Appendix B

Reading an MSDS
CO2 Cartridge
EFS 2/3A Battery
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HDX-106 Explosive
Lead Chloride Battery
LiSO2 Battery
Silver Chloride Battery
Squib
SX2 Explosive
Thermal Battery

Guide to Using Material Safety Data Sheets (MSDS)

This guide may be a useful starting point for interpreting MSDS's. Contact your local Environmental Safety Office for assistance.

The U.S. chemical manufacturing industry and federal government developed a chemical identification system, which requires that a descriptive paper document accompany every chemical shipped, used or stored. These documents are called Material Safety Data Sheets (MSDS) and they are sent to users such as industries, hospitals, universities and others when the chemicals are shipped. A company that produces chemical products writes MSDS's for them.

The following questions can be answered by reading an MSDS, although not all questions apply to all chemicals.

What is the Chemical or Substance and Who Makes It?

- What is the name of the chemical as it appears on a container's label?
- What is the trade or brand name that the manufacturer uses?
- What is the chemical's common name?
- What is the scientific name?
- Who makes it?
- What is the company's address?
- What is the company's emergency telephone number?

- What is the Chemical Abstracts Service (CAS) number (for identifying it in case you misspell or misread the name)?

Hazardous Ingredients--What is in a chemical?

- What is the "permissible exposure level" (PEL)? The PEL tells how much (the concentration) of an air contaminant a worker can be exposed to for 8 hours a day, 40 hours a week, over a working lifetime (30 years), without suffering adverse health effects.

- What is the "threshold limit value" (TLV) recommended by the American Conference of Governmental Industrial Hygienists even though the TLV is not enforceable? The TLV is a term used to express how much of a substance in the air nearly everyone can be exposed to day after day, without adverse effects.

    - The TLV is expressed in three ways:

        - ♦ TLV-TWA: the allowable time-weighted average concentration for a normal 8-hour workday or 40-hour workweek.

        - ♦ TLV-STEL: the short-term Exposure Limit, or maximum concentration for a continuous 15-minute exposure period. The most allowed are four such periods in a workday, with at least 60 minutes between exposure periods, as long as the TLV-TWA is not exceeded.

        - ♦ TLV-C: the Ceiling limit--the amount of concentration that should not be exceeded, even for brief periods.

- Unfortunately, because most chemicals have not been tested for their long-term health hazard, reproductive effects or potential to cause cancer, these PEL and TLV descriptions merely serve as warnings.

Physical Data--How does it react?

What is the vapor pressure?

This is important for people concerned with shipping, storing and disposal. Vapor pressure is the pressure of gas at the surface of a liquid that is evaporating. Gasoline, for example, evaporates easily. Sometimes you can see it evaporating as you fill your cars gas tank. Liquids that evaporate easily are worrisome because vapor can build up around you quickly. It is a particularly big problem in confined spaces. The lower the boiling point of a substance, the higher its vapor pressure.

What is the Specific Gravity?

This refers to a material's weight compared to that of an equal amount of water. Substances having a specific gravity of 1, such as liquid Drano (a household flushing liquid for toilet and sink drains) and other acids, will sink in water; those with specific gravity less than 1, such as oils, will float. Most flammable liquids have a specific gravity less than 1.0 and if not soluble, will float on water. This is important for fire suppression and for handling emergency spill situations where something might enter a body of water. It also has bearing on how the substance is handled in conjunction with other substances with which it might be mixed.

What is its Appearance and Odor?

These are important to someone who handles it. Appearance and odor refer to what something looks and smells like. SaniTuff, for example, is described as green and viscous (soupy) with a citrus (orangy-lemony) odor. The big concern is that just because you can smell something doesn't mean you can tell how much of it is present! Some gases, such as carbon monoxide, affect you without you ever knowing it. You can become accustomed to others, such as hydrogen sulfide, without ever knowing it and therefore you wouldn't notice that it was building to a deadly level.

What is its Solubility?

This might be important for someone concerned with environmental effects. Solubility refers to how much of a substance can dissolve in water or other substances. Water is frequently used as a standard or base for comparison. If less than 0.1 percent can dissolve, such as kerosene and propane, then the amount is considered “negligible.” If 0.1 percent to 1.0 percent can dissolve, it is considered “slight.” If 1 to 10 percent can dissolve, it is considered “moderate.” If more than 10 percent can dissolve, it is considered “appreciable.” Complete means the whole works, such as windshield solvent and ammonia, can dissolve.

What is the boiling point?

This is the temperature at which a liquid boils and turns into a gas; something to worry about with liquids that are highly flammable. This factor is of concern during storage and transportation, as well as handling on the job.

What is its Vapor Density?

This is the weight of a gas compared to an equal amount of air, which is 1. If the density is greater than 1, like kerosene (4.7), its vapors will sink. If it is lower than 1, like ammonia is (0.596), it will rise. This factor can be a problem depending upon whether you are working in a low or high position, particularly in confined spaces, and the vapor rises or falls easily. It is also of interest in emergency spill situations where

large quantities might escape and either rise quickly above ground level presenting little danger to people, or remain close to ground level and present a health threat.

What are its Melting and Freezing Points?

These are the temperatures at which a solid, such as ice, becomes a liquid under normal atmospheric pressure, or freezes and becomes a solid.

What is the Evaporation Rate?

This describes how slowly or quickly a substance evaporates in comparison to another material. This measure is similar to the volatility mentioned for vapor pressure except that it uses materials other than mercury as a reference standard. A number greater than 1 (ether is rated as 1) indicates a material that evaporates more easily than the comparison substance. Alcohol, benzene and 1,1,1-trichloroethane are examples of substances that evaporate rapidly or easily. A number less than 1 means it evaporates more slowly, such as ammonia.

What is the Potential for Fire and Explosion?

When will a fire start and what should be done about it? How easily will a substance catch fire or explode and what material should be used to fight fires and explosions?

What is the flash point of a substance?

This is the lowest temperature at which you better start worrying about flammable or explosive vapors. Benzene, lighter fluid and gasoline, for example, have low flash points--they ignite easily. Tar-like Number 6 fuel oil is an example of a substance with a high flash point--it doesn't ignite easily.

What is the flammability or explosive limit?

This tells you how much gas or vapor must be present before a spark (including a lit cigarette) will set it off. LEL and UEL (lower and upper explosive limit) numbers are used to describe the range within which fire or explosion can occur. This means that if an ignition source, such as a flame or heat is present, a fire can occur. When the mixture is present at concentrations below the LEL, the mixture is too lean to burn. At concentrations higher than the UEL, the mixture is to rich to burn. For example, a range of LEL of 7% and a UEL of 15% of 1,1,1-trichloroethane must be present for fire to occur. A range of LEL 2.1% to UEL 9.5% applies to propane.

What Extinguishing media are required to put out Class A, B, C and D fires?

- Quench Class A wood and paper fires with water.

- Smother Class B fires of flammable liquids and greases with foams, dry chemicals, halon and other inert gases.

- Smother Class C electrical fires with nonconductive materials such as dry chemicals, halon and other inert gases. Do not use water because it conducts electricity.

- Smother Class D Fires involving metals and metal alloys with fine sand, graphite powder and mixtures of salt and polymer binders or inert gases.

What is its Reactivity?--What are the conditions under which a substance will change form?

When is a substance likely to undergo chemical reaction either by itself or with other materials? In other words, what must the conditions be like for a chemical to change from a solid to liquid or liquid to gas.

What is the Stability?

This tells you whether the bonds that hold chemicals molecules together are strong or weak and make the substance stable or unstable under various conditions.

Is there any incompatibility?

What other substances should be kept away from the substance? If a substance contacts certain incompatible substances, the two may react and form a new hazard or may burn or explode and break down into newer hazards. For example, propane is incompatible with oxidizing agents and chlorine dioxide; and 1,1,1 -trichloroethane is incompatible with caustic soda, caustic potash, and oxidizing agents. Some brands of scouring cleanser may be incompatible with acid.

Are there hazardous decomposition products?

This tells you whether the substance can break down under certain conditions and release toxic or flammable vapors or gases.

Brake fluid, windshield solvent and propane, for example, all break down and produce carbon monoxide when burned. 1,1,1-trichloroethane, a common degreaser used in industry, produces hydrogen chloride (hydrochloric acid) and possibly traces of phosgene, a highly dangerous nerve gas.

Can hazardous polymerization occur?

This is a chemical reaction that can cause a fire or explosion and sometimes release hazardous gases. Burning plastics, for example, releases the highly harmful hydrochloric acid.

Hydrogen cyanide is another example. It is flammable and poisonous, and in the liquid state has a tendency to polymerize in the presence of alkaline materials. One of the materials from the polymerization reaction is ammonia, which means eventually an explosive reaction will take place. When potassium cyanide and sodium cyanide contact acids poisonous and flammable hydrogen cyanide vapor is released.

Health Hazards

- Can substances enter your body either by inhalation, ingestion or through the skin?
- What are the short- (acute) and long-term (chronic) harmful effects?
- What are the short-term reactions to high exposures?
- Are there Carcinogens? For example, methylene chloride, found in paint removers and thinners, that can cause cancer. What are the signs and symptoms of exposure, medical conditions generally aggravated by exposure?
- Are there Corrosives? Acids, for example, destroy skin cells or cause irreversible damage at the site of contact. Battery acid is an example of a corrosive.
- Are there toxic chemicals? Chlorine gas, for example, can kill in high doses.
- Is it an irritant? For example, household ammonia can irritate the eyes and skin of animals and people.
- Are there sensitizers? These cause an allergic reaction in a "substantial proportion" of an exposed group of people. Certain plants found in forests, fields and marshes are common sensitizers because they cause skin rash. In the workplace, for example, toluene diisocyanate, found in some polyurethane, and methylene biphenyl isocyanate, found in urethane foams, are sensitizers.
- Are there target organ effectors? These selectively damage one major organ or system of the body such as the lungs, kidneys or nervous system. For example, asbestos damages the lungs and butyl cellosolve, found in consumer products such as Fantastik, damages the kidneys. Used in small quantities around the home, consumer products present no danger, but when used for long periods of time in a workplace they do.

Spill or Leak Procedures

If a substance is released, how should it be disposed of? What precautions should be taken during handling and storage?

Special Protection

What respiratory protection, ventilation, protective gloves, eye protection, other protective clothing, and hygiene practices should be taken in the workplace?

First Aid

What first aid should be given in case of exposure?

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