

# HAZARDOUS CARGO

Dangerous Goods

## What is Hazardous Cargo?

A hazardous material is any item (radioactive, flammable, explosive, corrosive, oxidizing, asphyxiating, biohazardous, toxic, pathogenic), which has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors. Hazardous materials professionals are responsible for and properly qualified to control such materials. This includes managing and controlling other executives on hazardous materials at any point in their life-cycle, from process planning and development of new items through manufacture, distribution and use and to disposal, cleanup and remediation.

Hazardous materials are defined and regulated in the United States first by laws and regulations administered by the U.S. Environmental Protection Agency (EPA), the U.S. Occupational Safety and Health Administration (OSHA), the U.S. Department of Transportation (DOT), and the U.S. Nuclear Regulatory Commission (NRC). Each has its own definition of a "hazardous material."

OSHA's definition includes any substance chemicals which are carcinogens, toxic agents, irritants, corrosives, sensitizers; agents which act on the hematopoietic system, or mucous membranes, chemicals which are combustible, explosive, flammable, agents which damage the lungs, skin, eyes, oxidizers, pyrophoric, unstable reactive or water reactive, and chemicals which in the course of normal handling, use, or storage may produce or release dusts, gases, fumes, vapors, mists or smoke which may have any of the previously mentioned characteristics. (Full definitions can be found at 29 Code of Federal Regulations (CFR) 1910.1200.)

EPA incorporates the OSHA definition, and adds any product or chemical which can cause harm to people, plants, or animals when released by spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping or disposing into the environment. (40 CFR 355 contains a list of over 350 hazardous and extremely hazardous substances.)

DOT defines a hazardous material as any item or chemical which, when being transported or moved in commerce, is a risk to public safety or the environment, and is regulated as such under its Pipeline and Hazardous Materials Safety Administration regulations (49 CFR 100-199), which includes the Hazardous Materials Regulations (49 CFR 171-180).

The NRC regulates materials that are considered hazardous because they produce ionizing radiation, which means those materials that produce alpha particles, beta particles, gamma rays, x-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable

of producing ions. This includes "special nuclear material," by-product material, and radioactive substances. (See 10 CFR 20). See the Hazardous Cargo show in Figure 1.1.



Figure 1.1. Hazardous Cargo

## Classification of Hazardous Cargo

### Class 1: Explosives

#### Subclass 1.1: Explosives with a mass explosion hazard

Consists of explosives that have a mass explosion hazard. A mass explosion is one which affects almost the entire load instantaneously

#### Subclass 1.2: Explosives with a severe projection hazard

Consists of explosives that have a projection hazard but not a mass explosion hazard.

#### Subclass 1.3: Explosives with a fire

Consists of explosives that have a fire hazard and either a minor blast hazard or a minor projection hazard or both but not a mass explosion hazard.

#### Subclass 1.4: Minor fire or projection hazard

Consists of explosives that present a minor explosion hazard. The explosive effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package.

#### Subclass 1.5: An insensitive substance with a mass explosion hazard

Consists of very insensitive explosives with a mass explosion hazard (explosion similar to 1.1). This division is comprised of substances which have a mass explosion hazard but are

so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport.

**Subclass 1.6:** Extremely insensitive articles

Consists of extremely insensitive articles which do not have a mass explosive hazard. This division is comprised of articles which contain only extremely insensitive detonating substances and which demonstrate a negligible probability of accidental initiation or propagation.

**Class 2: Gases**

**Subclass 2.1:** Flammable Gas

Gases which ignite on contact with an ignition source, such as acetylene and hydrogen. Flammable gas means any material which is ignitable at 101.3 kPa (14.7 psi) when in a mixture of 13 percent or less by volume with air, or has a flammable range at 101.3 kPa (14.7 psi) with air of at least 12 percent regardless of the lower limit.

**Subclass 2.2:** Non-Flammable Gases

Gases which are neither flammable nor poisonous. Includes the cryogenic gases/liquids (temperatures of below -100°C) used for cryopreservation and rocket fuels. This division includes compressed gas, liquefied gas, pressurized cryogenic gas, compressed gas in solution, asphyxiate gas and oxidizing gas. A non-flammable, nonpoisonous compressed gas means any material which exerts in the packaging an absolute pressure of 280 kPa (40.6 Pisa) or greater at 20°C (68°F), and does not meet the definition of Division 2.1 or 2.3.

**Subclass 2.3:** Poisonous Gases

Gases liable to cause death or serious injury to human health if inhaled. Gas poisonous by inhalation means a material which is a gas at 20°C or less and a pressure of 101.3 kPa (a material which has a boiling point of 20°C or less at 101.3kPa (14.7 psi)) which is known to be so toxic to humans as to pose a hazard to health during transportation, or in the absence of adequate data on human toxicity, is presumed to be toxic to humans because when tested on laboratory animals it has an LC50 value of not more than 5000 ml/m3.

**Class 3: Flammable Liquids**

A flammable liquid means a liquid which may catch fire easily or any mixture having one or more components with any flash point. As example: acetone, diesel, gasoline, kerosene, oil etc. Transportation is strongly recommended at or above its flash point in a bulk packaging. There are three main groups of flammable liquid.

Low flash point - liquids with flash point below -18°C

Intermediate flash point - liquids with flash point from -18°C. Up to +23°C

High flash point group - liquids with flash point from +23°C

#### **Class 4: Flammable solids or substances**

##### **Subclass 4.1: Flammable solids**

For the purpose of this Code, flammable solids means readily combustible solids and solids which may cause fire through friction.

##### **Subclass 4.1: Self-reactive substances**

Self-reactive substances are thermally unstable substances liable to undergo a strongly exothermic decomposition even without participation of oxygen (air).

##### **Subclass 4.1: Solid desensitized explosives**

Solid desensitized explosives are explosive substances which are wetted with water or alcohols or are diluted with other substances to form a homogeneous solid mixture to suppress their explosive properties.

##### **Subclass 4.1: Polymerizing substances and mixtures (stabilized)**

Polymerizing substances are substances which, without stabilization, are liable to undergo a strongly exothermic reaction resulting in the formation of larger molecules or resulting in the formation of polymers under conditions normally encountered in transport. Explosives included under class 1 however deactivated or substances specially included under this class by the producer.

##### **Subclass 4.2: Substances liable to spontaneous combustion**

##### **Subclass 4.2: Comprises**

1 Pyrophoric substances, which are substances, including mixtures and solutions (liquid or solid), which, even in small quantities, ignite within 5 minutes of coming into contact with air. These substances are the most liable to spontaneous combustion; and 2 Self-heating substances, which are substances, other than pyrophoric substances, which, in contact with air without energy supply, are liable to self-heating. These substances will ignite only when in large amounts (kilograms) and after long periods of time (hours or days).

##### **Subclass 4.3: Substances which, in contact with water, emit flammable gases**

For the purpose of this Code, the substances in this class are either liquids or solids which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.

### **Class 5: Oxidizing substances and organic peroxides**

#### **Subclass 5.1: Oxidizing substances**

Substances which, while in themselves not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material. Such substances may be contained in an article.

#### **Subclass 5.2: Organic peroxides**

Organic substances which contain the bivalent –O–O– structure and may be considered derivatives of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals. Organic peroxides are thermally unstable substances which may undergo exothermic self-accelerating decomposition.

#### **Subclass 6.1: Toxic substances**

Toxic substances which are able to cause death or serious hazard to human's health during transportation.

#### **Subclass 6.2: Infectious substances**

These are substances known or reasonably expected to contain pathogens. Pathogens are defined as microorganisms (including bacteria, viruses, rickettsia, parasites, and fungi) and other agents such as prions, which can cause disease in humans or animals.

### **Class 7: Radioactive material**

Radioactive material means any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in 2.7.2.2.1 to 2.7.2.2.6.

### **Class 8: Corrosive substances**

Class 8 substances (corrosive substances) means substances which, by chemical action, will cause severe damage when in contact with living tissue or, in the case of leakage, will materially damage, or even destroy, other goods or the means of transport.

### **Class 9: Miscellaneous dangerous substances and articles and environmentally hazardous substances**

Substances and articles (miscellaneous dangerous substances and articles) are substances and articles which, during transport, present a danger not covered by other classes.

- Substances which, by inhalation as fine dust, may endanger health.
- Substances evolving flammable vapor.
- Lithium batteries.
- Life-saving appliances.
- Capacitors.
- Substances and articles which, in the event of fire, may form dioxins.
- Substances transported or offered for transport at elevated temperatures.
- Environmentally hazardous substances.
- Genetically modified microorganisms (GMMOs) and genetically modified organisms (GMOs).
- Other substances or articles presenting a danger during transport, but not meeting the definitions of another class. See the Classification of Hazardous Cargo show in Figure 1.2.



Figure 1.2. Classification of Hazardous Cargo

**Packing groups** are used for the purpose of determining the degree of protective packaging required for dangerous goods during transportation.

**Group I:** great danger, and most protective packaging required. Some combinations of different classes of dangerous goods on the same vehicle or in the same container are forbidden if one of the goods is Group I.

**Group II:** medium danger.

**Group III:** minor danger among regulated goods, and least protective packaging within the transportation requirement.

### **Transport documents**

One of the transport regulations is that, as an assistance during emergency situations, written instructions how to deal in such need to be carried and easily accessible in the driver's cabin.

A license or permit card for hazmat training must be presented when requested by officials.

Dangerous goods shipments also require a special declaration form prepared by the shipper. Among the information that is generally required includes the shipper's name and address; the consignee's name and address; descriptions of each of the dangerous goods, along with their quantity, classification, and packaging; and emergency contact information. Common formats include the one issued by the International Air Transport Association (IATA) for air shipments and the form by the International Maritime Organization (IMO) for sea cargo.