Waste Management

Hazard Waste properties

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Hazard waste properties

- General knowledge of hazardous waste chemical properties is necessary for proper identification, operation and disposal.
- There are many chemical properties of hazardous waste from physical states to solubility.

Physical State

- Gas, liquid and solid states are physical states of matter
- *Gas* is matter that takes both the shape and volume of the container it fills.
- *Liquid* is matter that has definite volume but takes the shape of its container.
- *Solid* is matter that has definite shape and volume

Physical State

- Different physical states can affect the potential danger posed by the material.
- Materials dangerous in one physical state may be relatively harmless in another.
- In general, a solid is less harmful than liquid or gases.
- For example, lead in a solid form which is often used as a ballast is relatively nontoxic.
- On the other hand, a liquid form of lead which can be found in gasoline is very toxic.
- If a solid becomes a powder, it can be more harmful by having similar physical properties of a liquid or gas.

Physical State

	GASES	LIQUIDS	SOLIDS
DEGREE OF HAZARD	More hazardous than liquids or solids	More hazardous than solids.	Less hazardous than gases or liquids unless powdered.
FIRE HAZARD	Ignite easily.	Ignite easily when vaporized.	Ignite when ignition temperature reached.
PATHWAY TO BODY	Easily enter body through inhalation.	Absorbed by skin if splashed or spilled. Can only be inhaled when vaporized.	Great difficulty entering body unless in fine particles.

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Physical State

	GASES	LIQUIDS	SOLIDS
BEHAVIOR IN ENVIRONMENT	Easily dispersed.	Can sink, float or dissolve in water. Can be very hot (boiling) or very cold and thus cause burning or freezing. Can be collected, contained, or absorbed if insoluble or dispersed or diluted if soluble.	Easily collected and contained.

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Physical State

- It is important to understand the different physical states of a material, especially for emergency situations, where materials could quickly change to different states.
- Melting point and boiling point are two transitions of physical states. The melting point is the transitional point of a solid changing into a liquid, and the boiling point is the transitional point of a liquid changing into a gas.
- These transitions could start from heat, chemical reactions or ambient temperatures.

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Boiling Point

- The boiling point (BP) is the temperature at which a liquid becomes a gas.
- It is measured either in degrees Fahrenheit (°F) or Celsius (°C).

Water	212°F	100°C
Chlorine	-29°F	-34°C
Gasoline	102°F	39°C
Ethyl Alcohol	173°F	78°C

- Boiling points can indicate health hazards associated with inhalation.
- Generally, chemicals with low boiling points (similar to Chlorine) present a greater inhalation hazard under normal atmospheric conditions than chemicals with higher boiling points.

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Vapor Pressure

- The vapor pressure (VP) is measured in pounds per square inch (PSI) and measures a substance's tendency to emit vapors.
- It is when the vapor of a substance is in equilibrium with the liquid at a specified temperature. Higher vapor pressures indicate that the substance is very volatile.
- Vapor pressure and volatility also increase with temperature.
- Values of vapor pressure are often given as millimeters of mercury (mm Hg) of a specific temperature.
- In general, a greater inhalation hazard will occur with chemicals having high vapor pressure (VP>10 mg Hg at room temperature).

1 mm Hg=1 Torr
1 ATM (atmosphere)=760 mm Hg
14.7 PSI (pounds per square inch)=1 ATM=760 mm Hg

Specific Gravity/Density

- Specific gravity (SG) or density of a liquid is expressed as a pure number without units and is
- compared to that of water (defined as 1.0).
- The SG is the density of the material normalized to (divided by) the density of water (0.0361 lb/in^3).
- Materials with specific gravity greater than 1.0 will sink in water and those less than 1.0 will float on top of water.
- Gasoline will float on top of water because it has an SG of 0.8, while lead and mercury with SG value of 11.3 and 13.6 respectively, will sink.

Vapor Density

- Vapor density is the mass per unit volume of a given vapor or gas relative to air.
- Some vapors may be poisonous due to their toxic properties, while others may have no toxic properties but may pose a hazard by displacing air and causing an oxygen deficiency.
- Heavy vapors may also cause a fire or an explosion if the vapors are flammable and are presented with an ignition source.
- Carbon dioxide, chlorine, hydrogen sulfide and sulfur dioxide are examples of gases that are heavier than air.

Solubility

- Solubility is the amount of a given substance (the solute) that dissolves in a unit volume of liquid (the solution).
- It can also be termed as the ability of one substance to dissolve uniformly in another.
- An example of a soluble substance is alcohol in water and of an insoluble substance is oil in water.
- Insoluble substances can often be blended together. However, eventually these substances will separate.
- Solubility ranges from 0-100% and is dependent upon the substances involved and the temperature of the solution.
- It is important to know the solubility of a substance.
  - Knowledge of the solubility and reactivity of a spilled substance is critical to proper spill containment and clean up.
  - It can also provides important environmental information, for instance, could the spilled material dissolve in water and spread by rain water.

The pH Scale Flammability

- The pH scale measures a substance acidity or basicity by looking at the concentration of free hydrogen ions (H+).
- A substance (such as pure water) is termed neutral if the pH is 7.
- If the substance has a pH less than 7, it is considered acidic and if the substance has a pH greater than 7, it is considered to be basic.
- The measurement of pH is based on a logarithmic scale from 0 to 14.
- Therefore a substance with a pH of 5 is ten times more acidic than a substance with a pH of 6 and 100 times more acidic than a substance with a pH of 7.
- Materials with high (>12) or low (<2) pH readings are corrosives and therefore are considered hazardous.
- These substances can cause severe damage when in contact with human tissue and will deteriorate metals.
- Furthermore, strong acids and bases are very reactive and can produce high temperatures, cause explosions or emit toxic gases.

Flammability

- Flammability is the ease with which a material (gas, liquid or solid) will ignite either spontaneously or from exposure to high temperatures, flames, sparks or other ignition sources.
- Flammable gases are compressed gases such as hydrogen, acetylene and propane that will burn. Gases such as oxygen, carbon dioxide and nitrogen will NOT normally burn and are considered nonflammable gases.
- However, oxygen will support combustion.
- Flammable liquids do not burn but give off vapors that ignite.
- Flammable liquids are classified by DOT and OHSA into flammable and combustible materials.
- This classification is based upon the liquid flashpoint, which is the minimum temperature that a liquid must reach to produce an ignitable concentration of vapors.
- Flammable solids are materials other than an explosive that ignite quickly and burn vigorously.
- Some flammable solids can be ignited by friction, absorption of moisture or a spontaneous chemical change on exposure to air.

Spontaneous Combustion

- Spontaneous combustion occurs when used materials such as oily rags and wastepaper are improperly stored.
- Improper storage of these materials can prevent heat from transferring into the atmosphere causing it to accumulate in the container.
- The heat produced by the slow oxidation of these materials can build up in the container and ignite the substances involved.

Explosive Limits

- Specific air and vapor mixtures will burn upon exposure to an ignition source.
- The range of these mixtures concentration (percentage by volume) is defined as explosive limits.
- Lower explosive limits (LEL) exist when the air and vapor mixtures are too lean to burn, while upper explosive limits (UEL) exist when the mixtures are rich to burn.
- Mixtures that are in between these limits have the highest potential for fire and explosion.