AN IN-DEPTH LOOK AT GHS HAZARDS

In 2012, the U.S. adopted the Globally Harmonized System for the Classification and Labelling of Chemicals, or GHS for short.

GHS is a system used to: define health, physical, and environmental hazards of chemicals, classify these chemicals according to defined hazard criteria, and communicate hazard information in a clear and uniform manner.

In short, GHS is designed to effectively communicate chemical hazards uniformly, so that each label and SDS is set up similarly and easy to understand, no matter where in the world it is being used.

There have been various deadlines for GHS compliance that have come and gone in recent months and years.

- Dec. 1, 2013 – All employees should be trained on GHS formatting
- June 1, 2015 – Manufacturers should reclassify chemicals and implement use of labels and SDS's in GHS format
- Dec. 1, 2015 – Distributors should implement use of only GHS updated labels and SDS's
- June 1, 2016 – All employers should be in full compliance with GHS

GHS training should have taken place some time ago, and all chemicals should now be in full compliance with GHS. For distributors and users of chemicals, this means that you should know how to properly read and understand GHS labels and SDS's.

The purpose of this document is not to provide the basic training on reading GHS-compliant labels and SDS's, but to provide more information on the rationale behind the creation of these labels and SDS's. With this information, distributors and end users can:

- Become more knowledgeable about why specific hazard communications are or are not necessary
- Understand what the hazards actually mean
- Understand cases in which similar chemicals may be classified and handled differently

This is not a beginner's course in GHS; this is for those who want more information about what is behind the label, so they can make informed decisions about which chemicals to use and how to handle them.

This document focuses on the hazards and classes most commonly associated with chemical cleaners, but the information can be applied to any GHS chemical.

GHS HAZARDS

When classifying a chemical by GHS standards, it is first important to understand the various hazards and hazard classes under GHS, and the specific hazards that will commonly apply to the type of chemical you will be dealing with.

GHS divides all of its hazards into three hazard classes: physical hazards, health hazards, and environmental hazards. These hazards are then further classified into categories, which define the degree or extent of the hazard. Category 1 is the most severe or hazardous, with higher numbers becoming less hazardous (ie Category 3 is less severe than Category 2).

There are a wide variety of GHS hazards, and each is classified differently. It is best to focus on the specific hazards that are common to the area of the chemicals we are dealing with. In the case of cleaning chemicals, the following hazards are most common and therefore we will focus on these.

Flammable Liquids

A flammable liquid is a liquid with a flash point lower than 93 °C (200 °F). The lower the flash point of the liquid, the greater the hazard and the lower the category. Liquids with a flash point higher than 93 °C or with no flash point will not be categorized under flammable liquid. A Category 1 flammable liquid has a flash point below 23 °C (73 °F). Chemicals that fall in Categories 1 – 3 of the flammable liquid hazard will require a flame pictogram.

Corrosive to Metal

A chemical is considered corrosive to metal when chemical action will materially damage or destroy metals. Corrosion is measured on both steel and aluminum, and if corrosion exceeds 6.25 mm per year on either metal, the chemical is considered Category 1 corrosive to metal. Chemicals that corrode these metals by less than 6.25 mm per year, or do not cause any corrosion will not be classified under corrosive to metal. The corrosive to metal hazard requires the corrosion pictogram.

Acute Toxicity

Acute toxicity refers to adverse effects caused by oral (by mouth) or dermal (through the skin) exposure to a chemical. Acute toxicity is determined by the LD_{50} value of the chemical, or the lethal dose that kills 50% of a population of test subjects. The lower the LD_{50} value, the greater the hazard, and the lower the category. Chemicals with an oral LD_{50} of < 5 mg/kg are considered a Category 1 acute toxicity hazard, while those with an LD_{50} of > 2000 mg/kg will not be categorized under acute toxicity. Chemicals that fall in Categories 1 – 3 of the acute toxicity hazard will require the skull & crossbones pictogram.

Skin Corrosion/Irritation

Skin corrosion is the production of irreversible damage to the skin after exposure to a chemical. Skin irritation is the production of reversible damage to the skin after exposure to a chemical.

Skin effects are primarily determined by existing human experience, as well as test data from animal studies or observations. Other information, such as pH, is also sometimes used, but existing experience and test data should take precedence.

Chemicals are often considered corrosive to the skin if the pH is outside the range of 2 – 11.5. However, it is important to understand that existing experience and test data should take priority when classifying.

Special Case Example: A chemical has a pH of 1, which is outside the pH range of 2 – 11.5, therefore, logically this chemical should be classified as corrosive to skin. However, this chemical uses a special technology that causes it to be not corrosive, but an irritant to skin. There is testing data to prove the chemical is an irritant and not a corrosive. In this case, the testing data takes precedence, and the chemical should be considered an irritant, regardless of pH.

Chemicals that are corrosive to skin are classified as Category 1 under the skin effect hazard, while chemicals that are skin irritants are classified under Categories 2 & 3 under the skin effect hazard. Skin corrosives require the corrosive pictogram, while skin irritants require the exclamation point pictogram.

Eye Corrosion/Irritation

Eye corrosion, also referred to as serious eye damage, is the production of tissue damage in the eye, which is not reversible within 21 days after exposure to a chemical. Eye irritation the production of changes in the eye, but not tissue damage, which is reversible within 21 days after exposure to a chemical.

Eye effects are classified in a very similar way to skin effects. Existing human experience, as well as testing data is considered as the primary source of evidence in classification. pH is used to make general assumptions about eye effects, but prior experience and testing data take precedence.

Special Case: OSHA requires eye wash stations be present whenever chemicals are present that are corrosive to the eye. You are using a chemical with a pH of 1, so logic would dictate that this chemical is corrosive to the eye, and an eye wash station should be required. However, the chemical uses special technology that causes it to be an irritant to the eye, not a corrosive. There is testing data to support the claim that the product is not corrosive to the eye. In this case, the testing data takes precedence, and the chemical should not be considered corrosive. An eye wash station should not be required in this particular scenario.

Chemicals that are corrosive to the eye fall under Category 1 of eye effects, and eye irritants fall under Category 2A & 2B of eye effects. Category 1 corrosive chemicals require the corrosive pictogram, and Category 2A eye irritants require the exclamation mark pictogram, and Category 2B eye irritants do not require a pictogram.

Sensitization

A skin sensitizer is a chemical that leads to an allergic response following skin contact. A respiratory sensitizer is a chemical that leads to hypersensitivity of the airways following inhalation. The only way to determine if a chemical is a skin or respiratory sensitizer is by existing human experience and testing data. Chemicals that are found to be sensitizers will be classified under Category 1 of the sensitizer hazard. Respiratory sensitizers require the health hazard pictogram, while skin sensitizers require the exclamation mark pictogram.

Carcinogenicity

A carcinogen is a chemical that induces cancer or increases its incidence. Carcinogens are rarely found in cleaning chemicals, but they are used occasionally. GHS splits carcinogens into two groups: known or presumed carcinogens (Category 1), and suspected carcinogens (Category 2). If a chemical contains 0.1% or more of a carcinogen, it will be classified in the appropriate category of the carcinogen hazard. Carcinogens require the health hazard pictogram.

Reproductive Toxicity

Reproductive toxicity refers to adverse effects on sexual function and fertility in adults, as well as developmental toxicity. Alcohols are the most common reproductive toxicants, which is common knowledge (why you shouldn't consume alcohol while pregnant). Reproductive toxicants are classified similarly to carcinogens: known or presumed reproductive toxicants (Category 1), and suspected reproductive toxicants (Category 2). Reproductive toxicants require the health hazard pictogram.

Target Organ Toxicity

Target organ toxicity refers to chemicals that produce non-lethal toxicity to specific target organs following single or repeated exposure. Target organs include kidneys, liver, heart, lungs, and others. The primary means of classifying target organ toxicity is by prior human evidence. Target organ toxicants are split into three categories, based on severity of the toxicity. Category 1 target organ toxicants produce "significant toxicity," Category 2 substances are presumed to be harmful to human health, and Category 3 toxicants produce "transient target organ effects," such as narcotic effects and respiratory tract irritation. Category 1 & 2 target organ toxicants require the health hazard pictogram, while Category 3 requires the exclamation mark pictogram.

PICTOGRAMS

To communicate a chemical's hazards in the most efficient and easy-to-understand way possible, GHS established the use of universal pictograms.

Pictograms consist of images placed inside red diamonds to create emphasis. The image inside the diamond communicates the hazard of the chemical, and should be universal throughout any GHS-compliant material. There are 9 GHS pictograms: Explosive, Flammable, Oxidizing, Compressed Gas, Corrosive, Toxic, Harmful (Irritant), Health Hazard, and Environmental Hazard.

For the purpose of this document we will identify those pictograms that are common to chemical cleaners.

Flammable 

The Flammable pictogram is communicated by a flame. This pictogram communicates that a chemical is flammable, combustible, pyrophoric (ignitable by exposure to air), or self-heating.

Corrosive 

The Corrosive pictogram is communicated by a liquid contacting and corroding a surface and a hand. This pictogram communicates that a chemical is corrosive (not an irritant) to metal, skin, or eyes. This is one of the more common pictograms you will see on some cleaning chemicals.

Toxic

The Toxic pictogram is communicated by a skull and crossbones. This pictogram communicates that a chemical is toxic (poisonous) by either an oral (by mouth) or dermal (through skin) route. The Toxic pictogram mainly corresponds to the acute toxicity hazard.

Health Hazard

The Health Hazard pictogram is communicated by an "exploding chest." Health hazards communicated by this pictogram include carcinogenicity, reproductive toxicity, target organ toxicity, and sensitization.

Harmful (Irritant)

The Harmful pictogram is communicated by an exclamation mark. This pictogram communicates that there are lesser hazards associated with the chemical, and is generally considered less dangerous than the other pictograms. Hazards associated with the Harmful pictogram include lesser acute toxicity, skin and eye irritation, and lesser target organ toxicity.

Special Case: It is important to understand that if a chemical does not fall under any GHS hazards, then that chemical will not have any pictograms associated with it. Not every chemical needs a pictogram.

LABEL ELEMENTS

Once a cleaning chemical's hazards have been appropriately classified by GHS standards, we can create literature, labels, and SDS from this information.

GHS has created a system in which specific pictograms, hazard statements, and precautionary statements are required for use when a certain hazard classification is present. So once the classification is known, all of the rest of the relevant data can be generated using this system.

GHS has created special tables for each category of each hazard, which state which pictograms and hazard statements are required. As a chemical manufacturer, once you have classified the hazards of a chemical, all that is needed is to follow the appropriate GHS tables to generate the right pictograms, hazard statements, and precautionary statements.

Note that if a chemical has more than one hazard (for example, a Category 1 skin corrosive and a Category 3 acute toxicant) then each table must be followed and all pictograms, hazard statements, and precautionary statements must be included on the label and SDS.

Special Case: Signal words and pictograms are set up in such a way that more important hazards (more dangerous) outweigh lower hazards and eliminate redundancies.

In the presence of other pictograms (corrosion, health hazard, skull & crossbones), the exclamation mark pictogram does not need to appear. This is due to the fact that the exclamation mark is generally used to communicate a low hazard, and the others are used to communicate higher hazards. The higher hazards outweigh the low hazard and the exclamation mark is not needed.

If both signal words “Danger” and “Warning” are required, the word “Warning” does not need to appear, for the same reason.

Using all our knowledge of GHS hazards and classification we can effectively categorize our chemicals and communicate its hazards in a meaningful way.

When creating labels and SDS for GHS chemicals, the process mainly comes down to classifying the chemical by GHS standards. Once that is done, it is relatively simple to include the necessary pictograms and hazard statements according to GHS requirements.

There are always special cases to be aware of, and some exceptions to look out for when considering the hazards and label elements of a GHS chemical. Pictograms are not always required for GHS chemicals. If a chemical is not classified under any hazards, you won’t see any pictograms. This doesn’t mean it isn’t correct, it means the chemical isn’t considered hazardous under GHS.

Also, when classifying a chemical, there are certain guidelines set forth by GHS, but testing data and prior human experience always rule over the general guidelines of GHS. If a chemical has a low pH (corrosive by general GHS guidelines) but has testing data to show it isn’t corrosive, the testing data wins out. Always be on the lookout for other sources of data.

Armed with all the above knowledge, GHS should become more and more clear the more we deal with it. The purpose of GHS is to make hazard communication clear, concise, and universal, and having the proper knowledge of GHS is a huge step in the right direction.

RESOURCES

GHS Complete Guide (The Purple Book)

Multi-Clean GHS Training Webpage