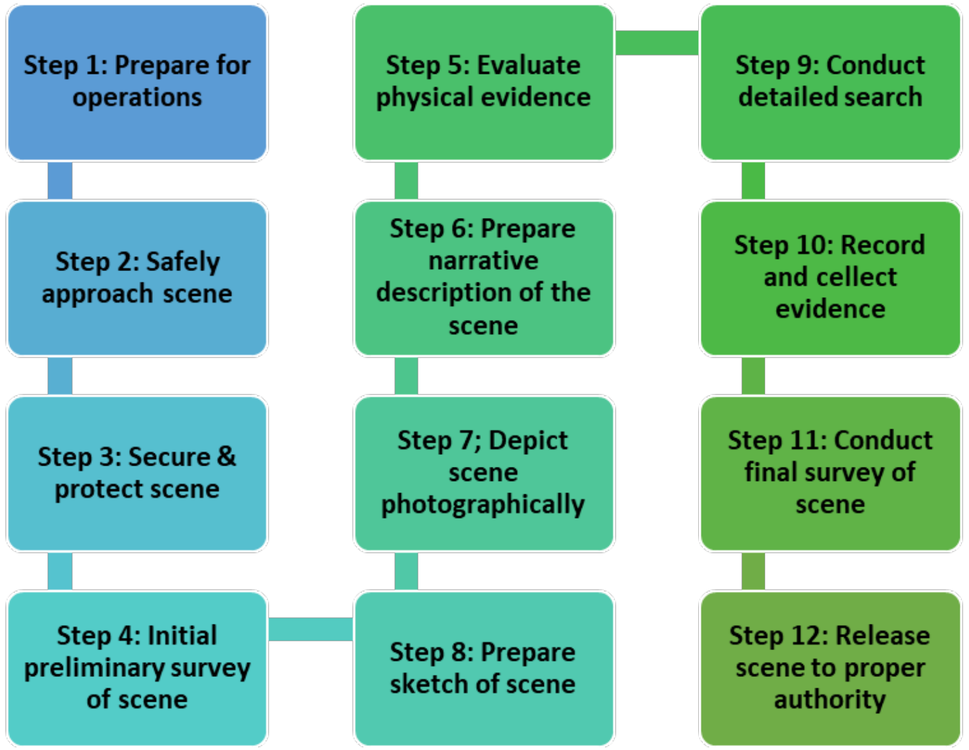


D. National Library Development



Human resource development and capacity building

A. Radiological Crime Scene Management



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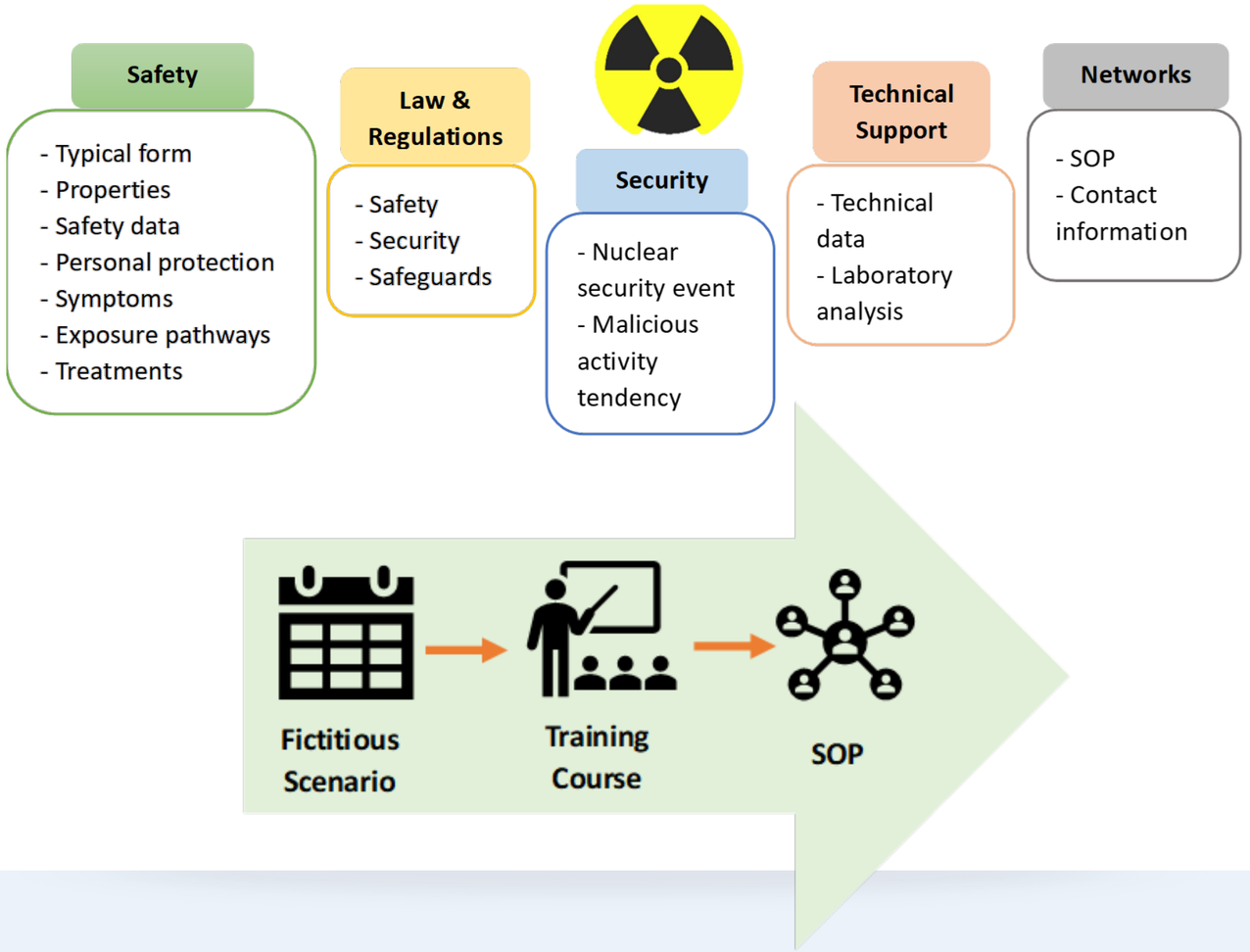

Human resource development and capacity building

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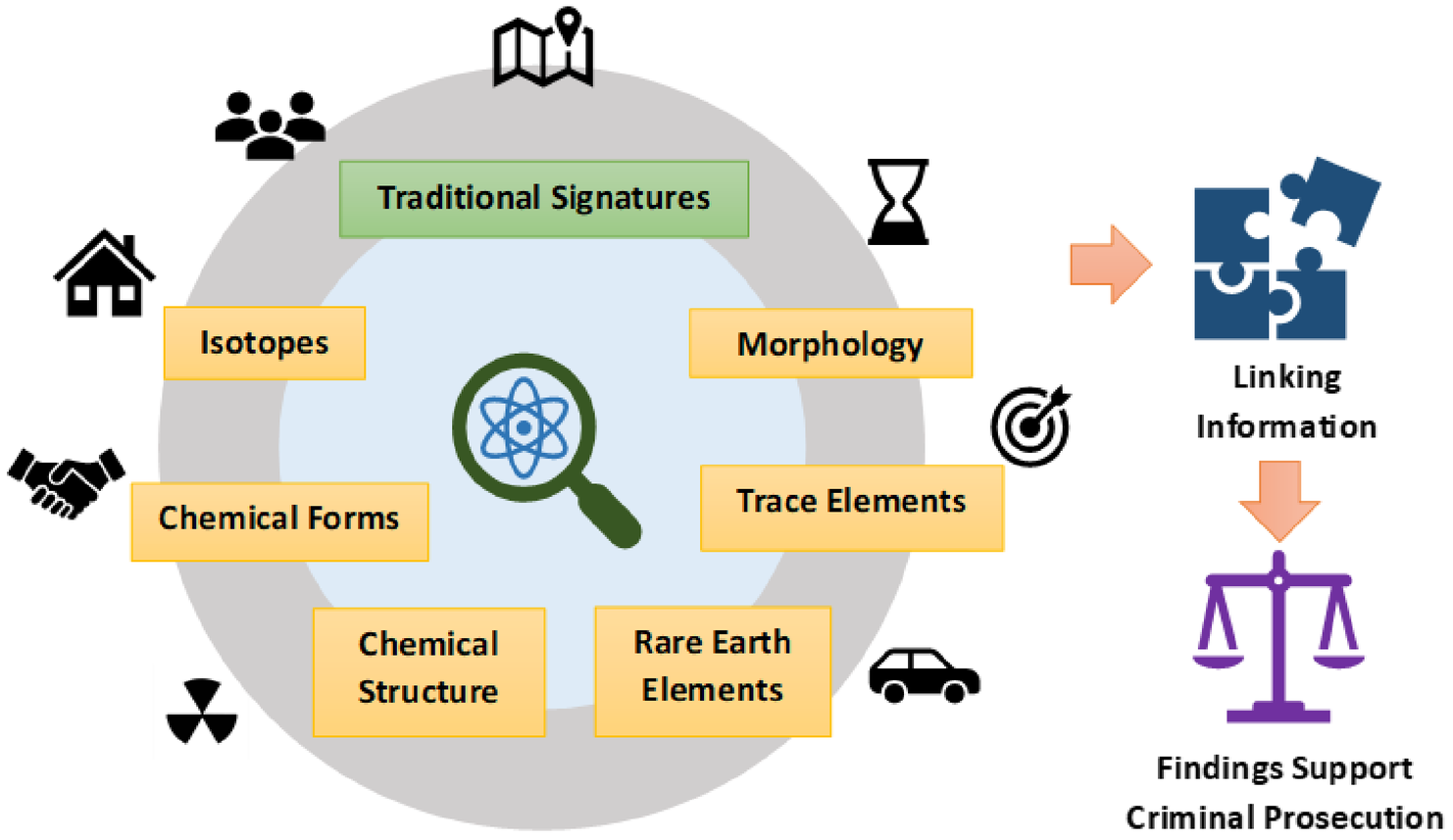

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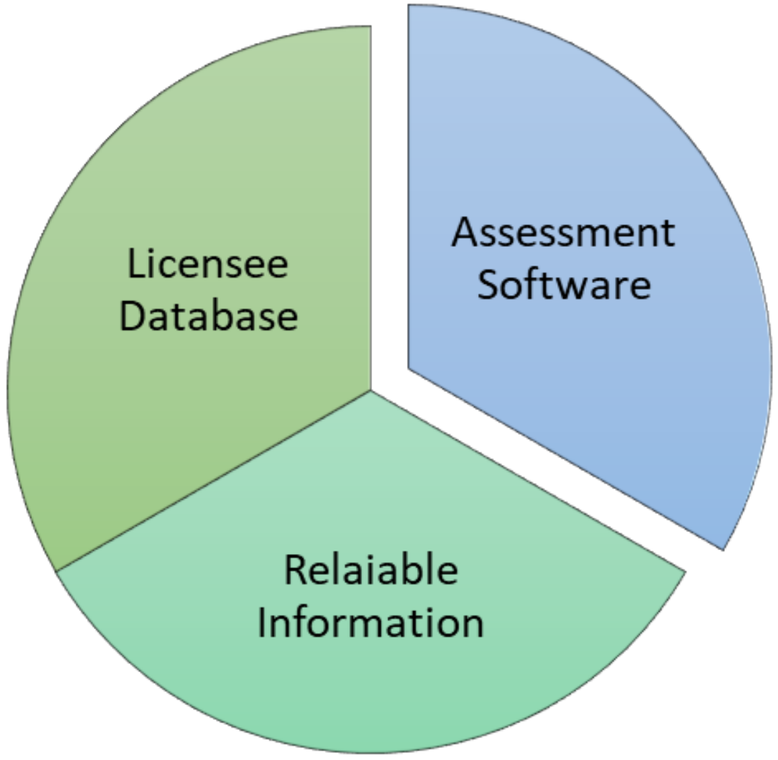
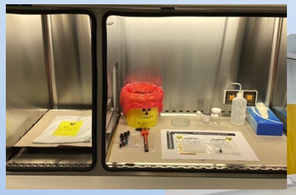


Nuclear Forensics Laboratory

Nuclear Forensics Signature Types

- Physical characteristic
- Chemical form
- **Elemental composition**
  - Ratios between elements
  - Trace elements
- **Isotopic composition**
  - Radioisotopes
  - Stable isotopes
  - Decay products

Sample receiving room



Clean laboratory

Destructive analysis

Non - destructive analysis

Nuclear Forensics Laboratory

Sample Type

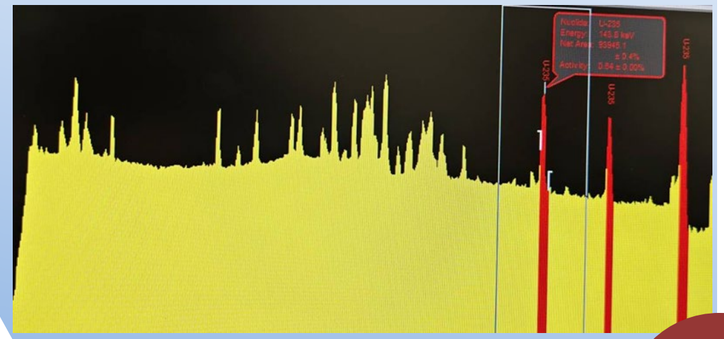
01 Bulk nuclear or other radioactive material

02 Items contaminated with radionuclides

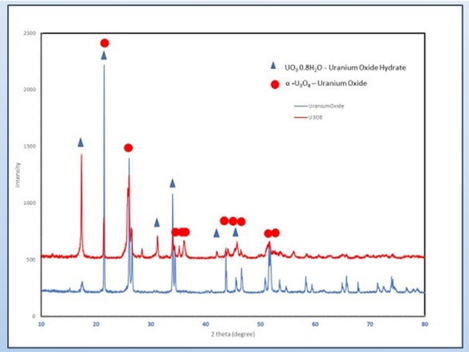
03 Biological samples

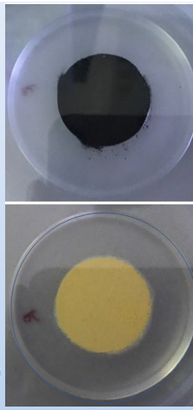
04 Environmental or geological samples associated with the nuclear or radioactive material

ISO/IEC 17025
Non - destructive analysis



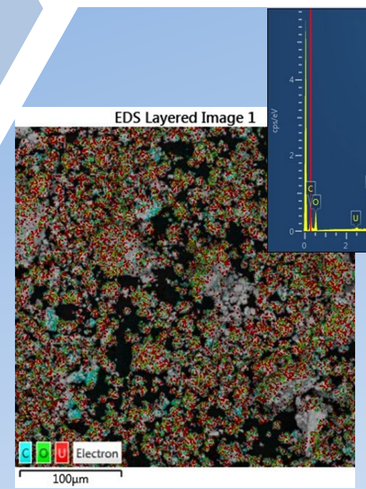
Chemical form and Phase analysis

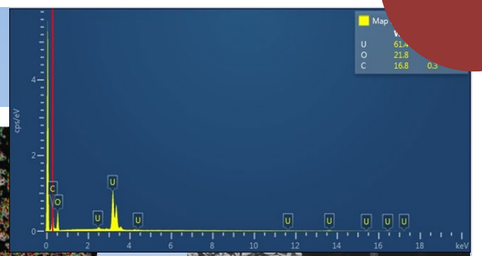


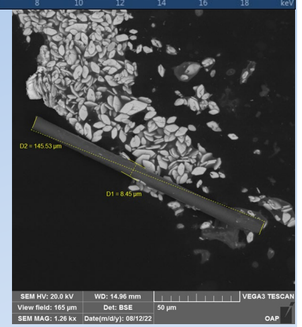


Uranium Oxide Hydrate $UO_3 0.8H_2O$
Uranium Oxide α-U_3O_8

R&D



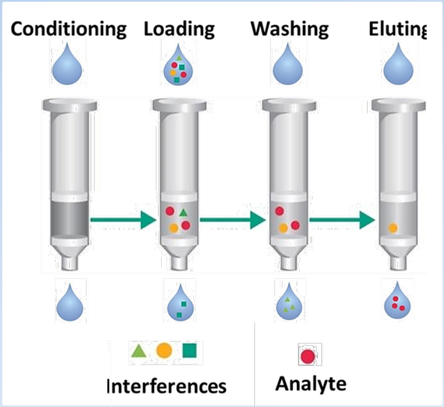




Material Identification
Process History
Detection of Contaminants

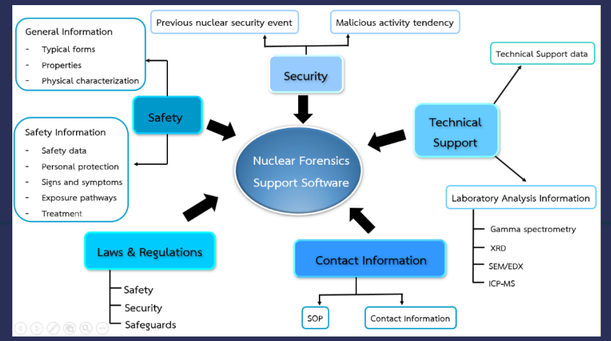
Isotopic composition
^{234} U, ^{235} U, ^{236} U, ^{238} U, ^{239} Pu, ^{241} Am

Chemical composition
trace impurities, REEs



Nuclear Forensics

Coordinated Research Project (CRP)



J02013 : Appling Nuclear Forensic Science to Respond to a Nuclear Security Event

(Establishment of Assessment Software for Nuclear Forensics Signatures to Deter Unauthorized Activities Involving Nuclear and Radioactive Materials in Thailand, 2019-2023)

J02020 : Nuclear Forensics Science to Bridge the Radiological Crime Scene to the Nuclear Forensics Laboratory

(Application of UVC Screening Technique for Investigation of Illicit Trafficking of Nuclear or Other Radioactive Materials to Identify Vulnerability at Border Control and Support Radiological Crime Scene Management, 2023-2026)

Expectation for Research institutions

01 Capacity building

02 Technological development

03 Collaborative effort

Nuclear Forensics in Thailand

Nuclear Energy for Peace Act, B.E.2559 (2016)

Thailand's primary law governing the development and use of nuclear energy and radiation for peaceful purposes.

Law Enforcement Investigation

Nuclear forensic science can be used alongside traditional forensic methods to support criminal investigations.

International Obligations and Instruments

- Treaties
- Conventions
- Agreements

Regional Collaboration in Southeast Asia

01 Project 30: Network of Excellence for Nuclear Forensics in the Southeast Asia Region. (OAP will serve as a hub laboratory in the regional network)

02 Practical Arrangements agreement on cooperation in the area of nuclear forensics science

- ✓ Capacity building
- ✓ Scientific visit
- ✓ Fellowship program
- ✓ Material analysis
- ✓ Interlaboratory comparision


THANK YOU