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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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Document Outline

37 # Glossary

Term	Definition
Adjudication	The process of identifying, with reasonable certainty, the type or nature of material or device that set off an alarm and assessing the potential threat that the material or device might pose with corresponding implications for the need to take further action
Awareness	A foundational state of knowledge about nuclear and other radioactive threats
CBRN(E)	Chemical, Biological, Radioactive, Nuclear, (Explosives)
NORM	Naturally Occurring Radioactive Materials
Reachback	Resources that provide specialized technical analysis of radiation spectra for the resolution of radiation detection alarms
RN	[Radioactive and Nuclear] refers to: nuclear and other radioactive materials
Search	The systematic application of radiation detectors and protocols to identify the presence of a source in a designated geographical location or region
Surge	To augment or introduce additional nuclear and radiological detection or search assets and capabilities into a geographic area or pathway for a limited time to address a potential threat or heightened vulnerability, increase deterrence, or respond to a credible threat

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1 Introduction and Document Scope

Nuclear terrorism and the illicit trafficking of nuclear and other radioactive materials (RN) and devices threaten global security. A national level nuclear detection architecture provides a State with the 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 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 the interior layer of the architecture. This document is intended to provide 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 highlighting anecdotal challenges, this document focuses on providing guidance for improving the application of existing technology to better support the nuclear detection mission within a State's interior. Particular areas of emphasis include the following:

- Techniques for using radiation detectors more effectively
- Methods of managing technical information flow to facilitate expeditious alarm adjudication as appropriate and/or expedite decision making by operators on scene (e.g. threat/no threat).
- Capitalizing on existing capabilities; (i.e. specialized CBRN teams)
- 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 within a nuclear detection architecture which are significant either to adversaries or to architecture stakeholders. Strategic locations may include facilities containing nuclear or other radioactive material that might be stolen; pathways that might be favored by illicit traffickers; critical infrastructure, key resources, cities, or regions that could represent attractive targets for an attack; and chokepoints that offer unique opportunities for detecting the illicit transport, possession, or use of nuclear or other radioactive materials.

Major public events -- including major sporting, political, and cultural events -- include a large number of participants and spectators and a high degree of publicity, and may therefore be 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 as well as opportunities for creating new sustainable capabilities.

[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). This document is not intended to duplicate the guidance outlined in IAEA NSS #18, but rather focuses on how a State can sustain nuclear detection capability for a Major Public Event between event cycles.

Other interior areas and pathways represent the remainder of the interior, in which many of the commercial, public, and private activities of the State occur. The complexity of this space creates unique challenges for the detection of nuclear and other radioactive materials out of regulatory control; 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 limit or 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 in 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 the strategic deployment of resources 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 international guidance.[2]

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

[2] Guidance related to interfacing with the diverse array of architecture stakeholders, resource limitations, legal constraints, and developing an integrated national architecture is provided in the first three volumes of the GICNT Developing a Nuclear Detection Architecture Series: *The Model Guidelines Document for Nuclear Detection Architectures*, *Guidelines for Awareness, Training, and Exercises*, and *Guidelines for Planning and Organization*.

2 Strategic Locations (e.g. major cities, critical infrastructure, key resources)

2.1 Challenges related to the Threat Environment

	Challenges	Mitigation Options
Threat Environment	(21-1) Nuclear and other radioactive materials may be present within the State which may pose a risk to the State or other States if they leave regulatory control through theft or loss	(21-1A) Develop personnel awareness campaigns for relevant competent authorities about materials within the geographic area and relevant processes for handling reported incidents
		(21-1B) Form partnerships with owners, transporters, and users of nuclear or other radioactive material to share information and enhance security. Provide training on risks, necessary security protocols, and appropriate points of contact for reporting irregularities
		(21-1C) Develop communication channels for integrating source accounting, controls, and physical security information to enable responsive deployment of detection assets as necessary. Communication channels may include interoperable radios for real time communications as well as shared databases, data formats, and common language or terminology.
		(21-1D) Develop knowledge of established secure container programs, including proper markings and paperwork, as appropriate
	(21-2) Maintaining awareness of potential targets and risks in a dynamic and constantly changing environment to meet evolving threats	(21-2A) Conduct threat and risk assessments and update appropriately
		(21-2B) Integrate intelligence as an information source for the architecture, particularly with respect to potential targets and adversaries
	(21-3) Deploying architecture capabilities and resources to secure the many potential targets that may exist in the interior (including large cities, key resources, and critical infrastructure) may be difficult	(21-3A) Identify targets and perform gap and cost-benefit analyses to prioritize relevant activities based on threat and risk assessments (national and local)
		(21-3B) 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
		(21-3C) Develop RN threat awareness among, train, and, where appropriate, equip law enforcement personnel located at potential targets
		(21-3D) Coordinate sharing of best practices across competent authorities with responsibilities for strategic locations

	(21-4) Adversary may reside, move, and operate close to potential targets, which may make it easy for the adversary to operate undetected	(21-4A) Gather local information about known adversary interest in potential targets as well as adversary presence, capability, and activity at or near potential target areas
		(21-4B) Conduct outreach to advise and build public awareness of potential indicators of illicit activity and appropriate reporting mechanisms
		(21-4C) Build or expand intelligence gathering efforts including review of open source information

99 ## 2.2 Challenges related to Geography and Pathways

	Challenges	Mitigation Options
Geography and Pathways	(22-1) Adversaries can capitalize on existing crime networks or non-networked criminal experts to exploit vulnerabilities for trafficking of nuclear or other radioactive materials	(22-1A) Integrate intelligence as an information source for the architecture, particularly with respect to knowledge of existing crime networks, their locations, capabilities, connections, and operations
		(22-1B) Conduct awareness and training campaigns with any established crime network task forces to ensure integration of the RN mission
	(22-2) Adversary operations can hide amongst the many locations and legitimate activities, including those involving nuclear and other radioactive materials	(22-2A) 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
		(22-2B) Integrate the nuclear detection mission with other missions as part of the considerations for resolving suspicious circumstances for local competent authorities
		(22-2C) Develop indicators for illegitimate activities and awareness of local legitimate commerce
		(22-2D) Integrate local competent authorities' knowledge regarding local illicit activity as an information source for the architecture
		(22-2E) Integrate information from the public and private organizations to identify suspicious indicators
	(22-3) Strategic locations may have multiple points of ingress and egress allowing adversaries multiple pathways to and from the locations	(22-3A) Develop awareness of all ingress and egress pathways and identify upstream or downstream funneling points to monitor traffic more efficiently
		(22-3B) Develop plans and procedures for restricting numbers of ingress and egress pathways to facilitate surging additional assets in a specific location to search for a particular source based on an information alert (surge and search), as appropriate
		(22-3C) Use random screening and monitoring operations to build in unpredictability for the adversary

		(22-3D) Consider how climate or terrain may limit or facilitate particular modes of travel by an adversary to or from the strategic location
	(22-4) Weapon detonation does not have to occur at the strategic location to cause significant negative impacts	(22-4A) Conduct detection activities surrounding strategic locations to prevent illicit trafficking near strategic location
		(22-4B) Increase awareness among law enforcement personnel of this possibility and the potential consequences to encourage mission adoption
		(22-4C) Integrate intelligence information for the areas surrounding strategic locations

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2.3 Challenges related to Technology

	Challenges	Mitigation Options
Technology	(23-1) Deploying and/or integrating detection equipment near strategic locations with dense, fixed infrastructure may significantly constrain the detection system options	(23-1A) Develop understanding of equipment range (both detection and communication) in all potential field operational conditions
		(23-1B) Develop an understanding of any physical constraints on deployment of detection equipment throughout the targeted area
		(23-1C) 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 Conduct feasibility studies on the use of any traffic control subsystems used for detection purposes. Case Study: United States, *Improving the application of available detection technology at a choke or check point*
	(23-2) Operating detection instruments in proximity with other equipment or infrastructure may cause interference	(23-2A) Ensure appropriate technical expertise in developing technical standard requirements for equipment purchasing Case Study: Russian Federation, *Methodology for ensuring electromagnetic compatibility of systems at the fixed control points and for preventing the stray electromagnetic radiation from affecting other infrastructure means*
		(23-2B) Test equipment in typical operational environment(s) prior to purchase and perform periodic calibration and function checks post-installation
		(23-2C) Use other equipment or indicators to identify suspicious items and isolate for secondary examination with more specialized RN equipment for purposes of adjudication Case Study: Russian Federation, *Use of x-ray, terahertz and other equipment for detection of explosives and other dangerous substances*
	(23-3) Coordination and cooperation among multiple stakeholders may be difficult if the equipment is not interoperable	(23-3A) Cross train with any equipment from other organizations that may be deployed to personnel and ensure necessary functionality in the operational environment
		(23-3B) Conduct joint training or exercises with all relevant stakeholders

	(23-4) The dynamic and varied environment (e.g., moving populations, varied building materials) may inhibit the ability to record accurate detector readings	(23-4A) Use radiation monitoring equipment to periodically survey or monitor background radiation to maintain awareness of typical operating conditions
		(23-4B) Develop and implement protocols and procedures to provide prompt access to technical reachback for source identification Case Study: Finland
		(23-4C) Consult with technical experts or equipment vendors to ensure effective operation of equipment (e.g., calibrating instruments periodically, adjusting detection threshold, using background subtraction)
		(23-4D) If the screening site permits, use radiation shielding to minimize interference from background radiation and nearby sources
	(23-5) High prevalence of nuisance alarms due to the population and infrastructure density may result in both difficulty in finding materials out of regulatory control and a lack of operator adoption of the detection mission	(23-5A) Conduct awareness and training activities with equipment operators regarding NORM and other legitimate sources
		(23-5B) Maintain knowledge of the location and type of source materials present within the relevant area (naturally-occurring radioactive materials [NORM] and medical/industrial sources)
		(23-5C) Combine equipment readings with situational information (e.g. properly documented paperwork) to adjudicate alarms
		(23-5D) Deploy equipment capable of identifying specific radiation sources for prompt adjudication of primary alarms
		(23-5E) Develop and implement protocols and procedures to provide prompt access to technical reachback for source identification
		(23-5F) Positively reinforce the detection and adjudication of NORM and other legitimate sources by law enforcement personnel as a successful outcome and a form of ongoing field-based training

		(23-5G) Use all information available (e.g., type of radiation: gamma, neutron or both, the energy spectrum, and the time history of sensor readings) to make an informed determination. This may require additional detection capabilities, the development of new data analysis techniques (e.g., consideration of the spatial profile of the radiation), and access to technically trained personnel or reachback facilities Case Study: Russian Federation, Improvements in the use of technology for detection and analysis of an object's radiation field structure
	(23-6) Adjudication of encounters may require technical support from remotely located personnel or equipment	(23-6A) Train operational personnel in techniques for collecting accurate readings to provide the necessary information for adjudication and reachback, as appropriate
		(23-6B) Develop secure communication of recorded data and contextual information between field operators and reachback centers

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2.4 Challenges related to Operations

	Challenges	Mitigation Options
Operations	(24-1) Competing missions and priorities as well as lack of awareness, knowledge, and training among law enforcement personnel may prevent personnel from identifying the presence of nuclear or other radioactive materials out of regulatory control	(24-1A) Conduct awareness campaigns among law enforcement personnel to explain the threat
		(24-1B) Improve communication among law enforcement personnel from different organizations to address differences in missions and priorities
		(24-1C) Develop easy-to-use reference guides with suspicious indicators, safety guidelines, and contact information for additional expertise for use among law enforcement personnel
		(24-1D) Conduct red teaming operations to motivate personnel and continually assess and improve operations
	(24-2) Technical expertise on nuclear and other radioactive materials and devices may be remotely located, limited, or reside within other organizations	(24-2A) Train existing specialized teams (Hazardous Materials, Special Incident, etc.) in nuclear detection activities such as the use of RN detection equipment for search
		(24-2B) Develop specialized teams within an organization with appropriate RN training and awareness campaigns and relevant policies and procedures for their mobile deployment Case Study: Spain, *Use of interior law enforcement specialized teams*
		(24-2C) Develop reachback connections outside the organization for additional technical expertise and develop procedures for coordinating with these resources
	(24-3) Opportunities for detection by instrument alarms may be limited due to a lack of RN detection equipment	(24-3A) Use other indicators (behavior, inconsistent paperwork, explosive/chemical detection, etc.) of suspicious activity to narrow the search for subsequent adjudication with RN-specific equipment
		(24-3B) Funnel large traffic volumes through specific points or focus on existing high throughput locations to maximize traffic coverage with minimal equipment
		(24-3C) Integrate information from detectors used for preventive nuclear security activities such as those located near nuclear energy facilities, as appropriate
		(24-3D) Use mobile equipment that can be redeployed or reallocated as situation or threat environment changes Case Study: United States, *Appropriate placement of Personal Radiation Detection equipment for tactical operations*

	(24-4) Deployment and integration of new equipment may be disruptive to existing operations	(24-4A) Conduct training with any new equipment and ensure that any new equipment has been operationally tested with existing equipment prior to full deployment
		(24-4B) Deploy new equipment initially for use by specialized teams with appropriate RN training and evaluate suitability before larger equipment deployment
	(24-5) Strategic and timely deployment of equipment and personnel for surge and search operations may be a challenge due to limited planning time for modifying operations, difficulty in identifying useful chokepoints, and need for collaboration across organizations (or States, as appropriate)	(24-5A) Develop surge and search operational procedures in preparation for periods of heightened threat and exercise them. Ensure consideration of • Assets and personnel that may be borrowed from other organizations • Area accessibility • Necessary specialized teams and equipment • Breadth of plausible scenarios
		(24-5B) Allocate equipment required for surge and search responsibilities and ensure timely access
		(24-5C) Develop early warning systems for materials out of regulatory control to initiate timely search Case Study: Spain, *National CBRNE Inventory Control and Notification System*
	(24-6) Integration with other nuclear security activities (i.e., prevention and response) as well as consequence management and nuclear forensics may be a challenge due to the range of responsibilities but is important as nuclear detection does not occur in isolation	(24-6A) 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 activities Case Study: Ukraine, *Coordination for an undercover operation to prevent theft of materials*
	(24-7) Integrating operations across many stakeholders may be a communication and coordination challenge	(24-7A) Identify and establish ongoing communication with other competent authorities with relevant responsibilities, and resources. Compile a list of available resources and contact information
		(24-7B) Develop complementary operational procedures with relevant competent authorities, particularly for surge or search events and exercise these procedures
	(24-8) Possible need for covert operations during surge and search to avoid alerting adversaries or creating panic among the public	(24-8A) Use personnel specially trained in covert or undercover operations
		(24-8B) Use inconspicuous detection equipment to search for materials and adjudicate encounters (e.g., detectors in unmarked vehicles, small portable detectors, equipment previously deployed in the field)

		(24-8C) Establish protected communication channels and information protection protocols
		(24-8D) Coordinate all public communication during an event to ensure a consistent message and accurate information are released while protecting sensitive information Case Study: Ukraine, *The importance of transparency during an event or at a public venue*

105 # 3 Major Public Events[3]

106 ## 3.1 Challenges related to the Threat Environment

	Challenges	Mitigation Options
Threat Environment	(31-1) Dynamic planning environment for a major public event may complicate efforts to understand potential vulnerabilities and consequences	(31-1A) Work closely with event planners to develop threat and risk assessments and update them frequently throughout the planning process
		(31-1B) Utilize intelligence to inform risk assessment in more dynamic planning environments
		(31-1C) 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
		(31-1D) Consider whether the nature of the event or its high visibility introduces different threat actors relative to day-to-day operations
		(31-1E) Develop understanding of the types of assets and resources available to combat a range of potential vulnerabilities
	(31-2) Event may have a mobile component (e.g., a political march)	(31-2A) Use mobile architecture elements, such as those designed for surge and search operations
		(31-2B) 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
		(31-2C) Develop threat and risk assessments across the full extent of the territory covered by the event
	(31-3) Event may occur spontaneously or with little warning (e.g., victory celebration for sporting championship)	(31-3A) Develop threat and risk assessments in advance for locations that are likely to draw large crowds of people
		(31-3B) 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

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[3] 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.

	(31-4) Major public event may trigger non-standard behaviors, alter normal commerce, or include uncommon activities, making it difficult to identify indicators of threatening activity	(31-4A) Focus on indicators that are likely to be robust across a variety of circumstances and/or develop indicators appropriate to the given event
		(31-4B) Analyze unusual elements of the event to identify whether they create attractive targets or potential vulnerabilities
		(31-4C) 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
	(31-5) There may be too many events or event locations to provide full screening at all of them	(31-5A) 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
		(31-5B) Use plans from similar major public events to estimate resource needs and to develop a robust plan for the specific event Case Study: Russian Federation, *Estimating the costs and forces for nuclear detection during the Universada (University Games) in Kazan and Olympics in Sochi*

3.2 Challenges related to Geography and Pathways

	Challenges	Mitigation Options
Geography and Pathways	(32-1) Event venue may lack appropriate chokepoints for establishing screening operations or event planners may restrict placement of screening operations to minimize impact to event	(32-1A) Use available mobile detectors and non-technical indicators to minimize the impact of screening and allow personnel to move among event participants
		(32-1B) Establish off-site locations for screening equipment, particularly for adjudication purposes
		(32-1C) Build awareness of radiological and nuclear threats among event planners to improve acceptance of the screening mission
		(32-1D) Use random screening and monitoring operations to build in unpredictability for the adversary
		(32-1E) Identify possible routes to the event of illicit trafficking of nuclear and other radioactive materials and equip with mobile or fixed detection equipment

110 ## 3.3 Challenges related to Technology

	Challenges	Mitigation Options
Technology	(33-1) 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.)	(33-1A) Develop non-technical indicators of suspicious activities and limit the use of technical equipment (possibly located off-site) for adjudication
		(33-1B) 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
	(33-2) Technologies may need to be mobile, be deployed quickly, and/or operate in an adverse environment	(33-2A) Use elements of the architecture that have been designed for surge and search operations
		(33-2B) When acquiring new technologies, include ruggedness, portability, and the ability to perform in adverse environments as part of the decision space
		(33-2C) Develop procedures for transporting and deploying existing equipment under a variety of conditions (e.g., protective transport containers, weatherproof screening tents, etc.)
	(33-3) Event security personnel may not have any radiation detection equipment	(33-3A) Borrow existing assets from other missions or organizations and deploy at the event Case Study: Ukraine, *Leveraging border equipment for a major public event, Eurocup 2012*
		(33-3B) 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	(34-1) Reallocating resources to support security screening at the event may introduce gaps elsewhere in the architecture	(34-1A) Use results of threat and risk assessments to prioritize deployments of staff and screening assets
		(34-1B) Provide means for existing personnel at event to support nuclear detection mission, backed by reachback and on-call resources as available
		(34-1C) Provide training to event staff regarding potential indicators of radiological and nuclear threats and provide points of contact for them to report suspicious observations
		(34-1D) Focus on random or unpredictable screening techniques to maximize effectiveness of limited resources
	(34-2) Event planners and/or event security personnel may not consider threats from radiological and nuclear devices or may lack training to assess threats	(34-2A) Share information about potential radiological and nuclear threats (possibly including results of risk assessments) with event planners
	(34-3) Event represents a deviation from normal procedures, increasing opportunities for human error, equipment malfunction, and interference between missions and/or technologies	(34-3A) 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
		(34-3B) Request permission from event planners to test equipment and train personnel at venue prior to event
		(34-3C) Organize joint exercises with other operational organizations that will be present at the event to identify potential gaps and interferences
	(34-4) Sustainment of capability between events; i.e. “Major” Public Event may happen infrequently but important to sustain capability between major events to apply practices to smaller-scale national or sub-national events	(34-4A) Ensure regular exercise and evaluation program to maintain stakeholder experience between events
		(34-4B) Integrate equipment acquired for use in Major Public Events in routine operations to augment capabilities and ensure continuous equipment functionality and operator training

4 Other Internal Areas and Pathways

4.1 Challenges related to the Threat Environment

	Challenges	Mitigation Options
Threat Environment	(41-1) RN materials and threats may originate from widely distributed locations within the borders, which allows for a large number of unfettered pathways from potential domestic source origin to potential target	(41-1A) 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. Include information about identifying non-indigenous materials to maintain general awareness of the spectrum of threats Case Study: Russian Federation, *Use of specialized law enforcement guidelines/manuals on detecting the smuggling of nuclear and other radioactive materials or explosive devices containing such materials*
		(41-1B) Identify and monitor transit pathways and mechanisms that may be used as part of an illicit trafficking path, such as those used for trafficking of other illegal goods
		(41-1C) Integrate intelligence information about potential adversary actions to maintain awareness of sources that may be targeted
	(41-2) Widely distributed potential targets may require widely distributed defenses	(41-2A) Integrate intelligence information about potential adversary actions and interests to maintain awareness of potential targets
		(41-2B) Develop and maintain communication mechanisms with other competent authorities located at neighboring strategic locations to share information and strategically deploy resources
		(41-2C) Identify and monitor pathways that lead to strategic locations to create opportunities to encounter materials before they reach the intended targets
		(41-2D) Create perimeter screening or monitoring zones around multiple strategic locations
		(41-2E) Develop surge operation procedures and utilize mobile detection equipment to allow for targeted detection in response to information alerts

	(41-3) Adversary may reside, move, and operate freely anywhere throughout the interior, which makes it easy for the adversary to operate undetected	(41-3A) Develop reporting mechanisms for suspicious behavior and public awareness campaigns to publicize these mechanisms. Tailor these campaigns to specific populations through coordination with locally trusted agencies
		(41-3B) Integrate intelligence to develop profiles of adversaries

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4.2 Challenges related to Geography and Pathways

	Challenges	Mitigation Options
Geography and Pathways	(42-1) Vast land area to manage and control, which may disperse available resources	(42-1A) Train and equip established patrols for the RN detection mission Case Study: Russian Federation, *Guardian 2012*
		(42-1B) Prioritize detection resources based on threat and risk assessments
		(42-1C) Use random screening and monitoring operations to build in unpredictability for the adversary
		(42-1D) Develop specialized RN teams for adjudication of suspicious indicators
		(42-1E) Develop reporting mechanisms for suspicious behavior and public awareness campaigns to publicize these mechanisms. Tailor these campaigns to specific populations through coordination with locally trusted agencies
	(42-2) Harsh and variable terrain and lack of available infrastructure support in some areas may pose difficulties for patrolling, communicating, or powering equipment	(42-2A) Overlay nuclear detection mission on established patrols, utilizing experience in navigating difficult terrain
		(42-2B) Overlay on existing or develop long-range communication equipment or manual information relay procedures, as necessary
		(42-2C) Deploy mobile, battery-powered equipment as available and appropriate
		(42-2D) Develop and deploy alternative sensing systems to identify suspicious movements (e.g. unattended ground sensors, airborne or aerostat sensors)

	(42-3) 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	(42-3A) Integrate intelligence to develop adversary profiles to understand capabilities and attractive pathways
		(42-3B) Identify natural chokepoints for use as checkpoints
		(42-3C) Use random screening and monitoring operations to build in unpredictability for the adversary
		(42-3D) Identify zones within the area of responsibility and monitor movement between zones
		(42-3E) 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	(43-1) Equipment interference with equipment for other missions may prevent the effective use of RN detection instruments	(43-1A) Ensure appropriate technical expertise is involved in the drafting of equipment specifications
		(43-1B) Test equipment in the operational environment alongside other mission equipment to assess compatibility prior to purchase
		(43-1C) Develop RN-specific teams for deployment of RN detectors for use in adjudicating suspicious incidents
		(43-1D) Use other indicators or equipment to identify and isolate suspicious items prior to use of specialized RN equipment
	(43-2) 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	(43-2A) Perform proper calibration of equipment as needed in the location of operation
		(43-2B) Develop trainings and reference materials for law enforcement personnel on types of NORM
		(43-2C) Develop operational procedures for resolving instances of intentional distortion of background radiation or actuation of false alarms used to discredit the detection system
	(43-3) Limited equipment communication range may sever contact between data gathering equipment in remote areas and technical/operational experts	(43-3A) Develop reference guides for use by law enforcement personnel in adjudicating suspicious encounters
		(43-3B) Establish routine maintenance schedules for outlying equipment to maintain long range communications

		(43-3C) Install communication relay equipment or develop other information relay procedures, such as information forwarding procedures among personnel, to reach outlying areas Case Study: Russian Federation, *Use of cellular networks to transmit information on detection from control points up the chain of command*
		(43-3D) Utilize satellite communications (e.g. satellite phones) for robust and reliable long-distance communications
	(43-4) Access to and deployment of necessary equipment and expertise to conduct effective alarm adjudication may pose a challenge across the vast interior area	(43-4A) Develop reachback resources for highly technical assistance where necessary and establish secure communication mechanisms to facilitate use of these resources
		(43-4B) Develop mobile, specialized RN adjudication teams responsible for operating equipment and developing or coordinating with necessary technical expertise
	(43-5) Software incompatibility across the many pieces of equipment owned by individual or separate competent authorities throughout the interior may inhibit information and equipment sharing	(43-5A) 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
		(43-5B) Include hardware upgrade and software update resources in a sustainability plan to enable consistent and timely system updating
		(43-5C) Cross train with equipment owned by multiple competent authorities to ensure preparedness for cooperative surge or search efforts
		(43-5D) Build a shared information database that serves as a software interface and information repository for the breadth of equipment in operation

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4.4 Challenges related to Operations

	Challenges	Mitigation Options
Operations	(44-1) Competing missions and priorities as well as lack of awareness, knowledge, and training among law enforcement personnel may prevent personnel from identifying the presence of nuclear or other radioactive materials out of regulatory control	(44-1A) Conduct awareness campaigns for law enforcement 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 such as broader CBRNe programs, as appropriate.
		Case Study: Argentina, *Multi-disciplinary training programs*
		(44-1B) Develop RN engagement opportunities for law enforcement personnel from different organizations to build awareness, knowledge, and expertise networks to support detection efforts
		(44-1C) Develop and distribute reference materials for identifying the presence of RN materials
	(44-2) Lack of technical expertise and equipment among interior law enforcement may preclude effective RN adjudication of suspicious incidents	(44-2A) Develop communication channels to reachback technical expertise
		(44-2B) Develop and/or capitalize on specialized RN (or CBRN) 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
		(44-2C) 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*
	(44-3) Strategic deployment of equipment for surge and search operations to follow up on possible incidents of illicit trafficking may be a challenge with constrained resources	(44-3A) Integrate intelligence information about the activities of adversaries and knowledge of pathways exploited for other illicit trafficking activities to prioritize the deployment of resources
		Case Study: Georgia, *Combining intelligence and mobile detection systems*
		(44-3B) Use equipment and techniques from other mission areas to identify and localize suspicious people and materials for further adjudication with RN detection equipment

		(44-3C) Develop agreements for resource sharing with other organizations that may have equipment and trained personnel, including international partners as appropriate Case Study: Russian Federation, *Methodology for determining and distributing the resources for the detection of nuclear and other radioactive materials*

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5 Conclusions

- Listed activities represent a way forward as part of initial steps in developing and implementing a nuclear detection architecture within a state's interior.
- Summarize the findings of the document
    - 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