

Interfaces of Nuclear Safety and Security for Nuclear Power Plants

Workshop on Managing the Interface between Safety and Security of Research Reactors

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IAEA

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Introduction

Definitions

- **Nuclear Safety**

- The achievement of proper operating conditions, prevention of accidents or mitigation of accident consequences, resulting in protection of workers, the public and the environment from undue radiation hazards

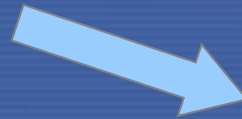
- **Nuclear Security**

- The prevention and detection of, and response to, theft, sabotage, unauthorized access, illegal transfer or other malicious acts involving nuclear material, other radioactive substances or their associated facilities

Specificity of Nuclear Power



NPP operation



Inventory of
radioactive
materials



Proliferation Issues



**Radiation hazards to
workers, public and
the environment**



**Nuclear Safety
& Nuclear
Security**

Protect people and environment
against the risks of radiation



Common Purpose

Safeguards

Events on Each Sphere



Safety



Security



Risks arising from unintended events

- Natural occurrences (earthquake, tornadoes, etc.)
- Hardware failures (pipe break, I&C defects, etc.)
- Internal events (flood, fire, etc.)
- Human errors

Risks arising from malicious acts with the intent to steal material or cause damage

Basic Principles for Safety and Security

Fundamental Safety Principles

The IAEA Fundamental Safety Principles state that:

*“ **safety measures and security measures** have in common the aim of protecting human life and health and the environment” and;*

*“ **safety measures and security measures** must be designed and implemented in an integrated manner so that security measures do not compromise safety and safety measures do not compromise security”*

Defence-in-Depth

Safety

1. Prevention

- Robust technical design and safety margins

2. Early Detection

- I&C systems

3. Mitigation

- Safety Systems

4. Emergency Planning

- For unintentional events

Security

1. Prevention

- Deterrence steps to discourage the aggressor

2. Early Detection

- Security systems (alarms)

3. Mitigation

- Recovery actions

4. Emergency Planning

- For intentional malicious acts

Leadership and Management

- Effective management system to ensure proper balance and coordination between safety and security cultures

**Communication with Interested Parties
Transparency vs. Confidentiality**

Optimization of Protection

- Radiation risks must be kept as low as reasonably achievable, taking social and economic factors into account

All risks should be assessed and re-assessed both in the design phase and in operation

- Risks from natural events, equipment failure or human errors relies on deterministic and probabilistic methods
- Risks on the security domain relies **only** on deterministic methods

Responsibilities for Safety and Security

Government

- The **State** must set up an appropriate **legislative and regulatory framework** to ensure control of nuclear power plants and thus require safety and security provisions
- The **State** must designate a **regulatory authority or authorities** in both safety and security and provide the regulator(s) with the authority, competence and the financial and human resources

Safety and security responsibilities

A **single** regulatory body may be responsible for both nuclear safety and security

Nuclear security requires specific structures and means of control of different types. The regulatory body may consist of several separate competent authorities owing to the different areas covered involved

A consultation and coordination mechanism is required between the safety and security authorities to ensure effective protection with regard to possible malicious acts and to manage nuclear regulatory requirements that may be conflicting

Safety and Security at the various stages of the NPP Lifetime

Safety and security synergies

- All organizations involved in a nuclear power programme should be made aware of the **commonalities and differences** between safety and nuclear security to be able to factor both into development plans.
- The **synergies** between safety and security have to be developed and encouraged; safety and security have to complement and enhance one another.

Interface Safety - Security

- **Synergies**
 - Elements or actions in one area enhances also the other area

Containment structure



Safety: serves to prevent a significant release of radioactive material to the environment in the event of an accident

Security: provides a robust structure that protects the reactor from a terrorist assault.

Interface Safety - Security

- Challenges
 - Elements or actions in one area may be **antagonistic** to the other area



Delay barriers created for security reasons can prevent rapid access needed by plant personnel to respond to a safety event or to act during an emergency

Operators

- **Operating organization has the prime responsibility for the safety and security of the nuclear power plant**
- In the case of security, the operator's responsibility may be limited to mitigate a **Design Basis Threat (DBT)**

DBT outlines the set of adversary characteristics for which the **Operators and State organizations together have protection responsibility and accountability**

A clear description of this threat is an essential prerequisite for assured and effective physical protection

Siting

Safety

- Assess the **frequency and severity** of various external natural and human induced events that could affect the safety of the NPP
- Assess the feasibility of an **emergency plan**

Security

- Assess the **vulnerability** to assault of the site. For certain types of threat, the location and layout of the plant site may limit the likelihood that particular on-site areas will be affected
- Assess the **areas** of the country that are more **prone** to terrorists or activists or near the border with an unfriendly country

Design

Synergies

- Passive Systems
- Single failure criteria
- Doors and barriers

Antagonisms

- Heavy bunkering
- Doors and barriers



Construction and Commissioning

- Oversight of the construction and commissioning is intended to ensure that the plant is constructed as designed, thereby serving both safety and security purposes
- For security, the oversight is aimed at preventing the inadvertent or intentional introduction of weaknesses that may result in a radiological release during operation. Such oversight can present a major challenge because of the large number and diversity of workers entering the site during a construction period.
- During commissioning demonstration of fulfilling Safety Functions is accomplished; whereas, demonstration of sufficiency of security systems is assured

Operation

Synergies

- Consideration of Objectives of nuclear security in safety programs (SSR 2/2. Req.17)
- Feedback from operating experience (sharing of information may differ)
- Access and control measures

Antagonisms

- Maintenance, surveillance and inspections
 - Disabling systems in one area may impact the other (e.g. electric supply)
 - External workers to conduct the activities

Safety-Security Interface Challenges

- Cultural differences
- Traditional organizational separation
- Lack of integration in the design process
- Lack of adequate coordination during facility operation

Development of Guidance Document by NSNS and NSNI

**IAEA Technical Report Series (TRS) on:
Safety and Security Interfaces in the Regulatory
Infrastructure for the Oversight of Nuclear Power Plants**

Need for Further Guidance Document by NSNS and NSNI

- Feedback from Member States revealed that some regulatory authorities are in need of guidance **how to** manage the interface between safety and security when performing their regulatory functions and activities
- Harmony between safety standards and security recommendations is considered extremely important in the establishment of the regulatory infrastructure and during the application of various regulatory functions of regulatory authorities

Objective

- The objective of the Technical Report series is to collect good practices on identifying and addressing interfaces (commonalities and contradictions) between safety and security during the application of various regulatory functions in relation to the regulatory oversight of the various lifecycle stages of nuclear power plants:
 - ✓ **siting, design, construction, commissioning, operation to decommissioning**
- The Safety Fundamentals, Security Fundamentals, associated Safety Standards and Security Recommendations are the major basis

Scope (1/2)

The list of areas to be covered in the document include:

- **Regulatory frameworks for the oversight of safety and security involving single authority and multiple authorities**
- **Cooperation and joint actions among the competent authorities**
- **Staffing, competence, training of staff**
- **Organizational structure and allocation of resources**
- **Determination of design basis conditions**
- **Drafting regulations and guidance**
- **Licensing and authorization**
- **Management and documentation system:**
 - ✓ **maintaining records, databases, nuclear and other radioactive material inventory lists**

Scope (2/2)

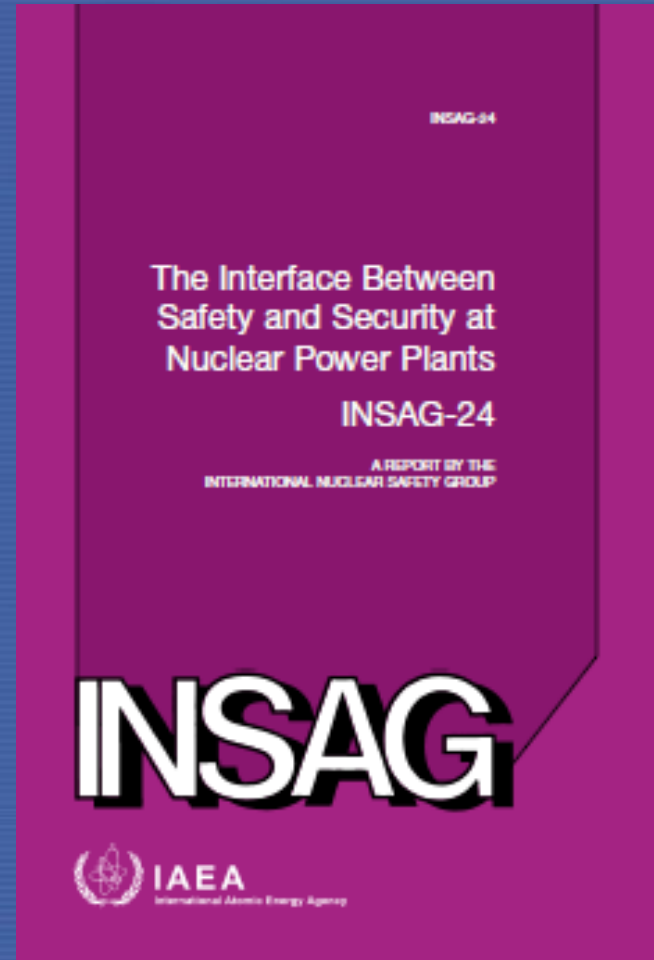
- **Communication and consultation with licensed entities**
- **Promotion of safety and security culture**
- **Public relations**
- **International cooperation**
- **Inspection and enforcement**
- **Review and assessment including analysis of operating experience**
- **Emergency/contingency planning and response**
- **...etc**

Development Status of TRS

- Joint effort of NSNI and NSNS
- Developed by the involvement of experts from the experienced IAEA Member States
- Internal QA process of NSNI and NSNS completed and approved for publication
- Currently under publication process with the Publication Committee

Reference Document

The International Nuclear Safety Group (INSAG) is a group of experts with high professional competence in the field of safety working in regulatory organizations, research and academic institutions and the nuclear industry



Conclusion

- There are **similarities and differences** in the regulatory approaches, management of nuclear safety and nuclear security, including regulatory supervision, organizational aspects, design concepts/methods, operating principles, emergency preparedness, etc.
 - ✓ All above aspects should be considered in an **integrated and systematic** manner
- Responsibility for safety and responsibility for security should be clearly assigned
- IAEA Guidance document TRS to further enhance understanding for managing interface during the lifetime of NPPs

International Atomic Energy Agency



Thank you for your attention