

# Dangerous Goods Shipping Guidelines

## Packaging



U.S. Department of Transportation

Pipeline and Hazardous Materials  
Safety Administration





## **Mission:**

The P.S.U. Environmental Health & Safety Dangerous Goods Shipping Program is designed to provide faculty, staff and students with the guidance to ensure that shipments of dangerous goods are safely processed while meeting federal and international regulatory requirements. By properly identifying, classifying, documenting, handling, packaging, marking & labeling dangerous goods shipments a safe atmosphere is created for all who are involved.

## **Background:**

Every day, thousands of shipments containing dangerous and hazardous materials are safely transported over the ground, through the air, and on the water. These shipments include materials like fuels, biological agents and chemicals used in a variety of manufacturing areas, agricultural applications, and research. The transport of dangerous goods materials is very important for the continuance of strong national and international economies.

Since 1974 the Department of Transportation (DOT) has regulated the commercial transport of hazardous materials. In 1990 Congress passed the Hazardous Materials Transportation Act Uniform Safety Act, the purpose of which is to “improve the regulatory and enforcement authority of the Secretary of Transportation to protect the Nation adequately against the risks of life and property which are inherent in the transportation of hazardous materials in commerce.” Simply stated, the purpose is to ensure that all who come into contact with a shipment of hazardous material are properly informed of the hazards presented by the material and the measures necessary for safe transport.

As a result of unreported or improperly packaged hazardous materials, the National Transportation Safety Board has compiled investigative records of numerous instances of materials that have caused extensive damage and loss of life. These instances often result in civil fines and penalties.

## **What are dangerous goods?**

Dangerous goods are substances or materials that are capable of posing a risk to health, safety, or property. This can include hazardous substances, hazardous waste, marine pollutants and elevated temperature materials. Also included are laboratory chemicals, radioactive materials, compressed gases, biological agents, diagnostic specimens, refrigerants and instruments or equipment that might contain hazardous materials.

Materials that are shipped to labs for testing or analysis, to a colleague for collaborative research, to another research facility, returned to the manufacturer or sent to a field research site must all follow applicable shipping requirements. To comply, regulated materials are classified according to their hazards, properly packaged, labeled, documented and handled by trained employees.

## **How do I know if a material is covered by the regulations?**

It is the responsibility of you, the shipper to identify the material and provide information on physical characteristics (flash point, pH, weight/volume, etc.) This will assist the Environmental Health & Safety representative to properly classify materials that are subject to the Hazardous Materials Regulations (HMR). To determine if a material is regulated, the following references in 49CFR are checked to see if the material is listed:

- 172.101 – The Hazardous Materials Table
- 172.101 Appendix A – Hazardous Substances (RQ)
- 172.101 Appendix B – Marine Pollutants
- 173, Subparts C, D, & I – The nine DOT hazard classes.

The table on the following pages lists the 9 hazard classes, basic definitions, and a few examples of hazardous materials for each class. Click on the *49CFR Reference* link to view the DOT full definition.

## **Material Classification**

**There Are Nine Hazardous Material Classifications.**

### **Class 1 - Explosives**

[Reference 49CFR173.50 \(Definitions\)](#)

There are 6 sub-divisions for explosives based on the type and severity of explosion. Materials or devices in Class 1.1 present a mass explosion hazard, while Class 1.6 applies to very insensitive explosive articles that do not present mass or projectile explosion risks. Some examples of Class 1 items are air bag inflators, ammunition, gun powder, water-activated contrivances, liquid propellant, primers, jet fuel and fireworks. Some explosives are forbidden from being offered for commercial transportation.

### **Class 2 - Gases**

[Reference 49CFR173.115 \(Definitions\)](#)

There are three types of gases - flammable, poisonous and compressed. Examples of flammable gases are certain aerosols, starting fluids, butane, propane, acetylene and cigarette lighters. Examples of poisonous gases are carbon monoxide, chlorine, nitric oxide, hydrogen and anhydrous ammonia. Compressed gases may be neither flammable nor poisonous but are packaged in a manner so that the absolute pressure is 40.6 psi or greater. Compressed gases can include liquefied gas, cryogenic gas, asphyxiate gas and oxidizing gas, also including compressed air and airbag inflators.

### **Class 3 - Flammable Liquids**

[Reference 49CFR173.120 \(Definitions\)](#)

The number of materials that qualify as flammable liquid is large. Flammable liquids are generally defined as "liquid having a flash point of not more than 60.5 C (141F). This class also included combustible liquids which are liquids that do not meet the requirements of any other hazard class, and has a flashpoint above 60.5 C (141F), but below 95 C (200F). Examples of flammable liquids can include gasoline, diesel fuel, kerosene, crude oil, methanol, paint, adhesives, certain medicines and rosin oil. Although there are no class subdivisions, flammable liquids fall into three packing groups which are determined by both flash point and initial boiling point.

### **Class 4 - Flammable Solids**

[Reference 49CFR173.124 \(Definitions\)](#)

In general there are three types of materials that qualify as flammable solids. 1: certain types of desensitized explosives. 2: certain self-reactive materials (materials that are thermally unstable and can undergo strongly exothermic decomposition without air) and 3: readily combustible materials such as certain metal powders, or materials that can cause fire through friction (such as matches) or that have an accelerated burn rate. There are two types of spontaneous combustible material...pyrophoric and self-heating material. Material that is dangerous when wet is material that is liable to become spontaneously combustible if in contact with water.

## Class 5 – Oxidizers

Reference 49CFR173.128 (Definitions)

Oxidizers are materials that may, generally by yielding oxygen, cause or enhance the combustion of other materials. The hazardous materials regulations generally defines organic peroxides to be any organic compound containing oxygen in the bivalent O-O structure and which may be considered a derivative of hydrogen peroxide, where one or more of the hydrogen atoms have been replaced by organic radicals. There can be some overlap between qualifying as a Class 5.2 organic peroxide and a Class 1 explosive, and when this occurs the material must generally be classified as a Class 1 explosive. There are seven different organic material types, Types A - G, in descending order of hazard risk presented, with type A being banned from commercial transportation.

## Class 6 - Toxic and Infectious Substances

Reference 49CFR173.132 & 134 (Definitions)

The hazardous material regulations define poisonous material as any material, other than a gas which is known to be so toxic to humans as to afford a hazard to health during transportation, or if the material is presumed to be toxic to humans because of animal testing with respect to oral toxicity, dermal toxicity, or inhalation toxicity.

Arsenic, arsenic compounds, copper-based pesticides, tear gas, anti-knock compounds, trichloroethylene, and 1,1,1-trichloroethane are examples of Class 6.1 poisonous materials. The biohazard materials from Class 6.2 include infectious substances, diagnostic specimens, biological products, and regulated medical wastes. There are a number of exceptions and exclusions associated with Class 6.2, and in some cases compliance with OSHA regulations can be substituted for compliance with the hazardous materials regulations.

## Class 7 - Radioactive Material

Contact the Department of Radiation Protection

The hazardous materials regulations define radioactive materials as any material having a specific activity greater than 70 Becquerel (Bq) per gram. The specific activity of a radionuclide is the activity of the radionuclide per unit mass of that nuclide. The specific activity of a material in which the radionuclide is essentially uniformly distributed is the activity per unit mass of the material. Articles or instruments, such as clocks, electronic tubes or apparatus that have radioactive material in gaseous or solid, non-dispersible solid form as a component part of the article or instrument are subject to regulation as Class 7 radioactive materials. There are however, fairly broad exceptions for articles or instruments containing radioactive material as a component part when certain packaging formats are used, and certain radiation measurements can be satisfied. For questions about shipping radioactive materials, please contact the Radiation Protection Department.

## Class 8 - Corrosives

Reference 49CFR173.136 (Definitions)

Liquids or solids that cause full thickness destruction of human skin at the site of contact within a specified time period, and liquids that can have a severe corrosion rate on steel or aluminum qualify as Class 8 corrosive material under the hazardous materials regulations. Numerous industrial and consumer products qualify as Class 8 corrosive items, including certain wet and dry batteries and alkali battery fluid, certain dyes, formic acid, hydrochloric acid, nitric acid, mercury and devices containing mercury (such as thermometers and electron tubes).

## Class 9 - Miscellaneous

### Reference 49CFR173.140

One of the most common materials in use at University Park that falls into this category is the use of ***dry ice***. The shipper is responsible for supplying the dry ice and the shipping container, however if needed EHS can assist with locating proper containers. This classification can also be used for materials that present a hazard but do not fall within the guidelines of any of the other classifications. Examples would be any material that has an anesthetic or noxious property that could interfere with the duties of a flight crew member during transportation by air, asbestos, chemical kits and equipment containing hazardous materials. Class 9 serves as a "catch-all" for a wide variety of items that do not fall within the specific definitions of the other classes. When in doubt, ask an EHS representative.

If your material meets the definition of a hazardous substance or marine pollutant, and the material is not listed in the Hazardous Materials Table and does not meet any hazard class, the material is regulated as a Class 9 *Environmentally hazardous substance (liquid or solid), n.o.s. (not otherwise specified)* which is listed on the 49CFR 172.101 Hazardous Materials Table.

Manufacturers and suppliers are required to provide Material Safety Data Sheet (MSDS) for their products. On newly formatted MSDS's, Section 14 is dedicated to Transportation Information. Review the MSDS, container labels, and prior shipping documents carefully for reference to "UN" numbers.

In addition to the DOT regulations mentioned above, by reference, the transportation of hazardous materials is also regulated by the International Air Transportation Association (IATA) which oversees the transport of hazardous materials by almost all airlines. Other carriers such as FedEx, UPS, Yellow Freight, USPS etc. are also bound by these regulations, and may have their own more stringent restrictions.

By following the procedures outlined here, you can:

Ensure that your package arrives intact and on-time without regulatory delays.

Avoid costly non-compliance penalties. (penalties are levied against the shipper)

Rest assured that all individuals who come into contact with your package will know what it is, and how to safely handle it.

If you are unsure if the material you wish to ship is regulated, contact EHS at 865-6391 and they will answer your questions.

## Procedures

**Training.** Any individual who prepares a hazardous material package or documentation must be trained. There are substantial fines and penalties for offering a hazardous material for shipment if you've not been certified to do so. EHS's involvement will help to avoid training requirement issues. If needed, EHS can also provide training for specific applications.

**Collect information to identify your material.** This information must include physical data, toxicological data and other pertinent information such as flammability/flash point, reactivity, pH/corrosivity, etc. Also provide information about the container(s). Glass, plastic, metal, etc.? Size of the container? Are there any markings indicating that the container is "UN-approved"? These are all questions that will help EHS properly process your shipment.

**Contact EHS.** Complete the *Online Request* form and submit it to EHS via email at [HAZMATSHIP@EHS.PSU.EDU](mailto:HAZMATSHIP@EHS.PSU.EDU). Shipping requests should be made a minimum of 24 hours prior to the time you'd like your package to be shipped. Shipments with dry ice as the only hazard will be taken on shorter notice on a first come, first served basis. Complete the online request form with the information that you've gathered about your material along with the full name, address and telephone number for both the sender and the recipient. You will also be asked to provide the FedEx charge number for either your department or the recipients if they are to pay shipping costs. There is no charge for EHS services, however you are responsible for all shipping related costs. In the event you do not have a FedEx charge number you must provide budget and fund information to allow charges to be directed to your department.

**Process the shipment.** You must make arrangements with EHS for a time and a location that you will be available to meet with an EHS representative to finalize preparation of the package and to sign any necessary documentation. EHS will provide all required documentation, labels and markings, and in some cases UN-approved packing materials required to meet regulations. For shipments where dry ice is the only hazard, you should provide the container, however EHS can assist with these. You are responsible for obtaining dry ice. You may have your samples packed in dry ice, in the container...but it must not be sealed in order to allow for EHS inspection. EHS will have arranged for pickup by the commercial carrier and in most cases will transfer your package from your location to common pickup points near you.

**Follow-up.** You will be notified via email when your material has been delivered. Per DOT Regulations, EHS will maintain a copy of all documentation for a period of two years after delivery has been completed.