**The Nuclear Forensics International Technical Working Group (ITWG):**

**The Evidence Working Group**

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**Abstract.** In a law enforcement investigation, evidence from the scene of a crime is critical in identifying suspects, developing tangential investigative leads, and linking individuals or groups to criminal actions. It is therefore imperative that evidence be collected, stored, and examined in a manner to best preserve those characteristics important to the investigation, the prosecution, and the defense. While the proper handling of evidence is practiced on a daily basis worldwide, evidence from a nuclear security event, that is, the addition of radioactive/nuclear material to the event site and to the evidence, can present unique and very difficult challenges to both the forensic collector and the forensic service provider.

The Nuclear Forensics International Technical Working Group (ITWG) is an informal collaboration among practitioners of nuclear forensics - laboratory scientists, law enforcement personnel, and regulatory officials - who share a common interest in preventing illicit trafficking in nuclear and other radioactive materials out of regulatory control. In 2012, the ITWG established the Evidence Working group to address common issues with the collection, storage, and analysis of evidence contaminated with or consisting of radioactive and nuclear materials. In 2013 at the annual ITWG meeting in St. Petersburg, Russia, this group met for the first time to discuss the scope of this working group and prioritized future work for its volunteers.

**1. Introduction**

One of the most powerful investigative tools law enforcement relies upon is the information which can be extracted from physical evidence. Finger print comparison, DNA analysis, trace evidence analysis, and questioned document examinations to name a few have become routine traditional forensic examination techniques used by law enforcement around the world because of their proven abilities to link persons or groups of persons to locations, times, or in some cases directly to criminal actions. The proper handling of evidence to undergo these traditional forensic examinations is well practiced and has been validated and established in trial law. The proper handling of radioactive/nuclear materials is also well established as seen through commercial and international organizations such as the IAEA. An area ripe for exploration is the combination of the two, that is, what about the handling, processing, and examination of evidence which contains or may be contaminated with radioactive/nuclear materials? Questions quickly arise, such as to what may be the effect of radiation on other items of evidence? Does it damage the DNA, fingerprint, hair, etc to a point where the common forensic exams are compromised? Does the difference in the requirements for safely packaging a piece of evidence contaminated with radioactive/nuclear material interfere with evidence preservation? Which should be done first, a latent fingerprint examination or radioactive/nuclear material analysis?

In 2012, the Nuclear Forensics International Technical Working Group (ITWG) established the Evidence Working group to address common issues with the collection, transport, analysis, and reporting on evidence contaminated with or consisting of radioactive and nuclear materials. The ITWG is a multinational, informal association of official practitioners of nuclear forensics - laboratory scientists, law enforcement personnel, and regulatory officials - who share a common task in responding to nuclear security events involving nuclear or other radioactive materials out of regulatory control. The ITWG was established in 1995-1996 as a result of an initiative of the G-8 (both the 1995 Ottawa Summit and the 1996 Moscow Nuclear Security Summit), largely through the efforts of concerned scientists from the national laboratories of the US Department of Energy and the Institute for Transuranium Elements representing the European Commission, with the encouragement of Government officials. Its establishment reflected heightened concerns over the threat posed by nuclear smuggling. Currently, the ITWG reports informally to the Nuclear Safety and Security Group of the G-8.

The ITWG Evidence Working group is focused on developing documents to support the radioactive/nuclear materials laboratory, the nuclear forensics laboratory, and law enforcement communities. In 2013 at the annual ITWG meeting in St. Petersburg, Russia, approximately twenty volunteers from over 10 different nations met for the first time as the ITWG.

**2. Proposed List of Tasks**

Prior to the meeting in 2013, the following four (4) tasks were developed by the ITWG leadership.

***2.1 Proposed Task #1:*** ***Develop a document to discuss chain of custody/continuity of evidence.***

The chain of custody/continuity of evidence refers to those procedures and documents that account for the integrity of physical evidence by tracking its handling and storage from its point of collection to its final disposition.[1] While forensic collectors and forensic service providers for non-nuclear event type crime scenes have well established chain of custody/continuity of evidence procedures, the added safety and surety requirements of radioactive/nuclear materials may not be compatible with existing chain of custody/continuity of evidence practices. For example, it is well known to the nuclear power industry that some plastic coated labels and printer inks are highly susceptible to certain types and doses of radiation and will degrade and fade over time. Chain of custody/continuity of evidence forms which consist of plastic coated labels attached directly to the evidence may not be appropriate when processing evidence containing radioactive/nuclear materials. Chain of custody/continuity of evidence requirements may need to be modified or deviations to standard practices may need to be put in place by the laboratory to satisfy the facilities safety requirements and the requirements of law enforcement.

The purpose of this proposed document would be to aid radioactive/nuclear material analysis laboratories which may not frequently perform forensic work. By understand the intricacies and issues associated with maintaining chain of custody/continuity of evidence, these laboratories can assess whether or not existing materials control and accountability procedures, security requirements, etc are compatible with the requirements of their law enforcement customers. For law enforcement, such a document would be helpful when they are making decisions on where evidence is to be taken for examination. Such decisions, often done under extreme time pressures, require law enforcement officials to quickly assess whether a nonstandard forensics service provider can meet their requirement for chain of custody/continuity of evidence.

***2.2 Proposed Task #2; Development of a series of topical papers on the conduct of traditional forensic examinations on evidence containing radioactive/nuclear material.***

While the characterization of radioactive/nuclear material is proven to yield valuable information, law enforcement will also expect traditional forensic techniques, such as finger print comparison, DNA analysis, trace evidence analysis, and questioned document examinations to be performed on the radioactive/nuclear material contaminated evidence as well. Whereas most traditional forensic service providers have decades of experience and robust quality assurance programs for examining evidence in the aforementioned disciplines, the presence of radioactive/nuclear material at the event site and likewise, on the evidence, presents unique challenges for both the evidence collector and the traditional forensic service provider.

The challenges can be separated in to two (2) categories:

2.2.1 Effects of radiation on the evidence to be examined

It has been shown that radiation can affect the viability of both physical evidence (ie. DNA, fibers, [2] etc.) and electronic evidence [3] (ie. computer memory storage devices). However most of the validation work (the systematic determination of efficacy of a given technique/procedure) performed to support traditional forensic techniques does not consider the effect of radiation exposure of the evidence. Thus there is a need for additional validation studies of traditional forensic examination techniques so as to determine and document the effects of dose, dose rate, and radiation type. Such validation work may be necessary to satisfy legal requirements to allow the courts to accept the results of traditional forensic techniques performed on evidence exposed to radioactive/nuclear materials.

2.2.2 Effects of radiation contamination/exposure control on the examination procedures

For non-nuclear event type crime scenes, most traditional forensic techniques are performed either at the scene or on the bench top or within chemical fume hoods at a forensic services provider. The examiners at these facilities have ready access to instruments which have undergone strict performance and maintenance checks, and these instruments are often solely dedicated to performing one specific type of examination. For example, the questioned document examiners rely upon the use of the video spectral comparator is to examine documents using various wavelengths of light and the electrostatic detection apparatus. These, and other task-specific traditional forensic instruments, are not commonly found in radioactive/nuclear materials analysis laboratories.

The presence of radioactive/nuclear materials on/in the evidence often requires facility and material specific safety and surety procedures which may be incompatible with the performance of these traditional forensic techniques or may require the placement of these highly specialized instruments in environments (ie. fume hoods, plastic enclosures, hot cells) for which they have not been designed. In addition, the traditional forensic examiners may be asked to perform their work in challenging environments, such as within restrictive personal protective equipment, strict radioactive materials contamination controls, and using limited instrumentation capabilities. Therefore, significant work (engineering, procedure modifications, quality assurance deviations, and training) is required before traditional forensic techniques can either be brought into a radioactive/nuclear materials laboratory or employed at a nuclear security event.

This series of documents would be developed for both the radioactive/nuclear materials laboratory where these techniques may be employed and for law enforcement forensic examiners, who may be bringing these techniques into a radioactive/nuclear materials laboratory or the nuclear security event.

***2.3 Proposed Task #3:*** ***Development of an evidence collection plan framework document.***

In the ITWG “Guidelines for Evidence Collection in a Radiological or Nuclear Contaminated Crime Scene” [4], the document emphasizes the necessity for planning prior to collecting evidence from a nuclear security event. The plan is the culmination of all of the information received from the first responders, the reconnaissance teams, and from other personnel at the scene.

This plan, to be implemented by the on-scene evidence collectors, contains information on known hazards (radiation, electrical, chemical, falling, etc) associated with the site as well as a detailed list of items to be collected. The list, annotated as to packaging requirements, provides a direct link between the law enforcement officials at the event (the items on this list should be only those probative to their investigation), the collectors who are collecting evidence and documenting what they have done, and the nuclear forensic and the traditional forensic laboratories who need to know under what conditions the evidence was collected and to determine if their facilities can accept such items.

Such a document would provide a generic framework so as to efficiently allow issues associated with collecting evidence from the event be discussed in a constructive, clear, and decisive manner between the law enforcement officials, the collectors, and the nuclear forensic/traditional forensic laboratories.

***2.4 Proposed Task #4:*** ***Development of an Examination Plan Checklist.***

Just as important as the Evidence Collection Plan is the Examination Plan. As called for in IAEA Nuclear Security Series No. 2[5], the examination plan is the master control of what happens to the evidence, who does what, which procedures are performed, etc. and represents an agreement between the law enforcement official and the nuclear forensic/traditional forensic service provider.

Even though examination plans are critical documents, they are often written in haste and with minimal forethought to other investigative and safety needs. By developing an Examination Plan checklist, this would provide the nuclear forensic and traditional forensic service providers a step-wise path to guide and document discussions ensuring that important points (such as destructive vs. nondestructive analysis) are brought out and agreed upon by the examiners and the law enforcement officials.

**3. Results from the ITWG Annual Meetings**

After discussion about the scope of this new working group and how the previous four (4) tasks are within this scope, the following points were agreed upon by the volunteers present.

3.1 Agreement Point #1

The Nuclear Forensics International Technical Working Group’s “Guidelines for Evidence Collection in a Radiological or Nuclear Contaminated Crime Scene”, published in 06 June 2011 is the basis for our work.

3.2 Agreement Point #2

Several volunteers agreed to begin working on Proposed Task #1 and Proposed Task #2. Volunteers for Proposed Task #1 will be using a draft version of a document begun in the ITWG Guidelines Working Group, while other volunteers will be developing Proposed Task #2 by drawing from published scientific works and personal experiences.

3.3 Agreement Point #3

Proposed Task #3 and Proposed Task #4 require further discussions and were tabled until a later date to be determined.

**4. Summary**

Overall, the first meeting of the ITWG Evidence Working Group was a success. It established a clear path forward for several new documents which will aid those who will handle, examine, and store radioactive/nuclear evidence. Emphasis will be placed on supporting the radioactive/nuclear materials laboratory, the nuclear forensics and traditional forensic laboratory, and law enforcement organizations.

**REFERENCES**

[1] UNITED NATIONS OFFICE ON DRUGS AND CRIME, Policing. Forensic Services and Infrastructure. Criminal Justice Assessment Toolkit, United Nations, New York, 2010.

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[3] Messenger, G., Ash, M., The Effects of Radiation on Electronic Systems, Van Nostrand Reinhold Co, 1986.

[4] NUCLEAR FORENSICS INTERNATIONAL TECHNICAL WORKING GROUP, Guidelines for Evidence Collection in a Radiological or Nuclear Contaminated Crime Scene, 06 June 2011.

[5] IAEA Nuclear Security Series No. 2. Nuclear Forensics Support, IAEA, Vienna, 2006, pg 23.