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Introduction

Transport of dangerous goods

• Dangerous goods:

- are produced and transported in very large quantities;
- cover a very large range of products;
- present risks



Dangerous Goods (examples) Class 1: Explosives



Military ammunitions, bombs, etc (all types); Industrial explosives (dynamite...),
Fireworks...

Dangerous Goods (examples) Class 2: Divisions 2.1, 2.2 and 2.3



Gases compressed, liquefied or refrigerated

- Div. 2.1: Flammable gases
 - (propane, LPG, cigarette lighters)
- Div. 2.2: Non-flammable, non-toxic gases
 - (air, oxygen, nitrogen, helium)
- Div.2.3: Toxic gases
 - (ammonia, chlorine)

Dangerous Goods (examples) Class 3: Flammable liquids



Petroleum products, Paints, Alcoholic beverages

Dangerous Goods (examples) Class 4: Div. 4.1, 4.2 and 4.3



- Division 4.1: Flammable solids (Ex: Sulphur, matches)
- Division 4.2: Substances liable to spontaneous combustion (Ex: phosphorus; fish meal, seed cake...)
- Division 4.3: In contact with water emit flammable gases (Ex: metal powders; sodium)

Dangerous Goods (examples) Class 5: Div. 5.1 and 5.2



- Division 5.1: Oxidizing substances
 - Ammonium nitrate fertilizers, hydrogen peroxide, bleaching agents
- Division 5.2: Organic peroxides
 - Dibenzoyl peroxide, catalysts for polyester resin

Dangerous Goods (examples) Class 6: Div. 6.1 and 6.2



- Div. 6.1: Toxic substances (Sodium cyanide, pesticides)
- Div. 6.2: Infectious substances (Cultures for bacteria, viruses, etc; medical diagnostic specimens, medical wastes)

Dangerous Goods (examples) Class 7: Radioactive material



Nuclear fuel,
Uranium hexafluoride,
Medical radioisotopes



Dangerous Goods (examples) Class 8: Corrosive substances



Sulphuric acid, Caustic soda, Car batteries

Dangerous Goods (examples) Class 9: Miscellaneous



Environmentally hazardous substances;
Mobile phone/computer batteries...

Dangerous goods in limited quantities



Cosmetics, perfumes, cleaning products...

Statistics



From the statistics in the USA and in Europe, it appears that:

- (a) Transport of dangerous goods increases regularly
- (b) The highest volumes transported are:
 - energy products (petroleum products, flammable gases)
 - flammable liquids and gases (other than energy products)
 - corrosive substances
- (c) Road transport is by far the most used inland transport mode (in terms of quantities and of number of shipments)



Accidents (1) – 25 June 2017



- More than 150 people killed in Pakistan last Sunday / another 50 people are still in critical condition
- 25000 litres of fuel
- The driver lost control and the vehicle overturned
- They were collecting fuel leaking from a tank-vehicle
- The tank exploded in a huge fireball, burning everybody on and around the spot
- Pakistan has an appalling record of fatal traffic accidents due to poor roads, badly maintained vehicles and reckless driving



Accidents (2)



•1978 Los Alfaques (Spain):

- Substance involved: 43 m³ liquefied propylene
- Mode of transport: by road
- 217 people killed; 400 yards devastated in all directions

•1990 Bangkok (Thailand):

- Substance involved: LPG
- Mode of transport: by road
- 63 people killed; 90 injured



Accidents (3)

- **1998 Kirghizstan:**

- Substance involved: 1800 kg of sodium cyanide
- Mode of transport: by road
- Hundreds of people injured due to contamination of water

- **1999 Tauerntunnel (Austria):**

- Substance involved: lacquer
- Mode of transport: by road
- 12 people killed; 50 injured; close of the tunnel for 3 months, economic cost: 17 millions DM



Accidents (4)

China:

Since 2005, 11 serious accidents (more than 10 deaths, more than 50 injuries or economic losses of over 50 million yuan)

Methanol tank-vehicle explosion in Yanhou Tunnel of Jinji Expressway on Mar 1, 2014, 31 deaths





Accidents (5)



Accidents have also negative effects on the environment.

Well-known examples are oil spillages:

- Torrey-Canyon;
- Amoco Cadiz;
- Exxon Valdez;
- Erika...

although small spillages of highly toxic substances may also have disastrous effects.



Conclusion

Accidents during the transportation of dangerous goods often have serious consequences: the socio-economic cost of a tanker accident may be twice as high as that of a non-dangerous goods-transport accident due to the dangerous goods escaping and the environmental and subsequent damage.



However, compared with the accident occurrence in the transportation of goods in general, accidents involving dangerous goods are rare: around eight out of 1,000 personal injury accidents involving a goods vehicle are classified as accidents involving dangerous goods.

