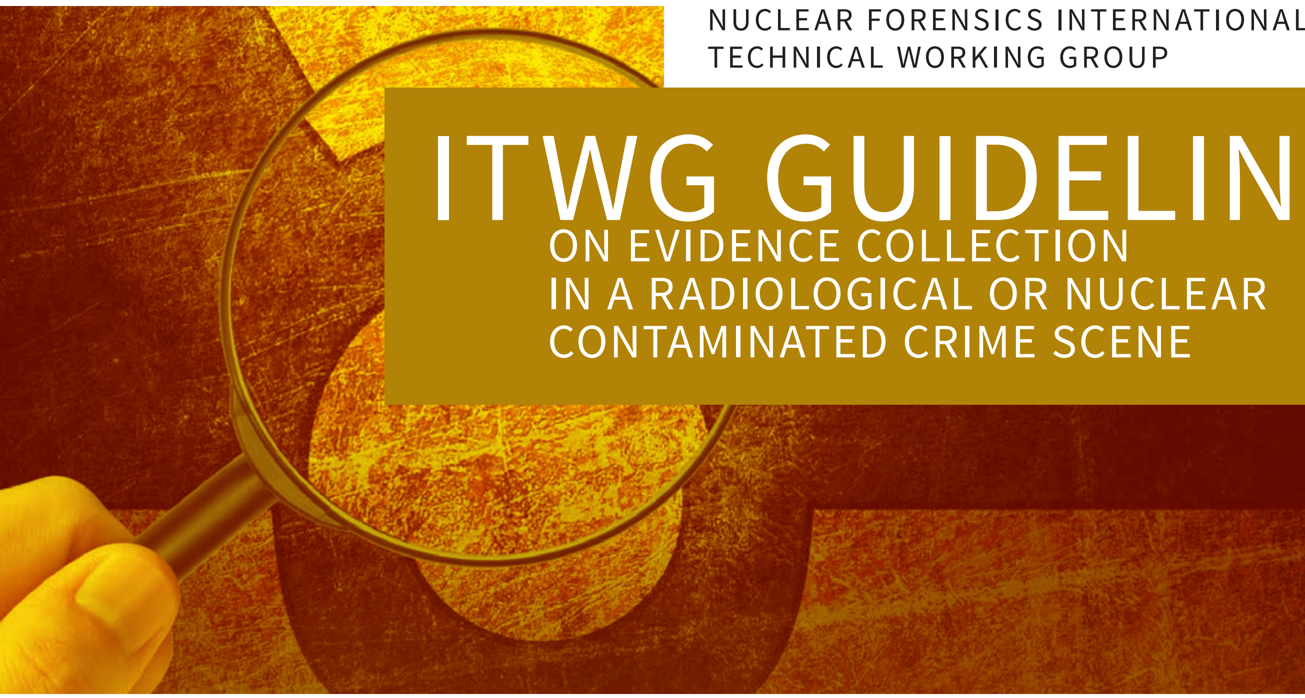
NUCLEAR FORENSICS INTERNATIONAL
TECHNICAL WORKING GROUP

ITWG GUIDELINE

ON EVIDENCE COLLECTION IN A RADIOLOGICAL OR NUCLEAR CONTAMINATED CRIME SCENE



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ITWG Guidelines are intended as consensus-driven best-practices documents. These documents are general rather than prescriptive, and they are not intended to replace any specific laboratory operating procedures.

1. INTRODUCTION

The Nuclear Forensics International Technical Working Group (ITWG) is an informal association of nuclear forensic practitioners, created in 1996 following a G8 summit in Ottawa, Canada, and a subsequent International Conference on Nuclear Smuggling Forensic Analysis held in the United States in 1995. The ITWG aims to provide a framework for combating the illicit trafficking of nuclear materials and other radioactive substances by establishing informal communications and cooperation among international experts, including policy makers, scientists, and law enforcement personnel. In addition, the ITWG Nuclear Forensics Laboratories (INFL) was formed in 2003 to promote technical advancement in the area of nuclear forensics.

The ITWG is focused on the promotion of nuclear forensic best practice through the development of guidelines for forensic analysis of nuclear, radioactive, and radiologically contaminated materials. This is supported through the work of various task groups, of which five currently exist: Communications, Outreach and Training; Evidence Collection; Exercises; Guidelines; and Nuclear Forensic Libraries. This document represents an output of the Evidence Collection Task Group.

The focus of the Evidence Collection Task Group is to balance the collection and preservation of nuclear forensic evidence and the need to protect law enforcement working within a potentially contaminated crime scene. Obtaining reliable nuclear forensics conclusions is only possible if the entire process from sample collection at the incident site through to the analysis and data interpretation in the laboratory is controlled and technically rigorous. Nuclear forensics commences at the incident site (or crime scene) as a key component of a comprehensive response. The objective of this document is to describe best practices for evidence collection activities given a radiologically contaminated crime scene.

2. SCOPE

Effective response to the wide range of possible radiological incidents requires the development and implementation of a national response plan. This plan should describe the roles and responsibilities of the relevant national agencies involved in response to radiological incidents. Having such a plan in place in advance of an incident, as well as regularly exercising the plan, will facilitate an effect overall response to an actual incident.

Following a radiological or nuclear incident, the types of evidence that may be collected include the radiological or nuclear material itself, referred to as radiological evidence, and traditional types of evidence contaminated with these materials, referred to as contaminated traditional evidence. Throughout this document, the term radioactive and its variations will be used to describe both radiological and nuclear materials. It is important to highlight that this document is focused on providing radiation-specific advice relevant to evidence collection activities and not to re-iterate forensic best practice. The need for evidence collectors to follow forensic best practice and validated methods (when available) for each type of evidence collected should be understood.

The target audience for this document includes crime scene managers, law enforcement evidence collectors or forensic practitioners, first responders, radiation regulators, border officials, forensic evidence-processing laboratories and nuclear forensic practitioners. In fact, any stakeholder interested or involved in the response, evidence collection or evidence analysis following a radiological or nuclear event may find this guideline of interest.

The advice contained in this guideline is intended to apply to any situation wherein radioactive contamination is encountered and forensic evidence must be collected. Such situations could range from the seizure of slightly contaminated material to a large-scale release of radioactivity. For the purposes of this document, it should be assumed that (as needed) many of the initial incident response actions have been carried out by the appropriate agencies, including the establishment of a hot zone boundary with contamination check points and assessment of the presence of airborne radioactivity, and that evidence collectors have arrived on site and are ready to process the scene. Additionally, considering the potential for coupling radiological and explosive materials (as in a so-called dirty bomb), it should be assumed that the crime scene has been cleared of all active explosive devices by qualified personnel. However, evidence collectors should continue to remain aware during their activities for other such devices that could be found. All actions taken in the crime scene by first entry teams, including those of explosives ordnance disposal personnel, should be fully documented for later reference.

3. SPECIAL CONSIDERATIONS FOR EVIDENCE COLLECTION

Each situation involving the collection of radiological forensic evidence will be unique. As such, it is difficult to adequately cover all considerations for all scenarios. Coordination and ongoing communication with radiological experts is therefore extremely important to ensure that all considerations specific to a given event are discussed and considered throughout the response process. In some countries, Mobile Expert Support Teams (MEST) have been established, consisting of personnel equipped and trained to use basic radiation monitoring instruments and perform simple assessment tasks, to provide timely expert support to detection and response activities. In addition, many countries require that radiation regulatory authorities be informed, if not involved, following an incident involving radiological material.

In contrast to a conventional (uncontaminated) crime scene, a radiological crime scene may require considerably shorter time in the hot zone, longer distance between the responder and the radioactivity, and the use of radiation shielding. These will all add complexities to the response. Given the uniqueness of this type of activity, teams carrying out evidence collection tasks in a contaminated environment must be trained and equipped to work in such environments. Consideration that such a response will involve multiple agencies dictates the need for extensive liaison across the various agencies prior to any such event. In addition, response operations following a radiological incident will most likely have a higher profile than conventional incidents, resulting in higher scrutiny on actions taken, not to mention additional associated challenges.

This document will cover considerations for collecting evidence from radiologically contaminated environments, including general radiation safety practices, contamination control, evidence removal considerations, sampling practices, and evidence packaging and transportation.

4. GENERAL SAFETY CONSIDERATIONS

As early as possible, a qualified radiological safety officer (RSO), preferably from the national regulator or safety authority, should be named by the incident commander to take on the role for the overall radiological safety at the scene. The RSO should establish maximum permissible doses and back-out dose rates in accordance with national regulations for responders entering the hot zone, which should be clearly communicated to all responders entering the crime scene. Personal Alarming Dosimeters should be set in accordance with these values. The RSO should also confirm that responders are following appropriate personnel protection guidelines (likely already established following initial reconnaissance entries), and should maintain a dose record for all responders entering into the potentially contaminated areas. Evidence collectors should liaise with the RSO prior to entering the crime scene to undertake evidence collection activities.

Staging for a response should be done in a clean (contamination-free) environment at background dose rates. Any prior reconnaissance information about the crime scene (radiation related and otherwise) should be considered when planning entry to the crime scene and tasks to be carried out therein. In the absence of any information, performing a quick gamma and (if possible) neutron dose rate survey of the outside of the perimeter of the crime scene or around buildings involved may indicate the location of any “hot spots”. In addition, always monitor dose rate upon approach of the crime scene. In some countries, the accepted practice may be for radiation expert teams (such as the MEST described above) to accompany forensic investigators into a contaminated crime scene in order to provide technical advice on radiological hazards present. When this is the case, close coordination between these teams is needed to ensure that evidence collection practices are performed safely.The ALARA principle (keeping doses ‘as low as reasonably achievable’) and time/distance/shielding concepts should be employed to keep doses low. Actions to remediate radioactive sources can be undertaken in order to lower radiation dose rate fields to acceptable working levels once the source has been forensically documented. However, suspected radioactive items including bomb fragments should not be touched or held directly.

5. CONTAMINATION CONTROL CONSIDERATIONS

While in all crime scenes investigators need to consider the potential for cross contamination of evidence, this factor becomes increasingly important in the radiologically contaminated crime scene. In order to avoid cross contamination of evidence, equipment and personnel, all surfaces in the crime scene should be assumed contaminated until proven otherwise. Actions such as wearing disposable durable boot covers and laying plastic sheets or plastic bags under equipment will aid in preventing cross contamination.

To confirm the presence of loose contamination and to estimate its extent, swipes can be taken from surfaces that are poor for finding fingerprints or DNA. These swipes should be measured in a low radiation area with an appropriate contamination monitor to verify the presence of radioactivity above ambient levels. It should be kept in mind that the act of swiping surfaces to check for radioactive contamination has the potential to destroy traditional forensic evidence, thus balancing the value of collecting evidence with the need to check certain surfaces for contamination needs to be considered.

Swipe or sample collection activities should be undertaken by a two person team, with one person performing sample collection activities, while the second person provides support by retrieving equipment, holding open and sealing evidence bags, and measuring collected samples for contamination. Both members of the sampling team should always wear two layers of gloves, with the person performing sample collection activities changing gloves often, as required, in order to prevent cross contamination. Regular contamination checks with a contamination monitor should be made of both sampling team members hands throughout the process. All items exiting the crime scene including personnel, equipment and exhibits should exit the controlled area through a contamination check point.

6. TRADITIONAL EVIDENCE COLLECTION CONSIDERATIONS

The collection and management of evidence is the first step towards tracing a route and origin of the interdicted or involved radioactive material. It is, therefore, important that evidence be collected and preserved in the same conditions as it is found at the incident scene. Improperly preserved evidence may affect its suitability for analysis as well as its authenticity. In addition, chain of custody must be established for all types of evidentiary samples collected. This includes chain of custody labels and associated documentation that accompany each individual item of evidence throughout all stages of transportation, analysis, and prosecution in accordance with national laws.

Prior to undertaking any evidence collection activities, consideration of what types of evidence can be dealt with by national laboratories should be made prior to collecting that evidence, particularly for traditional evidence contaminated with radiological material but also important for analysis of the radiological or nuclear material itself (i.e. radiological forensic evidence). This is particularly important given the wide variety of evidence ranging – plausibly – from grams of nuclear material to hundreds of kilograms of a contaminated vehicle. In addition, categorization of the radioactivity in the field at the scene of the crime will also be necessary given that many nuclear forensics laboratories will not accept true “unknowns” without some measure of the in-coming constituent radioactivity or radionuclides. In these regards, communication with both forensic and radiological laboratories is imperative.

With possible restrictions for analyzing contaminated evidence in mind, prolific documentation of the crime scene via photographic or videographic means is a key component to the evidence collection tasks, as this may be the main source of evidence in some cases or countries. It is also important to keep in mind any requirements for long-term evidence retention, which may be resource intensive.

Evidence collection from a radiologically contaminated crime scene should not be limited due to the concern for radiation effects on the evidence. In general, if a piece of evidence is thought to be important to the investigation and facilities exist for analyzing that evidence, then it should be collected. Current research has demonstrated that many types of traditional forensic evidence remains acceptable for analysis following exposure to even high radiation doses (on the order of 1000 Gy), and in many cases decontamination of the evidence can be performed without compromising its integrity.

Attempts to collect uncontaminated evidence from contaminated crime scenes should involve an assessment of the collected exhibits for the presence of radioactivity at the contamination checkpoint, the results of which should be documented for the receiving forensic laboratory. The possibility should be considered that swipes taken to check for removable contamination and identified as clean may also be useable for DNA analysis provided the swipe used are appropriate for DNA analysis.

For some forensic procedures, for example the collection of fingerprint evidence, care should be taken to prevent cross contamination of equipment. All equipment used in a contaminated crime scene should be regularly checked for contamination, as well as undergoing a thorough assessment when exiting the scene at the contamination checkpoint. For fingerprint collection using powder, the brush and powder container should be checked for radioactive contamination after dusting each potentially contaminated area. If contamination is detected, use of contaminated brushes and powder should be discontinued and disposed of as radioactive waste. As with all crime scene evidence, fingerprints identified in the crime scene should be photographed. In the case of a country not having a contaminated evidence analysis facility, consideration should be made for the potential of identified fingerprint lifts to pick up contamination. If photographs of the fingerprint are of good quality, the contaminated lift might be left behind.

7. RADIOLOGICAL EVIDENCE COLLECTION CONSIDERATIONS

Equally important to the investigative process is the collection of radiological evidence (i.e. the collection of radioactive materials themselves), which can be used to identify the type of radiation and (potentially) the origin of the radioactive material. When taking samples of radioactive material, samples with no other forensic value should be chosen. Almost any media (i.e. soil, water, clothing, etc) may be acceptable for laboratory analysis if necessary. Prior to collecting radiological samples, coordination with the receiving laboratory will allow a determination of what type and amount of material should be collected. Samples taken for radiological analysis often only need to be small, and radiation readings on the order of 10 to 100 times the background levels are typically sufficient for laboratory analysis. This, however, does not preclude the collection of hotter samples, particularly in the collection of intact sources or source fragments.

It should be noted that there is a distinction in the number and type of samples for radiological forensic analysis and those for public health assessment and use, particularly in a post-detonation scenario. For public health related analysis, samples of many different matrices and from many different locations will be necessary to assess the radiation hazard to the public. Such samples would be collected during the consequence management phase of a response, likely by radiation protection specialists. Radiological forensic evidence will be focused on identifying and determining the origin of the radiological material in question, as well as providing any additional investigative leads that may gleaned from the material. This point is made to highlight that forensic investigators only need to collect radiation samples thought to have forensic value, and need not necessarily sample all surfaces or materials contaminated with radioactive material. Coordination with the nuclear forensic laboratory will assist in determining the number and potential value of radiological forensic samples.

Radioactive solid samples can be scooped into clean plastic bags using a spatula or shovel. Liquid samples can be collected into clean plastic bottles using syringes or pipettes. An industrial wet vacuum may be needed for the collection of extremely large volumes of liquid. The vacuum would then require decontamination or disposal when finished. Collectors should minimize cross-contamination by using a different collection tool (shovel, spatula, pipette, etc) to collect each type of material or, at least, cleaning the tool between samplings.

In general, any container with a good seal should be adequate for holding radiological samples. Containers should be appropriately labeled with their contents and the appropriate reference designator. Samples should then be double bagged and the outside of the bag should be swiped and checked for contamination prior to removal from the crime scene. Collection apparatus, including spatulas and syringes, should be decontaminated or disposed of as radioactive waste. In addition to radiological samples, control or blank samples and background samples should be taken and appropriately labelled. Documentation should provide all measurement results, including background readings, count rates, the type of instrument used to take the measurements, and details and results from any swipe tests taken from the scene. Serial numbers of any radiation equipment used should also be recorded for later reference to calibration information. As with the collection of traditional evidence, appropriate chain of custody procedures and associated documentation should be followed throughout all stages of transportation, analysis, and prosecution.

8. TRANSPORTATION CONSIDERATIONS

Depending on local regulations and the procedures of the receiving nuclear forensic laboratory, it may be necessary to store the evidence after collection and before ultimate transportation to the nuclear forensic laboratory. Secure temporary storage facilities may need to be established for radioactive exhibits at the crime scene with appropriate permits to cover the hazardous material being stored.

In collaboration with the identified receiving laboratory, the regulatory authority, and with consideration of national dangerous goods transportation regulations, the requirements for packaging each category or type of evidence for transport from the crime scene should be identified. Determination should also be made as to whether such packaging is readily available or can be reasonably obtained. Information about each packaged quantity of evidence material should be thoroughly documented prior to transport. A copy of associated documentation should accompany each shipment from the scene to its destination. Determination of the appropriate means to transport the evidence from the crime scene to the designated analysis laboratory should be made, with volume and packaging type dictating the size and type of vehicle(s) required. The need for in-transit security should also be considered.

There may be cases where evidence needs to be transported trans-nationally. International agreements and regulations may apply and should be followed. In addition, assistance with the transportation of radioactive material from the incident site or holding site to the nuclear forensics laboratory can be requested from the IAEA.

9. CONCLUSIONS

The information in this document describes accepted best practice for evidence collection activities given a radiologically contaminated crime scene, with a focus on radiation-specific advice relevant to evidence collection activities. The document is intended for any stakeholder interested or involved in the response, evidence collection or evidence analysis following a radiological incident. Coordination and ongoing communication between evidence collectors, radiological experts, and all receiving laboratories is extremely important throughout the response process to ensure an effective response and investigation. Inter-agency cooperation, extensive liaison and ongoing interaction should exist and be maintained in advance to ensure States are prepared to respond to such an incident. In addition, for cases where international assistance has been requested or might be expected, having agreements in place in advance is paramount to a timely investigation.

10. CONTRIBUTORS

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