

Chemical Safety Presentation

Chemical safety is very important, it might not seem so now, but many times the effects of exposure to harmful materials can appear years after the initial exposure. So if in doubt; read the Safety Data Sheet, or SDS. Actually, before handling any chemical; read the SDS. If you don't understand the SDS, we're going to cover what the different sections mean shortly.

The policy before handling any new chemical is to read the Safety Data Sheet. Often times it is called the MSDS, or Material Safety Data Sheet, but it was renamed to Safety Data Sheet.

The sections of a SDS are, however sometimes arranged differently are:

1. Chemical product and company information.

Section 1 of the SDS contains the information on the product and manufacturer, which includes the contact information for the manufacturer, the recommended use of the chemical, as well as emergency phone numbers.

2. Composition/Information on ingredients

Section 2 of the SDS contains the other names that refer to the chemical. It also contains the chemical ingredients, trade secret claims, the Chemical Abstract Service (CAS) name and number, which can be looked up online.

3. Hazards identification

Section 3 of the SDS includes all of the hazards associated with the chemical. It contains pictograms, all elements associated with the chemical, and the mixtures with the mass fractions of the hazardous components.

4. First aid measures

Section 4 of the SDS contains the first-aid instructions in the case of exposure, which includes the symptoms and delayed symptoms associated with exposure to the chemical. It also includes the recommendations for immediate medical care and special treatment.

5. Firefighting measures (NFPA)

Section 5 of the SDS contains information on the firefighting measures as well as the flammability information. The flammability information includes the flashpoint, FP, which is the temperature that the material emits enough flammable vapors to ignite in air, but the fire wouldn't be sustained. It also includes the lower and upper flammability limits. The Lower Flammability Limit, or LFL/LEL, is the temperature in which the vapor pressure is high enough to sustain a fire. The Upper Flammability Limit, UFL, is the maximum concentration, in volume percent, in which the material can ignite. Above the UFL – the material will not ignite due to too little oxygen being available to sustain a fire.

Section 5 of the SDS also includes the suitable equipment to extinguish a fire, the equipment that is not appropriate for extinguishing a fire, advice on hazards created during a fire (such as hazardous combustion products), and recommendations on special protective equipment or precautions for firefighters.

6. Accidental release measures

Section 6 of the SDS contains information on the appropriate response to a spill, leak, or release including recommendations for small or large spills. It also states what personal protective equipment, or PPE, and personal precautions are necessary. Section 6 also contains details on the emergency procedures for accidental release of the material, the materials used to contain the material, and the cleanup procedures.

7. Handling and storage

Section 7 of the SDS includes the precautions for the safe handling of the material, the chemicals that are incompatible with it, minimizing release of the material into the environment, general hygiene practices, and specific storage requirements (such as ventilation).

8. Exposure control/Personal protection

Section 8 of the SDS includes the PPE required, OSHA Permissible Exposure Limits (PEL), the Threshold Limit Values (TLV), which are the legal limits for exposure to a chemical, usually in PPM or milligrams of the substance per cubic meter of air. It also contains special requirements, such as the type of material that the gloves need to be made of. The PEL is the time weighted average for 8 hours of exposure to a material. Section 8 also includes the Short Term Exposure Limit, or STEL, and the Ceiling Limit, TLV-C. The STEL is the maximum limit for an exposure of 15 minutes to a chemical, which can't be repeated more than 4 times per day. The TLV-C is the exposure limit that should not be exceeded at any time.

9. Physical and chemical properties

Section 9 of the SDS includes the appearance of the chemical (which includes the physical state it is in, the color, and other notable properties of the substance), the UFL and LFL, the odor threshold (which is the minimum concentration in which it can be detected by its smell), the vapor and liquid density, the boiling point and boiling range, the auto-ignition temperature (which is the temperature in which the material will spontaneously combust), the decomposition temperature, and other notable properties of the material.

10. Stability and reactivity

Section 10 of the SDS includes reactivity test data for the chemical, the chemical stability under normal conditions with descriptions of stabilizers, and safety issues if the material changes appearance. It also can include information on other hazardous reactions, which are conditions to be avoided and incompatibilities.

11. Toxicological information

Section 11 is a very important section of the SDS! It contains the likely routes of exposure to the chemical. (ingestion, inhalation, injection (cuts in skin), and dermal absorption)[3]. It contains information on the immediate, delayed, and chronic effects for short term and long term exposure. It also contains the description of the symptoms that can appear from exposure to the material and numerical measures of toxicity, such as the LD50. The units that LD50 are in are the weight of the material in grams or milligrams per kilogram of body weight. Section 11 also contains the Immediate Danger to Life or Health (IDLH) concentrations. The lower the IDLH – the more hazardous the material is. Fun fact: it would take about 37 12 ounce beers with a 7% ABV to maybe kill me. That's 13 liters or 3.434 gallons of beer! Funny enough, it only would take 6.3 L or 1.664 gallons of water to maybe kill me.

Some terms that may be featured in the section of the SDS regarding toxicological information are listed below:

Irreversible effects [3]

Carcinogenic: Material is known to cause cancer in laboratory animals (and people).

Mutagenic: Material is known to cause damage to DNA which can cause a mutation to occur. (An example would be exposure to Agent Orange causing dermatological problems).

Teratogenic: Material is known to cause birth defects (An example would be that would be that Thalidomide is known to cause severe deformities)

Reproductive Hazard: Material is known to damage the reproductive system.

Effects that may or may not be reversible [3]

Dermatotoxic: affects skin

Hemotoxic: affects blood

Hepatotoxic: affects liver

Nephrotoxic: affects kidneys

Neurotoxic: affects nervous system

Pulmonotoxic: affects lungs

12. Ecological effects

Section 12 of the SDS covers information on the effects that the chemical has on terrestrial and aquatic organisms as well as the potential of bioaccumulation, potential to persist or degrade in the environment, and the adverse effects it has on the environment.

13. Disposal considerations

Section 13 of the SDS contains information on how the material is to be disposed of properly and descriptions of physical and chemical properties that may affect disposal as well as special considerations for disposal.

14. Transportation

Section 14 of the SDS contains information for DOT Classification of the material, the UN number, the proper shipping name, the environmental hazards, guidance for bulk transportation, and other special precautions.

15. Regulatory

Section 15 of the SDS includes information on safety, health, and environmental regulations not previously covered in another section of the SDS.

16. Other

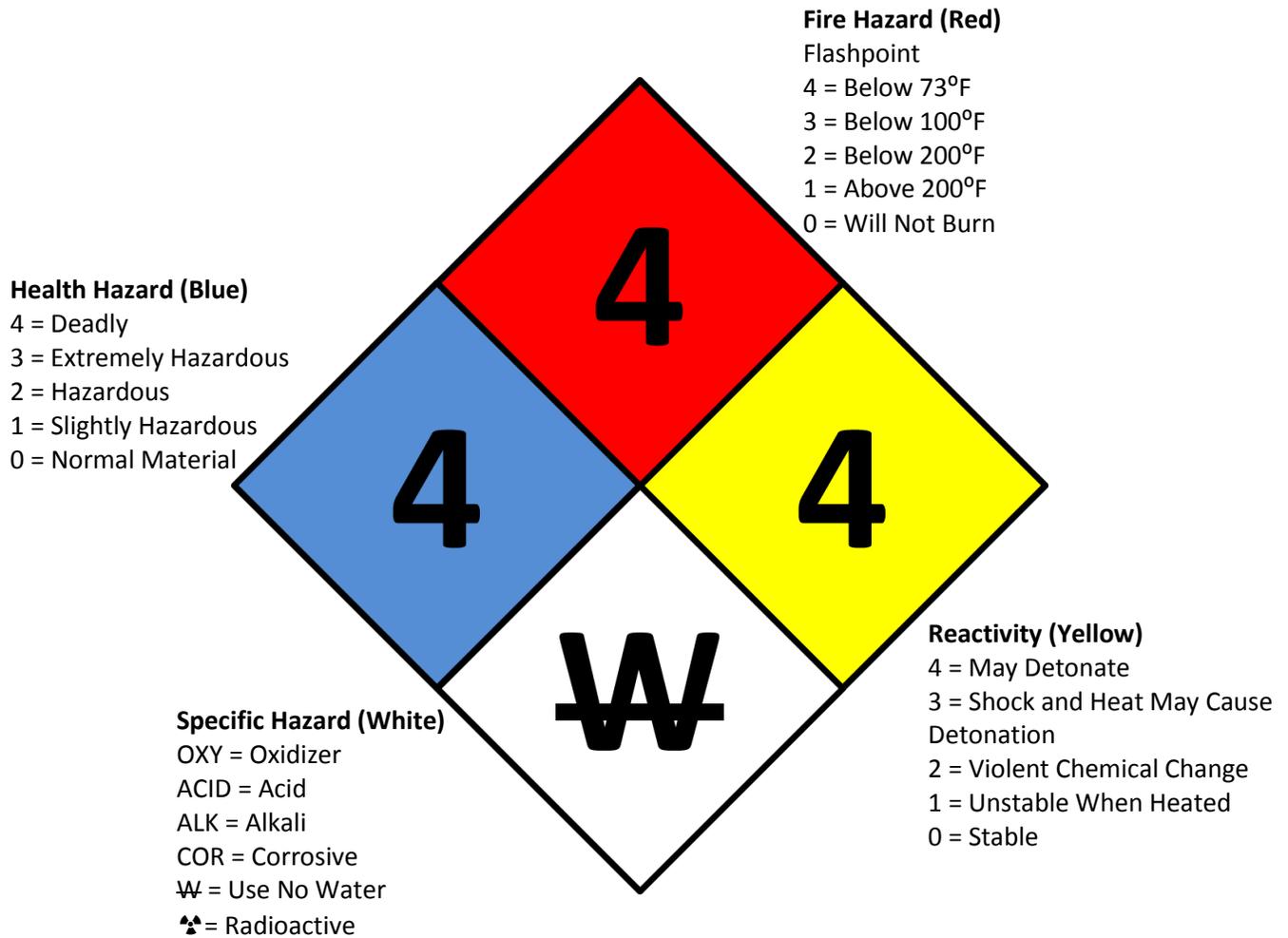
Section 16 of the SDS includes changes from the previous SDS.

Sections 1-16 of the presentation unless otherwise noted: cited [1].

Now for the quick reference material that is commonly used.

The National Fire Protection Association has something known as the Fire Diamond, or NFPA 704. The NFPA 704's sections, apart from the specific hazard section, range from 0 to 4 with 0 being the safest and 4 being the most hazardous.

Display NFPA 704: cited [2].



Now for the different classes of flammability:

Class IA: FP < 22.8°C Boiling Point < 37.8°C

Class IB: FP < 22.8°C Boiling Point > 37.8°C

Class IC: FP < 22.8°C Boiling Point: All

Class II: FP > 22.8°C Boiling Point: All

Class IIA: FP > 60°C Boiling Point: All

Class IIIB: FP > 93°C Boiling Point: All

There is another commonly used hazard awareness system is the Hazardous Material Identification System, or HMIS. Between the NFPA 704 and the HMIS the difference is that reactivity is replaced with physical hazard and the special hazards section has PPE instead.

This is a useful link:

http://www.uah.edu/images/administrative/facilities/facilities/Hazard_Communication.pdf

Cited:

[1]: Cerro, Ramon. "OSHA and Safety at Work." ChE 439 Class Notes, October 28, 2015, 2-33. Accessed March 20, 2016.

[2]: Cerro, Ramon. "Fire and Intrinsic Safety." ChE 439 Class Notes, November 18, 2015, 10-12. Accessed March 20, 2016.

[3]: Cowl, Daniel A., and Joseph F. Louvar. Chemical Process Safety Fundamentals With Applications. 3rd ed. Upper Saddle River: Prentice Hall, 2011.

For [3] all information is from chapters 2 and 3.