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Developing a Nuclear Forensics Library in Ukraine: The Pilot Project Stage

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Ukraine's extensive handling of nuclear and other radioactive materials (NRM) necessitates an appropriate system of regulatory control and the timely prevention of its weakening or loss. In addition to large uranium ore reserves and the operation of uranium purification facilities, nuclear power generation facilities and research reactors, Ukraine also retains radioactive waste materials accumulated from significant Soviet-era uranium production and the Chornobyl catastrophe and has plans to develop infrastructure for the fabrication of low-enrichment nuclear fuel. Nuclear forensics is a powerful tool to further strengthen regulatory control within Ukraine and to help counteractions against nuclear smuggling.

The Institute for Nuclear Research of the National Academy of Sciences of Ukraine (INR) is designated by the Ukrainian Government as the main expert organization for the study and characterization of NRM seized from illicit trafficking in Ukraine. In support of Ukraine's efforts, INR is working to apply its expertise in the handling of NRM as well as its expertise in database development to improve nuclear forensic capabilities in Ukraine. The value of nuclear forensic analysis is increased if the tools exist to both characterize NRM and to conduct comparative research of interdicted materials with known, previously documented NRM. Therefore, the STCU partner project P459, titled "Development of a Nuclear Forensics Database in Ukraine", with Lawrence Livermore National Laboratory (LLNL) under support from the USA Department of State and Department of Energy was developed and initiated in July of 2013.

Careful consideration is being used to populate the Ukraine database with data. To avoid issues concerning the management of sensitive information, only open source information will be used for the population of the pilot database. As a result of discussions with potential users of the Ukraine database and the preliminary analysis of data from open sources, the following basic set of data has been selected for inclusion: data about uranium bearing materials that was obtained as a result of work from the partner STCU project P465; data describing the radionuclide content of soil samples from the nearest zone of Chornobyl NPP; and data about samples of fuel containing mass from the "Shelter" object.

Database experts at INR have developed a structure for the database, which covers a wide range of objects and metadata (which can exchange roles), as well as relations between data in order to maximize the flexibility of the database for future forensic applications. To avoid significant changes of the database structure in the process of database utilization, our approach to introducing new objects or their attributes to the database is based on the conception of a relational database with a limited number of tables and the utilization of a comprehensive scheme of relationships. This proposed approach enables us to complete both present and future tasks without considerable modifications of the database structure and without corresponding significant efforts for implementation.

The general scheme of the pilot version of database is based on a client - server architecture. The client part of system is based on standard Internet browsers and does not require any special software to be developed. The proposed architecture for the web server is similar to the common open source server architecture (LAMP) which comprises: Linux –the server's operating system; Apache –the web server component; MySQL –a relational database; PHP –the application layer. The main principals of the pilot version are its easy transfer for different operating systems and utilization of the most general data types, commands and procedures.

The project progress and lessons learned from the development of a nuclear forensics library in Ukraine will be presented and discussed.

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