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Alternative Database for Domestic LOF Nuclear Materials and Fuel

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INTRODUCTION

The information of nuclear materials, only location outside facilities (LOF) in Thailand, total 93 facilities, was created as database in 2016 via Microsoft Access 2010. The data input was compiled from Office of Atoms for Peace (OAP) licensing information of nuclear materials. The nuclear material query template, both Thai and English, was also setup to survey for more material details. This necessary information was supposed to support law enforcement or regulatory investigations. The multimedia CourseLab demonstration module for the attractive descriptions, to complete OAP nuclear material license forms, was created for more understanding of the end users who have to fill that query template [1].

In 2017, the nuclear forensics database was created simply using Microsoft Access-2010, to be the prototype for developing the National Nuclear Forensics Library (NNFL). NNFL is the tool to support the National Nuclear Forensics Laboratory, which was established in 2013 under the Project No. 30, "Network of Excellence for Nuclear Forensics in South East Asia Region (2013-2014)", assisted by EU CBRN CoE [2-3]. Additional databases were developed via Microsoft Access-2010, as 1) Additional nuclear forensics information, including LOF database of year 2016 [1]; and 2) OAP Nuclear Forensics Laboratory Inventory [4].

The Library data were summarized for some domain expertise, i.e. fresh fuel and irradiate fuel in nuclear fuel cycle stage, sealed source, and unsealed source, following NNFL Master Index [5], as well as their Microsoft Word-2010 templates. The algorithms for comparative analysis are on-going developed for interpretation between the information of the seized materials and of those existed in NNFL, to identify and report, for nuclear forensics conclusions of crime investigation in the events of nuclear security.

METHODOLOGY

To implement nuclear forensics investigation, 3 step procedures are required [6].

1) Collection, packaging, and transport of seized nuclear/radioactive materials from terrorism or smuggling detection in nuclear security event.

2) Laboratory analysis for cataloguing characteristics and signatures of these materials

3) Data interpretation and analysis via nuclear forensics database and comparative algorithms in NNFL

To support the mission plan of OAP nuclear forensics laboratory, this work was performed to develop NNFL as the following tasks [7].

1) Data collection relating to OAP conventional radioactive and nuclear material database of licensing systems

2) Developing architecture as templates and databases cataloguing characteristics and signatures of materials holdings under regulatory control

3) Storage functions using Microsoft Access 2010 software

4) Algorithm setup for comparative analysis

WORK PERFORMED

The architecture of this nuclear forensics database prototype was designed and was constructed preliminary as 3 main Microsoft Access 2010 databases. The comparative analysis is also planned to be developed for data interpretation and analysis to complete NNFL systems. All performed work is briefly explained as the following.

1) Nuclear and radioactive materials information

The nuclear and radioactive materials information was collected based on OAP conventional radioactive and nuclear material database of licensing systems. This information was sorted related to Material Master Index of IAEA NNFL-notional structure [5].

Because of only one nuclear facility, 2 MW research reactor, in Thailand, the domain expertise, fresh and spent/irradiated nuclear fuel, was recorded together as nuclear fuel element. Other domain expertises of nuclear or radioactive materials are sealed and unsealed sources, which can be found in hospitals, industrial plants, and research laboratories.

The templates of nuclear fuel element, sealed and unsealed sources were created via Microsoft Word 2010 and Access 2010 [7] and were attached in this nuclear and radioactive materials database.

2) Additional nuclear forensics information, including LOF database (2016-2017) [1, 7]

Other nuclear forensics information which is planned to collect, except LOF database (2016-2017), are concerning articles, IAEA documents, ISO, legislative work, nuclear forensics analytical summary reports, and templates.

3) OAP Nuclear Forensics Laboratory Inventory [4]

The inventory database of Nuclear Forensics Laboratory is planned to be complied including the following information.

a. General: List of buildings, floors, and rooms

b. Analytical equipment information: List of analytical instruments/equipment & parameters, i.e. identification data, physical data, hazardous materials, radiological data, etc.

c. Technical support information: List of technological systems, inventory materials, laboratory materials, radionuclides, etc.

4) Comparative algorithm

Comparative analysis plan is setup to compare the obtained results which those in existing in NNFL [8-10], as the following procedures.

a. Upload nuclear forensics analytical results, sample information and all available signatures, in the library system

b. Interpretation via the algorithm for searching and findings:

Searching: Data comparison

- Choose only some signatures which are relevant to this case.
- Flexible program and use only relevant signatures for searching

Findings: Agreement among samples

- Based on numerical data and simple words
- Requested and identified samples

DISCUSSION AND CONCLUSIONS

The progress of this work is summarized as the following:

1) The architecture of the domestic forensic databases is setup and organized using Microsoft Access 2010 and Word 2010;

2) The algorithm setup for comparative analysis is on-going processed.

3) The collection of data/information of fresh/spent nuclear fuel, sealed sources and unsealed sources, will be performed in the long term project, for the whole country;

4) Accessibility and website link to another concerning domestic organizations may be performed after the establishment of national framework of nuclear forensics.

Present Availability:

1) It takes time to collect all data/information following nuclear forensics database from the whole country, Thailand.

2) The methods for determination of signatures are in research and development for the standard method to support the determination of nuclear materials and radioactive materials by using Inductively Coupled Plasma Spectrometry (ICP-MS), Scanning Electron Microscopy with Energy Dispersive (SEM/EDX) and Gamma Spectrometry, in OAP nuclear forensics laboratory [11].

3) There are only a few domestic radiological incident and criminal cases, so there are not a lot of seized samples for confirming trials in comparative analysis. The simulated scenarios are planned to be created for test runs, as well as the examples of analytical results.

4) However, the flexible program for searching and finding is planned to be developed, to complete NNFL for protection against nuclear terrorism in the future.

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Thailand

Primary author: Ms KRAIKAEW, Jarunee (Office of Atoms for Peace)

Co-authors: Ms MUNGPAYABAN, Harinate (Office of Atoms for Peace); Ms CHANGKRUENG, Kalaya (Office of Atoms for Peace); Ms SRIJITTAWA, Ladapa (Office of Atoms for Peace); Mr PHAUKKACHANE, Paphon (Office of Atoms for Peace); Ms THONG-IN, Saowaluck (Office of Atoms for Peace)

Presenter: Ms KRAIKAEW, Jarunee (Office of Atoms for Peace)

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