FIRE SAFETY TRAINING

THE LOSS PREVENTION UNIT
OF THE
OFFICE OF RISK MANAGEMENT

COURSE OUTLINE

INTRODUCTION TO SAFETY

I. FIRE SCIENCE

II. FIRE SAFETY INSPECTIONS

III. EVACUATION PLAN

IV. FIRE EXTINGUISHERS

V. OTHER FEATURES OF FIRE PROTECTION

Safety:-

Safety means saving from injury. In industrial context, it is the completion of work without **accident.**

Accident:-

Accident is an undesired event. It brings harm to the body and loss of property.

Accident could cause -

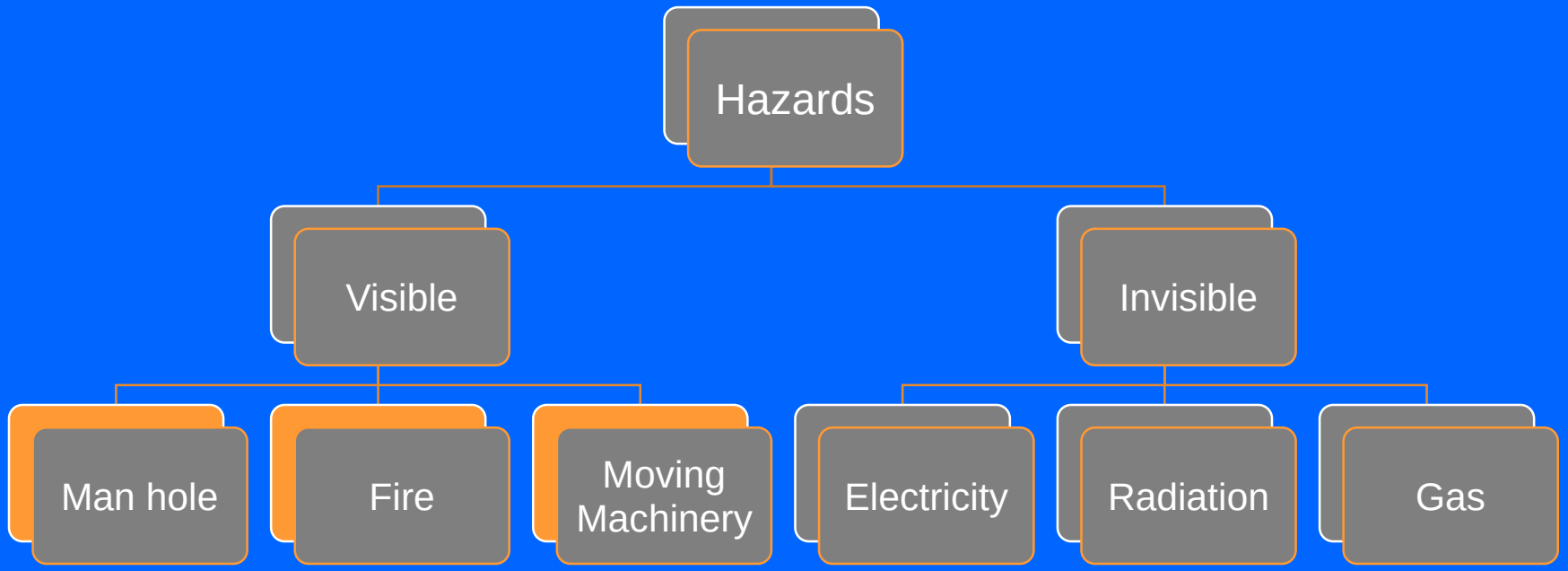
i. Physical injury to the workmen

ii. Damage to property

iii. Wastage of raw-materials

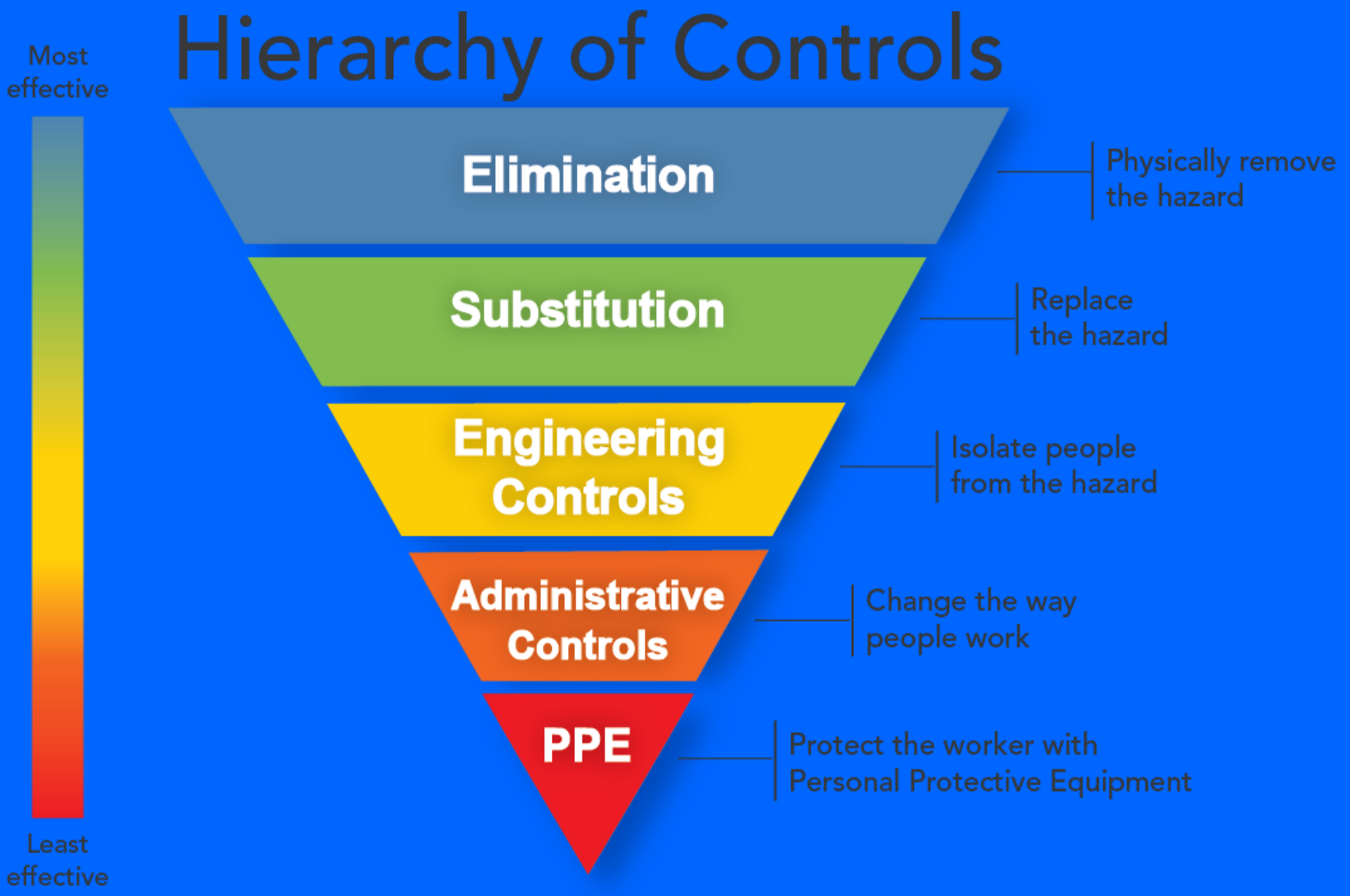
Hazard:-

Hazard means the object or condition which causes accident or have potential to cause accident.



Information on **invisible hazards** must be obtained for prevention of accidents.

Control of Hazards

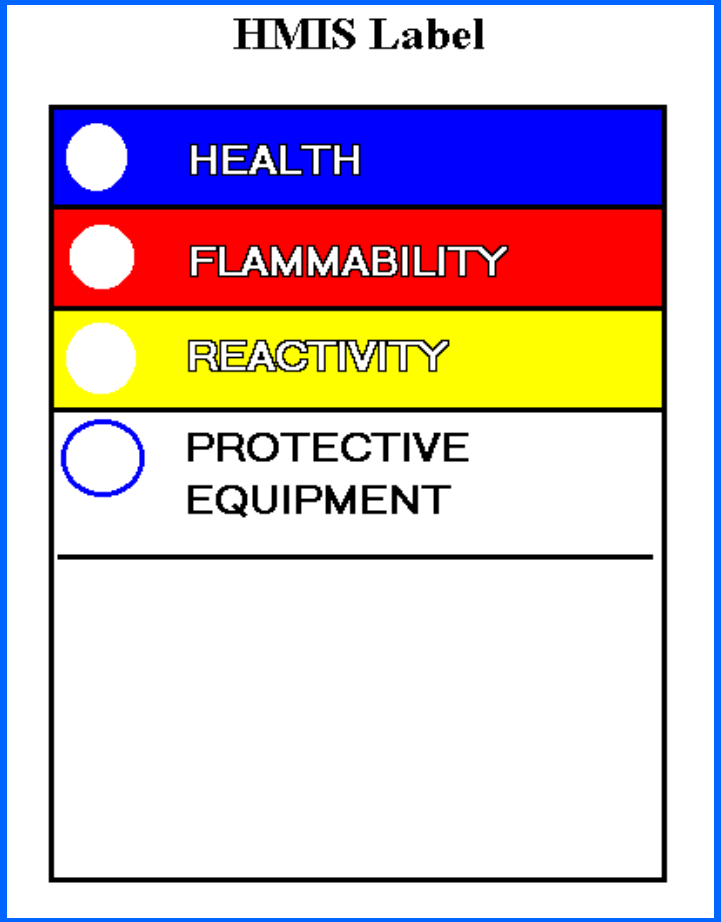


Chemical Hazards

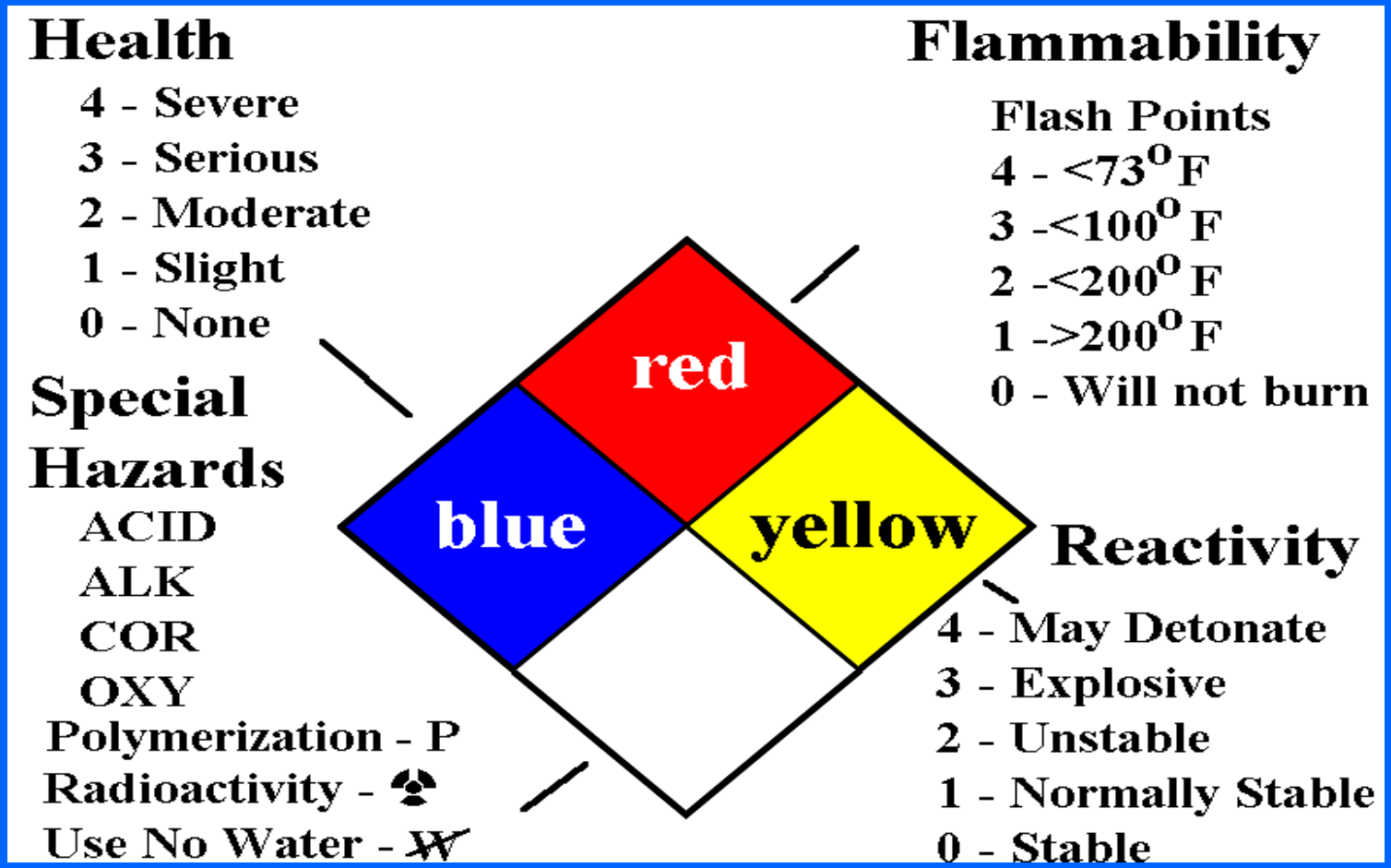
- Flammable/Explosion
  - Flash point
  - LEL
- Toxic/Poison
  - Acute / Chronic
  - Local / Systemic
  - Routes of entry
- Reactive
- Corrosive

Container Labels

- Shipping Labels
- Manufacturer's Warnings
- NFPA Diamond / HMIS Labels
- Health, Fire, and Reactive Hazards



NFPA Diamond



Material Safety Data Sheets

- Identity of Material and Manufacturer
- Hazardous Ingredients
- Physical and Chemical Characteristics
- Fire and Explosion Hazard Data
- Reactivity Data
- Health Hazard Data (Limits, Symptoms, etc.)
- Precautions for Safe Handling
- Control Measures and First Aid

Respiratory Hazards

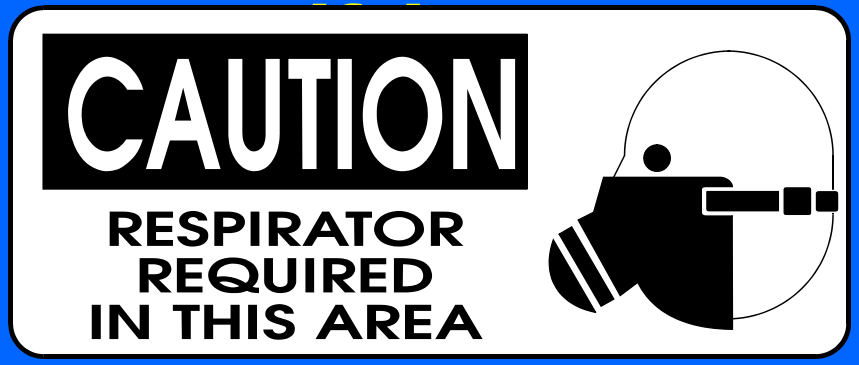
- Toxic
  - Dusts, fumes, and mists (particulate)
  - Gases and vapors
- Oxygen deficiency or enrichment
- Immediately Dangerous to Life and Health (IDLH)

Respiratory (Occupational) Exposure Limits

- Permissible Exposure Limit - OSHA PEL
- Threshold Limit Value - ACGIH TLV
- Time-Weighted-Average - TWA
- Short Term Exposure Limit - STEL
- Ceiling Limit - TLV-C or PEL-C
- “Skin” notation
- Protection for a Working Lifetime

Respiratory Protection

- Air-Purifying (APR)
  - Dust Mask
  - Half Face
  - Full Face
  - Powered Air-



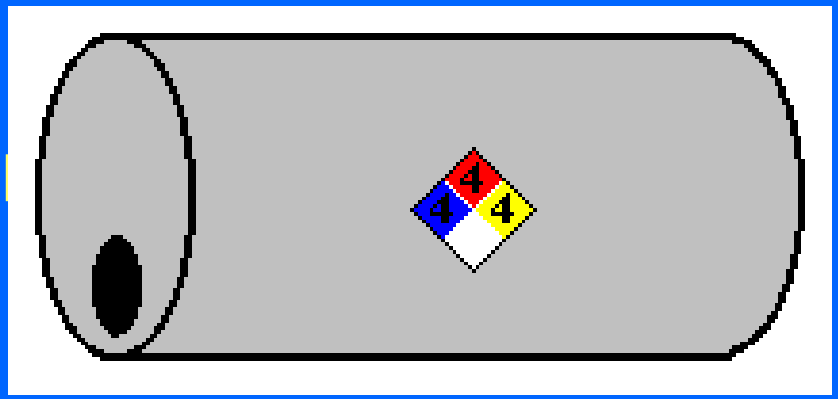
- Supplied Air (SAR)
  - Air-line
    - Hood style
    - Facepiece style
      - Half Face
      - Full Face
    - Escape provisions
  - Self Contained Breathing Apparatus (SCBA)

Respirator Protection Factors (PF)

- Air-Purifying (APR)[1]
  - Dust Mask - 10
  - Half Face - 10
  - Full Face - 50
  - Powered Air-Purifying Respirators (PAPR) - 100
- Supplied Air (SAR)[2]
  - Air-line
    - Hood style - 100
    - Facepiece style - 1000
    - Escape provisions - >10,000
  - Self Contained Breathing

Atmospheric Hazards

- Oxygen Deficiency / Enrichment - below 19.5% or above 23.5%
- Flammable / Explosive - LEL above 5%
- Toxic - above PEL, unknown, or IDLH
- Control with testi
and/or PPE



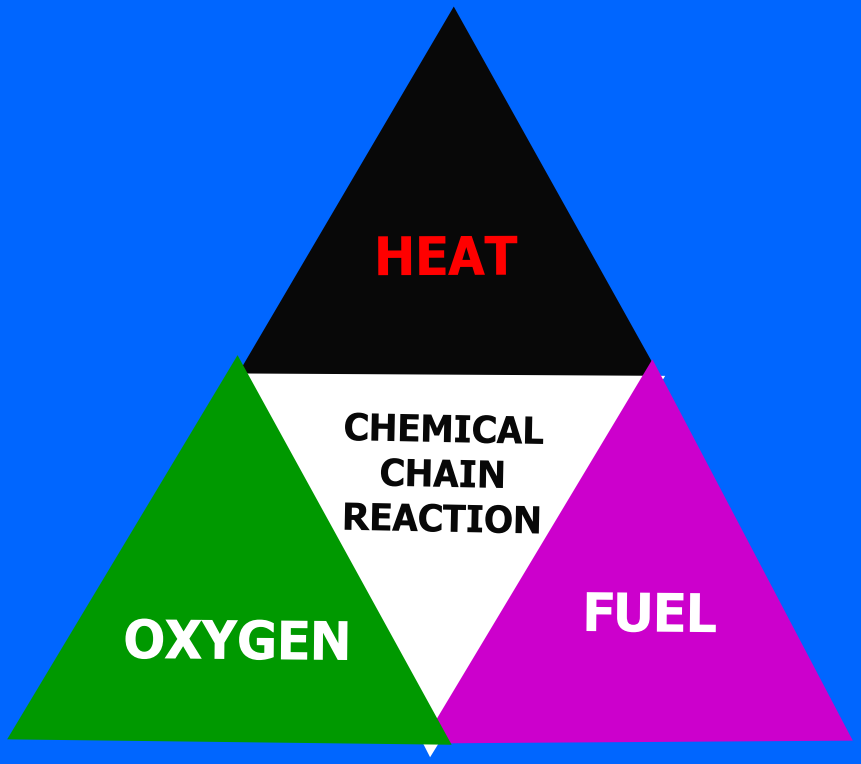
FIRE SCIENCE

FIRE SCIENCE

What elements are needed to start a fire?

FIRE SCIENCE

The Fire Tetrahedron



Tetrahedron is a 3-D triangle – a triangle base pyramid.

Elements of Fire

- Elements of Combustion (Fire Triangle)
- All required for a fire to occur.
- Trend is to include "Chemical Reaction" as fourth element (Fire Tetrahedron).

Fire Properties & Chemistry

- Fuel must release gases/vapors – may require heating. (Ray Bradbury – Fahrenheit 451)
- Fuel gases must mix /w Oxygen in proper proportion (Lean / Rich - Flammable Range).
- Must be a source of ignition.

Fire Terms

- Flash Point
- Flammable Range (Lean/Rich)
- LEL/UEL (LFL/UFL)
- Ignition Temperature
- Flammable vs. Combustible liquids
- Bonding and Grounding

1 - **Flash Point** – minimum temperature a fuel must be heated before it will ignite

2 - **Flammable Range (Lean/Rich)** – when there is an appropriate fuel/air mixture for combustion I.e. not too lean (too little fuel), not too rich (too much fuel)

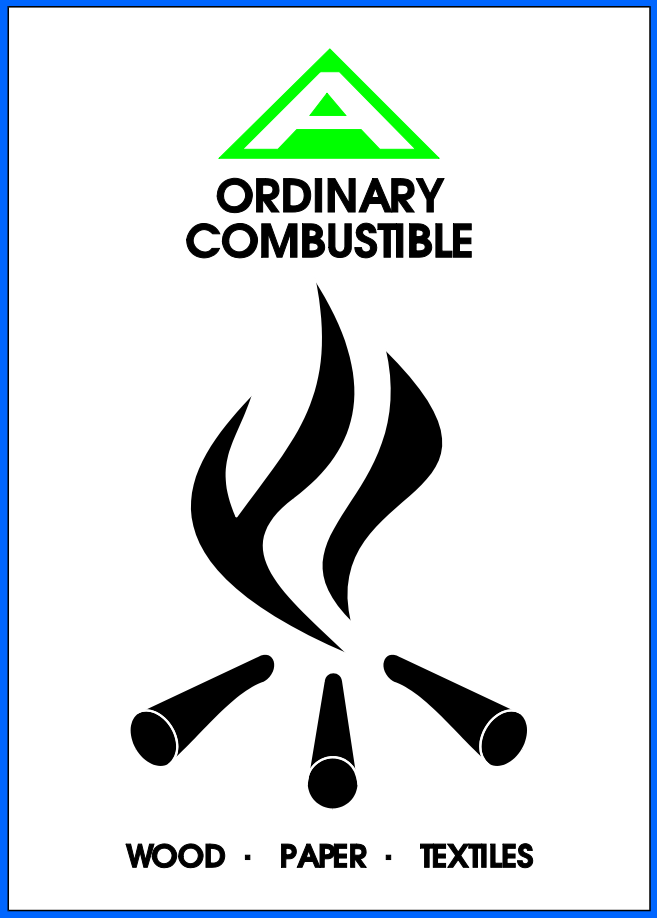
3 - **LEL/UEL (LFL/UFL)** – Lower Explosive (Flammability) Limit / Upper Explosive (Flammability) Limit. These are the upper and lower limits of the Flammable Range.

4 - **Ignition Temperature –** How hot the ignition source has to be – usually higher than the flash point.

5 - **Flammable vs. Combustible liquids –** Flammable liquids have flash points less than 100F for OSHA rules, 140F for DOT rules, and 140F for EPA Hazardous Waste rules (EPA uses the term “ignitable” instead of “flammable”). Combustible liquids have flash points higher than those. Flammable liquids are at or above flash point at normal/ambient temperatures.

6 - **Bonding and Grounding –** refers to procedures to dissipate static electricity during handling or transfer of flammable/combustible liquids. Bonding means to electrically bond 2 containers. Grounding means to electrically connecting them to ground.

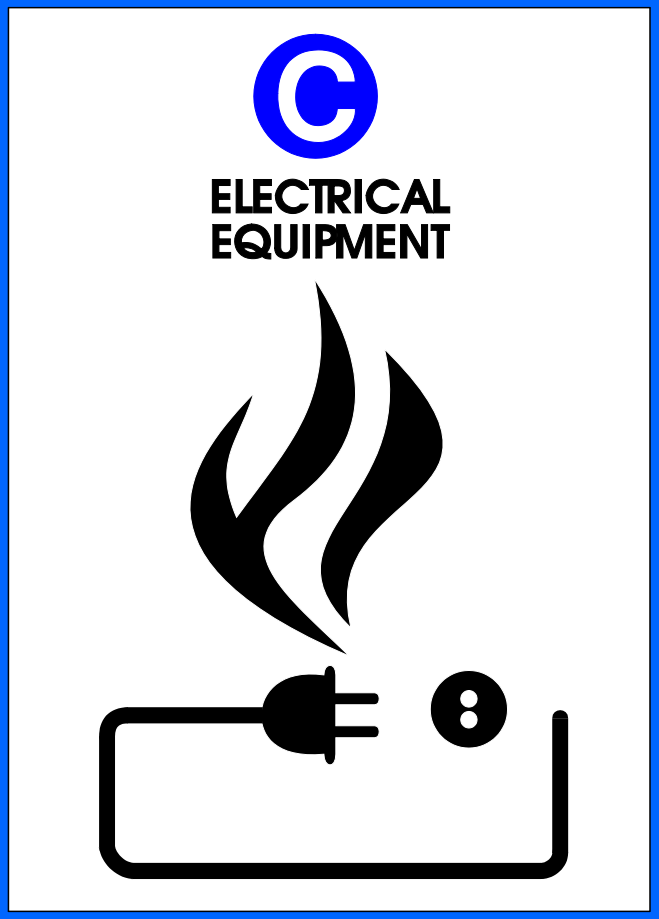
Classes of Fires



Class A – most common fire. A burning house is a class A fire.

Class B – at home would occur with household chemicals (paint, strippers, solvent cleaners, etc.) or fuels (gasoline, oils, etc.) or in the kitchen with grease.

Classes of Fires



Class C – danger from live electricity. GET POWER TURNED OFF.

Class D – many metals will burn magnesium, aluminum, metallic sodium, are examples. Metal burns easier if it is in powder form or chips. Putting water on a metal fire is very dangerous – it may explode.

FIRE SCIENCE

FUEL CAN BE

- **LIQUID:** Grease, Oil, Fuel;
- **SOLID:** Wood, Paper, Metal;
- **GAS:** Natural Gas, Propane, Acetylene.

FIRE SCIENCE

What is smoke?

Smoke is simply combustible organic compounds.

FIRE SCIENCE

WHAT IS THE DIFFERENCE BETWEEN *COMBUSTIBLE* AND *FLAMMABLE* MATERIAL?

***Combustible material* has a flashpoint of 100 F or above**

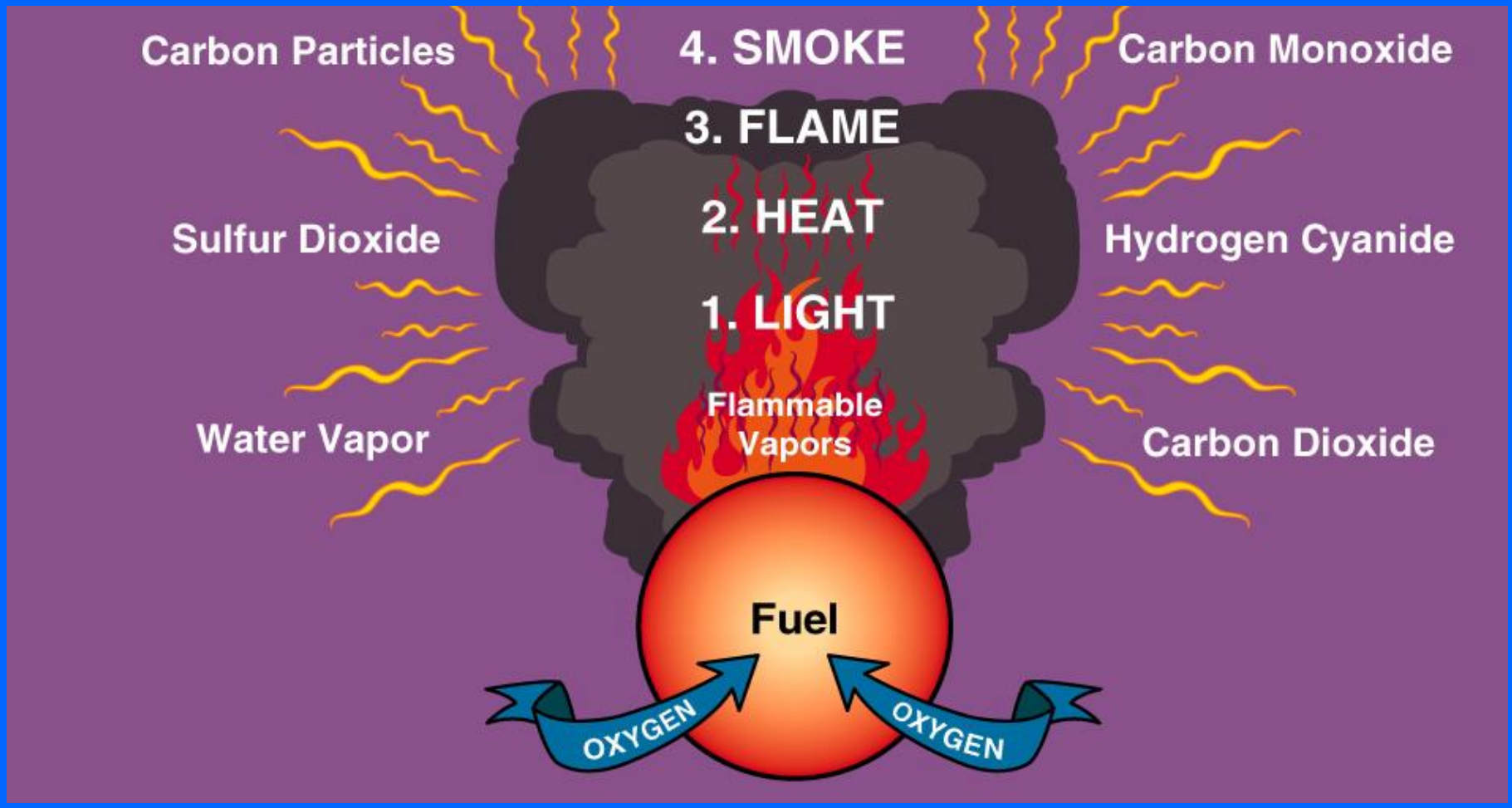
***Flammable material* has a flashpoint below 100 F [Ref. NFPA 96]**

Flammable is a substance which under normal conditions has the ability to catch fire with a minimal ignition source (such as a spark). An example of this might be a substance such as propane. - Combustible materials would be any material that will burn. In this category we could also place propane and the like but it would also include materials that need more vigorous conditions to burn and are not likely to catch fire with a simple spark. An example of a combustible material of this sort would be wood or paper. In my opinion therefore, all flammable materials are combustible, but all combustible materials are not necessarily flammable.

COMBUSTIBLE - BURNS ALL AT ONCE, AND MAY PRODUCE AN EXPLOSION

FLAMMABLE - BURNS, BUT AT A STEADY RATE

FIRE SCIENCE



FIRE SCIENCE

REGARDING FIREFIGHTING, MSDSs TELL YOU IMPORTANT FACTS ABOUT THE CHEMICALS OR PRODUCTS YOU STORE!

The proper extinguishing agent to use on the fire.

FIRE SAFETY INSPECTIONS

YOUR ORM
LOSS PREVENTION OFFICER
IS AVAILABLE TO ASSIST

FIRE SAFETY INSPECTIONS

SOME HAZARDS TO LOOK FOR IN YOUR WORKPLACE

EXAMPLES

- Locked or blocked exits (common hazard)
- Trash or debris Electrical hazards Cooking hazards Chemical, Gas Cylinders/ System, and Labs
- Smoking Areas
- Exit Signs Blocked exits/isles/hallways
- Fire extinguisher hazards
- Emergency lighting hazards
- Emergency stairway doors blocked or propped open

FIRE SAFETY INSPECTIONS

FIRE SAFETY INSPECTIONS

REMEMBER

The best way to fight fire is to prevent it

FIRE EVACUATION PLAN

EVACUATION PLAN

COMPONENTS OF AN EVACUATION PLAN

- Emergency Control Committee - develops plan
- Emergency Crews - administer plan
- Escape routes - primary & secondary
- Maps - posted indicating escape routes, first aid kits and extinguishers

FIRE EVACUATION PLAN

WHAT TO DO IN CASE OF FIRE

FOLLOW YOUR AGENCY'S FIRE EVACUATION PLAN

FIRE EVACUATION PLAN

WHAT TO DO IF YOU SHOULD BECOME TRAPPED IN A BUILDING

- Don’t panic
- Try to find a secondary exit
- Feel doors for heat with your hand
- If the door is hot, don’t open it!
- If you can’t find another exit, stay where you are

FIRE EVACUATION PLAN

- Seal doors and vents to prevent smoke penetration.
- If possible call “101” and report your exact location.
- Stay low to avoid smoke and heat.

EVACUATION PLAN

The plan should be reviewed and, if possible, approved by

- **Fire officials (either State or Local officials)**
- **Office of State Buildings.**

EVACUATION PLAN

FIRE DRILLS…

…are conducted at least once each year, but some agencies may require them more frequently.

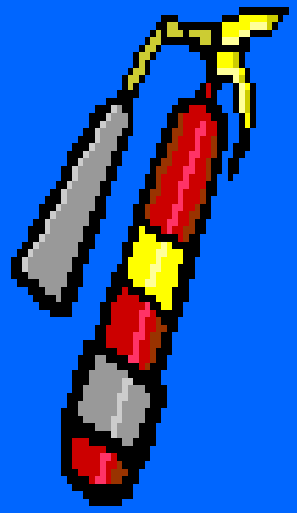
EVACUATION PLAN

FIRE DRILLS… cont.

Remember to DOCUMENT:

- **Date & time**
- **Employees & visitors present**
- **Outside meeting location**
- **Headcount**
- **Time of entire drill**

FIRE EXTINGUISHERS



FIRE EXTINGUISHERS

KNOW WHERE FIRE EXTINGUISHERS ARE LOCATED IN YOUR WORKPLACE

LEARN HOW TO USE THEM FFECTIVELY

NEVER LEAVE AN EXTINGUISHED FIRE UNATTENDED

FIRE EXTINGUISHERS

INSPECTIONS

- The National Fire Protection Association (NFPA) defines an inspection as a "quick check" that the extinguisher is available and will function

- NFPA requires extinguishers be inspected monthly, or more frequently if circumstances require it

FIRE EXTINGUISHERS

WHO CAN INSPECT A FIRE EXTINGUISHER

Anyone.

NFPA says *"minimal knowledge required"*

"Minimal Knowledge" is needed to perform an inspection on an extinguisher, so almost anyone can perform this inspection.

FIRE EXTINGUISHERS

INSPECTION PROCEDURES

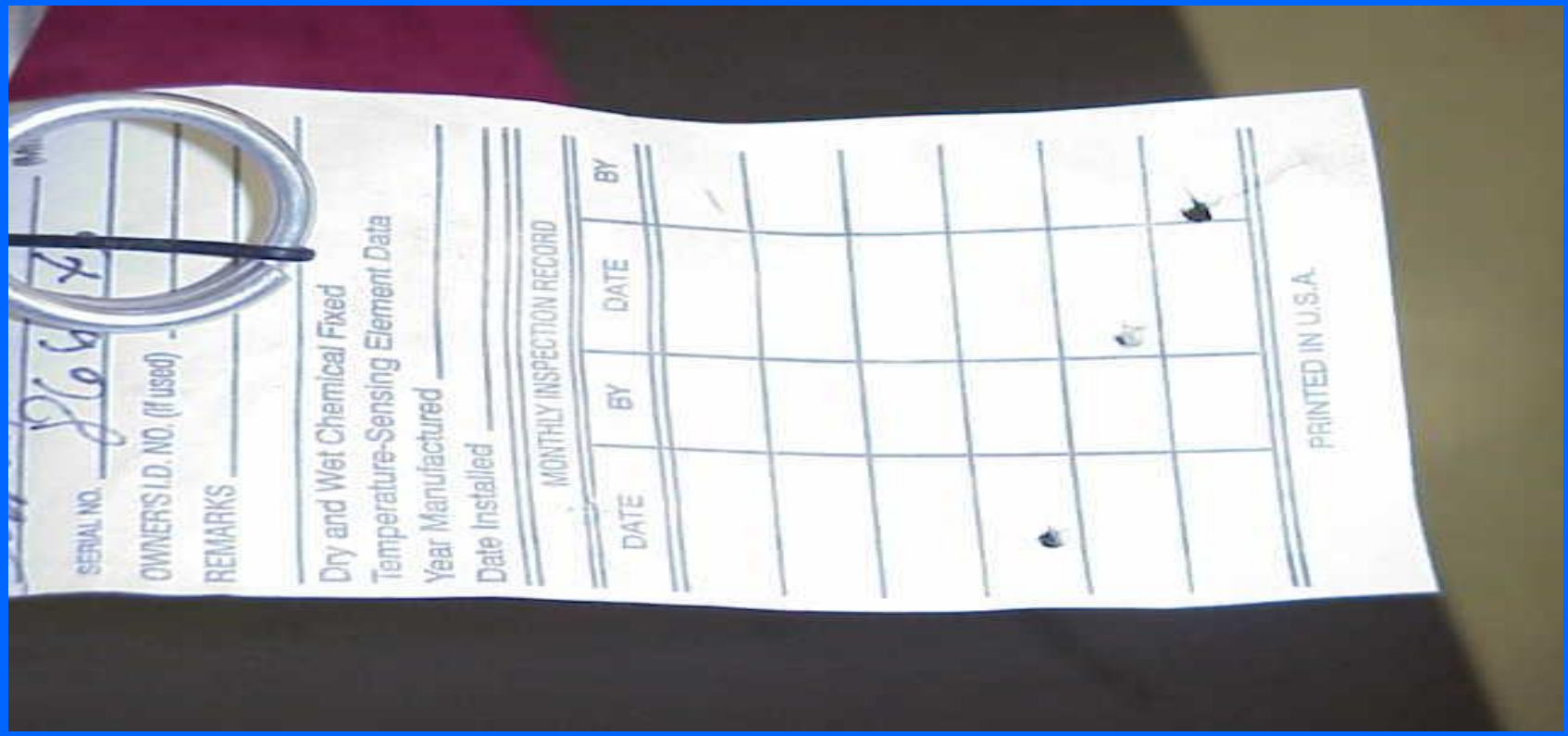
- **Extinguisher located in designated place?**
- **Obstructions to access or visibility?**
- **Operating Instructions on nameplate legible & facing outward?**
- **Seals & tamper indicators in place & intact?**

FIRE EXTINGUISHERS

- **Determine fullness by weight or by *"hefting."* Invert & shake it will help ensure *"caking"* or hardening of powder has not occurred.**
- **Visually examine for obvious physical damage, corrosion, leakage, or a clogged nozzle.**
- **Check to see if the pressure gauge is in operable range.**

FIRE EXTINGUISHERS

INSPECTION TAG:



FIRE EXTINGUISHERS

MAINTENANCE

NFPA defines maintenance as a *"thorough check"* of the extinguisher.

It is intended to give "maximum" assurance that an extinguisher will operate effectively and safely

FIRE EXTINGUISHERS

HOW OFTEN SHOULD MAINTENANCE BE PERFORMED

The NFPA says that maintenance should be performed at least annually

FIRE EXTINGUISHERS

MAINTENANCE RECORDKEEPING

NFPA requires that a tag be attached to the extinguisher indicating:

1. **The month & year the maintenance was performed, and**
2. **Identification of the person & the company performing the work.**

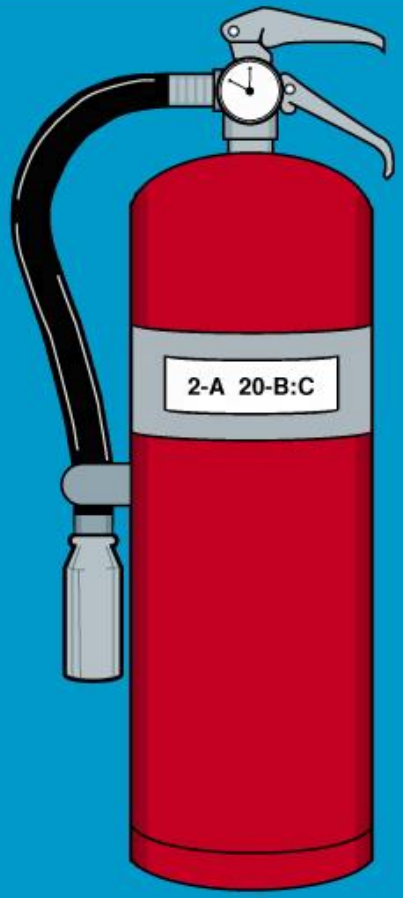
FIRE EXTINGUISHERS

MAINTENANCE TAGS

These are the different types of tags that appear on fire extinguishers. The 2 on the right are obviously ones that appear if something's wrong with the extinguisher & needs repair or replacement.

FIRE EXTINGUISHERS

Extinguisher Rating System



LETTERS indicate the fuel class on which the extinguisher will be effective.

A	B	C	D
Ordinary Combustibles	Flammable Liquids	Electrical Equipment	Combustible Metals

NUMBERS indicate the relative effectiveness of the extinguisher:

For example,

- A 2-A extinguisher extinguishes twice as much fuel as a 1-A extinguisher.
- A 20-B extinguisher extinguishes 20 times as much fuel as a 1-B extinguisher.

Numbers are used with letters on Class A and Class B extinguishers only.

Classes of Fire:

- **CLASS A – Fires in combustible materials – wood, clothe, paper, etc.**
- **CLASS B – Fires in flammable or combustible liquids – oils, greases, tars, oil, base paints, flammable gasses.**
- **CLASS C – Fires involving energized electrical equipment.**
- **CLASS D – fires in combustible metals, such as magnesium, titanium, sodium, etc.**

FIRE EXTINGUISHERS

TYPES OF EXTINGUISHERS:

Carbon Dioxide
(CO_2)

FIRE EXTINGUISHERS

TYPES OF EXTINGUISHERS:

Stored pressure dry powder (ABC)

FIRE EXTINGUISHERS

TYPES OF EXTINGUISHERS:

Clean agent type extinguishers (Halon)

FIRE EXTINGUISHERS

SIZES:

Minimum size is 2A:10BC. The number indicates the number of square feet & the letter indicates the type of fire.

Minimum size is 2A & the largest above is 10BC

Number indicates square feet coverage & letter indicates type of fire.

2 sq. ft for Class A (wood, paper, rubber, etc.)

10 sq ft. for Class B (grease, oil, paint) & C (electrical fire)

FIRE EXTINGUISHERS

IMPORTANT TO REMEMBER

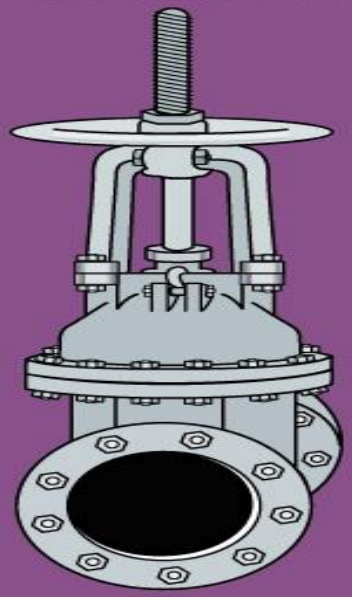
Ensure that each area has the proper type fire extinguisher!

OTHER FEATURES OF FIRE PROTECTION

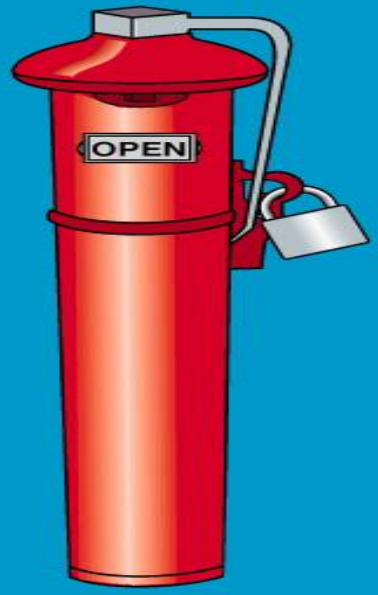
SPRINKLERS

TYPES OF CONTROL VALVES

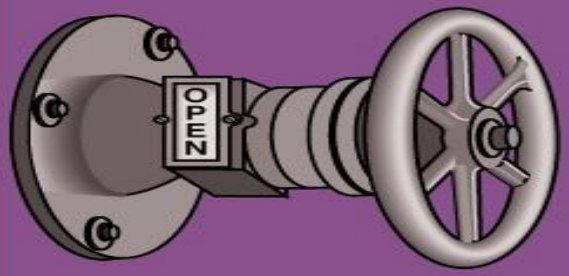
OS&Y
(Outside
Screw and Yoke)



PIV
(Post Indicator
Valve)



WPIV
(Wall Post
Indicator Valve)



These are not applicable to all agencies. Primarily apply to large agencies such as hospitals, perhaps some universities where fire hose systems are used.

OTHER FEATURES OF FIRE PROTECTION

ALARMS

OTHER FEATURES OF FIRE PROTECTION

DETECTORS & STOBES

OTHER FEATURES OF FIRE PROTECTION

FIRE DOORS

Fire doors are often located in newer buildings. They are either shut automatically when an alarm is engaged or are shut by employees. Their function is to keep the fire from spreading by keeping oxygen flow behind.

OTHER FEATURES OF FIRE PROTECTION

SUPPRESSION SYSTEMS

These are used in **CLASS K** fires – that occur where agencies have large kitchens & require special fire suppression systems to prevent fires in cooking appliances that involve combustible cooking such as vegetable or animal oils & fats.

THE END!

THANK YOU FOR ATTENDING!