U.S. Experience Implementing Nuclear Material Accountancy and Control (NMAC) & Physical Protection (PP) for Nuclear Security

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Introduction

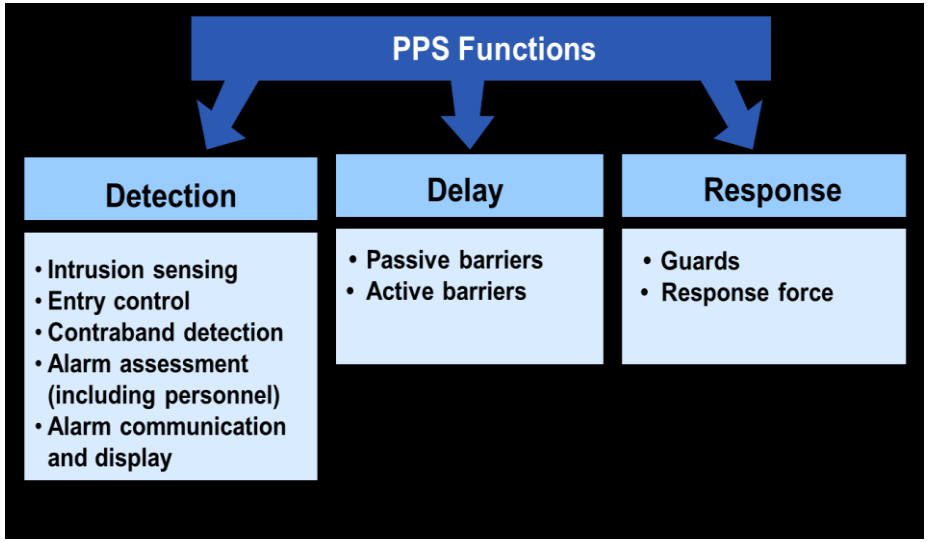
- **Nuclear security needs**
  - Quantify the type and amount of nuclear material (NM) effectively as well as protect and secure the material at a broad range of nuclear facilities
  - Robust physical protection (PP) and NM accounting and control (NMAC) systems to meet domestic and international standards and recommendations
- **Objectives**
  - Highlight the common factors that support both nuclear security and safeguards, specifically focused on NMAC and PP, and provide specific examples of areas where better utilization of common factors could benefit both security (NMAC, PP) and safeguards
- **Significance**
  - In recent years, we have seen a considerable increase in global terrorism, cyber security attacks, regional instability → All of which pose significant nonproliferation challenges

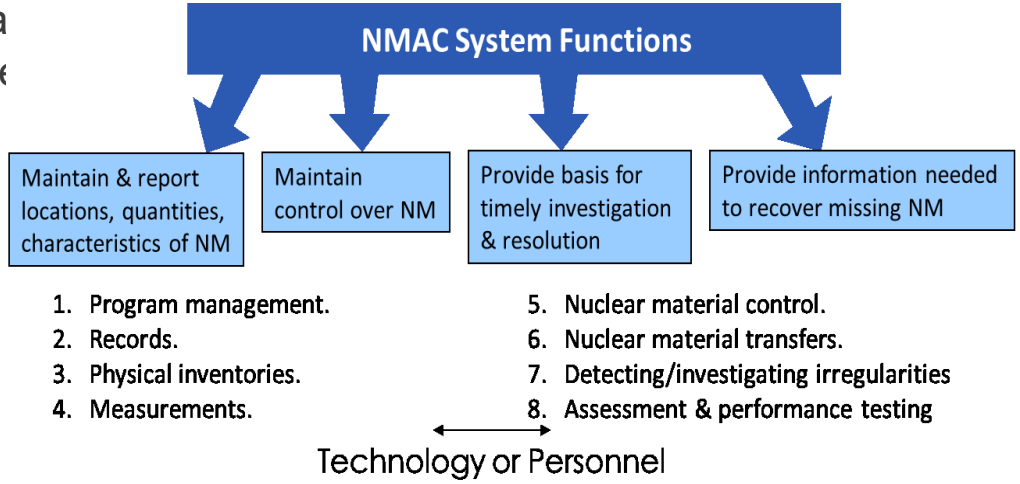
NMAC & PP Challenges at Large Nuclear Sites

- **The DOE National Laboratory Complex is comprised of a large number of diverse R&D facilities with very different NMAC and PP requirements for materials ranging from check sources to CAT I materials**
  - How to most effectively implement NMAC and PP on such a broad range materials and facilities?
- **Multiple different programs with their own set of requirements may need to access NM and NM databases**
  - Criticality safety, Radiation Protection, etc.
- **Access controls and threat response**
  - How easy can system be accessed and reports be generated to achieve nuclear security objectives?
- **NMAC and PP present overlapping challenges that require integrated solutions while <u>not hindering operations</u>**

NMAC & PP for Nuclear Security

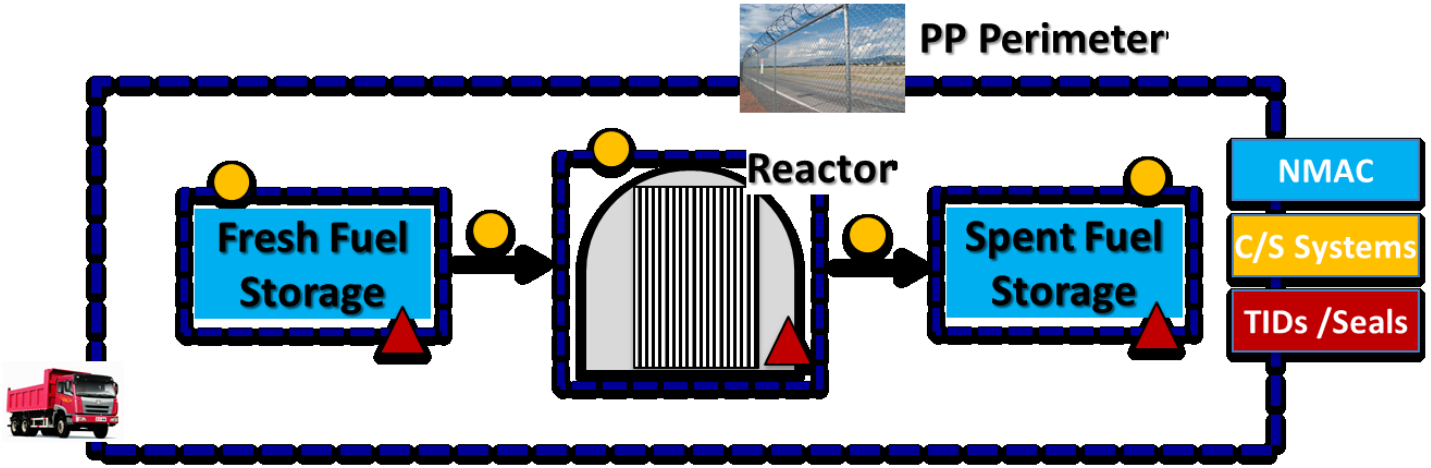
- **NMAC and PP systems are 2 distinct systems that should complement each other to achieve nuclear security objectives**
  - NMAC and PP should be coordinated with other facility systems that could contribute to deterring and detecting unauthorized removal of nuclear material
    - e.g. operations, radiation protection, wa management, criticality safety, personne health and safety, environmental protection, and safeguards





The Nuclear Facility

- **One important commonality is the nuclear facility at which nuclear security & safeguards are implemented**
  - Domestic NMAC and PP measures at a facility are inherently interlinked by the fact that the PP measures are developed and implemented based on amounts and locations provided by the NMAC system for nuclear security
  - For the simple example below, the NMA for item accounting is similar for both nuclear security and safeguards



Yet the flow of NM is very complicated at many nuclear facilities requiring additional resources to meet both security & safeguards objectives

Nuclear Security & Safeguards

- **There are several commonalities and differences between nuclear security and safeguards**
  - Nuclear security and safeguards programs both require access to the NM and information about the NM (usually stored in databases)
- **United Nations Security Counsel Resolution 1540**
  - All States have the common obligation to prevent the proliferation of nuclear chemical, or biological weapons and their means of delivery
  - The IAEA is competent authority for safeguards and plays a central role in sharing experience, issuing guidance documents, and providing bilateral assistance to member States on NMAC and PP for nuclear security
- **Utilizing shared overall goals can help strengthen both nuclear security and safeguards**

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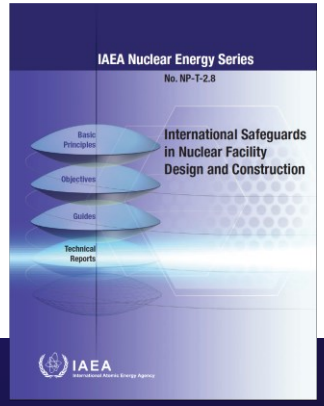

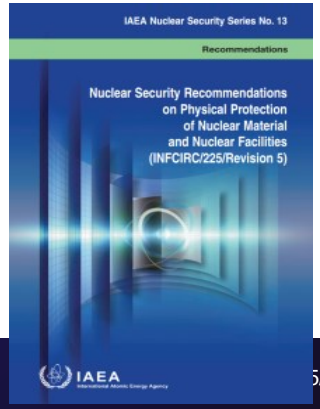

Key Differences

- **Scope and Purpose**
  - Nuclear security has a much broader scope that concerns all States (proliferation threat by non-State actors) all nuclear material and radioactive sources and includes NMAC and PP measures → Responsibility of State
  - Compared to safeguards, where the concern is State proliferation and not all States have comprehensive safeguards agreements, nuclear material is not tracked at the same resolution for nuclear security and includes NMA and C/S measures → State implements safeguards and IAEA verifies
- **Different timeliness objectives**
  - Nuclear security is real-time immediate response, versus 1 month or longer for safeguards
- **Definition of material quantities of concern**
  - Nuclear security uses Category I, II, and III compared to safeguards which defines significant quantities (SQ) of nuclear material (8kg Pu, 25kg ^{235}U, etc)

Common Goals

- **While the fundamental objectives of nuclear security and safeguards are different, there are several common goals such as:**
  - Detect and deter unauthorized removal of nuclear material
  - Provide assurance that all nuclear material is under a quality accountancy system
  - Detect the diversion or loss of nuclear material
  - Determine the amount of any nuclear material loss

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- **Common tools are used for both and in many cases common personnel at the facility level**
  - Thus, a strong and robust NMAC system is crucial to meeting evolving nonproliferation challenges for nuclear security and can also benefit safeguards

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Areas where Better Integration Could Benefit Both Safeguards & Nuclear Security

- **NMAC is important to nuclear security and safeguards**
  - If anomaly occurs, are both nuclear security and safeguards reporting impacted?
  - Is there a way to better integrate to improve both without compromising either?
- **Example: adding radiation detectors to nuclear security monitoring systems could benefit safeguards by:**
  - Enabling NMA on difficult to access material
  - Providing confidence in the absence of undeclared material
- **Example: security measures that credibly prevent moving safeguards-traceable item could benefit safeguards**
  - Prevention of removal of fresh and spent fuel assemblies
- **Example: using process monitoring systems for safeguards could benefit nuclear security by:**
  - Providing an independent mechanism to inform nuclear security of a process upset/failure and deter unauthorized removal (insider threat)

Areas where Better Integration Could Benefit Both Safeguards & Nuclear Security

- **Design of safeguards and security systems**
  - Can be better integrated by making it a requirement of the Organizational Assets portion of the design project charter
- **There are several nuclear facilities in the world that are planning or undergoing decommissioning**
  - Recently this has raised questions regarding termination of safeguards and at what point during decommissioning this could occur
- **Key Questions:**
  - What impact does termination of safeguards have on PP and NMAC systems?
  - How does facility decommissioning impact and/or change design basis threat?
  - Are there ways to disable key pieces of equipment (e.g. cranes, hotcell manipulators) and/or consolidate nuclear material during decommissioning to benefit both?
- **Example: construction and installation of New Safe Confinement at Chernobyl Nuclear Power Plant**

Measures of Success & Sustainability

- **Developing and maintaining expertise in a variety of fields is crucial to both nuclear security and safeguards**
  - Human capital development continues to remain a challenge in many States
- **IAEA conducts voluntary assessments at request of a State of both a State's physical protection regime and their State's System for Accounting and Control (SSAC)**
  - International Physical Protection Advisory Service (IPPAS)
  - IAEA SSAC Advisory Service (ISSAS)

  → Comparing the results from these assessments could provide valuable information regarding the relationship between implementation of nuclear security and safeguards in a State
- **Training and strong Quality Management System (QMS)**
  - Essential to maintaining personnel competence for both nuclear security and safeguards, especially NMAC and PP

Summary & Conclusions

- **We have summarized U.S. experiences with NMAC and PP domestically and internationally and provided specific examples of areas where better utilization of common factors would benefit both nuclear security and safeguards**
  - The purpose of this assessment was to identify key mechanisms that could be implemented to better address evolving nonproliferation challenges
- **Multiple IAEA General Conference resolutions (e.g. GC(48)/RES/11, GC(59)/RES/10, GC(59)/RES/13) have recognized the mutual benefits between nuclear security and safeguards**
  - Yet there remain many opportunities for improved utilization of common nuclear security and safeguards measures in order to appropriately leverage this relationship

Acknowledgements

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Interface between Nuclear Security & Safeguards