Thematic Area 9: Addressing interfaces

Safety and Security Interfaces in Transport of Radioactive Material - Regulator's Perspective

Sumathi Ellappan
Bhabha Atomic Research Centre
Mumbai, India
E_mail: sumathi@barc.gov.in

Third International Regulator's Conference on Nuclear Security - 2019
Marrakech, Morocco, October 3, 2019

Transport of Radioactive Material – Overview

- About 20 million consignments of radioactive material are transported each year on public roads, railways and waterways
- Regulated in accordance with national and international regulatory requirements
- Transport Safety regulations are uniformly adopted by member-states and International Organizations
- Widespread implementation of transport regulations resulted in favorable results
- The challenges during transport are unique and requires dedicated approach

International and National Regulations

	Safety	Security
IAEA	IAEA Specific Safety Requirements No. SSR-6 (Rev. 1) -2018 “Safe Transport of Radioactive Material”.	• IAEA NSS-13, Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/ Revision 5), 2011 • IAEA NSS-14, Security Recommendations on Radioactive Material and Associated Facilities, 2011 • IAEA NSS-9, Implementing Guide on Security in Transport of Radioactive Material, 2008
INDIA	AERB Safety Code ‘Safe Transport of Radioactive Material’, AERB/NRF-TS/SC-1 (Rev.1), March 2016 based on IAEA SSR-6, 2012	AERB Safety guide on “Security of Radioactive Material during Transport”, (AERB/NRF-TS/SG-10), 2008

CPPNM, Amendments to CPNM, UN modal regulations, Code of conduct and Guidance Import/export

India - Nuclear Safety and Security Responsibilities

- **Prime Minister of India directly heads the ministry concerned with Department of Atomic Energy (DAE)**

- **Chairman, Atomic Energy Commission, who is also Secretary to DAE, is responsible for nuclear Safety and Security**

- **Regulatory Bodies**
  - **Atomic Energy Regulatory Board (AERB): For NPPs, Radiation Facilities and other related facilities**
  - **BARC Safety Council (BSC): BARC Facilities with Research Reactors & Facilities engaged in Research and Developmental Activities**

Radioactive and Nuclear Material (NM)

- **RIA kits, Check/Calibration sources, Radiopharmaceuticals, Radiography cameras, teletherapy sources, Rad Waste, LSA Material, fresh fuel and Irradiated fuel**

- **Excepted Package; IP-1,2,3; Type-A; Type-B; Type-C**

- **Risks - Radiation + Nuclear (NM)**
  - **NED**
  - **RDD**
  - **Sabotage**

- **IAEA NSS-9**
  - **Graded approach, Levels are based on threshold values**

- **IAEA NSS-13**
  - **Levels of Protection based on categorization of NM for use in the NED**

Safety and Security

Link between Safety and security

- **SSR-6 (Para 109) - Measures should be taken to ensure that radioactive material is kept secure in transport so as to prevent theft or damage and to ensure that control of the material is not relinquished inappropriately**

Approach to Safety and Security

- **(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."**

Why Safety and Security?

- **Transport is potentially the most vulnerable phase in the life cycle of a radioactive material**
  - **Occurs in the public domain (not in well-secured fixed facility)**

- **If a conveyance is seized, it could be used to quickly move the material to high consequence locations for dispersion or coercion**

Safety Vs. Security

Safety

- Focuses on the effects of human or mechanical error
- Emphasizes on Transparency
- Prescriptive approach

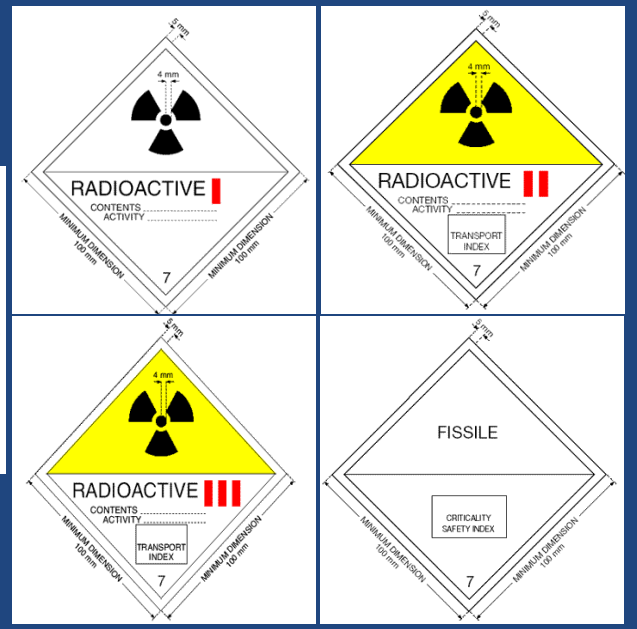
Security

- Focuses on deliberate acts intended to do harm
- Emphasizes on confidentiality
- Prescriptive + Pragmatic approach

Both safety and security need to co-exist during transport to protect people and the environment from radiation and other hazards.

Main Components of Transport Safety

- **Identification and classification of material**
  - Graded approach; Routine, Normal and Accident conditions
- **Packaging**
  - Prevention from Radiation Hazard (Shielding, dose rate limits, contamination limits, segregations)
  - Containment (Leak tightness, multiple barriers, retention systems)
  - Prevention from heat (Thermal protection, limits on temperature)
  - Preventing criticality accident (CSI)
- **Hazard communication**
  - Marking, Labeling, Placarding, Shipping documents
- **Training**
- **Emergency Preparedness and Response**
- **Other controls**
  - Exclusive use shipment
  - Special Arrangements etc.,

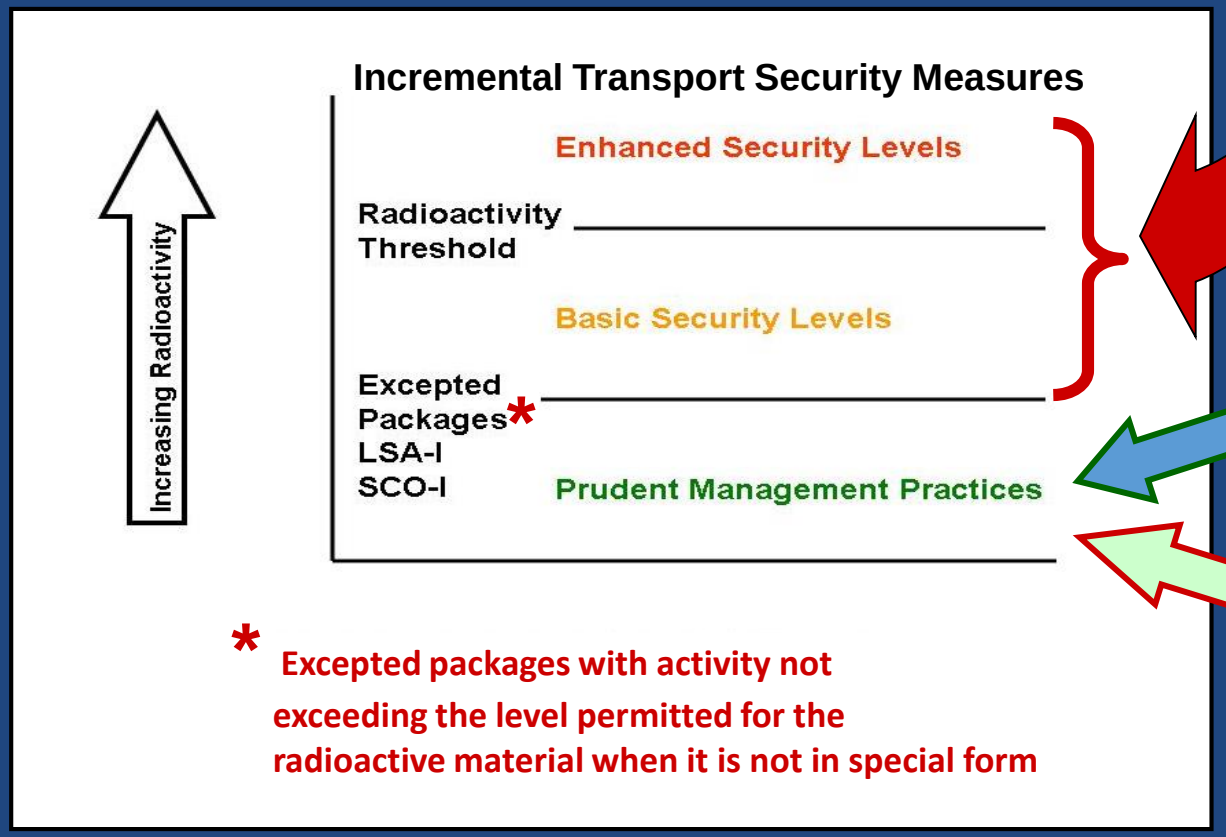


Main Elements of Transport Security

- **Design Features**
  - **Defence-in-Depth and graded approach**
- **Security Functions**
  - **Deterrence, Detection, Delay and Response**
- **Access Control**
- **Administrative Control (Personnel verification)**
- **Information Control**
- **Specific Training of carrier's personnel**
- **Tracking of Shipment**
- **Alerting state authorities prior to and during shipment**

Transport Security Levels (NSS 9)

Two Security Levels are Recommended



Additional security measures in certain circumstances

Some small risk shipments fall below the lesser of the two levels of security

For radioactive materials posing a minimal threat, only prudent management practices are necessary

Threshold is based on 10 D per single package for listed radionuclides and 3000 A_2 per single package for all other radionuclides

Interface between Safety and Security

- A balanced safety and security measures are to be strictly followed during design, maintenance, movement of the radioactive material as per the national / international regulatory requirements.

- Nuclear security and nuclear safety have in common the aim of protecting persons, property, society and the environment from the harmful effects of ionizing radiation.

- Security measures and safety measures have to be designed and implemented in an integrated manner to develop synergy between these two areas and ensure that security measures do not compromise safety and vice versa.

Interface 01 – Regulatory Framework

- **Built on a legal and regulatory framework monitored by competent authorities**
- **Consenting Process, Inspection and enforcement**
- **Clearly defined and documented Procedures**
  - **Accountabilities, Responsibilities, lines of communication, Emergency and Contingency procedures.**
- **Joint assessments by the safety and security professionals during design stage of the package itself.**
- **Several well established concepts in nuclear safety like defence-in-depth, use of multiple barriers and redundancy or spatial separation promote nuclear safety as well as nuclear security.**
- **The safety and security interfaces should be strengthened by building safety culture and security culture into the management system.**

Interface 02: Hazard Communication

- **Transparency vs. confidentiality**
- **Transparency and information exchange promote nuclear safety**
- **Marking, labeling, Placarding, shipping documents are designed to indicate the presence of radioactive material**
- **Security point of view it violates confidentiality**
- **However, with pragmatic approach it can be dealt in different ways**

Eg.

- **Depending upon the threat assessment the hazard communications may be changed.**
- **Providing escorts for safety and security purposes**

Interface 03 – Emergency Response

- **A security event may impact on nuclear safety (e.g. malicious damage of a containment system) and vice versa (e.g. a safety event may require cordoning off the vicinity and delineation of traffic etc. while prompt access for emergency personnel may be required).**

- **Additionally, the cause of a safety related event may not be immediately be identifiable (malicious activity should be considered).**

- **It should be ensured that security measures during a response to a nuclear security event do not adversely affect the safety of the personnel. Security personnel should manage their actions in a way that maintains the safety of all potentially affected persons.**

- **Plans to limit the radiological consequences and joint emergency exercises by the safety and security professionals are made.**

Interface 04 – Staff Qualification and Training

Nuclear safety and nuclear security have the following in common:

- **Personnel qualification and experience should be complied with relevant requirements of both nuclear safety and nuclear security regimes.**

- **Roles, responsibilities and accountability for each level of the organization should be clearly defined and supported by effective training.**

Interface 05- Routeing:

- **One of the recommended operational control during movement of the package is to avoid highly populated area in view of exposure to the public.**

- **However, the same is recommended security measure to avoid highly populated areas where the radiological and economic consequence of a successful sabotage event might be very high.**

- **When such route is selected it is necessary to ensure that the threat remains low in such routes. Routes of natural disaster, civil disorder or known threats, alternative routes are identified in advance of such shipments.**

Interface 06- Design safety:

- **Graded approach:** Type B(U)/B(M), Type-C packages undergo the tests simulating accident conditions either prescriptive or performance based approach which will retain its integrity up to some level of malicious attacks by the time, the response mechanism regain the control over the package. This aspect is complemented during malicious attack of moderate level on the shipment.

- **Bulk packages:** Deterrence against malicious use

- **Portable Designs:** The devices such as radiography cameras, well logging sources, high activity calibrations sources are designed for portability. Consideration should be given to provide adequate security for such devices against malicious use.

Interface 06- Design safety (Contd.):

- **Protection against valves:** The licensee shall establish measures to identify the operating status of components of the packaging, such as tagging valves and switches, to prevent inadvertent or malicious operation.

- **Retention System:** Retention system such as braces, tie-downs are provided to restrain the package and prevent movement within or on a conveyance during routine conditions of transport and assessed by Regulatory body. To breach the tie-down in many cases, specialised tools may be required. Along with tie-down appropriate security systems (locks etc.) will make the shipment more secure.

- **Special Form Material:** Higher hazard alpha emitting radionuclide in special form possesses low safety hazard. However, very attractive for adversary because its potential use in RDD. Safety and security need to be considered in integrated manner in such cases.

Challenges

- Non confirmation on checking the integrity of the locks and seals on the package, vehicle, compartment or freight container
- Portable designs
- Collateral theft
- Lack of training for the stack holders
- Lack of Cohesion among safety and security professionals
- Delayed and Denial of Shipments
- Advancements in Technology , **Are we ready?**

Conclusion

- **Better integration of safety and security practices will enhance the capability.**

- **The security measures are to be adopted at the earliest stages of design of the packages and ensure there is no conflict with safety requirements. Accordingly, the security requirements should not conflict with safety requirements.**

- **The discussed interfaces consist of aspects that are in common or need to be managed in an integrated way in order to achieve the common aim of nuclear safety and nuclear security.**

Thank You