

Building National Nuclear Forensics Programs

Introduction

Nuclear forensics is a critical component in identifying and attributing radioactive and nuclear (R/N) materials out of regulatory control (e.g., illicit nuclear smuggling). Instilling a dedicated nuclear forensics capability at the national or regional level, or having dedicated communication pathways and information exchange mechanisms with capable international partners, is critical to exposing smuggling pathways, but the resources, expertise, equipment, and interagency networks required to execute such programs are difficult to implement and sustain. This paper leverages the knowledge and experience of countries establishing national nuclear forensics programs (NNFPs) to highlight the challenges, successes, and international connectivity required to bolster global nuclear security efforts.

National Nuclear Forensics Programs

National nuclear forensics programs are used to identify the source, history, and characteristics of smuggled nuclear materials, providing valuable information to law enforcement agencies and intelligence communities in the event of a nuclear smuggling incident. These programs are typically operated by interoperating government agencies with heavy interagency communication protocol and established exchange mechanisms connecting scientists, investigators, prosecutors, and nuclear regulators during the investigation, attribution, and prosecution stages of illicit nuclear material smuggling incidents. NNFPs are often strengthened by national legislation formally establishing interagency roles and responsibilities.

Infrastructure and Expertise

National-level infrastructure is critical for the success of NNFPs and depending on the investigation or prosecutorial needs of the country, can include a range of specialized technical capabilities and facilities such as gamma spectrometry, microscopy, separation chemistry, mass spectrometry, nuclear material transport and storage, and secured laboratories. The infrastructure can be pulled from existing capabilities at government agencies, national laboratories, universities, and industry to support identified nuclear forensics needs in a given country, from sample collection and preservation to analysis and interpretation. In addition, the infrastructure should ensure secure handling and storage of nuclear materials to minimize risks of theft, diversion, or accidental release. Robust quality assurance and control measures, including stringent chain of custody procedures, are also essential to ensure accuracy, reliability, and reproducibility of analytical results. Finally, the infrastructure should be supported by a well-trained and experienced workforce that can operate and maintain the equipment and interpret the analytical data, a challenge in and of itself.

Challenges with Establishing NNFPs

Building a national nuclear forensics program presents several challenges. First, it requires significant investment in understanding needs and existing capabilities. Should a country decide to build a full domestic capability, financial resources to establish the necessary infrastructure, equipment, and facilities beyond existing infrastructure is needed. Second, building and sustaining a skilled and

experienced workforce can be difficult, as nuclear forensics requires highly specialized training and expertise in a range of scientific disciplines. Third, access to nuclear materials and debris for training and validation purposes can be limited due to security and regulatory constraints. Fourth, the international nature of nuclear terrorism and proliferation means that building a national program in isolation is not enough, and international cooperation and collaboration are essential. Finally, the potential for political, legal, and ethical challenges, including issues related to national sovereignty and the handling of sensitive information, cannot be overlooked. These challenges highlight the need for a comprehensive and coordinated approach to building a national nuclear forensics program, involving not only technical experts but also policymakers, legal experts, and stakeholders from various sectors.

Conclusion

In conclusion, despite the challenges associated with building a national nuclear forensics program, the importance of nuclear security and nonproliferation to national security cannot be overstated. Effective nuclear forensics can play a vital role in preventing nuclear terrorism and proliferation, and it requires a sustained effort and commitment from the international community. By overcoming the technical, financial, and political obstacles, countries can establish a robust and resilient national nuclear forensics program that enhances their security and contributes to global nuclear security efforts. It is, therefore, imperative that governments continue to invest in this critical area of nuclear security and work together to build a safer and more secure world.