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Developing a Nuclear Detection Architecture Series: Volume IV

Nuclear Security Detection Architecture Within a State's Interior

(Working Title)

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1 Introduction

Nuclear terrorism and the illicit trafficking of nuclear and other radioactive materials (RN) and devices threaten global security. A nuclear detection architecture provides a framework for integrating capabilities and resources for the detection of nuclear and other radioactive material out of regulatory control. Previously, in both the "Model Guidelines Document for Nuclear Detection Architectures" and "Guidelines for Planning and Organization", a risk-informed, multi-layered, and defense-in-depth architecture design approach was highlighted. To this end, developing detection capabilities and resources within a State's interior is a necessary component of a balanced nuclear detection architecture.

While guidance for detection capabilities and resources at borders (e.g., official points of entry/exit) is covered by existing international publications (e.g., the IAEA nuclear security series), there is a gap in guidance for interior layer of the architecture. This document provides guidance for operational stakeholders with responsibility for supporting the interior layer of a State's nuclear detection architecture. It is intended that the guidance provided is actionable for the operational organizations without requiring additional authorities or resources from lawmakers, regulatory agencies, or other partners in the architecture.

Presented primarily through a series of case studies from the international community, this document focuses on providing guidance for improving the application of existing technology to better support the nuclear detection mission in a State's interior. Particular areas of emphasis include the following:

- Techniques for using radiation detectors more effectively
- Methods of managing information flow to improve deployment of detection resources and to manage the information generated by those resources
- Other non-technical options, such as operational changes, that are identified in the case studies

This document describes challenges that are specific to the interior, along with options for addressing those challenges. The next three chapters discuss challenges in each of these three contexts: strategic locations, major public events, and other interior areas and pathways.

Strategic locations are areas that deserve particular attention in the development of the nuclear detection architecture because they are significant either to adversaries or to architecture operators. Strategic locations may include domestic facilities containing nuclear or other radioactive material that might be stolen, pathways that might be favored by illicit traffickers, facilities or regions that could represent attractive targets for an attack, and geographical formations that offer unique opportunities for detecting the illicit transport, possession, or use of radioactive or other nuclear materials.

Major public events -- including major sporting, political, and cultural events -- warrant particular attention since the large number of participants and spectators, as well as the high degree of publicity, may make them attractive targets for adversaries intending to use a radiological or nuclear device.[1] These are discussed separately from other strategic locations, as major public events are often temporary, creating a unique set of challenges.

Other interior areas and pathways represent the remainder of the interior, in which many of the commercial and personal activities of the State occur. The complexity of this space creates unique challenges for nuclear

[1] The International Atomic Energy Agency also provides guidance for major public events in *IAEA Nuclear Security Series No. 18: Nuclear Security Systems and Measures for Major Public Events* (2012).

detection; however, it also creates many opportunities for elements of the nuclear detection architecture to encounter and detect illicit trafficking.

Within each of these contexts, the following broad categories of challenges are considered:

- **Threat environment**
  Operating in the interior may create different options for adversaries, changing the threat environment encountered by the State.
- **Geography and pathways**
  The large area, varied terrain, and range of pathways within the interior create additional challenges that are not present for the border layer of the architecture.
- **Technical challenges**
  While radiation detectors and other technologies may offer critical support to the nuclear detection mission, there can be significant challenges in deploying them effectively within the interior of the State.
- **Operational challenges**
  Interior detection activities often rely on organizations with a broad range of other responsibilities, and significant challenges can arise in identifying opportunities for them to support the nuclear detection mission without impacting other important missions. Further challenges exist in deploying resources strategically to cover the wide geographical area and broad array of legitimate activities within the interior.

Challenges outside of these categories also exist in the interior, but are covered in existing guidance.

Note: All case study topics listed in this draft are intended to serve as initial examples and are subject to change

2 Strategic Locations

2.1 Challenges related to the Threat Environment

	Challenges	Mitigation Options
Threat Environment	Nuclear and other radioactive materials may be present within the State which may pose a risk to the State if they leave regulatory control through theft or loss	Develop personnel awareness campaigns for relevant competent authorities about materials within the jurisdictional area and relevant processes for handling reported incidents
		Train source owners about risks, necessary security protocols, and appropriate points of contact for reporting irregularities
		Develop communication channels for integrating source accounting, controls, and physical security information to enable responsive deployment of detection assets as necessary
	Maintaining awareness of potential targets and risks may be difficult in a dynamic and constantly changing environment which impacts planning and deployment to meet evolving threats	Conduct threat and risk assessments on an ongoing basis
		Integrate intelligence as an information source for the architecture, particularly with respect to potential targets within jurisdiction
	Deploying architecture capabilities and resources to secure the many potential targets that may exist in the interior, including large cities and critical infrastructure	Identify targets within organizational jurisdiction and prioritize relevant activities based on threat and risk assessments (national and local)
		Consider strategic points of screening interest, including • High volume traffic flow locations • Natural chokepoints • Pathways to specific potential targets • Known trafficking routes • Sets of points that all traffic must pass through
		Develop awareness among, train, and equip personnel with established presence at potential targets
		Coordinate sharing of best practices across competent authorities with responsibilities for strategic locations
	Adversary may reside, move, and operate freely close to potential targets, which makes it easy for the adversary to operate undetected	Gather local information about known adversary presence and activity in potential target areas
		Build public awareness of indicators of illicit activity and appropriate reporting mechanisms

88 ## 2.2 Challenges related to Geography and Pathways

	Challenges	Mitigation Options
Geography and Pathways	Adversaries can capitalize on existing crime networks to exploit vulnerabilities for trafficking of nuclear or other radioactive materials	Integrate intelligence as an information source for the architecture, particularly with respect to knowledge of existing crime networks, their locations, capabilities, connections, and operations
		Conduct awareness and training campaigns with any established crime network task forces to ensure integration of the RN mission
	Adversary operations can blend in with the many locations and legitimate activities, including those involving nuclear and other radioactive materials	Integrate intelligence as an information source for the architecture, particularly with respect to knowledge of illicit activities within and in the vicinity of strategic locations
		Integrate the nuclear detection mission with other missions as part of the considerations for resolving suspicious circumstances for local competent authorities
		Develop indicators for legitimate and illegitimate activities
		Integrate local competent authorities' knowledge regarding local illicit (and legitimate) activity as an information source for the architecture
		Integrate information from the public and private organizations to identify suspicious indicators
	Strategic locations may have multiple points of ingress and egress allowing adversaries multiple pathways to and from the locations	Develop awareness of all ingress and egress pathways and identify upstream or downstream funneling points to monitor traffic more efficiently
		Develop advance plans and procedures for restricting numbers of ingress and egress pathways for search and surge, as appropriate

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2.3 Challenges related to Technology

	Challenges	Mitigation Options
Technology	Deploying and/or integrating detection equipment near strategic locations with dense, fixed infrastructure	Develop understanding of equipment range (both detection and communication) throughout the jurisdictional area
		Develop understanding of accessibility of mobile equipment through the jurisdictional area
		Identify and develop procedures for strategic points of screening interest, including • High volume traffic flow locations • Natural chokepoints • Pathways to specific potential targets • Known trafficking routes • Sets of points that all traffic must pass through Case Study: United States, *Improving the application of available detection technology at a choke or check point*
	Operating detection instruments in close proximity with other equipment or infrastructure may cause interference	Ensure appropriate technical expertise in developing technical requirements for equipment purchasing
		Test equipment in the operational environment prior to purchase
		Use other equipment to identify suspicious items for quarantine and isolate for adjudication with more specialized equipment
	Multiple stakeholder organizations may have their own capabilities and resources, which may complicate coordination and cooperation if the equipment is not interoperable	Cross train with any equipment from other organizations that may be deployed to personnel and ensure necessary functionality in the operational environment
		Conduct joint training or exercises with all relevant stakeholders with jurisdiction at the strategic location
	Accounting for changes in background radiation in a dynamic and varied environment (e.g., moving populations, different building materials)	Maintain knowledge of the location and type of source materials present within jurisdiction (NORM and medical/industrial sources)
		Use radiation monitoring equipment to periodically survey or monitor background radiation throughout jurisdiction to maintain awareness of normal levels
		Develop expertise (either within the organization or through relationships with other organizations) for identifying sources from spectra

	High prevalence of nuisance alarms due to the population and infrastructure density may result in both difficulty in identifying materials out of regulatory control and a lack of operator adoption of the detection mission	Conduct awareness and training activities with equipment operators regarding NORM and other legitimate sources
		Combine equipment readings with situational information to adjudicate alarms (e.g. credible paperwork)
		Deploy equipment capable identifying specific radiation sources for prompt adjudication of any alarms
		Develop expertise (either within the organization or through relationships with other organizations) for identifying sources from spectra

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2.4 Challenges related to Operations

	Challenges	Mitigation Options
Operations	Competing missions and priorities as well as lack of awareness, knowledge, and training among front-line personnel may prevent personnel from identifying the presence of nuclear or other radioactive materials out of regulatory control	Conduct awareness campaigns among front-line personnel to explain the threat
		Develop easy-to-use reference guides with suspicious indicators, safety guidelines, and contact information for additional expertise for use among front-line personnel
	Technical expertise on nuclear and other radioactive materials and devices may be remotely located or limited	Train existing specialized teams (Hazardous Materials, Special Incident, etc.) in the nuclear detection mission
		Develop specialized teams within an organization with appropriate training and awareness campaigns and relevant policies and procedures for their mobile deployment Case Study: Spain, *Use of interior law enforcement specialized teams*
		Develop reachback connections outside the organization for additional technical expertise and develop procedures for coordinating with these resources
	Opportunities for detection by instrument alarms may be limited due to a lack of RN detection equipment	Use other indicators (behavior, presence of explosives/chemicals, etc.) of suspicious activity to then be adjudicated with RN-specific equipment
		Funnel large traffic volumes through specific points or focus on existing high throughput locations to maximize traffic coverage with minimal equipment
		Integrate information from detectors used for preventive nuclear security activities to increase detector coverage, as appropriate
		Use mobile equipment that can be redeployed/reallocated as situation changes Case Study: United States, *Appropriate placement of Personal Radiation Detection equipment for tactical operations*
	Deployment and integration of new equipment may be	Conduct training with any new equipment and ensure that any new equipment has been operationally tested with existing equipment

	disruptive to existing operations	Deploy new equipment initially for use by specialized teams with appropriate RN training and evaluate suitability before larger equipment deployment
	Strategic and timely deployment of equipment for search and surge operations may be a challenge due to limited planning time for modifying operations	Develop search and surge operation procedures for areas within jurisdiction and exercise them. Ensure consideration of • Assets and personnel that may be borrowed from other organizations • Accessibility of areas within jurisdiction • Necessary specialized teams and equipment • Breadth of plausible scenarios
		Allocate equipment congruent with search and surge responsibilities and ensure timely access
		Develop early warning systems for materials out of regulatory control to initiate timely search Case Study: Spain, *National CBRNE Inventory Control and Notification System*
	Integration with other nuclear security activities (e.g., prevention, response, consequence management, nuclear forensics) may be a challenge due to the range of responsibilities but is important as nuclear detection does not occur in isolation	Assign roles and responsibilities for specific nuclear security activities within the organization and identify any transitions in authority that occur during transitions from detection activities to other nuclear security activities Case Study: Ukraine, *Coordination for an undercover operation to prevent theft of materials*
	Integrating operations across many stakeholders may be a communication and coordination challenge	Identify and establish ongoing communication with other competent authorities with relevant jurisdictions, responsibilities, and resources. Compile a list of available resources and contact information.
		Develop complementary operational procedures with relevant competent authorities, particularly for wide area search or surge events and exercise these procedures

3 Major Public Events[2]

3.1 Challenges related to the Threat Environment

	Challenges	Mitigation Options
Threat Environment	Dynamic planning environment for a major public event may complicate efforts to understand potential vulnerabilities and consequences	Work closely with event planners to develop threat and risk assessments and update them frequently throughout the planning process.
		Identify potential targets created by the event and analyze the new pathways that may be used by smugglers or attackers attempting to access the event.
		Consider whether the nature of the event or its high visibility introduces different threat actors relative to day-to-day operations.
	Event may have a mobile component (e.g., a political march)	Leverage mobile elements of the architecture, such as those designed for swarm and search operations.
		Have security personnel move with the event and use non-technical indicators to identify suspicious activities; adjudication can be performed using nearby stationary detectors, reachback services, or on-call resources.
		Develop threat and risk assessments across the full extent of the territory covered by the event.
	Event may occur spontaneously or with little warning (e.g., victory celebration for sporting championship)	Develop threat and risk assessments in advance for locations that are likely to draw large crowds of people.
		If likely event triggers can be identified, pre-position personnel in the vicinity with either portable radiation detectors or a solid understanding of non-technical indicators of concern.
	Major public event may trigger non-standard behaviors, alter normal commerce, or include uncommon activities, making it difficult to identify indicators of threatening activity	Focus on indicators that are likely to be robust across a variety of circumstances and/or develop indicators appropriate to the given event.
		Analyze unusual elements of the event to identify whether they create attractive targets or potential vulnerabilities.

[2] IAEA Nuclear Security Series No. 18 provides guidance related to Major Public Events. The purpose of this section is to supplement, not duplicate, the guidance provided in that document.

		Provide public education and establish a tip hotline, as event participants may have the best understanding of what constitutes unusual or suspicious behavior in this context.
	There may be too many events or event locations to provide full screening at all of them	Use results of up-to-date threat and risk assessments to determine which events or locations have the highest priority and to determine the best approaches to screening at each site

97 ## 3.2 Challenges related to Geography and Pathways

	Challenges	Mitigation Options
Geography and Pathways	Event venue may lack appropriate chokepoints for establishing screening operations or event planners may restrict placement of screening operations to minimize impact to event	Leverage available portable detectors and use non-technical indicators to minimize the impact of screening and allow personnel to move among event participants.
		Establish off-site locations for screening equipment, particularly for adjudication purposes.
		Build awareness of radiological and nuclear threats among event planners to improve acceptance of the screening mission.

98 ## 3.3 Challenges related to Technology

	Challenges	Mitigation Options
Technology	Certain types of screening equipment may not be appropriate for the event (e.g., screening method may be too invasive for event culture, screening equipment might be too large, etc.)	Develop non-technical indicators of suspicious activities and limit the use of technical equipment (possibly located off-site) for adjudication.
		Maximize the use of technologies that can be acceptably deployed at the event -- even if they permit only partial screening – as even an imperfect layer can play an important role in a defense-in-depth strategy.
	Technologies may need to be mobile, be deployed quickly, and/or operate in an adverse environment	Leverage elements of the architecture that have been designed for surge, swarm, and/or search operations.
		When acquiring new technologies, include ruggedness, portability, and the ability to perform in adverse environments as part of the decision space.
		Develop procedures for transporting and deploying existing equipment under a variety of conditions (e.g., protective transport containers, weatherproof screening tents, etc.).
	Event security personnel may not have any radiation detection	Reallocate existing assets from other missions and deploy at the event.

	equipment	Develop indicators of suspicious activity that do not require radiation detecting equipment, supported by reachback or on-call resources for adjudication.

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3.4 Challenges related to Operations

	Challenges	Mitigation Options
Operations	Reallocating resources to support security screening at the event may introduce gaps elsewhere in the architecture	Use results of threat and risk assessments to prioritize deployments of staff and screening assets.
		Provide means for existing personnel at event to support nuclear detection mission, backed by reachback and on-call resources as available.
		Provide training to event staff regarding potential indicators of radiological and nuclear threats and provide points of contact them to report suspicious observations.
		Focus on random or unpredictable screening techniques to maximize effectiveness of limited resources.
	Event planners and/or event security personnel may not consider threats from radiological and nuclear devices or may lack training to assess threats	Share information about potential radiological and nuclear threats (possibly including results of risk assessments) with event planners.
	Event represents a deviation from normal procedures, increasing opportunities for human error, equipment malfunction, and interference between missions and/or technologies	Provide personnel with opportunities to train on the technologies that will be used at the event and to practice modified procedures in an environment that reflects the event venue as closely as possible.
		Request permission from event planners to test equipment and train personnel at venue prior to event.
		Organize joint exercises with other operational organizations that will be present at the event to identify potential gaps and interferences.

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4 Other Internal Areas and Pathways

4.1 Challenges related to the Threat Environment

	Challenges	Mitigation Options
Threat Environment	RN materials and threats may originate from widely distributed locations within the borders, which allows for a large number of unfettered pathways from source origin to potential target	Incorporate awareness and training activities and/or develop reference guides related to the variety of RN materials located throughout the interior. Topics may include what they look like, how they may be identified, what their legitimate uses are, where they may be found, how they are properly marked and transported, and how they are safely handled if encountered
		Identify and monitor transit pathways and mechanisms through the jurisdiction that may be used as part of an illicit trafficking path, such as those used for trafficking of other illegal goods
		Integrate intelligence information about potential adversary actions to maintain awareness of sources that may be targeted
	Widely distributed potential targets may require widely distributed defenses	Integrate intelligence information about potential adversary actions and interests to maintain awareness of potential targets
		Develop and maintain communication mechanisms with other competent authorities that have jurisdiction over neighboring strategic locations to share information and strategically deploy resources
		Identify and monitor pathways that lead to strategic locations to create opportunities to encounter materials before they reach the intended targets
		Create perimeter screening or monitoring zones around multiple strategic locations
		Develop surge operation procedures and utilize mobile detection equipment to allow for targeted detection in response to information alerts
	Adversary may reside, move, and operate freely anywhere throughout the interior, which makes it easy for the adversary to operate undetected	Develop public awareness campaigns and reporting mechanisms for suspicious behavior
		Integrate intelligence to develop profiles of adversaries

104 ## 4.2 Challenges related to Geography and Pathways

	Challenges	Mitigation Options
Geography and Pathways	Vast land area to manage and control, which may disperse available resources	Train and equip established patrols for the RN detection mission Case Study: Russian Federation, *Guardian 2012*
		Prioritize resources based on threat and risk assessments
		Use random screening and monitoring operations to build in unpredictability for the adversary
		Develop specialized RN teams for adjudication of suspicious indicators
	Harsh and variable terrain and lack of available infrastructure support in some areas may pose difficulties for patrolling, communicating, or powering equipment	Overlay nuclear detection mission on established patrols, utilizing experience in navigating difficult terrain
		Overlay on existing or develop long-range communication equipment or manual information relay procedures, as necessary
		Deploy mobile, battery-powered equipment as available and appropriate
	Almost unlimited transit pathways including many distributed small roads, ports, and airports which could be used to move materials or devices and which may be difficult to monitor	Integrate intelligence to develop adversary profiles to understand capabilities and attractive pathways
		Identify natural chokepoints for use as checkpoints
		Use random screening and monitoring operations to build in unpredictability for the adversary
		Identify zones within the area of responsibility and monitor movement between zones
		Provide training or reference materials to port and airport operators to help them to identify suspicious indicators and contact the appropriate competent authority

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4.3 Challenges related to Technology

	Challenges	Mitigation Options
Technology	Equipment interference with equipment for other missions may prevent the effective use of RN detection instruments	Ensure appropriate technical expertise is involved in the drafting of equipment specifications
		Test equipment in the operational environment alongside other mission equipment to assess compatibility prior to purchase
		Develop RN-specific teams for deployment of RN detectors for use in adjudicating suspicious incidents
		Use other indicators or equipment to identify and isolate suspicious items prior to use of specialized RN equipment
	Separating out background radiation and nuisance alarms to locate and identify illicit materials may pose a challenge in the wide variety of environments encountered throughout the interior	Perform periodic surveys of background radiation, possibly collected during routine trainings or exercises
		Develop trainings and reference materials for front-line operators on types of NORM
	Limited equipment communication range may sever contact between data gathering equipment in remote areas and technical/operational experts	Develop reference guides for use by front-line operators in adjudicating suspicious encounters
		Routine maintenance schedules for outlying equipment to maintain long range communications
		Install communication relay equipment or develop other information relay procedures to reach outlying areas
	Access to and deployment of necessary equipment and expertise to conduct effective alarm adjudication may pose a challenge across the vast interior area	Develop reachback resources for highly technical assistance where necessary and establish secure communication mechanisms to facilitate use of these resources
		Develop mobile, specialized RN adjudication teams responsible for operating equipment and developing or coordinating with necessary technical expertise
	Software incompatibility across the many pieces of equipment owned by individual or separate competent authorities throughout the interior may inhibit information and equipment sharing	Develop consistent equipment and software standards and requirements for use throughout the organization and communicate with other competent authorities to develop shared standards as appropriate

		Include hardware upgrade and software update resources in a sustainability plan to enable consistent and timely system updating
		Cross train with equipment owned by multiple competent authorities to ensure preparedness for cooperative search or surge efforts
		Build a shared information database that serves as a software interface and information repository for the breadth of equipment in operation

4.4 Challenges related to Operations

	Challenges	Mitigation Options
Operations	Competing missions and priorities as well as lack of awareness, knowledge, and training among front-line personnel may prevent personnel from identifying the presence of nuclear or other radioactive materials out of regulatory control	Conduct awareness campaigns for front-line personnel about the RN threat including how interior areas and pathways may be used in the transport of illicit materials, the potential consequences of adversary use of RN materials, and how the RN mission can be incorporated into ongoing activities. Integrate these campaigns with established awareness and training programs, as appropriate.
		Develop and distribute reference materials for identifying the presence of RN materials
	Lack of technical expertise and equipment on the front-line in the interior may preclude effective RN adjudication of suspicious incidents	Develop communication channels to reachback technical expertise
		Develop specialized RN teams with technical expertise and equipment to deploy to adjudicate suspicious incidents. As appropriate, develop specialized teams' awareness of the area geography and threat context
		Coordinate with competent authorities located at the borders to share equipment and technical expertise, as necessary and available
		Case Study: Netherlands, *Use of border protection assets for interior detection*
	Strategic deployment of equipment for search and surge operations to follow up on possible incidents of illicit trafficking may be a challenge with constrained resources	Integrate intelligence information about the activities of adversaries and knowledge of pathways exploited for other illicit trafficking activities to prioritize the deployment of resources
		Use equipment and techniques from other mission areas to identify and localize suspicious people and materials for further adjudication with RN detection equipment

5 Conclusions

- Review of the major challenges/categories of challenges faced in developing the interior layer of a nuclear detection architecture
- Review of the cross cutting options for mitigating challenges faced in the interior