

Nuclear Security Recommendations on the Physical Protection of Nuclear Materials and Nuclear Facilities (INFCIRC 225/Rev5)

Requirements for a
State's Physical Protection Regime and Overview of
Changes in Revision 5

June 11-12, 2012
Malaysia

Sandia National Laboratories is a multi-programme laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

SAND2011-7908P



INFCIRC/225/Revision 5

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Course Outline

- Introductions
- Background on INFCIRC/225/Revision 5
- INFCIRC/225/Revision 5 Chapters
 - Objectives of a State's Physical Protection Regime
 - Elements of A State's Physical Protection Regime For Nuclear Materials and Nuclear Facilities
 - State
 - Competent Authority
 - Licence Holders
 - Sustainment - all
 - Requirements for Measures Against Unauthorized Removal of Nuclear Material in Use and Storage
 - Requirements for Measures Against Sabotage of Nuclear Materials and Nuclear Material in Use and Storage
 - Requirements for Measures Against Unauthorized Removal and Sabotage Nuclear Material during Transport
- Summary



Introductions

- Moderators
- Participants
 - Name
 - Country
 - Organization
 - Experience with INFCIRC/225/Revision 4
 - Expectations

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Format of the Workshop

- Presentations on INFCIRC/225/Revision 5
- Individual Activities
- Group Discussions

4

INFCIRC/225/Revision 5

• **BACKGROUND**

SESSION 1

History of INFCIRC/225

INFCIRC/225 has been the de facto international standard for the physical protection of nuclear material for decades

- Originally prepared by a panel of experts convened by the IAEA Director General in 1972
- First published in the INFCIRC series in 1975
- Subsequently revised by member-state experts in
 - 1977 (Rev.1)
 - 1989 (Rev.2)
 - 1993 (Rev.3)
 - 1999 (Rev.4)
 - 2011(Rev.5)
- Revision 5 is also IAEA Nuclear Security Series No. 13



Why Revision 5?

- The 9/11/2001 attack resulted in greater recognition of the risk nuclear terrorism
- The IAEA Board of Governors (BOG) and General Conference GC(45)/INF/14, 14 September, 2001
 - Published new Physical Protection Regime Objectives
 - Published the Fundamental Principles of Physical Protection

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Why Revision 5? (continued)

- The IAEA Convention on the Physical Protection of Nuclear Material, INF/CIRC/274/Rev.1 (CPPNM)
 - First published in 1980 (primarily addressed international transport)
 - Amended in 2005 (Amendment to the CPPNM, GOV/INF/10-GC(49)INF/6, IAEA, Vienna [2005]) to adopt:
 - BOG Physical Protection Regime Objectives
 - BOG 12 Fundamental Principles of Physical Protection

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General Approach to Revision 5

- Achieve consistency with endorsement by the IAEA BOG (September 2001) and the CPPNM (Amended, July 2005)
 - The concept of four physical protection regime objectives
 - The concept of a State's *Physical Protection Regime*, comprised of the Twelve Fundamental Principles of Physical Protection
- Introduce the risk management approach and the tie to the graded approach, defence in depth, nuclear material categorization, and radiological consequence categorization
- Forge a stronger connection between the 3S - security, safety, and safeguards, which includes nuclear material accountancy and control (NMACS) measures

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Nuclear Security Series

- Seventeen documents published to date
- One in final stages
- 2 more in review
- Created and approved by member states through consultancy and technical meetings

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Scope of INFCIRC/225/Revision 5

- Nuclear Material and Nuclear Facilities Used for Civil Purposes
- In Use and Storage/During Transport



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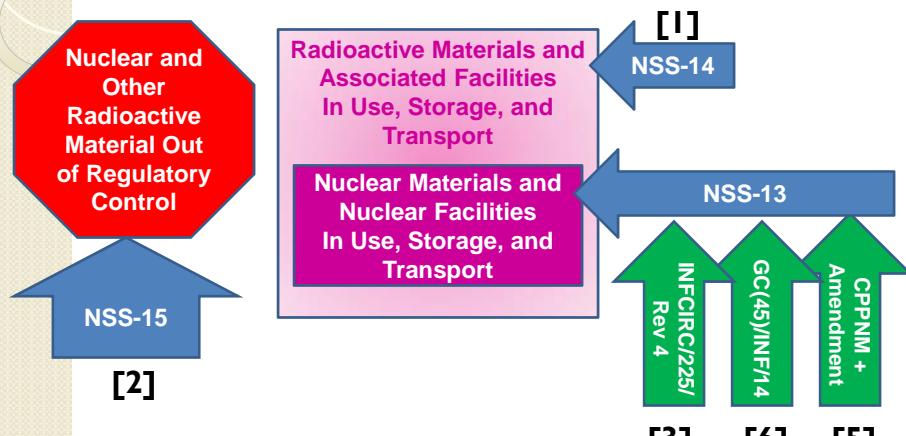
Scope of INFCIRC/225/Revision 5

- Protect Against
 - Unauthorized removal toward a nuclear explosive device
 - Unauthorized removal toward subsequent dispersal
 - Sabotage

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- TURN TO PARTICIPANT REFERENCES AND ACTIVITIES SECTION

References in INFCIRC/225 Revision 5



Revision 5 and 4 Structure Comparison

Revision 5

1. Introduction
2. Objectives (now 4)
3. Elements of a State's Physical Protection Regime
4. Unauthorized Removal of Material in Use and Storage (Includes categorization of material and the addition of measures to locate/recover missing/stolen material)
5. Sabotage of Facilities and Material in Use and Storage (Includes addition of process for graded measures for protection against sabotage and measures to mitigate/minimize consequences)
6. Unauthorized Removal and Sabotage of Nuclear Material During Transport (Includes addition of measures to locate/recover and mitigate/minimize consequences)
7. Definitions (39)

Revision 4

1. Introduction
2. Definitions (17)
3. Objectives (only 2)
4. Elements of a State's Physical Protection System
5. Categorization of Nuclear Material
6. Unauthorized Removal of Material in Use and Storage
7. Sabotage of Facilities and Material in Use and Storage
8. Nuclear Material During Transport

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INFCIRC/225/Revision 5 Introduction

- Introduces connection to IAEA Nuclear Security Program and Nuclear Security Series
- Complements other two recommendations document
 - Radioactive Materials
 - Material Out of Regulatory Control
- Assists Member States to meet their obligations and commitments, including the Amendment to CPPNM

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INFCIRC/225/Revision 5

• **DEFINITIONS**

SESSION 2

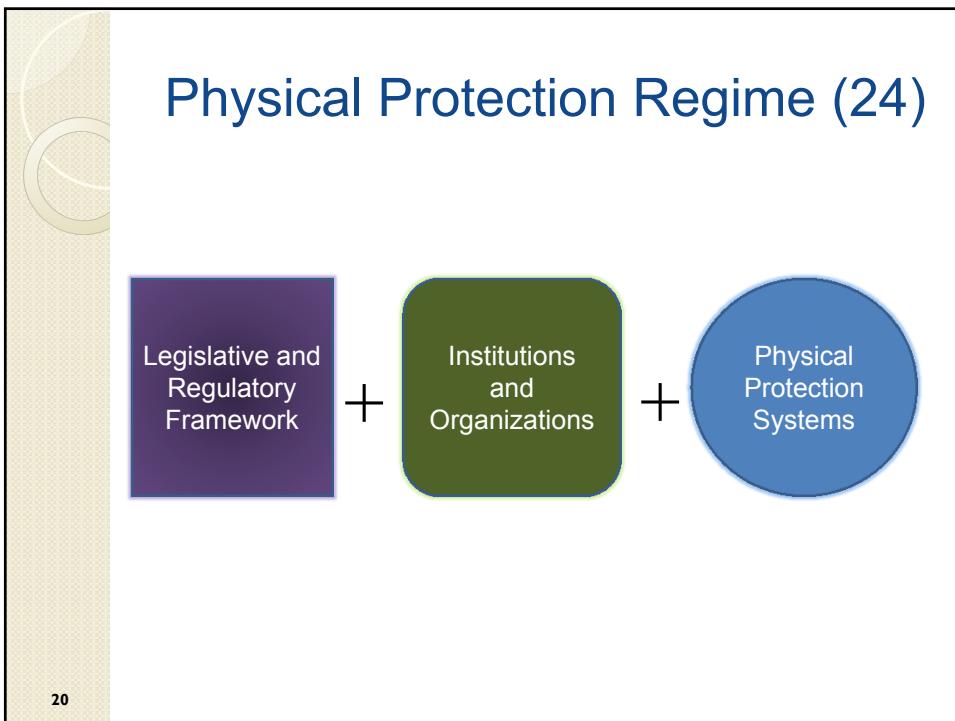
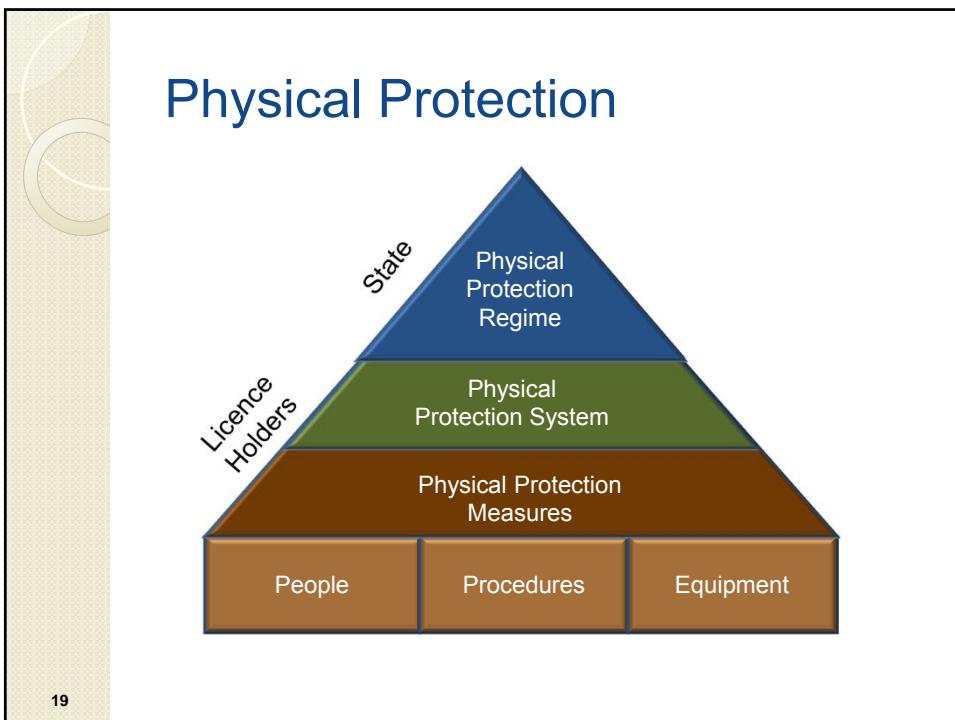
17

Session 2 Exercise

1. Turn to Activities section of your book, Session 2
2. There are 39 terms numbered in your book
3. Numbers in parenthesis on slides will correspond to those numbers
4. We will review the definitions using a context-based approach
5. As we discuss a term, check the box to the left of the definition.
6. When we have finished this section, all 39 terms will have been covered

- Definitions begin on page 51 of INFCIRC/225

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Physical Protection Regime Entities

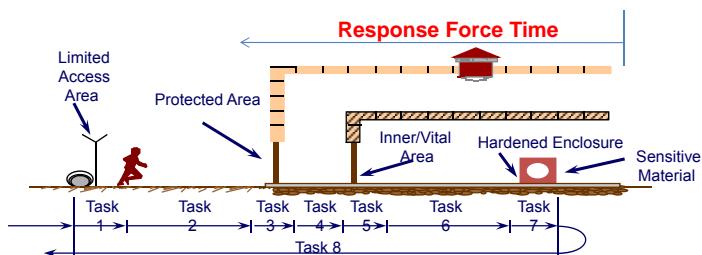
- State
- Competent Authority (3)
- Licence Holders
 - Operator (20) of nuclear facilities
 - Shipper (29) for transport of nuclear materials

Nuclear Security Culture (18) crosses all three levels

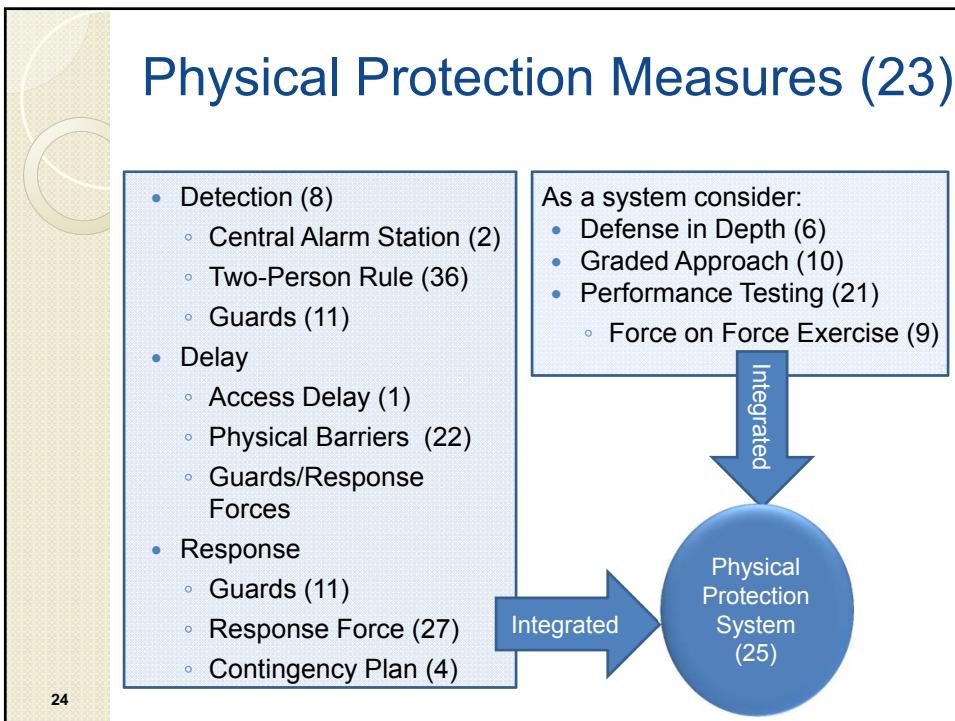
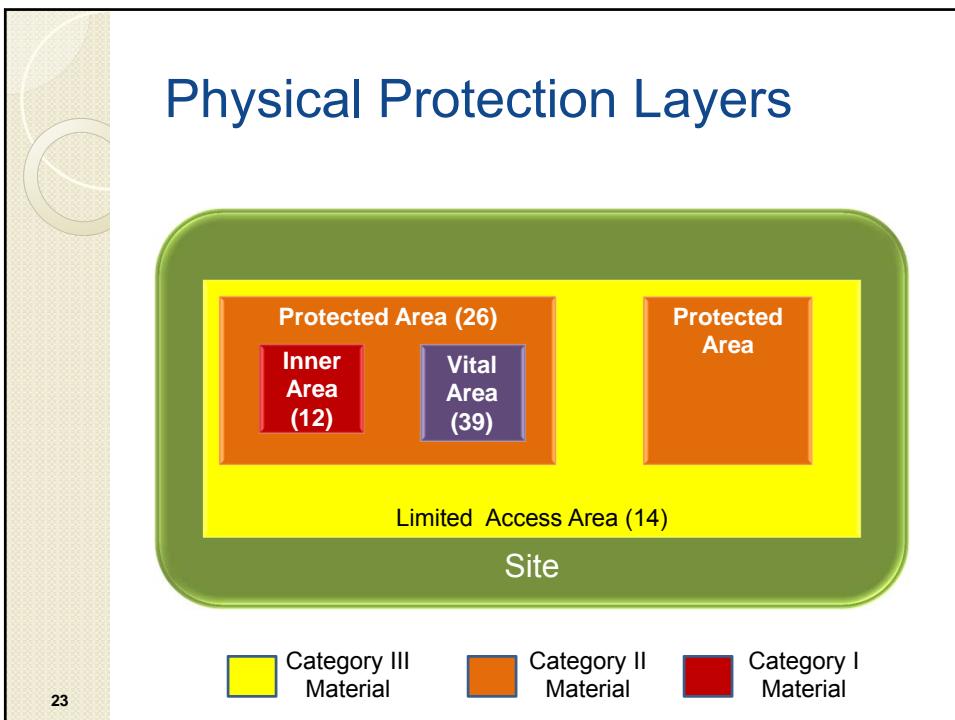
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Physical Protection System (25)

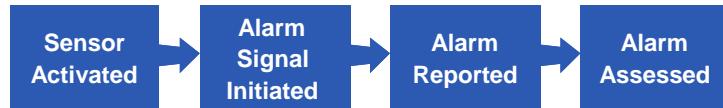
- An integrated set of *physical protection measures* intended to prevent the completion of a *malicious act*
- For a successful system design, the total time for detection, delay, and response must be less than adversary task time to complete his or her goal



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Detection



“An alarm without assessment is not detection.”

Delay

Provide obstacles to increase adversary task time after detection

Response



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Contingency Plans (4)

Predefined set of actions for response

- To unauthorized acts indicative of
 - Unauthorized removal
 - Sabotage
 - Threats of either
- Designed to effectively to counter such acts

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Nuclear Material (17)

IAEA Categorization of Nuclear Material

Material	Form	Category I	Category II	Category III ^c
1. Plutonium	Unirradiated ^b	2 kg or more	Less than 2 kg but more than 500 g	500 g or less but more than 15 g
2. Uranium-235	Unirradiated ^b - Uranium enriched to 20% ²³⁵ U or more	5 kg or more	Less than 5 kg but more than 1 kg	1 kg or less but more than 15 g
	- Uranium enriched to 10% ²³⁵ U but less than 20% ²³⁵ U		10 kg or more	Less than 10 kg but more than 1 kg
	- Uranium enriched above natural but less than 10% ²³⁵ U			10 kg or more
3. Uranium-233	Unirradiated ^b	2 kg or more	Less than 2 kg but more than 500 g	500 g or less but more than 15 g
4. Irradiated Fuel (The categorization of irradiated fuel in the table is based on international transport considerations. The State may assign a different category for domestic use, storage, and transportation taking all relevant factors into account.)			Depleted or natural uranium, thorium or low-enriched fuel (less than 10% fissile content) ^{d/e}	

^a All plutonium except that with isotopic concentration exceeding 80% in plutonium-238.

^b Material not irradiated in a reactor or material irradiated in a reactor but with a radiation level equal to or less than 1 Gy/hr

^c Quantities not falling in Category III and natural uranium; depleted uranium and thorium should be protected at least in accordance with prudent management practice.

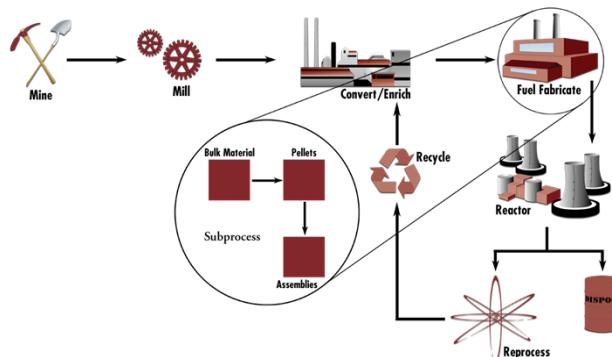
^d Although this level of protection is recommended, it would be open to States, upon evaluation of the specific circumstances, to assign a different category of physical protection.

^e Other fuel which by virtue of its original material content is classified as Category I or II before irradiation may be reduced one category level while the radiation level from the fuel exceeds 1 Gy/hr (100rad/hr) at one meter unshielded.

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Nuclear Facility (16)

- Facilities in which nuclear material is produced, processed, used, handled, stored, or disposed
- Requires a license from competent authority



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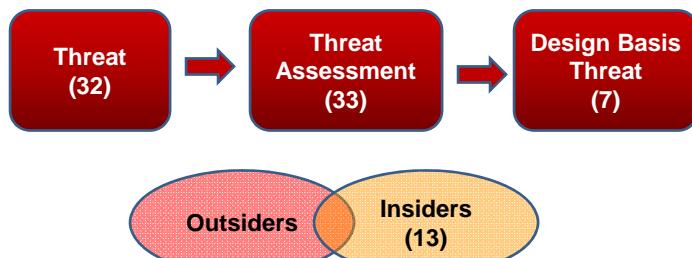
Consequence Terms

- Unacceptable radiological consequence (37)
- Nuclear Security Event (19)

29

Threat Terms

- Malicious Act (15)
 - Unauthorized Removal (38)
 - Sabotage (28)
 - Stand-off attack (30)



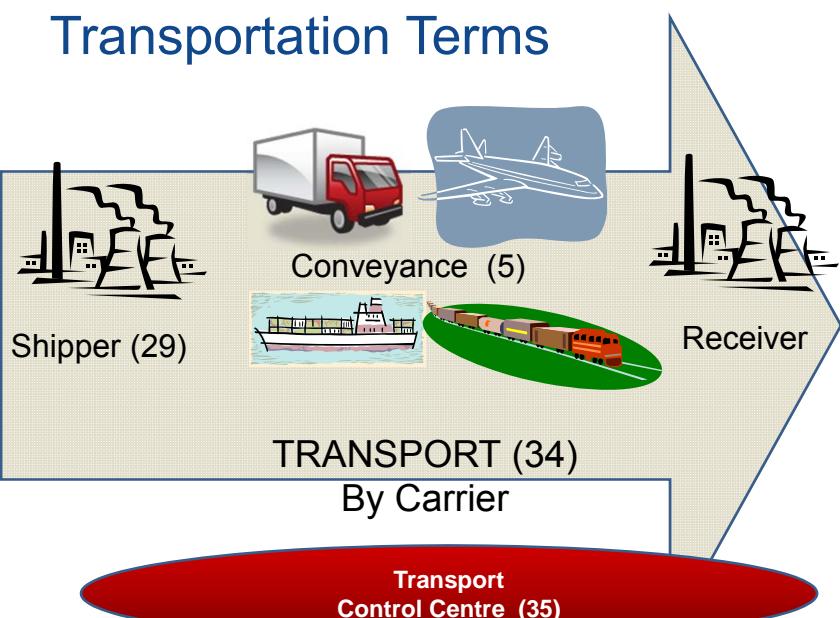
30

System for Nuclear Material Accountancy and Control (31)

- An integrated set of measures designed to provide
 - Information on the presence of *nuclear material*
 - Control of the presence of *nuclear material*
 - Assurance of the presence of *nuclear material*,
- Including those systems necessary to
 - Establish and track nuclear material inventories
 - Control access to *nuclear material*
 - Detect loss or diversion of *nuclear material*
 - Ensure the integrity of those systems and measures.

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Transportation Terms



32

Definition - Summary

- All 39 terms defined where use is different than Revision 4 or had more specialized meaning than the common dictionary
- All terms should be checked on your worksheet

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Changes from Revision 4

- Red terms have been added to Revision 5
- Blue terms have been changed from Revision 4
- Black terms are unchanged

Terms Deleted	Terms Modified
Assessment Intrusion Detection Patrol Security Survey	Central Alarm Station Defence in Depth Inner Area Physical Barrier Protected Area Response Forces Sabotage Transport Control Centre Vital Area

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Session 2 Activity

- Categorize the terms using the designated legend
 - A. Physical Protection Regime/Entities
 - B. PPS & PP Measures
 - C. Requirements – Threats and Targets
 - D. Transportation
 - E. Other

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- **CHECK YOUR ANSWERS**

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• **OBJECTIVES**

State's Nuclear Security Regime Objective (2.1)

Protect persons, property, society, and the environment from malicious acts involving nuclear material and other radioactive material



Objectives of State's Physical Protection Regime (2.1)

- **To protect against unauthorized removal:** protecting against theft and other unlawful taking of nuclear material.
- **To locate and recover missing nuclear material:** ensuring the implementation of rapid and comprehensive measures to locate and, where appropriate, recover missing or stolen nuclear material.
- **To protect against sabotage:** protecting nuclear material and nuclear facilities against sabotage.
- **To mitigate or minimize effects of sabotage:** mitigating or minimizing the radiological consequences of sabotage.

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Revision of Objectives

- **Revision 5** - The establishment of four distinct physical protection objectives
 - To protect against *unauthorized removal*...
 - To locate and recover missing *nuclear material*
 - To protect against *sabotage*...
 - To mitigate or minimize effects of *sabotage*
- **Revision 4**
 - To establish conditions which would minimize the possibilities for unauthorized removal of nuclear material and/or for sabotage
 - To provide information and technical assistance in support of rapid and comprehensive measures by the State to locate and recover missing nuclear material and to cooperate with safety authorities in minimizing the radiological consequences of sabotage

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Achieve PP Regime Objectives through: (2.2)

- Prevention of a malicious act by means of deterrence and by protection of sensitive information
- Management of an attempted malicious act or a malicious act by an integrated system of detection, delay, and response
- Mitigation of the consequences of a malicious act



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Approach (2.3)

Objectives should be addressed in an *integrated and coordinated* manner, taking into account the different risks covered by nuclear security

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Question

How many of you were familiar with
all four objectives?

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Question

Does your physical protection regime include:

- Location and recovery?
- Mitigation and minimization?

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INFCIRC/225/Revision 5

• **ELEMENTS OF PHYSICAL PROTECTION
REGIME**

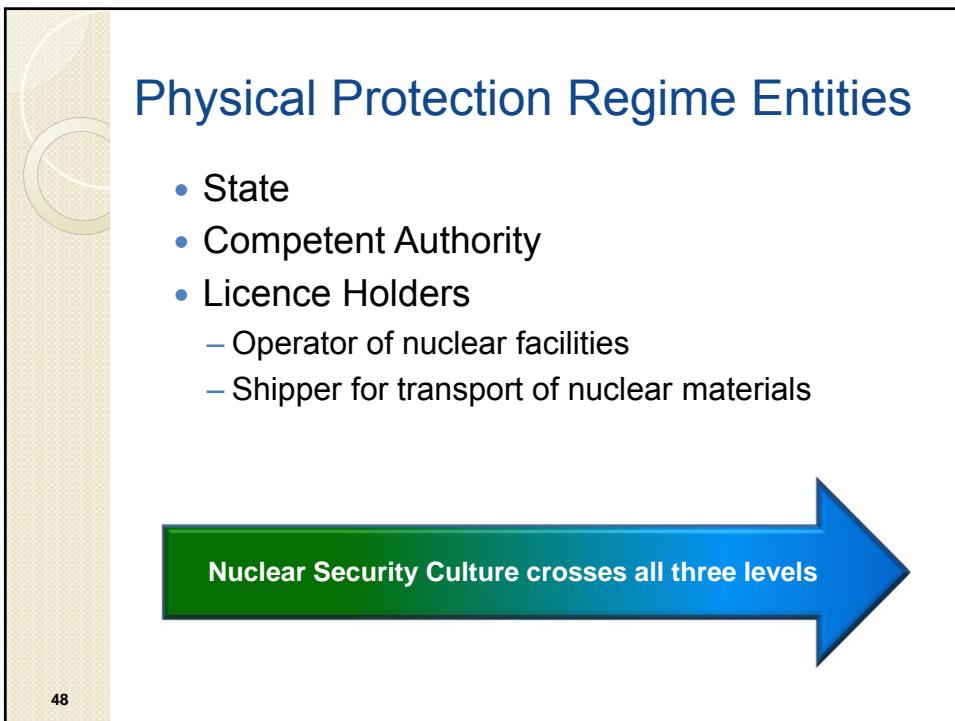
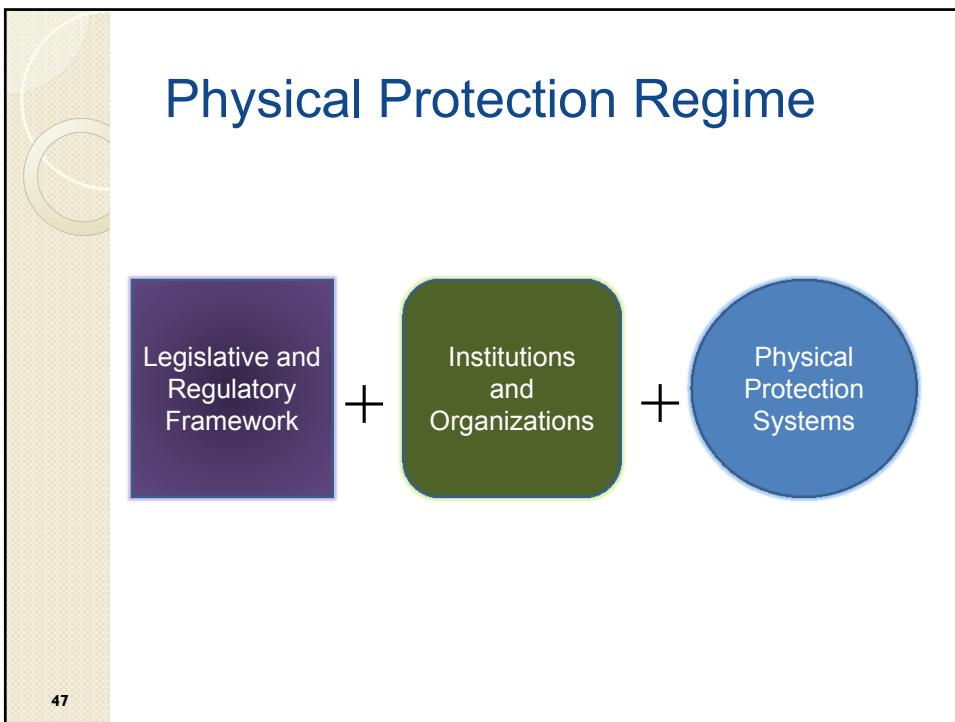
SESSION 3

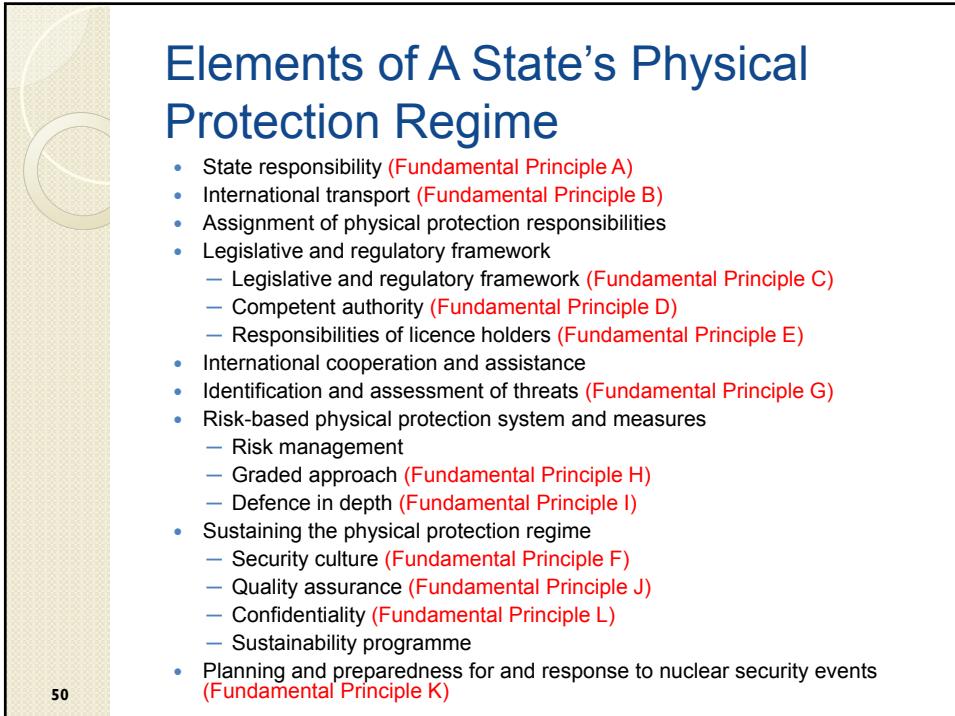
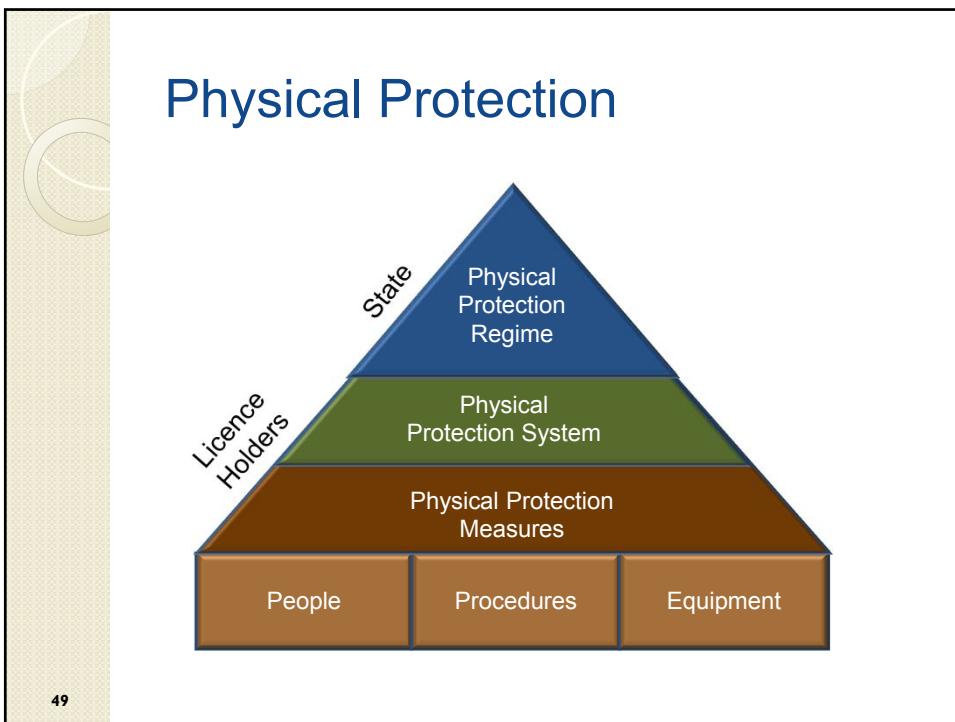
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Overview of Regime Changes

- Previously referred to as “State’s system of physical protection”
- More explicitly defined a State’s Physical Protection Regime as separate from Physical Protection Systems
- Directly aligns with CPPNM
- Includes process for regular review of the regime

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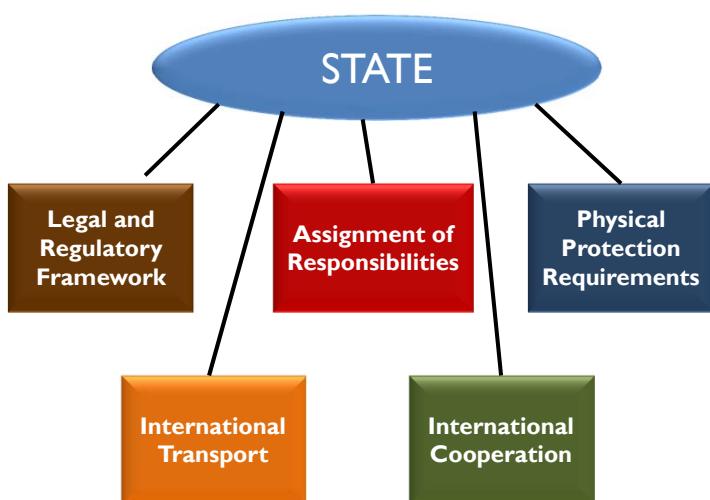


Physical Protection Regime

Part 1 Session 3	<ul style="list-style-type: none">• State responsibilities• Legal and regulatory framework• Assignment of PP responsibilities
Part 2 Session 4	<ul style="list-style-type: none">• Physical protection requirements• International transport• International cooperation and assistance
Part 3 Session 5	<ul style="list-style-type: none">• Competent authority
Part 4 Session 6	<ul style="list-style-type: none">• Licence holder
Part 5 Session 7	<ul style="list-style-type: none">• Sustainment and preparedness

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State Responsibilities



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State Responsibility

Fundamental Principle A

The responsibility for the establishment, implementation, and maintenance of a physical protection regime within a State rests entirely with that State.

State

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State Responsibility

- Establishment, implementation, and maintenance of a physical protection regime
 - All nuclear material in use and storage
 - During transport
 - For all nuclear facilities
- Protection of nuclear material and nuclear facilities
 - Unauthorized removal
 - Sabotage

State

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State

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State Responsibility (continued)

- Regular updates to reflect
 - Changes in threat
 - Advances in physical protection
 - Approaches
 - Systems
 - Technology
 - Introduction of new types of nuclear material and nuclear facilities



State

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Additional State Responsibilities

- Section 4 – Requirements for Measures to Locate and Recover Missing or Stolen Nuclear Material (4.50-4.56)
- Section 5 – Requirements for Associated Measures to Mitigate or Minimize the Radiological Consequences of Sabotage (5.45-5.53)
- Section 6 – Nuclear Materials During Transport, Locate and Recover (6.45 -6.51)
- Section 6 – Nuclear Materials During Transport, Mitigate/Minimize (6.61-6.69)

Legislative and Regulatory Framework

Fundamental Principle C

The State is responsible for establishing and maintaining a legislative and regulatory framework to govern physical protection. This framework should provide for the establishment of applicable physical protection requirements and include a system of evaluation and licensing or other procedures to grant authorization. This framework should include a system of inspection of nuclear facilities and transport to verify compliance with applicable requirements and conditions of the licence or other authorizing document and to establish a means to enforce applicable requirements and conditions, including effective sanctions.

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Legislative and Regulatory Framework

- Laws to establish and ensure proper implementation of the physical protection regime
- Requirements for physical protection
 - Unauthorized removal of nuclear material
 - In use or storage
 - During transport
 - Sabotage of
 - Nuclear facilities
 - Nuclear material
 - During transport

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Legislative and Regulatory Framework (continued)

- Includes
 - Trustworthiness policy
 - Information security
 - Enforcement
 - Sanctions (including criminal penalties)
- Interfaces with
 - Nuclear safety
 - Nuclear material accountancy and control
 - Radiation protection
 - Emergency response

Legislative and Regulatory Framework (continued)

- Regulatory framework
 - Licensing
 - Regulations
 - Evaluations
 - Compliance
 - Test physical protection systems including training and readiness of guards and/or response forces



Assignment of Physical Protection Responsibilities

- At all levels of involved governmental entities
 - Competent authorities
 - Response forces
 - Operators
 - Shippers/Carriers
 - Emergency response
- Clear lines of responsibility

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Session 3 Exercise

- Turn to the Activities Section of your book
- Identify who has the responsibility in your country

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Session 3 Exercise

- Are the answers known?
- If not,
 - Because you did not know, but could get the answer?
 - Because the responsibility has not yet been assigned?

Assignment of Responsibilities

Where is this information documented?

INFCIRC/225/Revision 5

◦ **ELEMENTS OF PHYSICAL PROTECTION
REGIME – PART 3**

**PHYSICAL PROTECTION REQUIREMENTS
AND INTERNATIONAL ASPECTS
SESSION 4**

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Physical Protection Requirements

- Threats
- Targets
- Risk Management

Physical Protection Requirements

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Identification and Assessment of Threats

Fundamental Principle G

The State's physical protection should be based on the State's current evaluation of the threat.

Identification and Assessment of Threats

- Design Basis Threat (DBT) only required for
 - Category I material protection
 - High radiological consequence facilities
- Otherwise, the State should decide whether to use a threat assessment or design basis threat for other nuclear material and nuclear facilities
- However, the DBT is recommended for use as a common basis for design and implementation of PPS



Identification and Assessment of Threats

- Threat considerations should include the
 - Insider threat
 - Cyber threats
 - Airborne threat
 - Stand-off attacks
 - Theft for off-site dispersal
- Be continuously updated



Special Session on the Threat

- Specific to your request

Overview on
Threat Assessment and Design Basis Threat

DEFINING THE THREAT

Special Session

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Defining the Threat

Outline

- Definitions
- Threat Assessment
- Design Basis Threat
- Value of Both

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Defining the Threat

Definitions

- **Threat** – A person or group of persons with motivation, intention, and capability to commit a malicious act
- **Malicious Act** – An act or attempt of unauthorized removal or sabotage
- **Threat Assessment** – An evaluation of the threat that describes motivations, intentions, and capabilities of threats
- **Design Basis Threat** – The attributes of potential adversaries who might attempt malicious acts against which a physical protection system is designed and evaluated

Threat Assessment

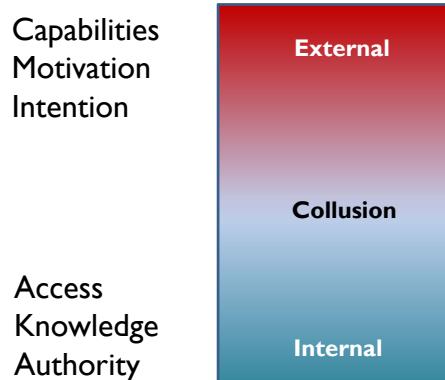
- Prepared by State's competent authority for intelligence
- Based on
 - Available intelligence
 - Law enforcement case histories
 - Open source information
- Common Assumptions
 - Peace time versus war time
 - Demonstrated versus potential behavior

Sources of Information

- State Intelligence Service
- Ministries of Interior and Foreign Affairs
- Ministry of Defence
- Other ministries
- Local law enforcement
- Facility operators
- Carriers
- Internet and other open sources

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Threats



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International/Regional Threats

- Non-state actors
- Terrorist groups
- Criminal
- Activists

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Military Engagements

- Considered beyond the limits of physical protection
- Considered to be the responsibility of the State versus the operator/carrier

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Domestic/Local

- Terrorists
- Activists, particularly anti-nuclear
- Criminal
- Violent labor unions
- Anti-government movements
- Ethnic groups

External Adversary Capabilities

- Known history
- Group size and organizational structure
- Weapons – guns, explosives, cyber
- Tools and transportation
- Skills, access, and knowledge
- Risk Acceptance
- Funding
- History of collusion

Insider Capabilities

ACCESS	KNOWLEDGE	AUTHORITY
<ul style="list-style-type: none">• To information• To facilities• To areas• To material	<ul style="list-style-type: none">• About the site and its operations• Handling of material and areas for sabotage• Security system	<ul style="list-style-type: none">• Direct activities• Authorize exceptions• Define access

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Defining the Threat

Motivations

- Ideological – political, ethnic, religious
- Financial gain
- Psychological
- Revenge
- Ego

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Defining the Threat

Intentions

- Many are possible
- Focus for Physical Protection Systems:
 - Unauthorized removal with intent to construct a nuclear explosives device
 - Unauthorized removal which could lead to subsequent dispersal
 - Sabotage which could lead to a radiological release

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Value of DBT

Provides a rational basis for making and justifying potentially expensive decisions about

- Regulations
- PPS designs
- PPS performance

to

- ensure sufficient countermeasures
- avoid unnecessary countermeasures
- know when to modify countermeasures

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Value of DBT (continued)

Provides a rational basis for

- Evaluating the adequacy of a PPS through testing and exercises
- Licensing conditions
- Identifying responsibilities

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Translating Threat Assessment into a DBT

- Select a specific threat type with its associated attributes
- Include:
 - External threat
 - Internal threat
 - Collusion between external and internal threats
- Correlate objectives to target types
 - Theft of Type, Material Category, Form
 - Sabotage

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Developing Design Criteria

- Graded Approach
- Defence in Depth
- Detection layers
- Delay times
- Response requirements

Developing Performance Criteria

- PPS must provide timely detection with adequate delay for response forces to interrupt and neutralize the adversary attack

Summary

- Many threats to consider
- DBT provides a basis for PPS design and performance evaluation
- National DBT course provides the process for developing a DBT

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Defining the Threat

• RETURN TO 225/REVISION 5 WORKSHOP

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Nuclear Material Categorization (IAEA Categorization)

Physical Protection Requirements

Material	Form	Category I	Category II	Category III ^c
I. Plutonium	Unirradiated ^b	2 kg or more	Less than 2 kg but more than 500 g	500 g or less but more than 15 g
2. Uranium-235	Unirradiated ^b - Uranium enriched to 20% ²³⁵ U or more	5 kg or more	Less than 5 kg but more than 1 kg	1 kg or less but more than 15 g
	- Uranium enriched to 10% ²³⁵ U but less than 20% ²³⁵ U		10 kg or more	Less than 10 kg but more than 1 kg
	- Uranium enriched above natural but less than 10% ²³⁵ U			10 kg or more
3. Uranium-233	Unirradiated ^b	2 kg or more	Less than 2 kg but more than 500 g	500 g or less but more than 15 g
4. Irradiated Fuel (The categorization of irradiated fuel in the table is based on international transport considerations. The State may assign a different category for domestic use, storage, and transportation taking all relevant factors into account.)			Depleted or natural uranium, thorium or low-enriched fuel (less than 10% fissile content) ^{d/e}	

^a All plutonium except that with isotopic concentration exceeding 80% in plutonium-238.

^b Material not irradiated in a reactor or material irradiated in a reactor but with a radiation level equal to or less than 1 Gy/hr

^c Quantities not falling in Category III and natural uranium; depleted uranium and thorium should be protected at least in accordance with prudent management practice.

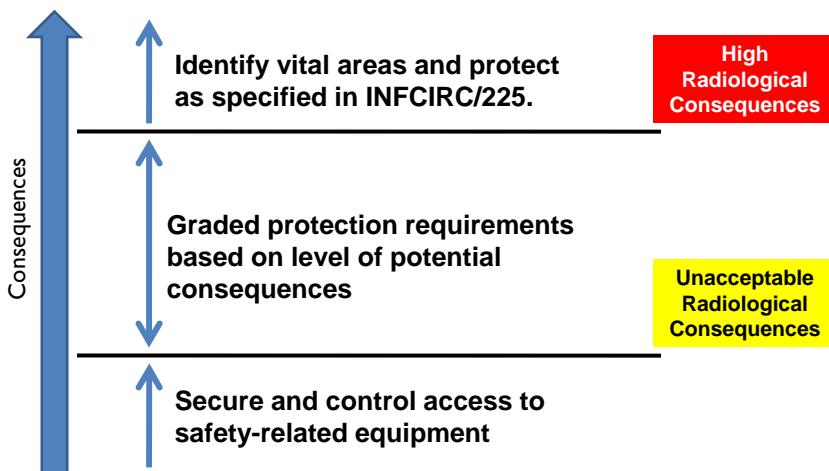
^d Although this level of protection is recommended, it would be open to States, upon evaluation of the specific circumstances, to assign a different category of physical protection.

^e Other fuel which by virtue of its original material content is classified as Category I or II before irradiation may be reduced one category level while the radiation level from the fuel exceeds 1 Gy/hr (100rad/hr) at one meter unshielded.

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Consequences - URC and HRC

Physical Protection Requirements



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Risk Based Physical Protection System and Measures

- Risk management
- Graded approach
- Defence in depth

Risk Management

- State is now asked to manage the risk of theft and sabotage to keep the risk at acceptable levels
- Requires assessing threat and potential consequences
- Developing a legislative, regulatory, and programmatic framework ensures that appropriate effective physical protection measures are put in place

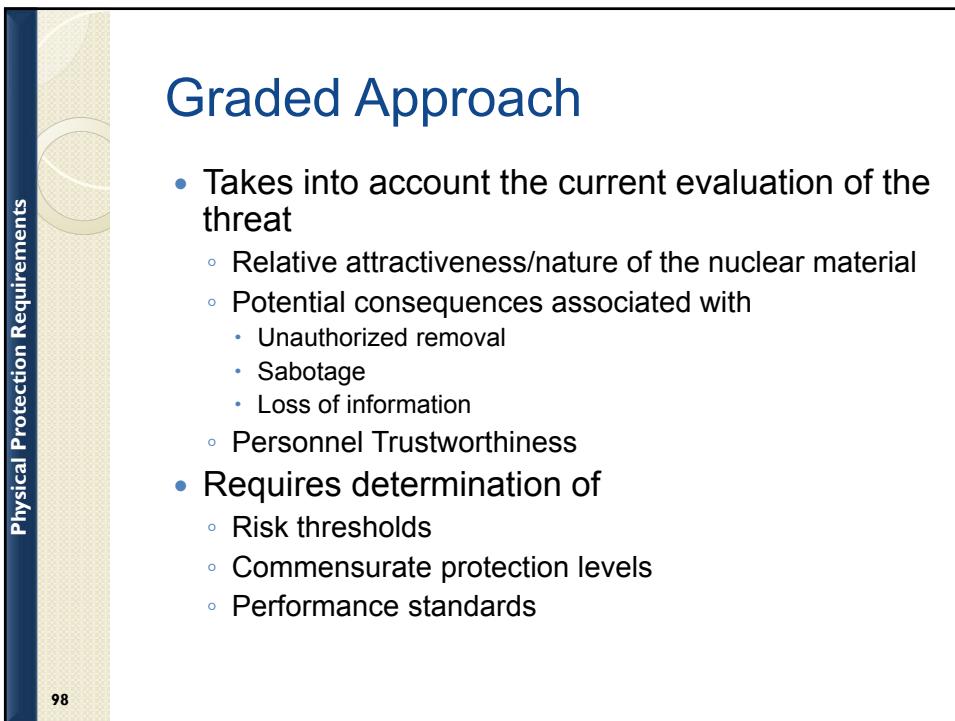
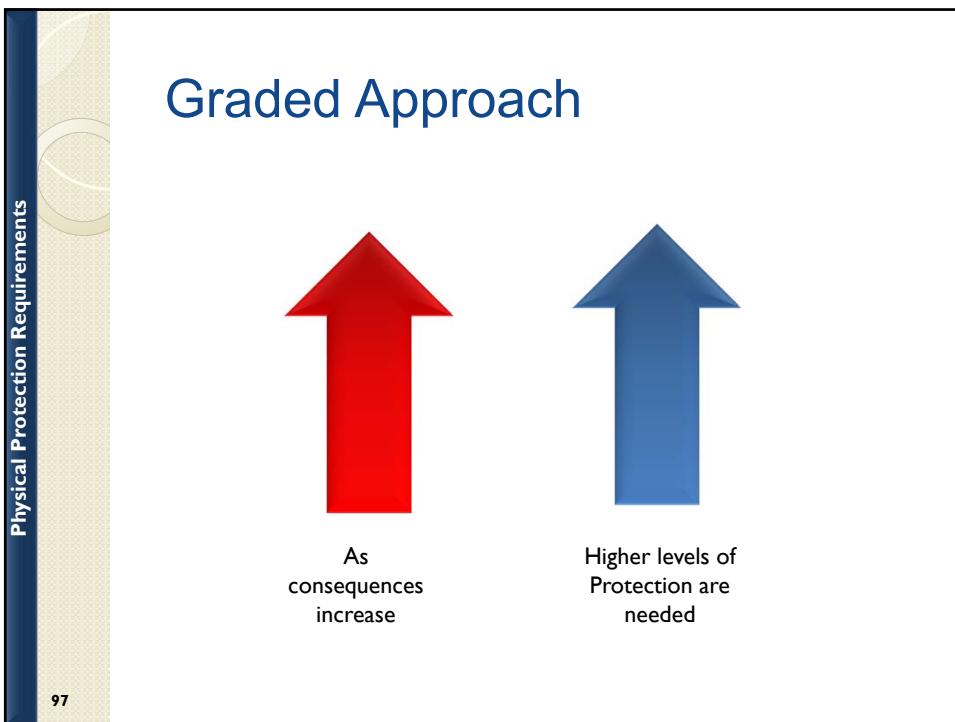
Risk Management (3.41-3.42)

- Risk can be managed by
 - Reducing the threat
 - Improving the effectiveness of the physical protection system
 - Reducing the potential consequences of malicious acts by modifying specific contributing factors

Graded Approach

Fundamental Principle H

Physical protection requirements should be based on a graded approach, taking into account the current evaluation of the threat, the relative attractiveness, the nature of the nuclear material, and potential consequences associated with the unauthorized removal of nuclear material and with the sabotage against nuclear material or nuclear facilities.



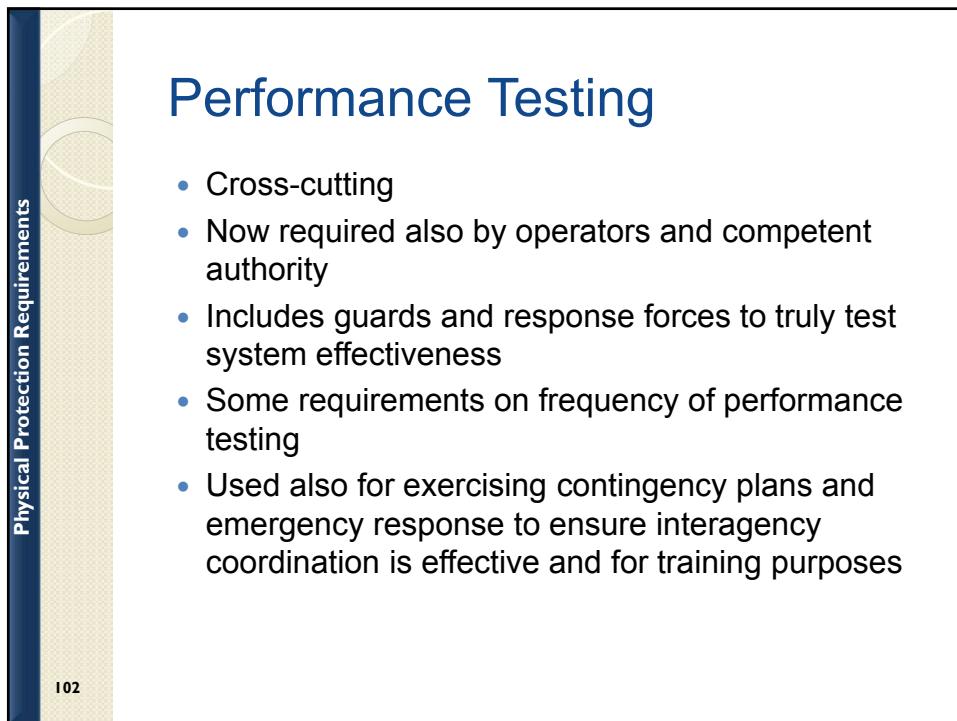
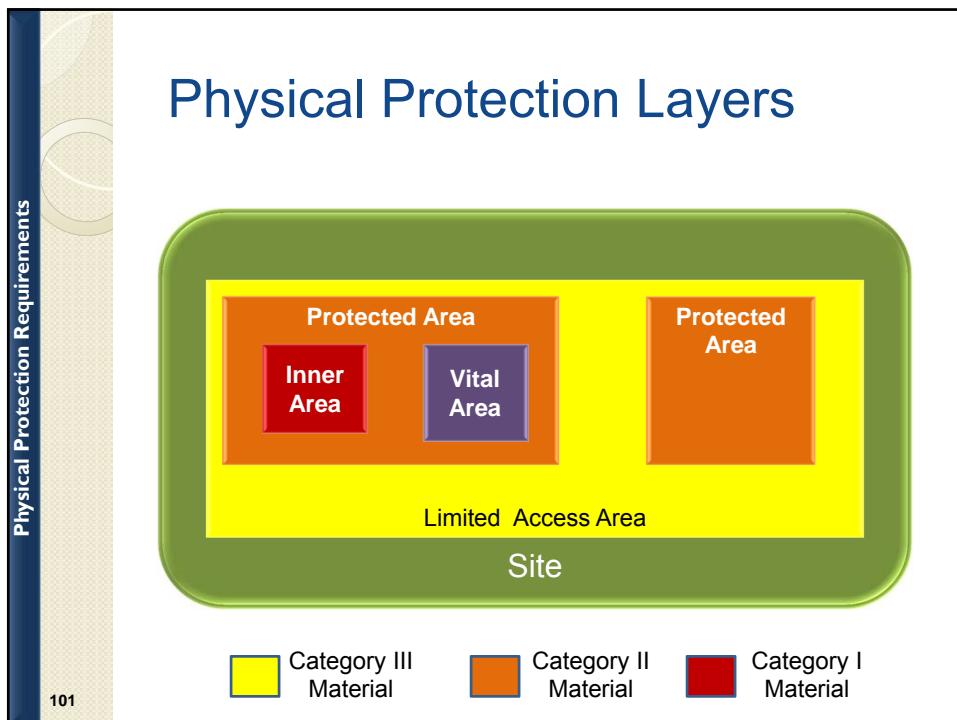
Defence In Depth

Fundamental Principle I

The State's requirements for physical protection should reflect a concept of several layers and methods of protection (structural, other technical, personnel, and organizational) that have to be overcome or circumvented by an adversary in order to achieve his objectives.

Defence in Depth

- Physical Protection System has layers of protection
- Includes mixture of protection methods
 - Hardware (security devices)
 - Procedures (including the organization of guards and the performance of their duties)
 - Facility Design (including layout)
- Applies to detection, delay, and response
- Takes into account system for nuclear material accountancy and control to protect against insiders and external threats





International Transport

Fundamental Principle B

The responsibility of a State for ensuring that nuclear material is adequately protected extends to the international transport thereof, until that responsibility is properly transferred to another State, as appropriate.



International Transport

- Continuous control of nuclear material while under jurisdiction of the State
- Custody transfer process
 - Fellow CPPNM party
 - Formal agreement for continued appropriate physical protection
 - Coordination and status communications
- Special provisions for Category I material

International Cooperation and Assistance

- Exchange information on physical protection techniques and practices
- Provide points of contact to the IAEA
- Share credible threat intelligence or information on nuclear security events

State Physical Protection Regime Responsibilities

Topic	INFCIRC/225/Revision 5 References
PP Regime	3.1-58
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

Summary of New Emphasis

- Graded approach applied to
 - Personnel trustworthiness (3.14)
 - Unacceptable radiological consequences for sabotage (3.44)
- Off-site response coordination (3.25)
 - Especially with off-site response
- Performance testing by the operator (3.29)
 - Previously just the responsibility of the State
- PPS & NMACS integration (3.47)
 - To protect against insiders and external threats

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Session 4 Activity

- Please complete Session 4 Activity in your book.

108

INFCIRC/225/Revision 5

◦ **ELEMENTS OF A STATE'S PHYSICAL PROTECTION REGIME – PART 3**

COMPETENT AUTHORITY

SESSION 5

109

Competent Authority

Fundamental Principle D

The State should establish or designate a competent authority that is responsible for the implementation of the legislative and regulatory framework and is provided with adequate authority, competence, and financial and human resources to fulfill the assigned responsibilities. The State should take steps to ensure an effective independence between the functions of the State's competent authority and those of any other body in charge of the promotion or utilization of nuclear energy.

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Competent Authority (continued)

- Designated by the State with clearly defined legal status and independent from
 - Applicants
 - Operators
 - Shippers
 - Carriers
- Provided adequate
 - Legal authority
 - Competence
 - Financial resources
 - Human resources

III

Competent Authority (continued)

- Have access to State's system for nuclear material accountancy and control
- Be responsible for verifying continued compliance
- Conducting evaluation based on performance testing
- Ensure corrective actions are taken when needed
- Provide timely reports for nuclear security events

112

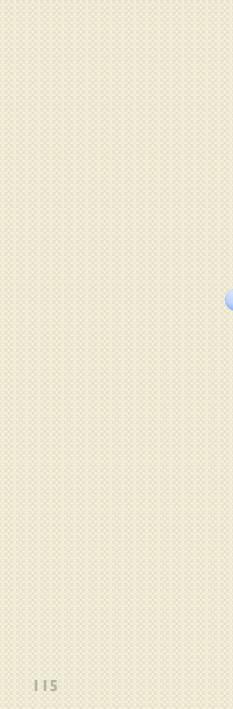
Competent Authority Physical Protection Regime Responsibilities

Topic	INFCIRC/225/Revision 5 References
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	5.4, 5.9, 5.15, 5.41
Transport	3.7, 6.22, 6.27, 6.33-34

113

COMPLETE EXERCISE 5

114



- **DO YOU KNOW WHO YOUR COMPETENT AUTHORITIES ARE?**

115

Competent Authority & Response

Is your response

- Off-site?
- On-site?

Who is the Competent Authority for Response?



116

INFCIRC/225/Revision 5

◦ **ELEMENTS OF A STATE'S PHYSICAL PROTECTION REGIME – PART 4**

LICENCE HOLDERS

SESSION 6

117

Licence Holders

Fundamental Principle E

The responsibilities for implementing the various elements of physical protection within a State should be clearly identified. The State should ensure that the prime responsibility for the implementation of physical protection of nuclear material or of nuclear facilities rests with the holders of the relevant licences or of other authorizing documents (e.g., operators or shippers).

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Responsibilities of Licence Holders

Defined as operators or shipper/carriers

- Compliance with regulations
- Cooperation & coordination with State entities having physical protection responsibilities
- Material accountancy and control
- Development of security plan and contingency plan
- Optimum site selection and design
- Development and implementation of means and procedures for evaluation and maintenance of the PPS
- Compensatory measures

119

Security Plans (3.27)

- Based on threat assessment or DBT
- Contain sections dealing with design, evaluation, implementation, and maintenance of the physical protection system and contingency plans
- Reviewed and approved by the competent authority
- Kept current by the operator
- Operator compliance verified by Competent Authority

120

Compensatory Measures (3.30)

- Used when the physical protection system is determined to be incapable of providing the required level of protection
- Used until corrective actions have been
 - Reviewed and approved by the competent authority
 - Implemented by the operator
 - Verified by the competent authority

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Licence Holder Physical Protection Regime Responsibilities

Topic	INFCIRC/225/Revision 5 References
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

122

Category-Based Physical Protection Requirements

Topic	Category I	Category II	Category III
Unauthorized Removal	4.1-49	4.1-35	4.1-20
Transport	6.1-43	6.1-31	6.1-18

123

• **COMPLETE EXERCISE 6**

124

INFCIRC/225/Revision 5

• **ELEMENTS OF A STATE'S PHYSICAL
PROTECTION REGIME**

**SUSTAINMENT & PREPAREDNESS – ALL
SESSION 7**

125

Sustaining the Physical Protection Regime

- Nuclear security culture
- Quality assurance
- Confidentiality
- Sustainability programme

126

Nuclear Security Culture

Fundamental Principle F

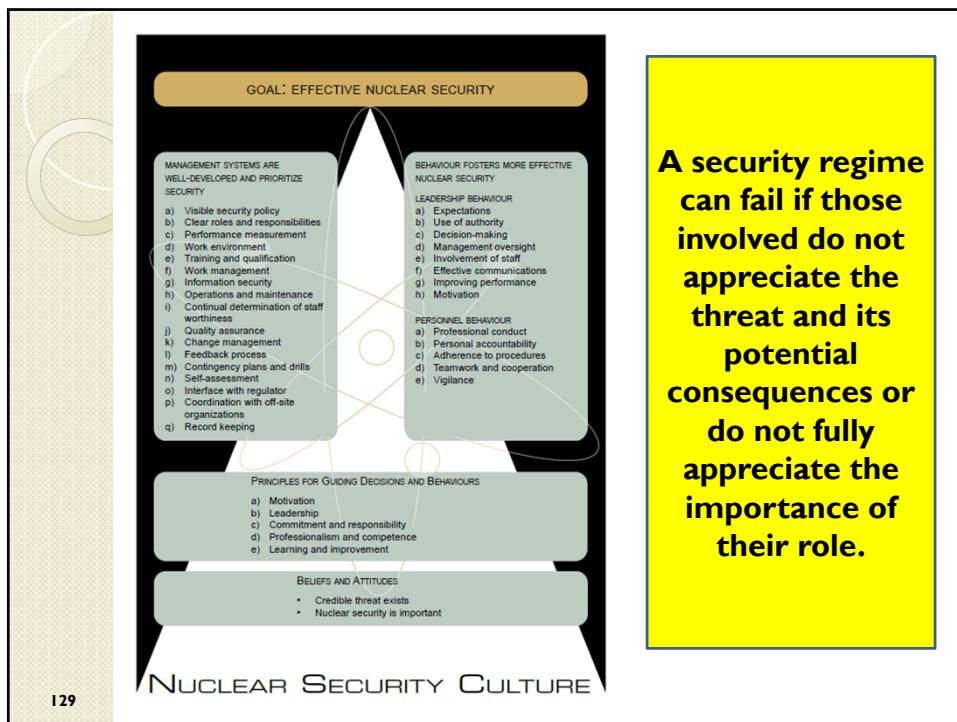
All organizations involved in implementing physical protection should give due priority to the security culture, to its development and maintenance necessary to ensure its effective implementation in the entire organization.

127

Nuclear Security Culture (3.48 – 3.51)

- Consistent with IAEA Nuclear Security Culture (NSS-7)
- Recognizes that a credible threat exists and that the individual plays an important role in preserving nuclear security
- Brings together State, organizations, managers, and individuals to work together for better security
- Includes establishment and communication of strong security policies, guidelines, and
- Provides regular security training
- Is pervasive in all elements of the regime

128



A security regime can fail if those involved do not appreciate the threat and its potential consequences or do not fully appreciate the importance of their role.

Quality Assurance

Fundamental Principle J

A quality assurance policy and quality assurance programme should be established and implemented with a view to providing confidence that specified requirements for all activities important to physical protection are satisfied.

130



Quality Assurance (3.52)

- Establish and implement policy and programmes to provide confidence that specified requirements for all activities important to physical protection are satisfied
 - Design
 - Implementation
 - Operation
 - Maintenance
- Ensure physical protection systems are designed, implemented, operated, and maintained in a condition capable of
 - Meeting State's requirements
 - Effectively responding to threats – **theft and sabotage**

131

Confidentiality

Fundamental Principle L

The State should establish requirements for protecting the confidentiality of information, the unauthorized disclosure of which could compromise the physical protection of nuclear material and nuclear facilities.

132



Confidentiality (3.53 – 3.55)

- Protection of specific or detailed information for which the unauthorized disclosure could compromise the physical protection of nuclear material and nuclear facilities
 - What information needs protection
 - How it should be protected
- Limit access to sensitive information
 - Those whose trustworthiness has been established
 - And who need to know it for the performance of their duties
- Sanctions for violations

133



Sustainability Programme (3.56)

- Requires commitment of necessary resources
- Encompasses:
 - Operating procedures (instructions)
 - Human resource management and training
 - Equipment updating, maintenance, repair, and calibration
 - *Performance testing* and operational monitoring
 - Configuration management
 - Resource allocation and operational cost analysis

134



Planning and Preparedness for and Response to Nuclear Security Events

Fundamental Principle K

Contingency (emergency) plans to respond to unauthorized removal of nuclear material or sabotage of nuclear facilities or nuclear material, or attempts thereof, should be prepared and appropriately exercised by all licence holders and authorities concerned.

135

Planning and Preparedness for and Response to Nuclear Security Events

- Established by the State
- Competent authority ensures operator contingency plans are consistent with and complementary to the State's contingency plan
- Operator contingency plans (approved by the competent authority) should effectively counter the threat taking the actions of response forces into consideration
- Coordination between guards and response forces during a nuclear security event should be regularly exercised
- Effectiveness of physical protection systems should be maintained during emergency conditions
- Initiated after detection and assessment of any malicious act.

136



Contingency Plans

- Roles, Responsibilities, and Associated Structure
- Description of Objectives
- Policy and concept of operations for a systematic, coordinated, and effective response
- Arrangement and protocols for appropriate State agencies, operators/shippers/carriers, and other response organizations or relevant entities
- Plans to counter the threat assessment or design basis threat
- Actions of the response force both on-site and off-site
- Maintenance of physical protection effectiveness

137

Contingency Plans (continued)

Exercised to

- Assess and validate contingency plans
- Train participants
- Ensure response forces
 - Are familiar with
 - Sites
 - Nuclear material locations
 - Sabotage targets
 - Have adequate knowledge of radiation protection

138

Contingency Plans Versus Emergency Plans

Contingency Plan

- Includes measures which focus on preventing further damage, on securing the nuclear facility, and on protecting emergency equipment and personnel

Emergency Plan

- Consists of measures to ensure mitigation or minimization of the radiological consequences as well as human errors, equipment failures and natural disasters

Contingency plans and emergency plans should be comprehensive and complementary.

139

Session 7 Exercise

- Please complete the worksheet for Session 7 Exercise

140

INFCIRC/225/Revision 5

• **CHANGES TO PPS FOR NUCLEAR
MATERIALS IN USE AND STORAGE**

SESSION 8

141

Overview of Changes

- New structure that is additive and material category-based structure
- Addresses measures to locate and recover missing or stolen nuclear material
- Includes protection of computer-based systems
- Describes prudent management practices

142

General Requirements

- Integration of physical protection systems against theft and sabotage
- Application of the most stringent measures between theft and sabotage
- Prudent management practices include securing against unauthorized removal and unauthorized access.

143

Categorization of Materials

- No changes to table or footnotes
- Moved to this section to emphasize its application to theft versus misapplication for sabotage
- Caution added for downgrading level of protection based on radiation level without considering time to incapacitate the potential adversary

144

Protection of Computer-Based Systems

Potentially Vulnerable Systems

- Physical protection
- Nuclear safety
- Nuclear material accountancy and control

Compromise Concerns

- Cyber attack
- Manipulation
- Falsification

145

Additive Approach for Category-Based Physical Protection

Category	Relevant Paragraphs
Category III	4.1-4.20
Category II	4.1-4.35
Category I	4.1-4.49

146

New Requirements for All Categories

Revision 5	Why Change Revision 4?
Limited access area is defined and required (4.14)	Previously referred to as “area to which access is controlled”
Access control systems should be protected against compromise (4.17)	Previously only for Cat I and Cat II access control systems
Response forces should be familiar with the site and nuclear material locations (4.20)	New requirement for more effective response

147

Additional Requirements for Categories II and I

Revision 5	Why Change Revision 4?
Security Communications (4.32)	Previously no requirement for secure communications
24-hour guard service and response force (4.33)	Previously just Cat I; also appropriate for Cat II
Random patrols with specified functions (4.34)	Also appropriate for Cat II and defines specified functions
Regular performance testing, including guards and response force (4.35)	Called only for periodic evaluation

148

Additional Requirements for Category I

Revision 5	Why Change Revision 4
Inner area delay for both insider and external adversaries (4.39)	No recommendations to address the insider
Vehicle barriers should be installed at an appropriate distance (4.41)	No requirement for vehicle barriers
Redundant capability for initiation of response and communication should be provided for CAS (4.47)	No requirements for back-up-CAS
Annual performance testing of PPS including response forces, e.g. force-on-force (4.49)	No annual testing requirement or force-on-force example

149

Greater Protection Against the Insider Threat

Revision 5	Why Change Revision 4?
NMACS systems integrated with physical protection systems to protect against insider threats	NMACS systems were not required or linked to either the Physical Protection System or the Insider Threat
Category I facilities ➤ Inner area delay ➤ Two-person rule ➤ Vehicles, persons, and packages inspections inner areas	No recommendations for protection against the insider threat in inner areas for Category I facilities
Category I and II facilities ➤ Record of all persons with access to computer systems that control access to nuclear material	List of persons only included those who had access (keys) to the containment or storage of nuclear material only
Category III facilities ➤ Custody and shift inventory check for nuclear material handlers	Custody and shift inventory check previously applied to Category I and II only

150

New Locate & Recover Requirements (4.50-4.63)

State	Licence Holder
Ensure rapid response to locate and recover	Timely detection of missing material
Define roles and responsibilities	Confirmation of missing material through rapid inventory using NMACS
Ensure State and operator contingency plans exist	Notification of competent authority
Assure exercise and review of State contingency plans	Contingency plans, including <ul style="list-style-type: none">• Off-site pursuit, if needed• Measures to locate and recover material
	Ability to security and return material to appropriate nuclear facility
	Provide assistance to the State

151

• **ANY QUESTIONS ABOUT PROTECTION OF MATERIALS IN USE AND STORAGE?**

152

INFCIRC/225/Revision 5

• **CHANGES TO PPS FOR NUCLEAR
MATERIALS AGAINST SABOTAGE**

SESSION 9

153

Overview of Changes

- Basis for Graded Approach
- Design Process
- Requirements for High Consequence facilities
- Requirements for Measure to Mitigate or Minimize the consequences from sabotage

154

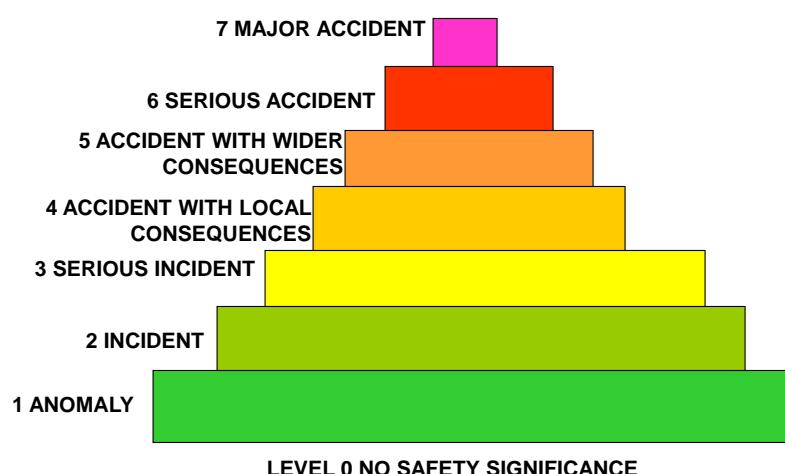
Basis for Graded Approach (5.4-5.8)

Revision 5

- Analysis validated by the competent authority to determine whether the radioactive inventory has the potential to result in unacceptable radiological consequences as determined by the State
 - Consideration for the range of radiological consequences associated with nuclear facilities
 - Grade radiological consequences that exceed unacceptable radiological consequences and assign appropriate levels of protection with defined physical protection design objectives and/or measures
 - Otherwise, protect safety related equipment and devices by controlling access to them and securing them
- Identify sabotage targets using graded radiological consequences

155

Nuclear and Radiological Event Scale



156

www.iaea.org/Publications/Factsheets/English/ines.pdf

Design Process (5.9-5.19)

Revision 5

- Operator designs and implements PPS that is effective against the defined threat and credible scenarios, including insider adversaries and stand-off attacks, and using a response strategy of denial of access

Revision 4

- No explanation of process and no mention of response strategy

157

Requirements for High Consequence Facilities (5.20-5.42)

Revision 5

- Includes but not limited to Nuclear Power Plants
- Requires protection measures for high consequence facilities analogous to those for Category I theft
- Discusses the protection of vital areas to prevent high radiological consequences

Revision 4

- Only Nuclear Power Reactors (NPRs) were cited
- Measures for NPRs analogous to Category I theft
- Vital areas were linked to just NPRs and not to unacceptable radiological consequences

158

Requirements for Measures to Mitigate or Minimize (5.44-5.48)

Revision 5

- New sets of requirements for the State and operator
- Develop security contingency plans
 - Prevent further damage
 - Secure the facility
 - Protect emergency equipment and personnel
 - Response forces must be familiar with site, sabotage targets and knowledge of radiation protection
- Contingency plan complements safety emergency plan by focusing on preventing further damage, securing the nuclear facility, and protecting emergency equipment and personnel

Revision 4

- Mentions, but does not provide requirements for measures

159

New Mitigation/Minimization Requirements (5.44-5.58)

State	Licence Holder
Define roles and responsibilities	Prepare facility personnel to act in full coordination with response
Ensure State and operator contingency plans exist, are complementary, and regularly reviewed and updated	Establish contingency plans
Coordinate response to prevent further damage, security of the nuclear facility, and protect emergency equipment and personnel	Take measures to prevent further damage, security of the nuclear facility, and protect emergency equipment and personnel
Response force familiarization with site and sabotage targets	Notify competent authority of sabotage or sabotage attempt

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INFCIRC/225/Revision 5

• **CHANGES TO PPS FOR NUCLEAR
MATERIALS DURING TRANSPORT**

SESSION 10

161

Overview of Changes

- New organization of requirements
 - Graded, additive approach
 - Covers all 4 objectives
 - Unless otherwise noted, applies to the shipper/carrier
- Use of most stringent requirements (6.1-6.3)
- Consideration for the aggregation of material when planning physical protection (6.5)
- Minimize the time that packages and conveyances are let unattended (6.6)

162

New Structure

Section	Paragraphs		
General requirements	6.1-6.5		
Common requirements	6.6-6.10		
Unauthorized Removal	Category III 6.11-6.18	Category II 6.11-6.31	Category I 6.11-6.43
Locate and Recover	State 6.45-6.61	Carrier 6.52-6.55	
Sabotage	6.56-6.59		
Mitigate or Minimize	State 6.61-6.69	Carrier 6.70-6.73	

163

New Requirements for All Categories for Unauthorized Removal

- Packages should be in closed, locked conveyance, compartment or containers and packages should be tied down
- Locks and seals should be checked before dispatch and after an intermodal transfer
- Communication from the conveyance should be used to summon responders
- Receiver should check integrity of package and associated locks and seals

164

New Requirements for Categories II and I for Unauthorized Removal -

Revision 5	Why Change Revision 4?
Encourages the use of armed guards	No recommendation regarding guards (armed or otherwise) or response was included in Category II recommendations
Ensures delay is sufficient for the response	Only had recommendations for locks
Include surveillance of the cargo	Improve measures during transport
Maintain security of the conveyance	Improve measures during transport
Transport Security Plan	Better coordination of physical protection

165

New Requirements for Category I for Unauthorized Removal - Carrier

Revision 5	Why Change Revision 4?
Two-way communications should be secure and frequent	No requirement for secure communications
Guards or conveyance crew should report frequently	No requirements covering hand-over of materials, overnight stops, and arrival notices
For shipment by road, conveyance should carry second person with driver (two-person rule)	Only the load vehicle carried a guard

166

New Locate & Recover Requirements (6.44-6.55)

State	Carrier
Ensure rapid response to locate and recover	Alert for indication of theft or tampering
Define roles and responsibilities	Determination of missing material or misplaced, but still under control
Ensure State and operator contingency plans exist	Notification of competent authority and shipper
Assure exercise and review of State contingency plans	Provide assistance to the State

167

New Requirements for Sabotage

Revision 5	Why Change Revision 4?
Determine if measures additional to those for theft are needed based on potential radiological consequences	No distinction is made between measures for protection against theft and sabotage
Take into account safety features of package, container, and conveyance	Not mentioned
Consider alternative shipment options in case of elevated threat level	Not considered

168

New Mitigation/Minimization Requirements (6.60-6.73)

State	Carrier
Define roles and responsibilities	Prepare transport personnel to act in full coordination with response
Ensure State and operator contingency plans exist, are complementary, and regularly reviewed and updated	Establish contingency plans that interface with safety as appropriate
Coordinate response to prevent further damage, security of the nuclear transport, and protect emergency personnel	Take measures to secure the transport and minimize the consequences of the act.
Response force familiarization with typical transport operations and sabotage targets	Notify shipper, competent authority, response forces, and other relevant State organizations of sabotage or sabotage attempt

169

• **ANY QUESTIONS ABOUT PROTECTION OF MATERIALS DURING TRANSPORT?**

170

• PLEASE COMPLETE EXERCISE 10

171

Revision 5 Impacts

Do you see impacts to transportation of nuclear materials

- To your country?
- Within your country?
- Within your Facility?

172

INFCIRC/225/Revision 5

• **SUMMARY**

173

Summary

- INFCIRC/225/Revision 5 was revised to address an increased threat environment and ensure its compatibility with and guidance for implementation of the Amended CPPNM
- Revision 5 contains many strengthened recommended requirements for the protection of nuclear material during use, storage and transport

174

Summary of New Elements

- Risk Management with graded approach
- Sustaining the Physical Protection Regime
 - Security Culture
 - Confidentiality
 - Graded Approach
 - Quality Assurance
- Location and Recovery of Missing or Stolen Nuclear Material
- Minimize/Mitigate Consequences of Nuclear Sabotage

175

Additional Considerations

- Information Security including
 - Physical protection information
 - Digital alarm and communication
 - Digital instrumentation and control
- Personnel Trustworthiness
- Interfaces with
 - Nuclear material accountancy and control
 - Nuclear safety

176



Summary of Where More Detail Was Provided

- Clarification of use for design basis threat (DBT) and State's threat assessment
 - Category I
 - High consequence facilities
- New Threat Considerations
 - Stand-off attacks
 - Suicidal attacker - application of self-protecting principle
- Performance testing
- Contingency planning versus emergency planning

177



Conclusion

- Now Aligns with CPPNM
 - 4 Physical Protection Objectives
 - 12 Fundamental Principles of Physical Protection
 - Realization of the Physical Protection Regime
- Is based on risk management and performance testing
- Recommends elements for a physical protection regime

178



179

THANK YOU



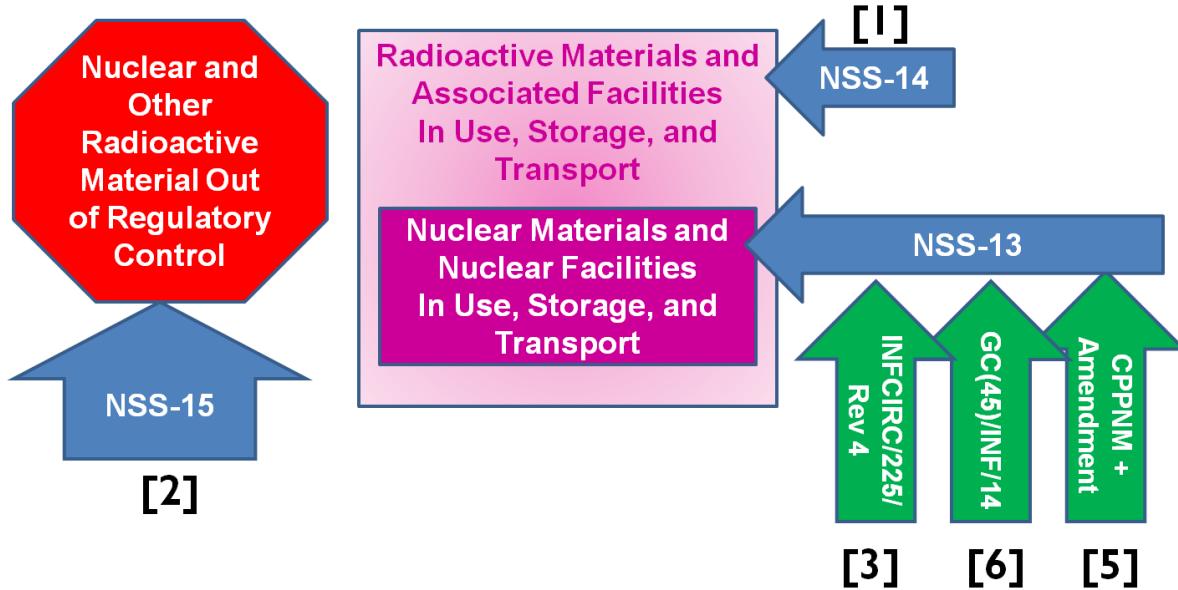
Nuclear Security Recommendations on the Physical Protection of Nuclear Materials and Nuclear Facilities (INFCIRC 225/Revision 5)

Requirements for a
State's Physical Protection Regime
and Overview of Changes in Revision 5

References and Student Activities

June 11-12, 2012

Session 1 References



[4] International Legal Framework for Nuclear Security

- [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. INF/CIRC/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). INF/CIRC/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).

Session 2

NSS-13 Definitions

Terms used in this publication are defined below and are italicized in the text.

No.	Term	Definition	Notes	✓
1	Access delay	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	Central alarm station	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	Competent authority	Governmental organization(s) or institution(s) that has(have) been designated by a State to carry out one or more nuclear security functions.		
4	Contingency plan	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	Conveyance	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	Defense-in-depth	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	Design basis threat	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	Detection	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	Force-on-force exercise	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	Graded approach	The application of <i>physical protection measures</i> proportional to the potential consequences of a <i>malicious act</i> .		
11	Guard	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	Inner area	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	Insider	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	Limited access area	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	Malicious act	An act or attempt of <i>unauthorized removal</i> or <i>sabotage</i> .		
16	Nuclear facility	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	Nuclear material	Material listed in Table 1, in Section 4 of this publication, including the material listed in its footnotes.		
18	Nuclear security culture	The assembly of characteristics, attitudes and behaviors of individuals, organizations and institutions which serves as means to support, enhance and sustain nuclear security.		
19	Nuclear security event	An event that is assessed as having implications for physical protection.		
20	Operator	Any person, organization, or government entity licensed or authorized to undertake the operation of a <i>nuclear facility</i> .		
21	Performance testing	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	Physical barrier	A fence, wall or similar impediment which provides <i>access delay</i> and complements access control.		
23	Physical protection measures	The personnel, procedures, and equipment that constitute a <i>physical protection system</i> .		
24	Physical protection regime	A State's regime including: <ul style="list-style-type: none"> - The legislative and regulatory framework governing the physical protection of <i>nuclear material</i> and <i>nuclear facilities</i>; - The institutions and organizations within the State responsible for ensuring implementation of the legislative and regulatory framework; - Facility and transport <i>physical protection systems</i>. 		
25	Physical protection system	An integrated set of <i>physical protection measures</i> intended to prevent the completion of a <i>malicious act</i> .		
26	Protected Area	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	Response forces	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	Sabotage	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	Shipper	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	Stand-off attack	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	System for nuclear material accountancy and control	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	Threat	A person or group of persons with motivation, intention and capability to commit a <i>malicious act</i> .		
33	Threat Assessments	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	Transport	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	Transport control centre	A facility which provides for the continuous monitoring of a <i>transport</i> conveyance location and security status and for communication with the <i>transport</i> conveyance, <i>shipper/receiver</i> , carrier and, when appropriate, its <i>guards</i> and the <i>response forces</i> .		
36	Two person rule	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	Unacceptable radiological consequences	A level of radiological consequences, established by the State, above which the implementation of <i>physical protection measures</i> is warranted.		
38	Unauthorized removal	The theft or other unlawful taking of <i>nuclear material</i> .		
39	Vital area	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.		

Session 2 Exercise

INCIRC/225/Revision 5 - Definitions

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

- A. *Physical Protection Regime/Entities*
- B. *PPS & Measures*
- C. *PPS Threats & Targets*
- D. *Transportation*
- E. *Other*

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

Session 3 Exercise

Name the associated responsible organization for the following physical protection regime legislative and regulatory framework elements.

Legal and Regulatory Framework Element	Responsible Organization
International transportation	
Assignment of responsibilities within all levels of involved governmental entities	
Formulation for defining a threat assessment and, if needed, a design basis threat	
Requirements for physical protection	
Requirements for licensing	
Requirements for evaluating elements of a physical protection system	
Specification of a trustworthiness policy	
Requirements for enforcing physical protection regulations	
Sanctions against the unauthorized removal and against sabotage	
Designation of a competent authority	
Protocols for interacting with the International Atomic Energy Agency	
Risk-management process capable of maintaining the risk of unauthorized removal and sabotage at acceptable levels	
Identifying methods to ensure an effective nuclear security culture is established	
Quality assurance policy and quality assurance programmes	
Requirements and sanctions for protecting the confidentiality of information,	
Sustainability programme sustained and long term by commitment of necessary resources	
Contingency plan to respond to unauthorized removal of nuclear material or sabotage of nuclear facilities or nuclear material	
Rapid and comprehensive measures to locate and recover missing or stolen nuclear material during transport	
International cooperation points of contact	

Session 4 Exercises

1. Does your State use a threat assessment or design basis threat as the basis for its physical protection systems?

2. Identify the category of nuclear material according to the table in INFCIRC/225/Revision 5:
 - 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

3. Match the term to the protection requirements:

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

4. Name 3 ways graded approach is applied:
 - A) _____
 - B) _____
 - C) _____

5. What organization in your State handles international transport of nuclear materials?

6. Who is your point of contact for the IAEA?

Session 5 Exercise

Who is your competent authority for the following:

1. Threat Assessment/Definition of DBT? _____
2. Licensing? _____
3. Regulations? _____
4. Inspections? _____
5. Response? _____
6. Emergency Response? _____

Session 6 Exercise

1. What category of nuclear material do you expect to use or are using at your nuclear facility? _____
2. What requirements are relevant to you?

3. Does your design include:
 - Limited Access Area? _____
 - Protected Areas? _____
 - Inner Areas? _____
4. Does your design include security by design? _____
5. Do your security plans include contingency plans?

Session 7 Exercise

1. How pervasive is the nuclear security culture in your country and facilities?
2. How do you assure confidence that physical protection systems are adequately performing?
3. How do you identify sensitive information?
4. How is access to this information limited?
5. What resources do you have in place to ensure continuity of physical protection systems?
 - a) Human resources
 - b) Technology
 - c) Procedures
 - d) Configuration management
 - e) Financial
6. How are your contingency plans exercised and how often?

Session 8 Activity

Which category(s) of material does the recommended protection requirement refer to?

Category(s)	Recommended Requirement	Para. Reference
	Computer-based systems used for physical protection, nuclear safety, and nuclear material accountancy and control should be protected against compromise.	
	Nuclear material handlers should follow procedures for custody and shift inventory checks.	
	Guards should conduct random patrols of the protected area.	
	Provisions, including redundancy measures, should be in place to ensure the functions of the central alarm station continue during an emergency.	
	Constant surveillance should be used to counter the insider threat.	
	Regular testing should involve operator and response forces.	
	Caution should be exercised regarding the categorization level for irradiated nuclear material.	
	Records should be kept of all persons having access to computer systems that control access to nuclear material.	
	Physical protection systems should be tested at least annually, for example by force-on-force exercises.	
	Nuclear material should be used and stored in a limited access area.	
	Response forces need to be familiar with the site, nuclear material locations, and knowledge of radiation protection.	
	Nuclear material that is required to be protected in accordance with prudent management practice should be secured against unauthorized removal and unauthorized access.	
	Inner area delay should counter insiders and external adversaries.	
	Airborne threats should be considered.	
	24-hour guards and response forces should be provided.	
	Access control measures should be protected against compromise.	
	Vehicle barriers against land and water vehicles should be installed an appropriate distance outside the inner area.	
	Voice communication between the central alarm station and response forces should be secure.	
	Vehicles, persons, and packages should be subject to search upon entering both the protected area and the inner area.	

Session 9 Activity

Identify whether or not the item is a requirement for facilities with High Radiological Consequences?

Y/N	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	
	Protection level depending on the degree of radiological consequence	

Name 3 things the contraband detection system should be capable of detecting?

1. _____
2. _____
3. _____

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

Session 10 Activity

Which category(s) of material does the recommended protection requirement refer to?

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.	

Identify a new requirement for location and recovery of material missing or stolen during transport.

Name two notification requirements for minimizing/mitigating the effects of sabotage consequences.

1.

2.

Summary Tables

INFCIRC/225/Revision 5 references pertaining to the responsibilities for each of the following Physical Protection Regime entities.

Topic	INFCIRC/225/Revision 5 Reference
STATE	
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
COMPETENT AUTHORITY	
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
LICENCE HOLDER	
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

Category-Based Physical Protection Requirements

Topic	Category I	Category II	Category III
Unauthorized Removal	4.1-49	4.1-35	4.1-20
Transport	6.1-43	6.1-31	6.1-18

**Fixed Facility Physical Protection Measures Reference Sheet to
INFCIRC/225/Revision 5**

Material State	In Use and Storage			Sabotage for High Consequence Facilities
Material Category	Category III	Category II	Category I	
Protection Layer	Limited Access Area	Protected Area	Inner Area	Vital 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

Discussion Questions

1. Describe your State's provisions for locating and recovering missing or stolen nuclear material.
2. Describe your State's provisions for mitigating or minimizing the effects of a sabotage nuclear event.
3. Do your State's laws specifically address:
 - a. Trustworthiness?
 - b. Information Security?
 - c. Enforcement?
 - d. Sanctions (including criminal penalties)?
4. Discuss how your threat assessment and/or DBT is developed. How often is it updated?
5. Do your inspection processes include regular performance, inspection criteria, and performance-based evaluations?
6. Do your facility evaluations include performance testing? If so, how are they conducted?
7. Do your facilities have security plans, contingency plans, compensatory measures, and emergency plans?
8. What is the biggest challenge in physical protection regime and system sustainment?

9. Discuss the interactions between response forces and guards and your country's decision on whether response forces are on-site or off-site.

10. Discuss whether you have existing physical protection systems and how these changes will affect your country's physical protection regime or the decisions that will need to be made when planning physical protection for new facilities.