Radioactive Material Transport Security

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Background

- Focus has been on Safety
- The rising threat of terrorism and sabotage is now recognized and transport has been recognized as a vulnerable part of the nuclear and radioactive material supply chain.

Dangerous Goods Transport Security

- Radioactive material is one of nine classes of dangerous goods regulated in transport (both safety and security)
- Radioactive material security must be compatible with the security approaches of the consignor, carrier, port authority, consignee, etc.
- Many other dangerous goods pose equally serious potential consequences
  - Infectious substances
  - Bulk quantities of poisonous materials
  - Explosives
- Dangerous goods transport security is now being implemented worldwide

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All Nine Classes of Dangerous Goods Require Appropriate Security During Transport

Class 1 Explosives	**Class 6 Toxic and infectious substances**
Class 2 Gases	***Class 7 Radioactive material***
Class 3 Flammable liquids	**Class 8 Corrosives**
Class 4 Flammable solids	**Class 9 Miscellaneous dangerous goods**
Class 5 Oxidizing substances and organic peroxides	

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Dangerous Goods Transport Security
International Roles and Responsibilities

- International Atomic Energy Agency – radioactive material guidance
- UN Committee of Experts on the Transport of Dangerous Goods – recommendations for all classes (relies on the IAEA for class 7 recommendations)
- Modal organizations regulations
  - International Civil Aviation Organization
  - International Maritime Organization
- Universal Postal Union regulations
- Regional organizations regulations

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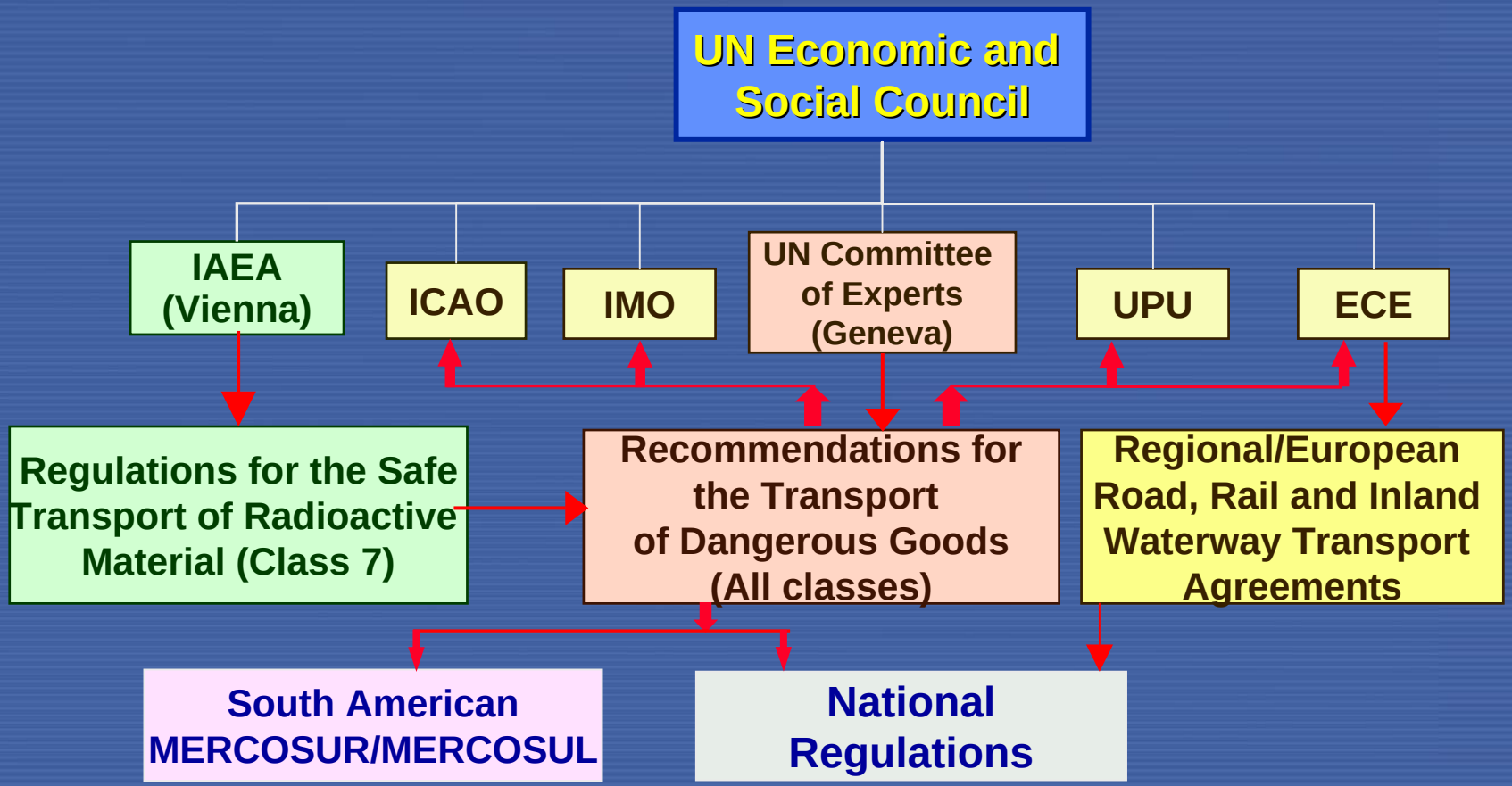
The International Regulation of the Transport of all Dangerous Goods



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Actions

- New guidance for the security in transport of nuclear and other radioactive material
- Training on guidance for security in transport of radioactive material
- Assessment procedure on security of transport of radioactive material

What are the Possible Consequences of Malicious Use of Radioactive Material?

- Acute radiation sickness or fatality
- Radiation doses to the public and emergency workers with subsequent increase in latent cancer fatality
- Contamination
  - Loss of function (area or facility)
  - Economic disruption
- Social disruption
- Psychological effects

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The Transport Security Guide Considers:

- Reference doses and other parameters
- Potential Radiological consequences to determine thresholds
- Categorization methodology
- Identification of security groups

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- Use of DBT
- Specific recommendations for Physical Protection measures
- The three dimensional aspect of security (security level, where and when)
- "Denial of shipment"

Purpose and Scope

- A uniform and consistent approach
- Guidelines apply to all radioactive material
- Should provide states with guidance in implementing or enhancing a state security system to protect radioactive material

Security Levels and Thresholds – Evaluating Potential Consequences

Planning basis for setting thresholds requires specifying:

- Type of event (dispersion – e.g., “dirty bomb” or other dispersal device, exposure device, etc.)
- Effect of concern, scenario, and parameters
  - Radiation dose criteria
  - Area involved (1 km^2, 500 acres, other)
  - Exposure pathways and parameters (time in area, distance to source, etc.)
  - Modeling approach (location-specific, theoretical, etc.)
- Defines the activity of each radionuclide that could cause such an event

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Dispersion Consequence Evaluation

- A simple planar model was used to examine potential dispersion consequences (“magic” model)
- Chosen parameters
  - 1 km^2
  - 1,000 mSv lifetime dose (ICRP 82)
  - IAEA TECDOC-955 dose conversion factors for long term dose from deposition

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Transportation Security Consequence Evaluation

$$A = \frac{D \times Area}{CF_4 \times RF}\left[\frac{1}{(OF \times SF) + (1 - OF)}\right] \times \frac{1TBq}{10^9 kBq}$$

A = activity (TBq)

D = ICRP lifetime dose value (1000 mSv)

CF_4 = long term dose conversion factor for deposition

Area = surface area covered (10^6 m^2)

OF = occupancy factor (0.6)

SF = shielding factor (0.16)

RF = release factor (0.1)

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Multiple Considerations in Setting a Transport Security Threshold

1. Current UN Model Regulation threshold
   - 3,000 A_1 or 3,000 A_2
   - Uses well established Q-system and A-values
2. Code of Conduct categories
3. Dispersion consequence calculations

- IAEA meetings concluded
  - 3,000 A_2 except for radionuclides included in the Code of Conduct
  - 10 D (Category 2) for radionuclides included in the Code of Conduct

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Example Radioactivity Thresholds

Radionuclide	Threshold (TBq)
Am-241	0.6
Cf-252	0.2
Cs-137	1
Hg-203	3,000*
I-131	2,100*
Mo-99	1,800*
Pu-238	0.6
U_{nat}	Unlimited*

*** Limited by 3,000 A_2**

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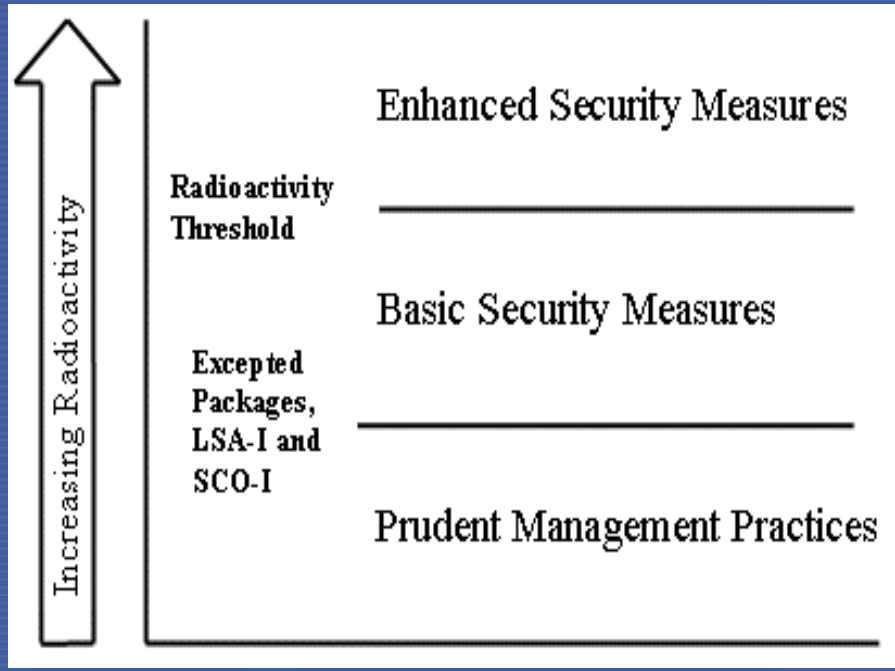
Security Levels

- Some materials only need Prudent Management Practices
- The threshold can be used to define materials requiring “basic” and “enhanced” security measures



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Security levels

- For small quantities of radioactive material transported as excepted packages, LSA-1 material or SCO-1, no specific security measures are proposed beyond the safety regulations and prudent management practices already implemented by consignors and carriers;
- For any package with contents exceeding the excepted package quantity and material other than LSA-1 and SCO-1, (but with quantities lower than 10D or 3000 A_2) a basic security level is proposed that includes some specific security measures; and
- For radioactive material packaged in significant quantities, such that it is deemed to be 'high consequence' dangerous goods (above 10D or 3000A_2), both the basic security measures and additional higher-level (i.e. enhanced) security measures should be applied.

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Considerations in Setting Transport Security Measures

- Consistency with the Model Regulations
  - Two security levels (basic and enhanced)
  - Minimizes additional costs and complexity
  - Minimizes likelihood of denial of shipments
- Thresholds based on consequence evaluation and consistency with the Code of Conduct
  - 10D for radionuclides included in the Code of Conduct
  - Other radionuclides captured at the 3,000 A_2 level

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Basic Transport Security Measures

- General security provisions
  - Competent Authority, at its discretion, should provide Threat information to operators
  - Operators should consider Security Requirements
  - commensurate with their responsibilities
  - Transfers limited to appropriately identified carriers/consignees
  - Use of appropriate security measures at in-transit storage sites
  - Procedures to initiate inquiry for overdue shipments and, if lost or stolen, to initiate efforts to locate and recover

Basic Transport Security Measures (continued)

- Security locks
  - Secure and closed conveyances or sealed packages >500 kg secured to the vehicle
  - State should consider need for additional measures for open vehicles
- Security awareness
- Security awareness training of personnel
  - Content of security awareness training
  - Verification of training
  - Record retention
- Personnel identity verification
  - Carrier personnel should carry positive identification
- Security verification of conveyances
- Security inspections of conveyances

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Basic Transport Security Measures (continued)

- Written instructions with required security measures
- Security related information exchange by operators
- Trustworthiness verification ("…may be subject to…commensurate with their responsibilities")

Enhanced Security Measures

- Apply to packages exceeding thresholds
- Competent Authority should identify carriers and consignors
- All operators should develop, implement and periodically review a security plan
  - Allocation of responsibilities
  - Records of packages/materials transported
  - Review of operations and assessment of vulnerability
  - Identification of measures used to reduce security risks
  - Procedures for reporting and dealing with threats, breaches, and incidents
  - Evaluating, testing and review/update of security plan
  - Measures to ensure information security
  - Measures to limit distribution of sensitive information
  - Measures to monitor the shipment

Enhanced Security Measures (continued)

- State should assign responsibility for security plans
- Security plan may be incorporated into other plans
- Operators should ensure appropriate response plans
- Advance notification
  - Consignor should notify consignee of planned shipment, mode, and expected delivery time
  - Consignee should confirm receipt/non-receipt
  - Consignor should notify receiving/transit States (if required)

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Enhanced Security Measures (continued)

- Tracking devises
  - When appropriate, transport telemetry or other tracking methods or devices should be used
    - Ranging from bar code to more sophisticated near real-time tracking systems
- Carrier should provide ability to communicate from conveyance
- Additional provisions for road, rail, and inland waterway
  - Carriers should ensure operational readiness of devices, equipment, etc.
  - Continuous attendance or secure parking of road conveyance

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Additional Security Measures

- States should consider enhancing measures based on a DBT, prevailing threat or nature of the material, inter alia:
  - Additional training
  - Carrier licensing, approval of their security plans, and auditing
  - Use of automated real-time tracking
  - Use of guards
  - Evaluation of potential for sabotage
  - Transfer of security responsibilities during shipment
  - Review of security plans, holding exercises, etc

Minimizing the Impact of Radioactive Transport Security Compliance

- Consistency with other dangerous goods security requirements
- Consistent application
  - National regulations and interpretations that set up unique requirements have caused some carriers to opt out of carrying radioactive material
  - “Context sensitive” (i.e., flexible) application of requirements, for example to air transport
- As requirements are put into place, Competent Authorities and carriers should share experience
  - Consistent interpretation of requirements
  - Application experience and ideas for improvement

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The Challenge is in the Future

- IAEA Guide “Security of Radioactive Material during Transport” has been circulated to Member states for comments
  - Specific comments will help improve the draft and minimize operational impacts
  - When finalized, it should provide a consistent approach for national and international transport security requirements

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