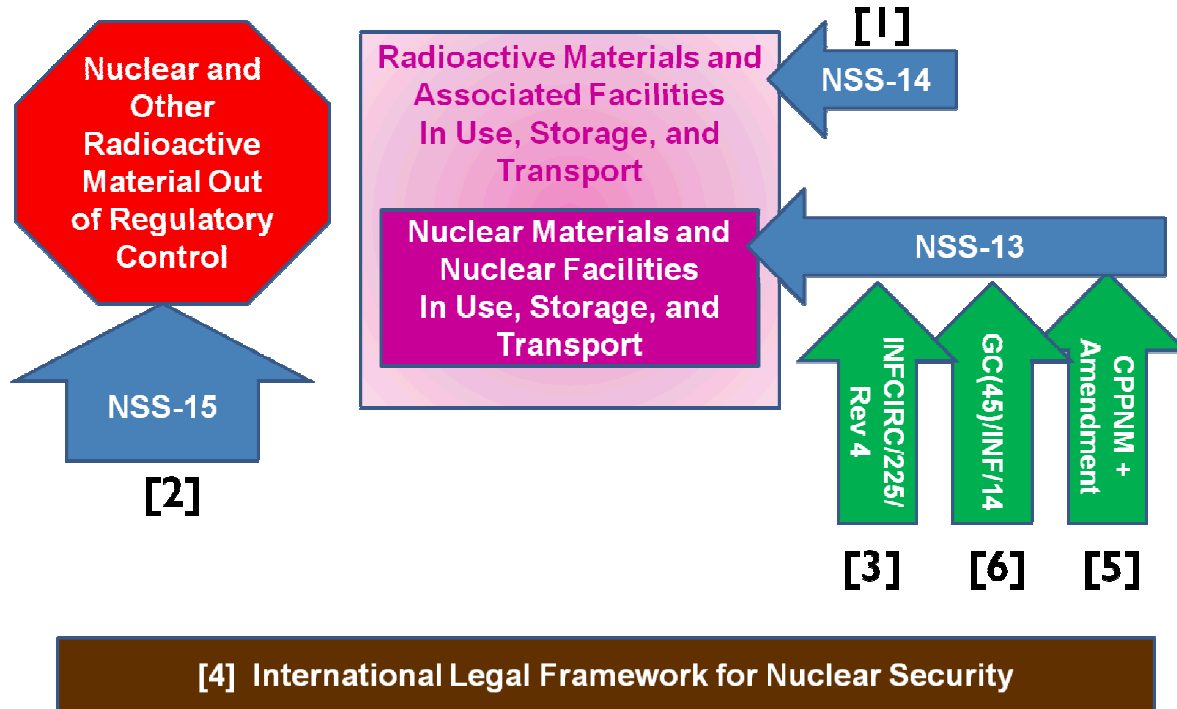


## Module 1 Session 2 References



- [1] INTERNATIONAL ATOMIC ENERGY AGENCY. Nuclear Security Recommendations on Radioactive Material and Associated Facilities, IAEA Nuclear Security Series No. 14, IAEA. Vienna (2011).
- [2] INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Security Recommendations on Nuclear and Other Radioactive Material out of Regulatory Control. IAEA Nuclear Security Series No. 15, IAEA. Vienna (2011).
- [3] Physical Protection of Nuclear Material and Nuclear Facilities. INFCIRC/225/Rev.4(Corrected). IAEA, Vienna (1999).
- [4] INTERNATIONAL ATOMIC ENERGY AGENCY. The International Legal Framework for Nuclear Security. IAEA International Law Series No. 4. IAEA. Vienna(2011).
- [5] Convention on the Physical Protection of Nuclear Material (CPPNM). INFCIRC/274/Rev. 1. IAEA. Vienna (1980): Amendment to the Convention on the Physical Protection of Nuclear Material. GOV/INF12005/10—GC(49)1NF/6, IAEA, Vienna (2005).
- [6] Measures to Improve the Security of Nuclear Materials and other Radioactive Materials, GC(45)/1NF/14. IAEA. Vienna (14 September 2001).

## Module 1 Session 3 Definitions Activity

*Definitions for italicized terms in NSS 13 are provided in alphabetical order below. An area is provided for you to take notes from the lecture.*

No.	Term	Definition	Notes
1	<b>Access delay</b>	The element of a <i>physical protection system</i> designed to increase adversary penetration time for entry into and/or exit from the <i>nuclear facility</i> or <i>transport</i> .	
2	<b>Central alarm station</b>	An installation which provides for the complete and continuous alarm monitoring, assessment and communication with <i>guards</i> , facility management and <i>response forces</i>	
3	<b>Competent authority</b>	Governmental organization(s) or institution(s) that has (have) been designated by a State to carry out one or more nuclear security functions.	
4	<b>Contingency plan</b>	Predefined sets of actions for response to unauthorized acts indicative of attempted <i>unauthorized removal</i> or <i>sabotage</i> , including <i>threats</i> thereof, designed to effectively counter such acts.	
5	<b>Conveyance</b>	For <i>transport</i> (a) by road or rail: any vehicle used for carriage of nuclear material cargo; (b) by water: any seagoing vessel or inland waterway craft, or any hold, compartment, or defined deck area of a seagoing vessel or inland waterway craft used for carriage of nuclear material cargo; and (c) by air: any aircraft used for carriage of nuclear material cargo.	
6	<b>Defense-in-depth</b>	The combination of multiple layers of systems and measures that have to be overcome or circumvented before physical protection is compromised.	

No.	Term	Definition	Notes
7	<b>Design basis threat</b>	The attributes and characteristics of potential <i>insider</i> and/or external adversaries, who might attempt <i>unauthorized removal</i> or <i>sabotage</i> , against which a <i>physical protection system</i> is designed and evaluated.	
8	<b>Detection</b>	A process in a <i>physical protection system</i> that begins with sensing a potentially malicious or otherwise unauthorized act and that is completed with the assessment of the cause of the alarm.	
9	<b>Force-on-force exercise</b>	A <i>performance test</i> of the <i>physical protection system</i> that uses designated trained personnel in the role of an adversary force to simulate an attack consistent with the <i>threat</i> or the <i>design basis threat</i> .	
10	<b>Graded approach</b>	The application of <i>physical protection measures</i> proportional to the potential consequences of a <i>malicious act</i> .	
11	<b>Guard</b>	A person who is entrusted with responsibility for patrolling, monitoring, assessing, escorting individuals or <i>transport</i> , controlling access and/or providing initial response.	
12	<b>Inner area</b>	An area with additional protection measures inside a <i>protected area</i> , where Category I <i>nuclear material</i> is used and/or stored.	
13	<b>Insider</b>	One or more individuals with authorized access to <i>nuclear facilities</i> or <i>nuclear material</i> in <i>transport</i> who could attempt <i>unauthorized removal</i> or <i>sabotage</i> , or who could aid an external adversary to do so.	

No.	Term	Definition	Notes
14	<b>Limited access area</b>	Designated area containing a <i>nuclear facility</i> and <i>nuclear material</i> to which access is limited and controlled for physical protection purposes.	
15	<b>Malicious act</b>	An act or attempt of <i>unauthorized removal</i> or <i>sabotage</i> .	
16	<b>Nuclear facility</b>	A facility (including associated buildings and equipment) in which <i>nuclear material</i> is produced, processed, used, handled, stored or disposed of and for which a specific license is required.	
17	<b>Nuclear material</b>	Material listed in Table 1, in Section 4 of this publication, including the material listed in its footnotes.	
18	<b>Nuclear security culture</b>	The assembly of characteristics, attitudes and behaviors of individuals, organizations and institutions which serves as means to support, enhance and sustain nuclear security.	
19	<b>Nuclear security event</b>	An event that is assessed as having implications for physical protection.	
20	<b>Operator</b>	Any person, organization, or government entity licensed or authorized to undertake the operation of a <i>nuclear facility</i> .	
21	<b>Performance testing</b>	Testing of the <i>physical protection measures</i> and the <i>physical protection system</i> to determine whether or not they are implemented as designed; adequate for the proposed natural, industrial and threat environments; and in compliance with established performance requirements.	

No.	Term	Definition	Notes
22	<b>Physical barrier</b>	A fence, wall or similar impediment which provides <i>access delay</i> and complements access control.	
23	<b>Physical protection measures</b>	The personnel, procedures, and equipment that constitute a <i>physical protection system</i> .	
24	<b>Physical protection regime</b>	<p>A State's regime including:</p> <ul style="list-style-type: none"> <li>- The legislative and regulatory framework governing the physical protection of <i>nuclear material</i> and <i>nuclear facilities</i>;</li> <li>- The institutions and organizations within the State responsible for ensuring implementation of the legislative and regulatory framework;</li> <li>- Facility and transport <i>physical protection systems</i>.</li> </ul>	
25	<b>Physical protection system</b>	An integrated set of <i>physical protection measures</i> intended to prevent the completion of a <i>malicious act</i> .	
26	<b>Protected Area</b>	Area inside a <i>limited access area</i> containing Category I or II <i>nuclear material</i> and/or <i>sabotage</i> targets surrounded by a <i>physical barrier</i> with additional <i>physical protection measures</i> .	
27	<b>Response forces</b>	Persons, on-site or off-site, who are armed and appropriately equipped and trained to counter an attempted <i>unauthorized removal</i> or an act of <i>sabotage</i> .	

No.	Term	Definition	Notes
28	<b>Sabotage</b>	Any deliberate act directed against a <i>nuclear facility</i> or <i>nuclear material</i> in use, storage or <i>transport</i> which could directly or indirectly endanger the health and safety of personnel, the public or the environment by exposure to radiation or release of radioactive substances.	
29	<b>Shipper</b>	Any person, organization or government that prepares or offers a consignment of <i>nuclear material</i> for <i>transport</i> (i.e. the consignor).	
30	<b>Stand-off attack</b>	An attack, executed at a distance from the target <i>nuclear facility</i> or <i>transport</i> , which does not require adversary hands-on access to the target, or require the adversary to overcome the <i>physical protection system</i> .	
31	<b>System for nuclear material accountancy and control</b>	An integrated set of measures designed to provide information on, control of, and assurance of the presence of <i>nuclear material</i> , including those systems necessary to establish and track nuclear material inventories, control access to and detect loss or diversion of <i>nuclear material</i> , and ensure the integrity of those systems and measures.	
32	<b>Threat</b>	A person or group of persons with motivation, intention and capability to commit a <i>malicious act</i> .	
33	<b>Threat Assessments</b>	An evaluation of the <i>threats</i> — based on available intelligence, law enforcement, and open source information — that describes the motivations, intentions, and capabilities of these <i>threats</i> .	

No.	Term	Definition	Notes
34	<b>Transport</b>	International or domestic carriage of <i>nuclear material</i> by any means of transportation, beginning with the departure from a <i>nuclear facility</i> of the <i>shipper</i> and ending with the arrival at a <i>nuclear facility</i> of the receiver	
35	<b>Transport control centre</b>	A facility which provides for the continuous monitoring of a <i>transport conveyance</i> location and security status and for communication with the <i>transport conveyance</i> , <i>shipper/receiver</i> , carrier and, when appropriate, its <i>guards</i> and the <i>response forces</i> .	
36	<b>Two person rule</b>	A procedure that requires at least two authorized and knowledgeable persons to be present to verify that activities involving <i>nuclear material</i> and <i>nuclear facilities</i> are authorized in order to detect access or actions that are unauthorized.	
37	<b>Unacceptable radiological consequences</b>	A level of radiological consequences, established by the State, above which the implementation of <i>physical protection measures</i> is warranted.	
38	<b>Unauthorized removal</b>	The theft or other unlawful taking of <i>nuclear material</i> .	
39	<b>Vital area</b>	Area inside a <i>protected area</i> containing equipment, systems or devices, or <i>nuclear material</i> , the <i>sabotage</i> of which could directly or indirectly lead to high radiological consequences.	

## Module 1 Session 3 Definitions Exercise

Identify the best context for each term using the following categories:

- A. *Physical Protection Regime and Entities*
- B. *Physical Protection Measures and Functions*
- C. *Threats and Targets*
- D. *Transportation*
- E. *Other*

- |                                  |  |
|----------------------------------|--|
| _____ Access Delay               | _____ Malicious Act  |
| _____ Vital Area                 | _____ Operator   |
| _____ Protected Area             | _____ Guard  |
| _____ Transport Control Centre   | _____ Competent Authority                                    |
| _____ Central Alarm Station      | _____ Performance Testing                                    |
| _____ Unauthorized Removal       | _____ Physical Protection Measures                           |
| _____ Design Basis Threat        | _____ Nuclear Facility                                       |
| _____ Force-on-force Exercise    | _____ Physical Protection System                             |
| _____ Graded Approach            | _____ Conveyance   |
| _____ Two Person Rule            | _____ Response Forces  |
| _____ Inner Area                 | _____ Defence in Depth                                       |
| _____ Insider                    | _____ Sabotage   |
| _____ Shipper                    | _____ Stand-off Attack                                       |
| _____ Nuclear Security Event     | _____ Detection  |
| _____ Limited Access Area        | _____ Threat Assessment                                      |
| _____ Threat Assessment          | _____ Contingency Plan                                       |
| _____ Nuclear Material           | _____ Unacceptable Radiological<br>Consequences              |
| _____ Physical Barrier           | _____ System for Nuclear Material<br>Accountancy and Control |
| _____ Nuclear Security Culture   |  |
| _____ Physical Protection Regime |  |
| _____ Conveyance                 |  |

## Module 3 Session 1 - Physical Protection Regime Responsibilities

### Exercise

Name the associated responsible organization(s) for the following physical protection regime legislative and regulatory framework elements. Answer with your State's organization name(s), or by State, Competent Authority or License Holder (Operator).

Physical Protection Regime Requirement	Responsible Organization(s)
Establish, implement and maintain a physical protection regime	
Establish Legal and Regulatory Framework	
Implement Legal and Regulatory Framework	
Identification of Threats	
Threat Assessment or Design Basis Threat	
Manage the security risk at acceptable levels	
Regulations	
Prime responsibility for implementation of physical protection	
Licensing and requirements for licensing	
Performance Testing of physical protection systems	
Inspections and evaluations	
Establishing a trustworthiness policy	
Enforcement including sanctions	
Designation of a competent authority (ies)	
Define clear lines of responsibility	
Security Plans	
Contingency Plans	
Protocols for interacting with the International Atomic Energy Agency	
Establishing Unacceptable Radiological Consequence(s)	
Establishing a good Nuclear Security Culture	
International cooperation	



5) What are the three ways that security risk can be managed? Discuss possible examples.

a.

b.

c.

6) What are examples of layers and methods of protection that provide defence in depth?

7) Who is your point of contact for the IAEA?

## Module 3 Session3- Exercise

1) Match the term to the description:

Nuclear Security Culture	Provide confidence that requirements important to physical protection are satisfied
Quality Assurance	Required commitment of necessary resources and encompasses performance testing and operating procedures.
Confidentiality	Recognizes that a credible threat exists and the individual plays an important role in preserving nuclear security
Sustainability	Protection of information for which the unauthorized disclosure could compromise physical protection of nuclear material and facilities.

2) \_\_\_\_\_ to respond to unauthorized removal of nuclear material or sabotage of nuclear material, or attempts thereof, should be prepared and appropriately exercised by all \_\_\_\_\_ and authorities concerned.

3) Contingency Plans are to be \_\_\_\_\_ after detection and \_\_\_\_\_ of a malicious act.

4) The Operator's Contingency Plan should be \_\_\_\_\_ and \_\_\_\_\_ to the \_\_\_\_\_ Contingency Plan.

### Module 3 - Summary Tables

NSS 13 references pertaining to the responsibilities for entities in a Physical Protection Regime.

Topic	NSS 13 Reference
<b>STATE</b>	
Physical Protection Regime	3.1-3.58
Unauthorized Removal	4.6, 4.20
Locate and Recover	4.50-59
Sabotage	5.4-6
Mitigate/Minimize Consequences	5.45-53
Transport	6.20, 6.24, 6.58, 6.45-51, 6.61-69
<b>COMPETENT AUTHORITY</b>	
Fundamental Responsibilities	3.18-22
Legislative and Regulatory Framework	3.12
Pertaining to Licence Holders	3.24, 3.26-27, 3.30
Threats	3.38-39
Nuclear Security Events	3.58-59
Unauthorized Removal	4.8, 4.35
Locate and Recover	4.60, 4.62
Sabotage	5.1, 5.9, 5.15, 5.41
Transport	3.7, 6.22, 6.27, 6.33-34
<b>LICENCE HOLDER</b>	
General Responsibilities	3.24-30
Unauthorized Removal*	4.1-49
Locate and Recover	4.57-63
Sabotage	5.1-43
Mitigate/Minimize Consequences	5.54-58
Transport*	6-1-43, 6.52-59, 6.70-73

\*Depends on Category of Nuclear Material

## Module 4 Measures Against Unauthorized Removal – In Use and Storage Exercises

1. Does your State use or will your state use a threat assessment or design basis threat as the basis for physical protection system design?
2. Identify the category of nuclear material according to the table in NSS #13:
  - \_\_\_ 12 Kg of Uranium-235 Enriched to 7%
  - \_\_\_ 3 Kg of Uranium-235
  - \_\_\_ 15 Kg of Unirradiated Uranium-233
  - \_\_\_ 12 Kg of Uranium-235 Enriched to 15%
  - \_\_\_ 0.5 Kg of Plutonium
  - \_\_\_ 0.5 K g Thorium
3. What category of nuclear material do you or do you expect to use at your nuclear facility or within your State? \_\_\_\_\_
4. How have you implemented security by design? \_\_\_\_\_

Identify the category(s) of material associated with the listed requirement.

Category				Recommended Requirement	Para. Reference(s)
I	II	III	<III		
				Computer-based systems used for physical protection, nuclear safety, and nuclear material accountancy and control should be protected against compromise.	
				Nuclear material that is required to be protected in accordance with prudent management practice should be secured against unauthorized removal and unauthorized access.	
				Nuclear material should be used or stored within at least a limited access area	
				Provision should be made for detecting unauthorized intrusion and for appropriate response to nuclear security event	
				Nuclear material handlers should follow procedures for custody and shift inventory checks.	
				Contingency plans should be prepared to counter malicious acts, to provide for appropriate response and train facility personnel in their actions.	
				Response forces need to be familiar with the site, nuclear material locations, and knowledge of radiation protection.	
				Nuclear material should be used or stored within at least a protected area, located inside a limited access area with intrusion detection and assessment to detect unauthorized access.	
				Vehicles, persons, and packages should be subject to search upon entering and exiting the protected area.	
				Records should be kept of all persons having access to or possession of keys, keycards and computer systems that control access to nuclear material.	
				Permanently staffed Central Alarm Station should be provided and located in a Protected Area.	
				24 hour guard service and response force should be provided and be trained and adequately equipped for their functions.	
				Voice communication between the central alarm station and response forces should be secure.	
				Guards should conduct random patrols of the protected area.	

				Evaluations, including performance testing should be conducted regularly and should involve operator and response forces.	
				Physical protection systems should be tested at least annually, for example by force-on-force exercises.	
				Nuclear material should be used or stored within an Inner Area within a protected area and be appropriately secured when unattended.	
				Inner area delay should counter insiders and external adversaries.	
				Vehicles, persons, and packages should be subject to search upon entering and exiting the inner area.	
				Records should be kept of all persons accessing inner areas and of all persons who have access to or possession of keys, keycards and computer systems that control access to inner areas.	
				Guards and response forces should provide an effective and timely response to prevent an adversary from unauthorized removal. Response should be performance tested, for example, force-on-force exercises.	
				Provisions, including redundancy measures, should be in place to ensure the functions of the central alarm station continue during an emergency. (i.e. Backup alarm station)	
				Constant surveillance should be used to counter the insider threat.	
				Vehicle barriers against land and water vehicles should be installed an appropriate distance.	

5. Does or will your facility need to include:

Limited Access Area? \_\_\_\_\_

Protected Areas? \_\_\_\_\_

Inner Areas? \_\_\_\_\_

6. What access control measures does your facility or should your facility implement to limit access to:
  - a. Category I material:
  - b. Category II material:
  - c. Category III material:

If not applicable indicate by N/A.

7. At what point is nuclear material considered out of regulatory control?
8. What is the role of NMAC in the determination material is out of regulatory control?
9. In a small group, list several actions that might be included in a contingency plan the following hypothetical scenario.

*A Category 1 quantity of experimental reactor fuel material is found missing from the vault during an item inventory taken at the end of the day just prior to securing the vault.*

## Module 5 Measures Against Sabotage – In Use and Storage

### Exercise

- 1) Identify whether the requirement is for facilities with
  - A. High Radiological Consequences,
  - B. Exceed limits for unacceptable radiological consequences
  - C. Do not exceed limits for unacceptable radiological consequences

	Requirement?	Para. Reference
	Intrusion detection system and assessment	
	Physical barrier	
	Contraband detection	
	Continuously staffed central alarm station	
	Redundant and dedicated communication with response forces	
	Timely detection	
	Contingency plan	
	Access control, limit number of persons with access	
	Vital area located within a protected area	
	Random patrols	
	Protect computer-based systems from compromise	

- 2) Order the design process for physical protection systems against sabotage:

- \_\_\_ Identify sabotage scenarios
- \_\_\_ Evaluate the design
- \_\_\_ Consult the threat assessment or design basis threat
- \_\_\_ Design the physical protection system against sabotage scenarios

- 3) Match the term to the protection requirements:

<b>Acceptable Radiological Consequences</b>	Identify vital areas and protect as specified in INFCIRC/225
<b>High Radiological Consequences</b>	Graded protection requirements based on level of potential consequences
<b>Unacceptable Radiological Consequences</b>	Secure and control access to safety-related equipment

4) How do contingency plans support emergency response?

5) In a small group, list several actions that might be included in a contingency plan to minimize and mitigate consequences in the following hypothetical scenario.

*A cooling system pump for a pool-type research reactor is sabotaged such that cooling water cannot be circulated to cool the reactor. The reactor was operational for a test and was approaching maximum operational output.*

## Module 6 Measures against Unauthorized Removal and Sabotage - Transportation

### Exercise

Identify the Category of material and the NSS 13 Paragraph reference for the transportation requirements identified below.

Category(s)	Recommended Requirement	Para. Reference
	Further authorization just prior to shipment should be required.	
	Arrangements should be made to provide adequately sized response forces to deal with nuclear security events.	
	While nuclear material is on board pending departure, provisions should be made for sufficient access delay to meet the threat.	
	Aggregate total quantity of nuclear material on a conveyance to identify appropriate requirements.	
	Communication from the conveyance should be provided to summon responders.	
	For unexpected extended stops provide protection equivalent to nuclear material in storage.	
	Consignments should be shipped by rail in a freight train in an exclusive use, fully enclosed, and locked conveyance.	
	Locks and seals should be checked before dispatch and after any intermodal transfer.	
	Measures should include sufficient delay for time to intervene to prevent removal of material.	
	Guards should conduct surveillance of the route.	

- 1) Name notification requirements for locating and recovering missing or stolen nuclear materials.
  
- 2) Name two notification requirements for minimizing/mitigating the effects of sabotage consequences during transport.
  - a.
  
  - b.

## Additional Discussion Questions

1. Describe your State's provisions for locating and recovering missing or stolen nuclear material. When is material considered out of regulatory control?
  
  2. Do your State's laws specifically address:
    - a. Trustworthiness?
    - b. Information Security?
    - c. Enforcement?
    - d. Sanctions (including criminal penalties)?
  
  3. Describe your State's mechanism for performance testing of:
    - a. Response to a nuclear security event?
    - b. Response to a nuclear safety event?
    - c. Compensatory measures?
    - d. Emergency plans?
  
  4. What is the biggest challenge in physical protection regime and system sustainment?
    - Human Resources
    - Technology
    - Procedures
    - Configuration Management
    - Financial
  
  5. Describe the interactions between response forces and guards and your country's decision on whether response forces are on-site, near-site, or off-site
-

## Physical Protection Measures Reference Sheet for NSS 13

Material State	In Use and Storage			Sabotage for High Consequence Facilities
Material Category	Category III	Category II	Category I	Vital Area
Protection Layer	Limited Access Area	Protected Area	Inner Area	
PP Measure				
Intrusion Detection	4.12, 4.15	4.12, 4.15, 4.23, 4.31	4.12, 4.15, 4.23, 4.31, 4.38, 4.46, 4.48	5.14, 5.21, 5.26, 5.29, 5.33, 5.36, 5.37
Alarm Assessment		4.23, 4.30	4.23, 4.30, 4.47	5.21, 5.36
Entry Control	4.17	4.24, 4.25, 4.26, 4.27, 4.28, 4.30	4.24, 4.25, 4.26, 4.27, 4.28, 4.30, 4.38, 4.40, 4.42, 4.44, 4.45	5.14, 5.22, 5.23, 5.24, 5.25, 5.26, 5.28, 5.31, 5.32, 5.34, 5.35, 5.36
Contraband Detection		4.25	4.43	5.23
Alarm Control & Display		4.30, 4.31, 4.32	4.30, 4.31, 4.32, 4.47	5.36, 5.37, 5.38
Access Delay		4.23	4.23, 4.38, 4.39, 4.41, 4.46	5.14, 5.21, 5.26, 5.27, 5.30
Response	4.19, 4.20	4.19, 4.20, 4.30, 4.32, 4.33, 4.34	4.19, 4.20, 4.30, 4.32, 4.33, 4.34, 4.49	5.14, 5.36, 5.38, 5.39, 5.40, 5.42
Evaluation				
Performance Testing	4.20	4.20, 4.35	4.20, 4.35, 4.49	5.15, 5.16, 5.41