American National Standard

for Hazardous Industrial Chemicals – Precautionary Labeling

ANSI Z129.1-2006

Approved American National Standard

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American National Standard

for Hazardous Industrial Chemicals – Precautionary Labeling

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American National Standard

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Foreword (This foreword is not part of American National Standard ANSI Z129.1-2006.)

ANSI Z129.1-2006, American National Standard for Hazardous Industrial Chemicals - Precautionary Labeling was developed by a technical committee of the American Chemistry Council (ACC) and was submitted for approval under ACC's ANSI-approved canvass method operating procedures.

The need for consistent precautionary labeling was recognized in 1944, when the Manufacturing Chemists Association (which later became the Chemical Manufacturers Association [CMA] and then the American Chemistry Council [ACC]) established the Labels and Precautionary Information (LAPI) Committee. The LAPI Committee developed the first published industry guide to precautionary labeling for hazardous chemicals titled "A Guide for the Preparation of Warning Labels for Hazardous Chemicals" or Manual L-1. The first edition of Manual L-1 was published in 1945 and was followed by six revisions. To broaden review of the document, the Manual L-1 was converted to the current American National Standard in 1976 (ANSI Z129.1-1976). Since then, the Standard has undergone five revisions - 1982, 1988, 1994, 2000 and 2006.

Most of the changes made to the 2006 edition of the Standard are organizational, rather than substantive, in nature. Revisions were made to improve clarity, readability and consistency. Several annexes were partially incorporated into the text of the Standard, and all remaining annexes were revised and updated.

This standard contains four annexes, all of which are informative and are not considered part of the standard.

Suggestions for the improvement of this standard are welcome and will be considered for subsequent revisions. They should be addressed to the American Chemistry Council, 1300 Wilson Boulevard, Arlington, VA 22209.

The following organizations, recognized as having an interest in the standardization of precautionary labeling of industrial chemicals, were contacted prior to the approval of this standard. Inclusion in this list does not necessarily imply that an organization concurred with the version of the proposed Standard submitted to ANSI

Aerospace Industries Association
AFL-CIO
Air and Waste Management Association
Air Conditioning Contractors of America, Inc.
American Academy of Clinical Toxicology
American Association of Occupational Health Nurses
American Association of Poison Control Centers
American Chemical Society
American Dental Assn.
American Electronics Association
American Feed Industry Association.
American Fiber Manufacturers Association
American Forest & Paper Association
American Industrial Hygiene Association
American Institute of Chemical Engineers (AIChE)
American Iron & Steel Institute
American Petroleum Institute
American Public Health Association
American Supply Association
American Trucking Associations
Argonne National Laboratory
Asphalt Roofing Manufacturers' Association
ASTM E34.40 Haz Com
Automotive Industry Action Group
Canadian Chemicals Producers' Association

Canadian Labour Congress
Chemical Abstracts Service
Chemical Producers & Distributors Association
Chemical Safety & Hazard Investigation Board
CIIT Centers for Health Research
Color Pigments Manufacturers Association
Compressed Gas Association
Consumer Specialties Product Assocation
Cosmetic, Toiletry & Fragrance Association
CropLife America
Data Interchange Standards Association
Defense Supply Center
Edison Electric Institute
Environmental Protection Agency
ETAD North America
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Dangerous Goods Advisory Council
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MDL Information Systems, Inc.
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National Institute of Environmental Health Sciences
National Institute of Standards and Technology
National Paint & Coatings Association
National Petrochemical & Refiners Association
National Safety Council
National Toxicology Program
Healthcare Distribution Management Association
Naval Supply Systems Command
North American Insulation Manufacturers Association
Organizational Resource Counselors
Pharmaceutical Research and Manufacturers of America
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Roof Coatings Manufacturers Association
Rubber Manufacturers Association
Screenprinting & Graphic Imaging Assoc. International
Semiconductor Safety Association
Society for Chemical Hazard Communication
Society of American Florists
Society of the Plastics Industry
Society of Toxicology
Synthetic Organic Chemical Manufacturers Association
The Adhesive and Sealant Council, Inc.
The American Society of Safety Engineers
The Soap and Detergent Association
The Sulphur Institute
The Weinberg Group
U.S. Consumer Product Safety Commission
U.S. Coast Guard
U.S. Dept. of Transportation
US General Services Administration
WHS Consulting LLC
WHMIS Division, Health Canada

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American National Standard

Hazardous Industrial Chemicals – Precautionary Labeling

1 Introduction

The development of new chemicals, the re-evaluation of existing chemicals, and the ever-widening use of chemicals and chemical processes in a variety of applications have accentuated the need to provide information to people who use, handle or store hazardous industrial chemicals. The dissemination of this information includes appropriate precautionary statements that are expressed as simply and briefly as possible on labels affixed to containers of hazardous chemicals and in other written material provided for the guidance of industrial users. Precautionary labeling communicates this information through appropriate precautionary statements in a manner that is accurate, clear and concise.

2 About the Standard

For purposes of this Standard, the term “chemical” includes a single chemical substance or a mixture of substances. A **label** is the display of written, printed, or graphic matter, which is intended to provide information and which is affixed to, printed on, or attached to the immediate chemical container, as well as any outside packaging. The term **labeling** as used in this Standard includes container labels and other documents that contain precautionary and hazard communication information. These other documents include product literature, technical brochures, material safety data sheets (MSDSs), training materials, process standards and other communications.

The term **precautionary labeling** includes hazard warning statements and other precautionary statements. Precautionary labeling is not intended to include all information on the properties and hazards of the chemical or the complete details of its handling under all conditions. **The precautionary labeling used may not necessarily be identical from one document type to another, but it must always be consistent.**

2.1 Scope

This Standard establishes sound principles and guidelines for the preparation of precautionary labeling for hazardous industrial chemicals. The Standard must be applied in a manner consistent with all statutory and regulatory requirements, including the United States Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (HCS; 29 CFR 1910.1200) and the substance specific standards (29 CFR 1910.1001-1052). This Standard is not intended to provide a rote specification for complying with the HCS or any other government requirements.

Some or all elements of this Standard may be applicable in preparing permissible, alternative workplace chemical labeling approaches, such as stationary process containers and portable containers (29 CFR 1910.1200(f)(7) and (8) respectively). However, this Standard is not intended to address these specific labeling issues.

There are use-specific statutory and regulatory requirements for consumer (Federal Hazardous Substances Act [FHSA]), medical (Federal Food, Drug and Cosmetic Act [FFDCA]), and pesticide (Federal Insecticide, Fungicide and Rodenticide Act [FIFRA]) products, as well as materials in transportation (Department of Transportation [DOT] Hazardous Materials Regulations). There are other federal and state regulations that may contain precautionary labeling requirements. For example, state and local governments may regulate labeling through statutes, including “Right-to-Know” laws. It is not the intent of the Standard to substitute for these requirements or to list each and every unique requirement.

This Standard is not intended to address or incorporate other alternative industry labeling methods, such as the National Paints and Coatings Association’s Hazard Material Information System (HMIS® III) or the National Fire Protection Association’s (NFPA) NFPA 704 Standard System for the Identification of Hazards of Materials for Emergency Response.

Precautionary labeling requirements and definitions are subject to change. It is the responsibility of the label preparer to be aware of current regulatory requirements and/or other guidelines. Where there is a conflict between the applicable regulations and this Standard, the regulations must take precedence over this Standard. References to the Code of Federal Regulations (CFR) in the Standard are to the CFR available as of January 1, 2005.

2.2 Purpose

The purpose of this Standard is to provide a common approach for assessing chemical hazards and to provide guidance for the preparation of precautionary labeling. It provides a framework to communicate useful, understandable information for materials and hazardous chemicals. The Standard is based on two general principles. Foremost, labeling should provide sufficient information for the safe handling of the chemical. The precautionary information should be based on the inherent properties of the chemical and include recommendations on how to avoid potentially hazardous exposures resulting from customary and reasonably foreseeable occupational use, misuse, handling and storage.

Second, the precautionary information should neither overstate nor minimize the hazards or precautions for the chemical. Some chemicals may not be inherently hazardous and do not present a potential for harm in customary or reasonably foreseeable occupational use, misuse, handling and storage. For these chemicals, precautionary labeling may be unnecessary.

2.3 Application

This Standard focuses on precautionary labeling, with an emphasis on container labels.

2.4 Audience

This Standard is designed as an aid for individuals responsible for developing and reviewing precautionary labeling of hazardous industrial chemicals. The Standard is most effectively used by individuals who are qualified by education, professional training and/or experience in the field of hazard communication. The Standard assumes that the hazard communication professional is fully aware of the current regulatory requirements. These regulatory requirements may be dependent on where the chemical is manufactured and used, and its intended end uses. As emphasized in the Scope, this Standard is not designed to replace, but is to be used in conjunction with the appropriate regulatory requirements.

2.5 Content and organization

The content of this document is based on professional judgment of expert label preparers. The information is presented in the order that it is likely to be utilized. Within this Standard, the intended interpretation of the words “shall, must, should, may and can” range in degree from compliance with the OSHA HCS to a voluntary, permissible or possibly appropriate action by the label preparer.

This ANSI publication contains two parts - the Standard and the Annexes. The Annexes are provided as ancillary information that may be useful to the reader but are not an official part of the Standard.

Chapter 3 discusses general guidelines, processes and requirements for assessing the hazards of a chemical.

Chapter 4 lists the elements of a precautionary label and outlines the requirements for each.

Chapter 5 describes the general approach that should be followed in selecting precautionary label text once the hazards of a chemical have been identified. This chapter also provides guidelines for labeling immediate and delayed hazards to human organs or systems and provides information for carcinogenicity and teratogenicity precautionary labeling. Additional guidelines are included on developing first aid, antidote, spill or leak, and fire action statements.

Chapter 6 provides precautionary label text in the form of tables for immediate hazards. The chapter also provides statements that have been used by industry professionals in conjunction with or in lieu of the statements in the tables.

Chapter 7 lists resources useful in preparing precautionary labeling.

Annex A, *Examples of Labels*, illustrates several different types of precautionary labels.

Annex B, *Hazard Criteria Information*, compares hazard ratings or categories based on acute toxicological and flammability endpoints.

Annex C, *Background: The Globally Harmonized System of Classification and Labelling of Chemicals (GHS)*, provides a brief overview of this system.

Annex D, *Glossary*, defines important terms found in this Standard as well as some additional terms useful to preparers of precautionary labeling.

3 Hazard evaluation

Hazard evaluation, also known as hazard determination, is the process of evaluating all relevant data and producing scientifically sound conclusions that identify the specific hazards of a particular chemical. The hazard evaluation process includes the identification of physical hazards (e.g., flammability or reactivity), health hazards (e.g., cancer or skin sensitization) and environmental hazards (e.g., toxicity to fish). For additional information on the hazard evaluation process, see 29 CFR 1910.1200 (OSHA), Appendix B titled, "Hazard Determination", and also "Draft Guidance for Hazard Determination for Compliance with the OSHA Hazard Communication Standard" (OSHA) dated March 18, 2004 (see www.OSHA.gov).

Hazard evaluation is not the same as risk assessment. An assessment of risk involves the evaluation of hazard and exposure information to estimate the probability that an adverse effect will occur under specific exposure conditions.

3.1 Definition of a hazard

For the purposes of this labeling Standard, *hazard* is an inherent property of a chemical to cause harm. A chemical can be classified as a physical hazard, health hazard and/or an environmental hazard. Hazards can be either immediate or delayed. A chemical may present additional hazards as a result of customary or reasonably foreseeable handling, storage, use, misuse and emergencies. These hazards include any hazardous reaction products that may be formed during recommended storage, handling or use of the product. For example, intended conditions of use of a chemical as recommended by the manufacturer may include elevated temperatures or pressures that may result in the release of a hazardous chemical. These hazards should also be included in the hazard evaluation.

The following sections provide definitions and supporting criteria for hazards, and guidance on the hazard evaluation process.

3.2 Physical hazards

3.2.1 Definition of a physical hazard

A chemical for which there is scientifically valid evidence that it is a combustible liquid, a combustible dust, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive), or water-reactive.

3.2.2 Physical hazard criteria

The following criteria are used throughout this Standard and apply when developing appropriate precautionary statements for hazardous industrial chemical labels. They serve only as a guide for applying the labeling principles set forth in this Standard. Table 1 in Chapter 6 contains appropriate precautionary label text; Section 6.1 contains additional precautionary label text and statements that may be useful.

It should be noted that varying degrees of differences exist between the regulatory definitions and criteria for classification between different regulatory agencies. In some cases, the criteria set forth in this Standard may not match those established by a particular regulatory authority.

The test method specified by the regulations is based on the physical properties of the substance. Selection of the incorrect test method can yield an inappropriate value resulting in the wrong classification. It is very important that the method used to determine the physical hazard property matches those defined in the appropriate regulations.

3.2.2.1 Fire hazard chemical

A fire hazard chemical is a substance falling within any of the following categories: flammability hazards, oxidizers, or pyrophoric chemicals. Where definitions differ between regulatory authorities, the source(s) of the definition is noted. (See Annex B, Tables B.5 and B.6)

3.2.2.1.1 Flammability hazards

— **Gases**

- flammable gas:
  a) A gas that, at ambient temperatures and pressure, forms a flammable mixture with air at a concentration of thirteen (13) percent by volume or less; OR
  b) A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than twelve (12) percent by volume, regardless of the lower limit (OSHA).

OR:

A material that is a gas at 68°F (20°C) or less and 101.3kPa (14.7 psi) of pressure (a material that has a boiling point of 68°F (20°C) or less at 101.3 kPa (14.7 psi) and:

a) is ignitable at 101.3 kPa (14.7 psi) when in a mixture of 13% or less by volume with air; OR
b) has a flammable range at 101.3 kPa (14.7 psi) with air of at least 12% regardless of the lower limit (DOT).

— **Liquids**

Significant regulatory differences exist between DOT, OSHA and CPSC even when applied to the same material. The definitions offered in this Standard for "extremely flammable," “flammable" and "combustible" are based on a combination of the classification criteria from these regulations and may be used to promote consistent use of these terms on the label. The full range of warnings for potential flammability hazards up to a flash point of 200°F (93.3°C) will continue to be covered by the Standard.

- extremely flammable liquid:
  a) Any liquid having a flash point at or below 20°F (-6.7°C), OR
  b) Any liquid having a flash point of not more than 141°F (60.5°C) and a boiling point of not more than 95°F (35°C).

- flammable liquid:
  Any liquid having a flash point of not more than 141°F (60.5°C) and a boiling point greater than 95°F (35°C).

- combustible liquid:
  Any liquid having a flash point above 141°F (60.5°C) and below 200°F (93.3°C).

Note that a flammable liquid with a flash point at or above 100°F (38°C) may be considered a ‘combustible liquid’ for purposes of this Standard. See more details on the DOT regulations below.

For purposes of classification, an accurate determination of the flash point is highly dependent on the method used. Flash points determined by methods other than those specified in the applicable regulations can yield results inconsistent with the intended classification criteria and can result in improper classifications. Refer to the Glossary for a description of applicable flash point test methods.

OSHA regulations, at 29 CFR 1910.1200(c), currently define combustible liquids as any liquid having a flash point at or above 100°F (37.8°C) but below 200°F (93.3°C), except any mixture

having components with flashpoints of 200°F (93.3°C) or higher, the total volume of which make up 99% or more of the total volume of the mixture. Flammable liquids are defined as any liquid having a flash point below 100°F (37.8°C) except any mixture having components with flashpoints of 100°F (37.8°C) or higher, the total volume of which make up 99% or more of the total volume of the mixture.

DOT classification and labeling requirements may be different from those in the OSHA Hazard Communication Standard. The OSHA HCS requires (29 CFR 1910.1200 (f)(3)) that each container leaving the workplace must be labeled in a manner that does not conflict with the Hazardous Materials Transportation Act and regulations issued under that act by the DOT.

Current DOT regulations (49 CFR 173.120(b)(2)) provide a limited exception for flammable liquids with a flash point at or above 100°F (37.8°C) for domestic transportation purposes. This provision does not apply to transportation by vessel or aircraft, except where other means of transportation is impracticable.

These liquids may be reclassified as combustible liquids provided that they do not meet the definition of any other hazard class. The OSHA HCS also provides an exception for liquid mixtures with a flash point not more than 141°F (60.5°C), having components with a flash point of 141°F (60.5°C) or higher that make up at least 99% of the total volume of the mixture. Users wishing to exercise these exceptions will not need to classify these liquids as flammable or extremely flammable liquids.

CPSC regulations, at 16 CFR 1500.3(c)(6), currently define extremely flammable liquids as those having a flash point at or below 20°F (-6.7°C), flammable liquids as those having a flash point above 20°F (-6.7°C) to less than 100°F (37.8°C), and combustible liquids as those having a flash point of 100°F (37.8°C) up to and including 150°F (65.6°C).

— **Solids**

- flammable solid: A solid, other than an explosive, that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or that can be ignited readily and, when ignited, burns so vigorously and persistently that it creates a hazard. A chemical is considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis (See Glossary, “flammable solid”).

- combustible dust: A finely divided solid material, other than an explosive (e.g., dynamite), that presents a fire or explosion hazard when dispersed and ignited in air. NFPA 484 and NFPA 654 define a combustible dust as a finely divided solid material that is 420 microns or smaller in diameter (material passing a U.S. No. 40 Standard Sieve) and presents a fire or explosion hazard when dispersed and ignited in air.

  Different dusts of the same chemical material will have different ignitability and explosibility characteristics, depending upon many variables, such as particle size, shape, and moisture content. Additionally, these variables can change, for example, while the material is passing through process equipment. (See OSHA Safety and Health Information Bulletin, *Combustible Dust in Industry: Preventing and Mitigating the Effects of Fire and Explosions*, 07-31-2005; and, Chemical Safety and Hazard Investigation Board U.S. CSB, Report No. 2003-09-1-Ky, February, 2005.)

3.2.2.1.2 Oxidizer

A chemical other than a blasting agent or explosive as defined in 1910.109(a), that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases (OSHA).

Oxidizers exist in every physical state. Materials may be evaluated for oxidizing characteristics using the appropriate test methods in the UN Manual of Tests and Criteria, (current edition). A test method for the evaluation of oxidizing solids is also published in the IATA Dangerous Goods Regulations (current edition).

3.2.2.1.3 Organic peroxide

Any organic peroxide containing oxygen (O) in the bivalent -O-O- structure and that may be considered to be a structural derivative of hydrogen peroxide where one or more of the hydrogen atoms have been replaced by an organic radical. Thermally unstable organic peroxides may decompose, sometimes violently. An organic peroxide is considered thermally stable if its self-accelerating decomposition temperature (SADT) is equal to or greater than 50°C for a 50 kg package (49 CFR 173.128).

3.2.2.1.4 Pyrophoric chemical

A chemical that will ignite spontaneously in air at a temperature of 130°F (54.4°C) or below (OSHA). Materials may be evaluated for pyrophoric hazards using the appropriate test methods in the UN Manual of Tests and Criteria.

3.2.2.2 Pressure-generating chemical

A chemical that meets either of the following criteria:

1) A chemical that may present a pressure hazard, typically over time by decomposition and/or spontaneous polymerization; OR
2) A chemical used to pressurize the contents of a self-pressurized container.

3.2.2.3 Water reactive chemical

A substance that reacts with water to release a gas that is either flammable, or presents a health hazard.

3.2.2.4 Compressed gas

— OSHA

(i) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70°F (21.1°C); OR

(ii) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130°F (54.4°C) regardless of the pressure at 70°F (21.1°C); OR

(iii) A liquid having a vapor pressure exceeding 40 psi at 100°F (37.8°C) as determined by ASTM D323-72.

— DOT (three divisions)

- compressed gas (nonflammable, nonpoisonous compressed gas-including compressed gas, liquefied gas, pressurized cryogenic gas in solution, asphyxiant gas and oxidizing gas): Any

material (or mixture) which (1) exerts in the packaging an absolute pressure of 280 kPa (41 psia) at 68°F and (2) does not meet the definition of Division 2.1 or 2.3.

- compressed gas (liquefied): A gas which in a packaging under the charged pressure, is partially liquid at a temperature of 68°F (20°C)

- compressed gas (non-liquefied): A gas, other than in solution, which in a packaging under the charged pressure, is entirely gaseous at a temperature of 68°F (20°C)

3.2.2.5 Cryogenic liquid

A refrigerated liquefied gas having a boiling point colder than -130°F (-90°C) at atmospheric pressure.

3.2.2.6 **Unstable reactive** (dangerously reactive chemical)

A chemical that falls within any of the following categories:

— A chemical which in the pure state, or as produced or transported, will vigorously polymerize, decompose, condense or will become self-reactive under conditions of shock, pressure or temperature; OR
— A chemical that reacts with water to release a gas that is either flammable and/or presents a health hazard (Section 6.1 contains precautionary label text that may be useful.)

3.2.3 Physical hazard evaluation

For the purpose of this Standard, a physical hazard evaluation is the process of determining whether a chemical is a physical hazard. The results of the appropriately conducted physical hazard evaluation will support the decision as to what physical hazard information needs to be on the container label and other forms of precautionary labeling.

If a chemical has been tested to determine its physical hazards, the results of the testing should be used to determine whether the chemical substance is a physical hazard.

For an untested chemical the evaluator should use any available, scientifically valid data and methods (such as mathematical models or structure activity relationships), if applicable, when estimating a chemical's physical hazard potential. In addition, for untested mixtures, the hazards of a mixture's components may be considered when estimating the mixture's physical hazard potential. For example, the lowest measured flashpoint of all components in the mixture could be used as a "worst case" or "most conservative" scenario to estimate a mixture's flashpoint. However, when an estimate does not meet a regulatory requirement (e.g., DOT's Hazardous Material Regulations, 49 CFR Parts 170-180), the only acceptable option may be to test the chemical or mixture to determine its physical hazards.

3.3 Health hazards

A health hazard is the inherent property of a chemical to cause an adverse effect on human health following exposure. Exposures to chemicals can be either acute or chronic. **Acute exposure** is typically a single, short-term exposure (usually less than 24 hours). **Chronic exposure** is continuous or repeated exposure over a long period of time.

Health hazards can be either immediate or delayed. **Immediate health effects** are usually of short duration and reversible (e.g., eye or skin irritation, narcosis), but may be of longer duration and may not be reversible (e.g., eye or skin corrosion, and death). Such effects generally manifest themselves soon

after an acute exposure. The term “acute toxicity” may be used to describe immediate effects following single or short-term exposure to a substance, including human health effects and LD_{50}/LC_{50} studies in animals or in aquatic and terrestrial organisms. (See also Annex B).

There may be delayed onset of health effects after an acute exposure. **Delayed health effects** are the result of a single, short-term, continuous or chronic exposure. Such effects manifest themselves over a long period of time and are usually irreversible or of long duration (e.g., cancer, birth defects). The term “chronic toxicity” may be used to describe the results of delayed health effects in humans and repeated-dose/chronic studies in animals or in aquatic and terrestrial organisms.

Health effects can be either local or systemic. **Local health effects** occur primarily at the site of contact or exposure (e.g., chemical burns). **Systemic health effects** occur, following absorption and circulation, in a part or parts of the body distant from the site of exposure or administration (e.g., lead ingestion and neurological effects).

3.3.1 Immediate health hazards

3.3.1.1 Corrosive

A chemical that causes visible destruction of or irreversible alterations in living tissue by chemical action at the site of contact (e.g., eyes, skin, digestive tract or respiratory tract). This term does not refer to action on inanimate surfaces (i.e., steel and aluminum). Corrosivity is determined by using recognized testing guidelines or other appropriate procedures, which may include validated *in vitro* tests.

3.3.1.2 Irritant

A non-corrosive chemical that causes a reversible inflammatory effect on living tissue by chemical action at the site of contact (e.g., eyes, skin or respiratory tract.) This may include defatting agents that, by removal of natural skin oils, cause irritation following prolonged or repeated exposure. The potential for irritation can be determined by using recognized guidelines or other appropriate techniques. For example, the OSHA HazCom Standard defines a skin irritant as a chemical that when tested by appropriate techniques results in an empirical test score of “five or more.” A number of published approaches for classifying the degree of irritation are available (see Annex B, Table B.4). There may be instances where labeling for mechanical irritation (irritation due to friction) is warranted. Professional judgment should be used.

3.3.1.3 Inhalation

3.3.1.3.1 Highly toxic (poison) by inhalation

A chemical that has a median lethal concentration (LC_{50}) in air of 200 parts per million (ppm) 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 for 1 hour (or less, if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.

3.3.1.3.2 Toxic by inhalation

A chemical that has a median lethal concentration (LC_{50}) in air of more than 200 parts per million (ppm), but not more than 2000 parts per million (ppm) 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 1 hour (or less, if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.

3.3.1.3.3 Additional information for inhalation toxicity

Technological advances in inhalation toxicity for aerosols and changes in classification have resulted in test procedures that require four-hour exposure times and the exposure concentration measurements to be expressed in mg/L. This provides more precise data but does not allow direct conversion to the one-hour exposures required in some classification schemes. In order to avoid duplicate testing, formulas are used in certain cases (most notably transportation classifications) to convert four-hour exposure values to one-hour exposure values. A conversion factor multiplier of four (4) is used for particulates and two (2) is used for vapors. Applications of such extrapolations should involve professional judgment.

3.3.1.4 Dermal

3.3.1.4.1 Highly toxic (poison) by skin contact

A chemical that has a median lethal dose (LD_{50}) of 200 mg/kg or less of body weight when administered by continuous contact for 24 hours (or less, if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.

3.3.1.4.2 Toxic by skin contact

A chemical that has a median lethal dose (LD_{50}) of more than 200 mg/kg, but no more than 1000 mg/kg of body weight, when administered by continuous contact for 24 hours (or less, if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.

3.3.1.4.3 Harmful by skin contact

A chemical that has a median lethal dose (LD_{50}) of more than 1000 mg/kg, but no more than 2000 mg/kg of body weight when administered by continuous contact for 24-hours (or less, if death occurs within 24-hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.

3.3.1.5 Oral

3.3.1.5.1 Highly toxic (poison) by ingestion

A chemical that has a median lethal dose (LD_{50}) of 50 mg/kg or less of body weight when administered orally to albino rats weighing between 200 and 300 grams each.

3.3.1.5.2 Toxic by ingestion

A chemical that has a median lethal dose (LD_{50}) of more than 50 mg/kg, but no more than 500 mg/kg of body weight, when administered orally to albino rats weighing between 200 and 300 grams each.

3.3.1.5.3 Harmful by ingestion

A chemical that has a median lethal dose (LD_{50}) of more than 500 mg/kg but no more than 2000 mg/kg of body weight when administered orally to albino rats weighing between 200 and 300 grams each.

3.3.2 Allergic reactions/Sensitizer

A chemical that causes a substantial proportion of exposed people or animals to develop an allergic reaction (skin or respiratory) in normal tissue after repeated exposure to the chemical. It is the result of a complex immune reaction. An allergic reaction may occur the second time a person is exposed to the chemical allergen, or may not occur until years later, following repeated exposure to the allergen. Once sensitization has been induced, allergic reactions may be triggered by very low doses of the chemical allergen. Respiratory allergic reactions are of particular concern since the reactions can be severe and may be fatal.

3.3.3 Delayed health hazards

3.3.3.1 Target organ effects

Organs or tissues where the major adverse effects occur are generally referred to as target organs. Some chemicals only cause target organ effects at very high doses in animal testing. Damage that results from testing under unusual conditions or when other unique circumstances are involved, are not usually addressed on a label. These effects may be described in other precautionary labeling, such as the MSDS.

In some cases, adverse effects that are produced in the target organ(s) may result in adverse effects in other, secondary organs or tissues. Damage to secondary organs other than the target organ(s) is not usually addressed on a label but may be described in other precautionary labeling. For example, a chemical causes the red blood cells to be destroyed. This damage can result in kidney failure. Labeling the kidney as a target organ for this substance would be misleading because the primary toxicity is to the red blood cells. In this case, recommended precautionary measures to protect the red blood cells will also protect the kidneys. Kidney effects, though not included on the label, may be discussed in the MSDS.

OSHA addresses cancer, reproductive toxicity and developmental toxicity separately from other target organ effects.

3.3.3.2 Carcinogenicity/Cancer

A carcinogen is defined as a material that causes cancer. OSHA considers a chemical to be a carcinogen subject to labeling requirements if:

(a) It is listed by the International Agency for Research on Cancer (IARC), and found to be a human carcinogen (Group 1) or a probable human carcinogen (Group 2A) [Note: IARC Group 2B carcinogens do not need to be identified as such on the label, but must be added to the MSDS]; OR

(b) It is listed as a carcinogen or potential carcinogen in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); OR

(c) OSHA regulates it as a carcinogen; OR

(d) The manufacturer or importer considers it to be a carcinogen based on available data, including information from other agencies and regulatory bodies (e.g., ACGIH, EPA).

Other agencies and regulatory bodies also define and classify carcinogens, (e.g., ACGIH, EPA).

The following references can be used to evaluate carcinogenicity data for chemicals not listed or regulated by the above organizations. Professional scientific judgment should be used in these evaluations.

- J. Ashby, et al., "A Scheme for Classifying Carcinogens," Vol. 12 *Regulatory Toxicology and Pharmacology,* pp. 270-295 (1990).
- IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, International Agency for Research on Cancer, World Health Organization, Lyon, France.
- U.S. EPA Office of Research and Development Draft Final Guidelines for Carcinogenic Risk Assessment, EPA No. 600/P-92/003C (February 2003).

For labeling recommendations for carcinogenicity, see Section 5.5.1.3.1.

3.3.3.3 Reproductive, developmental and teratogenic effects

Both reproductive and developmental toxicity have been described as forms of target organ toxicity in which the reproductive organs or the developing fetus are affected. Reproductive toxicants are those chemicals that affect male or female fertility while developmental toxicants affect embryonic/fetal development. Developmental toxicity has also been broadly defined to include any effect interfering with normal development and includes embryotoxic/fetotoxic effects, teratogenic effects or other effects that occur before and after birth. A teratogen usually refers to a chemical that causes malformations or permanent structural change in the embryo or fetus that may adversely affect survival, development or function.

Identification of reproductive/developmental/teratogenic toxicants is usually based on the specific effects they have on the reproductive organs and developing embryos/fetuses. These effects may be observed in acute, subchronic, reproductive, developmental and teratogenicity studies in animals. Epidemiological studies and case reports of adverse effects should also be considered. Professional scientific judgment should be used when evaluating effects on specific reproductive organs or on developing fetuses/ embryos.

The following references can be used to evaluate reproductive/developmental data for chemicals:

- U.S. EPA Guidelines for Developmental Toxicity Risk Assessment, 56 Federal Register 63798-63826 (Dec. 5, 1991).
- U.S. EPA Guidelines for Reproductive Toxicity Risk Assessment. 61 Federal Register 56274-56322 (Oct. 31, 1996).
- Moore JA, et al. An evaluative process for assessing human reproductive and developmental toxicity of agents. 1995. Reproductive Toxicology 9(1): 61-95.

For labeling recommendations for reproductive and developmental toxicity, see Section 5.5.1.3.2.

3.3.3.4 Mutagenicity

A mutagen is a substance or agent capable of altering genetic material (e.g., DNA and chromosomes) in a living cell. Although mutagenicity data may be supportive in determining human cancer risk, existing animal and epidemiological evidence have not established the link between chemical exposures and heritable genetic damage (e.g., germ cell mutations) in humans. If supporting evidence demonstrates a causal relationship between such data and human effects, then labeling for mutagens is appropriate.

3.3.4 Health hazard evaluation

For the purpose of this Standard, a health hazard evaluation is the process of determining whether a chemical substance is either an immediate or delayed health hazard, or both. The results of the appropriately conducted health hazard evaluation will support the decision as to what health hazard information needs to be included in precautionary labeling, such as the material safety data sheet (MSDS) and the container label.

The health hazard evaluation process relies to a great extent on the use of professional judgment. The professional judgment of the person conducting the health hazard process is the key factor for identifying the chemical hazards, which then may be communicated effectively via precautionary labeling. Therefore, it is necessary for the hazard evaluator to have a basic understanding of the types of data and information that need to be presented in a study report or publication, and for determining if the study was designed and conducted according to established scientific principles.

The steps or procedures used for the health hazard evaluation should be documented and accessible. There is no internationally accepted set of guidelines or methodology for performing a health hazard evaluation. However, a health hazard evaluation generally consists of two basic, integrated steps.

The first step in the health hazard evaluation process is to gather all available scientific data and information on the chemical. For mixtures, the scientific data and information on components should also be obtained. This step involves searching all available sources, including primary sources, such as company and trade organization testing reports and peer-reviewed scientific literature, as well as secondary sources. Sources of data may include, but are not limited to:

- Peer-reviewed scientific journals;
- In-house and other (other companies, trade organizations) testing results;
- The numerous databases found in the U.S. National Library of Medicine's (NLM) TOXNET and MEDLARS systems such as HSDB, DART, IRIS, etc., and MEDLINE and TOXLINE;
- The Occupational Safety and Health Administration's (OSHA) subpart Z, Toxic and Hazardous Substances, found in 29 CFR Part 1910;
- The American Conference of Governmental Industrial Hygienists (ACGIH) Documentation of Threshold Limit Values and Biological Indices (latest edition);
- The American Industrial Hygiene Association's (AIHA) Documentation of the Workplace Environmental Exposure Limits (WEELs) (latest edition);
- The U.S. National Toxicology Program's (NTP) *Report on Carcinogens* (latest edition);
- The International Agency for Research on Cancer's (IARC) Monographs (numerous volumes);
- Reports, documents, publications and data/information from U.S. governmental agencies such as the Environmental Protection Agency (EPA), the National Institute for Occupational Safety and Health (NIOSH), the National Institute for Environmental Health Sciences (NIEHS), the Agency for Toxic Substances and Disease Registry (ATSDR), the National Toxicology Program (NTP), and the Occupational Safety and Health Administration (OSHA); and,
- Standard reference texts in toxicology, industrial hygiene, occupational medicine.
- Additional sources as noted in Appendix B of OSHA's Draft Guidance for Hazard Determination: for Compliance with OSHA's Hazard Communication Standard (2004).

The second step of the health hazard evaluation process is to review critically the scientific data and information gathered in the first step. The goal of this critical review is to produce a scientifically defensible evaluation of the relevant data in order to determine the hazard(s) of a chemical. Once the health hazards have been identified, then there is a firm basis for selecting the appropriate precautionary labeling statements. See Section 5.5 for more information on the statement of hazards.

Studies addressing chemical effects on animals are commonly reviewed in the health hazard evaluation process. When reviewing animal studies, the routes of exposure relevant to the workplace are: skin contact, skin absorption, eye contact, inhalation and ingestion (that is, inadvertent swallowing of the chemical). Available animal studies using these routes are considered when performing hazard evaluations. Studies conducted by non-workplace routes of exposure such as subcutaneous (SQ), intramuscular (IM), intraperitoneal (IP) or intravenous (IV) should not be used in the hazard evaluation process unless they are the only acceptable studies available. Professional judgment should be used to decide how data that are not specific to the relevant route of exposure should be considered in the hazard evaluation process.

Data and information reported in toxicological studies can vary widely. Examples of types of data and information usually reported include:

- Test animals (species, strain, sex, etc.);
- Test substance (purity);
- Route of exposure (oral, inhalation, dermal, etc.);
- Duration of exposure (acute, chronic, etc.);
- Exposure dose;
- Clinical and experimental parameters/endpoints examined (e.g., mortality, clinical signs of toxicity, changes in food/water consumption, clinical chemistry, urinalysis, organ weights, gross and microscopic pathology, etc.);
- Methods of statistical analysis of data; and
- Dose-response relationships.

3.3.4.1 Evaluating health hazards for mixtures

When performing a health hazard evaluation on mixtures, one should use test data available on the mixture itself or comparable mixtures. Often, however, there are incomplete or no test data available for the mixture as a whole.

Pursuant to the OSHA HCS, if appropriate test data are not available for the mixture, then it is assumed that the mixture presents the same non-carcinogenic health hazards as each of the components present at greater than or equal to 1%. The mixture is assumed to be a carcinogenic hazard if it contains a carcinogenic component at 0.1% or greater.

If a hazardous component is present in a mixture below the 1% threshold (0.1% for carcinogens) and could be released in concentrations exceeding the OSHA or ACGIH exposure guidelines, the mixture is assumed to present the same hazards as the components.

If a hazardous component is present in a mixture below the 1% threshold (0.1% for carcinogens) and could still present a hazard, the mixture is assumed to present the same hazard as the components.

3.4 Environmental hazards

3.4.1 Definition of environmental hazard

A chemical is an environmental hazard if, based on its inherent ecotoxicity and/or potential to bioaccumulate or biodegrade, it causes adverse effects to living organisms or their habitats.

3.4.2 Environmental hazard criteria

Currently there is no OSHA requirement to include environmental hazards on the label.

There is no single set of agreed-upon criteria to determine fully the impact a chemical may have on the environment. The U.S. Environmental Protection Agency (EPA), the European Commission (E.C.), the International Maritime Organization (IMO) and the Globally Harmonized System for Classification and Labelling of Chemicals (GHS), have developed environmental hazard criteria. For more information see references in Sections 7.3 and 7.4.

3.4.3 Environmental hazard evaluation

Environmental effects of chemical materials will vary based on numerous factors such as amount or volume of material released into the environment, media-related conditions (temperature, air flow, water flow, etc.) and other inherent characteristics of a single chemical substance or mixture of substances. A complete description of the potential environmental impacts may not be practical with the use of brief label statements. However, it may be useful, in some cases, to include on the label the major potential environmental impacts since they can influence the proper handling and disposal of a particular material.

Often, more detailed information can be provided using MSDSs or supplemental labeling. In these instances, a reference to such a resource on the label is appropriate.

4 Label considerations

Preparation of a precautionary label is the next step in the process that begins with a hazard evaluation. Consideration should be given to the placement of the label text on the container label. The precautionary text should be prominent relative to other information on the label.

Studies have confirmed that it is very valuable to use the same phrase consistently when communicating a specific hazard on a label.

When developing label statements and warnings to address hazards, consider the following guidelines:

- Major emphasis should focus on warnings for severe and high likelihood hazards;
- Label warnings are for alerting rather than educating;
- Brief statements using plain language and no more than two subordinate clauses are more likely to be understood;
- Avoid the use of double negatives;
- Phrases that recommend positive action (i.e., do this…) are usually more effective than phrases that prohibit action (i.e., do not do that…); and,
- Obtaining worker feedback on phrases can be useful in developing new statements.

The effectiveness of symbols in communicating hazards is dependent upon their recognition and association to a specific hazard. Training greatly improves the comprehension and effectiveness of symbols. Currently the use of some symbols to convey hazards is required by some regulatory agencies such as the U.S. Department of Transportation (49 CFR 172.300 to 172.560). If using symbols for precautionary labeling, consider ones that are well-recognized and limit them to the most serious immediate hazard(s). (See also ANSI Z535 series.)

4.1 Elements of a label

Selection of precautionary label text requires individual discretion and professional judgment, but in all cases the label must meet the requirements specified in OSHA's HCS and other applicable regulations.

The OSHA required elements of a label are: identity of the hazardous chemicals; appropriate hazard warnings; and, the name and address of the chemical manufacturer, importer or other responsible party. See 29 CFR 1910.1200(f)(1) for additional information on the OSHA required elements; see 29 CFR 1910.1001-1052 for substance specific OSHA requirements.

The space available on a small package label may prohibit the inclusion of complete precautionary text. In addition, if label space limitations compromise text legibility, some precautionary text may appear on other labeling rather than on the container label. In those instances, the applicable precautionary information with the highest priority should appear on the container label.

The label elements are listed below. Individual discretion and professional judgment, based on the particular hazards of the chemical, are necessary to determine the priority/inclusion of the following precautionary labeling text:

- identification of the chemical product;
- identification of its hazardous component(s);
- statement(s) of hazard(s);
- name, address;
- telephone number;
- signal word;
- precautionary measures;
- instructions in case of contact or exposure (first aid);
- antidotes, and notes to physician;

- instructions in case of fire;
- instructions in case of spill or leak;
- instructions for container handling and storage; and
- reference(s) to additional labeling/other documents.

4.1.1 Importer/Distributor requirements

The importer (see Glossary) and/or distributor (see Glossary) is responsible for ensuring that labeling is compliant with OSHA and other applicable regulations.

4.2 Physical characteristics of a label

When creating a label, the physical characteristics should be taken into consideration for effective communication of precautionary information. The two most important physical characteristics affecting labels are readability and durability.

The readability of a label has several aspects including:

- color
- type style and size
- layout

It is helpful to consider how the color contrast can emphasize important sections such as statements of hazards (e.g., a contrast of black on white has a high level of readability). The use of color in other sections should not detract from the readability of the precautionary text and other required labeling. Type size can improve the readability of a label by: emphasizing certain label areas with enlarged or bolded typeface; using a larger point size; combining upper and lower case lettering (rather than using all upper case letters); and, using simple rather than ornate type faces. When considering the layout, it is helpful to look at the other information, not related to hazard communication that is sometimes added to a label (e.g., barcodes, lot numbers, weights, certificate of analysis and label dates). The layout or design is often very important for label readability and communication.

The durability of a label has several aspects including:

- adhesives
- label stock
- ink or coatings
- product characteristics

When considering adhesives for a product label, it may be helpful to consider the application conditions and techniques, surface temperatures, humidity, type of container (steel, fiberboard drum, etc.) and how long the adhesive is likely to adhere in a given environment. For label stock, ink or coatings, it may be helpful to consider whether the stock will be synthetic or paper, how soluble the ink is and whether a coating over the label may be necessary to protect it. The characteristics of the product itself can sometimes affect the kind of label that should be used.

5 Preparing precautionary labeling

5.1 Overview

This section describes the procedure for preparing precautionary labeling for hazardous industrial chemicals. Writing precautionary label text is part of the process of creating appropriate health and safety information for persons who use or may otherwise come into contact with hazardous industrial chemicals. First, a hazard evaluation of the chemical is performed in keeping with applicable regulatory requirements. Next, documents are identified that must be created or revised to provide necessary health and safety information. These documents can include precautionary labels, MSDSs, technical bulletins and other forms of communication. While MSDSs and technical bulletins contain large amounts of detailed information, precautionary labels provide the most important hazard information in a simple and succinct manner. The information in these documents will not necessarily be identical but it must always be consistent.

Since the audience for precautionary labeling includes individuals with a variety of education and training, label text should convey the necessary information in as simple and clear a fashion as possible. Varying levels of education and training can best be accommodated by:

- integrating warnings into work tasks and hazard related context;
- being selective and providing short focused messages;
- making symbols and text as specific as possible;
- simplifying the syntax of text and combinations of symbols; and
- making the labeling (e.g., labels, warning signs, etc.) conspicuous and legible.

The use of readily recognizable symbols that are further defined with simple text may be helpful. Such an approach would be consistent with modern methods of warning label design as presented in ANSI 535.4, for example.

5.2 Product identification

Product identification consists of a product identifier and/or the chemical name(s) of the product's component(s). "Product identifier" is the name of a chemical product (e.g., brand name, code name, trade name, product number, etc.). The product's identifier or chemical names must directly link the label to other documents, such as the MSDS and/or an employer's list of hazardous chemicals. The product identifier and the product's hazardous component(s) shall be disclosed on the label. When a product lacks a product identifier and is composed of a single chemical substance, the chemical name shall be used.

5.3 Component identification

The chemical names of the components contributing substantially to the hazards of a product shall be included as part of the label. Several state right-to-know regulations may require the listing of chemical components including those that do not contribute to the hazards of the product. (See Annex A.)

5.3.1 Trade secrets

There are cases where one or more components of a product may be a trade secret. For valid trade secret claims, the specific component identity need not be included on the label. Where a state with right-to-know regulation requires that a trade secret registry number replace the chemical identity, the trade secret number shall be disclosed on the label where the chemical identifiers would otherwise be located. (See Annex A.)

When a chemical's identity is a trade secret, the chemical manufacturer, importer or employer shall have a procedure to immediately disclose the specific chemical identity where a treating health care professional determines that a medical emergency exists and the trade secret chemical's identity is necessary for emergency or first-aid treatment. See 29 CFR 1910.1200(i)(2).

5.4 Signal word

The signal word shall indicate the relative degree of severity of an immediate hazard in diminishing order: **DANGER, WARNING** and **CAUTION**. It comes immediately before the statement of hazard section on the label and is intended to call the worker's attention to the level of a chemical's hazard severity. An exclamation mark (!) may be used for emphasis following the signal word. When a chemical has more than one hazard, only the signal word corresponding to the class of greatest immediate hazard shall be used.

DANGER Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.

WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury.

Signal words can also be used for delayed hazards and hazards that may arise under conditions of use (by-products, decomposition products, etc.).

5.4.1 Poison symbol

The word **POISON** and the skull and crossbones symbol should appear on the label when it is necessary to attract attention to a severe and immediate harm that could result from exposure to a highly toxic chemical (see Section 3.3.1). When used, the word and the symbol should appear together on the label. These are typically placed before the "First Aid" instructions. (See Chapter 6, Tables 6, 7, and 8, and Annex A.) The word **POISON** and the skull and crossbones symbol should be used in addition to, and not replace, a signal word.

5.5 Statement of hazard

The results of the hazard evaluation, as described in Chapter 3, are the identification of health, physical and environmental hazards associated with a particular chemical or mixture. Significant hazards then need to be communicated in clear, concise statements on the label (e.g., EXTREMELY FLAMMABLE; CAUSES SKIN IRRITATION). The hazard warning must convey the particular hazards of the chemical, including target organ effects. Statements for immediate hazards should usually precede the statements for delayed hazards. In general, the most serious immediate hazard shall be placed first, followed by all other immediate hazards. It is also desirable to group and prioritize delayed hazards.

In addition, statements of hazard should be included for any potential hazardous reaction chemicals that would be expected to form under normal conditions of storage, handling or use. The statement of hazard for such a chemical should usually follow the statements for the immediate and delayed hazards. See Annex A.

5.5.1 Health hazards

Statements of hazard for health effects, such as “CAUSES,” “CAN CAUSE,” and “MAY CAUSE” are used differently depending on the type and severity of effect.

5.5.1.1 Precautionary labeling for immediate health hazards

Immediate health hazards include irritation/corrosion to eyes, skin, respiratory tract, gastrointestinal tract and acute toxicity by ingestion, skin contact or inhalation. Statements for these types of hazards convey information about an immediate health hazard and the degree to which the chemical can cause damage. For example, “MAY BE FATAL…” is used for a chemical that is highly toxic, while “HARMFUL IF…” is used for a chemical that has a moderate toxicity. The examples below demonstrate how the statements of hazard may change based on the severity of effects. See Chapter 6, Tables 2-8 for criteria for using hazard statements.

Examples:

Severity of effect	**Irritation/Corrosion**
Severe	CAUSES EYE BURNS
Moderate	CAUSES EYE IRRITATION
Mild	MAY CAUSE EYE IRRITATION

Severity of effect	**Acute toxicity**
Severe	MAY BE FATAL IF ABSORBED THROUGH SKIN
Moderate	HARMFUL IF ABSORBED THROUGH SKIN
Mild	MAY BE HARMFUL IF ABSORBED THROUGH SKIN

5.5.1.2 Precautionary labeling for allergic skin and respiratory reactions

Most allergic reactions will occur in only a small percentage of people that are exposed. For this reason, statements for allergic reactions typically use “MAY CAUSE…”

Examples

MAY CAUSE ALLERGIC SKIN REACTION

MAY CAUSE ALLERGIC RESPIRATORY REACTION

5.5.1.3 Precautionary labeling for delayed health hazards

Delayed health hazards include target organ effects, carcinogenicity and reproductive/developmental effects. Delayed health hazard statements indicate the level of certainty in the data. "CAN CAUSE…" is used when there is generally accepted, well-established evidence that a chemical or mixture causes significant damage to target organs in humans. In most cases, human data is unavailable. If there is indication that significant damage to human organs may be possible based on laboratory animal data (i.e., morphological, functional or histological organ changes), the statement "MAY CAUSE… BASED ON ANIMAL DATA" is used. See examples below.

Examples:

	Target organ
Human evidence	CAN CAUSE LIVER DAMAGE
	CAN CAUSE LUNG DAMAGE IF INHALED
Animal evidence	MAY CAUSE LIVER DAMAGE BASED ON ANIMAL DATA
	MAY CAUSE LUNG DAMAGE IF INHALED BASED ON ANIMAL DATA

Delayed health hazard statements are often used together with immediate health hazard statements to indicate degree of hazard and route of exposure (e.g., "MAY CAUSE KIDNEY DAMAGE BASED ON ANIMAL DATA"; "HARMFUL IF INHALED, ABSORBED THROUGH SKIN OR SWALLOWED").

Whenever appropriate, the term "DAMAGE" may be replaced by more specific terms such as "BLOOD DISORDERS", "NERVOUS SYSTEM EFFECTS" and the like. It may be appropriate to convey that the risk of damage or adverse effects depends on duration and level of exposure. In addition, it may be appropriate to state that the risks are most likely to occur by a single route of exposure.

As described in Section 3.3.4.1, untested mixtures are assumed to present the same health hazards as each of the components present at greater than or equal to 1% (0.1% for carcinogens). It may be desirable to indicate which component is responsible for a particular health hazard. See examples below.

Examples

CONTAINS ETHYLENE GLYCOL THAT CAN CAUSE KIDNEY DAMAGE

CONTAINS MATERIAL THAT MAY CAUSE KIDNEY DAMAGE BASED ON ANIMAL DATA

5.5.1.3.1 Carcinogenicity

The table below provides some commonly used carcinogen categories and suggested precautionary labeling language.

NOTE: A direct comparison of categories is not always possible. This comparison is proposed as a reasonable approximation. For example, NIOSH-designated carcinogens do not appear to consistently fit into any of the categories for systems used by other organizations, and are not included in this table. The precautionary labeling language in the table below is suggested guidance only. Companies may decide to use different wording.

ORGANIZATION	CATEGORY	RATING	SUGGESTED PRECAUTIONARY LABELING LANGUAGE
Carcinogenic			
IARC	Carcinogenic to humans	1*	CANCER HAZARD – CAN CAUSE CANCER
NTP	Known to be a human carcinogen	K*	
OSHA	Carcinogen defined with no further categorization	Ca*	
ACGIH	Confirmed human carcinogen	A1	
EPA	Carcinogenic to humans	CaH	
Probably Carcinogenic			
IARC	Probably carcinogenic to humans	2A*	SUSPECT CANCER HAZARD – MAY CAUSE CANCER
NTP	Reasonably anticipated to be a human carcinogen	R*	
ACGIH	Suspected human carcinogen	A2	
EPA	Likely to be carcinogenic to humans	L	
Possibly Carcinogenic			
IARC	Possibly carcinogenic to humans	2B**	Carcinogenicity labeling language may not be necessary, however, if labeling is appropriate suggested language is POSSIBLE CANCER HAZARD – MAY CAUSE CANCER BASED ON ANIMAL DATA
ACGIH	Confirmed animal carcinogen with unknown relevance to humans	A3	
EPA	Suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential	S	

ORGANIZATION	CATEGORY	RATING	SUGGESTED PRECAUTIONARY LABELING LANGUAGE
Not Classifiable			
IARC	Unclassifiable as to carcinogenicity in humans	3	Carcinogenicity labeling language is not necessary in most cases.
ACGIH	Not classifiable as a human carcinogen	A4	
EPA	Data are inadequate for an assessment of human carcinogenic potential	I	
Not Carcinogenic			
IARC	Probably not carcinogenic to humans	4	Carcinogenicity labeling language is not necessary.
ACGIH	Not suspected as a human carcinogen	A5	
EPA	Not likely to be carcinogenic to humans	NL	

* Per OSHA HCS, chemicals that are in these categories must be identified as carcinogens in precautionary labeling language.
** Per OSHA HCS, IARC 2B chemicals need to be identified as such in an MSDS, but a carcinogenicity warning is not required on the label.

5.5.1.3.2 Reproductive/Developmental/Teratogenic effects

There are no generally accepted labeling schemes for reproductive or developmental toxicants/teratogens in current use in the United States. If a chemical is determined to be a reproductive toxicant, developmental toxicant or teratogen, then an appropriate warning statement should be placed on the label. Some examples of appropriate label warning statements appear in the tables below.

	Reproductive Toxicity
Human evidence	REPRODUCTIVE HAZARD – CAN CAUSE ADVERSE REPRODUCTIVE EFFECTS (IN FEMALES) (IN MALES)
Animal evidence	POSSIBLE REPRODUCTIVE HAZARD – MAY CAUSE ADVERSE REPRODUCTIVE EFFECTS (IN FEMALES) (IN MALES) (BASED ON ANIMAL DATA)

	Developmental Toxicity
Human evidence	DEVELOPMENTAL HAZARD – CAN CAUSE ADVERSE REPRODUCTIVE EFFECTS
Animal evidence	POSSIBLE DEVELOPMENTAL HAZARD – MAY CAUSE ADVERSE DEVELOPMENTAL EFFECTS (BASED ON ANIMAL DATA)

	Teratogenicity
Human evidence	BIRTH DEFECT HAZARD – CAN CAUSE BIRTH DEFECTS
Animal evidence	POSSIBLE BIRTH DEFECT HAZARD – MAY CAUSE BIRTH DEFECTS (BASED ON ANIMAL DATA)

5.5.1.3.3 Mutagenicity

No precautionary labeling recommendations will be made for mutagens in this Standard. (See Section 3.3.3.4)

5.5.1.4 No significant adverse health effects

If there are sufficient data for a material indicating that there are no significant adverse health effects, this may be included on the label. Although there is no regulatory requirement for this, it may be important to the user of the product.

Example

NOT EXPECTED TO PRODUCE SIGNIFICANT ADVERSE HEALTH EFFECTS WHEN RECOMMENDED USE INSTRUCTIONS ARE FOLLOWED

5.5.2 Physical hazards and environmental hazards

Statements of hazard as explained in Section 5.5 apply to physical and environmental hazards as well. The criteria developed by agencies in the U.S. that have labeling requirements for physical and environmental hazards are not harmonized. Attempting to harmonize these is beyond the scope of this Standard. Other than the scheme used in this Standard for fire hazards, the individual regulations should be consulted for specific requirements and criteria for physical and environmental statements. See Chapter 6, Table 1 and Section 3.2 for physical hazards; Section 3.4 for environmental hazards; and Section 6.1 for additional statements.

5.5.3 Other statements of hazards

Hazardous reaction products

Statements of hazard should be included for potential hazardous reaction chemicals that would be expected to form under normal conditions of storage, handling or use. See examples and Annex A.

Examples

HEAD SPACE MAY CONTAIN ETHYLENE OXIDE.

CONTACT WITH AIR CAN LEAD TO FORMATION OF HYDROCHLORIC ACID.

5.6 Name, address and telephone number

The name and address of the manufacturer, importer or other responsible party shall be included on product labels leaving the workplace and intended for outside sale or distribution. The name should be the actual corporate name or name under which the business is conducted. The address should include:

- the street address (the U.S. street address may be omitted if this is shown in a current city or telephone directory);
- city;
- state or province;
- ZIP or postal code;
- country (where applicable).

A telephone number for additional product information should be included on the label. Restrictions, such as hours of operation (e.g., Monday – Friday, 8:00 a.m.- 6:00 p.m. EST, or 24-hours) or the type of information available (e.g., medical, transportation) should be indicated. International dialing codes should be included when applicable.

5.7 Precautionary statements

Precautionary statements (e.g., “Keep away from heat, sparks and flame”, “Avoid breathing dust” and “Do not flush to sewer”) should supplement the statement of hazard by briefly providing measures to be taken to avoid injury from physical, health or environmental hazards. Recommendations on specific precautionary measures and instructions in case of contact or exposure are dependent on many factors. Professional judgment should be used to determine the specific appropriate statements on a case-by-case basis. (See Chapter 6, Tables 1 – 8, and Section 6.1.5 for additional Precautionary statements.)

5.8 First aid/Antidotes/Notes to physician

Instructions in case of contact or exposure should be included where the known or potential adverse effects of contact or exposure warrant immediate treatment (first aid), and where simple measures may be taken before professional medical assistance is available. This section on the label should be captioned: FIRST AID.

Procedures recommended for providing assistance should be limited to those that can be performed by individuals without specialized medical or emergency training. Simple remedial measures (such as flushing eyes and skin with water, or removal of contaminated clothing) should be included when they will serve to lessen or avoid serious injury following exposure.

If appropriate, it may be advisable to recommend protective equipment for individuals providing first aid.

Example

Wear self-contained breathing apparatus (SCBA) before attempting rescue.

The determination of the most appropriate first aid statements/instructions and antidotes/notes to physicians to include on industrial chemical labels is best accomplished by a trained professional on a case-by-case basis. Because of the need for case-by-case evaluation, as well as label space considerations, it is difficult to give a set of standard first aid statements or antidote/notes to physicians that will fit everyone's needs in all situations.

See Chapter 6, Tables 2-8, and Section 6.1.6 for additional first aid statements.

5.8.1 First aid statements

First aid statements should be easily understood, in brief and clear language so individuals who have no specialized training as medical or emergency responders can administer treatment.

5.8.1.1 First aid for exposure to eyes and skin

The following advice applies to most chemicals. See Tables 2, 3, 5 and 7 in Chapter 6 for more specific first aid instructions.

(a) If the material gets into the eye, the first aid advice recommended is to flush the eye under running water for at least 15 minutes. If easy to do, remove contact lenses and continue to flush with water.

(b) For skin exposure, the removal of contaminated clothing and the rinsing or washing of the exposed surface is recommended.

Some exposures may warrant different first aid measures.

(1) For contact with hot materials that cause thermal burns, clothing should not be removed and exposed skin should be cooled with plenty of water.

(2) For eye and skin exposure to corrosive chemicals, medical personnel should be contacted immediately and the eyes and skin should be flushed under running water for longer than 15 minutes.

5.8.1.2 First aid for inhalation

Moving the person from the contaminated area to fresh air is the most immediate first aid measure following inhalation exposure. See Tables 4, 5 and 6 in Chapter 6.

5.8.1.3 First aid for ingestion

In general, it is not recommended to induce vomiting for ingested chemicals. The induction of vomiting following ingestion of potentially harmful substances may not always be effective and may even prove to be harmful with some materials.

A statement should be included to obtain advice from a physician, poison control center or health care professional before the induction of vomiting. The instruction "to induce vomiting" is not recommended if:

— the material is corrosive,

— the material is petroleum distillate or other hydrocarbons that have the potential for aspiration into the lungs leading to chemical pneumonitis, such as:
    - certain low viscosity petroleum hydrocarbons (e.g., kerosene, mineral seal oil, naphtha, gasoline, mineral spirits, Stoddard solvent and related petroleum distillates);
    - aromatic hydrocarbons (e.g., benzene, toluene and xylene); and,
    - products containing 10% or more by weight of aromatic and/or petroleum hydrocarbons.

  In addition to the aspiration hazard, the following may present immediate and other systemic health effects after ingestion. Current medical practice recommends that immediate medical assistance be sought to determine the most appropriate course of emergency medical treatment for ingestion of halogenated hydrocarbons (e.g., perchloroethylene, trichloroethylene, methylene chloride) or their mixtures.

  For more detailed information on hydrocarbon aspiration, the reader should refer to various resources in clinical toxicology, such as:

  — M. Ellenhorn, Ellenhorn's Medical Toxicology: Diagnosis and Treatment of Human Poisoning, 2nd ed. (1996);
  — K.R. Olson, ed., Poisoning & Drug Overdose, 4nd Edition (2003);
  — L. R. Goldfrank, ed., Goldfrank's Toxicologic Emergencies, 7th Edition (2002);
  — P. Viccellio, ed., Emergency Toxicology, 2nd Edition (1998).
  — See also, the first aid section of the CPSC's Labeling Guide (Final , 2000).

Example

First Aid: If swallowed, call a physician or poison control center immediately. Do NOT induce vomiting unless directed to do so by a physician or poison control center. Never give anything by mouth to an unconscious person.

For substances that warrant immediate removal from the digestive tract if swallowed, such as those chemicals having a high acute toxicity, the recommendation to induce vomiting may be appropriate.

For substances that present an ingestion hazard, the recommended first aid instructions for container labels are presented in Table 8 of Chapter 6.

5.9 Antidotes/Notes to physicians

When a specific, effective antidote is known and is of such a type that it may be administered by either medical or non-medical personnel (with appropriate training), it should be included on the label with the caption: *ANTIDOTE/NOTES TO PHYSICIANS*.

Generally, antidotes are considered agents that prevent or reduce the effects of a poison. They can:
— change the movement and metabolism of a chemical within the body;
— enhance the elimination of a specific toxic agent; and,
— interfere with the chemical toxic mechanism of action.

Many, if not all, antidotes need to be administered by trained professionals such as physicians, nurses and emergency responders. While there are relatively few clinically proven antidotes for specific chemical

over-exposures or poisonings, those that are available, when administered in a timely manner, can significantly reduce both morbidity and mortality.

The user of this Standard should discuss with a medical professional both the need for and the appropriateness of an antidote statement in their precautionary labeling. Physicians should approve all antidote statements. If possible, physicians trained in occupational medicine or clinical toxicology should be consulted. Some industrial chemicals for which specific antidotes are available are listed below:

- carbon monoxide;
- cyanides and those substances that release the cyanide ion;
- ethylene glycol;
- hydrofluoric acid;
- heavy metals such as arsenic, lead, cobalt, mercury;
- methanol;
- methemoglobinemia-producing chemicals; and
- organophosphate and carbamate compounds (insecticides).

Physicians may not always be immediately familiar with a specific antidote(s) and its appropriate administration or with specific protocols found useful by medical experts in the management of industrial poisonings. Therefore, it is highly desirable to acquaint the physician with an available antidote and a protocol for its administration or with a specific protocol of medical management through a “Notes to physicians” on the label.

There may be more than one way to present a “Notes to physicians” for exposures to specific chemicals (e.g., cholinesterase-inhibitors, cyanides and substances that release the cyanide ion, and methemoglobinemia-producing chemicals, etc.). Consider including the following information in a “Notes to physicians”:

- information on symptomology
- appropriate supportive treatment/medical management of the patient
- specific antidote (if available) with instructions on its proper administration and any contraindications

Again, it is recommended that the user of this Standard discuss with a medical professional the need for, or the appropriateness of, a “Notes to physicians” in the labeling of products. A physician should approve all “Notes to physicians”.

5.10 Fire instructions

Instructions in case of fire should be included when applicable. This provides the person handling the material with appropriate instruction for confining and extinguishing fires.

The instructions on the container label should be direct, simple and recommend the suitable extinguishing media for control. If there is an unsuitable extinguishing media that would create a hazard, that information should be included on the label and explained further in other precautionary labeling. Detailed instructions can be included on other precautionary labeling documents, such as the MSDS.

In some cases, to minimize contamination and when personnel and property are not at risk, instructions to allow the chemical to burn rather than extinguish the fire are appropriate.

See table below for fire instructions. The instructions in the table are applicable in most cases. Be advised that certain chemicals will require very specific procedures. Additional fire hazard statements are found in Sections 6.1.2.1 and 6.1.7.

Fire action statements

Type of chemical	Fire extinguishing statements
For water-soluble, miscible or dilutable liquids	In case of fire, use water fog, dry chemical, CO_2 or "alcohol-resistant" foam.
For water-immiscible liquids with specific gravity <1 (lighter than water)	In case of fire, use water fog, foam, dry chemicals or CO_2. Liquid will float and may re-ignite on surface of water.
For water-immiscible liquids with specific gravity >1 (heavier than water)	In case of fire, use water spray (fog)*, foam, dry chemical or CO_2.
For solids such as oxidizing agents where water is appropriate and not dangerous	In case of fire, soak (flood)* with water.
For solids where water is not appropriate	In case of fire, smother with dry sand or Class D fire extinguishing agents.
For flammable gases	In case of fire, allow gas to burn until flow can be safely shut off. Apply water spray from a safe distance to cool adjacent containers and protect surrounding area.
* Substitute or add appropriate words in parentheses.	

The following reference can be used to evaluate fire control methods. Professional judgment should be used in these evaluations.

Fire Protection Handbook, 19th edition, January 1, 2003 or most recent edition; National Fire Protection Association; Quincy, MA.

5.11 Spill or leak instructions

Methods for handling spills or leaks, in the absence of fire, shall be included when appropriate to allow immediate action to contain spills. This will minimize exposures and help prevent personal injury and environmental contamination.

See table below for statements to be used in case of spill or leak hazards**.** The instructions in the table are applicable in most cases. Be advised that certain chemicals will require very specific procedures. Additional spill or leak statements are found in Section 6.1.8.

Spill or leak statements

Type of chemical	Spill or leak statement
Most liquids	Use appropriate Personal Protective Equipment (PPE). Contain and/or absorb spill with inert material (specify sand, vermiculite or other appropriate material)*, then place in suitable container. Prevent run-off from entering drains, sewers or waterways.
Liquids where water may cause dangerous reaction or otherwise create further hazard	Use appropriate Personal Protection Equipment (PPE). Contain and/or absorb spill with inert material (specify sand, vermiculite or other appropriate material)*, then place in suitable container. Do not flush to sewer. Prevent run-off from entering drains, sewers or waterways.
Flammable/Combustible liquid, low water solubility	Eliminate all ignition sources. Use appropriate Personal Protective Equipment (PPE). Absorb and/or contain spill with inert materials (specify sand, vermiculite or other appropriate material) *, then place in appropriate container. For large spills, use water spray to disperse vapors, flush spill area. Do not flush to sewer. Prevent run-off from entering drains, sewers or waterways.
Flammable/Combustible liquid, water-soluble	Eliminate all ignition sources. Use appropriate Personal Protective Equipment (PPE). Absorb and/or contain spill with inert material (specify sand, vermiculite or other appropriate material)*, then place in suitable container. For large spills: use water spray to disperse vapors and dilute spill to a nonflammable mixture. Do not flush to sewer. Prevent run-off from entering drains, sewers or waterways.
Most solids	Use appropriate Personal Protective Equipment (PPE). Carefully shovel or sweep up spilled material and place in suitable container. Avoid generating dust.
Oxidizers	Evacuate area. Wear a self-contained breathing apparatus and appropriate Personal Protective Equipment (PPE). Contain and recover liquid when possible. Flush spill area with water spray. Do not flush to sewer. Prevent run-off from entering drains, sewers or waterways.

Type of chemical	Spill or leak statement
Flammable gas	Evacuate area. Do not enter flammable release area. Eliminate all ignition sources. Stop flow of gas. Increase ventilation to release area. Wear a self-contained breathing apparatus and appropriate Personal Protective Equipment (PPE).
Toxic gas (non-flammable)	Evacuate area. Wear a self-contained breathing apparatus and appropriate Personal Protective Equipment (PPE). Stop flow of gas.
Strong acid or strong base	Use Personal Protective Equipment (PPE). Absorb and/or contain spill with inert material (specify sand, vermiculite or other appropriate material),* then place in suitable container. For large spills: neutralize spill area with (specify appropriate material). Flush spill area with water spray. Do not flush to sewer. Prevent run-off from entering drains, sewers or waterways.
Pyrophoric solid or liquid	Use Personal Protective Equipment (PPE). Cover with sand or earth. Scoop up and store in non-combustible container. Flush spill area with water spray. Do not flush to sewer. Prevent run-off from entering drains, sewers or waterways.
* Select applicable word or words.	

5.12 Handling and storage instructions

Instructions for container handling and storage should be included to provide additional information for those chemicals requiring special or unusual handling and storage procedures.

Storage regulations for flammable and combustible liquids are in part based on flash point. In some cases, it may be useful to include the flash point and/or storage class on labels as information pertinent to storage regulations and codes. (See NFPA 30, Flammable and Combustible Liquids Code.)

Applicable instructions may be selected from the examples provided in Section 6.1.9.

5.13 References to additional labeling/other documents

If additional precautionary labeling, such as an MSDS, technical bulletin, etc., exists, a reference to it may be printed on the label. If all precautionary label text does not fit on the container label or if it compromises text legibility, a statement referring to additional precautionary labeling must appear on the product label.

This additional precautionary labeling may be on the outer, secondary container (which holds the small containers), in the MSDS, a technical bulletin or conveyed by other means. In those instances, the precautionary information with the highest priority should appear on the inner container label. (See Section 4.1, Elements of a label.) Foldout container labels, which accommodate larger amounts of text on small containers, are another alternative to standard container labels. **The precautionary labeling used may not necessarily be identical from one document type to another, but it must always be consistent.**

5.14 Revision of precautionary labeling

The HCS requires that chemical manufacturers, importers, distributors and employers who become newly aware of any significant information regarding the hazards of a chemical shall revise the labels for the chemicals within three months of becoming aware of the information. Labels on containers of hazardous chemicals shipped after that time shall contain the new information. When precautionary labels are updated, all related labeling should be reviewed and revised as needed to ensure that the information is consistent.

6 Tables of precautionary label text

Tables 1 – 8 contain precautionary label text recommendations for immediate hazards. **It is essential to read Chapters 3 and 5 before using these tables.** The information provided in the tables is organized, as follows, according to the type of hazard (e.g., physical) and in addition, for health hazards, by the route of administration (e.g., skin):

Table 1 – Physical Hazards (see Section 3.2)
Table 2 – Health Hazards: Skin Corrosion/Irritation (see Section 3.3)
Table 3 – Health Hazards: Eye Corrosion/Eye Irritation (see Section 3.3)
Table 4 – Health Hazards: Respiratory Irritation (see Section 3.3)
Table 5 – Health Hazards: Sensitization (see Section 3.3)
Table 6 – Health Hazards: Inhalation Toxicity (see Section 3.3)
Table 7 – Health Hazards: Dermal Toxicity (see Section 3.3)
Table 8 – Health Hazards: Oral Toxicity (see Section 3.3)

The tables are not intended to cover all possible precautionary labeling needs; however, the general approach illustrated should be followed in developing additional label statements. Suitable label text should be selected or developed as appropriate based on the results of the hazard determination. When a chemical presents multiple hazards, the precautionary label text may be combined. The intent of such combination is to minimize repeated wording consistent with concise communication of hazard.

Precautionary label text recommendations for delayed health hazards (carcinogenicity, reproductive/developmental/teratogenic effects and target organ effects) can be found in Section 5.5.1.3. Additional precautionary label text recommendations also appear in Section 6.1.

Note: It is essential to read Chapters 3 and 5 before using these tables.

Table 1 – Physical hazards

Hazard	Criteria	Description	Signal word	Statement of hazard [1]	Precautionary measures
Flammable liquid	Flash point ≤20°F OR Flash point ≤141°F and boiling point ≤95°F	Extremely flammable liquid	DANGER	EXTREMELY FLAMMABLE LIQUID AND VAPOR - VAPOR MAY CAUSE FLASH FIRE	Keep away from heat, sparks and flame. Keep container tightly closed. Use only with adequate ventilation.
	Flash point ≤141°F and boiling point >95°F	Flammable liquid (see NOTE)	WARNING	FLAMMABLE LIQUID AND VAPOR	Keep away from heat, sparks and flame. Keep container tightly closed. Use only with adequate ventilation.
	Flash point >141°F - <200°F	Combustible liquid	CAUTION	COMBUSTIBLE LIQUID AND VAPOR	Keep away from heat and flame.
Flammable gas	At atmospheric temperature and pressure, lower flammability limit is ≤13% or flammable range is ±12% OR Above atmospheric pressure, projects a flame >18 inches beyond ignition source with valve opened fully or flame flashes back and burns with any degree of valve opening.	Flammable gas	DANGER	FLAMMABLE GAS, MAY CAUSE FLASH FIRE	Keep away from heat, sparks and flame. Keep container tightly closed. Use only with adequate ventilation.
Flammable solid	Readily ignitable solids burn vigorously and persistently.	Flammable solid	WARNING	FLAMMABLE SOLID	Keep away from heat, sparks and flame. Keep container closed.
Combustible dust	A finely divided solid material, other than an explosive (e.g., dynamite), that presents a fire or explosion hazard when dispersed and ignited in air.	Combustible dust	WARNING	MAY FORM COMBUSTIBLE (EXPLOSIVE) DUST- AIR MIXTURES	Keep away from heat, sparks and flame. Keep container closed. Prevent dust accumulation.
Pyrophoric	Ignites spontaneously in air ≤130°F	Pyrophoric solid or liquid or gas	DANGER	EXTREMELY FLAMMABLE, CATCHES FIRE IF EXPOSED TO AIR	Keep away from heat, sparks and flame. Keep container tightly closed.
Oxidizer	Oxidizes readily and, on contact with combustible material, may cause fire.	Oxidizer	DANGER	(STRONG) OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE	Keep from contact with clothing and other combustible materials. Store in tightly closed container.

Water reactive	A substance that reacts with water to release a gas that is either flammable, or presents a health hazard.	Water reactive	DANGER	WATER REACTIVE SUBSTANCE. REACTS (VIGOROUSLY) WITH WATER TO RELEASE FLAMMABLE (TOXIC) GAS. MAY CAUSE FIRE. MAY BE FATAL (HARMFUL) IF INHALED	Keep away from water or moist air. (Keep away from heat, sparks and flame). Keep container tightly closed. Use only with adequate ventilation.
Organic Peroxide	An organic peroxide is considered thermally unstable if its SADT is less than 50°C. for a 50 kg package (49 CFR 173.128).	Organic Peroxide	DANGER!	ORGANIC PEROXIDE TEMPERATURE CONTROLLED HAZARDOUS DECOMPOSITION MAY OCCUR	Temperature controlled! Cool and maintain proper temperature for product . Prevent product contamination. Keep container tightly closed and away from heat, sparks and flame. Keep away from combustible materials.
	An organic peroxide is considered thermally stable if its SADT is equal to or greater than 50°C. for a 50 kg package (49 CFR 173.128).	Organic Peroxide	WARNING!	ORGANIC PEROXIDE. HAZARDOUS DECOMPOSITION MAY OCCUR	Keep away from heat, sparks and flame. Prevent product contamination. Keep container tightly closed and away from combustible materials.
Compressed gas	A gas or mixture of gases having, in a container, a pressure of 40 psia (25 psig) at 70°F (21.1°C).	Compressed gas	CAUTION	HIGH PRESSURE GAS	Use only with adequate ventilation. Use equipment rated for cylinder pressure. Use a backflow preventative device in piping. Close valve after each use and when empty.
Cryogenic liquid	A refrigerated liquefied gas having a boiling point colder than -130°F (-90°C) at atmospheric pressure.	Cryogenic liquid	WARNING	EXTREMELY COLD LIQUID AND GAS UNDER PRESSURE CAUSES SEVERE FROSTBITE	Store and use with adequate ventilation. Wear cold-insulating gloves/face shield/eye protection. Use a backflow preventative device in piping. Close valve after each use and when empty. Do NOT change or force fit connections.
Unstable reactive	A chemical that will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.	Unstable	DANGER	UNSTABLE. SENSITIVE TO HEAT OR SHOCK. MAY BECOME EXPLOSIVE.	Keep away from heat, sparks and flame. Protect container from physical shock.
1) Use alternative statements in parentheses as appropriate. NOTE – For liquids having a flash point ≥100°F and ≤141°F, see the definition of Flammable liquid in 3.2.2.1.1.					

See table in 5.10 for selection of appropriate fire action statements.

Note: It is essential to read Chapters 3 and 5 before using these tables.

Table 2 – Health hazards: Skin corrosion/irritation

Hazard	Criteria [1]	Description	Signal word	Statement of hazard [2]	Precautionary measures [2]	Instructions in case of contact or exposure [3]
Skin corrosion	Reported human experience and/or appropriate test data.	Corrosive to living tissue	DANGER	CAUSES (SEVERE) SKIN BURNS	Do NOT get on skin. Avoid breathing (dust, vapor, mist, gas). Keep container tightly closed. Use only with adequate ventilation. Wash thoroughly after handling.	FIRST AID: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. (Call a physician or poison control center immediately.) Wash clothing before reuse. Destroy contaminated shoes. (Thoroughly clean shoes before reuse.)
Skin irritation	Reported human experience and/or appropriate test data.	Irritant, severe skin	WARNING	CAUSES SKIN IRRITATION	Avoid contact with skin and clothing. Wash thoroughly after handling.	FIRST AID: In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention. (Get medical attention immediately.) (Call a physician or poison control center.) Wash clothing before reuse. Destroy contaminated shoes. (Thoroughly clean shoes before reuse.)

Hazard	Criteria [1]	Description	Signal word	Statement of hazard [2]	Precautionary measures [2]	Instructions in case of contact or exposure [3]
		Irritant, moderate skin	CAUTION	MAY CAUSE SKIN IRRITATION	Avoid contact with skin and clothing. Wash thoroughly after handling.	FIRST AID: In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if irritation develops and persists. (Get medical attention immediately if irritation develops and persists.) (Call a physician if irritation develops and persists.) Wash clothing before reuse. Destroy contaminated shoes. (Thoroughly clean shoes before reuse.)
		Irritant, defatting, skin	CAUTION	PROLONGED OR REPEATED CONTACT MAY DRY SKIN AND CAUSE IRRITATION		

1) See also definitions in 3.3.1.1 and 3.3.1.2.
2) Select applicable word or words.
3) Use alternative statements in parentheses as appropriate.

Note: It is essential to read Chapters 3 and 5 before using these tables.

Table 3 – Health hazards: Eye corrosion/irritation

Hazard	Criteria[1]	Description	Signal word	Statement of hazard[2]	Precautionary measures[2]	Instructions in case of contact or exposure [3]
Eye corrosion	Reported human experience and/or appropriate test data.	Corrosive to living tissue	DANGER	CAUSES (SEVERE) EYE BURNS	Do NOT get in eyes. Avoid breathing (dust, vapor, mist, gas). Keep container tightly closed. Use only with adequate ventilation. Wash thoroughly after handling.	FIRST AID: In case of contact, immediately flush eye with plenty of water for at least 15 minutes. (If easy to do, remove contact lenses, if worn.) Get medical attention immediately. (Call a physician or poison control center immediately.)
Eye irritation	Reported human experience and/or appropriate test data.	Irritant, severe eye	WARNING	CAUSES EYE IRRITATION	Avoid contact with eyes. Wash thoroughly after handling.	FIRST AID: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. (If easy to do, remove contact lenses, if worn.) Get medical attention. (Get medical attention immediately.) (Call a physician.)
		Irritant, moderate eye	CAUTION	MAY CAUSE EYE IRRITATION	Avoid contact with eyes. Wash thoroughly after handling.	FIRST AID: In case of contact, immediately flush eyes with plenty of water (for at least 15 minutes). (If easy to do, remove contact lenses, if worn.) Get medical attention. (Get medical attention immediately if irritation persists.) (Call a physician if irritation persists.)

1) See also definitions in 3.3.1.1 and 3.3.1.2.
2) Select applicable word or words.
3) Use alternative statements in parentheses as appropriate.

Note: It is essential to read Chapters 3 and 5 before using these tables.

Table 4 – Health hazards: Respiratory irritation

Hazard	Criteria[1]	Descriptor	Signal word	Statement of hazard	Precautionary measures[2]	Instructions in case of contact or exposure[3]
Respiratory irritation	Reported human experience and/or appropriate test data.	Irritant, severe respiratory	WARNING	CAUSES RESPIRATORY TRACT IRRITATION (or specify nose, upper respiratory tract, etc., if appropriate)	Avoid breathing (dust, vapor, mist, gas). Keep container tightly closed. Use only with adequate ventilation.	FIRST AID: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention. (Get medical attention immediately.) (Call a physician.)
		Irritant, moderate respiratory	CAUTION	MAY CAUSE RESPIRATORY TRACT IRRITATION (or specify nose, upper respiratory tract, etc., if appropriate)	Avoid breathing (dust, vapor, mist, gas). Keep container tightly closed. Use only with adequate ventilation.	FIRST AID: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention. (Get medical attention immediately.) (Call a physician.)

1) See also definitions in 3.3.1.
2) Select applicable word or words.
3) Use alternative statements in parentheses as appropriate.

Note: It is essential to read Chapters 3 and 5 before using these tables.

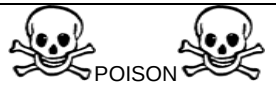
Table 5 – Health hazards: Sensitization

Hazard	Criteria[1]	Descriptor	Signal word	Statement of hazard	Precautionary measures[2]	Instructions in case of contact or exposure[3]
Skin sensitizer	Reported experience and/or appropriate test data.	Sensitizer, skin	WARNING	MAY CAUSE ALLERGIC SKIN REACTION	Avoid prolonged or repeated contact with skin. Wash thoroughly after handling.	FIRST AID: If case of contact, immediately flush skin with soap and plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. (Get medical attention immediately if symptoms occur.) (Call a physician if symptoms occur.) Wash clothing before reuse. Destroy contaminated shoes. (Thoroughly clean shoes before reuse.)
Respiratory sensitizer	Reported experience and/or appropriate test data.	Sensitizer, respiratory	DANGER	MAY CAUSE ALLERGIC RESPIRATORY REACTION	Do NOT breathe (dust, vapor, mist, gas). Keep container closed. Use only with adequate ventilation.	FIRST AID: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention. (Get medical attention immediately.) (Call a physician.)

1) See also definitions in 3.3.2.
2) Select applicable word or words.
3) Use alternative statements in parentheses as appropriate.

Note: It is essential to read Chapters 3 and 5 before using these tables.

Table 6 – Health hazards: Inhalation toxicity

Hazard	Criteria[1]	Description	Signal word	Statement of hazard[2]	Precautionary measures[2]	Instructions in case of contact or exposure[3]
Inhalation toxicity	≤ 200 ppm (gas/vapor) OR ≤ 2 mg/l (mist, fume or dust) 1 hour inhalation LC_{50} (rat)	Highly toxic	DANGER	MAY BE FATAL IF INHALED	Do NOT breathe (dust, vapor, mist, gas). Keep container closed. Use only with adequate ventilation.	 POISON Get medical attention. (Get medical attention immediately.) (Call 911, if available.) (Call a physician.) (Contact a poison control center.) FIRST AID: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.
	> 200-2000 ppm (gas/vapor) or > 2-20 mg/l (mist, fume or dust) 1 hour inhalation LC_{50} (rat)	Toxic	WARNING	HARMFUL IF INHALED	Avoid breathing (dust, vapor, mist, gas). Keep container closed. Use only with adequate ventilation.	FIRST AID: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention. (Get medical attention immediately.) (Call a physician.) (Contact a poison control center.)
Simple asphyxi-ants	Physiological inert vapor or gas	Potential suffocation	CAUTION	(VAPOR)(GAS) REDUCES OXYGEN AVAILABLE FOR BREATHING	Keep container closed. Use only with adequate ventilation. Do NOT enter (storage areas, confined spaces) unless adequately ventilated.	FIRST AID: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention. (Get medical attention immediately.) (Call a physician.)

1) See also definitions in 3.3.1.3.
2) Select applicable word or words.
3) Use alternative statements in parentheses as appropriate.

Note: It is critical to read Chapters 3 and 5 before using these tables.

Table 7 – Health Hazards: Dermal Toxicity

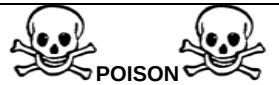
Hazard	Criteria[1]	Description	Signal word	Statement of hazard	Precautionary measures	Instructions in case of contact or exposure[2]
Dermal Toxicity	≤ 200 mg/kg dermal LD_{50} (rabbit)	Highly toxic	DANGER	MAY BE FATAL IF ABSORBED THROUGH SKIN	Do NOT get in eyes, on skin or on clothing. Wash thoroughly after handling.	 **POISON** Call a physician immediately. (Call a physician or poison control center immediately.) (Get medical attention immediately.) (Call 911, if available.) FIRST AID: In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Destroy contaminated shoes. (Thoroughly clean shoes before reuse.)
	> 200 < 1000 mg/kg dermal LD_{50} (rabbit)	Toxic	WARNING	HARMFUL IF ABSORBED THROUGH SKIN	Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.	FIRST AID: In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Get medical attention. (Get medical attention immediately.) (Call a physician.) (Call a physician or poison control center.) Destroy contaminated shoes. (Thoroughly clean shoes before reuse.)

Hazard	Criteria[1]	Description	Signal word	Statement of hazard	Precautionary measures	Instructions in case of contact or exposure[2]
	> 1000 ≤ 2000 mg/kg dermal LD_{50} (rabbit)	Harmful	CAUTION	MAY BE HARMFUL IF ABSORBED THROUGH SKIN	Avoid prolonged contact with eyes, skin and clothing. Wash thoroughly after handling.	FIRST AID: In case of contact, immediately flush eyes or skin with plenty of water (for at least 15 minutes) while removing contaminated clothing and shoes. Wash clothing before reuse. Get medical attention. (Get medical attention if symptoms occur.) (Call a physician (if symptoms occur.)) (Call a physician or poison control center if symptoms occur.) Destroy contaminated shoes. (Thoroughly clean shoes before reuse.)

1) See also definitions in 3.3.1.4.
2) Use alternative statements in parentheses as appropriate.

Note: It is essential to read Chapters 3 and 5 before using these tables.

Table 8 – Health hazards: Oral toxicity

Hazard	Criteria[1]	Description	Signal word	Statement of hazard	Precautionary measures[2]	Instructions in case of contact or exposure[2]
Ingestion	≤ 50 mg/kg oral LD_{50} (rat)	Highly toxic	DANGER	MAY BE FATAL IF SWALLOWED	Do NOT take internally. (Do NOT taste or swallow.) Wash thoroughly after handling.	 **POISON** Get medical attention immediately, (call 911, if available.) (Call a physician immediately.) (Call a physician or contact a poison control center immediately.) FIRST AID: If swallowed, do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. OR FIRST AID: If swallowed, induce vomiting immediately, as directed by medical personnel. Never give anything by mouth to an unconscious person.
	> 50 ≤ 500 mg/kg oral LD_{50} (rat)	Toxic	WARNING	HARMFUL IF SWALLOWED	Do NOT take internally. (Do NOT taste or swallow.) Wash thoroughly after handling.	FIRST AID: If swallowed, do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. OR FIRST AID: If swallowed, induce vomiting immediately, as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention. (Call a physician.) (Call a physician or contact a poison control center.)
	> 500 ≤ 2000 mg/kg oral LD_{50} (rat)	Harmful	CAUTION	MAY BE HARMFUL IF SWALLOWED	Do NOT take internally. (Do NOT taste or swallow.) Wash thoroughly after handling.	FIRST AID: If (large quantities of this material are) swallowed, call a physician immediately. Do NOT induce vomiting unless directed to do so by a physician. Never give anything by mouth to an unconscious person. OR

Hazard	Criteria[1]	Description	Signal word	Statement of hazard	Precautionary measures[2]	Instructions in case of contact or exposure[2]
						FIRST AID: If (large quantities of this material are) swallowed, induce vomiting immediately, as directed by a physician. Never give anything by mouth to an unconscious person. Get medical attention. (Call a physician.) (Call a physician or contact a poison control center.)
Aspiration	Low viscosity petroleum and other hydrocarbons	Potential for aspiration if swallowed		HARMFUL OR FATAL IF SWALLOWED. CAN ENTER LUNGS AND CAUSE DAMAGE		FIRST AID: If swallowed, do NOT induce vomiting. If vomiting occurs have person lean forward. Call a physician or poison control center immediately. Never give anything by mouth to an unconscious person.
Digestive tract corrosion	Reported human experience and/or appropriate test data.	Corrosive to living tissue	DANGER	CAUSES (SEVERE) DIGESTIVE TRACT BURNS	Do NOT taste or swallow. (Do NOT take internally.) Wash thoroughly after handling.	FIRST AID: If swallowed, do NOT induce vomiting. Get medical attention immediately. (Call a physician or poison control center immediately.) If victim is fully conscious, give cupful of water. Never give anything by mouth to an unconscious person.

1) See also definitions in 3.3.1.5.
2) Use alternative statements in parentheses as appropriate.

6.1 Additional statements

Additional label statements that have been used by industry professionals in conjunction with or in lieu of those statements listed in the tables above. Terms in parenthesis are optional.

6.1.1 Statements of health hazard

6.1.1.1 Immediate health hazards

6.1.1.1.1 Inhalation

INHALATION MAY BE FATAL OR CAUSE DELAYED LUNG INJURY

HARMFUL IF INHALED AND MAY CAUSE DELAYED LUNG INJURY

MAY CAUSE DELAYED LUNG INJURY AND BURNS

VAPOR EXTREMELY IRRITATING

EXTREMELY IRRITATING GAS AND LIQUID UNDER PRESSURE

GAS EXTREMELY IRRITATING

MAY BE FATAL IF INHALED IN LARGE QUANTITIES

MAY CAUSE NOSE, THROAT AND LUNG IRRITATION

INHALATION MAY CAUSE CENTRAL NERVOUS SYSTEM EFFECTS

CAUSES HEADACHE, DROWSINESS OR OTHER EFFECTS TO THE CENTRAL NERVOUS SYSTEM

6.1.1.1.2 Skin or Eye Contact

CORROSIVE – CAUSES IRREVERSIBLE EYE (AND SKIN) DAMAGE

RAPIDLY ABSORBED THROUGH SKIN

CAUSES SEVERE BURNS WHICH MAY NOT BE IMMEDIATELY PAINFUL OR VISIBLE

MAY CAUSE RASH OR EXTERNAL ULCERS

MAY CAUSE BURNS OR EXTERNAL ULCERS

MAY CAUSE THERMAL BURNS

MAY CAUSE SEVERE FROSTBITE

CONTACT WITH HOT PRODUCT WILL CAUSE THERMAL BURNS

PROLONGED OR REPEATED SKIN CONTACT WITH LIQUID MAY CAUSE DEFATTING RESULTING IN DRYING, REDNESS AND POSSIBLE BLISTERING

LIQUID OR VAPOR CAUSES BURNS WHICH MAY BE DELAYED

CAUSES SEVERE BURNS - EFFECTS ON EYES MAY BE DELAYED

MAY CAUSE BLINDNESS

MAY CAUSE PERMANENT EYE INJURY

MAY CAUSE EYE INJURY - EFFECTS MAY BE DELAYED

CAUSES FROSTBITE BURNS TO THE EYES

6.1.1.1.3 Ingestion

MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED

ASPIRATION HAZARD IF SWALLOWED – CAN ENTER LUNGS AND CAUSE DAMAGE

6.1.1.2 Delayed health hazards

REPRODUCTIVE HAZARD

REPEATED INHALATION OR SKIN CONTACT MAY, WITHOUT SYMPTOMS, INCREASE SUSCEPTIBILITY TO (add specific effects)

REPEATED ABSORPTION MAY RESULT IN BLADDER TUMORS

SUSPECT REPRODUCTIVE HAZARD - CONTAINS MATERIAL WHICH MAY TERMINATE PREGNANCY (CAUSE MISCARRIAGE) (BASED ON ANIMAL DATA)

SUSPECT REPRODUCTIVE HAZARD - CONTAINS MATERIAL WHICH MAY INJURE UNBORN CHILD (CAUSE BIRTH DEFECTS) (BASED ON ANIMAL DATA)

THIS PRODUCT CONTAINS A MATERIAL THAT MAY CAUSE ADVERSE REPRODUCTIVE EFFECTS (SEE MSDS FOR DETAILS)

THIS PRODUCT MAY CAUSE ADVERSE REPRODUCTIVE EFFECTS (SEE MSDS FOR DETAILS)

6.1.2 Statements of physical hazards

6.1.2.1 Fire hazards

VAPORS MAY TRAVEL TO AREAS (ROOMS) AWAY FROM WORK SITE BEFORE IGNITING/FLASHING BACK TO VAPOR SOURCE

VAPORS MAY SPREAD LONG DISTANCES AND IGNITE

CONTACT WITH WATER MAY CAUSE FLASH FIRE

MAY IGNITE IF ALLOWED TO BECOME DAMP

HEAT, SHOCK or CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE OR EXPLOSIVE DECOMPOSITION

MAY FORM FLAMMABLE DUST-AIR MIXTURE

BURNS WITH INVISIBLE FLAME

SPILL MAY CAUSE FIRE OR LIBERATE DANGEROUS GAS

CONTENTS ARE PACKED UNDER WATER AND WILL IGNITE IF WATER IS REMOVED

SPILLS ON CLOTHING OR COMBUSTIBLE MATERIALS WILL CAUSE FIRE

CLOTHING AND VEGETATION CONTAMINATED WITH CHLORATE OR ITS SOLUTIONS ARE DANGEROUSLY FLAMMABLE

CONTENTS OF PACKAGE ARE UNDER KEROSENE AND WILL IGNITE IF EXPOSED TO AIR OR WATER

6.1.2.2 Explosion hazards

HEAT, SHOCK OR CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE OR EXPLOSIVE DECOMPOSITION

VAPORS MAY IGNITE AND EXPLODE

FORMS SHOCK-SENSITIVE MIXTURES WITH CERTAIN OTHER MATERIALS

MAY EXPLODE IF WATER CONTENT IS 10 PERCENT OR BELOW

MAY FORM EXPLOSIVE MIXTURES IN AIR

MAY FORM EXPLOSIVE DUST- AIR MIXTURE

POTENTIAL DUST EXPLOSION HAZARD

CONTAINER MAY RUPTURE ON HEATING

EXPLOSIVE REACTION MAY OCCUR ON HEATING OR BURNING

MAY FORM EXPLOSIVE PEROXIDES

AN UNCONTROLLED POLYMERIZATION MAY PRODUCE A RAPID RELEASE OF ENERGY WITH THE POTENTIAL FOR AN EXPLOSION OF UNVENTED CLOSED CONTAINERS

RISK OF EXPLOSION IF HEATED UNDER CONFINEMENT

6.1.2.3 Reactivity/Pressure hazards

REACTS VIOLENTLY WITH WATER, LIBERATING (RELEASING) HYDROGEN, WHICH MAY IGNITE

CONTAMINATION MAY RESULT IN DANGEROUS PRESSURE INCREASES – CLOSED CONTAINERS MAY RUPTURE

UNSTABLE (REACTIVE) UPON DEPLETION OF INHIBITOR

HAZARDOUS POLYMERIZATION MAY OCCUR UPON DEPLETION OF INHIBITOR

HAZARDOUS POLYMERIZATION MAY OCCUR UPON DEPLETION OF INHIBITOR – MAY CAUSE HEAT AND PRESSURE BUILD-UP IN CLOSED CONTAINERS

AN UNCONTROLLED POLYMERIZATION MAY PRODUCE A RAPID RELEASE OF ENERGY WITH THE POTENTIAL FOR AN EXPLOSION OF UNVENTED CLOSED CONTAINERS

EXTREMELY HAZARDOUS LIQUID AND VAPOR UNDER PRESSURE

CONTENTS UNDER PRESSURE

MAY REACT VIOLENTLY WITH WATER

POTENTIAL FOR SPONTANEOUS COMBUSTION

CONTAINER MAY RUPTURE ON HEATING

PROLONGED EXPOSURE OF THE NEAT PRODUCT TO TEMPERATURES ABOVE 200°F (93°C) WILL RESULT IN AN EXOTHERMIC, AUTOCATALYTIC DECOMPOSITION AND BUILD-UP PRESSURE IN SEALED CONTAINERS

DANGEROUS, AUTOACCELERATED, EXOTHERMIC DECOMPOSITION MAY OCCUR AT TEMPERATURES GREATER THAN 140°F (60°C)

IF MATERIAL IS HEATED ABOVE 320°F (160°C) HIGHLY EXOTHERMIC REACTIONS MAY RESULT

6.1.3 Statements of environmental hazards

VERY TOXIC TO AQUATIC ORGANISMS

TOXIC TO AQUATIC ORGANISMS

HARMFUL TO AQUATIC ORGANISMS

MAY CAUSE LONG-TERM ADVERSE EFFECTS IN THE AQUATIC ENVIRONMENT

TOXIC TO FLORA (PLANTS)

TOXIC TO FAUNA (ANIMALS)

TOXIC TO SOIL ORGANISMS

TOXIC TO BEES

MAY CAUSE LONG-TERM ADVERSE EFFECTS IN THE ENVIRONMENT

DANGEROUS FOR THE OZONE LAYER

VERY TOXIC TO AQUATIC ORGANISMS; MAY CAUSE LONG-TERM ADVERSE EFFECTS IN THE AQUATIC ENVIRONMENT

TOXIC TO AQUATIC ORGANISMS; MAY CAUSE LONG-TERM ADVERSE EFFECTS IN THE AQUATIC ENVIRONMENT

HARMFUL TO AQUATIC ORGANISMS; MAY CAUSE LONG-TERM ADVERSE EFFECTS IN THE AQUATIC ENVIRONMENT

MARINE POLLUTANT

DANGEROUS FOR THE ENVIRONMENT

6.1.4 Miscellaneous statements of hazard

CONTACT WITH WATER OR MOIST AIR LIBERATES IRRITATING GAS

CONTACT WITH ACID LIBERATES (RELEASES) POISONOUS GAS

CONTACT WITH METALS LIBERATES POISONOUS GAS

LIBERATES GAS WHICH MAY CAUSE SUFFOCATION

LIBERATES POISONOUS GAS

CONTACT WITH WATER OR ACID SLOWLY LIBERATES POISONOUS AND FLAMMABLE HYDROGEN SULFIDE GAS

CONTACT WITH METALS LIBERATES HYDROGEN GAS

CANNOT BE MADE NON-POISONOUS

6.1.5 Precautionary measures

Avoid breathing dust or solution spray.
Avoid breathing dust or spray mist.
Avoid prolonged or repeated breathing of vapor.
Avoid exposure to vapor.
Avoid breathing dust or vapor.
Do NOT enter places where used or stored until adequately ventilated.
Use only with adequate ventilation and in closed systems.
Use ventilation adequate to keep exposures (airborne levels of dust, fume, vapor, etc.) below recommended exposure limits. See MSDS.
Use ventilation adequate to exhaust vapors (fumes, dust, etc.) See MSDS.
Use NIOSH approved respiratory protection.
Have available emergency self-contained breathing apparatus or full-face airline respirator when using this chemical.
Always wear a self-contained breathing apparatus or full-face airline respirator when using this chemical.
Have available emergency gas masks approved by NIOSH for bromine service.
This gas deadens the sense of smell. Do NOT depend on odor to detect presence of gas.
Gas (vapor) has little odor (is odorless.) Do not depend on odor to detect the presence of gas (vapor.)
Use adequate ventilation and/or engineering controls in high temperature processing to prevent exposure to vapors.
Keep away from heat and flame.
Avoid creating dust.
Avoid dust accumulation in enclosed space.
Keep from any possible contact with water.
No special precautions are needed in handling this material.
Use only with adequate ventilation/personal protection.
Keep container closed when not in use.
Do not inhale fumes.
Wash hands before eating, drinking or smoking.

Prevent vapor buildup by providing adequate ventilation during and after use.
Use with local exhaust ventilation.
Do not use in areas without adequate ventilation.

6.1.6 First aid

Do not induce vomiting.
If swallowed and the victim is conscious and alert, induce vomiting immediately, as directed by medical personnel.
Flush eyes with water at least 15 minutes. Get medical attention if eye irritation develops or persists.
If breathing has stopped, apply artificial respiration.
If breathing is labored, administer oxygen.
Do not induce vomiting. If conscious, give 2 glasses of water. Get immediate medical attention.
Immediately wash with tincture of green soap in flowing water for 15 minutes.
Immediately flush eyes for at least 15 minutes. Get medical attention.
Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. Get medical attention.
Flush eyes with water for at least 15 minutes while holding the eyelids open. Remove contact lenses, if worn. Get medical attention immediately.
Flush skin with large amounts of water. If irritation develops and persists, get medical attention.
Immediately flush skin with large amounts of water.
Remove contaminated clothing. If irritation (redness, rash, blistering) develops, get medical attention.
Wash contaminated clothing before reuse.
Remove person to fresh air. If signs/symptoms continue, get medical attention.
Remove to fresh air immediately. Get medical attention immediately.
Do not induce vomiting. Drink (one glass) (two glasses) of water. Call a physician (or poison control center) immediately.

6.1.7 Fire fighting measures

Keep away from contact with clothing and other combustible materials to avoid fire.
Drying of this product on clothing or combustible materials may cause fire.
Avoid friction or rough handling because of fire hazard.
Keep wet in storage - dry powder may ignite by friction, static electricity or heat.
Prevent contamination with readily oxidizable materials and polymerization accelerators.
Do not add water to contents while in a container because of violent reaction and possible flash fire.
Clothing and vegetation contaminated with chlorate or its solutions are DANGEROUSLY FLAMMABLE.
Remove clothing and wash thoroughly with water.
Keep persons and animals off treated areas.
Keep away from fire.
Use CO_2, dry chemical or foam. Water can be used to cool and protect exposed material.
Allow gas to burn if flow cannot be shut off.
Eliminate sources of ignition.
Keep away from contact with oxidizing materials.
Avoid friction or rough handling because of fire hazard.

6.1.8 Spill procedures

Cover with absorbent or contain. Collect and dispose.
Avoid runoff to waterways and sewers.
Do not flush to sewer.
Do not apply water unless directed to do so by a hazardous materials expert.
Do not place spilled materials back into the original container.
Clean up spill immediately.

Allow product to cool and pick up as a solid.
Sweep up and remove immediately.
Use nonsparking equipment when cleaning up flammable spill.
Avoid release to the environment.
Prevent release to the environment.
Do not empty into drains.
Use appropriate container to avoid environmental contamination.
Avoid release to the environment. See Material Safety Data Sheet for instructions.
Avoid release to the environment. Refer to the manufacturer's special instructions.

6.1.9 Handling and storage

Do not store near combustible materials.
Keep container closed when not in use.
Keep away from acids and heat.
Keep away from acids. Store in dry place.
Do not heat cylinders.
Keep from freezing.
Loosen closure cautiously before opening.
Keep from any possible contact with water.
Do not store near…
Store in original vented container.
Keep container closed to prevent drying out.
If frozen, do not use steam to liquefy.
Solidifies at about ___°F (___°C) and may break container.
Store in moderately warm place.
Shut off all gas pilot lights and electrical (spark or hot wire) igniters and other sources of ignition.
Keep away from heat, sparks, flame and other sources of ignition (i.e., pilot lights, electric motors and static electricity.)
Shut off main gas valve.
Use explosion-proof electrical (ventilation and lighting) equipment.
Do not smoke or use matches or lighters during use and until vapors (odors) are gone.
Static charges can accumulate during shipping, unloading, pouring or conveying.
To avoid fire or explosion, ground and bond container and receiving equipment (and ground personnel) before transferring material.
To dissipate static electricity during transfer, ground drum and connect to receiving container with bonding strap.
Packaging film can build static electrical charges. Do not handle (remove or empty) packaging film (wrap or liner) in presence of flammable (ignitable) vapors.
Prevent contamination by any source including metals, dust and organic materials.
Such contamination can cause rapid decomposition, generation of high pressures or formation of explosive mixtures.
Do not add to hot materials; do not grind or subject to heat or shock - explosive decomposition may result.
Do not allow evaporation to near dryness. Addition of water or appropriate reducing agents will lessen peroxide formation.
Keep containers sealed until ready for use.
Possibility of explosion exists under dusty conditions. Avoid dusting when handling and avoid all possible sources of ignition (spark or flame.)
NOTE - Suck-back into cylinder may cause explosion. Under no circumstances should the cylinder entry tube be inserted in a liquid or gas without a vacuum break or other protective apparatus in the line to prevent suck-back. Fire or high temperatures may cause explosive decomposition if confined.

6.1.10 Disposal/Disposition

See MSDS for detailed disposal information.
Dispose of material as a hazardous waste.
Do not dispose of with household waste, trash or other solid waste.
Improper disposal or reuse of this container may be dangerous and illegal. Refer to applicable local, state and federal regulations as well as industry standards.
Dispose of wastes in an approved waste disposal facility.
Do not contaminate water, food, or feed by storage or disposal.
Do not allow into any sewer, on the ground or into any body of water.
Avoid release to the environment.
Prevent release to the environment.
Do not empty into drains.
Use appropriate container to avoid environmental contamination.
Avoid release to the environment. See Material Safety Data Sheet for instructions.
Avoid release to the environment. Refer to the manufacturer's special instructions.
The (preferred) waste management option(s) is (are) to (select appropriate statement(s) listed below):

- reuse
- recycle
- reuse or recycle
- send to a licensed recycler, reclaimer or incinerator
- burn
- burn in a municipal incinerator
- dispose of in approved landfill

Contact (insert name of company) for additional information.

6.1.11 Container handling and storage

This section identifies additional label statements that have been used by industry professionals for container handling and storage.

6.1.11.1 Metal drums

Keep closure (bung, cap or plug) up to prevent leakage.
Keep drum out of sun and away from heat.
Relieve internal pressure when received and at least weekly thereafter by slowly loosening plug. Re-tighten immediately.
Drums should be grounded and bonded to receiving container(s) when being emptied.
Do not drop onto or slide across, sharp objects.
Never use pressure to empty; drum is not a pressure vessel.
Drum must not be washed out or used for other purposes.
Replace plug (bung or cap) after each withdrawal and return plug with empty drum.
Do not expose drum to direct sunlight for long periods of time.
"UP" vented container. Keep upright.
Do not use container for food, feed or drinking water.
Use adequate ventilation when opening the container due to potential headspace contaminants.
Container headspace may contain (*name of vapor*). Open container with care, using adequate ventilation and avoiding ignition sources.
Container may be ruptured by polymerization under fire conditions.
Unscrew closure slowly. Allow all pressure to escape through threads before removing closure.

6.1.11.2 Glass carboys

Before moving carboy, be sure closure is securely fastened.
Avoid rough handling or dropping.
Loosen closure carefully.
Keep carboy out of sun and away from heat.
Never use pressure to empty; carboy is not a pressure vessel. Completely drain carboy before returning.
Do not refrigerate. This product crystallizes and may expand, breaking glass container.

6.1.11.3 Plastic container with/without overpacks

Keep closure (cap) up to prevent leakage.
Keep container out of sun and away from heat.
Do not drop onto or slide across, sharp objects.
Never use pressure to empty; drum is not a pressure vessel.
Container must not be washed out or used for other purposes.
Replace closure (cap) after each withdrawal.
Thoroughly drain containers and tighten closure (cap) before returning.
Do not use container as dilution or mixing vessel.
Remove closure (cap) carefully to relieve possible internal pressure.
Do not handle or empty container in presence of ignitable vapors.
Composite container has weep holes to drain moisture from space between liner and shell.
Continuous "weeping" may indicate leakage of plastic inner container (liner).
Static ignition hazard can result from handling and use.

6.1.11.4 Fiber drums

Protect from direct contact with water or excessive moisture.
Do not drop onto or slide across, sharp objects.
Do not store on side.
Avoid creasing or impacting of sidewalls.
Do not handle or empty bag or liner in presence of flammable vapors.

6.1.11.5 Shipping sacks

Protect from direct contact with water or excessive moisture.
Never store directly on ground.
Keep out of sun and away from heat.
Do not drop onto or slide across, sharp objects.
In case of puncture, use overslip bag and securely close.
Avoid dusting. Under dusty conditions avoid all sources of ignition, including sparks and static electricity.
Plastic container may cause static ignition hazard.
Ground container while being filled or emptied. Do not disperse in presence of ignitable vapors or dust.

6.1.11.6 Bulk containers

Never use pressure to empty container.
Container must not be washed out or used for other purposes.
Relieve internal pressure when received.
Do not remove label until container is thoroughly cleaned.
Do not remove label until container is cleaned of all residue or residual vapors.

Electrically bond and ground all containers and equipment before transfer or use of material.
High vapor pressure requires pressure rated storage tanks and piping. Avoid all ignition sources such as flames and sparks.
Plastic bag or liner may cause static ignition hazard.
Maintain proper grounding at all times.
Do not discharge at pressures above ___psi.
Before opening container, connect to dry, oxygen-free inert system.

6.1.11.7 Empty container warnings

Improper disposal or reuse of this container may be dangerous and illegal.
Refer to applicable federal, state and local regulations.
Since empty containers retain product residue, follow label warnings even after container is emptied.
Residual vapors might explode on ignition; do not cut, drill, grind or weld on or near this container.
Do not cut or weld on or near any container. Do not pressurize drums. Obey all label warnings, especially during container cleaning. Refer to all federal, state and local regulations prior to disposition of container and unused contents by reuse, recycle or disposal.

6.1.12 Miscellaneous

Keep out of reach of children.
Avoid exposure during pregnancy.
Before using, read Material Safety Data Sheet (MSDS) for this chemical.
For additional information, see Material Safety Data Sheet.
For Research and Development purposes only. Must only be handled by technically qualified individuals.
This is a chemical sample. Its chemical, physical and toxicological properties have not been fully investigated. Its handling or use may be hazardous. Exercise due care.
Cancer information: Has caused cancer in certain laboratory animals, tests of questionable relevance to humans. The toxicological properties of this material have not been fully investigated.

7 Resources

This Standard is intended for use in conjunction with the following publications.

7.1 American National Standards

When the American National Standards Institute approves a revised version of referenced standard(s) below, the latter version shall apply.

ANSI Z400.1-2004, Hazardous Industrial Chemicals - Material Safety Data Sheets Preparation.

ANSI Z535.1-2002, Safety Color Code.

ANSI Z535.2-2002, Standard for Environmental and Facility Signs.

ANSI Z535.3-2002, Standard for Criteria for Safety Symbols.

ANSI Z535.4-2002, Standard for Product Safety Signs and Labels.

ANSI Z535.5-2002, Standard for Accident Prevention Tags (for Temporary Hazards)

7.2 Other standards

ASTM E502-84(2000), *Standard Test Method for Selection and Use of ASTM for the Determination of Flash Point of Chemicals by Closed Cup Methods.*

ASTM D56-05, *Standard Test Method for Flash Point by Tag Closed Tester.*

ASTM D93-02a, *Standard Test Method for Flash Point by Pensky-Martens Closed Tester.*

ASTM D3278-96(2004)e1, *Standard Test Methods for Flash Point of Liquids by Small Scale Closed Cup Apparatus.*

NFPA 30-1996, *Flammable and Combustible Liquids Code*.

NFPA 430, *Code for the Storage of Liquid and Solid Oxidizing Materials, 2004 edition*.

National Fire Protection Association. *Fire Protection Guide to Hazardous Materials* (contains complete text of NFPA 49, 325M, 491M and 704). 11th Edition.

7.3 Regulatory standards

Commission Directive 2001/59/EC of 6 August 2001 adapting to technical progress for the 28th time Council Directive 67/548/EEC on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances.

Commission Directive 2001/58/EC of 27 July 2001 amending for the second time Directive 91/155/EEC defining and laying down the detailed arrangements for the system of specific information relating to dangerous preparations in implementation of Article 14 of European Parliament and Council Directive 1999/45/EC and relating to dangerous substances in implementation of Article 27 of Council Directive 67/548/EEC (safety data sheets).

U.S. CPSC, FHSA regulations, 16 CFR 1500 et seq.(2005).

U.S. DOL, OSHA's Hazard Communication Standard, 29 CFR 1910.1200 et seq. (2004).

U.S. DOT Hazardous Materials regulations, 49 CFR 170-178.(2004).

U.S. EPA, FIFRA regulations, 40 CFR 158 et seq.(2004).

U.S. EPA, Toxic Substances Control Act (TSCA) regulations, 40 CFR 798 et seq.(2004).

Workplace Hazardous Materials Information System (WHMIS), Federal Bill C-70 (Chapter 30[1987] of the Statute of Canada), amending the Hazardous Products Act (HPA), Canada Labor Code (Part IV), other federal legislation and introducing the Hazardous Materials Information Review Act (HMIRA).

7.4 References and other useful publications

Bureau of Explosives Flame Projection Apparatus (1987)

Documentation of the Threshold Limit Values and Biological Exposure Induces, 7th ed., ACGIH, Cincinnati, OH (2001) (2004 Supplement) (2005 Supplement).

Draize, J.H. et al. *Methods for the Study of Irritation and Toxicity of Substances Applied Topically to the Skin and Mucus Membranes*, *J. Pharmacol. Exp. Ther*. 82:377-390 (1944)

Draize, J.H., *Appraisal of the Safety of Chemicals in Foods, Drugs, and Cosmetics*, Association of Food and Drug Officials of the United States (1959)

International Air Transport Association (IATA) Dangerous Goods Regulations, 2005.

International Maritime Dangerous Goods Code (IMDG) Code, 2004

Klaassen, C.D., M.O. Amdur, and J. Doull, eds., *Casarett and Doull's Toxicology, the Basic Science of Poisons*, 6th edition. McGraw Hill, New York, 2001.

Molinelli, R.P., M.J. Reale, and R.I. Freudenthal, *Material Safety Data Sheets: The Writer's Desk Reference*, Hill & Garnett Pub, 1992.

Organization for Economic Co-operation and Development (OECD), *Guidelines for Testing of Chemicals*, Section 4: Health Effects.

Plog, B. et al., *Fundamentals of Industrial Hygiene,* 5th ed., National Safety Council, Itasca, IL, 2001.

Silk, J.C. and M.B. Kent, *Hazard Communication Compliance Manual: A Guide to OSHA's Hazard Communication Standard,* BNA Books, 1995.

Sowinski, E.J. et al. "Criteria for Identifying and Classifying Carcinogens, Mutagens and Teratogens." *Regulatory Toxicology and Pharmacology*. 7:1-20 (1987) Sponsored by European Council of Chemical Manufactures Federations, CMA, Synthetic Organic Chemical Manufacturers Association and Canadian Chemical Producers Association.

Technical Instructions for Safe Transport of Dangerous Goods by Air (Doc 9284), 2005-2006 Edition

The Globally Harmonized System of Classification and Labelling of Chemicals

Threshold Limit Values for Chemical Substances and Physical Agents and Biological exposure Indices. ACGIH, 2005.

United Nations Committee of Experts on the Transport of Dangerous Goods, *Recommendations for the Transport of Dangerous Goods.*

U.S. DOL, OSHA, *Inspection Procedures for the Hazard Communication Standard*, Directive No. CPL 2-2.38D (dated Feb. 1998, effective March 20, 1998)

U.S. DOL, OSHA regulations, Hazard *Determination Guidelines* (Draft 2005)

Worker's Compensation Board of British Columbia, *WHMIS Core Material: A Resource Manual for the Application and Implementation of WHMIS*, 1991.

Annex A
(informative)

Examples of Labels

This annex illustrates a few of the different label styles that can be used for industrial chemical labeling. There are many effective ways to present precautionary label information. It is not the intent of this annex to single out one way as better than others, nor do the examples illustrate regulatory requirements or items that may be unique to a chemical. This Standard does not prescribe specific label text format or the position of labels on containers.

The examples in this annex are not comprehensive. An industrial chemical label may contain other information in addition to precautionary labeling, such as bar codes, net weight, HMIS or NFPA ratings, and DOT information. The example labels are intended only as illustrations of precautionary label text.

The general example contains complete precautionary text in the recommended sequence. In some situations, it may not be appropriate or possible to include all precautionary information on the container label. Individual discretion and professional judgment based on the particular hazards of the chemical is necessary to determine the priority/inclusion of the precautionary text. For details concerning label content, refer to Section 4.1 of the Standard.

GENERAL EXAMPLE

PRODUCT NAME OR IDENTIFICATION	See Section 5.2
(Identity of hazardous component(s), where appropriate)	See Section 5.3
SIGNAL WORD	See Section 5.4
STATEMENT OF IMMEDIATE HAZARD(S)	See Section 5.5
DELAYED HAZARD(S) LABEL STATEMENT	See Section 5.5
Precautionary measures	See Section 5.7
Instruction in case of contact or exposure (First aid statements and antidotes where appropriate)	See Sections 5.8 and 5.9
Fire instructions	See Section 5.10
Spill or leak instructions	See Section 5.11
Container handling and storage instructions	See Section 5.12
References to additional labels or other documents	See Section 5.13
Additional useful statements	
Name and address of company telephone number	See Section 5.6

Unobtainium Gas

DANGER

POISONOUS, FLAMMABLE GAS UNDER PRESSURE
MAY BE FATAL IF INHALED
MAY FORM EXPLOSIVE MIXTURES IN AIR
CAUSES SEVERE BLOOD, LIVER, KIDNEY and OTHER ORGAN DAMAGE
SYMPTOMS MAY BE DELAYED

Garlic-like odor.

Do not breathe gas. Store and use with adequate ventilation. Keep away from heat flames and sparks.

FIRST AID
If inhaled or suspicion of any exposure: Remove to fresh air. If not breathing give artificial respiration with supplemental oxygen. If breathing, give oxygen. Call a physician even if no symptoms are present. Keep under medical observation. Symptoms may be delayed. Consider any exposure as a potentially toxic dose.

HANDLING AND STORAGE
Cylinder temperature should not exceed 52°C (125°F). Close valve after each use and when empty. Use a backflow preventative device in piping. When returning cylinder, install valve outlet cap or plug leak tight.

For additional information read Material Safety Data Sheet for this product.

CAS Number: 123456-78-9

Company Name
Address
Phone number

24 Hour emergency phone number:
1-888-555-2222 (US)
01-526-555-0515 (outside US)

DO NOT REMOVE THIS LABEL

Relevant Information
Unobtanium Gas is a single chemical substance (100%).

Hazard Information:
Extremely flammable and highly toxic gas.

Product React

Contains chemicals X and Y

DANGER
WATER REACTIVE SUBSTANCE
REACTS WITH WATER TO RELEASE FLAMMABLE GAS
MAY CAUSE FIRE
MAY CAUSE ALLERGIC SKIN REACTION
MAY CAUSE EYE IRRITATION

Use only with adequate ventilation. Avoid prolonged or repeated contact with skin. Avoid contact with eyes. Wash thoroughly after handling.

FIRST AID: In case of skin contact, immediately flush skin with soap and plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur.

In case of eye contact, immediately flush eyes with plenty of water for at least 15 minutes. If easy to do, remove contact lenses, if worn. Call a physician if irritation persists.

For additional information, see Material Safety Data Sheet (MSDS) for this chemical.

Company name
Address
Phone number
24-hour emergency phone number

Relevant Information
This product is a water reactive liquid with a flash point of 205°F and a boiling point of 212°F.

Composition:
Chemical X = 95%
Chemical Y = 5%

Chemical X is a skin sensitizer and moderate eye irritant, based on animal data.
Chemical Y reacts with water, liberating hydrogen.

Product XYZ

WARNING

CAUSES EYE AND RESPIRATORY TRACT IRRITATION
HARMFUL IF ABSORBED THROUGH SKIN – MAY CAUSE LIVER DAMAGE BASED ON ANIMAL DATA
POSSIBLE REPRODUCTIVE HAZARD – MAY CAUSE ADVERSE REPRODUCTIVE EFFECTS BASED ON ANIMAL DATA

Avoid breathing vapor or mist. Avoid contact with eyes, skin, and clothing. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling.

FIRST AID
If inhaled: Remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
In case of contact: Immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. If easy to do, remove contact lenses. Contact a poison control center. Wash clothing before reuse. Destroy contaminated shoes.

HANDLING AND STORAGE
Store in a cool, dry, well-ventilated area away from incompatible materials.

This product contains the following hazardous components:
CAS # 1 Chemical A
CAS # 2 Chemical C
CAS # 3 Chemical D

Company name
Address 24-hour emergency phone number
Phone number

Relevant Information
Product XYZ is an untested mixture of four chemicals.
Liquid with a flash point of 220°F

Composition:
- Chemical A = 50%
- Chemical B = 25%
- Chemical C = 23.5%
- Chemical D = 1.5%

Hazard Information:
- Chemical A: Severe eye and severe respiratory tract irritant per supplier MSDS
- Chemical B: Non-hazardous
- Chemical C: Mild eye irritation; dermal LD_{50} = 500 mg/kg; liver damage noted on subchronic study
- Chemical D: Supplier MSDS indicates reproductive effects based on animal data

Solid Stuff

WARNING
MAY FORM COMBUSTIBLE DUST-AIR MIXTURE
CAUSES EYE IRRITATION

Keep away from heat, sparks and open flame. Prevent dust accumulation. Avoid contact with eyes. Keep container closed. Wash thoroughly after handling.

FIRST AID

In case of contact: Immediately flush eyes with plenty of water for at least 15 minutes. If easy to do, remove contact lenses. Get medical attention.

FIRE INSTRUCTIONS

Flood with water.

HANDLING AND STORAGE

Store in a cool, dry, well-ventilated area away from incompatible materials.

For additional information, read Material Safety Data Sheet for this product.

This product contains:
Chemical S

Company name
Address 24-hour emergency phone number
Phone number

Relevant Information

Solid Stuff is a granular material capable of generating a dust.

Composition:

Chemical S = 100%

Hazard Information:

Chemical S is a severe eye irritant.
Chemical S is not water-reactive.

Product SOL

CAUTION

COMBUSTIBLE LIQUID AND VAPOR
VAPORS MAY CAUSE DROWSINESS AND DIZZINESS
HARMFUL - MAY CAUSE LUNG DAMAGE IF SWALLOWED
PROLONGED OR REPEATED CONTACT MAY DRY SKIN AND CAUSE IRRITATION

Keep away from heat, sparks and flame. Avoid breathing of or direct contact with material. Keep container closed when not in use. Use only with adequate ventilation.

FIRST AID
If inhaled: Remove to fresh air. If rapid recovery does not occur, transport to nearest medical facility for additional treatment.
If ingested: Do not induce vomiting. Transport to nearest medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration.
Skin contact: Remove contaminated clothing. Flush exposed area with water and follow by washing with soap if available.

FIRE FIGHTING
Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only. Do not use water jetstream. Will float on water and can be re-ignited.

SPILL PROCEDURES
Remove all possible sources of ignition in the surrounding area. Use appropriate containment to avoid environmental contamination. Transfer by mechanical means such as vacuum truck to a salvage tank or other suitable container for recovery or safe disposal.

HANDLING AND STORAGE
Keep container closed when not in use. Do not heat containers. Store in a cool, dry, well-ventilated area away from incompatible materials. Bond and ground handling equipment.

For additional information, read Material Safety Data Sheet for this product.
This product contains: CAS # 123456-78-9 and chemical name

Company name
Address **24-hour emergency phone number**
Phone number

Relevant Information
Product SOL is a water insoluble solvent with a specific gravity less than 1.
Liquid with a flash point of 150°F

Composition:
Chemical SOL = 100%

Hazard Information:
Chemical SOL is a low viscosity, combustible, organic solvent that can cause CNS depression if inhaled, aspiration pneumonitis if aspirated in lungs, and defatting of the skin upon prolonged or repeated skin contact. Electrostatic charge may be generated during pumping.

Product SAFE

NOT EXPECTED TO PRODUCE SIGNIFICANT ADVERSE HEALTH EFFECTS WHEN RECOMMENDED USE INSTRUCTIONS ARE FOLLOWED

Avoid prolonged contact with material. Keep container closed when not in use.

FIRST AID
In general no treatment is necessary. If symptoms occur, obtain medical advice.

FIRE FIGHTING
Product will not burn.

SPILL PROCEDURES
Contain spill transfer by mechanical means such as vacuum truck to a salvage tank or other suitable container for recovery or safe disposal.

HANDLING AND STORAGE
Keep container closed when not in use. Store in a cool, dry, well-ventilated area away from incompatible materials.

For additional information, read Material Safety Data Sheet for this product.

This product contains:

NJ Trade Secret Registry #	Generic chemical name S
CAS # 123456-78-9	Chemical F

Company name
Address 24-hour emergency phone number
Phone number

Relevant Information
Product SAFE is a soluble polymer with a specific gravity of 1.1.
No flash point
Chemical S is considered a trade secret.

Composition:
- Chemical S = 90%
- Chemical F = 10%

Hazard Information:
- Chemical SAFE has no health or physical hazards.

Annex B
(informative)

Hazard Criteria Information

The following tables compare hazard ratings or categories based on acute toxicological and flammability endpoints. Since the testing methods that are used to measure these endpoints are not always equivalent, values obtained from one organization's test methods may not always be directly comparable to values obtained from another organization's test methods. This is especially apparent with inhalation LC_{50} values because different organizations specify different exposure periods (e.g., one or four hours). This annex is not intended to be all-inclusive.

The following references were used in Tables B.1, B.2, B.3, B.5 and B.6:

1) American National Standard for Hazardous Industrial Chemicals-Precautionary Labeling (ANSI Z129.1).
2) U.S. DOL, OSHA, 29 CFR 1910.1200, HAZCOM, 2004.
3) U.S. EPA, 40 CFR Part 156, FIFRA regulations, 2004.
4) U.S. CPSC, 16 CFR 1500, FHSA regulations, 2005.
5) U.S. DOT, 49 CFR Part 107, Performance-Oriented Packaging Standards.
6) National Fire Protection Association 704, Standard System for the Identification of Fire Hazards of Materials, 2001.
7) National Paint and Coatings Association, Hazardous Materials Identification System, 3rd ed., 2001.
8) Council Directive 92/32/European Economic Community, amending for the 7th time, Directive 67/548/European Economic Community, approximation of the laws, regulations and administrative provisions on the classification, packaging and labeling of dangerous preparations, 1992.
9) Reference Manual for the WHMIS Requirements of the *Hazardous Products Act* and *Controlled Products Regulations,* CPR Section 43. Health Canada. Manual updated 2003/04/03.
10) Australia Worksafe, National Occupational Health and Safety Commission, Approved Criteria for Classifying Hazardous Substances, 1999.
11) Official Mexican NORM NOM-018-STPS-2,000.
12) Korean Ministry of Labor Notice 1997-27 “Preparation of MSDS and Labelling Regulation”.
13) Japanese Official Notice of Ministry of Labor No. 60 “Guidelines for Labeling of the Danger and Hazards of Chemical Substances”.
14) Malaysian Occupational Safety and Health Act (1994), Act 514 and Regulations, 1997.
15) The Globally Harmonized System of Classification and Labeling of Chemicals

Table B.1 - Hazard ratings/categories - Oral LD_{50} (rat) (in mg/kg body weight)

Organization/ Country/ Regulation or	High*		**Hazard**			Low
Standard	0 ----------		≤ 50 ----------		≤ 500 ----------	≤ 5000 ------
ANSI/US/Z129.1[1)]	≤ 50 Highly toxic		> 50 ≤ 500 Toxic		> 500 ≤ 2000 Harmful	
OSHA/US/$_{HCS}$[2)]	≤ 50 Highly toxic		> 50 ≤ 500 Toxic			
EPA/US/FIFRA[3)]	≤ 50 Toxicity Category I		> 50 ≤ 500 Toxicity Category II		> 500 ≤ 5000 Toxicity Category III	> 5000 Toxicity Category IV
CPSC/US/FHSA[4)]	≤ 50 Highly toxic		> 50 ≤ 5000 Toxic			
DOT/US[5)]**	≤ 5 Packing Group 1	> 5 ≤ 50 Packing Group II	> 50 ≤ 200 (solid) Packing > 50 ≤ 500 (liquid) Group III			
NFPA/US[6)]	≤ 5 Hazard category 4	> 5 ≤ 50 Hazard category 3	> 50 ≤ 500 Hazard category 2		> 500 ≤ 2000 Hazard category 1	> 2000 Hazard category 0
NPCA/US/ HMIS[7)]	≤ 1 Toxicity rating 4	> 1 ≤ 50 Toxicity rating 3	> 50 ≤ 500 Toxicity rating 2		> 500 ≤ 5000 Toxicity rating 1	> 5000 Toxicity rating 0
EEC/Europe/ 7th Amendment[8)]	≤ 25 Very Toxic	> 25 ≤ 200 Toxic	> 200 ≤ 2000 Harmful			
WHMIS/ Canada[9)]	≤ 50 Very toxic WHMIS Class D, Division 1, Subdivision A		> 50 ≤ 500 Toxic WHMIS Class D, Division 1, Subdivision B			
Australia/ NOHSC[10)]	≤ 25 Very toxic	> 25 ≤ 200 Toxic	> 200 ≤ 2,000 Harmful			
Mexico[11)]	< 1 Extremely toxic	> 20< 50 Highly toxic		> 50 < 500 Moderately toxic	> 500 < 5000 Mildly toxic	> 5000 Minimally toxic
Malaysia [14)]	< 25 Very toxic	25 to 200 Toxic		200 to 500 Harmful		
Japan [13)]	≤ 30 Poisonous	> 30 < 300		300 to 3000 Powerful		
Korea [12)]	≤ 25 Very Toxic	> 50 ≤ 200 Toxic		> 200 ≤ 2000 Harmful		
Global Harmonized System (GHS)[15)]	≤ 5 Category 1	> 5 ≤ 50 Category 2	> 50 ≤ 300 Category 3	> 300 ≤ 2000 Category 4	> 2000 ≤ 5000 Category 5	

Asterisks refer to Notes following Table B.3

Table B.2 - Hazard ratings/categories - Dermal LD_{50} (rabbit) (in mg/kg body weight)

Organization/ Country/ Regulation or Standard	Hazard											
	High* 0 ----------		≤ 200 ----------		≤ 1000 ----------		≤ 2000		Low -----	≤ 20,000		
ANSI/US/Z129.1[1]	≤ 200 Highly toxic		> 200 ≤ 1000 Toxic		>1000 ≤ 2000 Harmful							
OSHA/US/HCS[2]	≤ 200 Highly toxic		> 200 ≤ 1000 Toxic									
EPA/US/FIFRA[3]	≤ 200 Toxicity category I		> 200 ≤ 2000 Toxicity category II						> 2000 ≤ 20,000 Toxicity category III		> 20,000 Toxicity category IV	
CPSC/US/FHSA[4]	≤ 200 Highly toxic		> 200 ≤ 2000 Toxic									
DOT/US[5]**	≤ 40 Packing Group I	> 40 ≤ 200 Packing Group II	> 200 ≤ 1000 Packing Group III									
NFPA/US[6]	≤ 40 Hazard category 4	> 40 ≤ 200 Hazard category 3	> 200 ≤ 1000 Hazard category 2		> 1000 ≤ 2000 Hazard category 1				> 2000 Hazard category 0			
NPCA/US HMIS[7]	≤ 20 Toxicity rating 4	> 20 ≤ 200 Toxicity rating 3	> 200 ≤ 1000 Toxicity rating 2		> 1000 ≤ 2000 Toxicity rating 1				> 2000 Toxicity rating 0			
EEC/Europe/ 7th Amendment[8]	≤ 50 Very Toxic	> 50 ≤ 400 Toxic	> 400 ≤ 2000 Harmful									
WHIMIS/Canada[9]	≤ 200 Very Toxic WHMIS Class D, Division 1, Subdivision A		> 200 ≤ 1000 Toxic WHMIS Class D, Division 1, Subdivision B									
Australia/NOHSC[10]	≤ 50 Very toxic	> 50 ≤ 400 Toxic	> 400 ≤ 2000 Harmful									
Mexico[11]	< 20 Extremely toxic		>20 < 200 Highly toxic		>200 < 1000 Moderately toxic				> 1000 < 5000 Mildly toxic		> 5000 Minimally toxic	
Malaysia [14]	< 50 Very toxic											
Japan [13]	< 100 Poisonous				100 to 1000 Powerful							
Korea [12]	< 50 Very Toxic		> 50 ≤ 400 Toxic		> 400 ≤ 2000 Harmful							
Global Harmonized System (GHS)[15]	≤ 50 Category 1	> 50 ≤ 200 Category 2	> 200 ≤ 1000 Category 3		> 1000 ≤ 2000 Category 4				> 2000 ≤ 5000 Category 5			

Asterisks refer to Notes following Table B.3

Table B.3 - Hazard ratings/categories - Inhalation LC_{50} (rat)* For dusts, fumes, and mists (in mg/L) unless otherwise noted**

Organization/ Country/ Regulation or Standard	High* **Hazard** Low 0 ------- ≤ 0.5 -------- ≤ 2 ---------- ≤ 10 ---------- ≤ 20 -------- < 200 ---------					
ANSI/US/Z129.1[1] (1-hr)	≤ 2 Highly toxic		> 2 ≤ 20 Toxic			
OSHA/US/HCS[2] (1-hr)	≤ 2 Highly toxic		> 2 ≤ 20 Toxic			
OSHA/US/HCS[2] (1-hr) (gas/vapor)	≤ 200 ppm Highly toxic		> 20 0< 2,000 ppm Toxic			
EPA/US/FIFRA[3] (4-hr)	≤ 0.2 Toxicity Category I	> 0.2 ≤ 2 Toxicity Category II	> 2 ≤ 20 Toxicity Category III		> 20 Toxicity Category IV	
CPSC/US/FHSA[4] (1-hr)	≤ 2 Highly Toxic		> 2 ≤ 200 Toxic			
CPSC/US/FHSA[4] (1-hr) (gas/vapor)	≤ 200 ppm Highly toxic		> 200 ≤ 20,000 ppm Toxic			
DOT/US[5]** (1-hr)	≤ 0.5 Packing Group I	> 0.5 ≤ 2 Packing Group II	> 2 ≤ 10 Packing Group III			
NFPA/US[6] (1-hr)	≤ 0.5 Hazard category 4	> 0.5 ≤ 2 Hazard category 3	> 2 ≤ 10 Hazard category 2	> 10 ≤ 200 Hazard category 1	> 200 Hazard category 0	
NPCA/US/ HMIS[7] (4-hr)	≤ 0.05 Toxicity rating 4	> 0.05 ≤ 0.5 Toxicity rating 3	> 0.5 ≤ 2 Toxicity rating 2		> 2 ≤ 20 Toxicity rating 1	> 20 Toxicity rating 0
EEC/Europe/ 7thAmendment[8] (4-hr)	≤ 0.25 Very toxic	> 0.25 ≤ 1 Toxic	> 1 ≤ 5 Harmful			
WHMIS/Canada[9] (4-hr)	≤ 0.5 Very Toxic WHMIS Class D, Division 1, Subdivision A	> 0.5 ≤ 2.5 Toxic WHMIS Class D, Division 1, Subdivision B				
WHMIS/Canada [9] (4-hr) (gas)	≤ 2500 ppm Very toxic	-	-			
WHMIS/Canada [9] (4-hr) (vapor)	≤ 1500 ppm# Very toxic	> 1500 ≤ 2500 ppm## Toxic	# with a saturated vapor concentration at normal atmospheric pressure greater than 2 times the LC_{50} ## with a saturated vapor concentration at normal atmospheric pressure greater than 0.4 times the LC_{50}			
Australia/NOHSC[10] (4-hr)	≤ 0.25 Very toxic	> 0.25 ≤ 1 Toxic	> 1 ≤ 5 Harmful			

Australia/NOHSC[10] (4-hr) (gases/vapors)	≤ 0.5 mg/L	> 0.5 ≤ 2 mg/L Toxic	> 2 ≤ 20 mg/L Harmful			
Mexico[11] (1-hr)	< 0.2 Extremely toxic		≥ 0.2 ≤ 2 Highly toxic	≥ 2 < 20 Moderately toxic	> 20 < 200 Mildly toxic	
Mexico[11]	< 20 ppm Extremely toxic		≥ 20 ≤ 200 ppm Highly toxic	≥ 200 < 1000 ppm Moderately toxic	≥ 2000 < 10,000 ppm Mildly toxic	≥ 10,000 ppm Minimally toxic
Malaysia[14]	< 0.5 Very toxic					
Japan[13]	<200 ppm Poisonous			200 – 2000 ppm Powerful		
Korea[12]	≤ 0.5 (gas or vapor) ≤ 0.25 (particle or aerosol) Very Toxic		0.5 ≤ 2 (gas or vapor) > 0.25 ≤ 1 (particle or aerosol) Toxic	>2 ≤ 20 (gas or vapor) > 1 ≤ 5 (dust or particle) Harmful		
Global Harmonized System (GHS)[15] - DUST/MIST	< 0.05 Category 1		> 0.05 ≤ 0.5 Category 2	> 0.5 ≤ 1.0 Category 3	> 1.0 ≤ 5.0 Category 4	
Global Harmonized System (GHS)[15] -VAPOURS	< 0.5 Category 1		> 0.5 ≤ 2.0 Category 2	> 2.0 ≤ 10.0 Category 3	> 10.0 ≤ 20.0 Category 4	
Global Harmonized System (GHS)[15] - GASES	< 100 ppm Category 1		> 100 ≤ 500 ppm Category 2	> 500 ≤ 2500 ppm Category 3	>2500 ≤ 5000 ppm Category 4	

Notes to Tables B.1, B.2 and B.3

***** The numerical values on the hazard index scale in Tables B.1 through B.3 are not to scale.

****** The International Civil Aviation Organization (ICAO), International Maritime Organization (IMO), International Air Transport Association (IATA), and the United Nations Committee of Experts on the Transport of Dangerous Goods (UNCETDG) use the same packing groups and cut-offs as the U.S. Department of Transportation.

*** The concentrations of dusts, fumes, or mists presented in Annex B, Table B.3 are given in mass/volume concentration units of mg/L. These concentrations should not be converted to ppm equivalents for gases or vapors because this will result in hazard rating inequities. The unit ppm is a volume/volume value only and is not equal to the standard mass/volume relationship reported as mg/L. The organizations listed in Annex B, Table B.3 also have developed acute inhalation, toxicity driven, hazard ratings for gases or vapors based on volumetric concentrations, although other factors such as saturated vapor concentration are often considered in these ratings. When available, hazard ratings based on volumetric concentrations for vapors and gases are presented in Annex B, Table B.3 and are so indicated. As stated in the introduction to Annex B, different organizations specify different inhalation exposure periods. For convenience, the inhalation exposure time is given in column one of Annex B, Table B.3. Although approaches have been suggested to extrapolate from 4-hour to 1-hour exposures, professional judgment should always be used when extrapolating from different inhalation exposure periods. The critical question is whether the toxic response is related to the cumulative dose or to the absolute exposure concentration. Most extrapolation approaches assume that the response is a function of concentration and time, which is probably an oversimplification of the true relationship. In the absence of a "concentration x exposure time" constant (Haber's law) for individual chemicals, these approaches may not be technically supportable.

Table B.4 - Summary of rating systems for animal dermal irritation test scores

The cited references should be consulted for full details when using this summary table.

Organization or Reference	Country or Region	Non-irritating	Slightly/Mildly irritating	Moderately irritating	Primary irritant	Severely irritating
CPSC, 2005	U.S.	NA	NA	NA	$\geq$ 5	NA
OSHA, 2005	U.S.	NA	NA	NA	$\geq$ 5	NA
HPA	Canada	NA	NA	NA	$\geq$ 2(1)	NA
EU, 2,000	Europe	NA	NA	NA	$\geq$ 2(1)	NA
GHS, 2005(2)	International	NA	$\geq$ 1.5 < 2.3	NA	$\geq$ 2.3 < 4.0	NA
Draize, 1959	Literature	0	< 2	2 – 5	NA	> 6
Gad, 1999	Literature	0	> 0.5 - 2.0	> 2.0 - 5.0	NA	> 5.0 - 8.0
Griffin, 1977	Literature	NA	0 – 1.4	1.5 – 2.4	NA	2.5 – 8.0(3)
Levin, 2004	Literature	< 2	2-5	NA	NA	> 5

NOTES:
NA = No rating available
(1) Defined as significant irritation; mean score for either edema or erythema
(2) GHS dermal irritation categories are either mild or irritant.
(3) The range of 2.5 - 8.0 defines a strong irritant

Cited References:

- CPSC: Title 16 Code of Federal Regulations Sec. 1500.3; Definitions. Consumer Product Safety Commission. January 1, 2005.
- Draize, J.: Dermal Toxicity. Appraisal of the Safety of Chemicals in Foods, Drugs and Cosmetics. The Association of Food and Drug Officials of the United States. Page 47. 1959.
- EU: General Classification and Labeling Requirements for Dangerous Substances and Preparations, Annex VI, as amended by Directive 93/21/EEC, Directive 96/54/EC, Directive 97/69/EC and by Decision 2,000/368/EC. European Union.
- Gad, S.: Evaluating products for their potential to cause dermal and ocular irritation and corrosion. In, Product Safety Evaluation Handbook, 2nd Edition. Marcel Dekker, Inc. Pages 87-122. New York. 1999.
- GHS: The Globally Harmonized System of Classification and Labeling of Chemicals. http://www.unece.org/trans/danger/publi/ghs/officialtext.html. 2005.
- Griffin, J., Buehler, E.: Prediction of skin irritancy and sensitizing potential by testing with animals and man. In, Cutaneous Toxicity. Pages 155-173. 1977.
- HPA: Hazardous Products Act. Controlled Products Regulations. SOR/88-66.
- Levin, C., Maibach, H.: Animal and in vitro methods for predicting skin irritation. In, Dermatotoxicology, 6th Edition. Pages 679-693. CRC Press. Boca Raton, Florida. 2004.
- OSHA: Hazard Communication, Appendix A. 21 CFR 1910.1200. Occupational Health and Safety Administration. July 1, 2003.

Table B.5 - Flammability/Combustibility classifications for liquids (at ambient* temperature and pressure)

(Key: FP = Flash Point; BP = Boiling Point; LFL = Lower Flammability Limit)

Organization/ Country/ Regulation or Standard	Flammable / Flash point (°F) / Combustible 0 ------- 20 -------- 73 ---------- 100 ---------- 140 --------- < 200		
ANSI/US/Z129.1	Extremely Flammable FP ≤ 20°F	Flammable FP ≤ 141°F & BP > 95°F	Combustible FP > 141°F & < 200°F
	Extremely Flammable FP ≤ 141°F & BP ≤ 95°F		
OSHA/US/HCS	Flammable FP < 100°F		Combustible FP ≥ 100°F & < 200°F
DOT/US	Flammable Packing Group I: BP ≤ 35°C (90°F) Packing Group II: FP < 23°C (73°F) & BP > 35°C (90°F)	Flammable Packing Group III: FP ≥ 23°C (73°F) & ≤ 60.5°C (141°F) & BP > 35°C (90°F)	Combustible FP > 60.5°C (141°F) & < 93°C (200°F) OR ≥ 100°F < 200°F
TDG/CA IMDG/International IATA/International	Flammable Packing Group I: BP ≤ 35°C (90°F) Packing Group II: FP < 23°C (73°F) & BP > 35°C (90°F)	Flammable Packing Group III: FP ≥ 23°C (73°F) & ≤ 60.5°C (141°F) & BP > 35°C (90°F)	Not Regulated
WHMIS/Canada	Flammable (B2) FP < 100°F		Combustible (B3) FP ≥ 100°F & < 200°F
GHS	Extremely / Highly Flammable FP < 23°C (73°F) & BP ≤ 35°C (90°F) OR FP < 23°C (73°F) & BP > 35°C (90°F)	Flammable FP ≥ 23°C (73°F) & ≤ 60°C (140°F)	Combustible FP > 60°C (140°F) & ≤ 93°C (200°F)
NFPA 704 (assumes fire is present)	4: FP < 22.8°C (73°F) & BP < 37.8°C (100°F) 3: FP < 22.8°C (73°F) & BP ≥ 37.8°C (100°F) OR FP ≥ 23°C (73°F) & BP < 37.8°C (100°F)	2 FP ≥ 37.8°C (100°F) & < 93.4°C (200°F)	See NFPA 704 Standard for Categories 1 and 0 criteria, which are beyond the range of this table

* Ambient = 14.7 psia (1 bar) and 70°F (21°C)

Table B.6 - Flammability classifications for gases (at ambient* temperature and pressure)

(Key: LFL = Lower Flammability Limit)

Organization/ Country/ Regulation or Standard	**Lower Flammability Limit (%)**	
	0 ---------- 10 ---- -- --------- 13%	**20%**
ANSI/US/Z129.1 OSHA/US/HCS DOT/US WHMIS/Canada GHS	Flammable LFL ≤ 13% OR flammable range > 12%	Non-Flammable
NFPA	Flammable gases are NFPA 4	

* Ambient = 14.7 psia (1 bar) and 70°F (21°C)

Annex C
(informative)

Background: The Globally Harmonized System of Classification and Labelling of Chemicals (GHS)

Several countries and international agencies have developed and implemented their own systems for classification and labeling of chemicals. Companies must comply with different requirements that depend on where they do business and the types of chemicals involved. In addition, people, with different levels of education (including illiteracy), from various countries with different languages and alphabets, and from various social conditions are handling and using chemicals on a daily basis.

The Globally Harmonized System of Classification and Labelling of Chemicals (GHS) is the result of a ten-year international effort. An international mandate adopted in 1992 by the United Nations stated:

> "A globally harmonized hazard classification and compatible labeling system, including national safety data sheets and easily understandable symbols, should be available, if feasible..."

Under the auspices of the United Nations, experts from many countries, and international and stakeholder organizations, had the goals:

To protect people and the environment by promoting safe handling of chemicals; and
To reduce barriers to trade.

The group recognized that, while existing classification and labeling systems are similar in many respects, there are significant differences that result in different labels or material safety data sheets for the same product in different countries. For example, because of variations in definitions of hazards, a chemical may be considered to cause cancer in one country, but not in another.

A harmonized system should lead to greater consistency among countries and thereby:
Promote more effective hazard communication.
Promote regulatory efficiency and facilitate trade, without lowering the level of health and environmental protection afforded by current laws and regulations;
Promote the safer transportation and handling of chemicals;
Reduce the costs for companies involved in international trade; and
Reduce the need for animal testing that is needed for compliance.

The experts decided to harmonize existing communication systems into a single, global system that addresses the classification of chemicals according to their hazards and communicates the information through labels, based on universally understandable pictograms and safety data sheets.

The GHS was adopted by the United Nations in December 2002 and is now available for worldwide implementation. While national or regional governments are the primary audiences for the GHS document, it also contains sufficient context and guidance for those in industry who will ultimately be implementing the national requirements that will be introduced. This system will be regularly revised as experience is gained with its implementation.

GHS hazard classification criteria have been developed, standardized and adopted by consensus for the three hazard classes.

Physical Hazards
- Explosives
- Flammable gases
- Flammable aerosols
- Flammable liquids
- Flammable solids
- Pyrophoric liquids
- Pyrophoric solids
- Oxidizing gases
- Oxidizing liquids
- Oxidizing solids
- Gases under pressure
- Self-reactive substances and mixtures
- Substances that emit flammable gases when in contact with water
- Self-heating substances and mixtures
- Organic peroxides
- Corrosives to metal

Health Hazards
- Acute toxicity
- Skin and eye irritation/corrosion
- Respiratory and skin sensitization
- Germ cell mutagenicity
- Reproductive/developmental toxicity
- Carcinogenicity
- Target organ/systemic toxicity (TOST) – single and repeated exposure
- Aspiration

Environmental Hazards
- Aquatic toxicity

In addition, the GHS has elements that address

Label Elements
- Symbols
- Signal words
- Hazard statements

Safety Data Sheets
- Standard format and approach to the presentation of information

Guidance on
- Product identifiers
- Confidential business information
- Precedence of hazards

For additional information on GHS, please see the current United Nations/Economic Commission for Europe (UN/ECE) Transport Division website or obtain a copy of the purple book, Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

General example of a label in GHS

Product name	Product Identifier
Hazard symbol	SIGNAL WORD
	Hazard Statements
Precautionary Statements First Aid Spills or Leaks Handling and Storage Disposal	
Supplier Identification	

Example of a label in GHS

Product Name — Product Identifier

DANGER

Use only in well ventilated areas.	Toxic if swallowed
Do not breathe vapor or spray mist.	Toxic if inhaled
Do not get in eyes, skin or on clothing.	Toxic in contact with skin
Wash thoroughly after handling.	Harmful to aquatic life

First Aid:
If inhaled, move person to fresh air. Call a poison control centre or doctor for further treatment advice.
If swallowed, seek medical advice immediately and show this container or label. After contact with skin, take off immediately all contaminated clothing and wash immediately with plenty of water. Wash contaminated clothing before reuse.

Spill or Leak:
Clean up spill immediately. Do NOT wash away into sewer.

Handling and storage:
Wear protective clothing and gloves. Avoid release to the environment. Refer to special instructions/safety data sheet.

Disposal:
This material and its container must be disposed of as hazardous waste.

Company Name — Phone number

Relevant Information
Liquid
HAZARDS: toxic by inhalation, highly toxic by ingestion and absorption, harmful to aquatic environment

Annex D
(informative)

Glossary

The Glossary was developed to assist the labeling writer. It defines the terms used in the Standard and some other terms commonly used in labeling and source materials. It contains a number of regulatory definitions. Where multiple regulatory definitions exist, the OSHA definition is given first. Other regulatory definitions are given if relevant to information described in the Standard. These definitions are current as of the time of preparation of this Standard.

The Glossary definitions are meant to convey the concepts presented in the text of this Standard; they are not meant to be used outside the context of the Standard.

Where applicable, reference to the following sources is made by way of endnote on the Glossary entries. The sources should be referred to when using this Annex.

ACGIH: The American Conference of Governmental Industrial Hygienists is an organization of government and academic professionals engaged in occupational safety and health programs. ACGIH establishes recommended occupational exposure limits for chemical substances and physical agents known as Threshold Limit Values. [1] (See Glossary term TLV.)

acute exposure: A single, short-term exposure to a substance (usually less than 24 hours).

acute toxicity: Adverse effects on health caused by a single dose of, or short exposure to a chemical. The health effects usually occur rapidly or relatively immediately after the exposure.

aerosol: A suspension of tiny particles or droplets in the air, such as dusts, mists, or fumes. These particles may be inhaled or absorbed by the skin, and can sometimes cause adverse heath effects for workers. [2]

AIHA: American Industrial Hygiene Association. A professional organization that, among other things, develops and publishes airborne chemical exposure limits known as the WEEL guide. Also, see Glossary term "WEEL."

allergic reaction: See Glossary term "sensitizer."

antidote: A specific treatment or remedy used to counteract or prevent the adverse health effects of a chemical. The administration or giving of an antidote may require the services of medically trained personnel.

aspiration: The act of breathing a liquid or solid material liquid or solid material into the lungs directly from the mouth or nose, or indirectly through vomiting. For example, petroleum and other light hydrocarbons (with a viscosity less than 100 SUS at 100°F) can be aspirated if swallowed or if vomiting occurs after swallowing. Aspiration may lead to pneumonitis, an acute inflammation of the lungs that can be life threatening.

bioaccumulate: The process whereby a chemical is taken up and retained by an organism directly from the surrounding environment and from food.

biodegrade: The process whereby a chemical is broken down or decomposes via biological means, (e.g. by action of microorganisms) into other chemicals.

boiling point: Generally, the temperature at which a liquid rapidly becomes a vapor. Since the boiling point is the temperature at which the liquid's vapor pressure equals the surrounding atmospheric pressure, the boiling point will vary with changes in atmospheric pressure. Mixtures do not normally have a distinct boiling point.

°C (degree Celsius): A unit of temperature, where water boils at 100°C and freezes at 0°C. To convert °C to °F, multiply the °C by 9/5 and add 32.

carcinogen: A substance or agent that causes cancer based on human or relevant animal data. The HCS defines a chemical as a carcinogen or potential carcinogen if NTP, IARC and/or OSHA (29 CFR 1910 subpart Z) establishes that a chemical is a carcinogen or a potential carcinogen [3]. Other regulatory bodies (e.g. EPA) and non-governmental organizations (e.g. ACGIH) also identify and classify carcinogens. See Standard Section 3.3.3.2.

CAS #: Chemical Abstracts Service registry number (CASRN). A unique numeric identifier that is assigned to a substance by the Chemical Abstracts Service. A CAS # may be assigned to a single substance with a specific structure (e.g. 74-82-8, methane), or to a complex and variable substance that cannot be described in terms of a single structure, (e.g. 90604-37-8, alcohols, C11-C15-branched).

CAUTION: Signal word used in labeling that indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. Also, see Glossary terms *"DANGER!"* and *"WARNING!"* [4]

CFR: United States Code of Federal Regulations. An annual publication of Federal agency regulations that have been promulgated under United States Law. The CFR is divided into titles according to broad subject matter categories (e.g. Title 29 – Labor, contains OSHA regulations and standards, including HCS; Title 40 – Protection of Environment, contains EPA regulations; Title 49 – Transportation, contains DOT regulations).

NOTE – New and revised regulations not yet published in the CFR are found in the *Federal Register*.

chemical: The term "chemical", as used in this Standard, includes a single chemical substance or a mixture of substances.

NOTE – OSHA defines a chemical as any element, chemical compound or mixture of elements and/or compounds. [3]

chemical manufacturer: An employer with a workplace where chemical(s) are produced for use or distribution. [3]

chemical name: The scientific designation of a chemical in accordance with the nomenclature system developed by the International Union of Pure and Applied Chemistry (IUPAC) or the Chemical Abstracts Service (CAS) rules of nomenclature, or a name which will clearly identify the chemical for the purpose of conducting a hazard evaluation. [3]

chronic exposure: A continuous or repeated exposure to a substance over a relatively long period of time.

chronic toxicity: Adverse (chronic) effects resulting from repeated doses of, or exposures to, a substance over a prolonged period of time. [5]

combustible: A substance capable of fueling a fire. Also a term used to classify certain liquids on the basis of their flashpoint. [5] Also, see Glossary term "flammable."

combustible dust: A finely divided solid material, other than an explosive (e.g., dynamite), that presents a fire or explosion hazard when dispersed and ignited in air. (See also glossary term "explosive dust.")

combustible liquid:

Any liquid having a flash point above 141°F (60.5°C) and below 200°F (93.3°C). Note, however, that a flammable liquid with flash point at or above 100°F (38°C) but not more than 141°F (60.5°C) may be considered a "combustible liquid" for purposes of this Standard if it meets the DOT requirements for "combustible liquid" pursuant to 49 CFR 173.120(b)(2).

(OSHA): Any liquid having a flash point at or above 100°F (37.8°C), but below 200°F (93.3°C), except any mixture having components with flash points of 200°F (93.3°C) or higher, the total volume of which make up 99 percent or more of the total volume of the mixture. [3]

(DOT): Any liquid that does not meet the definition of any other [DOT] hazard class specified and has a flash point above 141°F (60.5°C) and below 200°F (93°C). Flammable liquids with a flash point at or above 100°F (38°C) that does not meet the definition of any other hazard class may be reclassed as combustible liquids. [6]

common name: Any designation or identification such as code name, code number, trade name, brand name or generic name used to identify a chemical other than by its chemical name [3]. Also, see Glossary term "identity".

component: A single chemical substance (e.g. methanol), or a complex and variable substance that cannot be described in terms of a single structure but under certain conditions can be considered as a single entity (e.g., alcohols, C11-C15-branched).

compressed gas:

(OSHA)
(i) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70°F (21.1°C); OR
(ii) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130°F (54.4°C) regardless of the pressure at 70°F (21.1°C); OR
(iii) A liquid having a vapor pressure exceeding 40 psi at 100°F (37.8°C) as determined by ASTM D323-72. [3]

(DOT)

- compressed gas (nonflammable, nonpoisonous compressed gas-including compressed gas, liquefied gas, pressurized cryogenic gas in solution, asphyxiant gas and oxidizing gas): Any material (or mixture) which (1) exerts in the packaging an absolute pressure of 280 kPa (41 psia) at 68°F and (2) does not meet the definition of Division 2.1 or 2.3. [6].
- compressed gas (liquefied): A gas which in a packaging under the charged pressure, is partially liquid at a temperature of 68°F (20°C). [6].
- compressed gas (non-liquefied): A gas, other than in solution, which in a packaging under the charged pressure, is entirely gaseous at a temperature of 68°F (20°C). [6]

container: Any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like that contains a hazardous chemical. Pipes or piping systems and engines, fuel tanks or other operating systems in a vehicle, are not considered to be containers. [3]

corrosive: A chemical that causes visible destruction of or irreversible alterations in living tissue by chemical action at the site of contact (e.g., eyes, skin, digestive tract or respiratory tract). This term shall not refer to action on inanimate surfaces [3]. Note that the DOT defines a ”corrosive material” as a liquid or solid that causes full thickness destruction in human skin at the site of contact within a specified period of time, or a liquid that has a severe corrosion rate on steel or aluminum based on test criteria. [7]

DANGER: Signal word used in labeling that indicates an **imminently** hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations. See Glossary terms “CAUTION” and “WARNING.” [4]

dangerously reactive chemical: A chemical that falls within any of the following categories: a chemical that undergoes a violent self-accelerating exothermic reaction with common materials or by itself, or under conditions of shock/impact, pressure or temperature; or a chemical that reacts with common materials (such as air, moisture) or reacts with itself, to release a gas or a type or in quantities that present an immediate hazard.

dangerous when wet: A DOT term that is synonymous with “water reactive material”. See Glossary term “water reactivity.”

decomposition: Breakdown of a material or substance (by heat, chemical reaction, electrolysis, decay or other processes) into parts or elements or simpler compounds. [1]

delayed health effects: Adverse health effects that occur after a single exposure, a short-term exposure, a continuous or chronic exposure to a substance. These effects manifest themselves after a relatively long period of time and are usually irreversible or of long duration (e.g., cancer, birth defects).

delayed hazard: A hazard where the adverse effects are delayed. This includes the potential for a substance to cause an adverse effect that manifests itself after a relatively long period of time. Carcinogenicity, teratogenicity and certain target organ/system effects are examples of delayed hazards.

dermatitis: Inflammation, irritation or reddening of the skin. [5]

developmental effects: See Glossary term “developmental toxicity”.

developmental toxicity: Broadly defined to include any effect interfering with normal development and includes embryotoxic/fetotoxic effects, teratogenic effects or other effects that occur before and after birth. See Section 3.3.3.3.

[EPA] Adverse effects on the developing organism that may result from exposure prior to conception (either parent), during prenatal development, or postnatally until the time of sexual maturation. The major manifestations of developmental toxicity include death of the developing organism, structural abnormality, altered growth, and functional deficiency. [9]

distributor: A business other than a chemical manufacturer or importer, which supplies hazardous chemicals to other distributors or to employers. [3]

DOT: Department of Transportation. The United States’ Federal agency with the primary regulatory and enforcement authority, regarding the transport (by air, land, and water) of hazardous materials.

dust: Solid particles generated by handling, crushing, grinding, rapid impact, detonation or decrepitation of organic or inorganic materials, such as rock, ore, metal, coal, wood, and grain. Dusts do not tend to flocculate, except under electrostatic forces; they do not diffuse in air but settle under the influence of gravity. [10] Also, see Glossary terms *“combustible dust”* and *“explosive dust.”*

ecotoxicity: The potential of a chemical to cause a toxic effect on an environmental organism other than humans.

employee: A worker who may be exposed to hazardous chemicals under normal operating conditions or in foreseeable emergencies. [3]

employer: A person engaged in a business where chemicals are either used, distributed, or are produced for use or distribution, including a contractor or subcontractor. [3]

environmental hazard: The adverse effects (measured as ecotoxicity) that may result from exposures (related to persistence and bioaccumulation potential) to a chemical or physical agent present in the environment.

EPA: Environmental Protection Agency. The United States’ Federal agency having primary regulatory authority on environmental matters.

epidemiological: That which is related to epidemiology.

epidemiology: The branch of science concerned with the study of human disease in specific populations in order to develop information about the causes of disease and identify preventive measures. [1]

explosive: A chemical that causes a sudden, almost instantaneous, release of pressure, gas and heat when subjected to sudden shock, pressure, or high temperature [3]. Note: The DOT defines an explosive as 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. [6]

explosive dust: A combustible dust that with confinement and in the presence of a suitable ignition source will explode when suspended in air in adequate concentrations. See U.S. CSB, 2005. (See also glossary term *"combustible dust."*)

exposure: "Exposure" or "exposed" means that an employee is subjected in the course of employment to a hazardous chemical that is a physical or health hazard and includes potential (e.g., accidental or possible) exposure. "Subjected" in terms of health hazard includes any route of entry (e.g., inhalation, ingestion, skin contact or absorption). [3]

extremely flammable liquid: Any liquid having a flash point less than 20°F (-6.7°C) or any liquid having a flash point of less than 141°F (60.5°C) and a boiling point of less than 95°F (35°C).

°F (degree Fahrenheit): A unit of temperature where water boils at 212°F and freezes at 32°F. To convert °F to °C, subtract 32, then multiply by 5/9.

first aid: Immediate medical or safety measures that can be administered to or taken by a person who has been adversely exposed to a hazardous chemical. First aid can include measures such as stopping the exposure and using materials generally available (e.g. water to flush eyes) to reduce or eliminate adverse health effects.

flammable: A material that is easily ignited and burns with extreme rapidity [5]. Also, see Glossary term *"combustible"*.

flammable gas:

(OSHA) (a) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of thirteen (13) percent by volume or less; or (b) A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than twelve (12) percent by volume, regardless of the lower limit. [3]

(DOT) A material which is a gas at 68°F (20°C) or less and 101.3 kPa (14.7 psi) of pressure. A material which has a boiling point of 68°F (20°C) or less at 101.3 kPa (14.7 psi) and: a) is ignitable at 101.3 kPa (14.7 psi) when in a mixture of 13% or less by volume with air; or b) has a flammable range at 101.3 kPa (14.7 psi) with air of at least 12% regardless of the lower limit. [6]

flammable liquid:

(OSHA) Liquid, flammable means any liquid having a flashpoint below 100°F (37.8°C) except any mixture having components with flashpoints of 100°F (37.8°C) or higher, the total of which make up 99 percent or more of the total volume of the mixture. [3]

(DOT) A flammable liquid (Class 3) means a liquid having a flash point of not more than 60.5°F (141°F) or any material in a liquid phase with a flash point at or above 37.8°C (100°F) that is intentionally heated and offered for transportation or transported at or above its flash point in a bulk packaging, with the following exceptions:
(1) Any liquid meeting one of the definitions specified in 49 CFR 173.1115;
(2) Any mixture having one or more components with a flash point of 60.5°C (141°F) or higher, that make up at least 99 percent of the total volume of the mixture, if the mixture is not offered for transportation or transported at or above its flash point;
(3) Any liquid with a flash point greater than 35°C (95°F) which does not sustain combustion. A procedure for determining if a material sustains combustion when heated under test conditions and exposed to an external source of flame is provided in 29 CFR Appendix H of this 49 CFR 173.120;
(4) Any liquid with a flash point greater than 35°C (95°F) and with a fire point greater than 100°C (212°F) according to ISO 2592;
(5) Any liquid with a flash point greater than 35°C (95°F) which is in a water-miscible solution with a water content of more than 90 percent by mass. [6]

flammable solid:

(OSHA) 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. A chemical shall be considered to be a flammable solid, if when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis [3]. Also see DOT definition for "flammable solid" at 49 CFR 173.124(a).

flash point: The minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested by one of the following:

(1) Tag closed cup tester (in accordance with ANSI/ASTM D56) is for liquids with a viscosity of below 5.5 centistokes at 104°F (40°C), or below 9.5 centistokes at 77°F (25°C) and a flash point below 200°F (93°C) that do not contain suspended solids and that do not have a tendency to form a surface film under test conditions.
(2) Pensky-Martens closed cup tester (in accordance with ANSI/ASTM D93-02a) is for liquids with a viscosity greater than 5.5 centistokes at 104°F (40°C) that contain suspended solids and that tend to form a surface film under test conditions.
(3) Setaflash closed-cup apparatus (in accordance with (ASTM D3278) is for liquids having flash points between 32°F (0°C) and 230°F (110°C) and a viscosity lower than 150 stokes at 77°F (25°C). For mixtures, if the result of the test by any of these methods is above 100°F (37.8°C), evaporate a fresh sample to 90% of the original volume and retest. The lower of the two values shall be taken as the flash point.

fume: Airborne particulate formed by the condensation of solid particles from the gaseous state. Usually, fumes are generated after initial volatilization from a combustion process, or from a melting process (such as metal fume emitted during welding). Usually less than 1 micron in diameter. [10]

GHS: The Globally Harmonized System of Classification and Labeling of Chemicals. Contains harmonized classification criteria and hazard communication elements. See Annex C.

hazard: An inherent property of a chemical to cause harm. A chemical can be classified as a health hazard, physical hazard and/or an environmental hazard. Hazards can be either immediate or delayed. See Section 3.1.

hazard determination: See *"hazard evaluation".*

hazard evaluation: The process of evaluating all relevant data and producing scientifically sound conclusions that identify the specific hazards of a particular chemical. May also be called *"hazard determination"*. See Section 3.

hazardous: The capability of a chemical to produce an adverse effect on human health or the environment based on the chemical's inherent physical, chemical, and toxicological properties,. Note also, that the term "hazardous" may be used in conjunction with other words (e.g., "hazardous chemical", "hazardous material", etc) that are defined by many laws and regulations including OSHA (29 CFR), DOT (49 CFR), CERCLA (40 CFR) and RCRA (40 CFR).

hazardous chemical: Any chemical which presents a physical, health or environmental hazard. [3]

HCS: Hazard Communication Standard; an OSHA regulation issued under 29 CFR Part 1910.1200. It details the regulatory requirements for manufacturers, importers and employers regarding chemical hazards evaluation, hazard communication and workplace training, and includes the prerequisites for MSDSs and chemical labeling in the workplace.

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 an acute or chronic health effect may occur in exposed employees. The term, health hazard, includes chemicals that are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents that act on the hematopoietic system and agents that damage the lungs, skin, eyes, or mucous membranes. [3]

hematopoietic system: System responsible for the formation of blood cells.

hepatotoxins: Chemicals which produce liver damage. [3]

highly toxic chemical: See Sections 3.3.1.3.1, 3.3.1.4.1, and 3.3.1.5.1.

HMIS®: Hazardous Material Information System. A system, developed by the National Paint and Coatings Association, designed to inform workers of the hazards of the chemicals they use and of means of protecting themselves from those hazards.

IARC: International Agency for Research on Cancer. A scientific panel of the World Health Organization (WHO) that evaluates and classifies the carcinogenic potential of chemicals and processes.

identity: Any chemical or common name which is indicated on the material safety data sheet (MSDS) for the chemical. The identity used shall permit cross-references to be made among the required list of hazardous chemicals, the label and the MSDS [3]. Also, see Glossary terms *"common name"* and *"specific chemical identity".*

IM (intramuscular): Injection into a muscle. A route of administration.

immediate hazard: The inherent property of a chemical to cause an adverse effect that manifests itself after a short period of time. As used in this Standard, immediate hazard includes acute toxicity and physical hazards.

immediate health effects: Adverse health effects that manifest themselves soon after an acute exposure. See Section 3.2.

importer: The first business with employees within the Customs Territory of the United States, which receives hazardous chemicals produced in other countries for the purpose of supplying them to distributors or employers within the United States. [3]

ingestion: The taking a substance into the body (stomach) through the mouth; swallowing. [5]

inhalation: The breathing in of air, gas, vapor, mist, fume or suspended particulates.

in vitro: Experiments with cells or tissues from organisms conducted outside of the organism.

IP (intraperitoneal): Injection into the peritoneal cavity. A route of administration.

irritant: A substance that will cause an inflammatory response or reaction of the eye, skin, or respiratory system, following a single or multiple exposures. [5] See Section 3.3.1.2

Also, note that according to OSHA, an irritant is a non-corrosive chemical, which causes a reversible inflammatory effect on living tissue at the site of contact (e.g., eyes, skin, or respiratory tract). This may include defatting agents, which by removal of natural skin oils, causes irritation following prolonged or repeated exposure. Materials with Draize skin tests scores below two are not generally considered skin irritants, while scores of five or above generally indicate severe skin irritants. The degree of irritation is determined by using recognized guidelines or other appropriate techniques. [3] (See 16 CFR 1500.41, 16 CFR 1500.42 and the OECD Guidelines for Testing of Chemicals, Number 404 and 405.)

(OSHA) A chemical is an eye irritant if determined by using the procedures in 16 CFR 1500.42 or other appropriate techniques.

IV (intravenous): Injection into a vein. A route of administration.

label: The display of written, printed, or graphic signs, pictures or symbols, which is intended to provide information and which is affixed to, printed on, or attached to the immediate chemical container, as well as on any outside packaging. Note: The HCS defines "label" as any written, printed, or graphic material displayed on or affixed to containers of hazardous chemicals. [3]

labeling: A term which encompasses container labels and all other documents that contain precautionary and hazard communication information. These other documents may include MSDS, product literature, technical brochures, training materials, process standards and other types of communication.

LC_{50} (Lethal concentration): The calculated concentration of a material in air that is expected to kill 50 percent of a group of test animals with a single exposure (usually 1 or 4 hours). The LC_{50} is expressed as parts of material per million parts of air, by volume (ppm) for gases and vapors, or as milligrams of material per liter of air (mg/l) or milligrams of material per cubic meter of air (mg/m^3) for dusts and mists as well as for gases and vapors.

LD_{50} (Lethal dose): A single calculated dose of a material expected to kill 50 percent of a group of test animals. The LD_{50} dose is usually expressed as milligrams or grams of material per kilogram of animal body weight (mg/kg or g/kg). The material may be administered by mouth or applied to the skin.

local health effects: An adverse health effect that occurs primarily at the site of contact or exposure. See Section 3.3.

mists: Suspended liquid droplets generated by condensation from the gaseous to the liquid state or by breaking up a liquid into a dispersed state, such as by splashing, foaming, or atomizing. Formed when a finely divided liquid is suspended in air. [10]

mixture: A physical combination of two or more components whereby the individual components do not chemically react with each other. Note: The HCS defines a "mixture" as any combination of two or more chemicals if the combination is not, in whole or in part, the result of a chemical reaction. [3]

MSDS: Material Safety Data Sheet.

mutagen: A substance or agent capable of altering the genetic material in a living cell. [1] See Section 3.3.3.4.

narcosis: A stupor or state of unconsciousness produced after chemical exposure.

neurotoxin: A material that affects the nerve cells and may produce emotional or behavioral abnormalities.

neutralize: To eliminate potential hazards by inactivating strong acids, caustics and oxidizers. For example, acids can be neutralized by adding an appropriate amount of caustic substance to the spill.

NFPA: National Fire Protection Association. An international membership organization focused on promoting and improving fire protection/prevention. The NFPA establishes more than 300 scientifically based consensus codes and standards. The "Flammable and Combustible Liquids Code" (NFPA 30) and the "Standard System for the Identification of the Hazards of Materials for Emergency Response" (NFPA 704) may be helpful to authors of hazardous industrial chemical labeling.

NIOSH: National Institute for Occupational Safety and Health. Part of the Centers for Disease Control and Prevention in the United.States Department of Health and Human Services (DHHS); a Federal agency which, in addition to other activities, tests and certifies respiratory protective devices, and air sampling detector tubes, recommends occupational exposure limits for various substances, and assists OSHA in occupational safety and health investigations and research. [5]

NTP: National Toxicology Program. A United States federal interagency program whose mission is to evaluate agents of public health concern. NTP oversees the external scientific evaluation of substances nominated for listing in or de-listing from the "Report on Carcinogens". Also, see Glossary term *"RoC".*

oral: Used in or taken into the body through the mouth. Also, see Glossary term *"ingestion"*.

organic peroxide: Any organic compound containing oxygen (O) in the bivalent -O-O- structure and that may be considered to be a structural derivative of hydrogen peroxide where one or more of the hydrogen atoms has been replaced by an organic radical. [3]

OSHA: Occupational Safety and Health Administration of the US Department of Labor. The U.S. Federal agency that regulates workplace safety and health for most U.S. industries and businesses. Also, see Glossary term *"Hazard Communication Standard (HCS)".*

oxidizer:

(OSHA) "Oxidizer" means a chemical other than a blasting agent or explosive as defined in 29 CFR 1910.109 (a), that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases. [3]

(DOT) A material that may, generally, by yielding oxygen, cause or enhance the combustion of other materials. [6]

physical hazard: See Section 3.2.

physical state: Physical form of a chemical (solid, liquid, gas).

pneumonitis: Inflammation of the lungs. [10]

poison: Substance that, taken into or formed within the organism, impairs the health of the organism and may kill it [12]. A highly toxic chemical. See Sections 3.3.1.3.1, 3.3.1.4.1, and 3.3.1.5.1. Also, see Glossary term *"poisonous material".*

poisonous material:
(DOT) 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:

(1) Is presumed to be toxic to humans because it falls into one of the following categories when tested on laboratory animals (whenever possible, animal test data that has been reported in the chemical literature should be used):

a) Oral toxicity. A liquid with an LD_{50} for acute oral toxicity of not more than 500 mg/kg or a solid with an LD_{50} for acute oral toxicity of not more than 200 mg/kg.
b) Dermal toxicity. A material with an LD_{50} for acute dermal toxicity of not more than 1000 mg/kg:
c) Inhalation toxicity.
   (A) A dust or mist with an LC_{50} for acute toxicity on inhalation of not more than 10 mg/l; or
   (B) A material with a saturated vapor concentration in air at 20°C (68°F) of more than one-fifth of the LC_{50} for acute toxicity on inhalation of vapors and with an LC_{50} for acute toxicity on inhalation of vapors of not more than 5000 ml/m^3; or

(2) Is an irritating material, with properties similar to tear gas, which causes extreme irritation, especially in confined spaces. [6]

polymerization: A chemical reaction in which two or more small molecules combine to form larger molecules (polymers) that contain repeating structural units of the original molecules. A hazardous polymerization is one with an uncontrolled release of energy. [10]

precautionary labeling: See Section 2.

PPE: Personal Protection Equipment. Clothing or devices worn by a worker to prevent exposure to hazards in the workplace. Examples include respirators, gloves, safety glasses, chemical-resistant clothing, etc.

product name: The name under which a product is sold. Also, see Glossary term *"identity".*

pulmonary edema: A build-up of fluid in the lungs.

pyrophoric: A chemical that will ignite spontaneously in air at a temperature of 130°F (54.4°C) or below [3]. See Glossary term *"spontaneously combustible material".*

pyrophoric material: A liquid or solid that, even in small quantities and without an external ignition source, can ignite within five (5) minutes after coming in contact with air when tested in accordance with UN Manual of Tests and Criteria [11]. See Glossary term *"spontaneously combustible material".*

reactivity: Chemical reaction with the release of energy. The tendency of a substance to undergo a chemical change with the release of energy. Undesirable effects (pressure buildup, temperature increase, formation of noxious, toxic, or corrosive by-products) may occur because of a reaction to heating, burning, direct contact with other materials, or other conditions when in use or in storage. [5]

reproductive toxicant: Chemical that adversely affect male or female fertility and may include damage to reproductive organs. See Section 3.3.3.3. Also note: HCS Appendix A defines "reproductive toxins" as chemicals that affect the reproductive capabilities including chromosomal damage (mutagens) and effects on fetuses (teratogenesis). [3]

respiratory: Related to breathing.

respiratory sensitizer: A substance that will induce hypersensitivity of the airways following inhalation of the substance. [8]

responsible party: Someone who can provide additional information on the hazardous chemical and appropriate emergency procedures, if necessary. [3]

risk assessment: The process for evaluating hazard *and* exposure information in order to estimate the probability that a chemical will cause an adverse effect under specific exposure conditions. See Section 3.

RoC (Report on Carcinogens): An informational scientific and public health document that identifies agents, substances, mixtures, or exposure circumstances that may pose a hazard to human health by virtue of their carcinogenicity. The RoC is published biennially and compiles data on carcinogenicity, genotoxicity (ability to damage genes), and biologic mechanisms of the listed substance in humans and/or animals. Also, see Glossary term *"NTP".*

routes of exposure: The means by which a chemical may gain access to the body, for example, through the gastrointestinal tract (ingestion), lungs (inhalation), skin (topical) or eyes.

RTECS: Registry of Toxic Effects of Chemical Substances. Published by NIOSH, RTECS is a compendium of the known toxic and biological effects of chemical substances.

SADT: The self-accelerating decomposition temperature. The SADT is the lowest temperature at which self-accelerating decomposition of an organic peroxide may occur in the packaging as used in transport. Organic peroxides with SADT values below 50°C. are temperature controlled for transport and storage.

SQ: See *Subcutaneous*.

sensitizer: A chemical that, following an initial exposure, causes a substantial number of exposed humans or animals to develop an allergic reaction in normal tissue during subsequent exposure to low doses of that chemical. Also, see Section 3.3.2.

sensitization: Immune process whereby individuals become hypersensitive to substances pollen, dandruff, or other agents that make them develop a potentially harmful allergy when they are subsequently exposed to the sensitizing material (allergen). [12]

signal word: Word used in labeling to indicate the relative degree of severity of an immediate hazard. They are used in diminishing order of severity: **DANGER, WARNING**, and **CAUTION**. Also, see Section 5.4. [4]

solubility: The ability of a substance to be dissolved in another substance. Can be expressed as a number describing the degree to which one material will dissolve in another. For example, a chemical's solubility in water can be expressed as the number of grams of the chemical that will dissolve in 100 mL of water, or as grams per Liter, or as weight percent at ambient temperature.

solution: Any homogeneous liquid mixture of two or more chemical compounds or elements that will not undergo any segregation under conditions normal to transportation. [13]

specific chemical identity: The chemical name, CAS #, or any other information that reveals the precise chemical designation of the substance. [3] Also, see Glossary term *"identity".*

specific gravity: The ratio of the density of a material to the density of water at a given temperature. Also the ratio of the density of a vapor or gas as compared to the density of air at a specified temperature.

spontaneously combustible material: DOT term used for "pyrophoric material" and "self-heating material." Also, see Glossary term *"pyrophoric material".*

Standard: This standard known as ANSI Z129.1, and is also known as *the "American National Standard for Hazardous Industrial Chemicals – Precautionary Labeling."*

subchronic (health effect): An adverse health effect that occurs after repeated daily exposure (usually for several weeks or months) of experimental animals to a chemical for part (approximately 10 percent) of the animals' life span.

subcutaneous: Under the skin.

SUS: Saybolt Universal Seconds, is a unit of measure for viscosity. It is the time in seconds required for 60 milliliters of a fluid to flow through the orifice of a Saybolt Universal viscometer at a given temperature. See also, Glossary term *"aspiration".*

systemic health effects: The adverse health effects that occur, following absorption and circulation of a chemical, in a part or parts of the body distant from the site of exposure or administration (e.g., lead ingestion and neurological effects). See Section 3.3.

target organ effect: An organ on which a chemical causes a toxic effect. The effect of a material on an organ or system can be a result of direct contact with the organ or through systemic toxicity. OSHA provides examples of the types of target organ effects in 29 CFR 1910.1200, Appendix A.

teratogen: A material that has the capability of causing physical defects or permanent structural change in a developing embryo or fetus that may adversely affect survival, development or function. Also, see Glossary term *"developmental toxicity".*

TLVs®: Threshold limit values. Refers to airborne concentrations of chemical substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed, day after day, over a working lifetime, without adverse health effects. [14] These values are established and published by ACGIH.

toxic chemical:

A chemical that falls within any of the following categories:

- A chemical that has a median lethal dose (LD_{50}) of more than 50 milligrams per kilogram (ppm), but no more than 500 milligrams per kilogram (ppm) of body weight, when administered orally to albino rats weighing between 200 and 300 grams each.
- A chemical that has a median lethal dose (LD_{50}) of more than 200 milligrams per kilogram, but no 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 the bare skin of albino rabbits weighing between 2 and 3 kilograms each.
- A chemical that has a median lethal concentration (LC_{50}) in air of more than 200 parts per million (ppm), but no more than 2000 parts per million (ppm) of gas or vapor by volume, or more than 2 milligrams per liter, but no more than 20 milligrams per liter, of mist, fume, or dust, when administered by continuous inhalation for 1 hour (or less, if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each. [3]

Also, see Standard Sections 3.3.1.3.2, 3.3.1.4.2, and 3.3.1.5.2.

toxicant: A substance that can cause harm to living organisms**.** A toxicant of biological origin is called a "toxin."

toxicology: The scientific discipline involving the study of the harmful effects of substances on living organisms and ecosystems.

trade secret: (OSHA) Trade secret means any confidential formula, pattern, process, device, information, or compilation of information that is used in an employer's business and that gives the employer an opportunity to obtain an advantage over competitors who do not know or use it. 29 CFR 1910.1200, Appendix D sets out the criteria to be used in evaluating trade secrets. [3]

vapors: The gaseous form of substances that are normally in the solid or liquid state (at room temperature and pressure). The vapor can be changed back to the solid or liquid state either by increasing the pressure or decreasing the temperature alone. Vapors also diffuse. [10]

vapor pressure: The pressure exerted by a saturated vapor above its own liquid in a closed container, usually reported on MSDS in millimeters of mercury (mmHg) at 68°F (20°C). [1]

WARNING: Signal word used in labeling that indicates a *potentially* hazardous situation which, if not avoided, could result in death or serious injury. See also signal words *"CAUTION"* and *"DANGER."* [4]

water reactive material: DOT term. See Glossary term *"water reactivity."*

water reactivity: Generally, the inherent ability of a chemical to react with water. The HCS defines "water reactive" as a chemical that reacts with water to release a gas that is either flammable or presents a health hazard. [3] The DOT term *"Water reactive material"* [13] is synonymous with "Dangerous when wet material", which means a material that, by contact with water, is liable to become spontaneously flammable or give off flammable or toxic gas at a rate greater than 1 liter per kilogram of material per hour when tested in accordance with UN Manual of Tests and Criteria [11].

WEEL (Workplace Environmental Exposure Level Guides): Developed and maintained by the AIHA WEEL Committee, the WEEL Guides are a compilation of airborne exposure limits. The WEEL Committee concentrates on chemicals, environmental agents and stresses for which there are no legal or authoritative limits in existence. All WEELs are expressed as time-weighted-average (TWA) concentrations. Exposure time periods listed in the 2004 guide include Short term TWA and 8-hr TWA. Also, see Glossary term *"AIHA".*

worker: See *employee.*

work area: A room or a defined space in a workplace where hazardous chemicals are produced or used, and where employees are present. [3]

workplace: An establishment, job site, or project, at one geographical location containing one or more work areas. [3]

List of Sources

[1] United States Department of Labor, *Draft Guidance for Hazard Determination – For Compliance with the OSHA Hazard Communication Standard*, Appendix A (March 18, 2004).

[2] National Institute for Occupational Safety & Health (NIOSH): http://www.cdc.gov/niosh/topics/aerosols/

[3] 29 CFR 1910.1200 et seq., (Jul 1, 2005). Occupational Health and Safety's Administration's Hazard Communication Standard (HCS).

[4] *American National Standard for Product Safety Signs and Labels*, ANSI Z535.4-2002.

[5] United States Department of Labor, *Draft Model Training Program for Hazard Communication* (March 18, 2004).

[6] See 49 CFR. 173 (Oct 1, 2004). Department of Transportation, Federal Hazardous Materials Regulations.

[7] See 49 CFR 136 – 137 (Oct 1, 2004). Department of Transportation, Federal Hazardous Materials Regulations.

[8] United Nations Globally Harmonized System of Classification and Labelling of Chemicals, Ch 3.4.1, p 151 (2005 rev. 1).

[9] Environmental Protections Agency, *Glossary of IRIS Terms*, (Sep 2003), http://www.epa.gov/iris/gloss8.htm.

[10] Fundamentals of Industrial Hygiene, Barbara A. Plog, et al. eds., (National Safety Council, 5th ed. 2001).

[11] 49 CFR 173.124 (Oct. 1, 2004), Department of Transportation, Federal Hazardous Materials Regulations.

[12] United States National Institutes of Health, National Library of Medicine – Environmental Health and Toxicology Specialized Information Services, Toxicology Glossary (2005), http://sis.nlm.nih.gov/enviro/glossarymain.html.

[13] 49 CFR 171.8, Department of Transportation, Federal Hazardous Materials Regulations.

[14] TLVs® and BEIs®, American Conference of Government Industrial Hygienists, p3 (2005 handbook).