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The Interface between Nuclear Safety and Security for Research Reactors

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Outline

- Introduction
- Safety-Security interface challenges
- Interface between safety and security: Organizational and management aspects
- Interface between safety and security in phases of facilities’ lifetime
- Concluding remarks

Introduction

- 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 materials, other radioactive substances, or their associated facilities”

Introduction

- Nuclear Safety: Main concerns are radiological risk to human and environment, whatever the cause. For research reactors causes could be human errors, equipment failure, internal events (fire, pipe break, etc.) and external events (earthquakes, flooding, etc.).

- Nuclear Security: Main concerns are theft of nuclear and other radioactive material and radiological sabotage of a nuclear facility or nuclear material. For research reactors high risk targets are HEU fuel (theft) and sabotage of large inventories of fission and activation products.

Introduction

- Nuclear safety and nuclear security share the same over all objective: To protect people and the environment from radiological hazards.

- The acceptable risk should be the same whether the initiating event of a radiological release is due to internal and external events or an event of malicious origin.

Introduction – Why interfacing?

Nuclear safety is necessary but cannot protect, on its own, nuclear or other radioactive material from un-authorized access, theft, diversion, sabotage, or other malicious acts.

Similarly, nuclear security is necessary, but not sufficient on its own to protect people or environment from an accident.

OPAL Reactor, Australia

Introduction: Why interfacing?

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Safety and security: Reinforcement of one another:

In most situations ➔ elements or actions in one area also enhances the other area.

Confinement building serves to prevent a significant release of radioactive material to the environment in accident conditions (safety), it also provides a robust structure that protects the reactor from a terrorist attack (security).

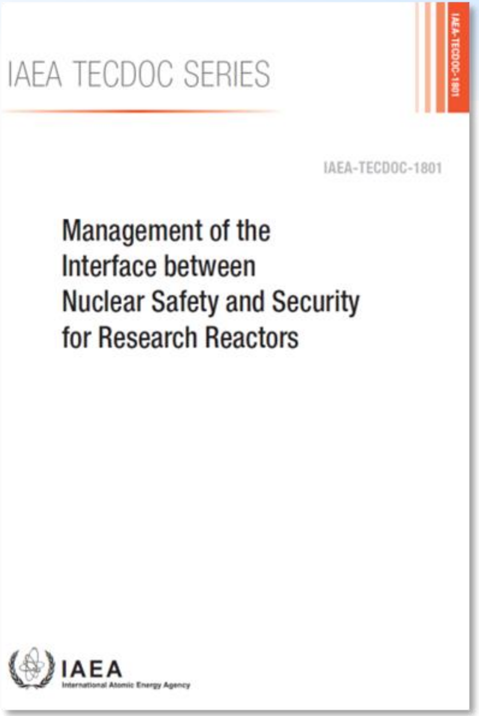
HFR Research Reactor (Netherlands)

Introduction: IAEA Safety Requirements

- *Requirements No. 11 and 90 of IAEA SSR-3* on interface between safety, security and State system for accounting for, and control of, nuclear material.

- Requirement No 90: “*Safety measures and security measures shall be established and implemented in such a manner that they do not compromise one another*”

- TECDOC 1801 on management of the interface between safety and security for research reactors.



Safety-Security Interface Challenges

- Inadequate regulatory guidance;
- Cultural differences: Transparency vs confidentiality;
- Traditional organizational separation;
- Lack of consideration in the design process;
- Inadequate coordination during facility operation.

Interface between safety and security

Similarities, differences and potential conflicts

- Organizational, and management aspects of managing the interface between safety and security:
  - Legislative and regulatory framework;
  - Roles and responsibilities;
  - Integrated management system;
  - Optimization of protection;
  - Training of personnel;
  - Use of a graded approach

Legislative and regulatory framework

- Legislative and regulatory framework: To ensure oversight of installations and activities of potential radiological risk and require security provisions.

- The regulatory body should be effectively independent and mainly have the same functions.

- The regulatory body may be the same - *but nuclear safety and nuclear security are subjected to different regulations.*

- Coordination is required for licensing and for safety and security inspections. *If there are two or more organizations regulating safety and security, more coordination efforts are likely required.*

Responsibility on safety and security

- Prime responsibility for nuclear safety rests with the operator. This responsibility can not be delegated. Operators have also responsibility for security.

- Involvement of the State is more broader/larger in security:
  - The operator usually can’t ensure alone the protection of the site and installation;
  - Direct involvement of the State in assessment of threats. Threats are evolving, and the State and operator should ensure that the security measures are adequate;
  - Management of crisis associated with a security event requires involvement of more State bodies.

Integrated management system

- A single and coherent system in which all the parts of an organization are integrated to enable achieving its objectives.
- The system should bring safety and security at the same level; and supports establishment of strong safety culture and security culture.
- Transparency (safety) vs confidentiality (security).
- Both cultures should not oppose each other, and could reinforce one another.

Optimization of protection

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- The principle is equally applicable whether exposure is assessed from safety or security viewpoints.

- Dose constraints for safety and security to be determined in a harmonized manner – doses to people or to environment should not depend whether the exposure is safety-related or security-related.

- *Coordination* is needed in establishing dose constrains – reviewed to consider operating experience, changes in threats, the facility, or requirements.

Training of personnel

- Training is needed for both areas to ensure personnel are qualified for their roles and responsibilities;
- For management of the interface between safety and security:
  - Complementary training of relevant personnel on the other area;
  - Mutual participation in exercises of both types (safety-security);
  - Safety analysts to be provided with working knowledge on security and vice-versa;
  - Facility safety basis and safety status/issues of the facility;
  - Security threat of the facility, and how arrangements and measures address the threat;
  - Information management.

Use of a graded approach

- Application of the safety requirements and security recommendations should be commensurate with the potential hazard of the facility.
- It is applied to the nuclear safety requirements, and to security recommendations related to the protection against sabotage and to the definition of the DBT.
- Parameters that are used in grading the application of safety requirements include inventory, quality of means of confinement, siting and proximity to population, etc.
- In security, the State will categorize nuclear and radioactive material into protection levels depending on their attractiveness. Security of information/computer security are also considered.

Managing the Interface through facility lifetime

Interface between safety and security in all stages of the nuclear fuel cycle facility lifetime

- Siting;
- Design: Design concepts and criteria;
- Construction;
- Modification;
- Operation: Operating programmes and procedures;
- Emergency preparedness and response

Siting and construction

- Siting:
  - Site selection be based on both safety and security criteria.
  - Characteristics that may benefit adversaries to be carefully considered (e.g. proximity to population, roads, railways), some areas may be more prone to malicious activities or unrest.
- Construction:
  - Oversight of constructers for both safety and security; Physical structure and layouts are becoming sensitive security issues;
  - Selection of Contractors: Assurance on one aspect does not necessarily imply assurance in the other;
  - Modification during construction: Affects both safety and security; prevention of intentional introduction of opportunities for sabotage or theft.

Design concepts and criteria (1/2)

- Defence-in-Depth (DID) concept applies for both nuclear safety and nuclear security.

- Application of the DID is slightly different for security than safety: Barriers are established to prevent risk of accident or delay malicious act.

- Design Basis Accident (DBA) for safety - Design of safety systems;

- Design Basis Threat (DBT) for security – Design of physical protection system.

Design concepts and criteria (2/2)

Design safety	Security advantage
Design for high reliability of safety systems (redundancy, diversity, physical separation, fail safe)	Delay or prevent unauthorized access – several targets need to be compromised simultaneously
Use of passive systems	Makes it more difficult for potential adversaries to tamper with safety systems
Introduction of robustness against human errors	Increases protection against an insider threat
Doors or barriers for radiation protection purposes	Delay or preventing unauthorized access
Safety specialists have knowledge of potential consequences of failures of equipment important to safety	Help security specialists to identify sensitive targets

Modifications

- Modifications (including to documentation) can be planned or emergent, permanent or temporary – thorough assessment is needed in accordance with a management system process.
- Security related modifications must not compromise operational limits and conditions;
- Safety related modifications must not compromise the effectiveness of security plans;
- *Coordination* is needed – e.g. security specialists in safety committees and vice-versa.

Operating programmes and procedures (1/4)

– Access control: Close cooperation to ensure requirements for both safety and security are met:

- Facilitated access is needed for emergency teams while it may be controlled for security purposes;
- Some areas within the facility may be subjected to special physical protection while it should be possible to be accessed for evacuation of personnel in case of emergency;
- Safety procedures in some cases may slowdown transport of materials, while the duration of transport should be minimized for security purposes.

Operating programmes and procedures (2/4)

– Operating procedures: Cooperation/consultation in developing procedures to ensure interface is considered.

- *Procedures for handling of nuclear material (e.g. information may be vital for planning malicious acts);*

- *Potential impact of performing safety procedures on security and vice-versa (e.g. maintenance on access points; erroneous bypass of safety systems, surveillance cameras, power supply, etc.);*

- *Harmonization/combining maintenance (e.g. operability checks, testing) for safety and security components could be possible.*

Operating programmes and procedures (3/4)

- **Ageing management:** Ageing of facilities is a concern in safety and security. Assessment of the components’ status may result in the need for modernization or refurbishment;
- **Periodic review:** Updating of procedures and documents, and revision of the safety analysis (including DBA) or the design basis threat.
- **Operating experience feedback:** More limited in security.

Operating programmes and procedures (4/4)

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Coordination in developing and implementing operating programmes and procedures. When conflicts are unavoidable, the matter should be resolved based on the philosophy of minimizing the risk to operators and the public.

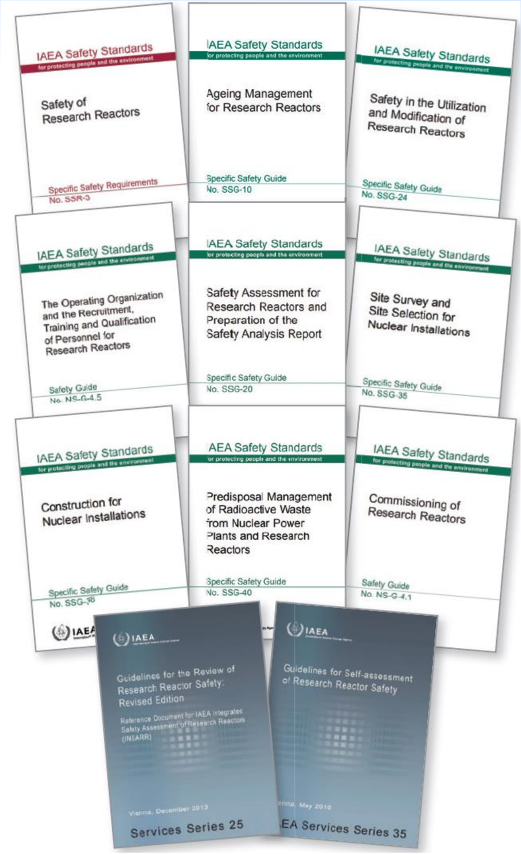
Emergency preparedness and response

- The radiological emergency plan address events related to the facility and due to malicious acts;
- Contingency plan is upstream radiological emergency plan. It is designed to secure the site before any mitigation action is taken.
- In security events , response aims at “reversing” the immediate consequences of unauthorized access or actions. Response to the radiological consequences that might occur is part of the radiological emergency plan;
- The two plans should be complementary and coherent, which to be tested in (coordinated) emergency exercises.

IAEA Assistance – Safety Standards

- Up-to-date safety standards covering all safety areas – Safety requirements and 11 safety guides revised recently, cover lessons learnt from Fukushima accident;

- Comprehensive set of supporting documents on topics of interest (18 publications since 2015).



Concluding remarks

- Interface exists between nuclear safety and security in organization and management aspects and in activities involved in all phases of research reactor lifetime.

- Safety and security both aim to protect people and the environment from radiological hazards. Work to strengthen safety must take security into account and vice-versa. In case that conflicts are unavoidable, work to be guided by minimizing the overall risk.

- Safety and security developed as separate disciplines. Unless managed well, measures to reinforce one discipline can harm the other. With good management they can reinforce each other.

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Thank you!