

Reference Data Sheet For Hazardous Chemicals, Hazardous Materials, And Hazardous Waste

By: William D. Sheridan, CIH, CHMM

POTENTIAL PROBLEM AREAS

Classification for:

- Preparation of shipping papers/manifests
- Segregation of materials in storage and transportation
- Contingency planning/emergency response
- Proper labeling and marking
- Agency reporting requirements
- Training of employees
- Remediation of contamination
- Employee health and safety
- Transportation safety
- Environmental/public health protection

REGULATORY AGENCIES AND RESPONSIBILITIES:

- [The Occupational Safety and Health Administration \(OSHA\)](#)
Implementing agency for the Occupational Safety and Health Act of 1970 (OSHA); responsible for codification and enforcement of regulations to protect employees in certain workplaces.
- [The Department of Transportation \(DOT\)](#)
Implementing agency for the Hazardous Materials Transportation Act of 1975 (HMTA) and the Hazardous Materials Transportation Uniform Safety Act of 1990 (HMTUSA); responsible for codification and enforcement of regulations to ensure safe transportation of materials in commerce.
- [The Environmental Protection Agency \(EPA\)](#)
Implementing Agency for several environmental acts; responsible for codification and enforcement of regulations to protect both human health and the environment.

IMPLICATIONS:

Regulatory agencies have received different Congressional mandates as to their function. Similar terminology

may be used by each agency (e.g., "hazardous chemicals," "hazardous substances," "hazardous materials," "hazardous waste"), but the terms are not necessarily interchangeable. Each agency defines a term on the basis of the agency's mandate. For example, "hazardous waste" as referred by **OSHA** will relate to employee health and safety protection (protection relative to employee exposure to a health hazard or physical hazard); **DOT** will relate to safe transportation of the waste as a material (packaging/labeling, emergency response information in case of an accident during transportation, preparation of shipping papers, releases during transportation); and, **EPA** will relate to protection of the environment (releases into the environment) and public health (minimizing a population exposure to an adverse health hazard). Therefore, each term may have unique applications and should only be used in accordance with the proper regulatory function.

Terminology:

OSHA:

Hazardous substance - "any substance designated or listed under paragraphs (A) through (D) of this definition, exposure to which results or may result in adverse effects on the health or safety of employees:

- A. Any substance defined under section 101(14) of CERCLA;
- B. Any biological agent and other disease-causing agent which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any person, either directly...or indirectly... , will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer genetic mutation, physiological malfunctions or physical deformations in such persons or their offspring;
- C. Any substance listed by the U.S. Department of Transportation as hazardous materials under 49 CFR 172.101 and appendices; and,
- D. Hazardous waste as herein defined." {29 CFR 1910.120(a)(3)}

Hazardous waste - "a waste or combination of wastes as defined in 40 CFR 261.3, or those substances identified as hazardous wastes in 49 CFR 171.8." {29 CFR 1910.120(A)(3)}

Hazardous chemical - "any chemical which is a physical or a health hazard." {29 CFR 1910.1200(c)}

Health hazard - "a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. ...includes...carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membrane." {29 CFR 1910.1200(c)}

Corrosive - "a chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact. For example, a chemical is considered to be corrosive if, when tested on the intact skin of albino rabbits by the method described by the U.S. DOT in Appendix A to 49 CFR Part 173, it destroys or changes irreversibly the structure of the tissue at the site of contact following an exposure period of four hours. This term shall not refer to action on inanimate surfaces." {29 CFR 1910.1200 Appendix A}

Highly toxic - "a chemical falling within any of the following categories:

- a. ...has a median lethal dose (LD50) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
- b. ...has a median lethal dose (LD50) of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with bare skin of albino rabbits weighing between two and three kilograms each.
- c. ...has a median lethal concentration (LC50) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume, or dust, when administered by continuous inhalation but not more than 1000 milligrams per kilogram of body weight when administered by continuous contact for 24

hours (or less if death occurs within 24 hours) with bare skin of albino rabbits weighing between two and three kilograms each.

- d. has a median lethal concentration (LC50) in air of more than 200 parts per million but not more than 2000 parts per million by volume of gas or vapor, or more than 2 milligrams per liter but not more than 20 milligrams per liter of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each." {29 CFR 1910.1200 Appendix A}

Combustible liquid - "any liquid having a flash point at or above 100 °F, but below 200 °F, except any mixture having components with flash points of 200 °F or higher, the total volume of which make up 99% or more of the total volume of the mixture." {29 CFR 1910.1200(c)}

Explosive - "...causes a sudden almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature." {29 CFR 1910.1200(c)}

Flammable - "a chemical that falls into one of the following categories:

- a. Aerosol, flammable - an aerosol that, when tested by the test method described in 16 CFR 1500.45, yields a flame projection exceeding 18 inches at full valve opening...;
- b. Gas, flammable -
 - i. at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13% by volume or less;
 - ii. at ambient temperature and pressure, forms a range of flammable mixtures with air wider than 12% by volume,...;
- c. Liquid, flammable - any liquid having a flash point below 100 °F, except...;
- d. Solid, flammable - a solid, other than a blasting agent or explosive as defined in 29 CFR 1910.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard..." {29 CFR 1910.1200(c)}

Oxidizer - "...initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases." {29 CFR 1910.1200(c)}

Pyrophoric - "...will ignite spontaneously in air at a temperature of 130 °F or below." {29 CFR 1910.1200(c)}

Unstable (reactive) - "...will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure, or temperature." {29 CFR 1910.1200(c)}

Water-reactive - "...reacts with water to release a gas that is either flammable or presents a health hazard." {29 CFR 1910.1200(c)}

DOT:

Hazardous material - "a substance or material, including a hazardous substance, which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and has been so designated." {49 CFR 171.8}

Explosive - "any substance or article, including a device, which is designed to function by explosion (i.e., an extremely rapid release of gas and heat) or which, by chemical reaction within itself, is able to function in a similar manner even if not designed to function by explosion, ..." {49 CFR 173.50}

Flammable gas - "any material which is a gas at 68 °F or less and 14.7 psi of pressure (a material which has a boiling point of 68 °F or less at 14.7 psi) which has:

- a. Ignition at 14.7 psi when in a mixture of 13% or less by volume with air; or
- b. Flammable range at 14.7 psi with air of at least 12% regardless of the lower limit." {49 CFR 173.115}

Flammable Liquid - "a liquid having a flash point of not more than 141 °F, or any material in a liquid phase with a flash point at or above 100 °F ...with the following exceptions:

- a. Any liquid meeting one of the definitions specified in §173.115 of this part;
- b. Any mixture having one or more components with a flash point of 141 °F or higher, that makes up at least 99% of the total [mixture] volume, if the mixture is not offered for transportation..." {49 CFR 173.120}

Combustible liquid - "...has a flash point above 141 °F and below 200 °F. A flammable liquid with a flash point at or above 100 °F that does not meet the definition of any other hazard class may be reclassified as a combustible liquid." {49 CFR 173.120}

Flammable solid - "any of the following three types of materials:

- a. Wetted explosives that -
 - i. When dry are explosives of Class 1 other than those of compatibility group A, which are wetted with sufficient water, alcohol, or plasticizer to suppress explosive properties; and,
 - ii. Are named either in the §172.101 Table or have been assigned a shipping name and hazard class by the Associate Administrator for Hazardous Materials Safety under the provisions of -
 - A. An exemption issued under subchapter B of this chapter; or,
 - B. An approval issued under §173.56(i) of this part.
- b. Self-reactive materials that are liable to undergo, at normal or elevated temperatures, a strongly exothermic decomposition caused by excessively high transport temperatures or by contamination; and,
- c. Readily combustible solids that -
 - i. Are solids which may cause a fire through friction, such as matches;
 - ii. Show a burning rate faster than 0.087 inches per second...; or,
 - iii. Any metal powders that can be ignited and react over the whole length of a sample in 10 minutes or less..." {49 CFR 173.124}

Spontaneously combustible material - "A pyrophoric material is a liquid or solid that, even in small quantities and without an external ignition source, can ignite within five minutes after coming into contact with air...; A self-heating material is a material that, when in contact with air and without an energy supply, is liable to self-heat..." {49 CFR 173.124}

Dangerous when wet material - "...by contact with water, is liable to become spontaneously flammable or to give off flammable or toxic gas at a rate greater than 1 liter per kilogram of the material per hour..." {49 CFR 173.124}

Oxidizer - "...may by yielding oxygen, cause or enhance the combustion of other materials." {49 CFR 173.127}

Poisonous material - "a material, other than a gas, which is known to be so toxic to humans as to afford a hazard to health during transportation, or which, in the absence of adequate data on human toxicity:

- a. falls within any one of the following categories when tested on laboratory animals:
 - i. Oral Toxicity. A liquid with an LD50 for acute oral toxicity of not more than 500 mg/kg or a solid with an LD50 for acute oral toxicity of not more than 200 mg/kg.
 - ii. Dermal Toxicity. A material with an LD50 for acute dermal toxicity of not more than 1000 mg/kg.
 - iii. Inhalation Toxicity. A dust or mist with an LC50 for acute toxicity on inhalation of not more than 10 mg/L; a material with a saturated vapor concentration in air at 68 ° F of more than one-fifth of the LC50 for acute toxicity on inhalation of vapors and with an LC50 for acute toxicity on inhalation of vapors of not more than 5000 mg/m³; or,
- b. causes extreme irritation, especially in confined spaces." {49 CFR 173.132}

Corrosive material - "a liquid or a solid that causes visible destruction or irreversible alterations in human skin tissue at the site of contact, or a liquid that has a severe corrosion rate on steel or aluminum, in accordance with the following criteria:

- a. A material is considered to be destructive or cause irreversible alteration in human skin tissue if, when tested on the intact skin of an albino rabbit...the structure of the tissue at the site of contact is destroyed or changed irreversibly after an exposure period of 4 hours or less.
- b. A liquid...if its corrosion rate exceeds 0.246 inches a year on steel or aluminum at a test temperature of 131 °F. An acceptable test method is described in NACE Standard TM-01-69." {49 CFR 173.136}

Miscellaneous hazardous material - "a material which presents a hazard during transportation but which does not meet the definition of any other hazard class. This class includes:

- a. [Materials having] an anesthetic, noxious or other similar property which could cause extreme annoyance or discomfort to a flight crew member so as to prevent...performance of...duties; or,
- b. [Materials meeting] the definition in §171.8 of this subchapter for an elevated temperature material, a hazardous substance, or a hazardous waste." {49 CFR 173.140}

Hazardous substance - "a material, including its mixtures and solutions, that -

- a. Is listed in the appendix to §172.101 of this subchapter;
- b. Is in a quantity, in one package, which equals or exceeds the reportable quantity (RQ) listed in the appendix to §172.101 of this subchapter; and,
- c. When in a mixture or solution -
 - i. For radionuclides, conforms to paragraph 6 of the appendix to §172.101 of this subchapter.
 - ii. For other than radionuclides, is in a concentration by weight which equals or exceeds the concentration corresponding to the RQ of the material, as shown in the following table:

RQ pounds (kilograms)	Concentration by Weight	
	Percent	PPM
5000 (2270)	10	100,000
1000 (454)	2	20,000
100 (45.4)	0.2	2,000
10 (4.54)	0.02	200
1 (0.454)	0.002	20

This definition does not apply to petroleum products that are lubricants or fuels." {49 CFR 171.8}

Hazardous waste - "any material that is subject to the Hazardous Waste Manifest Requirements of the U.S. Environmental Protection Agency specified in 40 CFR Part 262." {49 CFR 171.8}

EPA:

Solid waste - "any discarded material that is not excluded by 40 CFR 261.4(a) or that is not excluded by a variance under §§ 260.30 and 260.31." (A "discarded material" is an abandoned, recycled, or inherently wastelike material as defined by the EPA.) {40 CFR 261.2}

Hazardous substance - "any substance designated pursuant to 40 CFR Part 302." Listed hazardous substances are the elements, compounds, and hazardous wastes appearing in Table 302.4. Unlisted hazardous substances include solid wastes, which are not excluded from regulation as hazardous wastes under 40 CFR 261.4(b), if they exhibit any of the characteristics identified in 40 CFR 261.20 through 261.24. The statutory source for designating

a hazardous substance may be the Clean Water Act, the Clean Air Act, and/or the Resource, Conservation and Recovery Act. Hazardous substances are associated with "Reportable Quantities (RQ)" which are that quantity of a hazardous substance the release of which within a 24-hour period requires immediate notification to the National Response Center. {40 CFR 302}

Hazardous waste - a solid waste, as defined in §261.2, which:

1. Is not excluded from regulation as a hazardous waste under §261.4(b); and,
2. Meets any of the following criteria:
 - a. Exhibits any of the characteristics in 40 CFR Part 261, Subpart C (ignitability, corrosivity, reactivity, and toxicity);
 - b. Is listed in 40 CFR Part 261, Subpart D {hazardous wastes from non-specific sources (the "F-codes") hazardous wastes from specific sources (the "K- codes"); discarded commercial chemical products, off-specification species, container residues, and spill residues thereof (the acute hazardous wastes or "P-codes" and the toxic wastes or "U-codes")}; or,
 - c. Is a mixture with one or more listed hazardous wastes.*

** The "mixture" and "derived-from" rules were struck down in the case of Shell Oil Company vs. EPA, District of Columbia Court of Appeals, 1991. EPA is expected to propose the "Hazardous Waste Identification Rule" (HWIR), which is likely to restructure the methodology used for defining hazardous waste.*

Ignitability - "...a representative sample of the waste has any of the following properties:

1. It is a liquid, other than an aqueous solution containing less than 24% alcohol by volume and has a flash point less than 140 °F, as determined by a Pensky-Martens Closed Cup Tester, using the test method specified in ASTM Standard D-93-79 or D-93-80, or a Setaflash Closed Cup Tester, using the test method specified in ASTM Standard D-3278-78, or as determined by an equivalent test method...;
2. It is not a liquid and is capable, under standard temperature and pressure, of causing fire throughfriction, absorption of moisture or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it creates a hazard;
3. It is an ignitable compressed gas as defined [by the DOT] and as determined by [regulatory or equivalent] test methods...;
4. It is an oxidizer as defined [by the DOT]." The characteristic of ignitability has the EPA Hazardous Waste Number of D001. {40 CFR 262.21}

Corrosivity - "...a representative sample of the waste has either of the following properties:

1. It is aqueous and has a pH less than or equal to 2 or greater than 12.5, as determined by a pH meter using either an EPA test method or an equivalent test method...;
2. It is a liquid and corrodes steel at a rate greater than 0.250 inches per year at a test temperature of 130 °F ..." The characteristic of corrosivity has the EPA Hazardous Waste Number of D002. {40 CFR 261.22}

Reactivity - "...a representative sample of the waste has any of the following properties:

1. It is normally unstable and readily undergoes violent change without detonating;
2. It reacts violently with water;
3. It forms a potentially explosive mixture with water;
4. When mixed with water, it generates toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment;
5. It is a cyanide or sulfide bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health...;
6. It is capable of detonation...if subjected to a strong initiating source or if heated under confinement;

7. It is readily capable of detonating...or reaction at standard temperature and pressure;
8. It is a forbidden explosive..." The characteristic of reactivity has the EPA Hazardous Waste Number D003. {40 CFR 261.23}

Toxicity - "A solid waste exhibits [toxicity] if...the extract from a representative sample of the waste contains any of the contaminants listed in [40 CFR 262.24 Table 1] at the concentration equal to or greater than the respective value given in that table. Where the waste contains less than 0.5% filterable solids, the waste itself, after filtering..., is considered to be the extract for the purposes of this section." {40 CFR 262.24}

IMPLICATIONS:

Reportable quantity values and reporting regulations differ according to the defining agency. The DOT requires reporting if a reportable quantity is released from a single container; EPA requires reporting if a reportable quantity occurs within a 24-hour period.

Agency classifications of hazardous wastes, hazardous substances, hazardous materials, and hazardous chemicals may also appear to conflict when comparison is made between regulatory agencies. Several examples of this apparent conflict may exist, including:

1. *Differences in EPA's definition of ignitable, the OSHA definition of flammable, and the DOT definitions of flammable and combustible. For example, a liquid with a flash point of:*
 - a. *90 °F may be considered EPA ignitable, OSHA flammable, and DOT flammable;*
 - b. *110 °F may be considered EPA ignitable, OSHA combustible, and DOT flammable or a DOT combustible liquid (if a DOT flammable liquid has a flash point at or above 100 °F, and the liquid does not meet the definition of any other DOT hazard class, it may be reclassified as a combustible liquid).*
 - c. *150 °F may be considered a DOT and OSHA flammable, but is not EPA ignitable.*
2. *Anhydrous aluminum chloride may be classified as a corrosive hazardous material; a corrosive and reactive hazardous chemical; a corrosive (D002) and primarily reactive (D003) hazardous waste; and, is not specifically listed (by name) as a hazardous substance by EPA or DOT.*
3. *Acetyl chloride may be classified as a flammable hazardous material; a flammable, corrosive, and/or reactive hazardous chemical; a reactive (D003), corrosive (D002), as well as toxic (U006) hazardous waste; and, is a specifically listed hazardous substance.*
4. *Within the EPA hazardous waste classification system, a particular solid waste may have several possible EPA Hazardous Waste Numbers. For example:*
 - a. *A solid waste exhibiting the characteristic of toxicity for tetrachloroethylene has the EPA Hazardous Waste Number D039;*
 - b. *Tetrachloroethylene as a spent solvent used in degreasing has the EPA Hazardous Waste Number F001;*
 - c. *Tetrachloroethylene as a spent solvent has the EPA Hazardous Waste Number F005;*
 - d. *Column bottoms or heavy ends from the combined production of trichloroethylene and tetrachloroethylene have the EPA Hazardous Waste Number K030;*
 - e. *A bottle of tetrachloroethylene as a commercial chemical product being disposed has the EPA Hazardous Waste Number U210.*

This is not a Material Safety Data Sheet but rather a Reference Data Sheet that has been compiled from a number of sources, and is intended to be a concise, relatively non-technical source of information on a particular material or category of materials. It is provided in good faith and is believed to be correct as of the date compiled; however, Meridian Engineering & Technology makes no representation as to the comprehensiveness or accuracy of the information. It is expected that individuals receiving the information will exercise their independent judgment in determining its appropriateness for a particular purpose. Accordingly, Meridian Engineering & Technology will not be responsible for damages of any kind resulting from the use of or reliance upon such information.

