

2.INDUSTRIAL SAFETY

3.OCCUPATIONAL HEALTH AND SAFETY

BSS –DIPLOMA & Adv. Diploma

Forms of, Classification of and Health Risks from Hazardous Substances

Physical Forms of Chemicals

- The physical form greatly affects the hazard presented and the route of entry into the body

- **Solids (Lead ingot)**
- **Liquids (Solvents)**
- **Gases (Co)**
- **Vapour (toluene)**
- **Mists and aerosols (deodorant)**
- **Smoke (coal burning)**
- **Fumes (welding)**
- **Dusts (Pharma dust)**



Substances can occur in many physical forms. Knowledge of the physical form is essential in determining appropriate control methods, particularly in the use of respiratory protection.

Definitions of the forms of chemical agents (dusts, fumes, gases, mists, vapors and liquids) are as follows:

Dust: Airborne solid particles (an aerosol) that ranges in size from 0.1 to 50 mm and larger in diameter. Dusts are generated and dispersed into the air by, for example, handling, sieving, crushing and grinding of organic or inorganic materials such as rock, ore, metal, coal, wood and grain.

In still atmospheres, dust can tend to settle under gravity, and where dust accumulations are produced a serious hazard in regard to a dust explosion, can occur.

Toxic dusts may, in the event of constant exposure, cause serious lung damage. General poisoning can result from the inhalation of toxic dusts, e.g. **asbestos**.

Fume: An aerosol of solid particles generated by condensation from the gaseous state, generally after a metal has been converted from molten metals.

The solid particles that make up a fume are extremely fine, usually less than 1.0 mm in diameter.

In most cases, the volatized solid reacts with oxygen in the air to form an oxide, these produce highly toxic fumes. Common examples include cadmium oxide fume, welding and lead burning.

Lead, cadmium, zinc, copper and magnesium are particularly hazardous and inhalation of their fumes can give rise to an illness known as "metal fume fever". Complete removal from the exposure will see full recovery within a matter of days.

Gas: A formless fluid that completely occupies the space of any enclosure at the right temperature and pressure.

There are many toxic gases used in industry, such as chlorine, sulphureted hydrogen (hydrogen sulfide, H₂S) etc.

Many are nasal and respiratory tract irritants. This irritant factor can give rise to immediate evacuation (for example, sneezing) before too much harm is done to the tissues lining the respiratory passages.

Liquids, particulates, gases and various aerosols are all physical states which are liable to create hazards in terms of corrosion, toxicity, fire and explosion.

Mist: An aerosol of suspended liquid droplets generated by condensation from the gaseous to the liquid state or by the breaking up of a liquid into a dispersed state, such as by splashing, foaming, or atomizing.

Mist is formed when a finely divided liquid is suspended in the atmosphere.

Examples are the oil mist produced during cutting and grinding operations, acid mists such as chromium from electroplating, acid or alkali mists from pickling operations, and paint spray mist from spraying procedures.

Vapour: The gaseous phase of a material that is liquid or solid when there is a rise in temperature which causes the vapourization. Examples are organic solvent vapours.

Mercury is a particularly hazardous chemical; it can vaporize at room temperature and create a toxic atmosphere.

Liquids: It has been estimated that two-thirds of all industrial injuries from chemicals are skin injuries caused by direct bodily contact with liquid acids and alkalis due to the corrosive effect of these substances.

Aerosol: A dispersion of particles of microscopic size in a gaseous medium; may be solid particles (dust, fume, smoke) or liquid particles (mist, fog).

Smoke: An aerosol of carbon or soot particles less than 0.1 mm in diameter that results from the incomplete combustion of carbonaceous materials such as coal or oil. Smoke generally contains droplets as well as dry particles.

Fog: A visible aerosol of a liquid, formed by condensation.

The hazard of airborne particulate matter in the workplace has historically been one of the greatest challenges facing occupational safety and health practitioners.

Exposure to particulates is a problem in a bewildering array of industries, processes and occupations, which may encompass mining, quarrying, building & construction work, chemical or textile processing, foundry working, welding, spray-painting or crop-dusting, to name but a few.

The health effects caused by particulate exposure are equally diverse. Skin contact with some dusts, such as organic dusts from flour and grains, may cause **irritation or allergic responses** in sensitised persons, while inhalation of other organic dusts, particularly some wood dusts, has been shown to cause nasal cancer in heavily exposed workers. However, the major health effects are usually found in the lungs, where particulate matter may penetrate deep down to the gas exchange region (the alveoli) and cause severe **fibrotic reactions**. An example of this is silicosis, which results from exposure to silica.

Other lung reactions include **bronchitis**, which is over-production of mucous associated with inflammation of the bronchi; **asthma** which is a constriction of the bronchial tubes; and **cancer**. Restricted lung function can place burden on the right side of the heart and this additional strain can result in irreversible heart damage over time.

HAZARDS AND HAZARD MANAGEMENT

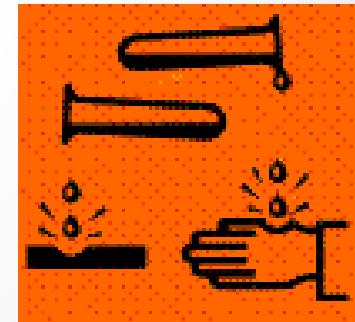
Irritant:

Inflammation on contact with skin, eyes or tissue may cause inflammation e.g. adhesives and detergents



Corrosive:

Destroys living tissue at point of contact (skin)
strong acids or alkalis i.e. H₂SO₄ (Sulphuric Acid), Caustic, ammonia



HAZARDS AND HAZARD MANAGEMENT

Harmful: Larger doses cause death or serious illness

e.g. Trichloroethylene



Toxic: Small doses cause death or serious illness

e.g. cyanide



HAZARDS AND HAZARD MANAGEMENT

Carcinogenic:

Substances which cause disorders in cell growth that may lead to cancer or increase its incidence e.g. Benzene



Acute and Chronic Health Effects

- Acute
 - High levels of exposure
 - Short exposure time
 - Quick effect
 - e.g. high concentration of chlorine gas
- Chronic
 - Lower levels of exposure
 - Longer exposure time
 - Long term effect
 - e.g. repeated exposure to solvents

Biological Agents

Fungi

e.g. Farmer's lung



Bacteria

e.g. legionnaire's disease, Leptospira

Bacteria



Viruses

e.g. HIV, Hepatitis B

HAZARDS AND HAZARD MANAGEMENT

Biological Hazards Control Measures

- 1) **Cleaning / Disinfecting**
- 2) **Water treatment programmes**
- 3) **Vermin control** A pest animal prohibited, controlled
- 4) **Procedures for handling, containment & disposal**
- 5) **Personal hygiene**
- 6) **Immunisation** to build resistance to specific infections
- 7) **Health surveillance** strategies and methods to detect and assess systematically the adverse effects of work on the health of workers.
- 8) **Specific training**
- 9) **PPE**

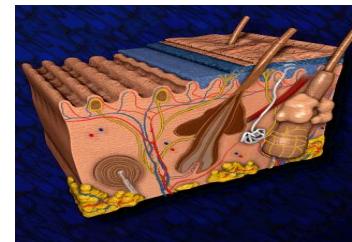
TOXICOLOGY - Routes of Entry

a) Inhalation

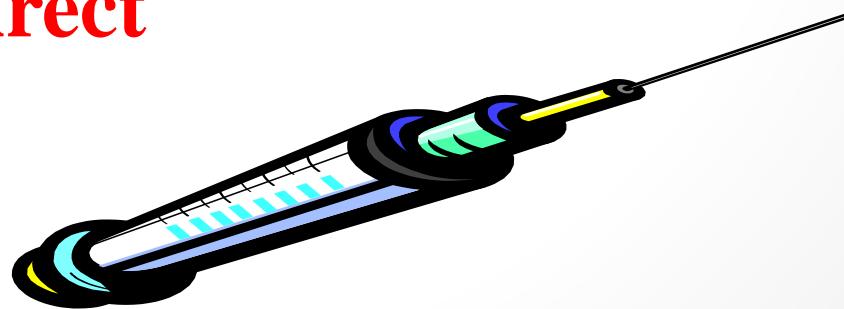


b) Ingestion

c) Absorption



d) Injection (Direct Entry)



TOXICOLOGY - Routes of Entry

Inhalation

- most important route of entry
- substances can directly attack lung tissue
- responsible for 90% of all cases of industrial poisoning

Ingestion

- via the mouth
- often accidental
- poor hygiene

Absorption

- through the skin
- solvents may penetrate unbroken skin

• Injection

- when skin is damaged
- puncture of the skin
- contact with liquid or gas under pressure

HAZARDS AND HAZARD MANAGEMENT

AIRBORNE DUST

Respirable dust:

Airborne dust of such a size about 0.5 microns that it is able to enter the lungs during normal breathing

Respiratory diseases:

- Asbestosis
- Silicosis
- Asthma
- Bronchitis
- Lung Cancer
- Farmer's lung

Assessing levels of dust

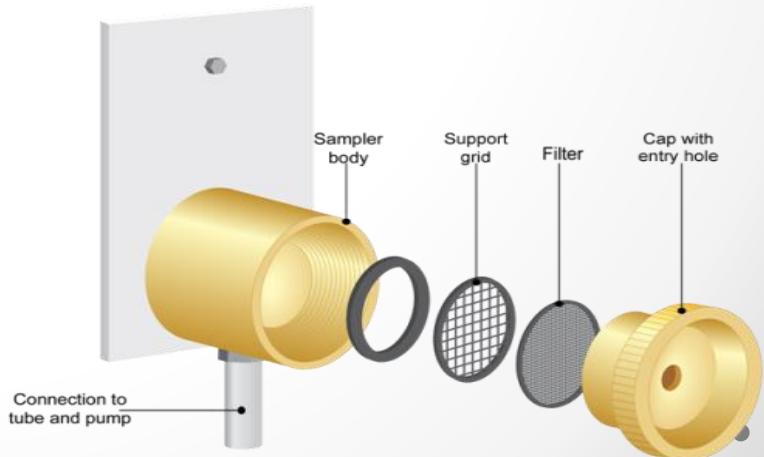
- Visual examination**
- Sampling for dust**
- Personal samplers**
- Fixed samplers**
- Sample for a fixed time**
- Dust lamps**
- Dust accumulation**

Control Measures to Reduce Exposure to Dust

- Eliminate at source**
- Substitute with pellets**
- Change process**
- Use liquid process**
- Enclose the complete process**
- Ventilation**
- Control by suppression**
- Housekeeping**
- Maintenance**

Dust Monitoring Equipment

- Worn by worker whilst working
- Indicates personal exposure
- Pre-weighed filter
- Pumped air
- Filter re-weighed
- Gives average value over time

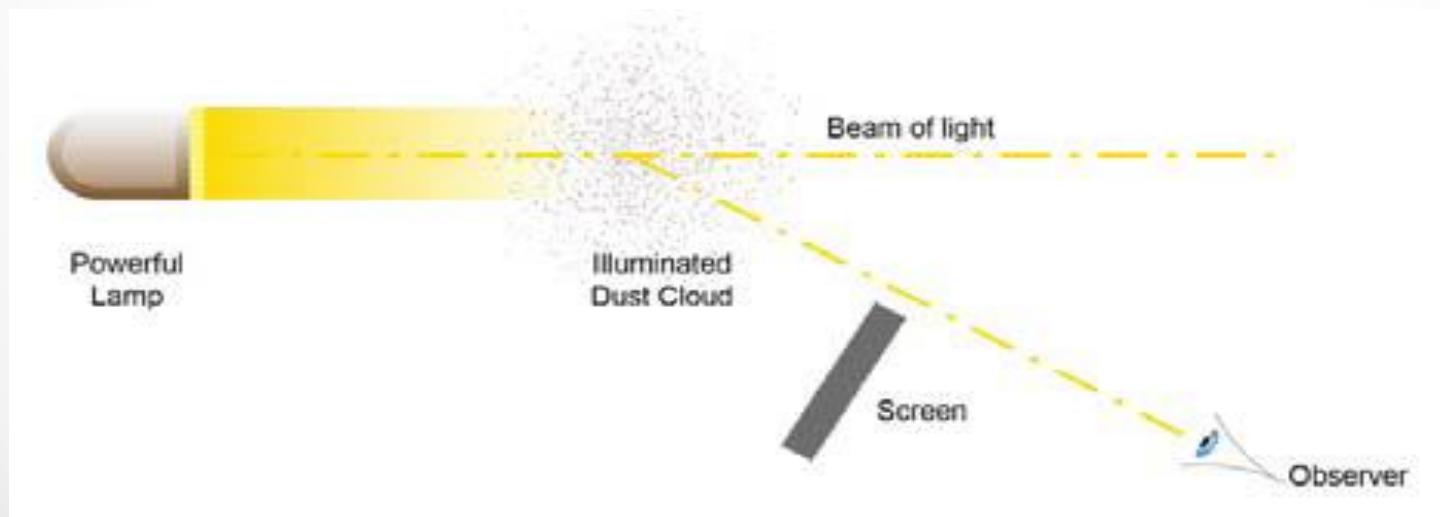


Dust Lamp (Tyndall Lamp)

Strong beam of light

Highlights fine particles of dust

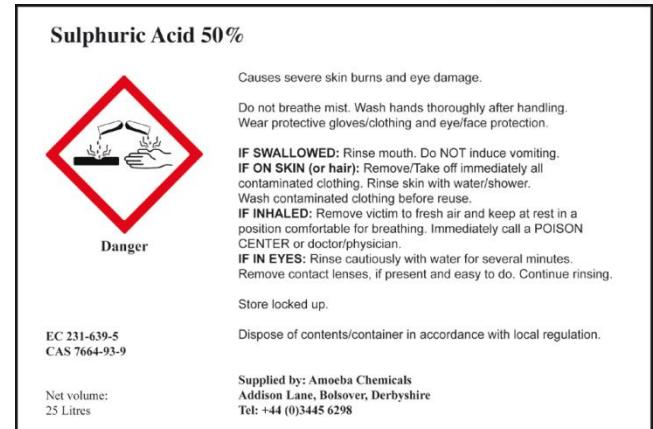
Used to determine efficiency of
exhaust ventilation



Sources of Information

Product Labels

- **Name of substance**
- **Hazardous components**
- **Risk phrases indicating danger**
- **Precautions**
- **Details of supplier**



Workplace Exposure Limits

The maximum concentration of an airborne substance averaged over a reference period, to which employees may be exposed by inhalation.”

Legal status in national law

	Time period	Combat ill-health effects of:
Short term exposure limits (STEL)	<u>15 minutes</u>	<ul style="list-style-type: none">• Acute effects• Very high exposure for a short time
Long term exposure limits (LTEL)	<u>8 hours</u>	<ul style="list-style-type: none">• Chronic effects• Lower exposure over longer period

International Variations

- **UK**
 - Workplace Exposure Limits (WEL's)
 - Published by HSE, full legal status
- **USA**
 - Threshold Limit Values (TLV's)
 - Published by American Conference of Government Industrial Hygienists
 - Guidelines, no legal status
- **No global standard as yet**
 - EU Indicative limit values

Common Methods of Control

- Elimination or substitution
- Process change
- Reduce exposure times
- Enclosure or segregation
- Local Exhaust Ventilation
- PPE
- Personal hygiene and protection
- Health Surveillance/monitoring

Elimination and Substitution

- Eliminate process, - Remove the Hazard
 - e.g. outsource painting
- Substitute – Reduce the hazard,
 - e.g. High Solvent Paint to Low solvent Paint
 - irritant to non-hazardous floor cleaner, or corrosive to irritant

Change the Process

- Do the job differently
 - E.g. applying solvent by brush rather than spraying
 - Vacuuming rather than sweeping to keep dust levels down

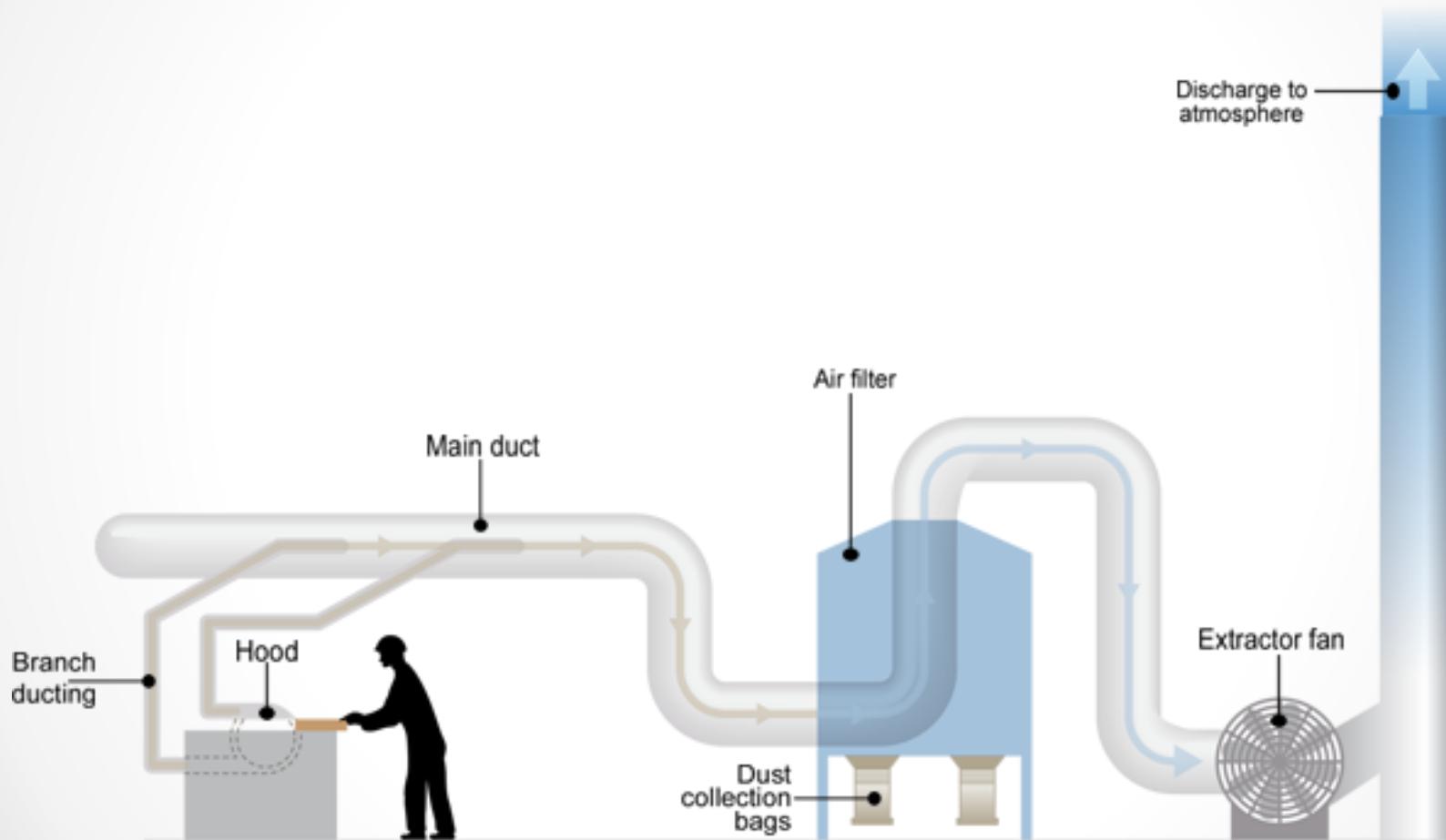
Reduce Exposure Times

- Job rotation
- Exclude non-essential personnel
- Link to WEL's

Enclosure or Segregation

- Enclosure
 - Totally enclose the substance
 - Prevent access to it
- Segregation
 - Keep people away
 - Designated areas

Local Exhaust Ventilation



Respiratory Protective Equipment (RPE)

Two types:

- Respirators
 - filter contaminated air
- Breathing apparatus (BA)
 - oxygen depleted atmospheres
 - provide clean source of air



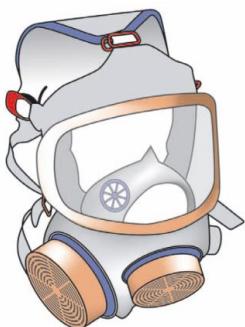
Filter Face-piece Respirators



Half Mask or Ori-nasal Respirator



Full Face Respirator



Fresh Air Hose BA

- Air demanded by user
- Pumped



Compressed Air BA

- Air under pressure



Self-contained BA

- Pressurised cylinder



The Suitability of RPE

Factors to consider:

- Concentration of the contaminant and its hazards
- Physical form of the substance
- Level of protection offered by the RPE
- Presence or absence of oxygen
- Duration of time that it must be worn
- Compatibility with other items of PPE
- Shape of the user's face
- Facial hair
- Physical requirements of the job
- Physical fitness of the wearer



Specific Agents

Asbestos

Naturally occurring mineral fibres used for fire-resistant building and lagging materials

- Diseases:
 - asbestosis
 - lung cancer
 - **TYPES OF ASBESTOS**
- ***Amosite - Brown***
- ***Tremolite - Green***
- ***Chrysotile - White***



Work with Asbestos

In general:

- Work must be notified to the enforcement agency
- Work area sealed
- PPE and RPE
- Negative pressure ventilation system with efficient filters
- Asbestos waste
 - securely double bagged
 - labelled
 - disposed as hazardous waste
- Dust levels monitored inside and outside sealed work area
- Worker exposure must not exceed control limit
- Health surveillance provided

Carbon Monoxide (CO)

Colourless, odourless gas

- By-product of combustion, e.g. poorly maintained boilers
- Inhalation hazard
- Prevents red blood cells absorbing oxygen
- Chemical asphyxiation
 - Low levels – worsening headaches
 - High levels – rapid unconsciousness and death

Carbon Monoxide (CO)

Typical controls:

- Competent engineers for gas systems
- Maintenance and testing of boilers and flues
- Good ventilation
- LEV for workshop vehicle exhausts
- Siting of equipment containing combustion engines
- CO alarms
- Confined space entry controls

Legionella Bacteria

Legionnaire's disease

- Water-loving soil bacteria
- Inhalation hazard
- Mists particularly high risk
- Flu-like fever, pneumonia
- Typical controls:
 - Enclosing water systems
 - Water treatment, e.g. chlorination
 - Hot water >60°C
 - Biocides (treatment chemicals)
 - Prevention of limescale
 - Routine cleaning of cooling towers
 - Water sampling and analysis

Leptospira Bacteria

- Infected urine from: rats, mice, cattle and horses
- Contaminated water in contact with cuts, grazes, etc.
- Dairy farmers, sewage workers, water sports instructors
- Flu-like symptoms, jaundice, liver damage (Weil's disease)

Typical controls:

- Preventing rat infestation – good housekeeping, pest control
- Good personal hygiene
- PPE, especially gloves
- Covering cuts and grazes
- Issuing 'at risk cards' to workers

Silica

- Component of rock
- Quarries, pottery and construction industry
- Inhalation hazard
- Causes scar tissue to form in lungs

Typical controls:

- Alternative work methods
- Dust suppression by water
- LEV
- RPE
- Health surveillance

Hazard communication

Material Safety Data Sheets (MSDS)



The Law

- Ensures all employees' right to know the hazards of chemicals they work with at their job
- Mandates that employees must be provided with information about chemicals they work with
 - through
 - information on chemical labels
 - Material Safety Data Sheets (MSDSs)
 - training on hazard communication

Hazard Communication Rules

- Intent - to provide employees with information to help them to make knowledgeable decisions about the chemical hazards in their workplace
- Manufacture, Storage And Import of Hazardous Chemicals Rules (MSIHC Rules) 1989
- Rule 17. Collection, Development and Disseminations of Information
- Schedule 9 (MSDS Format)

Requirements by MSIHC Rules

- Written On-Site Emergency Management Plan
- Labels to identify each chemical
- Material Safety Data Sheets (MSDSs)
- Safe work procedures/practices
- Information to be given to persons liable to be affected by a accident including Outside premises
- Employee training on MSDS information and safe chemical procedures/practices

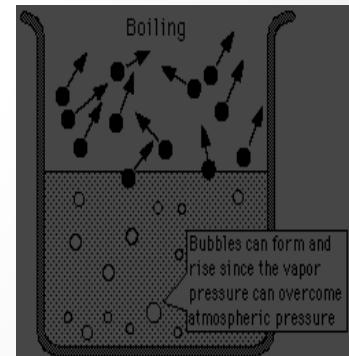
Why Is a Standard Necessary?

- To evaluate the hazards of all chemicals imported into, produced, or used in workplaces
- To prevent or minimize employee exposure to chemicals
- Chemical exposure can contribute to serious health effects
 - heart aliments
 - sterility
 - cancer
 - central nervous system damage etc.
 - kidney/lung damage
 - burns/rashes

Boiling Point

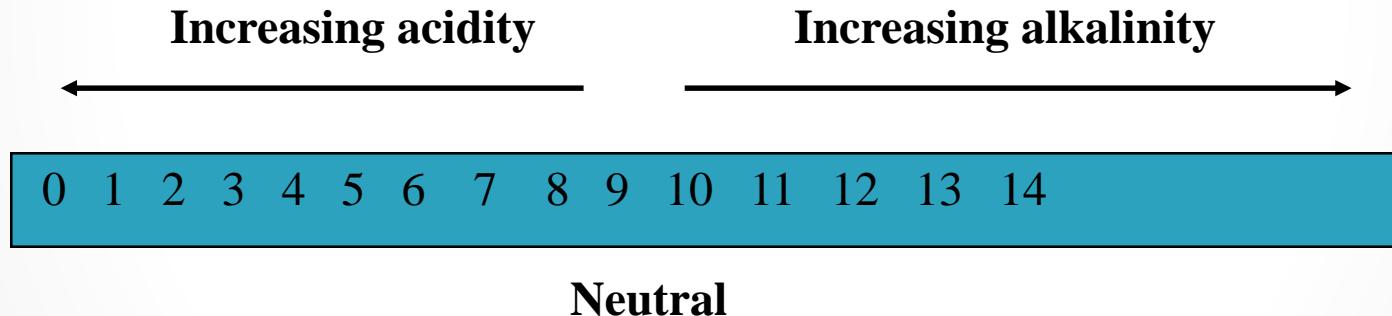
The temperature at which a substance changes its state from a liquid to a gas at a standard pressure (boils) - measured in *degrees Celsius* ($^{\circ}\text{C}$).

- Helps determine whether a material is a solid, liquid, or gas at room temperature
- Helps determine potential hazard and route of exposure:
 - Below 100°C: Inhalation Hazard
 - Above 100°C: Dermal Hazard



pH Scale

- Value used to represent the acidity or alkalinity of a solution
 - The neutral p^H (7) is that of water. The p^H range of 5.5 to 8.5 is normally acceptable. p^H less than 6.5 and more than 8.5 can affect flora, fauna and also people.



Never store Acids and Bases together!



Fire and Explosion Data

Flash point °C (OC) (CC)	-11	Flammability LFL % v UFL % v	1.4 8.0	TDG Flammability	3
Explosion sensitivity to impact	No	Explosion sensitivity to static electricity	Yes	Autoignition Temperature °C	580
Combustible Material	Yes	Explosive Material	No	Hazardous Polymerization	No
Flammable Material	Yes	Oxidiser	No	Corrosive Material	No
Pyrophoric Material	No	Organic Peroxide	No	Other information : Highly Flammable	
Hazardous Combustion Products	None				

Flash Point

- LOWEST TEMPERATURE AT WHICH A LIQUID GIVES OFF ENOUGH VAPOR TO FORM A FLAMMABLE MIXTURE WITH THE AIR ABOVE THE LIQUID. (**WILL NOT SUSTAIN FLAME**)
- **Flammable vs. Combustible**
 - FP <60.5 degrees C = Flammable
 - FP 60.5 to 93 degrees C = Combustible

Auto-ignition Temperature

- THE MINIMUM TEMPERATURE REQUIRED TO INITIATE SELF-SUSTAINED COMBUSTION OF A SUBSTANCE INDEPENDENT OF EXTERNAL IGNITION SOURCES.

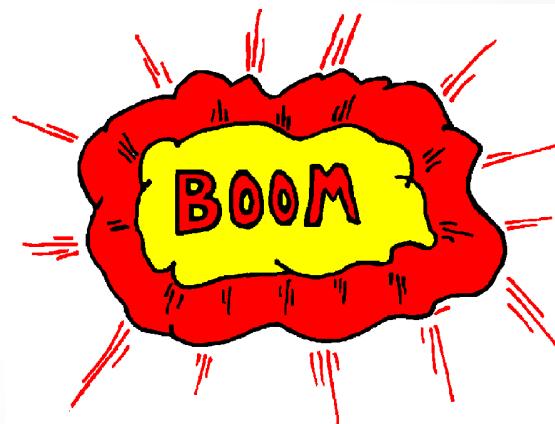


Explosive Limits

- Apply generally to vapors and are defined as the concentration range in which a flammable substance can produce a fire or explosion when an ignition source (such as a spark or open flame) is present.
- The concentration is generally expressed as percent fuel by volume.
 - LEL: Lower Explosive Limit
 - UEL: Upper Explosive Limit

Explosive Material

A chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.



EXPLOSIVE RANGE

- If Explosive Range falls below the **Lower Explosive Limit (LEL)**, the mixture of air and vapor is too *lean* for an explosion
- If Explosive Range is above the maximum explosive range or **Upper Explosive Limit (UEL)**, the mixture of vapor and air is too *rich* to be explosive



100%

GAS CONCENTRATION
(MIXTURE IN AIR)

TOO RICH FOR COMBUSTION

UEL

COMBUSTIBLE MIXTURE

LEL

TOO LEAN FOR COMBUSTION

0%

Upper and Lower Flammability Levels

TDG Flammability / Corrosive material / Hazardous polymerization

TDG Flammability

Transport of Dangerous Goods Flammability and is the same as flammable (dangerous) goods in the UN list of dangerous goods

Hazardous polymerization

Polymerization is a highly exothermic reaction, if a material having tendency to polymerise, starts polymerising the temperature increases which may lead to fire/explosion

Corrosive material:

Quite a few materials are corrosive to steel which is a common material of construction.

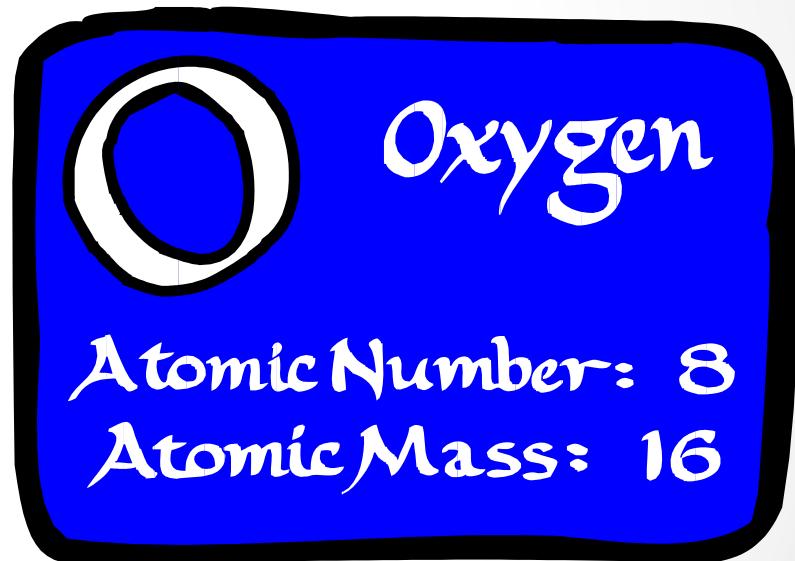
Reactivity Data

Chemical stability	Stable under normal conditions.
Incompatibility with other Materials	Oxidisers, perchlorates, K_2O_2 , N_2O_2 , H_2SO_4 with permanganates, chlorine or bromine with iron
Reactivity	Reacts vigorously with H_2 + Raney nickel and bromine trifluoride. Explodes on contact with Permaganic acid, Peroxo-mono / disulphric acid
Hazardous Reaction Products	None

Oxidizers

Oxidizers, the most familiar being oxygen, promote oxidation of other materials. In some circumstances, the oxidation will create fire or explosion hazards.

Oxidizers include: fluorine, chlorine, hydrogen peroxide, nitrates, picrates, perchloric acid, and many other compounds.



Reactive agents : Generally two types

Water reactives are materials that react violently with water. Examples include metals such as lithium, sodium and potassium; organometallic compounds; and some hydrides.

Pyrophorics are compounds that oxidize materials so rapidly that ignition occurs at room temperature. Many finely divided metals are pyrophoric.



Organic peroxides

Organic peroxides are generally low-power explosives that are sensitive to shock, sparks, or other accidental ignition. They can be far more shock sensitive than explosives such as TNT.

Also potentially hazardous are compounds that auto-oxidize when exposed to air. A familiar auto-oxidizer is ethyl ether. Be sure such materials are marked with the date of receipt, and (especially) with the date opened.



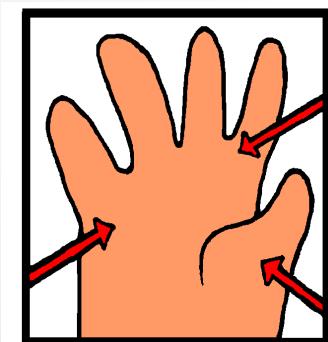
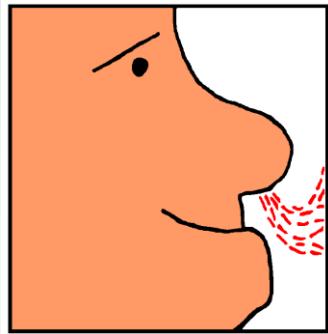
TOXIC RELATED TERMS



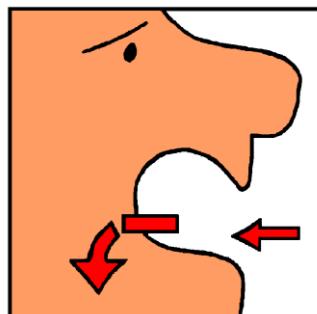
Health Hazard Data

Route of entry	Absorption through skin, inhalation, ingestion			
Effect of exposure/ Symptoms	Burning and redness of eyes and skin. Repeated contact leads to dermatitis, dizziness, excitation, pallor followed by flushing, weakness, headache, breathlessness, chest constriction, coma and possible death. It is a suspected human carcinogen			
Emergency treatment	Flush eyes with plenty of water for atleast 10 minutes. Remove contaminated clothing. Wash affected skin with soap and water. If inhaled, remove the victim to fresh air. Give artificial respiration, if breathing has stopped. If ingested, have victim, drink water or milk. Do not induce vomiting.. Obtain medical attention immediately.			
Permissible Exposure Limit	TLV-TWA (ACGIH)	10 ppm, 32 mg/m ³	STEL(ACGIH)	DNA
LD 50 orl-rat: 3400 mg/kg TCLo ihl-hmn: 210 ppm	IDLH	2000 ppm	Odour threshold	5 ppm
NFPA Hazard Signals	Health 2	Flammability 3	Reactivity 0	Special --

Routes of Occupational Exposure



- **Inhalation** - nearly all materials that are airborne can be inhaled
- **Skin Absorption** - skin contact with a substance can result in four possible actions
- **Ingestion** - most workers do not deliberately swallow materials they handle
- **Injection** - associated with bloodborne pathogens
- **Ocular** - absorbed through the eyes



Definitions

- 8 Hour Time Weighted Average (TWA)
- Permissible Exposure Limit (PEL)
- Threshold Limit Value (TLV)
- Short Term Exposure Limit (STEL)
- Ceiling Limit (C)



Definitions - 8-Hour TWAs

- Reflects an average exposure over a “normal” 8 hour shift
- All high and low concentrations are averaged with respect to time.
- Calculated as follows:

$$\text{TWA} = \frac{C_1T_1 + C_2T_2 + C_3T_3 + \dots + C_nT_n}{8}$$

C=Concentration of contaminant; T= Incremental exposure time

Definitions - PEL

- OSHA sets permissible exposure limits (PEL's) to protect workers against the health effects of exposure to hazardous substances. OSHA PEL's are based on an 8-hour time weighted average (TWA) exposure.
- PEL's are regulatory limits on the amount or concentration of a substance in the air.

Definitions - TLV

- Threshold Limit Values (TLVs®) represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects
- TLV's are intended for use as guidelines or recommendations in the control of potential workplace health hazards; they are not enforceable by law

Definitions - STEL's & Ceilings

- STEL: 15-minute average exposures which should not be exceeded at any time during a workday even if the 8-hour TWA is within acceptable levels.
- Ceilings: Concentrations that should not be exceeded during any part of the workday--not even for an instant.



Lethal Dose or Lethal Concentration

Toxicological data is frequently reported in terms of **lethal dose** or **lethal concentration**.

An LD₅₀ is the amount of material expected to kill one-half of a group of test animals. When the test compound is a gas, results are reported as an LC₅₀.



LD₅₀ values are reported in milligrams toxin administered to the test animal per kilogram of body weight. A lower LD₅₀ value means that it takes less material to induce a toxic effect, that is, the toxin is potentially more harmful.

LC₅₀ values are reported in milligrams toxin per cubic meter of air (mg/m³) or in parts per million (ppm). As with LD₅₀ values, a lower LC₅₀ means that the material has a higher toxicity.



The following three slides provide information intended to assist in developing a sense of the potential harm of a chemical agent given a particular toxicity rating.



The name and image of Sparky, and the Pledge, Learn More to Protect, are registered trademarks of the National Fire Protection Association in Quincy, Mass.

Acute Toxicity Hazard Levels

Toxicity Rating	Oral LD ₅₀ (Rats, per kg)	Skin contact LD ₅₀ (Rabbits, per kg)	Inhalation LC ₅₀ (Rats, ppm, 1 hr)	Inhalation LC ₅₀ (Rats, mg/m ³ , 1 hr)
high	<50mg	<200mg	<200	<2,000
medium	50-500mg	200-1,000mg	200-2,000	2,000-20,000
low	500-5,000mg	1-5g	2,000-20,000	20,000-200,000

Source: Prudent Practices in the Laboratory, 1995

Probable Lethal Dose for Humans

Toxicity Rating	Animal LD ₅₀ (per kg)	Lethal Dose When Ingested by 70-kg (150lb) Human
extremely toxic	<5mg	less than 7 drops
highly toxic	5-50mg	7 drops to 1 teaspoonful
moderately toxic	50-500mg	1 teaspoonful to 1 ounce
slightly toxic	500-5,000mg	1 ounce to 1 pint
practically nontoxic	above 5,000mg	above 1 pint

Source: Prudent Practices in the Laboratory, 1995

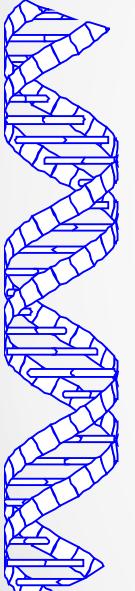
Lethal dose and lethal concentration examples

Compound	Animal	Route	LD ₅₀ /LC ₅₀
Ethanol	Rat	Inhalation	20,000ppm
Ascorbic Acid*	Rat	Oral	11,900mg/kg
Acetone $\varnothing \varnothing$	Rat	Oral	5,800mg/kg
Acetic Acid \varnothing	Rat	Oral	3,310mg/kg
Aspirin	Rat	Injection	1,450mg/kg
Formaldehyde	Rat	Oral	800mg/kg
Atrazine (herbicide)	Rat	Oral	672mg/kg
Phenol	Rat	Oral	317mg/kg

* a.k.a. Vitamin C

\varnothing Constituent of vinegar

$\varnothing \varnothing$ Constituent of nail polish remover



Carcinogen, Mutagens, Teratogens

- Carcinogen means “Cancer Causing”. Known Human Carcinogens , Suspect Carcinogens
- Mutagens** : Chemicals or forms of radiation that causes changes in the genetic structure of living cells. Reproductive cells Hemophilia, Mongolism), Body Cells (Cancer)
- Teratogens** Means “monster making”. An agent that may cause physical defects in the developing embryo or fetus when a pregnant female is exposed, without harming the mother Examples include: alidomide, Ethanol, Ethylene Glycol



NFPA Diamond

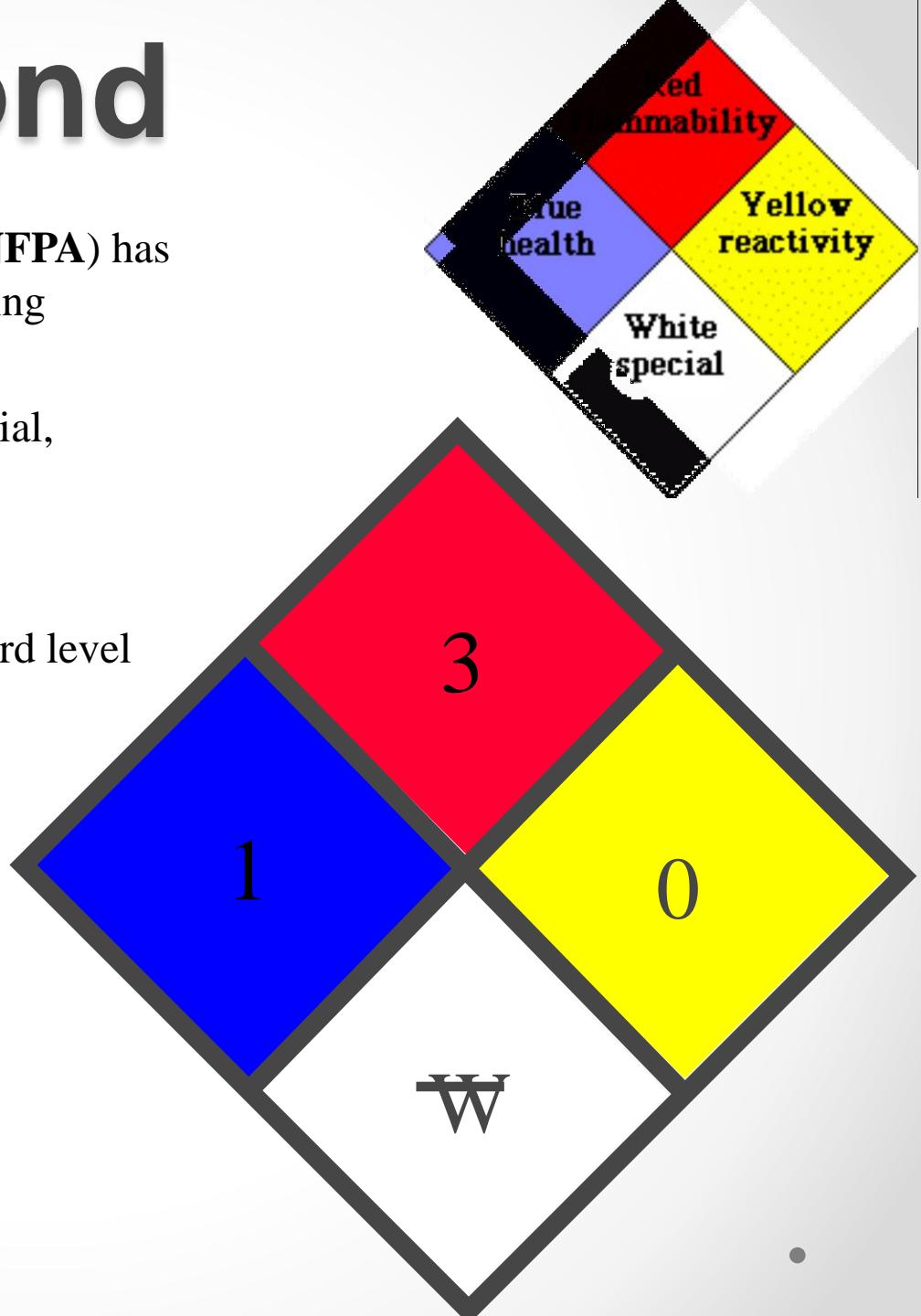
The National Fire Protection Association (NFPA) has developed a simple and effective hazard rating system.

Blue represents the health hazard of a material,

Red is for flammability, and

reactivity is represented by yellow.

The numbers 0 through 4 represent the hazard level within each category, with 4 being the most hazardous.



NFPA Flammability / Health Hazard Codes

4 Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature, or that are readily dispersed in air and that will burn readily. Liquids with a flashpoint below 73°F and a boiling point below 100°F.

3 Liquids and solid that can be ignited under almost all ambient temperature conditions. Liquids with a flashpoint below 73°F and a boiling point above 100°F or liquids with a flashpoint above 73°F but not exceeding 100°F and a boiling point below 100°F.

2 Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Liquids with flashpoint above 100°F but not exceeding 200°F.

1 Materials that must be preheated before ignition can occur. Liquids that have a flashpoint above 200°F.

0 Materials that will not burn.

4 Materials that on very short exposure could cause death or major residual injury.

3 Materials that on short exposure could cause serious temporary or residual injury.

2 Materials that on intense or continued, but not chronic exposure could cause incapacitation or possible residual injury.

1 Materials that on exposure would cause irritation but only minor residual injury.

0 Materials that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible material.

NFPA Reactivity Codes

4 Materials that in themselves are readily capable of detonation or of explosive decomposition or reaction at normal temperatures and pressures.

3 Materials that in themselves are capable of detonation or explosive decomposition or reaction but require a strong initiating source or which must be heated under confinement before initiation or which react explosively with water.

2 Materials that readily undergo violent chemical change at elevated temperatures and pressures or which react violently with water or which may form explosive mixtures with water.

1 Materials that in themselves are normally stable, but which can become unstable at elevated temperatures and pressures.

0 Materials that in themselves are normally stable, even under fire exposure conditions, and which are not reactive with water.

NFPA Special Hazard Codes

OX - oxidizer

ACID - acid

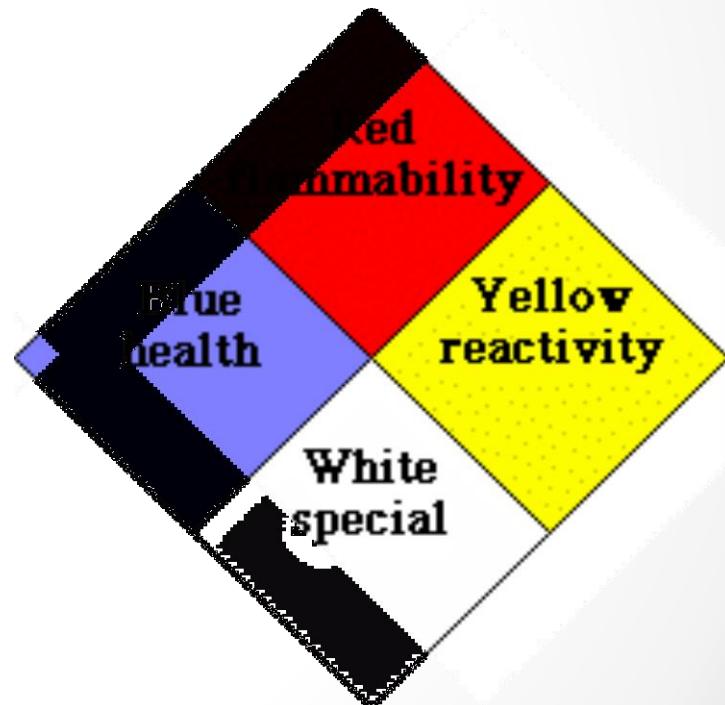
ALK - alkali

CORR - corrosive

W - use no water



- radioactive



Preventive Measures

PERSONAL PROTECTIVE MATERIAL	Use PVC or rubber gloves and apron, gum boots, goggles / face shield and overalls. Use breathing apparatus if required
HANDLING AND STORAGE PRECAUTIONS	Store in a cool, clean, ventilated, fireproof storage area. keep away from heat, sparks, open flame and incompatible materials(strong oxidising agents). Protect containers against physical damage.

Emergency and First Aid Measures

FIRE (Class of fire : B)

Fire extinguish media	Alcohol resistant foam or Dry agent (CO ₂ , dry chemical powder)
Special Procedures	None
Unusual Hazards	None

EXPOSURE

First Aid Measures	Eye : Flush eyes with plenty of water for atleast 10 minutes. Skin : Remove contaminated clothing and wash affected skin with soap and water. Inhalation : Remove victim to fresh air. If not breathing, give artificial respiration. Ingestion : if conscious, have victim drink water or milk. Do not induce vomiting. In all cases obtain medical attention immediately.
Antidotes/ Dosages	DNA

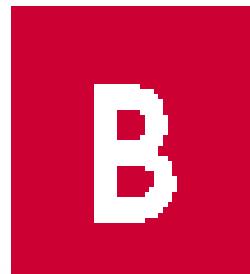
Class A Fires

- Are fires fueled by materials that, when they burn, leave a residue in the form of ash
- Paper, wood, cloth, rubber, and certain plastics
- Extinguisher type: Water, Dry Chemical (MAP)



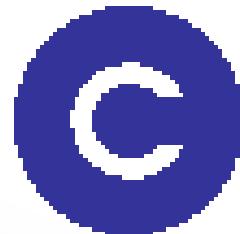
Class B Fires

- Fires which involve flammable liquids
- Gasoline, paint thinner, grease, propane, acetylene
- Extinguisher type: Carbon Dioxide, Dry Chemical, Foam



Class C Fires

- Flammable Gases
- Extinguisher type: Carbon Dioxide, Dry Chemical



Class D Fires

- Class D fires involve exotic metals, such as magnesium, sodium, titanium, and certain organometallic compounds such as alkyllithium and Grignard reagents
- Extinguisher Type : DCP 9 Special type – Ternary eutectic chloride)



Additional Information

ECOLOGICAL INFORMATION

Ecotoxicity	Harmful to aquatic life in very low concentrations. Aquatic toxicity : 5 ppm/6 h/minnow/ lethal/ distilled water : 20 ppm/24h/sunfish TLm/tap water
Persistence	Calculated half time in water at 25 ° C and 1m depth (based on evaporation rate of 0.144 m/h) = 4.81h
OTHER INFORMATION	BEI (total phenol in urine at end of shift) not to exceed 50 mg/l mean value

References (FOR OBTAINING MORE INFORMATION)

- | | |
|---|--|
| 1. Hazardous Cemicals Data Book: G Weiss: Noyes Data Corp USA | 2. Hand Book of Environment Data: Karen Verschueren : Van Nostrand Reinhold Co., USA |
|---|--|

Keeping it Safe

- Corrosives, solvents, and other chemical substances can be potentially dangerous
- Safe handling procedures
 - **read container labels**
 - **check Material Safety Data Sheets**
- Never sniff a chemical for identification
- Use appropriate personal protective equipment

Reading Chemical Labels

- Warning labels provide important information about the chemical
 -  “Danger”
 -  “Warning”
 -  “Caution”
- Always read the label ***before*** you begin a job using a potentially hazardous chemical

Hazard Communication Plan

- to develop and implement a written hazard communication program
- to provide Hazard Communication training for employees
 - initially to all
 - whenever a new hazard is introduced into the workplace

Hazard Communication Plan

The plan includes

a list of the hazardous chemicals known to

- ❖ **be present in your workplace**

- how MSDS filing requirements are being met
- type of labeling system being used
- detailed information on training and compliance
- methods to inform you of

- ❖ **non-routine tasks and safe procedures**

- methods to inform outside contractors of the HazCom program

Special Hazards

- Entering vessels, tanks, railcars, or any confined space
- Prior to opening or entry
 - safe work permit
 - reduce contents to minimum possible level
 - Lockout / Tag out
 - MSDS for the materials
 - Initial opening
 - utilize plant confined work space entry program criteria

Special Hazards, continued

- Working with unlabeled piping
 - Contact or member and have contents of piping verified
 - Seek Member assistance to remove contents or relieve any pressure
 - Preplan the job
- Management of process spills or leaks
 - Secure the area

Hazard Communication



Thanks !!!!!!!!!!!!!!!

