Contribution ID: **18** Type: **Poster**

# DEVELOPMENT OF CAPABILITY ON NUCLEAR FORENSICS SIGNATURE INVESTIGATION TO ESTABLISH A NATIONAL NUCLEAR FORENSICS LIBRARY

1. INTRODUCTION
   In 2013, with the support of the Royal Thai Government, the European Commission, and the IAEA, Thailand Nuclear Forensics Laboratory was established officially at the Office of Atoms for Peace. For almost ten years, Thailand has kept the momentum to enhance the national capability to fight against illicit trafficking on nuclear and other radioactive materials out of regulatory control in Thailand and Region. Thailand's Nuclear forensics laboratory staff were trained under the IAEA Human Resource Development Program. At the national level, the nuclear forensics network was strengthening in paralleled, raising awareness on the existing nuclear terrorism. The ability to reliably determine the origin and history of nuclear and other radioactive materials depends upon access to relevant sample materials, the identification of priority signatures, high confidence measurements or predictions, and the ability to perform inter-comparisons between data collected on an unknown sample and knowledge or database of known material to potentially including a national nuclear forensics library [1].To raise the confidentiality in the results from the nuclear forensics investigation, the laboratory has built up the capability to measure the nuclear forensics signature for the establishment of the national nuclear forensics library.
2. WORK CONDUCTED
   As we know, nuclear forensics identification provides information on the origin and history of nuclear and other radioactive materials out of regulatory control concerning the nuclear security event, leading to the prosecution under legal proceedings. Therefore, the increasing confidence of nuclear forensics signatures identification is significant in nuclear forensics investigation. It is important to develop the signature analysis methodology in-depth to ensure the accuracy and reliability of results. Based on the existing instrument and facilities in Thailand nuclear forensics laboratory, four techniques, Gamma spectrometry, X-ray Diffraction(XRD), Scanning Electron Microscope equipped with Energy Dispersive X-ray spectroscopy (SEM-EDX), and Inductively coupled plasma mass spectrometry (ICP-MS) were performed to develop the capacity of measurement the nuclear forensics signature. Due to the limitation of existing samples in the country, Certified Reference Material (CRM), standard point sources, monazite ore, and rare-earth were used to build up capability on nuclear forensics signature investigation. The analysis follows the recommendation on the Implementing Guide entitled Nuclear Forensics in Support of Investigations [2]. Gamma spectrometry provides isotropic analysis information, then, Chemical forms were identified by XRD. After that SEM-EDX technique was performed to identify particles, morphologies, and element distribution and also track the U/Th particles. Finally, the rare-earth elements and trace elements were determined by ICP-MS.
   In the beginning, the national nuclear forensic library was established based on existing of nuclear and other radioactive material under regulatory control in the national database and the results from the nuclear forensics laboratory, to confirm the existence of the nuclear and other radioactive material in the country. After that, the results from the nuclear forensics laboratory investigation of nuclear and other radioactive material out of regulatory control were included.
3. CONCLUSIONS
   To develop the national nuclear forensics library, Thailand's nuclear forensics laboratory develops capability on nuclear forensics signature investigation based on existing equipment and facilities. The nuclear forensics analytical results using the CRM contribute to increasing the investigation confidentiality. The first national nuclear forensics library was established which consisted of the national existing nuclear and other radioactive material under regulatory control and the results from the nuclear forensics laboratory investigation.
4. REFERENCE
   [1] IAEA-TECDOC-1820 Identification of High Confidence Nuclear Forensics Signatures Results of a Coordinated Research Project, and Related Research, International Atomic Energy Agency, Vienna, 2017
   [2] International Atomic Energy Agency, Nuclear Forensics in Support of Investigations: Implementation Guide, NSS. NO.2-G, International Atomic Energy Agency, Vienna, 2015.

**Primary authors:** RUEANNGOEN, Areerak (Bureau of Technical Support for Safety Regulation, Office of Atoms for Peace, Ministry of Science and Technology, Bangkok, 10900, Thailand); MUNGPAYABAN, Harinate; Mrs SRIJITTAWA, Ladapa (Office of Atoms for Peace); Ms CHANGKRUENG, Kalaya (Office of Atoms for Peace); KASI-WATTANAWUT, Haruetai (Office of Atoms for Peace, Thailand); Mr PHAUKKACHANE, Paphon (Office of Atoms for Peace); Ms THONG-IN, Saowaluck (Office of Atoms for Peace)

**Presenter:** RUEANNGOEN, Areerak (Bureau of Technical Support for Safety Regulation, Office of Atoms for Peace, Ministry of Science and Technology, Bangkok, 10900, Thailand)

**Session Classification:** Poster Session 3

**Track Classification:** 1. Nuclear Forensics Capability Building: Initiation and Sustainability: 1.2 New Technologies, R&D and Signature Research in Nuclear Forensics