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Translating Research Findings into Operational Capabilities in Nuclear Forensics: The Australian Experience

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The Australian Nuclear Science and Technology Organisation (ANSTO) is home to the Nuclear Forensic Research Facility (NFRF), which was commissioned in 2009. The NFRF is the central hub for nuclear forensics in Australia and possesses the unique capabilities required to undertake nuclear forensic analyses in support of investigations. Such capabilities include; facilities for handling radioactive material, access to a broad range of analytical services, staff with training and experience in fields ranging from radiochemistry to forensic science, and subject matter expertise for data interpretation.

Over a number of years, the NFRF has undertaken research to explore the effects of ionising radiation on forensic evidence and the handling of exhibits contaminated with radioactive material [1, 2, 3]. This research has demonstrated that some evidence types, such as DNA and fingerprints, may yield valuable information in spite of radiation exposure yet are not amenable to decontamination. Thus, the development of protocols for the safe handling of forensic evidence contaminated with radioactive material is an important step in preparing to respond to and investigate a nuclear security incident. It was recognised that relationships between the NFRF and law enforcement needed to be supported and procedures implemented in anticipation of a nuclear security event - not in response to one. This approach will enable key forensic practitioners to undertake a more effective, safer, and skilled investigation of a nuclear security event.

The role of the Australian Federal Police (AFP) is the enforcement of Commonwealth criminal law in Australia and the protection of Commonwealth and national interests from crime in Australia and overseas. ANSTO and the AFP have a long-standing relationship which includes research collaborations, training and development and exercise facilitation. This relationship has been formalised by a Memorandum of Understanding, under the auspices of which a project is being undertaken to translate research findings into operational capabilities in nuclear forensics.

Given the routine operational demands on organisational resources, it may not be possible for law enforcement forensic laboratories to maintain capabilities for the handling of evidence contaminated with radioactive material, as this would require a diverse range of supporting capabilities including regulatory compliance, health physics and waste management. Equally, although these support capabilities are in place for a nuclear or radiological facility, it may not be economically viable for these laboratories to establish full forensic capabilities. In Australia, ANSTO and the AFP elected to deploy existing resources in a collaborative manner, with AFP forensic scientists undertaking examination of evidence in the NFRF. NFRF staff, who have experience in both forensic science and nuclear science, form a key part of the analytical team by serving as the 'interface' between these disciplines – a role which is further enhanced by participation by NFRF staff in AFP training to gain a greater understanding of organisation-specific needs.

Evidence types and examination techniques selected for inclusion in this project were those most likely to yield operational intelligence and/or highly probative evidence for court proceedings. Facilities and techniques are amended or developed where required to suit the constraints inherent to radioactive material handling whilst still meeting the requirements of law enforcement, such as sample/source preservation, the avoidance of cross-contamination and maintenance of chain of custody. The centrepiece of this project is the fit-out of two custom-designed glove boxes within the NFRF for the safe handling of evidence contaminated with radioactive material.

Through this project, ANSTO and the AFP have developed capabilities unique just not in Australia but within the broader Asia-Pacific region for the handling of forensic evidence contaminated with radioactive material. It is anticipated that this capability will be a key component of the nuclear forensic response in support of the investigation of a nuclear security event. This presentation will describe in greater detail the technical aspects of this project, such as the modifications required to make the glove boxes suitable for forensic examinations, and the training required for AFP forensic scientists to work in a radiation environment. It will also describe the lessons learned through this project and plans for on-going collaboration.

1. Colella, M., et al., The Recovery of Latent Fingermarks from Evidence Exposed to Ionizing Radiation. *Journal of Forensic Sciences*, 2009. 54: pp. 583-90.
2. Colella, M., et al., The Effect of Ionizing Gamma Radiation on Natural and Synthetic Fibers and Its Implications for the Forensic Examination of Fiber Evidence. *Journal of Forensic Sciences*, 2011. 56(3): pp. 591-605.
3. Parkinson, A., et al., The Development and Evaluation of Radiological Decontamination Procedures for Documents, Document Inks, and Latent Fingermarks on Porous Surfaces. *Journal of Forensic Sciences*, 2010. 55(3): pp. 728-34.

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