Safe Transport of Dangerous Goods by Air

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An overview

- Dangerous goods and the international regulatory framework
- ICAO and the UN Recommendations
- Infectious substances
  - In the mail
- Radioactive material
  - Denial of shipments
What are dangerous goods?

• Articles or substances which are capable of posing a **risk to health, safety, property** or the **environment** and which are classified in the list of dangerous goods in the Technical Instructions or which are classified according to those Instructions
International Regulatory Framework

UN GENERAL ASSEMBLY

ECOSOC

Sub-Committee of Experts on Transport of Dangerous Goods

UN RECOMMENDATIONS

ICAO

IMO

IAEA

Sub-Committee of Experts on Transport of Dangerous Goods

UN RECOMMENDATIONS

ECOSOC

ICAO TIs

IMO DGR

IAEA

IMDG Code

State Variations

Air

Sea

Inland Water

Road

Rail

5 Santiago, Chile, 9 October 2012
ICAO Dangerous Goods Panel (DGP)
Annex 18

- The Safe Transport of Dangerous Goods by Air
- “Each Contracting State shall take the necessary measures to achieve compliance with the detailed provisions contained in the Technical Instructions.” (Annex 18, 2.2.1)
Technical Instructions

- Issued every two years to reflect UN cycle
The basics

• 9 classes or divisions
  – Indicates type of hazard
• Of these, 5 have packing groups assigned
  – Indicates degree of hazard
• 4 digit identifier (preceded by “UN”)
• Official UN transport name
  – Proper shipping name (PSN)
• 3000 substances or articles (approximately)
Classification

- Class 1: Explosives
- Class 2: Gases
  - Division 2.1: Flammable gas
  - Division 2.2: Non-flammable, non-toxic gas
  - Division 2.3: Toxic gas
- Class 3: Flammable liquids
- Class 4
  - Division 4.1: Flammable solids
  - Division 4.2: Substances liable to spontaneous combustion
  - Division 4.3: Substances, which on contact with water, emit flammable gases
- Class 5
  - Division 5.1: Oxidizer
  - Division 5.2: Organic Peroxides
- Class 6
  - Division 6.1: Toxic substances
  - Division 6.2: Infectious substances
- Class 7: Radioactive material
- Class 8: Corrosives
- Class 9: Miscellaneous dangerous goods
Emergency Response Guidance

- Emergency Response Guidance for Aircraft Incidents Involving Dangerous Goods (Doc 9481)
Drill Letters

- A  ANAESTHETIC
- C  CORROSIVE
- E  EXPLOSIVE
- F  FLAMMABLE
- H  HIGHLY IGNITABLE
- i  IRRITANT / TEAR PRODUCING
- L  OTHER RISK LOW OR NONE
- M  MAGNETIC
- N  NOXIOUS
- P  TOXIC* (POISON)
- S  SPONTANEOUSLY COMBUSTIBLE OR PYROPHORIC
- W  IF WET GIVES OFF POISONOUS OR FLAMMABLE GAS
- X  OXIDIZER
- Y  DEPENDING ON THE TYPE OF INFECTIOUS SUBSTANCE, THE APPROPRIATE NATIONAL AUTHORITY MAY BE REQUIRED TO QUARANTINE INDIVIDUALS, ANIMALS, CARGO AND THE AIRCRAFT
## Risk to Occupants

<table>
<thead>
<tr>
<th>DRILL NO.</th>
<th>RISK TO OCCUPANTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>As indicated by the drill letter(s)</td>
</tr>
<tr>
<td>2</td>
<td>As indicated by the drill letter(s)</td>
</tr>
<tr>
<td>3</td>
<td>Smoke, fumes and heat, and as indicated by the drill letter(s)</td>
</tr>
<tr>
<td>4</td>
<td>Smoke, fumes and heat, and as indicated by the drill letter(s)</td>
</tr>
<tr>
<td>5</td>
<td>Eye, nose and throat irritation; skin damage on contact</td>
</tr>
<tr>
<td>6</td>
<td>Acute toxicity, effects may be delayed</td>
</tr>
<tr>
<td>7</td>
<td>Exposure to radiation, and personnel contamination</td>
</tr>
<tr>
<td>8</td>
<td>Eye, nose and throat irritation; skin damage on contact</td>
</tr>
<tr>
<td>9</td>
<td>As indicated by the drill letter</td>
</tr>
<tr>
<td>10</td>
<td>Smoke, fumes and heat, and as indicated by the drill letter</td>
</tr>
<tr>
<td>11</td>
<td>Delayed infection to humans or animals</td>
</tr>
</tbody>
</table>
Example: Ethyl ether 3AH

- 3 = Flammable liquid or solid
- A = Anaesthetic
- H = Highly ignitable

- Risk to aircraft – fire and/or explosion
- Risk to occupants – smoke, fumes and heat, and as indicated by the drill letter(s)
Infectious substances

• Includes:
  – Infectious substances
  – Patient specimens
  – Cultures
  – Biological products
  – Medical or clinical waste
Classification of infectious substances

- Risk assessment
- Category A or B
- Previously, laboratory risk groups were used as basis for transport
Category A

An infectious substance which is transported in a form that, when exposure to it occurs, is capable of causing permanent disability, life-threatening or fatal disease to humans or animals in otherwise healthy humans or animals.
Classification

- Infectious substances assigned to Category A and which cause disease in humans or both in humans and animals must be assigned to UN 2814

  • UN 2814: Infectious substances, affecting humans

- Infectious substances assigned to Category A and which cause disease only in animals must be assigned to UN 2900

  • UN 2900: Infectious substances, affecting animals only
Category B

– An infectious substance which does not meet the criteria for inclusion in Category A

– Infectious substances in Category B must be assigned to UN 3373

– The proper shipping name of UN 3373 is Biological substance – Category B
Patient specimens

- Patient specimens for which there is minimal likelihood that pathogens are present are not subject to these Instructions if specimen is transported in a packaging:
  - which will prevent any leakage
  - which is marked with the words "Exempt human specimen" or "Exempt animal specimen", as appropriate
• Medical or clinical wastes which are reasonably believed to have a low probability of containing infectious substance must also be assigned to:

UN 3291  Clinical Waste, unspecified, n.o.s.
(or)
(Bio) Medical Waste, n.o.s.
(or)
Regulated medical waste, n.o.s.
If refrigerated or frozen....

– Most frequently used refrigerants are ‘Dry Ice’ and ‘Liquid Nitrogen’

– For ‘Dry Ice’, the outer packaging must allow the release of carbon dioxide gas

– For ‘Liquid Nitrogen’, the shippers must use plastic primary receptacles, which can withstand very low temperatures
Marking and labelling

- Primary Hazard
- Subsidiary Risk Label when required
- Orientation labels on opposite sides on combination packages containing more than 50 mL of liquid in the package
- “Cargo Aircraft Only” label if applicable
Packagings for Category B

• UN 3373 Biological substance – Category B are similar to these for Category A infectious substances, except that they have not been officially tested and no “Package Specification Markings” are required.
Problems....

- Availability of packaging
- Cost
- Export/import controls
Infectious substances in the mail

• Universal Postal Convention
  – Biological substance – Category B
  – Patient specimens
  – Refrigerant – dry ice

• Approval by CAA of procedures and training
  – Incident reporting
Safety and radioactive material

• The objective is to protect persons, property and the environment from the effects of radiation during the transport of radioactive material

• This protection is achieved by requiring:
  • a) containment of the radioactive contents
  • b) control of external radiation level
  • c) prevention of criticality
  • d) prevention of damage caused by heat
Risks

• The two primary risks from radioactive materials are:
  • **Contamination**: through direct contact with radioactive material
  • **Radiation**: through exposure to Alpha, Beta and Gamma radiation being emitted by radioactive material

• It is the ultimate goal of the regulations to limit during the transport of radioactive materials the absorbed dose for staff crew and passengers.
  • **ALARA** = As Low as Reasonable Achievable
Effective barriers
Radiation protection programme

• Nature and extent of measures to be taken must be related to the magnitude and likelihood of radiation exposures

• At least following elements must be included:
  – compliance with the ALARA-principle
  – emergency response procedures
  – training
  – if applicable, individual or work place monitoring records: where it is assessed that the effective dose
    • is likely to be between 1 and 6 mSv/year: a dose assessment program via workplace monitoring or individual monitoring must be conducted; and
    • is likely to exceed 6 mSv/year: individual monitoring must be conducted.
Radioactive Material definition

- Radioactive material is defined as any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in the Instructions.
Type A
Type B(U)
Excepted Packages

- Handling label for Excepted Packages of Radioactive Materials

Radioactive Material, Excepted Package

This package contains radioactive material, excepted package and is in all respects in compliance with the applicable international and national governmental regulations.

UN ___________

The information for this package need not appear on the Notification to Captain (NOTOC)
Storage

- Radioactive Material must be segregated sufficiently from workers and members of the public. The following values must be taken into account:
  
a) for workers in regularly occupied working areas, a dose of 5 mSv/year
b) for members of the public, in areas where the public has regular access, a dose of 1 mSv/year

- Additional requirements for fissile material
Loading – Separation Distances

Minimum distance: 1.15 m

Minimum distance: 1.0 m

Total TI = 6
Exceptions

• a) radioactive material implanted or incorporated into a person or live animal for diagnosis or treatment;
• b) contaminated person;
• c) consumer products
• d) ores
Contaminated Person

- a person who has been subject to accidental or deliberate intake of or contamination from radioactive material and is to be transported for medical treatment, taking into account the necessary radiological protection measures with respect to other passengers and crew, subject to approval by the operator;

(TIs, Doc 9284, Part 1;6.1.4 b))
Denial of shipments

- Many radiopharmaceuticals must be transported by air but sometimes delayed beyond useful life
  - negative perception
  - concern about cost/extent of training
  - lack of awareness about need to use and transport

- IAEA – International Steering Committee
  - To be a negligible problem by 2014........
Nuclear or Radiological Emergency

- Generic procedures for medical response during a nuclear or radiological emergency

http://www.iaea.org/newscenter/focus/fukushima/emergency.html
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http://www.icao.int/safety/DangerousGoods/Pages/default.aspx