Disaster Management: FIRE

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°C e.g. Gasoline,
    - Class-B- flash-point of 23°C and above but below 65°C e.g. HSD
    - Class-C- flash-point of 65°C and above but below 93°C e.g. FO
- **Ignition Temperature**: The least temperature at which the substance starts combustion
- **Auto-ignition Temperature**: The auto ignition temperature or kindling point of a substance is the lowest temperature in which it spontaneously ignites in a normal atmosphere without an external source of ignition, such as a flame or spark.

Products of Combustion

Smoke

Flame

Heat

Toxic Gases

Regulating Body of Fire Services & Standards

DGCD (Director General of Civil Defense)

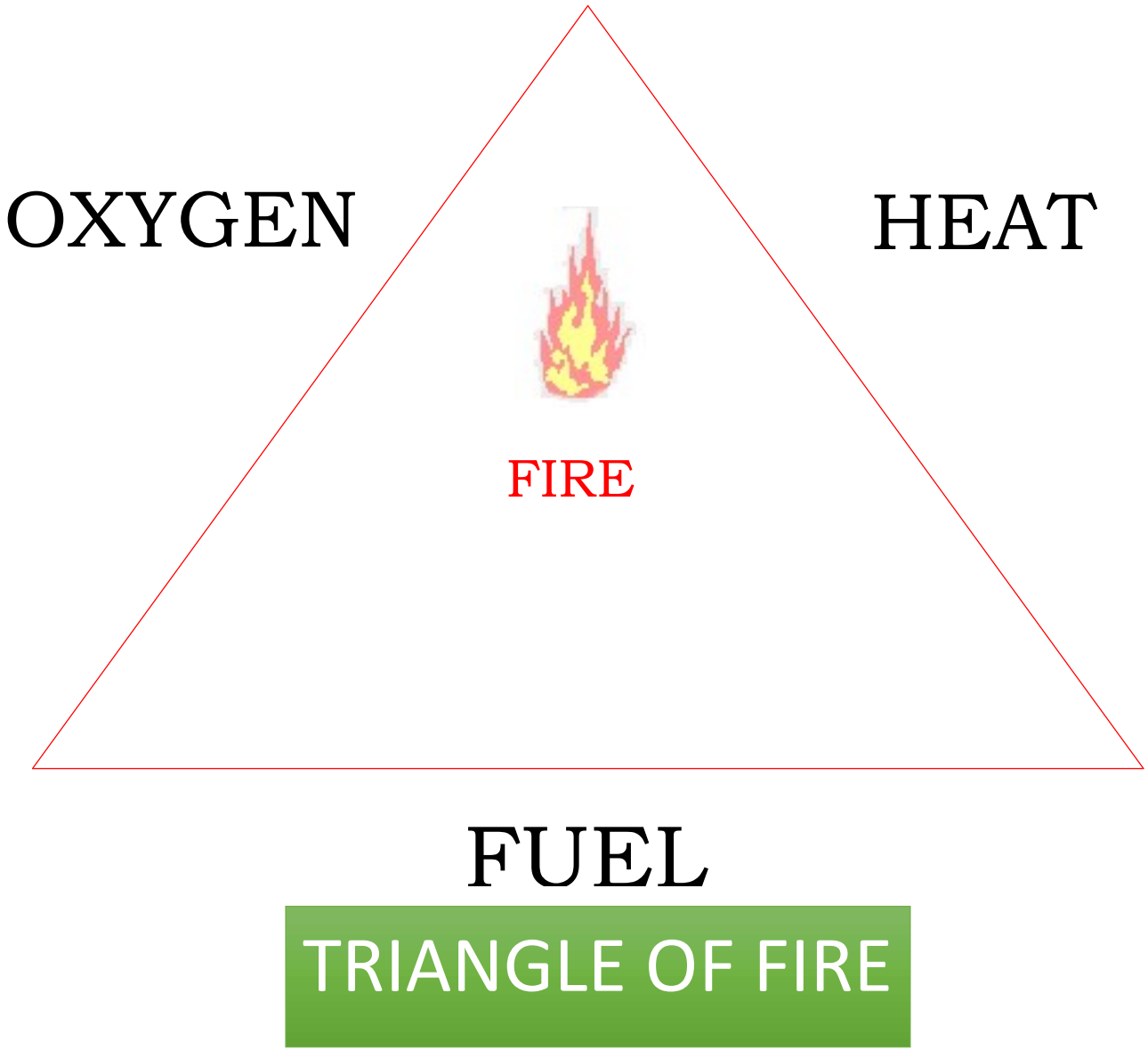
BIS (Bureau of Indian Standard)

TAC (Tariff Advisory Committee)

NFPA (National Fire Protection Association)

OISD (Oil Industries Safety Directorate)

Regulating Body of Fire Services & Standards



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.

FIRE =

Flammable vapor or gas (**FUEL**)

+

Air in correct proportion ($\mathbf{O_2}$)

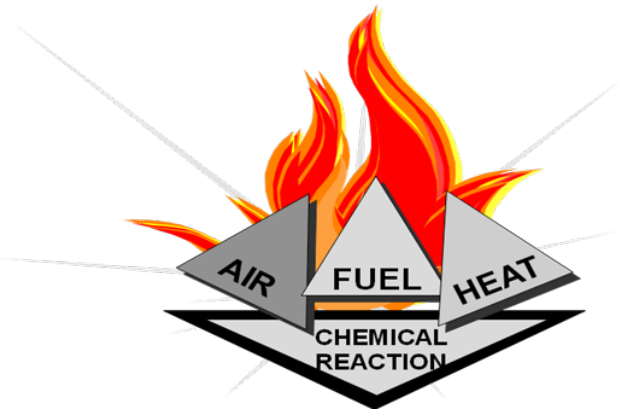
+

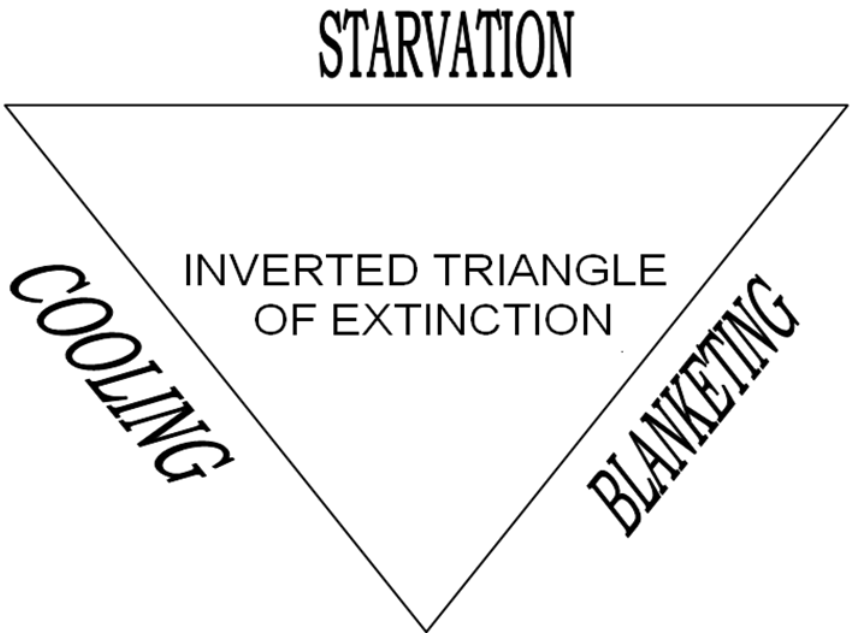
Source of ignition (**Naked Flame**)

+

Chain reaction

THE FIRE PYRAMID





Few Terminologies

- **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 temperatures 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
- **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.

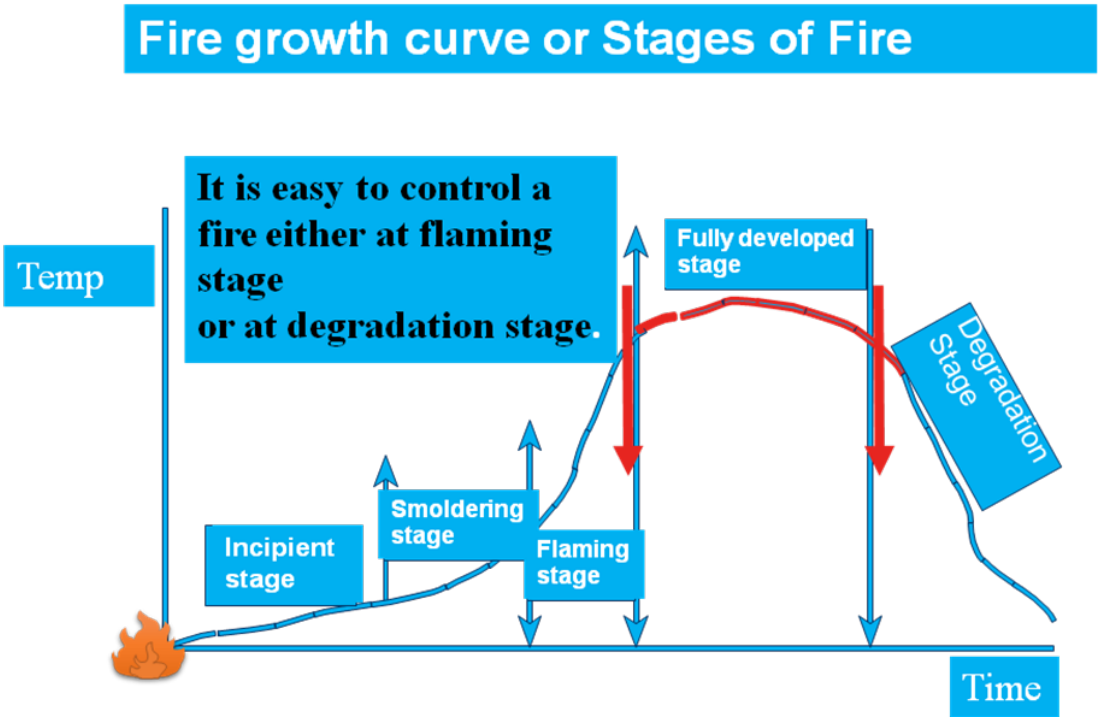
3. **Flame stage :**

   Actual fire now exists. Appreciable heat not presents, but follows almost instantaneously

4. **Fully Developed stage :**

   Uncontrolled heat and rapidly expanding in space

5. **DECAY/Degradation :**



METHODS OF EXTINGUISHING

STARVATION

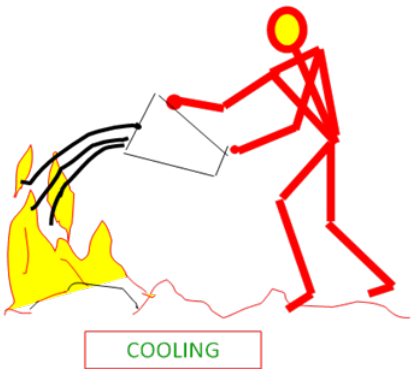
STARVATION

* REMOVE FUEL
* VACATE PEOPLE

BLANKETING

* CLOSE THE AIR ENTRANCE
* TRAP THE SMOKE
* MAINTAIN THE SAME FOR SOME TIME

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

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;

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

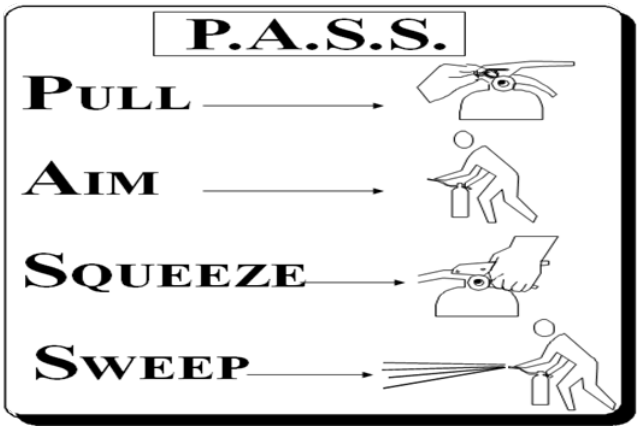
How to use Fire Extinguisher

Remember the PASS word:

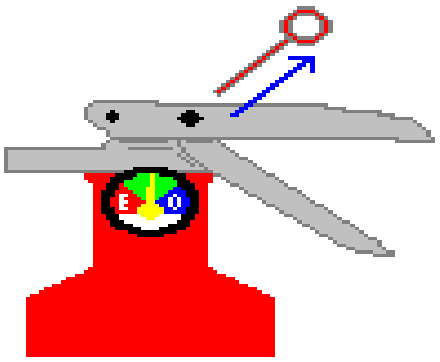
1) Keep your back to a clear escape route,

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

3) Then :

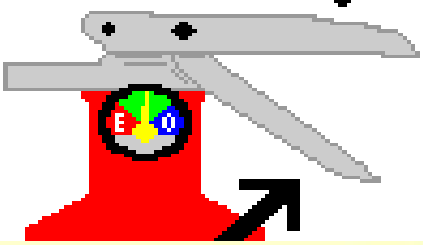


PULL the pin

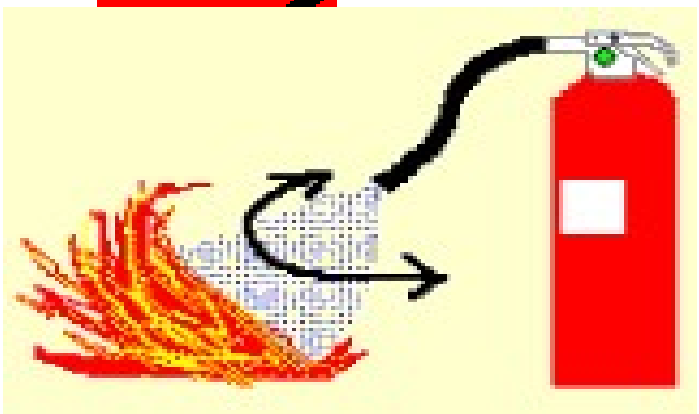


AIM

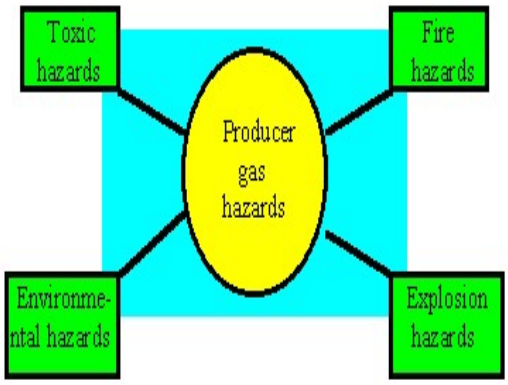
SQUEEZE
The lever



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.

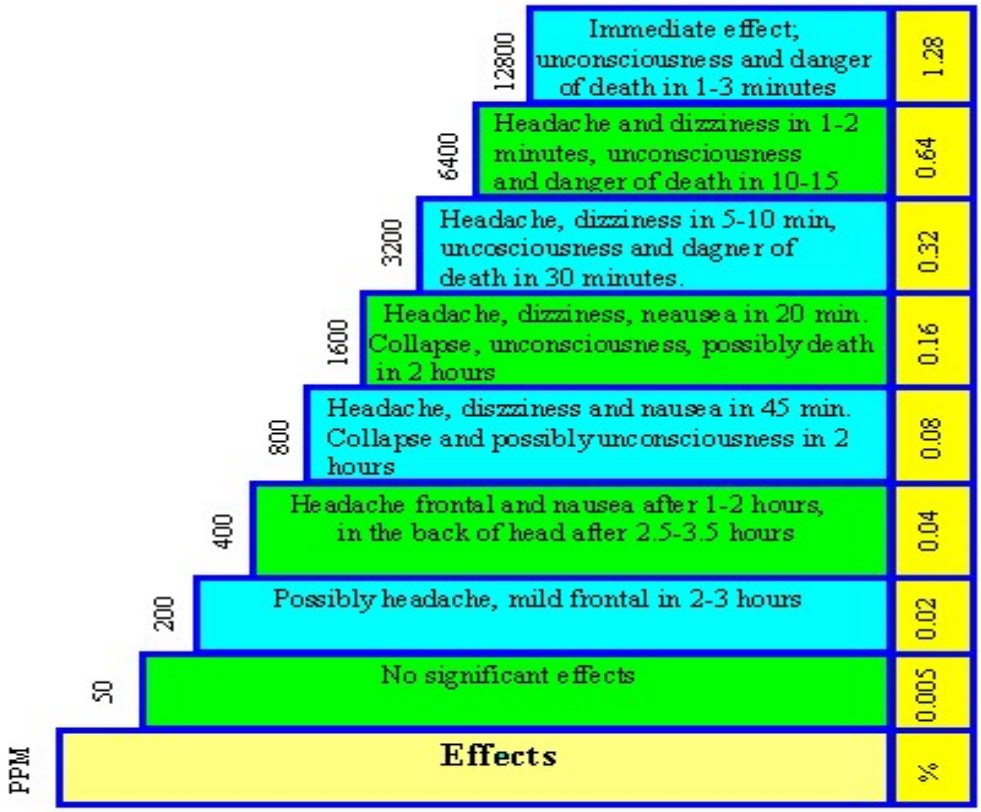
Fire hazards

Sources of fire hazards
High surface temperatue
Sparks during refuelling
Flames through gasifier

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

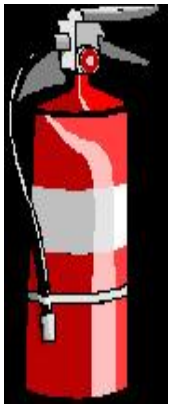
Toxic hazards



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

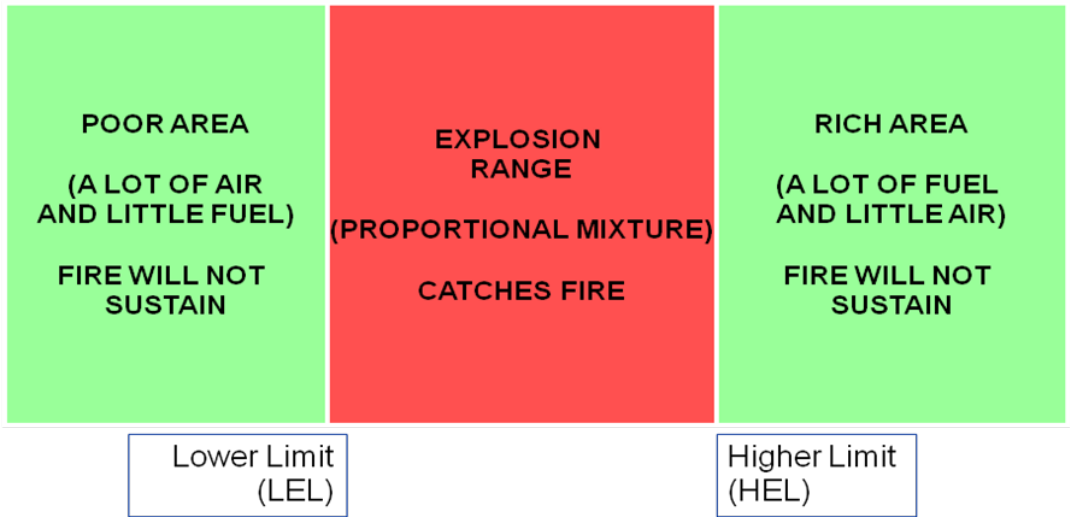
INEXPERIENCE

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



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.

JSPL BARBIL – FIRE SERVICES

NO OF HYDRANTS, PUMP CAPACITY & WATER STORAGE CAPACITY		
Plant	**Pellet Plant**	**Crusher Plant**
No. of hydrants	104	102
Jockey Pump	1 No (Capacity 18 m^3/hr, 70 m head)	2 Nos (Capacity 18 m^3/hr, 70 m head)
Electric Driven Main Pump	1 no (Capacity 273 m^3/hr, 70 m head)	2 nos (Capacity 273 m^3/hr, 70 m head)
Diesel Driven main Pump	1 no (Capacity 273 m^3/hr, 70 m head)	1 no (Capacity 273 m^3/hr, 70 m head)
Water Storage Capacity	20250 x 2 m^3	3540 m^3

JSPL BARBIL – FIRE SERVICES

Mobile Fire fighting System

JSPL Fire brigade is equipped with Mobile Fire Tender with ultra modern accessories to deal with any fire whether it is Solid, Liquid or Gaseous in nature. There are two multipurpose Fire Tender which serves in the Plant, Mines and adjacent dense forest. We are also having mutual aid scheme with Tata Steel and we have extended our services to Civil authorities.

Main Components	Multipurpose Tender – 1	Multipurpose Tender – 2
Water Tank	6000 Ltr	4000 Ltr
Foam Tank	2000 Ltr	500 Ltr
Fire fighting pump	1800 Lpm	2250 Lpm
Foam / Water Monitor	Yes	Yes
High Pressure mist system	No	150 Lpm at 100 bar
Light Mast	No	Yes

JSPL BARBIL – FIRE SERVICES

5. CLOSE PROXIMITY SUIT & FIRE ENTRY SUIT

Used for rescue, closure of valves etc

Fire proximity suits – 03 nos

Fire entry suit – 1 no

Temp resistance (Fire entry Suit) – 1250°C

Made of fire retardant material

JSPL BARBIL – FIRE SERVICES

6. CHAIN SAW & CUT-OFF SAW

- Very useful tool especially during rescue operation
- Used to cut the obstruction or permit the entry
- Chain saw is used to cut wood
- Cut off saw is used to cut metals, concrete etc