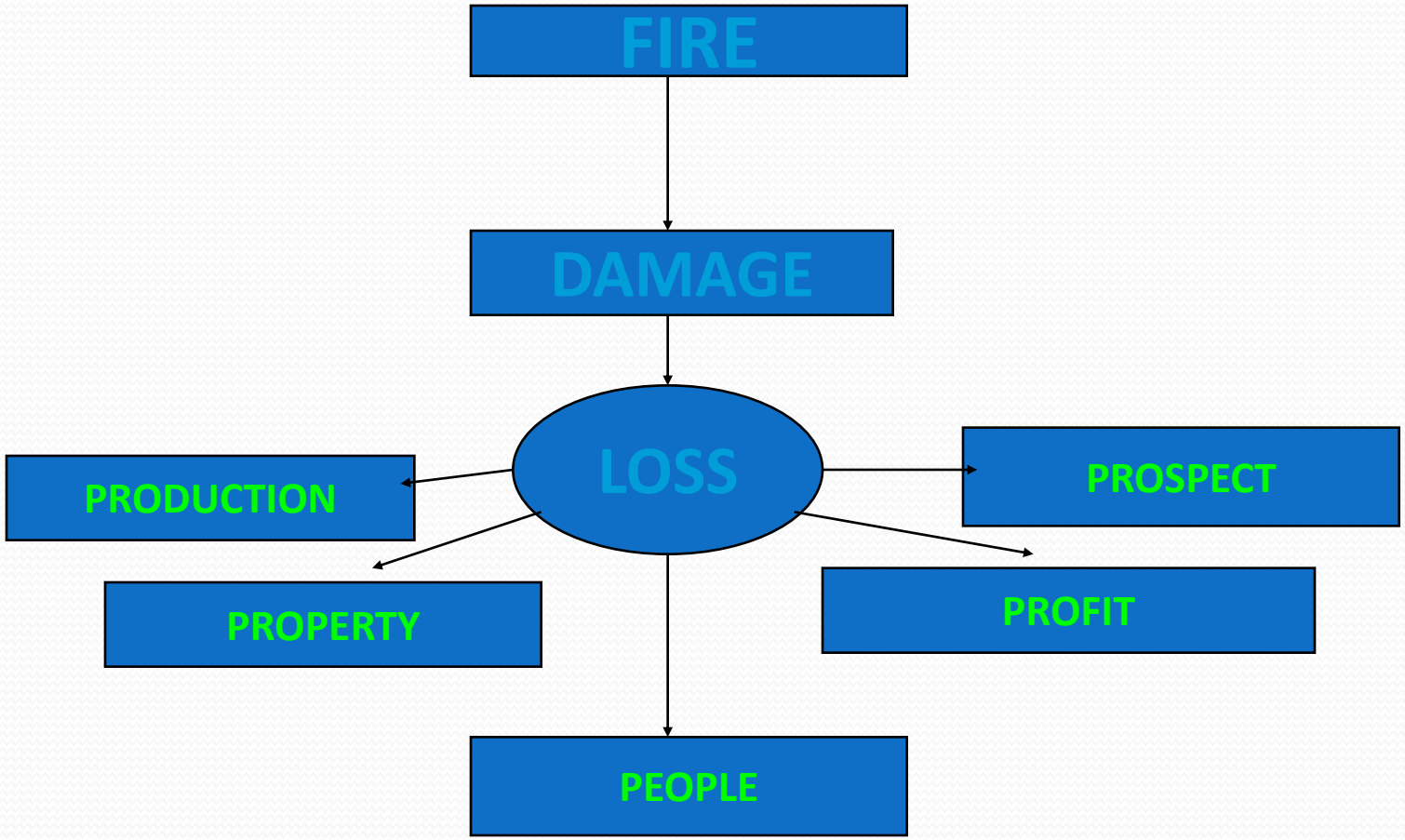
FIRE DISASTER

IDM Subject Code : CHM 2042

Definitions

- A process in which substances combine chemically with oxygen from the air and typically give out bright light, heat, and smoke; combustion or burning.
- Flash Point:
  - (Petroleum Classification
    - Class-A –Flash point below 23^{o}C e.g. Gasoline,
    - Class-B- flash-point of 23^{o}C and above but below 65^{o}C e.g. HSD
    - Class-C- flash-point of 65^{o}C and above but below 93^{o}C e.g. FO
- Ignition Temperature:
- Auto-ignition Temperature:


FIRE
DAMAGE
LOSS
PRODUCTION
PROSPECT
PROPERTY
PROFIT
PEOPLE

Products of Combustion

- Smoke
- Flame
- Heat
- Toxic Gases

Regulating Body of Fire Services & Standards

- DGCD (Director General of Civil Defense)
- BIS (Bureau of Indian Standard)
- TAC (Tariff Advisory Committee)
- NFPA (National Fire Protection Association)
- OISD (Oil Industries Safety Directorate)

TRIANGLE OF FIRE

The Fire Triangle

Three things must be present at the same time to produce fire:

1. Enough OXYGEN to sustain combustion
2. Enough HEAT to reach ignition temperature
3. Some FUEL or combustible material

Together, they produce the CHEMICAL REACTION that is fire

Take away any of these things and the fire will be extinguished

Fire Chemistry

Definition of FIRE :--

- Combustion reaction where heat and flame is evolved. $FUEL + O_2 \xrightarrow{Heat} CO_2 + CO$

FIRE =

Flammable vapor or gas (**FUEL**)

+

Air in correct proportion (**O_2**)

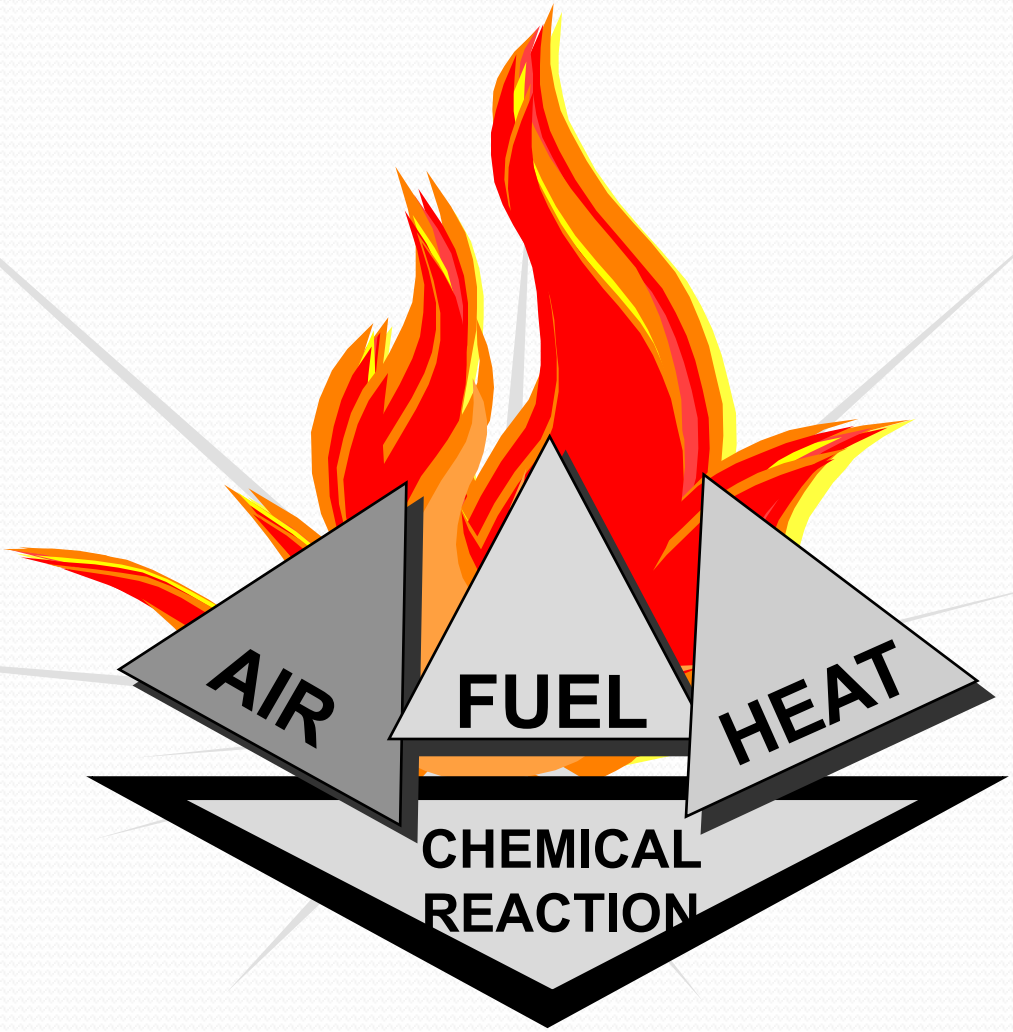
+

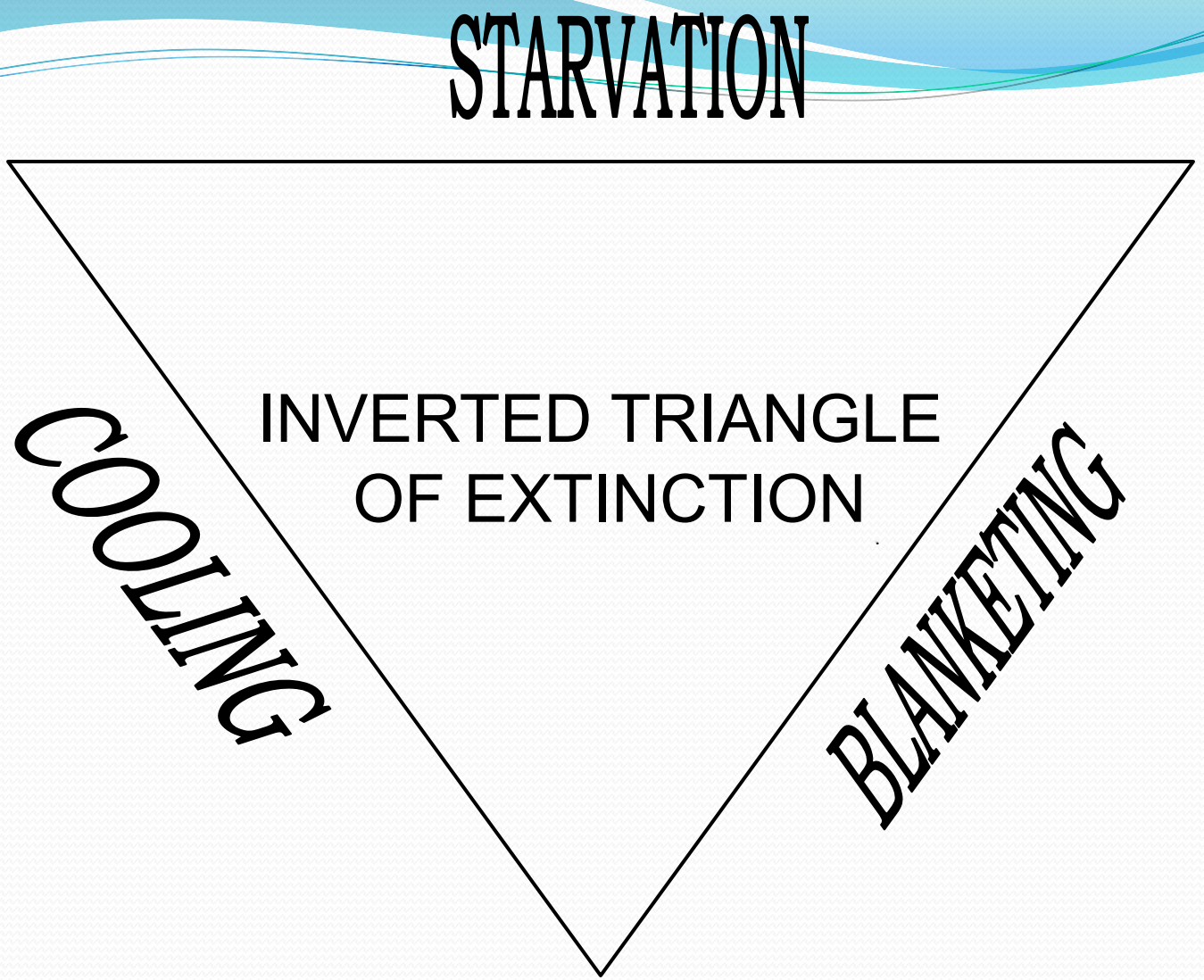
Source of ignition (**Naked Flame**)

+

Chain reaction

THE FIRE PYRAMID





FIRE EXTINGUISHING METHODS

Few Terminology

- **Flash point;** The temperature at which the combustible material gives off enough vapor in the vicinity to initiate ignition on application of external flame.
- **Flammability limits:** These limits give the **range** between the lowest and highest concentration of vapor in air that will burn or explode when an ignition source (such as a spark or open flame) is present.

  The concentration is generally expressed as percent fuel by volume.

- **Fire point;** It is the lowest temperature at which a mixture of vapour and air continues to burn when ignited.

- **Auto ignition temperature :** It is the temperature at which a material will self ignite and sustain combustion in the absence of a spark or flame.

- **Explosion** : It is an extremely rapid chemical (explosive) transformation of fuel accompanied by release of energy and compression of gases capable of producing mechanical work.

STARVATION	**REMOVAL OF THE FUEL**
BLANKETING / SMOTHERING	**REMOVAL OF OXYGEN**
COOLING	**REMOVAL OF HEAT**

CLASSIFICATION OF FIRE

- **CLASS A:** Solid combustible materials of organic nature such as wood, paper, rubber, plastics etc.
- ✓ Cooling effect of water essential for extinction of fire

- **CLASS B:** Flammable liquids like kerosene, petrol, diesel, benzene
- ✓ Blanketing effect is essential for extinction of fire

Classification Of Fire

- **CLASS C:** Flammable gases under pressure including liquefied gases like LPG, Acetylene, Methane, Hydrogen
- ✓ Starvation (Cut-off the supply) method shall be applied for quick extinction of fire

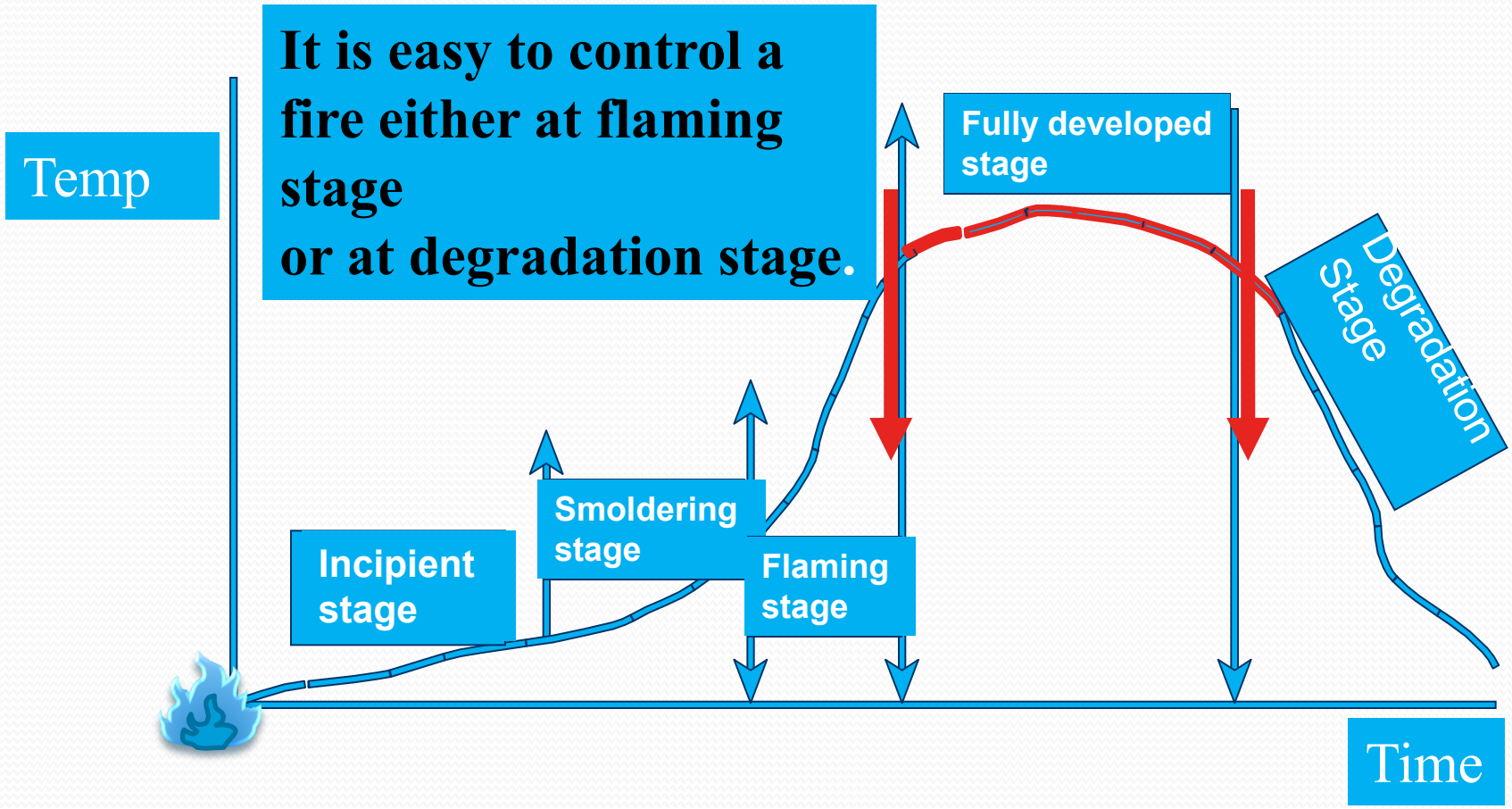
- **CLASS D:** Combustible metals like Na, Mg, Zn, Al, K etc.
- ✓ Special Dry Powders required for extinguishments

Stages of Fire

There are Five Stages of Fire :

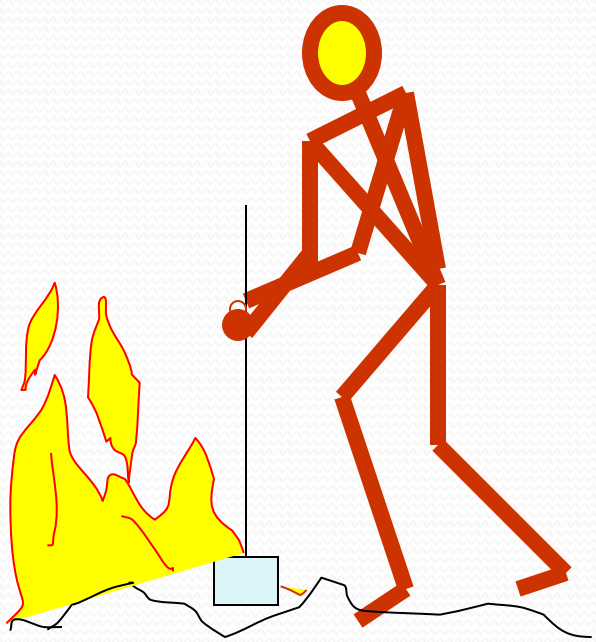
1. **Incipient stage :**
   Invisible products of combustion given off. No visible smoke , flame or heat.
2. **Smoldering stage :**
   Combustion products now visible as smoke. Flame or heat still not present.
3. **Flame stage :**
   Actual fire now exists. Appreciable heat not present, but follows almost instantaneously.
4. **Fully Developed stage :**
   Uncontrolled heat and rapidly expanding in space
5. **DECAY/Degradation :**

Fire growth curve or Stages of Fire



METHODS OF EXTINGUISHING

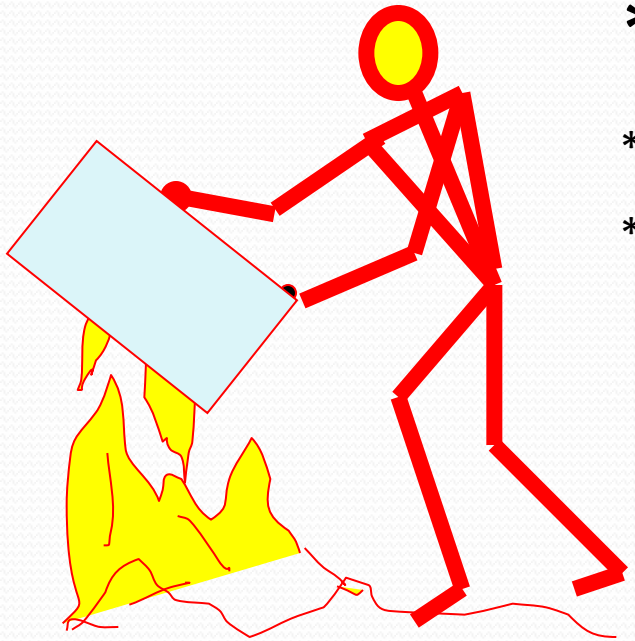
STARVATION



STARVATION

* REMOVE FUEL
* VACATE PEOPLE

BLANKETING

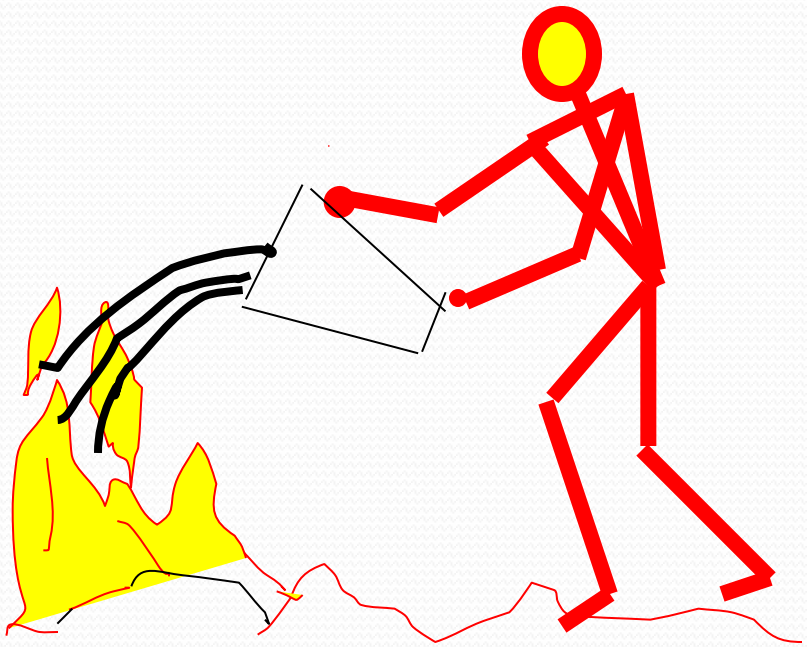


* CLOSE THE AIR ENTRANCE

* TRAP THE SMOKE

* MAINTAIN THE SAME FOR SOME TIME

COOLING



COOLING

* CONTROL THE FLOW OF HEAT & THE CHAIN REACTION BY POURING WATER OR ANY OTHER COOLING MEDIUM

Fire Extinguishers Media

Water

- High cooling capacity;
- Non-toxic;
- Inexpensive and readily available;
- Effective on solid combustibles (Class A Fires);
- Flammable liquids (Class B -45°C and above) where it is **applied as a spray;**
- Not effective on Class C fires;
- Not to be used on Electric fires.

Fire Extinguishers Media

Foam

- Due to its light weight, creates blanketing effect;
- Shall be applied on the surface of a container of the liquid;
- Cuts off oxygen supply and thus smothers;

Powder

- Several chemicals used to make extinguishing powders.
- Efficient in the extinction of Class A, B & C Fires.
- Extinction of solids by forming a flame- retardant layer on the surface of the material.
- On Electrical Installations
  - To be cleaned off;
  - Corrosion problem;

Fire Extinguishers Media

Gas

- Gases used are carbon dioxide and **HALON** agents, non-conductive gaseous agents and therefore are normally used for electrical fires;
- Do not leave undesirable residue;
- Suitable for Class B fires and Class A fires where these have not become deep-seated.

PORTABLE FIRE EXTINGUISHERS

1) WATER TYPE

1. SODA ACID (Obsolete)
2. STORED PRESSURE

2)FOAM TYPE

1. Chemical
2. Mechanical

3)DRY CHEMICAL POWDER TYPE

4) CARBON DI-OXIDE TYPE

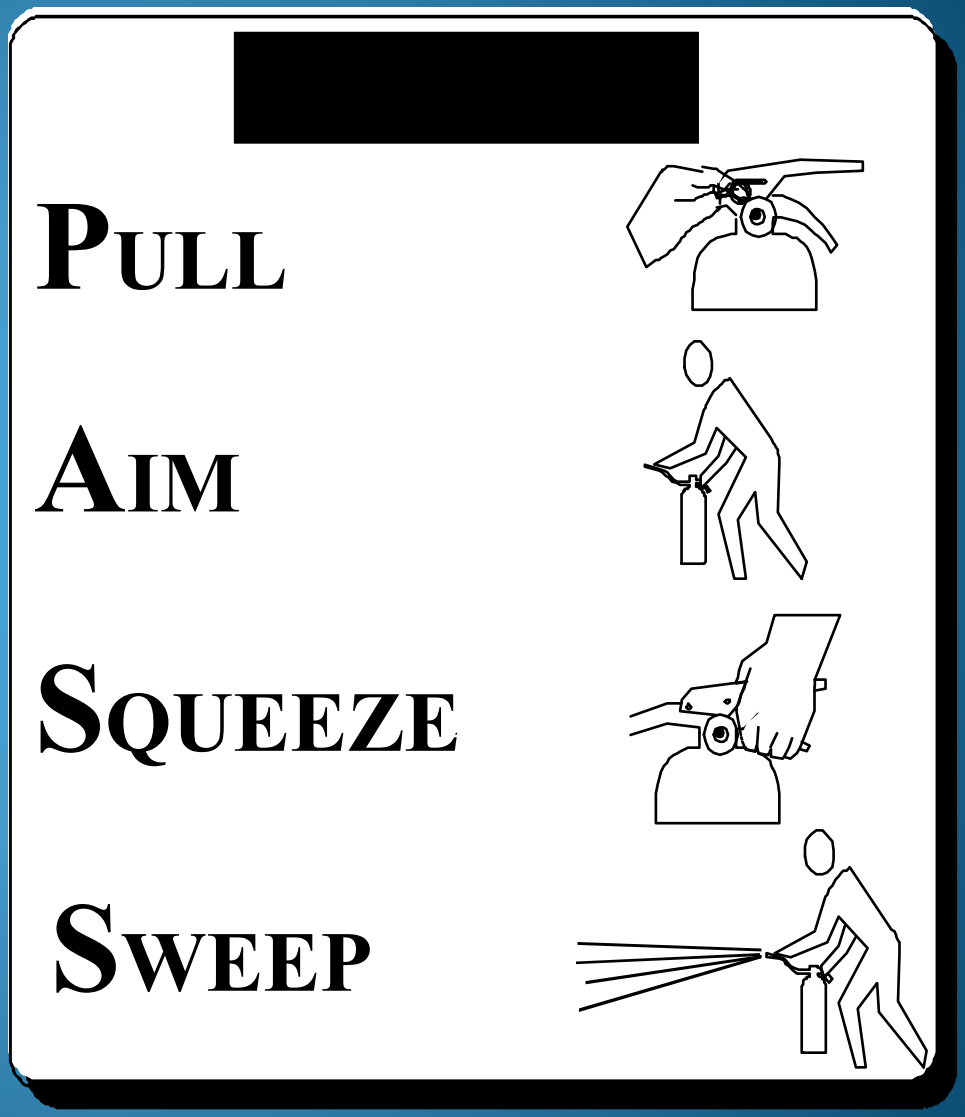
How to use Fire Extinguisher

Remember the PASS word:

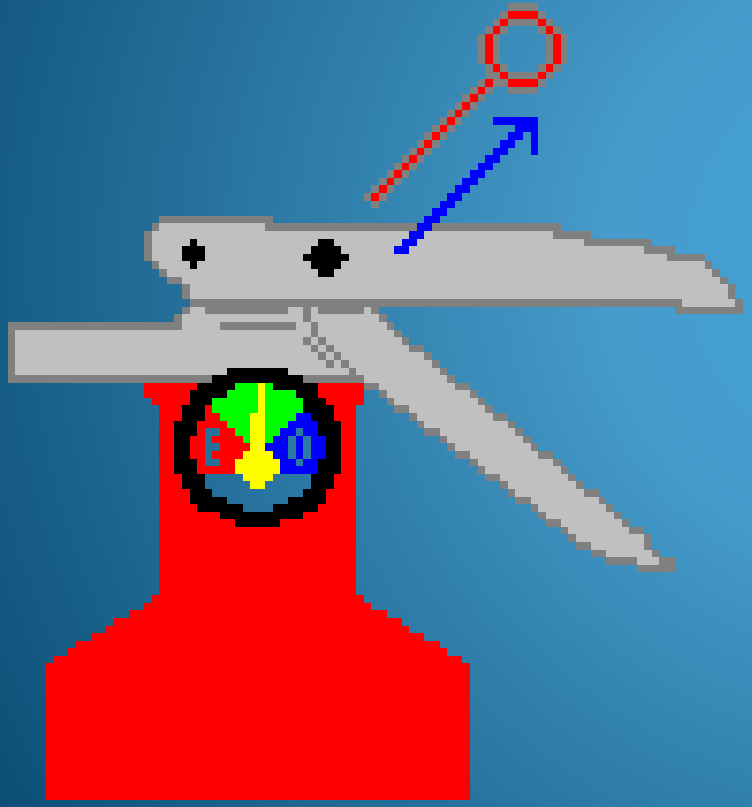
1) Keep your back to a clear escape route,

2) Stand back 6 to 8 feet from the fire,

3) **Then :**



PULL the pin

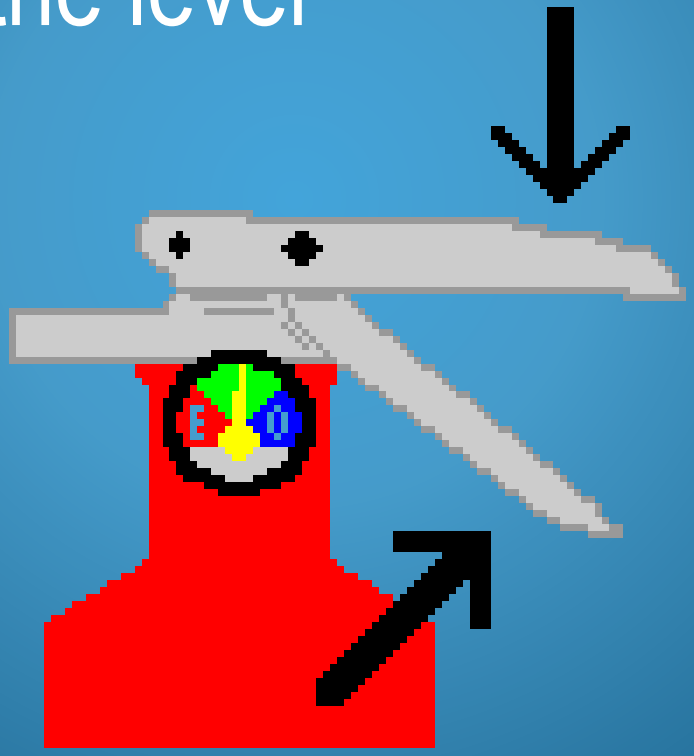


AIM

LOW at the base of the fire

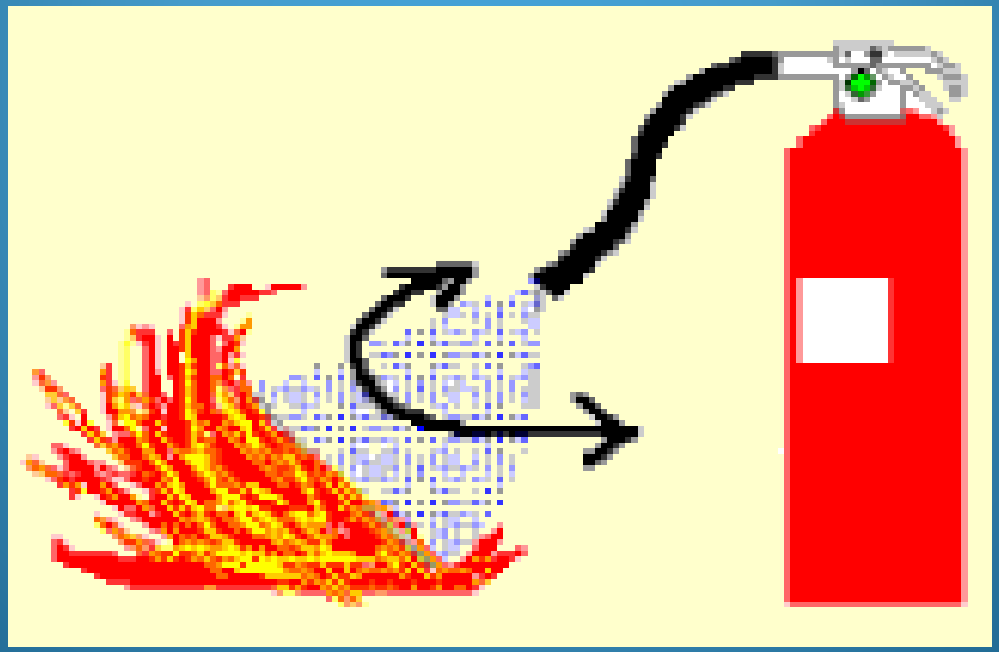
SQUEEZE

the lever

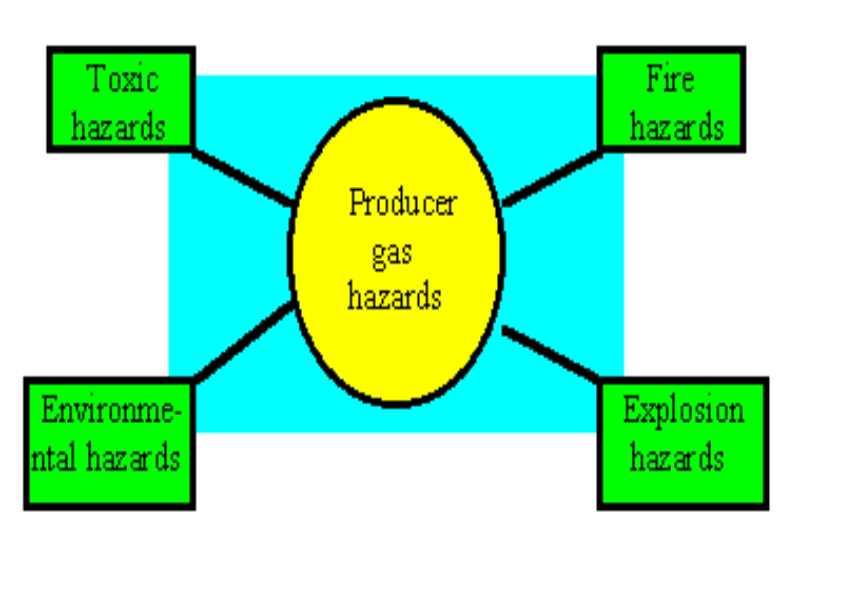


SWEEP

from side to side

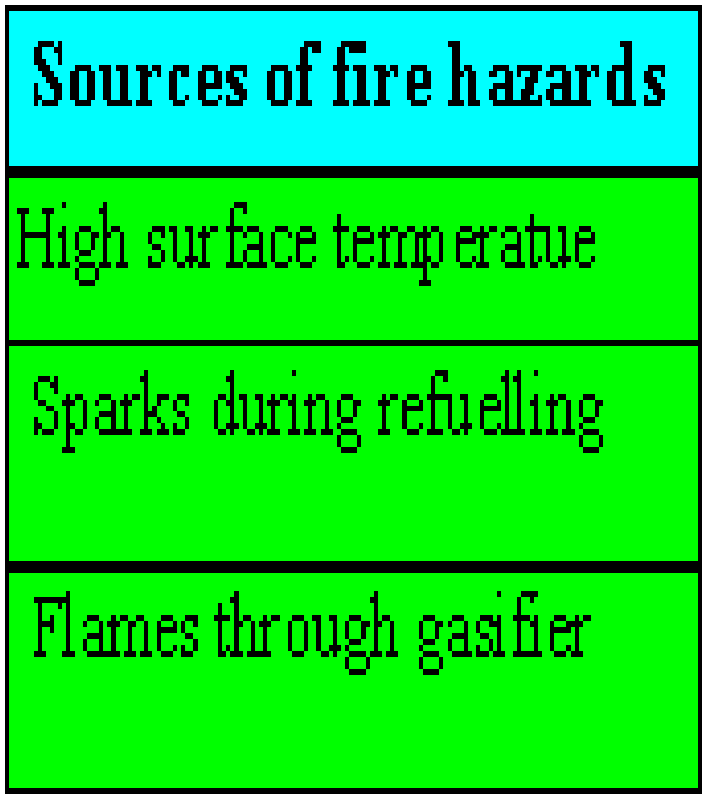


Hazards with Producer Gas



- Producer gas, the mixture of carbon monoxide, hydrogen, methane and other gases, is hazardous, if it is not handled and used properly. Poisonous component of producer gas is carbon monoxide. All hazards associated with use of producer gas are described here.

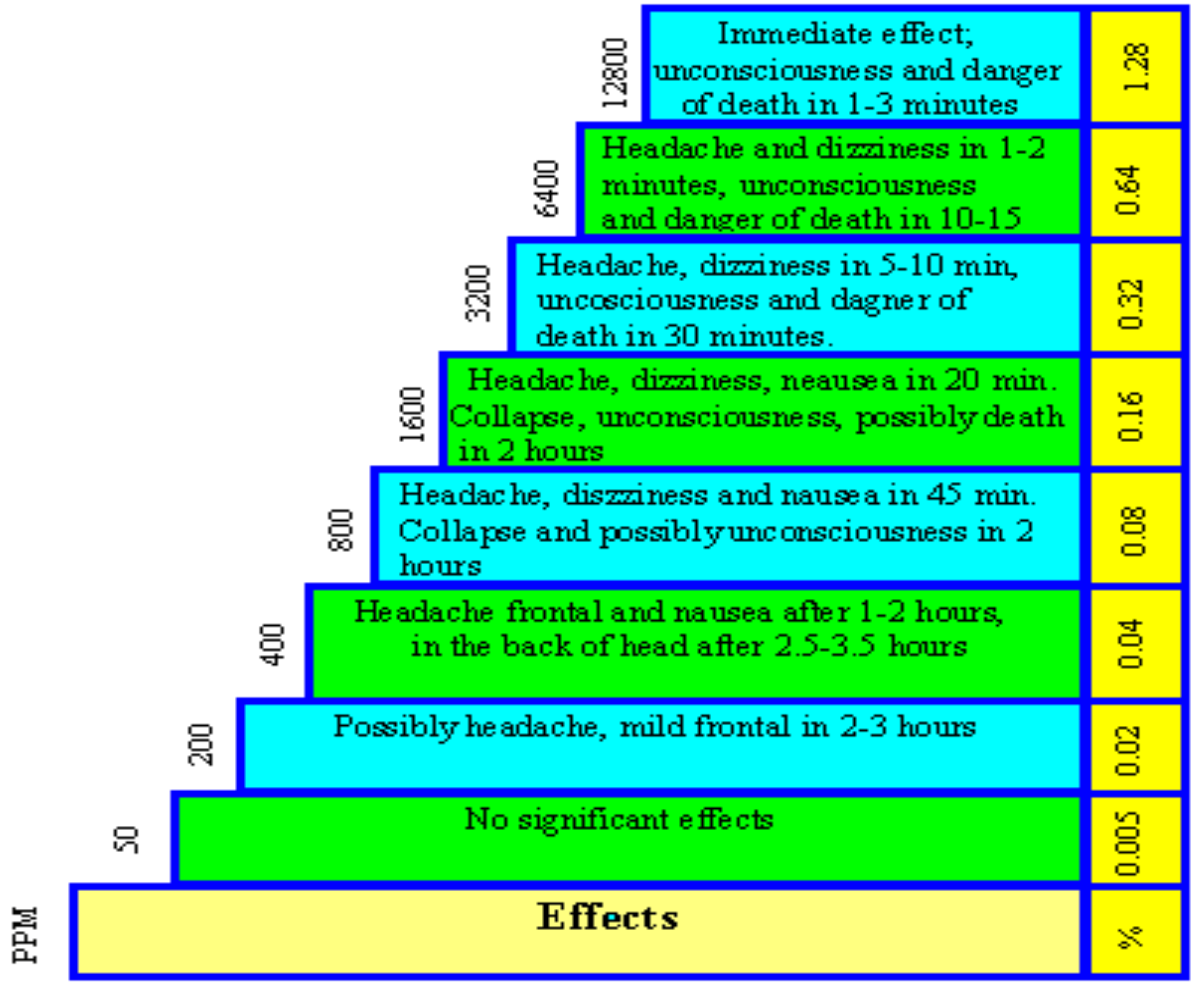
Fire hazards



Fire risks can be minimized by taking following precautions

1. **Insulation of hot parts of system**
2. **Insulation of double sluice filling device**
3. **Installation of back-firing valve in gasifier inlet**

Toxic hazards



Poisonous steps of carbon monoxide

UNTRAINED PEOPLE

Cannot use a fire extinguisher safely because they are:

- **UNABLE to evaluate a fire**
- **UNAWARE of DANGER**
- **LACKING JUDGEMENT regarding:**
  - **Safe and correct use of fire extinguisher,**
  - **Limitations of portable extinguishers**

WHY UNTRAINED PEOPLE

Can't use a fire extinguisher safely

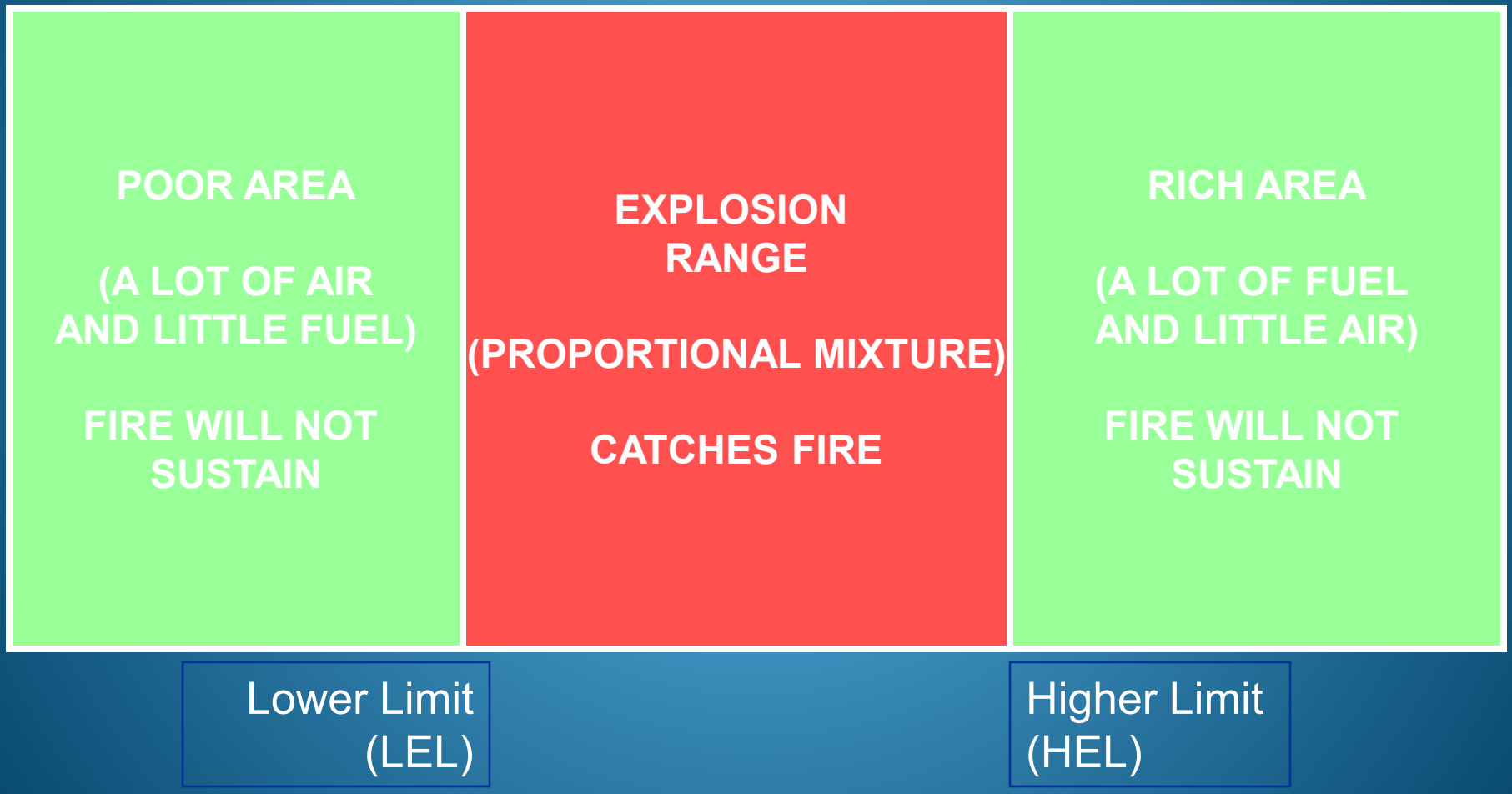
INEXPERIENCE

- Don't know about the proper type of extinguisher
- Don't know how to make a *"Fight or Flight"* analysis
- Unfamiliar with the "P.A.S.S. method"

Common Causes of Fire

- Carelessness – Smoking, Open flames
- Electrical Malfunction (Damaged ele. equipment, Over heating, Over loading)
- Hot Surface
- Poor Housekeeping
- Unsafe Hot works like Welding, cutting, grinding
- Static Electricity

Fire / Explosion Concentration



Consequences of Fire

- Burn Injury
- Danger to health
- Death
- Heavy damage / Loss
- Explosion
- Image / Reputation

Do not Fight Fire if :

- If you don't know to how to operate your fire extinguishers.
- You don't have adequate or appropriate equipment and if your extinguishers are not working.
- Fire is spreading beyond its point of origin , too large and beyond your control. You can fight a fire in the incipient stage only.
- You are not familiar with the fire exits. Don't get trapped and get out immediately.
- You might inhale toxic smoke. When synthetic materials is burning, they can produce hydrogen cyanide, acrolein and ammonia in addition to carbon monoxide. These gases can be fatal in very small amounts.

THANK YOU!