Pictograms and Hazard Statements

Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

OSHA Requirements

- As of June 1, 2015, the Hazard Communication Standard (29 CFR 1910.1200) will require pictograms on labels to alert users of the chemical hazards to which they may be exposed.
- OSHA is requiring that employees are trained on the new label elements and Safety Data Sheet (SDS) format by December 1, 2013, while full compliance with the final rule will begin in 2015.

OSHA Requirements

- OSHA believes that American workplaces will soon begin to receive labels and SDSs that are consistent with the GHS and feel it is important to ensure that when employees begin to see the new labels and SDSs in their workplaces, they will be familiar with them, understand how to use them, and access the information effectively.
- This is the second of four trainings that will be provided to ensure compliance with OSHA.

Pictogram Requirements

- Pictograms shall be in the shape of a square set at a point and shall include a black hazard symbol on a white background with a red frame sufficiently wide to be clearly visible.
- One of eight hazard symbols shall be used in each pictogram.
- Purpose is to convey specific information about the hazards of a chemical.

Health Hazards

Skull and Crossbones

- Acute Toxicity – Severe
  - *Acute toxicity* refers to those adverse effects occurring following oral or dermal administration of a single dose of a substance, or multiple doses given within 24 hours, or an inhalation exposure of 4 hours.
  - To be described as acute toxicity, the adverse effects should occur within 14 days of the administration of the substance.

Skull and Crossbones

- Hazard Statements
  - Fatal if swallowed
  - Toxic if swallowed
  - Fatal in contact with skin
  - Toxic in contact with skin
  - Fatal if inhaled
  - Toxic if inhaled

Exclamation Mark

- Irritant/Irritation
- Dermal Sensitizer
- Acute Toxicity – Harmful
- Respiratory Tract Irritation
- Narcotic Effects

Exclamation Mark

- Irritant/Irritation
  - *Skin irritation* is the production of reversible damage to the skin following the application of a test substance for up to 4 hours.
  - *Eye irritation* is the production of changes in the eye following the application of a test substance to the front surface of the eye, which are fully reversible within 21 days of application.

Exclamation Mark

- Dermal Sensitizer
  - *Skin sensitizer* means a chemical that will lead to an allergic response following skin contact.
- Acute Toxicity – Harmful
  - Substances assigned to acute toxicity hazard category 4 based on LD_{50} (oral, dermal) or LC_{50} (inhalation).
    - Criteria are shown in Table A.1.1 of 29 CFR 1910.1200 Appendix A.

Exclamation Mark

- Acute Toxicity – Harmful
  - LD_{50}: Median Lethal Dose
    - A toxicological test of dose that kills 50% of a group of test animals in one dose.
    - Applies to solids and liquids.
  - LC_{50}: Median Lethal Concentration
    - Concentration of a material in air that kills 50% of a group of test animals when administered as a single exposure.
    - Applies to vapors, dusts and mists.

Exclamation Mark

- Respiratory Tract Irritation
  - *Specific Target Organ Toxicity – Single Exposure (STOT-SE)* means specific, non-lethal target organ toxicity arising from a single exposure to a chemical.
  - All significant health effects that can impair function, both reversible and irreversible, immediate and/or delayed, and not specifically addressed by another health hazard class are considered STOT-SE.

Exclamation Mark

- Respiratory Tract Irritation
  - Category 3: Transient target organ effects. These are effects which adversely alter human function for a short duration after exposure and from which humans may recover in a reasonable period without leaving significant alteration of structure or function.

Exclamation Mark

- Respiratory Tract Irritation
  - Criteria for classification include:
    - Respiratory irritant effects (characterized by localized redness, edema, pruritus and/or pain) that impair function with symptoms such as cough, pain, choking, and breathing difficulties are included.

Exclamation Mark

- Respiratory Tract Irritation
  - Criteria for classification include:
    - Subjective human observations supported by objective measurements of clear respiratory tract irritation (e.g., electrophysiological responses, biomarkers of inflammation in nasal or bronchoalveolar lavage fluids).

Exclamation Mark

- Respiratory Tract Irritation
  - Criteria for classification include:
    - Symptoms observed in humans shall also be typical of those that would be produced in the exposed population rather than being an isolated idiosyncratic reaction or response triggered only in individuals with hypersensitive airways.

Exclamation Mark

- Respiratory Tract Irritation
  - Criteria for classification include:
    - Ambiguous reports simply of “irritation” should be excluded as this term is commonly used to describe a wide range of sensations including those such as smell, unpleasant taste, a tickling sensation, and dryness, which are outside the scope of this classification.

Exclamation Mark

- Narcotic Effects
  - Central nervous system depression such as drowsiness, narcosis, reduced alertness, loss of reflexes, lack of coordination, and vertigo.
  - These effects can also be manifested as severe headache or nausea, and can lead to reduced judgment, dizziness, irritability, fatigue, impaired memory function, deficits in perception and coordination, reaction time, or sleepiness.

Exclamation Mark

- Hazard Statements
  - Harmful if swallowed
  - Harmful in contact with skin
  - Harmful if inhaled
  - Causes skin irritation
  - Causes serious eye irritation
  - May cause allergic skin reaction
  - May cause respiratory irritation
  - May cause drowsiness or dizziness

Health Hazard

- Carcinogen
- Respiratory Sensitizer
- Reproductive Toxicity
- Target Organ Toxicity
- Mutagenicity
- Aspiration Toxicity

Health Hazard

- Carcinogen
  - *Carcinogen* means a substance or mixture of substances which induce cancer or increase its incidence.
    - Category 1: Known or presumed human carcinogens.
    - Category 2: Suspected human carcinogens.
    - Classification is based on epidemiological and/or animal data.

Health Hazard

- Respiratory Sensitizer
  - *Respiratory sensitizer* means a chemical that will lead to hypersensitivity of the airways following inhalation of the chemical.
  - Normally seen as asthma but could also present as rhinitis/conjunctivitis and alveolitis.
  - The condition will have the clinical character of an allergic reaction.

Health Hazard

- Reproductive Toxicity
  - *Reproductive toxicity* includes adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on development of the offspring.
    - *Adverse effects on sexual function and fertility* means any effect of chemicals that interferes with reproductive ability or sexual capacity.

Health Hazard

Adverse effects on sexual function and fertility

- Alterations to the reproductive system
- Adverse effects on onset of puberty
- Gamete production and transport
- Reproductive cycle normality
- Sexual behavior
- Parturition
- Fertility and pregnancy outcomes
- Premature reproductive senescence
- Modifications in other functions that are dependent on the integrity of the reproductive systems

Health Hazard

- Reproductive Toxicity
  - *Adverse effects on development of the offspring* means any effect of chemicals which interferes with normal development of the conceptus either before or after birth, which is induced during pregnancy or results from parental exposure.
  - These effects can be manifested at any point in the life span of the organism.
    - Death of the developing organism
    - Structural abnormality
    - Functional deficiency
    - Altered growth

Health Hazard

- Reproductive Toxicity
  - Category 1: Known or presumed human reproductive toxicant.
  - Category 2: Suspected human reproductive toxicant.

Health Hazard

- Target Organ Toxicity
  - *Specific Target Organ Toxicity – Single Exposure (STOT-SE)*
  - *Specific Target Organ Toxicity – Repeated Exposure (STOT-RE)*

Health Hazard

- Target Organ Toxicity
  - *STOT-SE* means specific, non-lethal target organ toxicity arising from a single exposure to a chemical.
  - All significant health effects that can impair function, both reversible and irreversible, immediate and/or delayed, and not specifically addressed by another health hazard class are considered STOT-SE.

Health Hazard

- Target Organ Toxicity
  - STOT-SE
    - Category 1: Substances that have produced significant toxicity in humans, or that, on the basis of evidence from studies in experimental animals can be presumed to have the potential to produce significant toxicity in humans following a single exposure.

Health Hazard

- Target Organ Toxicity
  - STOT-SE
    - Category 2: Substances that, on the basis of evidence from studies in experimental animals, can be presumed to have the potential to be harmful to human health following a single exposure.

Health Hazard

- Target Organ Toxicity
  - *STOT-RE* means specific target organ toxicity arising from repeated exposure to a substance or mixture.
  - All significant health effects that can impair function, both reversible and irreversible, immediate and/or delayed, and not specifically addressed by another health hazard class are considered STOT-RE.

Health Hazard

- Target Organ Toxicity
  - STOT-RE
    - Category 1: Substances that have produced significant toxicity in humans, or that, on the basis of evidence from studies in experimental animals can be presumed to have the potential to produce significant toxicity in humans following repeated or prolonged exposure at generally low exposure concentrations.

Health Hazard

- Target Organ Toxicity
  - STOT-RE
    - Category 2: Substances that, on the basis of evidence from studies in experimental animals, can be presumed to have the potential to be harmful to human health following repeated or prolonged exposure, with these effects produced at generally moderate exposure concentrations.

Health Hazard

Specific Target Organ Toxicity

- Morbidity
- Significant functional changes in organs, systems or senses
- Significant adverse change in clinical biochemistry, hematology or urinalysis parameters
- Significant organ damage that may be confirmed by microscopic examination
- Multi-focal or diffuse necrosis, fibrosis or granuloma formation in vital organs with regenerative capacity
- Morphological changes that are potentially reversible but provide clear evidence of marked organ dysfunction
- Evidence of appreciable cell death in vital organs incapable of regeneration

Health Hazard

- Mutagenicity
  - A *mutation* is a permanent change in the amount or structure of the genetic material in a cell.
    - This term applies to both inheritable genetic changes and to the underlying DNA modifications when known.

Health Hazard

- Mutagenicity
  - The terms *mutagenic* and *mutagen* are used for agents giving rise to an increased occurrence of mutations in populations of cells and/or organisms with this hazard class primarily concerned with chemicals that may cause mutations in the germ cells of humans that can be transmitted to the progeny.

Health Hazard

- Mutagenicity
  - Germ Cell Mutagens
    - Category 1: Substances known to induce heritable mutations or to be regarded as if they induce heritable mutations in the germ cells of humans.
    - Category 2: Substances which cause concern for humans owing to the possibility that they may induce heritable mutations in the germ cells of humans.

Health Hazard

- Aspiration Toxicity
  - *Aspiration* means the entry of a liquid or solid chemical directly through the oral or nasal cavity, or indirectly from vomiting, into the trachea and lower respiratory system.

Health Hazard

- Aspiration Toxicity
  - Category 1: Chemicals known to cause human aspiration toxicity hazards or to be regarded as if they cause human aspiration toxicity hazards.
  - Will cause severe acute effects such as chemical pneumonia, varying degrees of pulmonary injury or death.

Health Hazard

- Hazard Statements
  - May cause allergy or asthma symptoms or breathing difficulties if inhaled
  - May cause genetic defects*
  - Suspected of causing genetic defects*
  - May cause cancer*
  - Suspected of causing cancer*
  - May damage fertility or the unborn child†*
  - Suspected of damaging fertility or the unborn child†*

*State route of exposure if no other routes of exposure cause the hazard

† State specific effect if known

Health Hazard

- Hazard Statements
  - Causes damage to organs*†
  - May cause damage to organs*†
  - Causes damage to organs* through prolonged or repeated exposure†
  - May cause damage to organs* through prolonged or repeated exposure†
  - May be fatal if swallowed and enters airways

*State all organs affected, if known

†State route of exposure if no other routes of exposure cause the hazard

Physical Hazards

Exploding Bomb

- Explosives
- Self-Reactive Chemicals
- Organic Peroxides

Exploding Bomb

- Explosives
  - An *explosive chemical* is a solid or liquid chemical which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings.
  - A *pyrotechnic chemical* is a chemical designed to produce an effect by heat, light, sound, gas or smoke or a combination of these as the result of non-detonative self-sustaining exothermic chemical reactions.
  - An *explosive item* is an item containing one or more explosive chemicals

Exploding Bomb

- Explosives
  - A *pyrotechnic item* is an item containing one or more pyrotechnic chemicals.
  - An *unstable explosive* is an explosive which is thermally unstable and/or too sensitive for normal handling, transport, or use.
  - An *intentional explosive* is a chemical or item which is manufactured with a view to produce a practical explosive or pyrotechnic effect.

Exploding Bomb

- Explosives
  - Division 1.1: Chemicals and items which have a mass explosion hazard.
    - A mass explosion is one which affects almost the entire quantity present virtually instantaneously.
  - Division 1.2: Chemicals and items which have a projection hazard but not a mass explosion hazard.

Exploding Bomb

- Explosives
  - Division 1.3: Chemicals and items which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard.
    - Combustion of which gives rise to considerable radiant heat or which burn one after another, producing minor blast or projection effects or both.

Exploding Bomb

- Explosives
  - Division 1.4: Chemicals and items which present only a small hazard in the event of ignition or initiation.
    - The effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected.
    - An external fire shall not cause virtually instantaneous explosion of almost the entire contents of the package.

Exploding Bomb

- Self-Reactive Chemicals
  - *Self-reactive chemicals* are thermally unstable liquid or solid chemicals liable to undergo a strongly exothermic decomposition even without participation of oxygen (air).
    - An exothermic decomposition is a chemical reaction that results in a chemical breaking down into two or more parts resulting in a release of energy such as heat, sound or light.

Exploding Bomb

- Self-Reactive Chemicals
  - Type A: Any self-reactive chemical which can detonate or deflagrate* rapidly, as packaged.
  - Type B: Any self-reactive chemical possessing explosive properties and which, as packaged, neither detonates nor deflagrates* rapidly, but is liable to undergo a thermal explosion in that package.

*Deflagration is an exothermic reaction in which the reaction progresses through the unburned material at a rate less than the velocity of sound.

Exploding Bomb

- Organic Peroxides
  - *Organic peroxide* means a liquid or solid organic chemical which contains the bivalent -O-O- structure and as such is considered a derivative of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals.
    - Includes organic peroxide mixtures containing at least one organic peroxide.

Exploding Bomb

- Organic Peroxides
  - Organic peroxides are thermally unstable chemicals which may undergo exothermic self-accelerating decomposition.
    - Exothermic self-accelerating decomposition occurs when energy cannot dissipate fast enough, causing the temperature to rise, resulting in an increase in the rate of decomposition.

Exploding Bomb

- Organic Peroxides
  - May be liable to explosive decomposition, burn rapidly, be sensitive to impact or friction and/or react dangerously with other substances.
    - Type A: Any organic peroxide which, as packaged, can detonate or deflagrate rapidly.
    - Type B: Any organic peroxide possessing explosive properties and which, as packaged, neither detonates or deflagrates rapidly, but is liable to undergo a thermal explosion in that package.

Exploding Bomb

- Hazard Statements
  - Unstable explosive
  - Explosive; mass explosion hazard
  - Explosive; severe projection hazard
  - Explosive; fire, blast, or projection hazard
  - Fire or projection hazard
  - Heating may cause an explosion
  - Heating may cause a fire or explosion

Flame

- Flammables
- Self-Reactive Chemicals
- Pyrophorics
- Self-Heating Chemicals
- Emits Flammable Gas
- Organic Peroxides

Flame

- Flammables
  - *Flammable gas* means a gas having a flammable range with air at 20°C and a standard pressure of 101.3 kPa.
    - Category 1: Are ignitable when in a mixture of 13% or less by volume in air or have a flammable range with air of at least 12 percentage points regardless of the lower flammable limit.

Flame

- Flammables
  - *Aerosol* means any non-refillable receptacle containing a gas compressed, liquefied or dissolved under pressure, and fitted with a release device allowing the contents to be ejected as particles in suspension in a gas, or as a foam, paste, powder, liquid or gas.

Flame

- Flammables
  - Flammable Aerosols
    - Category 1: Contains ≥ 85% of flammable components and the chemical heat of combustion is ≥ 30 kJ/g or for
      - spray aerosols, the ignition distance test, ignition occurs at a distance ≥ 75 cm
      - foam aerosols, in the aerosol foam flammability test, the flame height is ≥ 20 cm and the flame duration ≥ 2 s or the flame height is ≥ 4 cm and the flame duration ≥ 7 s

Flame

- Flammables
  - Flammable Aerosols
    - Category 2: Contains > 1% flammable components, or the heat of combustion is ≥ 20 kJ/g and for
      - spray aerosols, in the ignition distance test, ignition occurs at a distance ≥ 15 cm, or in the enclosed space ignition test, the time equivalent is ≤ 300 s/m^3 deflagration density is ≤ 300 g/m^3
      - foam aerosols, in the aerosol foam flammability test, the flame height is ≥ 4 cm and the flame duration is ≥ 2 s and it does not meet the criteria for category 1

Flame

- Flammables
  - *Flammable liquid* means a liquid having a flash point of not more than 93°C.
    - *Flash point* means the minimum temperature at which a liquid gives off vapor in sufficient concentration to form an ignitable mixture with air near the surface of the liquid.

Flame

- Flammables
  - Flammable Liquids
    - Category 1: Flash point < 23°C and initial boiling point ≤ 35°C
    - Category 2: Flash point < 23°C and initial boiling point > 35°C
    - Category 3: Flash point ≥ 23°C and ≤ 60°C

Flame

- Flammables
  - *Flammable solid* means a solid which is a readily combustible solid, or which may cause or contribute to fire through friction.
  - *Readily combustible solids* are powdered, granular, or pasty chemicals which are dangerous if they can be easily ignited by brief contact with an ignition source, such as a burning match, and if the flame spreads rapidly.

Flame

- Flammables
  - Flammable Solids
    - Category 1: Burning rate test results in
      - Metal powders: burning time ≤ 5 min
      - Chemicals other than metal powders:
        - Wetted zone does not stop fire
        - Burning time < 45 s or burning rate > 2.2 mm/s

Flame

- Flammables
  - Flammable Solids
    - Category 2: Burning rate test results in
      - Metal powders: burning time > 5 min and ≤ 10 min
      - Chemicals other than metal powders:
        - Wetted zone stops the fire for at least 4 min
        - Burning time < 45 s or burning rate > 2.2 mm/s

Flame

- Self-Reactive Chemicals
  - *Self-reactive chemicals* are thermally unstable liquid or solid chemicals liable to undergo a strongly exothermic decomposition even without participation of oxygen (air).

Flame

- Self-Reactive Chemicals
  - These chemicals are regarded as possessing explosive properties when in laboratory testing the formulation is liable to detonate, to deflagrate rapidly or to show a violent effect when heated under confinement.

Flame

- Self-Reactive Chemicals
  - Type B: Any self-reactive chemical possessing explosive properties and which, as packaged, neither detonates nor deflagrates rapidly, but is liable to undergo a thermal explosion in that package.
  - Type C: Any self-reactive chemical possessing explosive properties when the chemical as packaged cannot detonate or deflagrate rapidly or undergo a thermal explosion.

Flame

- Self-Reactive Chemicals
  - Type D: Any self-reactive chemical which in laboratory testing meets the criteria of (1), (2) or (3).
    - (1) Detonates partially, does not deflagrate rapidly and shows no violent effect when heated under confinement
    - (2) Does not detonate at all, deflagrates slowly and shows no violent effect when heated under confinement
    - (3) Does not detonate or deflagrate at all and shows a medium effect when heated under confinement

Flame

- Self-Reactive Chemicals
  - Type E: Any self-reactive chemical which, in laboratory testing, neither detonates nor deflagrates at all and shows low or no effect when heated under confinement.
  - Type F: Any self-reactive chemical which, in laboratory testing, neither detonates in the cavitated state* nor deflagrates at all and shows only a low or no effect when heated under confinement as well as low or no explosive power.

*Would the popping of a bubble cause it to detonate?

Flame

- Pyrophorics
  - *Pyrophoric liquid* means a liquid which, even in small quantities, is liable to ignite within five minutes after coming into contact with air.
    - Category 1: The liquid ignites within 5 min when added to an inert carrier and exposed to air, or it ignites or chars a filter paper on contact with air within 5 min.

Flame

- Pyrophorics
  - *Pyrophoric solid* means a solid which, even in small quantities, is liable to ignite within five minutes after coming into contact with air.
    - Category 1: The solid ignites within 5 min of coming into contact with air.

Flame

- Self-Heating Chemicals
  - A *self-heating chemical* means a solid or liquid chemical, other than a pyrophoric liquid or solid, which, by reaction with air and without energy supply, is liable to self-heat.

Flame

- Self-Heating Chemicals
  - This chemical differs from a pyrophoric liquid or solid in that it will ignite only when in large amounts and after long periods of time.
  - Self-heating of a substance or mixture is a process where the gradual reaction of that substance or mixture with oxygen (in air) generates heat.
  - If the rate of heat production exceeds the rate of heat loss, the temperature of the substance or mixture will rise which, after an induction time, may lead to self-ignition and combustion.

Flame

- Self-Heating Chemicals
  - Category 1: A positive result in obtained in a test using a 25 mm sample cube at 140°C
  - Category 2: A negative result is obtained in a test using a 25 mm sample cube at 140°C, a positive result is obtained in a test using a 100 mm sample cube at 140°C and meets the criteria of (1), (2) or (3).
    - (1) The unit volume of the chemical is more than 3 m^3
    - (2) A positive result is obtained in a test using a 100 mm sample cube at 120°C and the unit volume of the chemical is more than 450 liters
    - (3) A positive result is obtained in a test using a 100 mm sample cube at 100°C

Flame

- Emits Flammable Gas
  - *Chemicals which, in contact with water, emit flammable gases* are solid or liquid chemicals which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.

Flame

- Emits Flammable Gas
  - Category 1: Any chemical which reacts vigorously with water at ambient temperatures and demonstrates generally a tendency for the gas produced to ignite spontaneously, or which reacts readily with water at ambient temperatures such that the rate of evolution of flammable gas is equal to or greater than 10 liters per kilogram of chemical over any one minute.

Flame

- Emits Flammable Gas
  - Category 2: Any chemical which reacts readily with water at ambient temperatures such that the maximum rate of evolution of flammable gas is equal to or greater than 20 liters per kilogram of chemical per hour, and which does not meet the criteria for category 1.
  - Category 3: Any chemical which reacts slowly with water at ambient temperatures such that the maximum rate of evolution of flammable gas is equal to or greater than 1 liter per kilogram of chemical per hour, and which does not meet the criteria for categories 1 and 2.

Flame

- Organic Peroxides
  - *Organic peroxide* means a liquid or solid organic chemical which contains the bivalent -O-O- structure and as such is considered a derivative of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals.
    - Includes organic peroxide mixtures containing at least one organic peroxide.

Flame

- Organic Peroxides
  - Organic peroxides are thermally unstable chemicals which may undergo exothermic self-accelerating decomposition.
  - They may be liable to explosive decomposition, burn rapidly, be sensitive to impact or friction and/or react dangerously with other substances.

Flame

- Organic Peroxides
  - Type B: Any organic peroxide possessing explosive properties and which, as packaged, neither detonates or deflagrates rapidly, but is liable to undergo a thermal explosion in that package.
  - Type C: Any organic peroxide possessing explosive properties when the chemical as packaged cannot detonate or deflagrate rapidly or undergo a thermal explosion.

Flame

- Organic Peroxides
  - Type D: Any organic peroxide which in laboratory testing meets the criteria of (1), (2) or (3).
    - (1) Detonates partially, does not deflagrate rapidly and shows no violent effect when heated under confinement
    - (2) Does not detonate at all, deflagrates slowly and shows no violent effect when heated under confinement
    - (3) Does not detonate or deflagrate at all and shows a medium effect when heated under confinement

Flame

- Organic Peroxides
  - Type E: Any organic peroxide which, in laboratory testing, neither detonates nor deflagrates at all and shows low or no effect when heated under confinement.
  - Type F: Any organic peroxide which, in laboratory testing, neither detonates in the cavitated state nor deflagrates at all and shows only a low or no effect when heated under confinement as well as low or no explosive power.

Flame

- Hazard Statements
  - Extremely flammable gas
  - Extremely flammable aerosol
  - Flammable aerosol
  - Extremely flammable liquid and vapor
  - Highly flammable liquid and vapor
  - Flammable liquid and vapor
  - Flammable solid
  - Heating may cause a fire or explosion
  - Heating may cause a fire

Flame

- Hazard Statements
  - Catches fire spontaneously if exposed to air
  - Self-heating; may catch fire
  - Self-heating in large quantities; may catch fire
  - In contact with water releases flammable gases, which may ignite spontaneously
  - In contact with water releases flammable gas

Flame Over Circle

- Oxidizers
  - *Oxidizing gas* means any gas which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does.
    - Applies to pure gases or gas mixtures with an oxidizing power greater than 23.5%.
    - Category 1: Any gas which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does.

Flame Over Circle

- Oxidizers
  - *Oxidizing liquid* means a liquid which, while in itself not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material.

Flame Over Circle

- Oxidizers
  - Oxidizing Liquids
    - Category 1: Any chemical which, in a 1:1 mixture, by mass, of chemical and cellulose tested, spontaneously ignites or the mean pressure rise time of a 1:1 mixture, by mass, of chemical and cellulose is less than that of a 1:1 mixture, by mass, of 50% perchloric acid and cellulose.

Flame Over Circle

- Oxidizers
  - Oxidizing Liquids
    - Category 2: Any chemical which, in a 1:1 mixture, by mass, of chemical and cellulose tested, exhibits a mean pressure rise time less than or equal to the mean pressure rise time of a 1:1 mixture, by mass, of 40% aqueous sodium chlorate solution and cellulose and the criteria for category 1 are not met.

Flame Over Circle

- Oxidizers
  - Oxidizing Liquids
    - Category 3: Any chemical which, in a 1:1 mixture, by mass, of chemical and cellulose tested, exhibits a mean pressure rise time less than or equal to the mean pressure rise time of a 1:1 mixture, by mass, of 65% aqueous nitric acid and cellulose and the criteria for categories 1 and 2 are not met.

Flame Over Circle

- Oxidizers
  - *Oxidizing solid* means a solid which, while in itself is not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material.

Flame Over Circle

- Oxidizers
  - Oxidizing Solids
    - Category 1: Any chemical which, in a 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time less than the mean burning time of a 3:2 mixture (by mass) of potassium bromate and cellulose.

Flame Over Circle

- Oxidizers
  - Oxidizing Solids
    - Category 2: Any chemical which, in a 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time equal to or less than the mean burning time of a 2:3 mixture (by mass) of potassium bromate and cellulose and the criteria for category 1 are not met.

Flame Over Circle

- Oxidizers
  - Oxidizing Solids
    - Category 3: Any chemical which, in a 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time equal to or less than the mean burning time of a 3:7 mixture (by mass) of potassium bromate and cellulose and the criteria for categories 1 and 2 are not met.

Flame Over Circle

- Hazard Statements
  - May cause or intensify fire; oxidizer
  - May cause fire or explosion; strong oxidizer
  - May intensify fire; oxidizer

Gas Cylinder

- *Gases under pressure* are gasses which are contained in a receptacle at a pressure of 200 kPa (29 psi) (gauge) or more, or which are liquefied or liquefied and refrigerated.
  - Compressed gas
  - Liquefied gas
  - Refrigerated liquefied gas
  - Dissolved gas

Gas Cylinder

- Gases under pressure
  - A *compressed gas* is a gas which, when under pressure, is entirely gaseous at -50°C, including all gases with a critical temperature ≤ -50°C.
    - The critical temperature is the temperature above which a pure gas cannot be liquefied, regardless of the degree of compression.

Gas Cylinder

- Gases under pressure
  - A *liquefied gas* is a gas which, when under pressure, is partially liquid at temperatures above -50°C.
  - A distinction is made between:
    - High pressure liquefied gas: a gas with a critical temperature between -50°C and +65°C
    - Low pressure liquefied gas: a gas with a critical temperature above +65°C

Gas Cylinder

- Gases under pressure
  - A *refrigerated liquefied gas* is a gas which is made partially liquid because of its low temperature.
  - A *dissolved gas* is a gas which when under pressure is dissolved in a liquid phase solvent.

Gas Cylinder

- Hazard Statements
  - Contains gas under pressure; may explode if heated
  - Contains refrigerated gas; may cause cryogenic burns or injury

The exception: Corrosion

Corrosion

- Skin Corrosion (Health Hazard)
- Serious Eye Damage (Health Hazard)
- Corrosive to Metals (Physical Hazard)

Corrosion

- *Skin corrosion* is the production of irreversible damage to the skin; namely, visible necrosis through the epidermis and into the dermis, following the application of a test substance for up to 4 hours.
  - Corrosive reactions are typified by ulcers, bleeding, bloody scabs, and, by the end of observation at 14 days, by discoloration due to blanching of the skin, complete areas of baldness, and scars.

Corrosion

- *Serious eye damage* is the production of tissue damage in the eye, or serious physical decay of vision, following application of a test substance to the front surface of the eye, which is not fully reversible within 21 days of application.

Corrosion

- *Corrosive to Metals* means a chemical which by chemical action will materially damage, or even destroy, metals.
  - Corrosion rate on either steel or aluminum surfaces exceeding 6.25 mm per year at a test temperature of 55°C when tested on both materials.

Corrosion

- Hazard Statements
  - Causes severe skin burns and eye damage
  - Causes serious eye damage
  - May be corrosive to metals




For more information:

OSHA® Occupational Safety and Health Administration

U.S. Department of Labor

www.osha.gov (800) 321-OSHA (6742)