

# ELEMENT 10

FIRE



# Element 10: Fire

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- 10.1**      **Fire principles**
- 10.2**      **Preventing fire and fire spread**
- 10.3**      **Fire alarms and firefighting**
- 10.4**      **Fire evacuation**



# Fire safety enforcement

- Enforced and regulated by local fire and rescue service authorities
- HSE/HSENI enforce fire legislation for construction projects.

## Specific legislation also in place for:

- Designing and constructing buildings (Building Regulations)
- Higher hazard workplaces with risks from dangerous substances capable of forming an explosive atmosphere (DSEAR and HSE guidance L138).



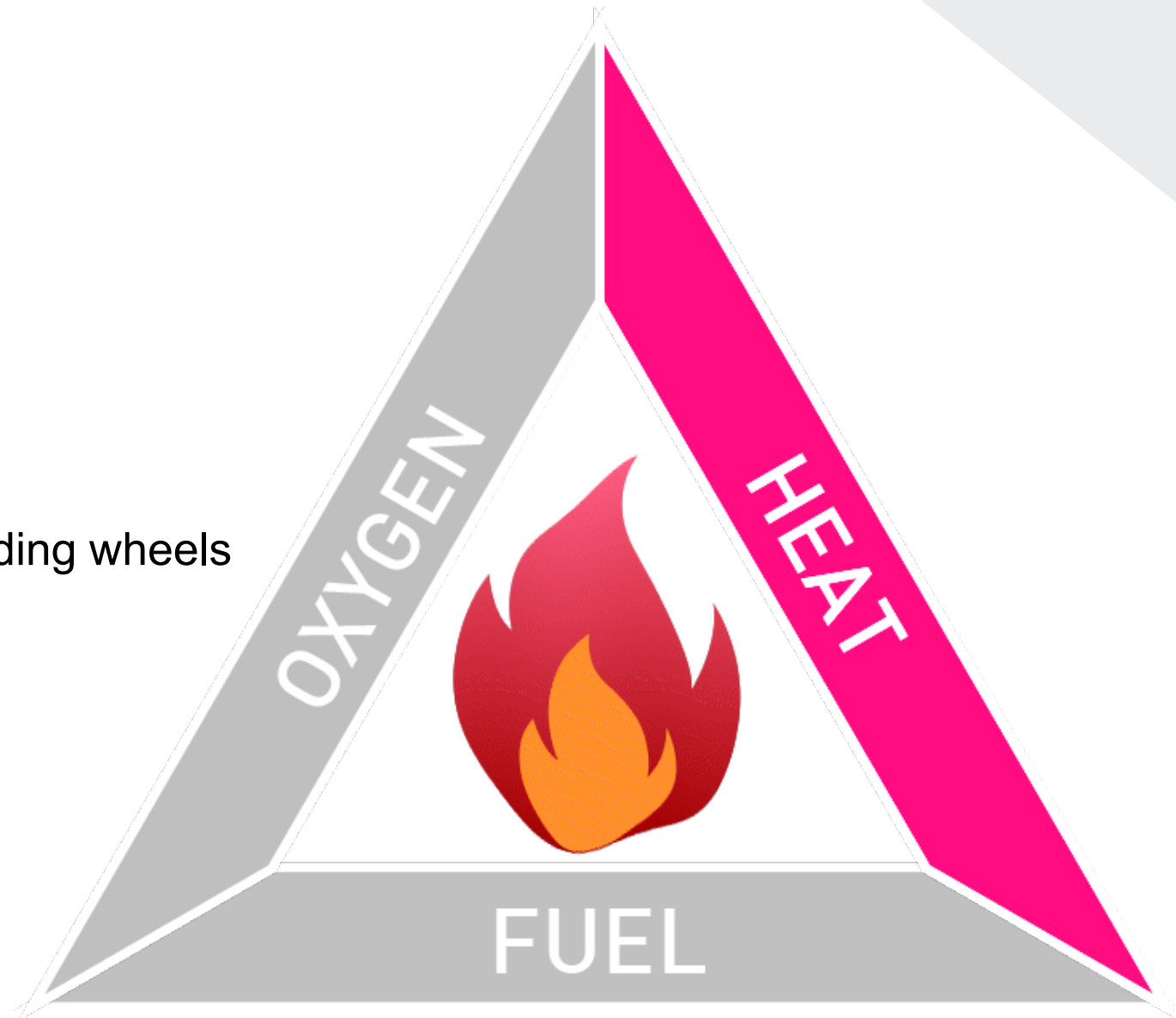
## UK fire safety legislation

1. Regulatory Reform (Fire Safety) Order 2005 (England and Wales)
2. Fire and Rescue Services (Northern Ireland) Order 2006
3. Fire Safety Regulations (Northern Ireland) 2010
4. Fire (Scotland) Act 2005
5. Fire Safety (Scotland) Regulations 2006

# Heat

## Sources of ignition

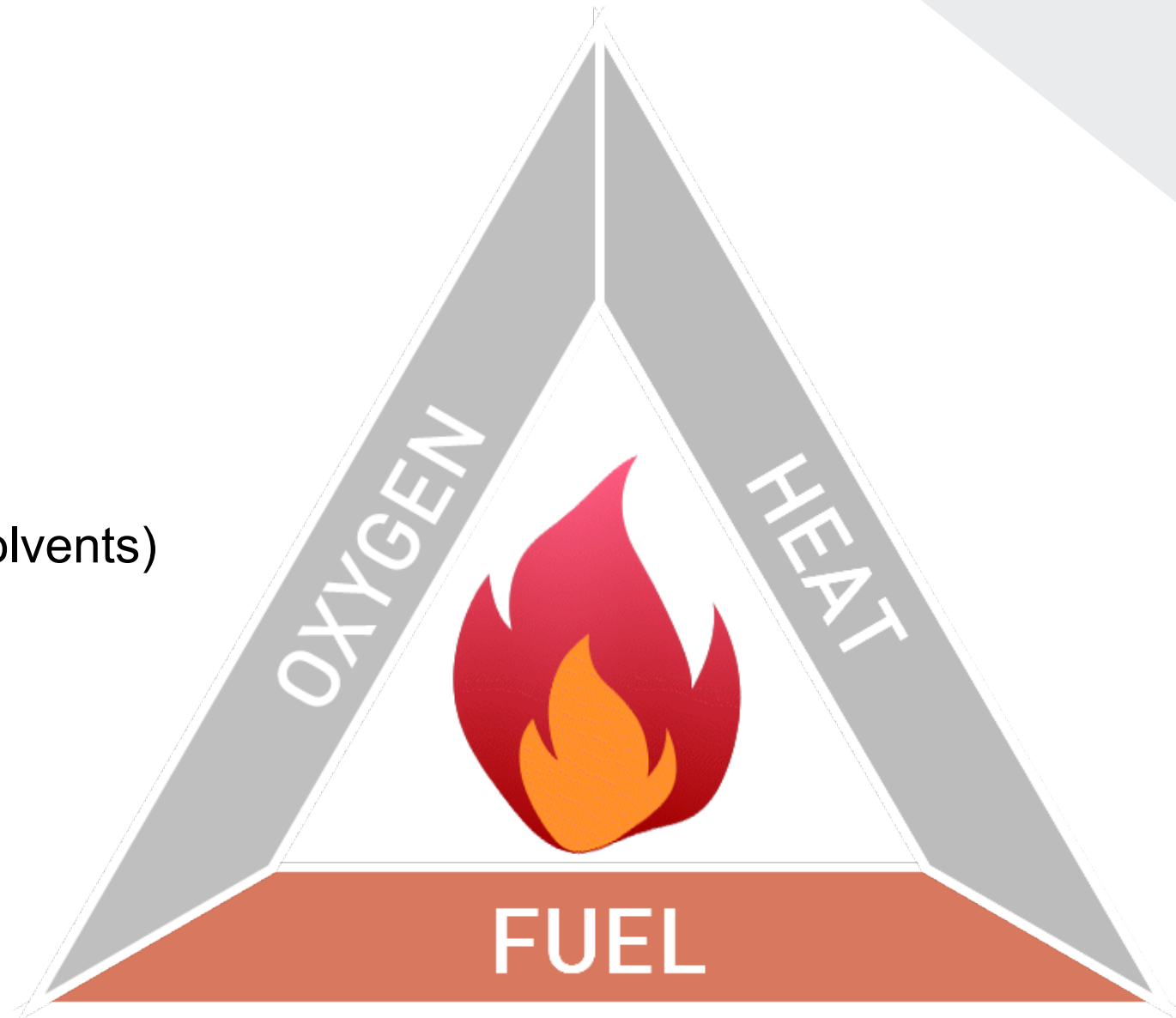
- Friction - from worn parts of machinery
- Hot surfaces
- Faulty electric supplies
- Faulty electrical equipment
- Static electricity
- Tools that can cause sparks by friction - grinding wheels
- Open flames - welding activities
- Smoking materials - matches and cigarettes
- Lightning strikes
- Radiant heat from the sun
- Faulty heating systems



# Fuel

Fuel is **any material that will combust** given the right set of conditions.

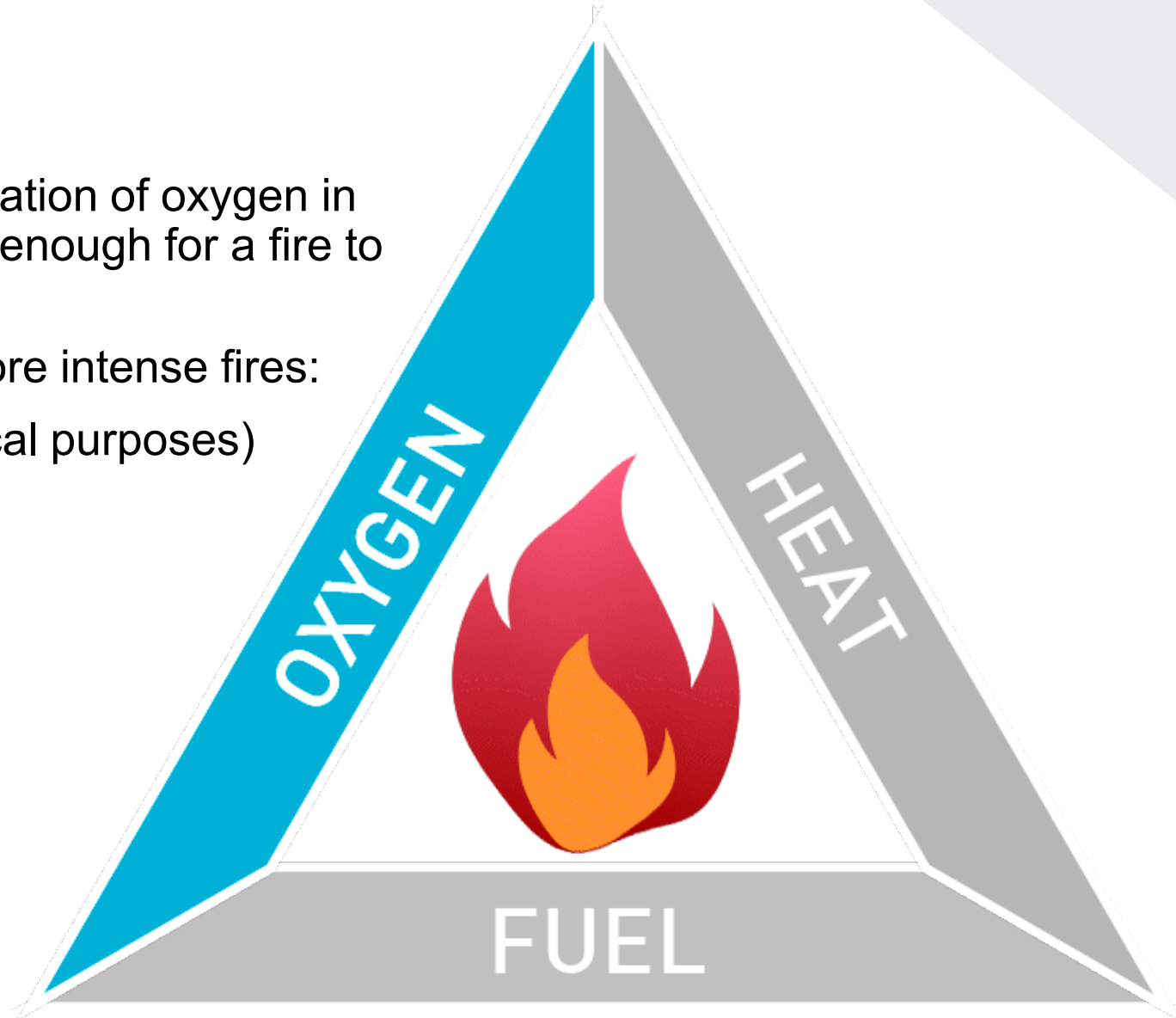
- Wood
- Paper and cardboard
- Fabrics
- Flammable liquids (including oils and solvents)
- Flammable gases
- Flammable metals
- Foam
- Rubber and plastics



# Oxygen

## Sources of oxygen

- The air that surrounds us. The usual concentration of oxygen in the air we breathe is 21% which is more than enough for a fire to start and continue to burn.
- Other sources of oxygen which will lead to more intense fires:
  - Oxygen bottles (used for welding or medical purposes)
  - Ventilation systems
  - Air-conditioning systems



# Oxygen

## Oxidising materials

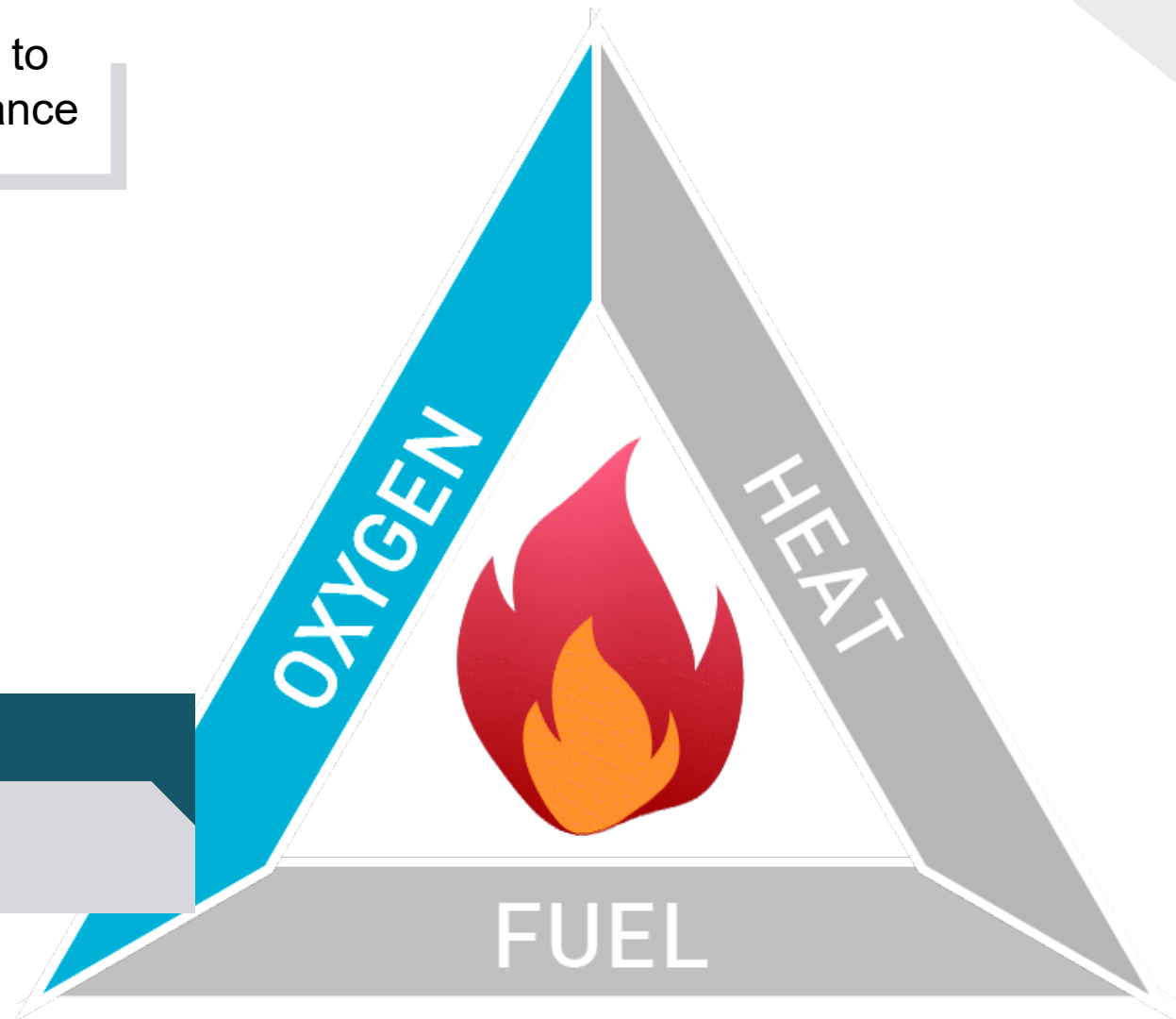
### Oxidising materials

chemicals that can easily decompose to release oxygen or an oxidising substance

- The oxygen is chemically bound in a material until it is freed by heat and/or a chemical reaction
- Can add to a fire and cause it to spread
- Should always be kept away from sources of fuel
- Can ignite sources of fuel without the presence of an ignition source

### EXAMPLES

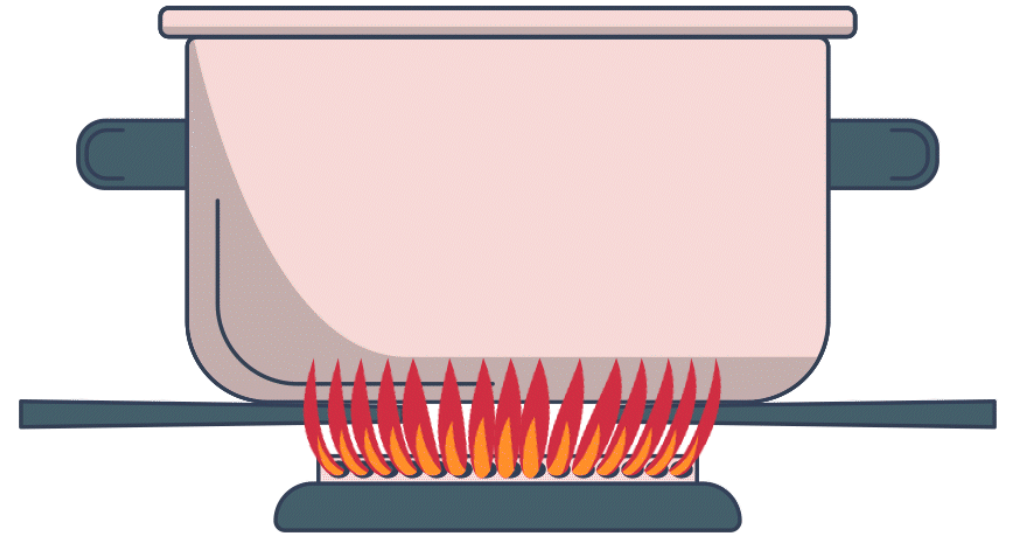
- Hydrogen peroxide (used in hairdressing salons)
- Sodium chlorate (used in weed killers)



# Principles of heat transmission and fire spread

## Conduction

- The most common form of heat transfer
- The transfer of heat in a static material
- Materials differ greatly in their heat-conducting ability
- Metals are usually good heat conductors while building materials (e.g. brick and stone) are poor conductors

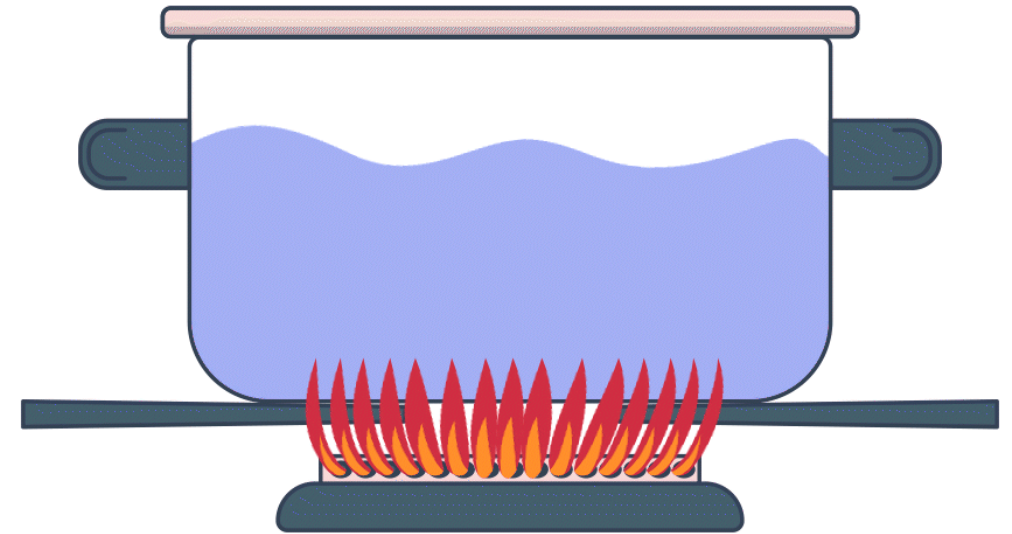




# Principles of heat transmission and fire spread

## Convection

- Heat is transferred through movement of a heated fluid such as air or water
- As the water is heated, its density decreases and it rises, being replaced by cooler fluid that is drawn in from below
- The hot fluid can travel both vertically and horizontally through gaps in the building fabric, along air vents and roof spaces, spreading the fire to other parts of the building



# Common causes and consequences of fire



## People

Making mistakes  
Lapses of concentration  
Being careless  
Arson



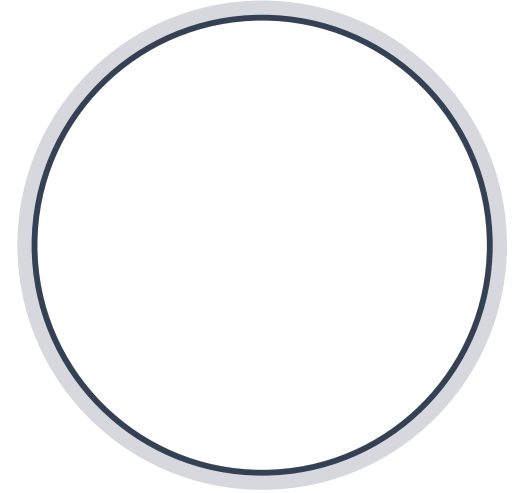
## Work activities

Working with open flames  
(e.g. welding equipment)  
Hot work activities or  
activities involving open  
flames or excessive heat



## Equipment/ electrical faults

Using faulty equipment  
Overloading circuits  
Poorly maintained equipment



## Other conditions

Static electricity  
Natural conditions  
(rays of sunlight or  
lightning)

# Consequences of a fire

## Personal injury

**Small fire** - Minor/superficial burns

**Major fire** - Major injuries/multiple deaths

Emergency workers are also at risk when responding to the fire.

## Financial consequences

Can take years for an organisation to recover from a catastrophic fire. Some may be unable to recover.

## Reputational impact

An organisation's reputation can be harmed if it is found to be cutting corners on fire protection.

E.g. If fire run-off water used to control a fire causes widespread environmental damage.

## Property damage

Ranges from minor smoke damage to total loss of the building; damaged/destroyed stock.

Seriousness of damage depends on design of building, degree of fire protection, alertness of workers and effectiveness of detection and alarm systems.



# Common fire-detection and alarm systems

Detection and alarm systems identify an outbreak of fire or smouldering materials in its early stages - by sensing heat, flames or smoke.



## Heat detectors

- Monitor the ambient air temperature and will sound an alarm when there is a change.
- **Rate-of-rise (ROR) detectors** sound an alarm when sudden, rapid temperature rise is detected.
- **Fixed temperature heat detectors** monitor ambient air temperatures against a pre-set level.



## Flame detectors

- Beams of ultraviolet/infrared light are transmitted across a protected area.
- If flames interrupt the beam, this is detected by a receiving unit and the alarm is sounded or suppression unit activated.



## Smoke detectors

- Early warning devices that sound an alarm when smoke is detected. They are very sensitive and often give false alarms.
- **Ionisation detectors**
  - **Light scatter detectors**
  - **Obscuration detectors**



# ACTIVITY

Consider what needs to be taken into account when providing a means of escape.

# Means of escape

- Allows you to turn away from a fire and walk to a place of safety.
- Should lead directly to an outside open space away from the building.
- Should not include mechanical/other aids, e.g. chutes, ladders, harnesses, lifts (except for evacuating workers with mobility problems).

## Consider:



# Role and appointment of fire marshals

Workers take on this role as well as their day-to-day duties.

Known as fire wardens, incident officers, responsible persons

Appointed to assist with an evacuation.

Each fire marshal is allocated an area of the building that they will check once the fire alarm is sounded.

May also be asked to supervise workers at the assembly points.



Will check that everyone leaves the area, then reports to a Co-Ordinator. This information may be passed on to the emergency services.

They may also look out for potential fire hazards, so that proactive measures can be taken to deal with problems before they become emergencies.

Arrangements should be put in place to ensure coverage for sickness absence and holidays.