SAND2011-7908P

INFCIRC/225/Revision 5

Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities

Sandia National Laboratories

October 2011

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SAND2011 - XXXX

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

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

Format of the Workshop

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

INFCIRC/225/Revision 5

BACKGROUND

SESSION I

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

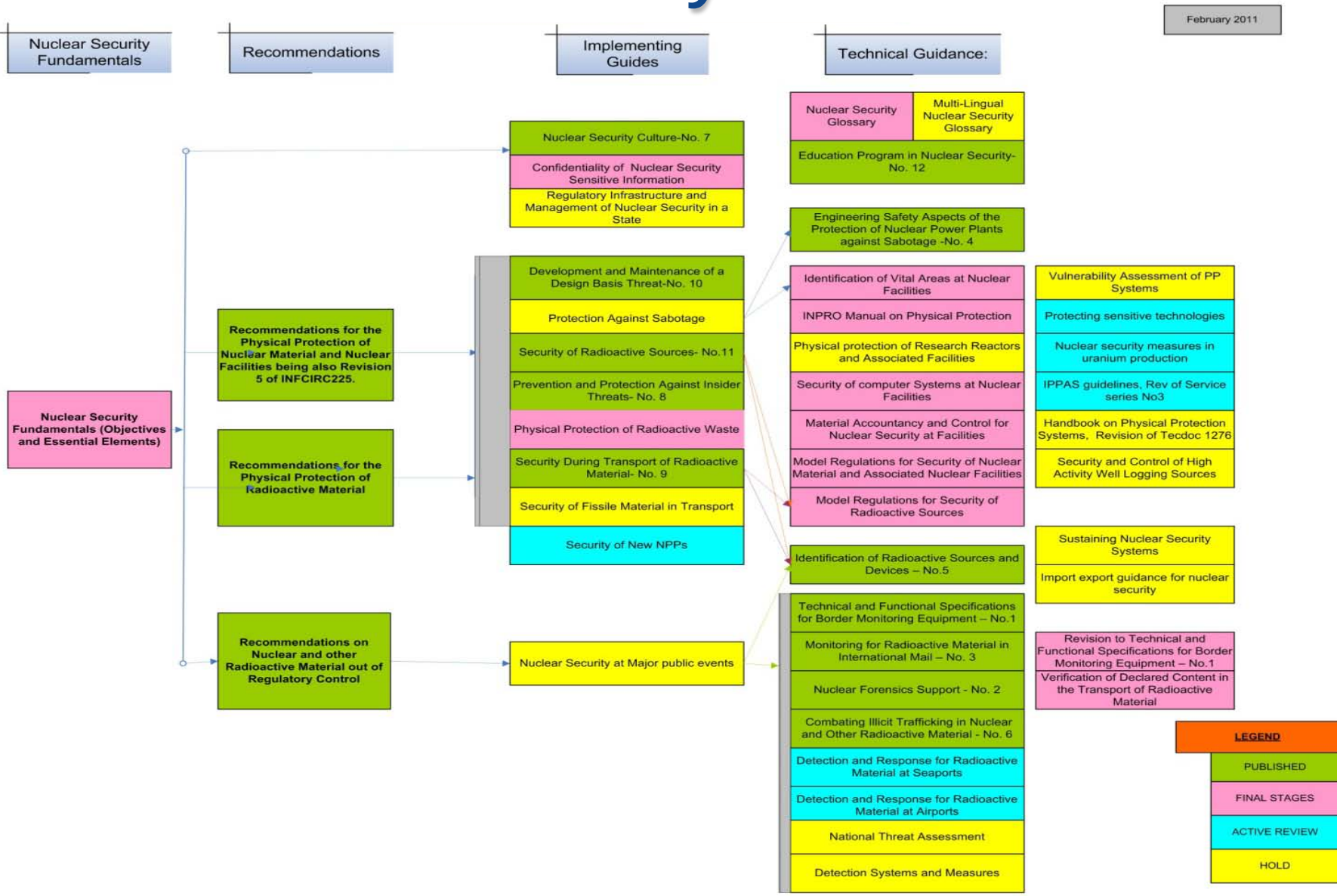
Why Revision 5? (continued)

- The IAEA Convention on the Physical Protection of Nuclear Material, INFCIRC/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

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 measures

Nuclear Security Series



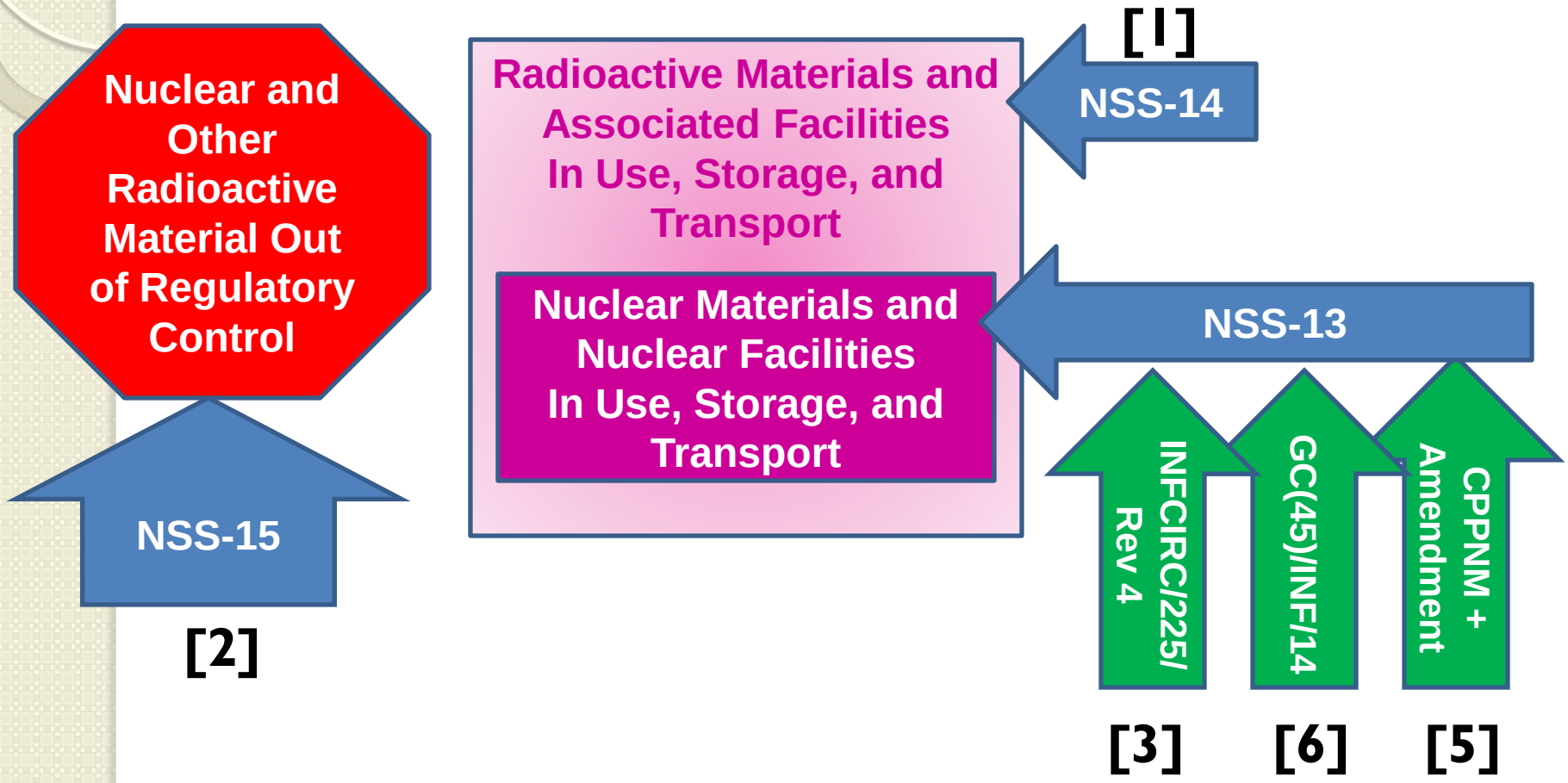
Scope of INFCIRC/225/Revision 5

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

Scope of INFCIRC/225/Revision 5

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

References in INFCIRC/225 Revision 5



[4] International Legal Framework for Nuclear Security

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

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

INFCIRC/225/Revision 5

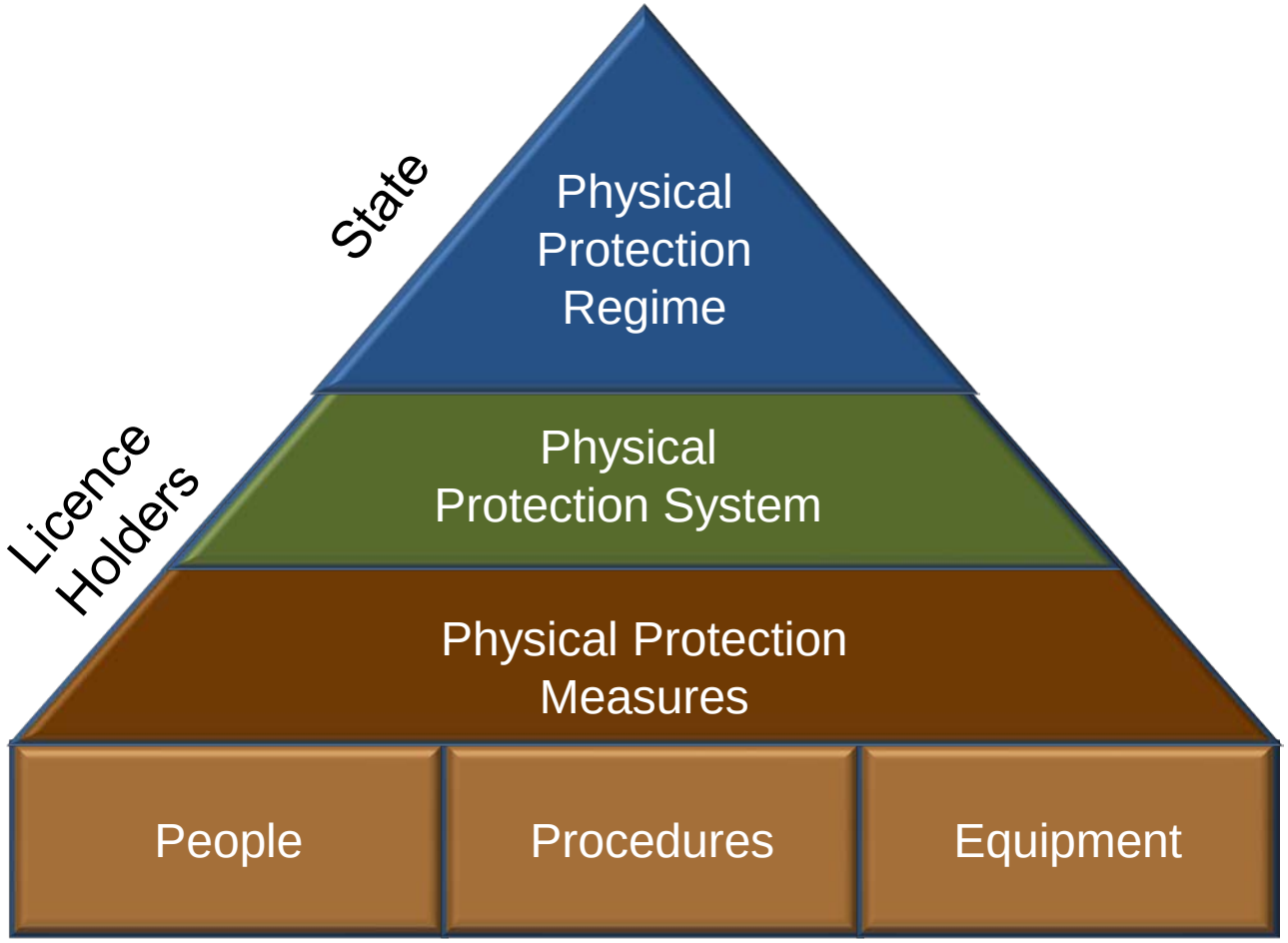
DEFINITIONS

SESSION 2

Session 2 Exercise

- 39 terms numbered in your book
- Numbers in parenthesis correspond to those numbers
- Go through definitions using context-based approach
- As we discuss a term, check the box to the left of the definition.
- When we have finished this section, all 39 terms will have been covered
- Definitions begin on page 51 of NSS-13

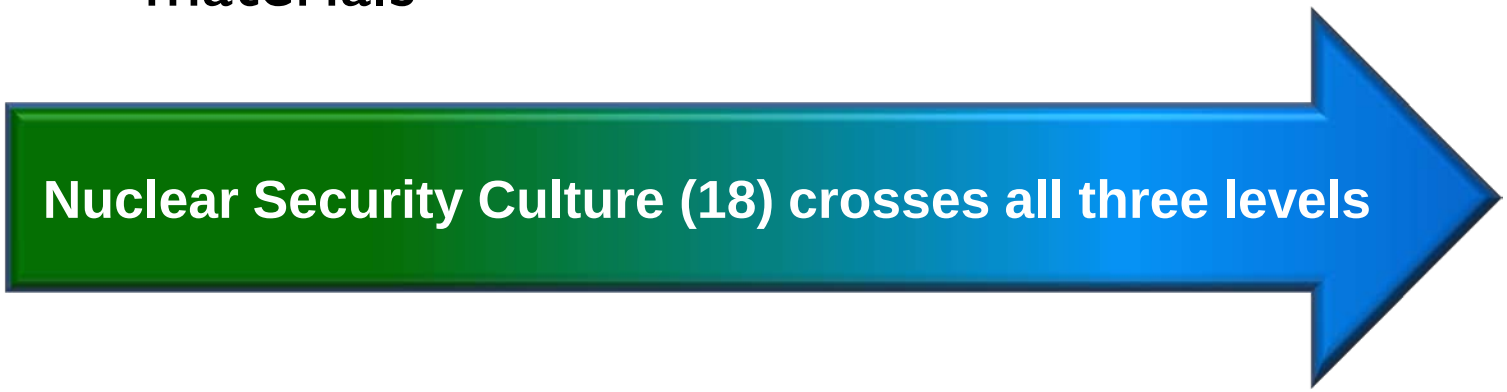
Physical Protection



Physical Protection Regime (24)

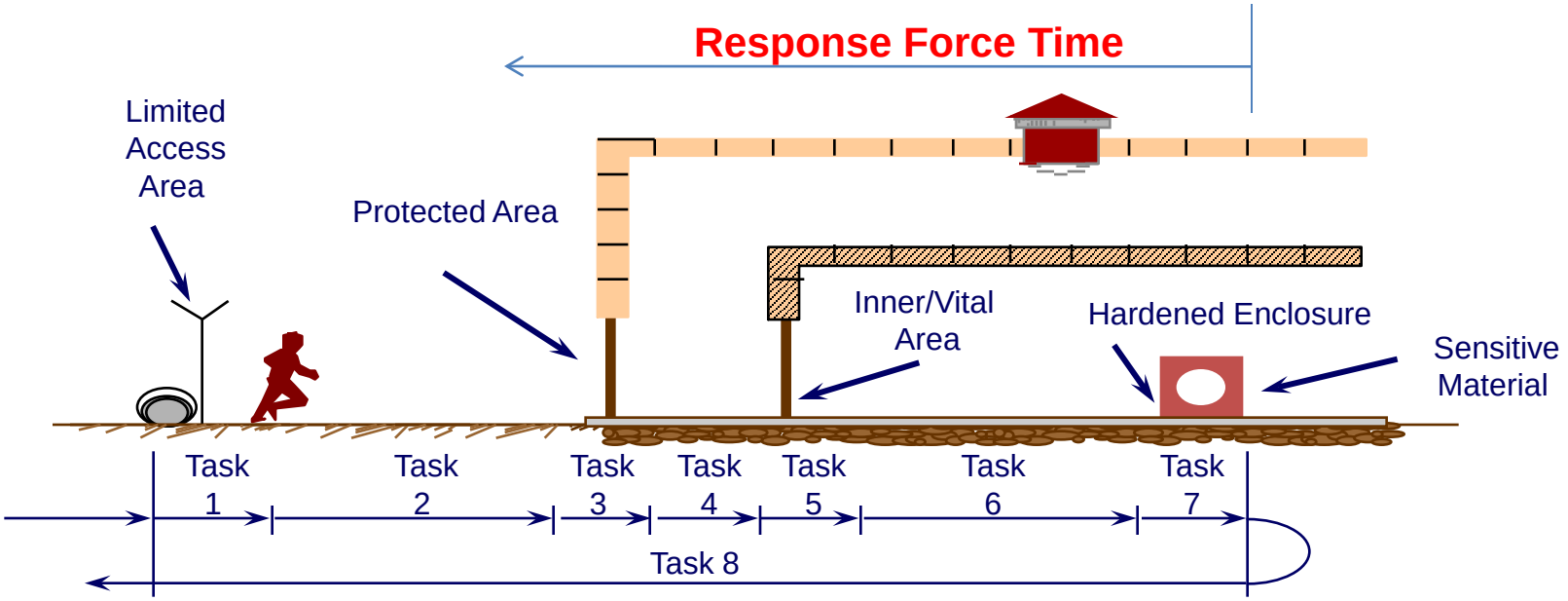
Physical Protection Regime Entities

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

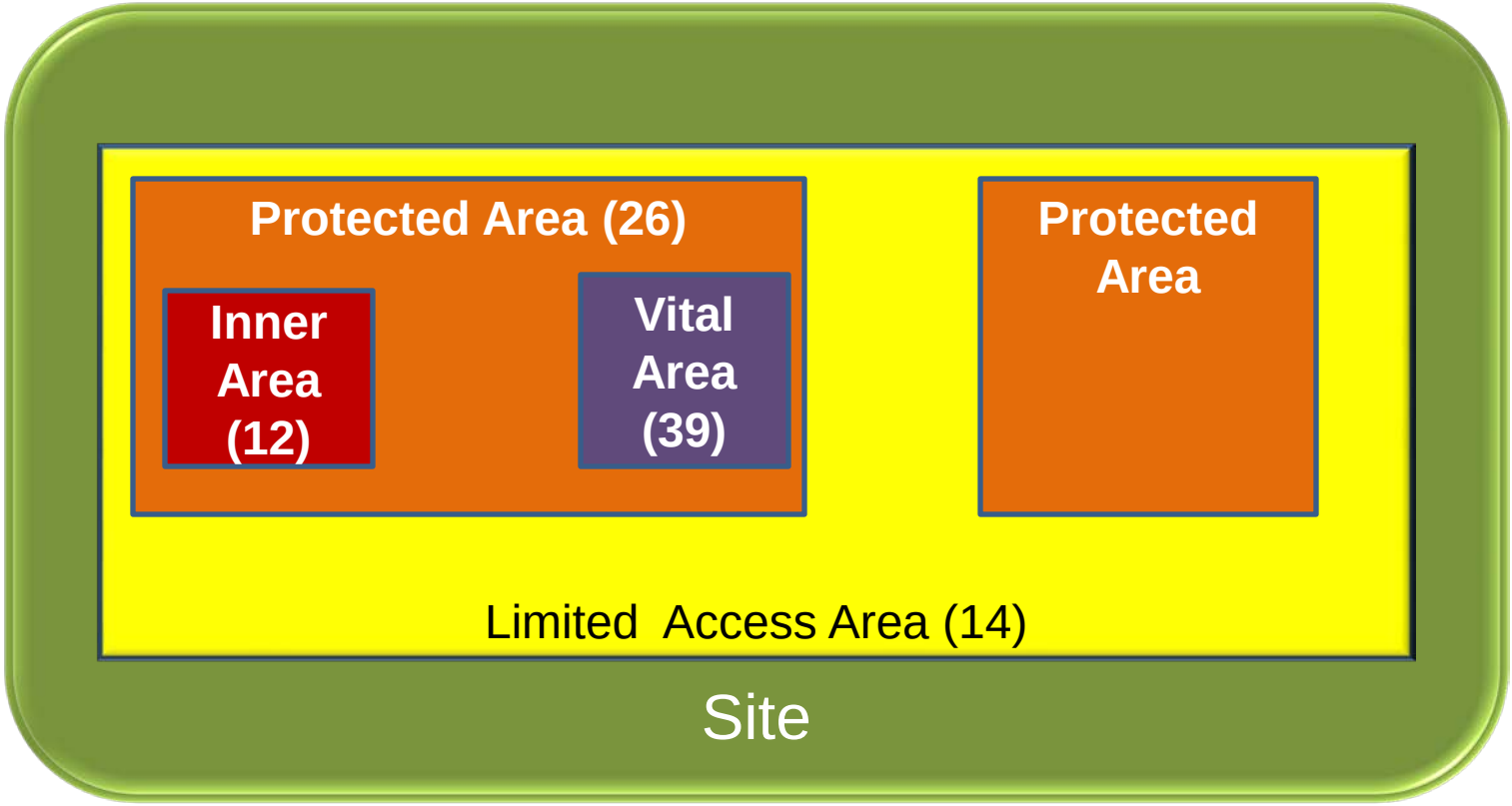


Physical Protection System (25)

- 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



Physical Protection Layers

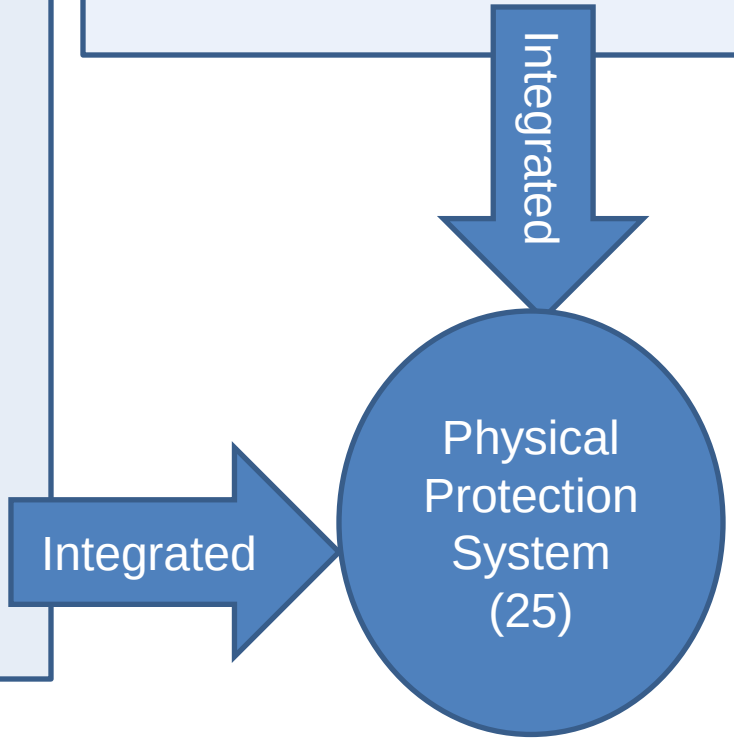


Physical Protection Measures (23)

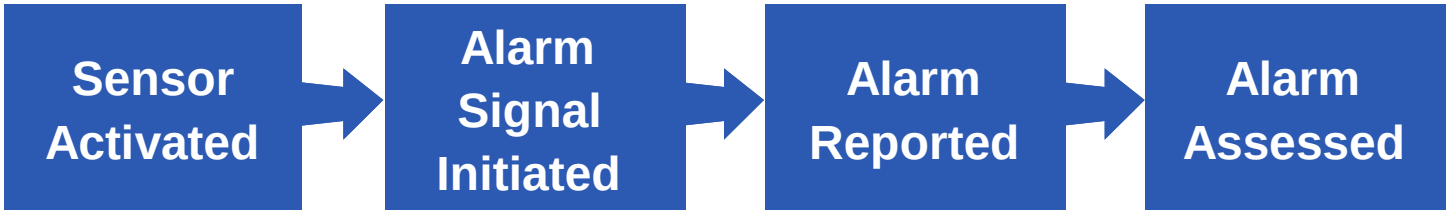
- Detection (8)
  - Central Alarm Station (2)
  - Two-Person Rule (36)
  - Guards (11)
- Delay
  - Access Delay (1)
  - Physical Barriers (22)
  - Guards/Response Forces
- Response
  - Guards (11)
  - Response Force (27)
  - Contingency Plan (4)

As a system consider:

- Defense in Depth (6)
- Graded Approach (10)
- Performance Testing (21)
  - Force on Force Exercise (9)



Detection

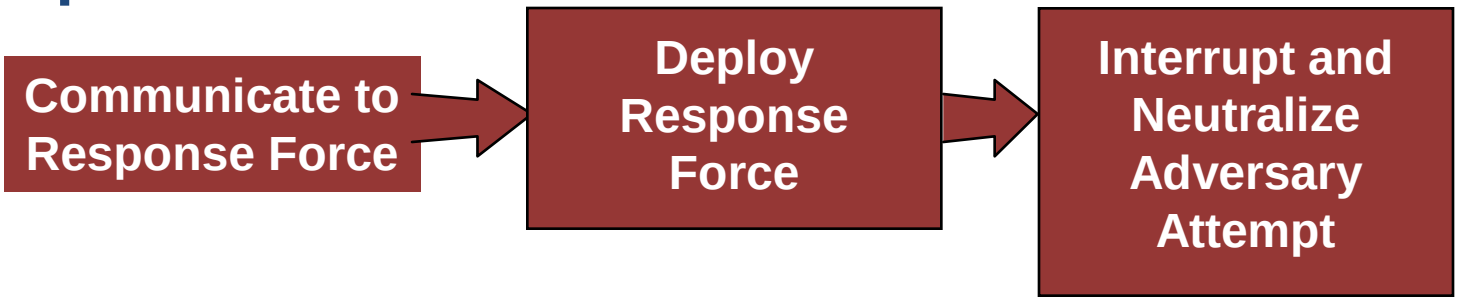


"An alarm without assessment is not detection."

Delay

Provide obstacles to increase adversary task time after detection

Response



Contingency Plans (4)

- Describes the objectives, policy, and concept of operations for the response to
  - Sabotage
  - Attempted sabotage
- Defines the structure, authorities, and responsibilities for a systematic, coordinated, and effective response

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.

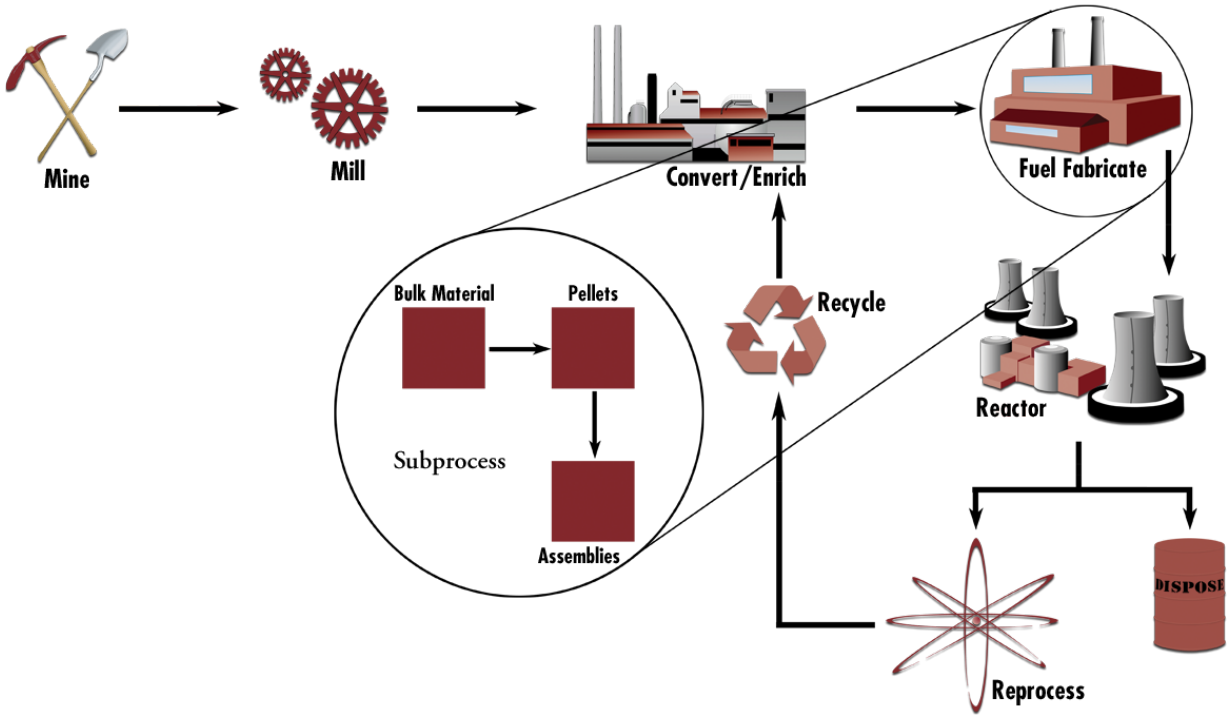
Nuclear Material (17)
IAEA Categorization of Nuclear Material

Material	Form	Category I	Category II	Category III[c]
1. Plutonium[a]	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] - Uranuim 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
	- Uranuim enriched to 10% ^{235}U but less than 20% ^{235}U		10 kg or more	Less than 10 kg but more than 1 kg
	- Uranuim 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.

Nuclear Facility (16)

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

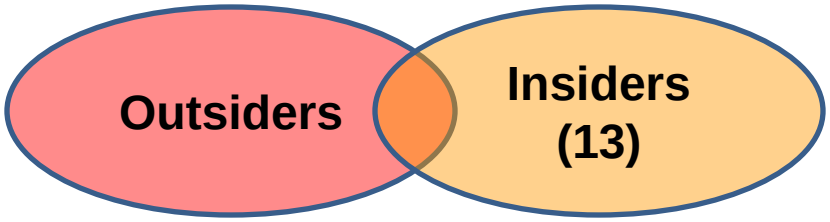


Consequence Terms

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

Threat Terms

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

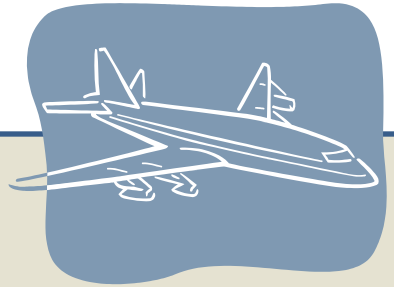


System for Nuclear Material Accountancy and Control (31)

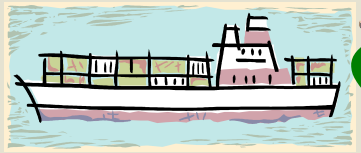
- An integrated set of measures designed to provide
  - Information on the presence of *nuclear material*
  - Control of the presence of *nuclear material*
  - Assurance of the presence of *nuclear material*,
- Including those systems necessary to
  - Establish and track nuclear material inventories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

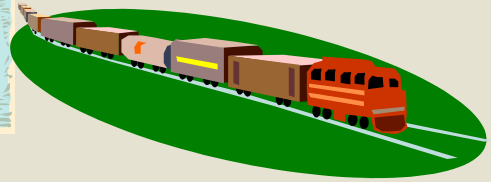
Transportation Terms

Shipper (29)



Conveyance (5)





Receiver

TRANSPORT (34)

By Carrier

Transport
Control Centre (35)

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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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.

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; and
  - 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.

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

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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ELEMENTS OF PHYSICAL PROTECTION REGIME

SESSION 3

Overview of Regime Changes

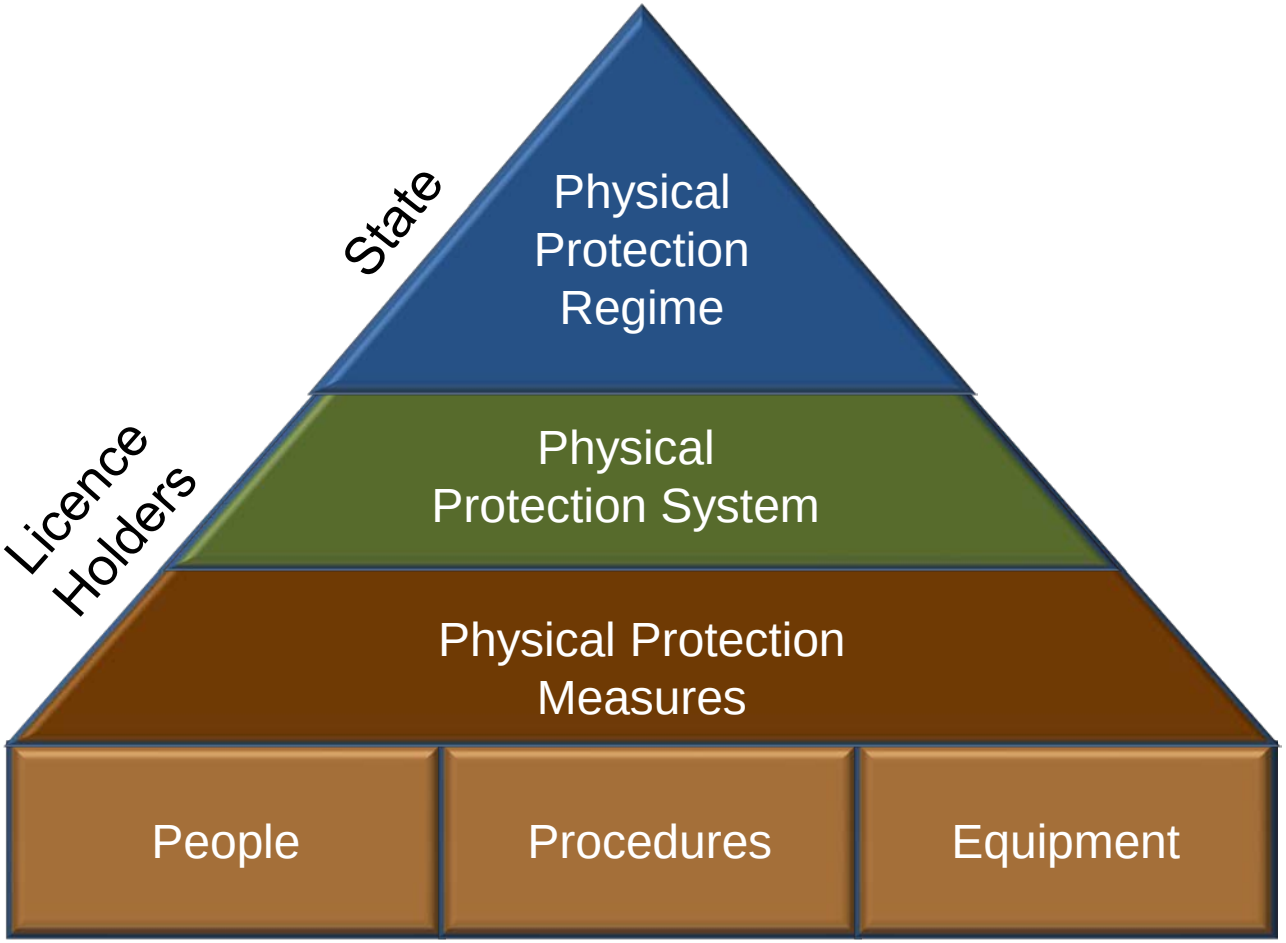
- Previously referred to as "State's system of physical protection"
- More explicitly defined a State's Physical Protection Regime as separate from Physical Protection Systems
- Directly aligns with CPPNM
- Includes process for regular review of the regime

Physical Protection Regime

Physical Protection Regime Entities

- State
- Competent Authority
- Licence Holders
  - Operator of nuclear facilities
  - Shipper for transport of nuclear materials

Physical Protection



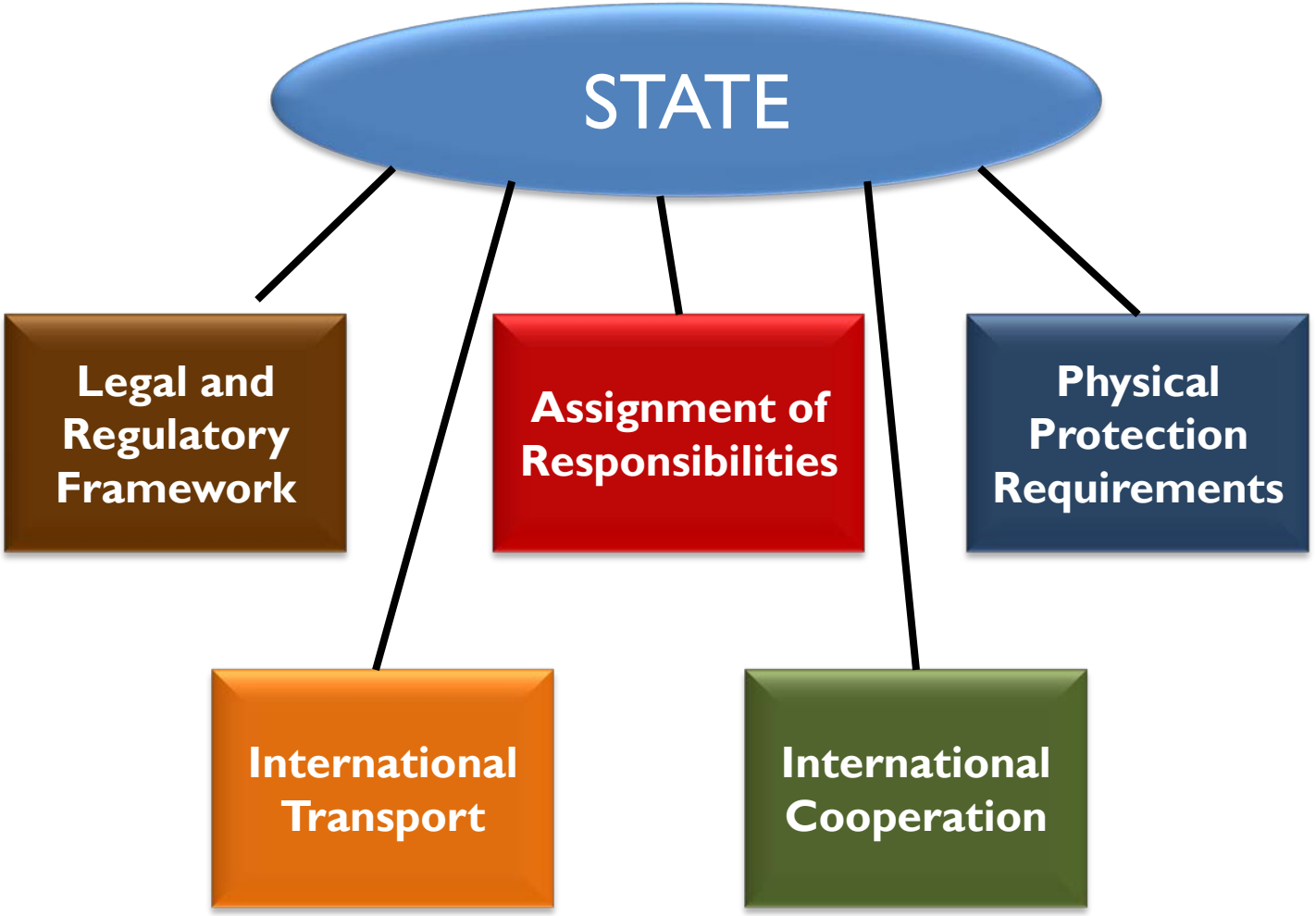
Elements of A State's Physical Protection Regime

- State responsibility (Fundamental Principle A)
- International transport (Fundamental Principle B)
- Assignment of physical protection responsibilities
- Legislative and regulatory framework
  - Legislative and regulatory framework (Fundamental Principle C)
  - Competent authority (Fundamental Principle D)
  - Responsibilities of licence holders (Fundamental Principle E)
- International cooperation and assistance
- Identification and assessment of threats (Fundamental Principle G)
- Risk-based physical protection system and measures
  - Risk management
  - Graded approach (Fundamental Principle H)
  - Defence in depth (Fundamental Principle I)
- Sustaining the physical protection regime
  - Security culture (Fundamental Principle F)
  - Quality assurance (Fundamental Principle J)
  - Confidentiality (Fundamental Principle L)
  - Sustainability programme
- Planning and preparedness for and response to nuclear security events (Fundamental Principle K)

Discussed in Five Parts

Part 1 Session 3	• State responsibilities • Legal and regulatory framework • Assignment of PP responsibilities
Part 2 Session 4	• Physical protection requirements • International transport • International cooperation and assistance
Part 3 Session 5	• Competent authority
Part 4 Session 6	• Licence holder
Part 5 Session 7	• Sustainment and preparedness

State Responsibilities



STATE

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

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

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

Additional State Responsibilities

- Section 4 – Requirements for Measures to Locate and Recover Missing or Stolen Nuclear Material (4.50-4.56)
  - Ensure rapid response and comprehensive measures to locate and recover missing or stolen material
  - Define roles and responsibilities for organizations
  - Ensure operator has contingency plans to locate and recover
  - Ensure all responsible State organizations have contingency plans to locate and recover any declared missing or stolen nuclear material (NSS-15 now applies)
  - Develop arrangements and protocols between appropriate response organizations and operators
  - Conduct evaluation exercises to assess and validate contingency plan and to train participants
  - Regularly review and update contingency plans

STATE

Additional State Responsibilities

- Section 5 – Requirements for Associated Measures to Mitigate or Minimize the Radiological Consequences of Sabotage (5.45-5.53)
  - Define roles and responsibilities for organizations
  - Contingency Planning
    - Develop contingency plans with prescribed content and make available to all relevant organizations
    - State's contingency plans complement operator contingency plans
    - Ensure operator has contingency plans to mitigate and minimize radiological consequences
  - Develop arrangements and protocols between appropriate response organizations and operators
  - Conduct joint exercises
    - To assess and validate contingency plan evaluation and to train participants
    - That simultaneously test emergency and contingency plans
  - Regularly review and update contingency plans
  - Ensure that response forces are familiar with sites and sabotage targets and have adequate knowledge of radiation protection measures

STATE

Additional State Responsibilities

- Section 6 – Nuclear Materials During Transport, Locate and Recover (6.45 -6.51)
  - Define roles and responsibilities for organizations
  - Ensure rapid response and comprehensive measures
  - Contingency Planning
    - Develop contingency plans with prescribed content and make available to all relevant organizations
    - State's contingency plans should include interface to nuclear safety and complement carrier contingency plans
  - Develop arrangements and protocols between appropriate response organizations
  - Conduct joint exercises
    - To assess and validate contingency plan evaluation and to train participants
    - That simultaneously test emergency and contingency plans
  - Regularly review and update contingency plans

STATE

Additional State Responsibilities

- Section 6 – Nuclear Materials During Transport, Mitigate/Minimize (6.61-6.69)
  - Define roles and responsibilities for organizations
  - Contingency Planning
    - Develop contingency plans with prescribed content and make available to all relevant organizations
    - State's contingency plans complement carrier contingency plans
    - Ensure operator has contingency plans to mitigate and minimize radiological consequences
  - Develop arrangements and protocols between appropriate response organizations
  - Conduct joint exercises
    - To assess and validate contingency plan evaluation and to train participants
    - That simultaneously test emergency and contingency plans
  - Regularly review and update contingency plans
  - Ensure that response forces are familiar with sites and sabotage targets and have adequate knowledge of radiation protection measures

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.

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

Legislative and Regulatory Framework (continued)

- 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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ELEMENTS OF PHYSICAL PROTECTION REGIME – PART 3

PHYSICAL PROTECTION REQUIREMENTS AND INTERNATIONAL ASPECTS SESSION 4

Physical Protection Requirements

- Threats
- Material Categorization
- Consequences
- Risk Management

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

Identification and Assessment of Threats

- Explicitly includes insider threat
- Suggests design basis threat is only needed for Cat I material and high radiological consequences
- Recommends the required use as a common basis for design and implementation of PPS
- Be continuously updated
- Includes airborne threat and stand-off attacks

Nuclear Material Categorization

Material	Form	Category I	Category II	Category III[c]
1. Plutonium[a]	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] - Uranuim 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
	- Uranuim enriched to 10% ^{235}U but less than 20% ^{235}U		10 kg or more	Less than 10 kg but more than 1 kg
	- Uranuim 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.
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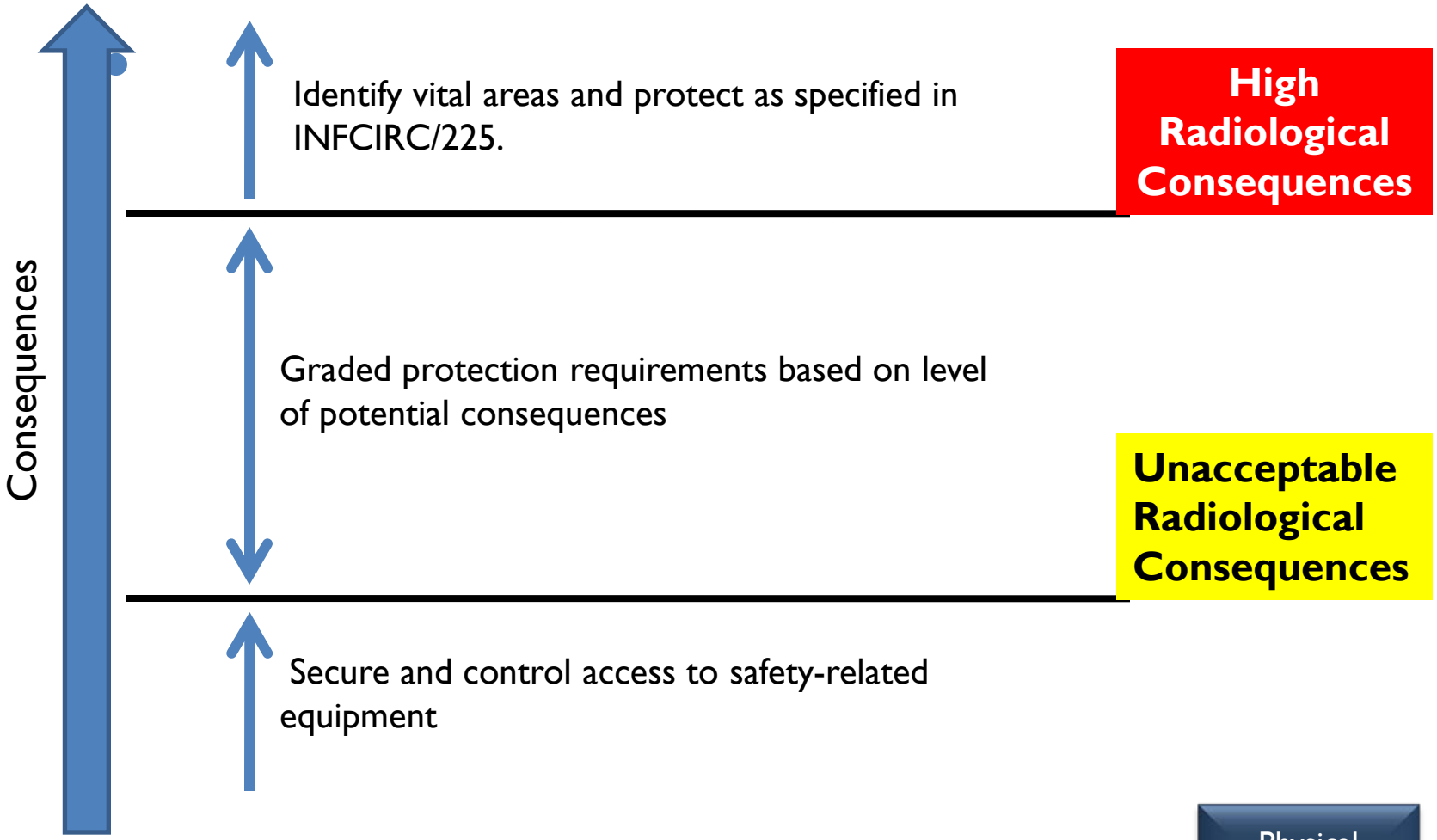
[e] Other fuel which by virtue of its original material content is classified as Category I or II before irradiation may be reduced one category level while the radiation level from the fuel exceeds 1 Gy/hr (100rad/hr) at one meter unshielded.

Consequences - URC and HRC



Physical Protection Requirements

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
- Risks can be managed by
  - Reducing the likelihood of an attack
  - Improving the effectiveness of the security system
  - Reducing the potential consequences of a malicious act

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.

Graded Approach

- Takes into account the current evaluation of the threat
  - Relative attractiveness/nature of the nuclear material
  - Potential consequences associated with
    - Unauthorized removal
    - Sabotage
    - Loss of information
  - Personnel Trustworthiness
- Requires determination of
  - Risk thresholds
  - Commensurate protection levels
  - Performance standards

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 heir 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

Performance Testing

- Regular performance testing including force-on-force
- Now required also by operators
- Guards and response forces are included to truly test system effectiveness
- Contingency plans and emergency response also performance tested to ensure interagency coordination is effective and for training purposes

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 & MC&A integration (3.47)
  - To protect against insiders and external threats

INFCIRC/225/Revision 5

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

COMPETENT AUTHORITY

SESSION 5

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.

Competent Authority (continued)

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

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

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	5.1, 5.9, 5.15, 5.41
Transport	3.7, 6.22, 6.27, 6.33-34

INFCIRC/225/Revision 5

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

LICENCE HOLDERS

SESSION 6

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).

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

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

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

Additional Operator Requirements

Section 4 – Requirements for Measures to Locate and Recover Missing or Stolen Nuclear Material (4.57-4.63)

- Ensure that any missing or stolen material is detected in a timely manner
- Confirm by means of rapid emergency inventory
- Notify competent authority
- Include in contingency plans and regularly evaluate measures
- Take appropriate measures to locate as soon as possible, including off-site hot pursuit if allowed
- Secure recovered material in an appropriate
- Cooperate during subsequent investigations and prosecution

Additional Operator Requirements

Section 5 – Requirements for Associated Measures to Mitigate or Minimize the Radiological Consequences of Sabotage (5.54-58)

- Establish a contingency plan
- Ensure coordination between all response organizations
  - Guards/response forces
  - Law enforcement agencies
  - Safety response teams
- Assess upon detection a malicious act to determine whether radiological consequences could result
- Notify appropriate organizations of sabotage or attempted sabotage
- Following an act of sabotage, take measures to prevent further damage, securing the nuclear facility, and protecting emergency equipment and personnel

Additional Carrier Requirements

Section 6 –Nuclear Materials During Transport

- Locate and Recovery (6.52-6.55)
  - Discovery, location, reporting, assistance
- Mitigate/Minimize (6.70-6.73)
  - Prepare transport personnel to act in full coordination with guards, response forces, and law enforcement agencies for implementing the contingency plan
  - Inform the transport control centre or carrier's management as soon as an attempt or an act of sabotage is detected
  - Provide timely notification to shipper, competent authority, response forces, and other relevant State organizations
  - Take measures to secure the transport and minimize the consequences of an act of sabotage

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

Category-Based Physical Protection Requirements

Topic	Category I	Category II	Category III
Unauthorized Removal	4.1-4-49	4.1-35	4.1-20
Transport	6.1-43	6.1-31	6.1-18

INFCIRC/225/Revision 5

ELEMENTS OF A STATE'S PHYSICAL PROTECTION REGIME

SUSTAINMENT & PREPAREDNESS – ALL

SESSION 7

Sustaining the Physical Protection Regime

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

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.

Nuclear Security Culture (3.48 – 3.51)

- Consistent with IAEA Nuclear Security Culture (NSS-7)
- Recognize that a credible threat exists and that the individual plays an important role in preserving nuclear security
- Bring 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
- Pervasive in all elements of the regime

Nuclear Security Culture

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.

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

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.

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

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

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.

Planning and Preparedness for and Response to Nuclear Security Events

- State's physical protection measures to address the physical protection objectives by
  - Responding to unauthorized removal of nuclear material in use, in storage, or during transport
  - Locating and recovering missing or stolen nuclear material
  - Responding to sabotage or attempted sabotage of nuclear facilities or nuclear material in use, in storage, or during transport
  - Mitigating/minimizing radiological consequences of sabotage

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

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

INFCIRC/225/Revision 5

CHANGES TO PPS FOR NUCLEAR MATERIALS IN USE AND STORAGE

SESSION 8

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

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.

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

Protection of Computer-Based Systems

Potentially Vulnerable Systems	Compromise Concerns
• Physical protection • Nuclear safety • Nuclear material accountancy and control	• Cyber attack • Manipulation • Falsification

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

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

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	Called only for periodic evaluation

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

Greater Protection Against the Insider Threat

Revision 5	Why Change Revision 4?
MC&A systems integrated with physical protection systems to protect against insider threats	Materials Control and Accounting (MC&A) 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

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 MC&A
Ensure State and operator contingency plans exist	Notification of competent authority
Assure exercise and review of State contingency plans	Contingency plans, including • 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

INFCIRC/225/Revision 5

CHANGES TO PPS FOR NUCLEAR MATERIALS AGAINST SABOTAGE

SESSION 9

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

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

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

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

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

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

INFCIRC/225/Revision 5

CHANGES TO PPS FOR NUCLEAR MATERIALS DURING TRANSPORT

SESSION 10

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)

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	

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

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

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

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

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

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

INFCIRC/225/Revision 5

SUMMARY

Summary

- INFCIRC/225/Revision 5 was revised to address an increased threat environment and unsure 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

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

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

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

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

THANK YOU

Session 2 Exercise
INCIRC/225/Revision 5 - Definitions

Identify the context for each term using the following categories:

A. Entities
B. PPS & Measures
C. Threats
D. Transportation
E. Other

_____ Access Delay
_____ Vital Area
_____ Protected Area
_____ Transport Control Centre
_____ Central Alarm Station
_____ Unauthorized Removal
_____ Design Basis Threat
_____ Force-on-force Exercise
_____ Graded Approach
_____ Two Person Rule
_____ Inner Area
_____ Insider
_____ Shipper
_____ Nuclear Security Event
_____ Limited Access Area
_____ Threat Assessment
_____ Nuclear Material
_____ Physical Barrier
_____ Nuclear Security Culture
_____ Physical Protection Regime
_____ Transport

_____ Malicious Act
_____ Operator
_____ Guard
_____ Competent Authority
_____ Performance Testing
_____ Physical Protection Measures
_____ Nuclear Facility
_____ Physical Protection System
_____ Conveyance
_____ Response Forces
_____ Defence in Depth
_____ Sabotage
_____ Stand-off Attack
_____ Detection
_____ Threat
_____ Contingency Plan
_____ Unacceptable Radiological Consequences
_____ System for Nuclear Material Accountancy and Control

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 INFCRIC/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 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 -10 Exercises

1. For the category of material at your facilities, what are the relevant recommended requirements for the physical protection system for protection

   Against unauthorized removal:_____

   Against Sabotage: _____

   During Transport: _____

2. What new requirements affect existing physical protection systems?

3. What new requirements affect the design of new physical protection systems?

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.