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20 Years of Nuclear Forensics: Between R & D and Case Work

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The first illicit trafficking incidents involving nuclear material were reported in 1992 in Europe and raised significant concerns with regard to nuclear security in the country where the incident occurred, in the (suspected) country of origin and in the states the material may have transited. With little or no circumstantial information on the provenance of the illicit material, it became clear that information inherent to nuclear material needed to be exploited in order to identify possible origin and pathways of the material. Nuclear material has either been subject to technological processing or is entirely of anthropogenic origin. Consequently, nuclear material carries signatures of the process it was subjected to. Signatures are to be understood as measureable parameters or a combination of parameters that allow drawing conclusions. Nuclear forensic science emerged as a new discipline, aiming at providing clues on the intended use of the material and on its history, providing investigative leads and possibly leading to a source attribution. To this end, research and development needed to be carried out in order to validate and further perfect the analytical tool-set. In parallel, the repeated seizures of nuclear material called for rapid analysis of the samples and for reliable interpretation of the data.

Significant research and development work has been carried out and a systematic and efficient methodology for analyzing seized material has been implemented. The paper will illuminate the parameters to be measured (such as isotopic and elemental composition, macroscopic and microscopic appearance) as well as the methodology and analytical techniques applied. Examples of case work of a 20 years track record in nuclear forensic investigations will be given to demonstrate the opportunities and limitations associated with nuclear forensics. Moreover, the interaction with other competent national and international authorities involved in nuclear security incidents and the associated training activities will be discussed.

Primary author: FANGHAENEL, T. (European Commission - Joint Research Centre, Institute for Transuranium Elements)

Co-authors: Dr MAYER, K. (European Commission - Joint Research Centre, Institute for Transuranium Elements); Dr WALLENIUS, M. (European Commission - Joint Research Centre, Institute for Transuranium Elements); Dr WISS, T. (European Commission - Joint Research Centre, Institute for Transuranium Elements); Dr VARGA, Z. (European Commission - Joint Research Centre, Institute for Transuranium Elements)

Presenter: Dr MAYER, K. (European Commission - Joint Research Centre, Institute for Transuranium Elements)

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