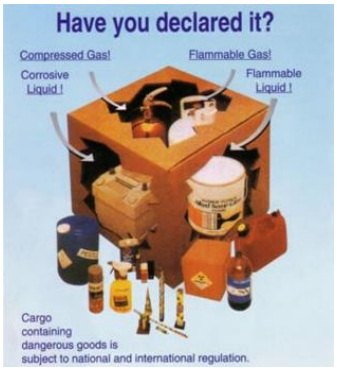
## 1.0 - Introduction






- Chemicals – a very important ingredient in the manufacture of host of items used by millions of people.
- Radioactive material – a very important application in the medical sector & consumer products.
- The increase in economic prosperity of the world leads to increase in demand for chemicals and radioactive material.
- Not all country has abundant supply of such substances as needed for such productive purpose, so they needed to be transported from one country to another, this results in increase of cross border transport of such chemicals and substances.
- Substances exists in one of 3 physical forms,
  Solids, Liquids & Gas.
- Physical state and physical properties of a substance will affect how easily and safely the goods can be handled in transport, however they should be packed and what hazards they present must be mentioned, especially if spilled.
- Physical properties,
  Melting point (Lowest temperature at which a solid will become a liquid when heated e.g. - ice turning to water.
  Boiling point (Temperature at which a liquid boils and begins to turn into vapor e.g. - water boiling in kettle and turning to steam.
- Chemical reactions occurring during transport are considered dangerous because of their uncontrolled nature and their potential to harm people and environment.
- Chemical reaction is a process in which a new substance is formed and which either requires energy to start it usually in the form of heat OR releases heat energy.

## 2.0 - Characteristics of Dangerous Goods

Basic chemical hazards,

- Flammability – Dangerous Goods which can catch fire,
- Toxicity – Dangerous Goods which has poison,
- Corrosivity – Dangerous Goods which burns,

Additional hazards are explosivity, radioactivity, infection which are not on regular basis,

### Flammability

- Substances which can catch fire are considered to be among the most dangerous cargoes.
- Substances which can cause fire can be identified by hazard warning label containing a flame symbol to risk from fire.

### Toxicity

- Substances that poison human or animal by either being breathed in (vapor inhalation) or by being absorbed through skin (dermal) or by being swallowed (oral).
- Toxic substances carry a hazard warning label containing skull and crossbones to signify health risk.

### Corrosivity

- Substances that destroy living tissues. When in contact with skin, eyes, mucous membrane (in mouth & nose) these substance in a mild form can cause irritation while in severe form can actually cause severe burns.
- Extreme corrosive substance can also cause damage to metals (including ship's structure).
- Substances which are corrosive carry a hazard label showing a hand and a piece of metal being burned when a corrosive liquid falls on them.

### Physical hazard

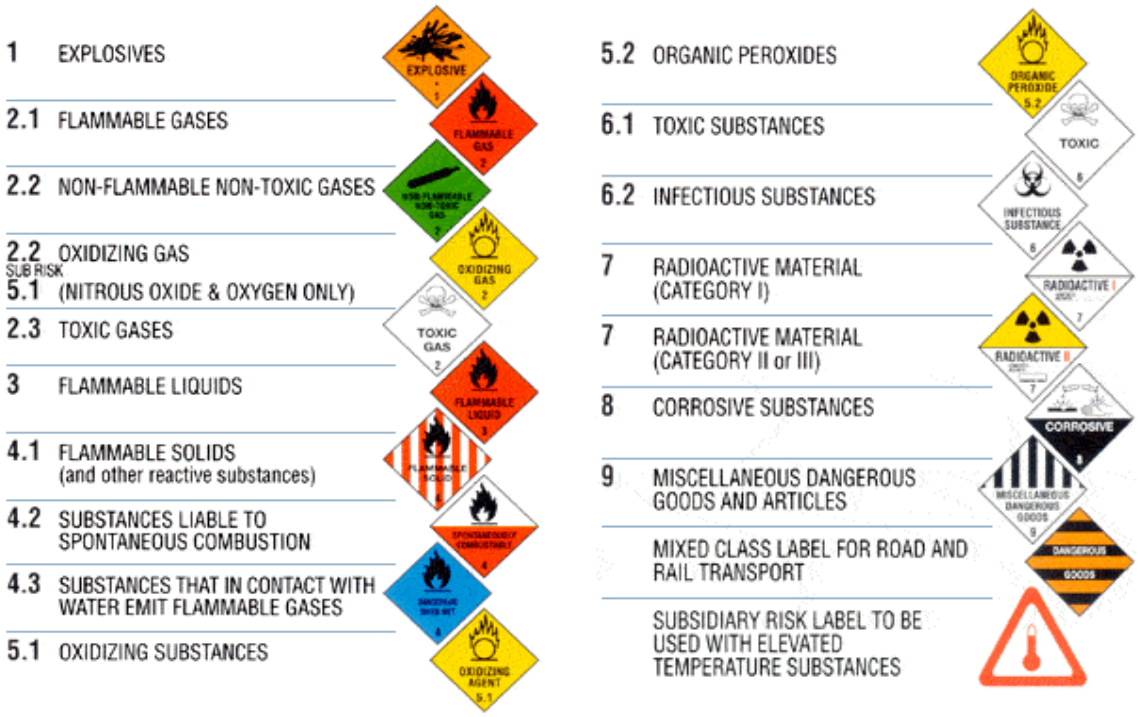
- Substance that due to its physical state, present physical hazards compressed gasses such a CO2 found in air we breathe come under class 2.2.
- Though otherwise not dangerous, they present danger due to being stored in cylinders or tanks in pressurized condition.
- If the pressure were to be released due to heat caused by fire during transport or storage, the cylinder or tank will burst and explode and may even take off like a rocket with serious consequences.

## 3.0 - Classification of Dangerous Goods

Based on aforesaid properties, substances and articles are classified into nine different hazard classes.

- Class 1 – Explosives divided into six divisions.
- Class 2 – Gases divided into three divisions.
- Class 3 – Flammable Liquids.
- Class 4 – Flammable solid; combustible solid; Solid dangerous when wet.
- Class 5 – Oxidizers and Organic Peroxides.

- Class 6 – Toxics and Infectious substances.
- Class 7 – Radioactive Material.
- Class 8 – Corrosives.
- Class 9 – Miscellaneous.




## 4.0 Packing Group

Each hazard present varying degree of danger,
The degree of danger is called Packing Group,

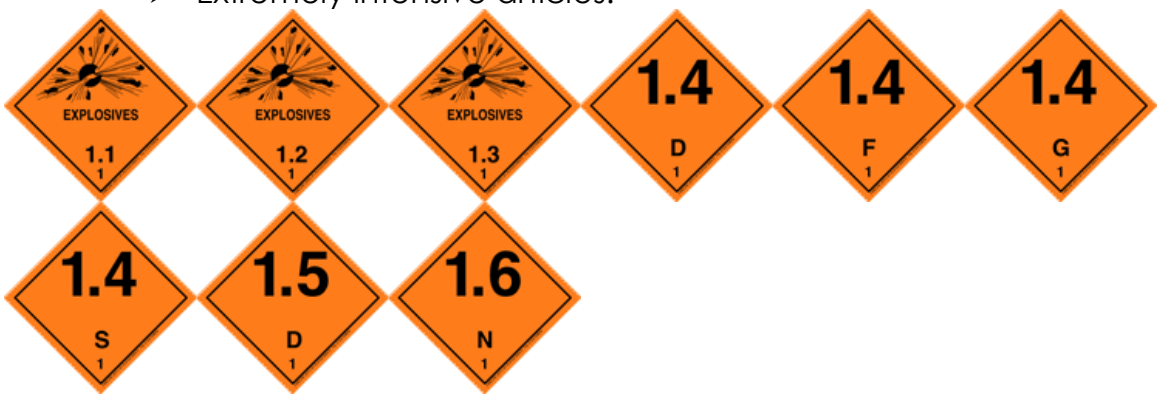
- PG I – High Danger,
- PG II – Medium Danger,
- PG III – Low Danger.

## 5.0 Classification by Class

**Class 1 – Explosives,** are classified in six divisions as under.

- Explosives with a mass explosion hazard. Ex:- Dynamite, Nitroglycerine etc.
- Explosives with a severe projection hazard.

- Explosives with a fire blast or projection hazard but not a mass explosion hazard.
- Minor fire or projection hazard (includes ammunition and consumer fireworks).
- Blasting agents.
- Extremely intensive articles.




**Class 2 – Gases**, are classified in three sub divisions as under.

- 2.1 - Flammable Gas, gases which ignite on contact with an ignition source.
  - Ex:- Hydrogen, Acetylene etc.
- 2.2 – Non-Flammable Gases, gases which are neither flammable nor poisonous.
  - Ex:- Oxygen, Nitrogen, Neon etc.
- 2.3 – Poisonous Gases, gases liable to cause death or serious injury to human health if inhaled.
  - Ex:- Fluorine, Chlorine, hydrogen cyanide etc.


**Class 3 – Flammable Liquids**, does not have any sub divisions but, classified as under.

- 3.1 – Highly Flammable Liquids with a boiling point below 35 Â°C.
  - Ex:- Carbon disulfide etc.
- 3.2 - Flammable liquids with a Flashpoint of less than 23 Â°C and boiling point above 35 Â°C.
  - Ex:- Petrol, Acetone etc.
- 3.3 - Liquids with a flashpoint above 23 Â°C but not exceeding 61 Â°C and a boiling point greater than 35 Â°C.
  - Ex:- Kerosene etc.


**Class 4 – Flammable Solids**, are classified in three sub divisions as under.

- 4.1 – Flammable Solids, which are easily ignited and readily combustible.
  - Ex:- Magnesium, Safety matches etc.
- 4.2 – Spontaneously combustible substances.
  - Ex:- White Phosphorous.
- 4.3 – Substances which emit a flammable gas when wet or react violently with water.
  - Ex:- Sodium , Calcium, Potassium etc.


**Class 5 – Oxidizing agents & Organic Peroxides**, are classified in two sub divisions as under.

- 5.1 – Oxidizing agents other than organic peroxides
  - Ex:- Ammonium nitrate, Hydrogen peroxide etc.
- 5.2 – Organic Peroxides.
  - Ex:- Benzoyl peroxides etc.


**Class 6 – Toxic & Infectious Substances**, are classified in two sub divisions as under.

- 6.1 – Toxic Substances, which are liable to cause death or serious injury to human health if inhaled, swallowed or by skin absorption.
  - Ex:- Potassium cyanide etc.
- 6.2 – Infectious Substances are known to contain pathogens.


**Class 7 – Radioactive Substances**, is classified as under,

Any material containing radionuclide where both, the activity concentration and the total activity in the consignment exceed the values specified in regulations. The following radioactive materials are not included,

- A – Implanted or incorporated into a person or live animal for diagnosis or treatment.
- B – In consumer products which have received regulatory approval, following their sale to end users.
- C – Non radioactive solid objects with radioactive substances present on any surfaces in quantities not in excess of the limit specified in the definition of contamination.


**Class 8 – Corrosives,** is classified as under,
Solids or liquids that can dissolve organic tissues or severely corrode certain metals.

- 8.1 Acids
  - Ex: sulfuric acid hydrochloric acid.
- 8.2 Alkalis
  - Ex: potassium hydroxide sodium hydroxide.


**Class 9 – Miscellaneous,** is classified as under,

- Articles and substances which otherwise not covered under the previous 8 classes, but nonetheless, present environmental or health hazard.
- Aviation regulated solids or liquids, magnetized material, Elevated temperature substances, environmentally hazardous goods, Marine pollutants.
  - Ex:- Asbestos, Dry Ice, Consumer Commodity etc.