FIRE PREVENTION AND PROTECTION

Fire is the rapid oxidation of a material in the exothermic chemical process of combustion, releasing heat, light, and various reaction products.

Fire Tetrahedron

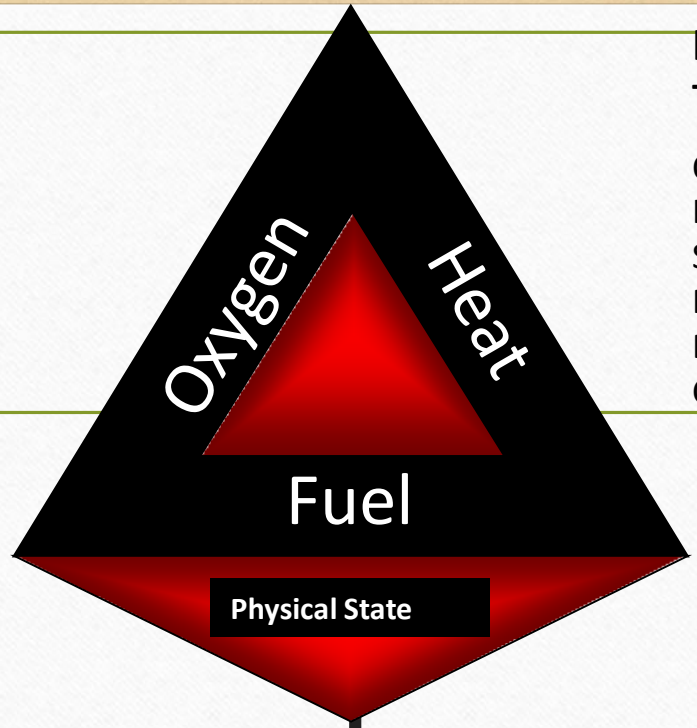
Four components are necessary to sustain combustion:

- Fuel
- Heat
- Oxygen
- A chemical reaction

Oxygen Sources

Approximately 16% Required

Normal air contains 21%
Some fuel materials contain sufficient oxygen within their makeup to support burning



Heat Sources

To reach ignition temperature

Open Flame, The Sun
Hot Surfaces
Sparks and Arcs
Friction, Chemical Action
Electrical Energy
Compression of Gases

Gases

Natural Gas
Propane
Butane
Hydrogen
Acetylene
Carbon Monoxide
others

Liquid

Petrol
Paraffin wax
Alcohol
others

Solids

Bulky - Dust
Finely Divided

Coal
Wood
Paper
Cloth
Wax
Grease
Leather
Plastic
Sugar
Grain
Hay
Cork
others

Sources of Fuel

- Any substance that burns is fuel for a fire, and thus a hazard.
- Substances that will burn easily and that are present in sufficient quantity to provide fuel for a fire, or which might cause a fire to spread to another fuel source.

Sources of Fuel (cont'd)

- Some of the most common fuels are:
- Flammable liquid based products such as paints, varnishes, thinners and adhesives.
- Flammable liquids and solvents such as crude oil, intermediates and refined products (e.g. petrol), white spirit, methylated spirit and paraffin. Consider that where flammable liquid has impregnated wood, textiles or other materials, it increasing the fire potential.

Sources of Fuel (cont'd)

- Chemicals such as sulphuric acids, nitric acids and other oxidizers.
- Wood, paper and card.
- Plastics, rubber and foam such as polystyrene and polyurethane, including foams used in upholstered furniture.

Sources of Fuel (cont'd)

- Flammable gases such as LPG, natural gas and acetylene.
- Molten metals or reactive powders such as Sodium, Magnesium, Titanium, Zirconium, metal powders
- Furniture (including fixtures and fittings) and textiles such as carpets, curtains and clothing.
- Packaging material.

Sources of Fuel (cont'd)

- Waste materials such as wood shavings, offcuts, dust, waste paper and textiles.
- It is also necessary to consider the construction of the workplace and how this might contribute to the spread of fire. In particular, buildings should be inspected for materials such as:

Sources of Fuel (cont'd)

- Hardboard, chipboard or blockboard in the construction of internal walls or ceilings.
- Synthetic ceiling or wall coverings such as polystyrene tiles or plastic T&G.
- If such features are present and they cannot easily be removed, then seek expert advice on the precautions necessary to reduce risks to people in the event of a fire.

Identifying fire hazards

Some pictures of fire hazards (fuel)


Viewtec
GINGER


GREASE


PURIFIED WATER
DASANI


LG
CHIGO
ROYAL AIR
Carrier


GIMPA

Sources of Ignition

- Sources of ignition are threats i.e. without these the fire hazards will never result in a fire.
- Common types of ignition sources found in workplaces include:
  - Hot surfaces.
  - Electrical equipment and static electricity.
  - Naked flames/smoking, welding and oxyacetylene torches.

Sources of Ignition (Cont'd)

- Fire Inspectors/Safety officers must be able to identify potential sources in the workplace by assessing the probabilities for sources of ignitions.
- Some common examples are:
  - Smokers materials such as cigarettes/cigars and especially unextinguished discarded cigarette buds.
  - Naked flames e.g. cigarette lighters, matches.

Sources of Ignition (Cont'd)

- Electrical, gas or oil fired heaters (fixed or portable).
- Work processes that generate heat such as welding or grinding
- Kitchen and cooking equipment e.g. kettles, water heaters.

Sources of Ignition (Cont'd)

- Electrical extension cords and/or adaptors e.g. excessive number of plugs connected into one socket, under-rated extension sockets or adaptors.
- Engines or boilers, Machinery, etc.
- Faulty or misused electrical equipment e.g. photocopiers, computers, paper shredders, window and/or split AC units.
- Lighting equipment such as halogen lamps.

Sources of Ignition (Cont'd)

- Hot surfaces on equipment.
- Equipment with obstructed ventilation.
- Faulty cooling systems.
- Friction e.g. from bearings, bushes or drive belts.
- Static electricity.
- Metal impact e.g. metal hammer striking a tool or object.
- Uncontrolled chemical reaction *(*pyrophoric or exothermic).

Sources of Ignition (Cont'd)

Indications of "Near Misses" such as scorch marks on furniture or fittings, discoloured or charred electric plugs and sockets, and cigarette burns, can help identify potential hazards.

Sources of Oxygen

- Oxygen is also a threat i.e. without oxygen, and even with the hazard and ignition sources present, there will be no fire.
- The main source of oxygen for fires is the air and in an enclosed building air is supplied in two ways:
  - Natural inflow through doors, windows and other openings.
  - Mechanical air conditioning and air handling systems.

Sources of Oxygen (Cont'd)

- It is important that both these types of air supply are considered.
- Additional sources of oxygen may also be present at workplaces, such as:
  - Some chemicals (oxidising agents) can provide fire with additional oxygen to assist burning.

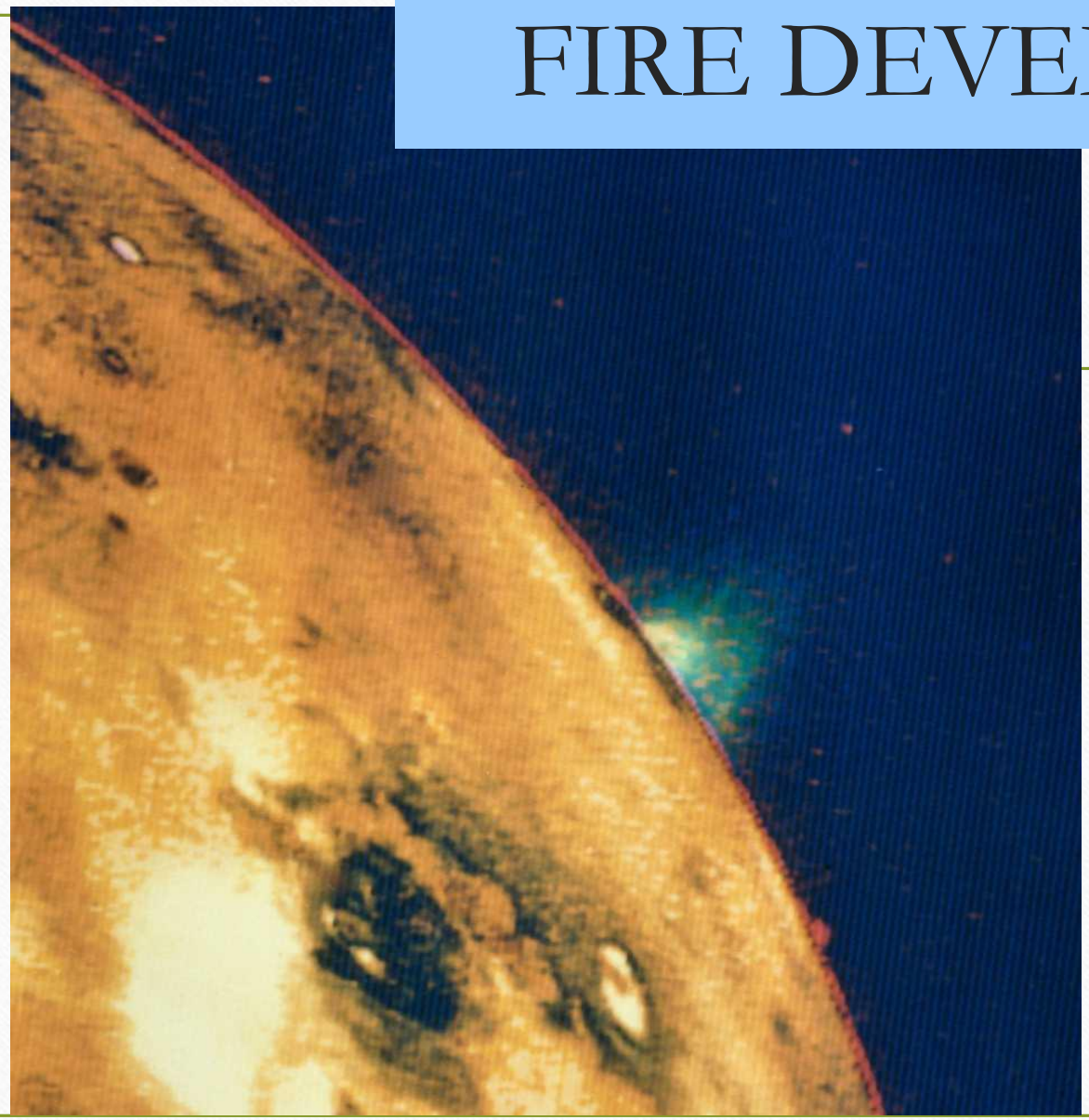
Sources of Oxygen (Cont'd)

- Oxygen supplies from cylinder storage or piped systems, such as used in welding processes or for health care.
- Vents from some types of inert gas generator can have higher oxygen content than ambient air.

Sources of Oxygen (Cont'd)

- Dry cell batteries e.g. commonplace Manganese Dioxide based dry cell/batteries are a frequently overlooked oxygen source and can accelerate fires in the workplace environment.

FIRE DEVELOPMENT



- Ignition
- Growth
- Flashover
- Fully developed
- Decay

Flashover

Flashover is the transition between growth and fully developed fire stages and is not a specific event such as ignition. During flashover, conditions in the room change quickly as the fire goes from ignition to burning all the combustibles in the room. The easiest way to explain this is all the combustibles in the room igniting at the same time. The temperature range in the room can be from 300 to 400 or more degrees celcius. If someone is still in the space he or she is most likely dead.

Flashover stage

Fully Developed

This is the stage when all the combustibles in the space are burning. The temperatures in the space will vary and the gases in the room will grow depending on the size of the room.

Fully developed stage

Decay

As fire consumes the fuel in the room, the rate of heat release begins to decline. Again the fire becomes fuel controlled, the fire diminishes, and the temperatures within the room decline.

Decay stage

Fire Prevention And Protection Of Property

Objective

To gain an appreciation of safety and loss-prevention issues involved in the occurrence of fire and of factors that can mitigate the extent of subsequent damage.

The aftermath of a fire

If a fire strikes, the otherwise healthy balance between the incoming and outgoing cash is disrupted since:

- Assets (human & physical) are damaged or destroyed
- Production is disrupted
- Sales, and hence, revenue drops
- Expenses for maintaining the business still have to be met

The aftermath of a fire Continued

- Certain increased costs also come into play as a result of fire, i.e. debris removal, salvage recovery, overtime payments, incident investigation, public relations exercise, etc.
- Salaries and wages of retained staff have to be paid despite the reduction in turnover.
- Redundancy payments according to labor or industrial agreements have to be paid to dismissed employees
- Profits are lost

The aftermath of a fire Continued

Long term and potentially devastating consequences include:

- Loss of consumers to competitors
- Loss of market share
- Loss of goodwill
- Bankruptcy.

Classes Of Fire

- Class A - fires involving solid materials such as wood, paper or textiles.
- Class B - fires involving flammable liquids such as petrol, diesel or oils.
- Class C - fires involving gases.
- Class D - fires involving metals.
- Class E - fires involving live electrical apparatus.
- Class F/K- cooking oils, animal fat and vegetable oils

Fire Extinguishers

Fire extinguishers are specialized pieces of equipment that are designed to put out fires of different classes. Fire extinguisher ratings are based on the five classes of fire.

Types Of Fire Extinguishers

- Class A fires are commonly put out with water or monoammonium phosphate.
- Class B fires are extinguished by removing the oxygen using carbon dioxide extinguishers or fire blankets.
- Class C fires are extinguished by cutting the power off and using non-conductive chemicals to extinguish the fire.
- To extinguish a Class D fire, use a dry powder agent. This absorbs the heat the fire requires to burn and smothers it as well.
- Class F/K fires are extinguished using wet chemical fire extinguishers. This has become popular in putting out these types of fires.