The Role of Nuclear Forensics Supporting Law Enforcement Investigations and Nuclear Security Vulnerability Assessments

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What is nuclear forensics?

Nuclear forensic science, referred to as nuclear forensics, is a subset of forensic science

Nuclear forensics is the examination of nuclear or other radioactive materials, or of evidence contaminated with radionuclides, in the context of legal proceedings under international or national law related to nuclear security

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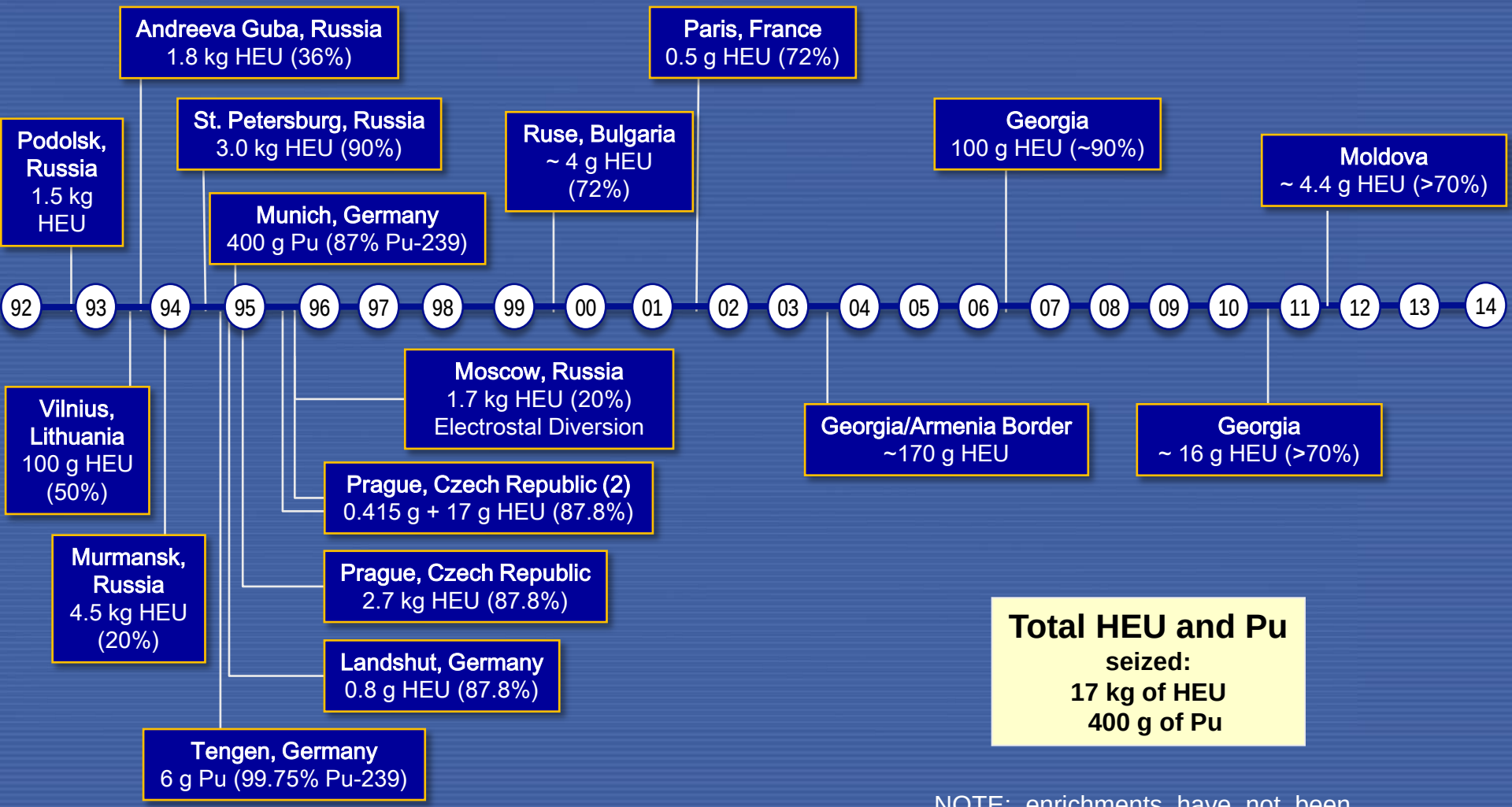
Nuclear forensics is not a contingency plan……



Total HEU and Pu
seized:
17 kg of HEU
400 g of Pu

NOTE: enrichments have not been independently verified for all seizures

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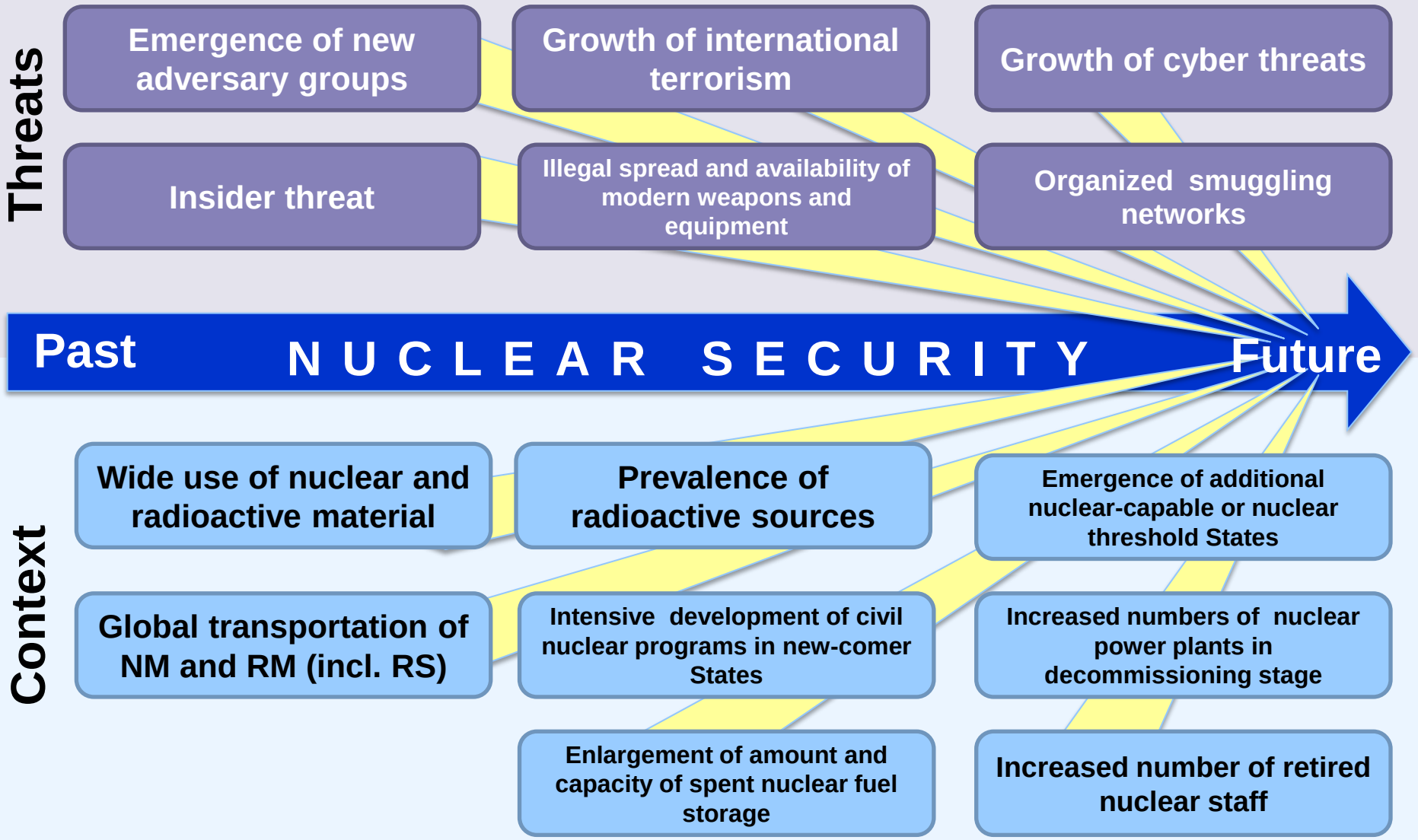
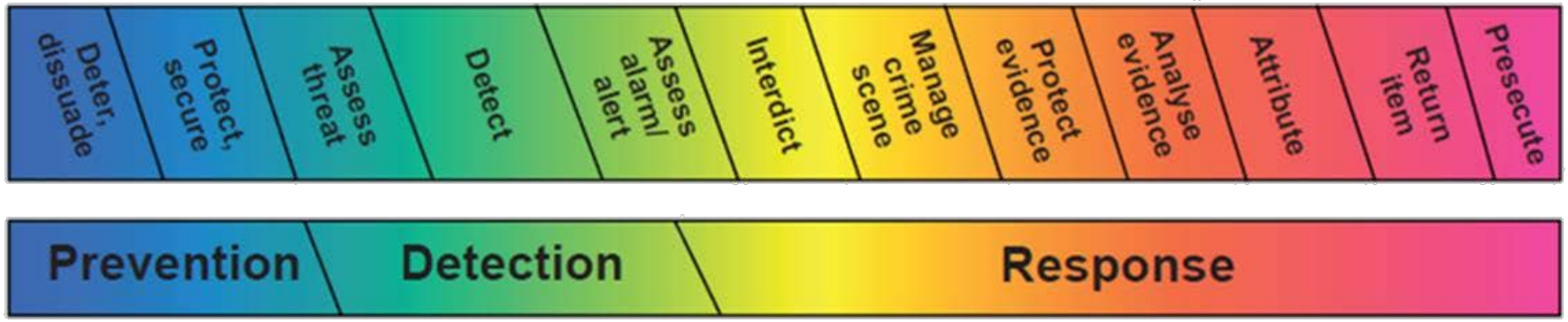
The evolving nuclear security threat ….



Nuclear forensics is one component of a nuclear security infrastructure



Elements of a comprehensive national nuclear security infrastructure

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Nuclear forensic capabilities support nuclear security response

Detection

Nuclear material (U, Pu) or other radioactive material (^{60}Co,^{137}Cs, ^{192}Ir,…)

Detection equipment, situational awareness

Categorization

Characterization

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An approach to the conduct of a nuclear forensics examination

Incident Response

Crime Scene Analysis

Forensic Examination Plan

Traditional Forensics

Nuclear Forensic Analytical Plan

Nuclear Forensic Analysis

Nuclear Forensic Interpretation

Nuclear Forensic Findings

Radiological Crime Scene Management

Nuclear Forensics

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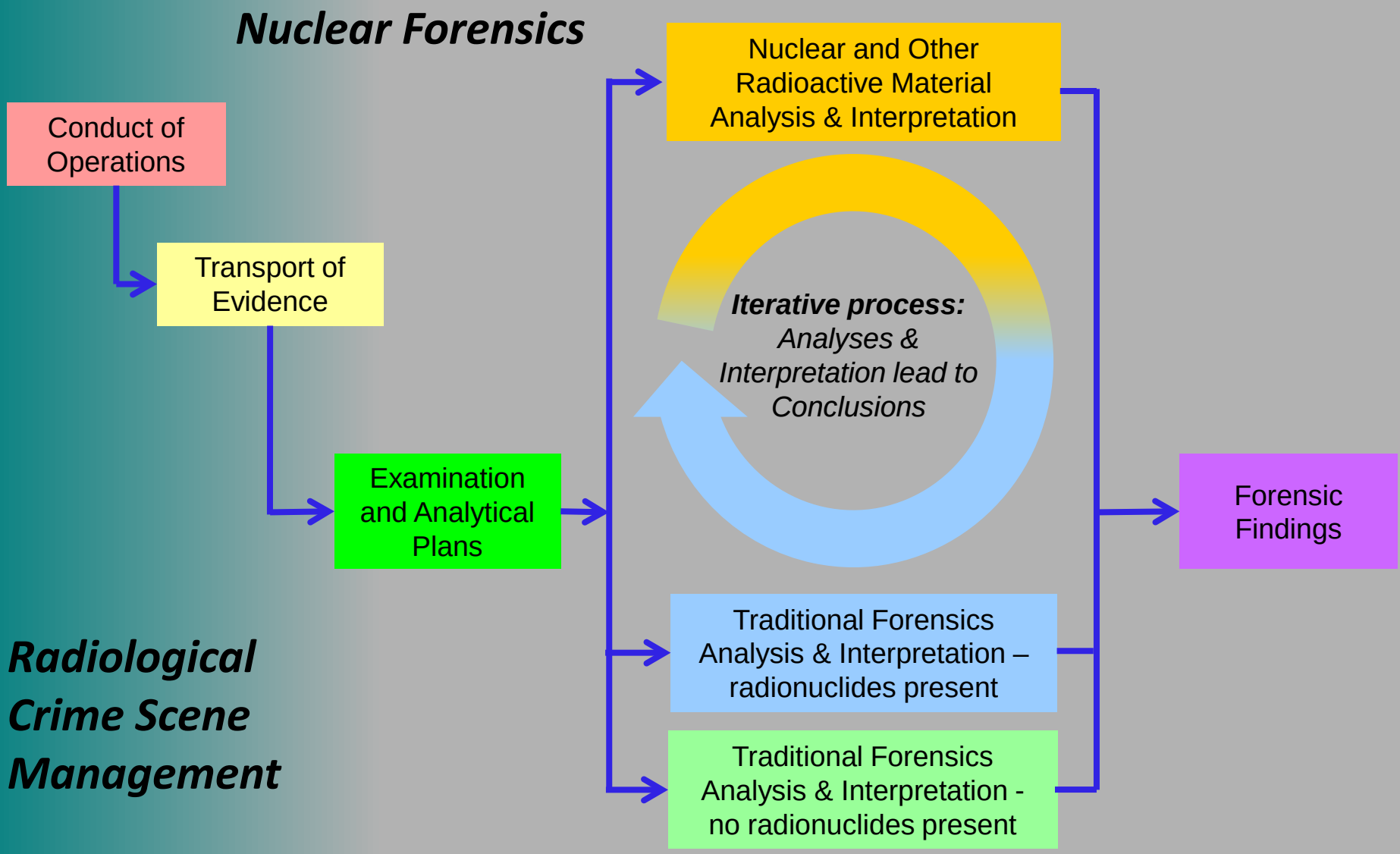
Model Action Plan



An array of forensic evidence can be examined…..

Traditional forensics

- Wax type
- Wax colorant
- Paper origin
- Lead metallurgy
- Lead isotopics
- Ampoule material

Nuclear material forensics

- Morphology
- Chemical form
- Impurity elements
- Residual radionuclides
- Age-dating
- U & Pu isotopics

Highly-enriched uranium (~3.96 grams uranium oxide)
Trace plutonium (2.8 parts per billion)

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IAEA perspective on nuclear forensics…..

- The IAEA does not conduct nuclear forensics examinations; we support state-of-practice of Member States
- Focus on the security of nuclear and other radioactive materials only
- Support criminalization for MORC
- Promote development of the nuclear capacity within the Member States (model action plan, training, research, national library or database)

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Differences between processing traditional and radiological evidence at a nuclear security event

Traditional

- **Time** - personnel typically have unlimited time to process the scene – ***No Rush!***
- **Distance** - personnel typically can get ***as close as they wish*** when collecting items or processing elements of the scene
- **Shielding** - personnel typically require ***minimal shielding*** from the items that they are collecting or otherwise examining

Radiological

- **Time** - personnel must manage time spent on scene to minimize dose of radiation received – ***Time Constrained!***
- **Distance** - personnel typically must be ***as far as possible*** from items contaminated or potentially contaminated with radioactive material
- **Shielding** - personnel must use ***physical measures to shield*** themselves and others from any radioactivity

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Using ALARA principle

Considerations to protect the public, the responders, the environment and the forensics evidence

- Establish scene control
- Perform common hazards risk assessment
- Reduce radiation hazards
- Maintain control over the nuclear and radiological material
- Preserve items of evidentiary value
- Implement forensics evidence collection plan
- Initiate chain of custody
- Collection, packaging, transit of evidence to the nuclear forensic laboratory

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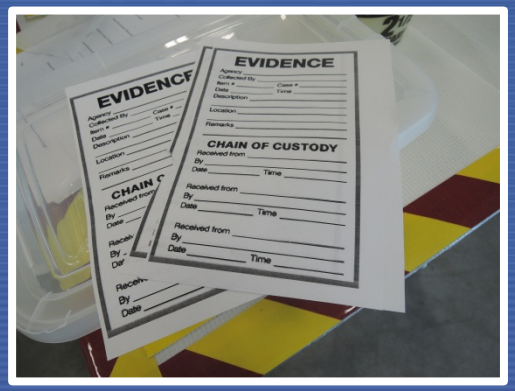
Confidence in findings

- Nuclear forensics analysis supports investigations that links suspects to MORC
- Laboratory analysis must be legally defensible
- Requires:
  - ✓ Written procedures and validated methods
  - ✓ Use of standards and certified reference materials
  - ✓ Trained personnel or demonstrated competencies



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To conclude…….

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