OTHM LEVEL 6
Diploma in Occupational Health and Safety

Element 5

othm® qualifications

SAFE WORK ENVIRONMENT

GLOBAL SAFETY STUDIES
Safety Training & Consulting

Learning Outcomes:

- Understand the range of factors to consider to maintain a safe work environment.
- Understand the hazards, risks and controls applicable to a range of workplace contexts.
- Understand the maintenance of fire safety and protection against explosion.
- Understand safe storage, handling and management of hazardous substances, including biological agents

Noise

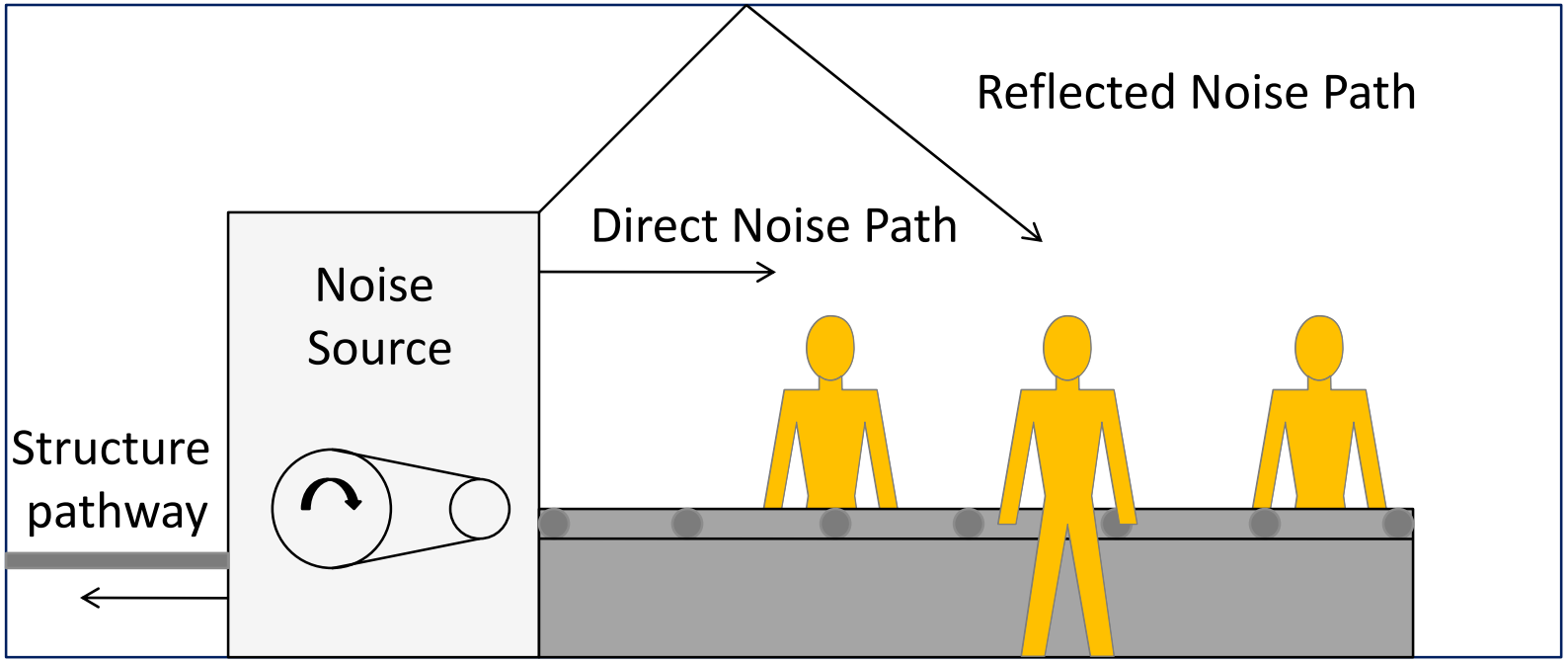
Health effects:

- Temporary:
  - reduction in hearing (Temporary threshold shift)
  - ringing in ears
  - Temporary tinnitus
- Permanent:
  - Permanent tinnitus
  - noise-induced hearing loss (Permanent threshold shift)
  - Physical damage to hearing mechanisms
- Stress
- Head ache

Safety issues:

- Inability to hear vehicles, warnings, conversations
- Concentration problems

Noise Exposure Control

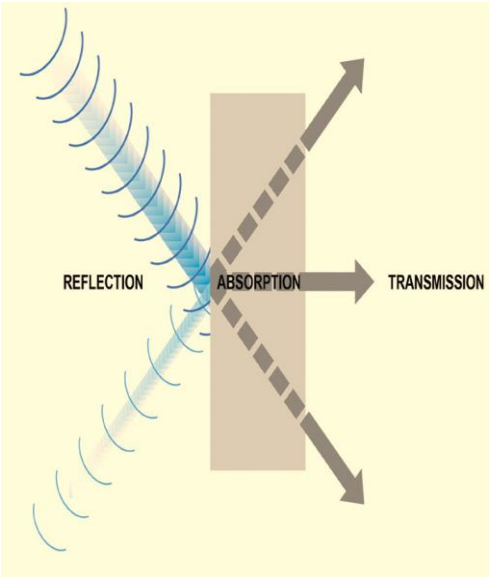


Noise: source, pathway, receiver

Noise Exposure Control

Source: Design, maintenance/lubrication, reduce speed/energy

Path: location, enclosure, silencers, absorption, damping, isolation, lagging, screens

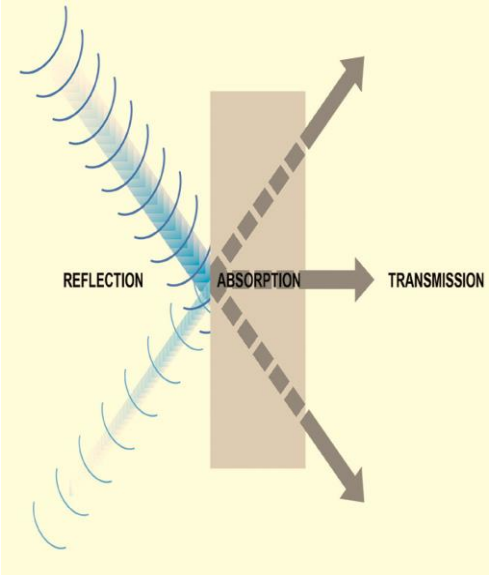


Receiver: ear protection, job rotation

Noise Exposure Control

Source:

- Tighten loose equipment
- Regular lubrication
- Eliminate unnecessary leaks
- Properly adjust machinery
- Padded containers for catching components
- Switch equipment off especially fans
- Use rubber or plastic bushes



Noise Exposure Control

Path:

Enclosure

Surrounding the noise source with sound insulating material (care to be taken not to overheat machine)

Silencers

Reducing noise from exhaust pipes etc. using absorbent materials or baffles

Absorption

Surrounding/obstructing noise source with absorbent materials (e.g. foam)

Damping

Reduction in structure borne noise by the use of rubber/cork, springs etc.

Isolation

Protection of persons from sound source by distance or sound proofed rooms

Noise Exposure Control

Receiver:

Ear protection, Provision of Ear Plug and Ear Muff

Job rotation

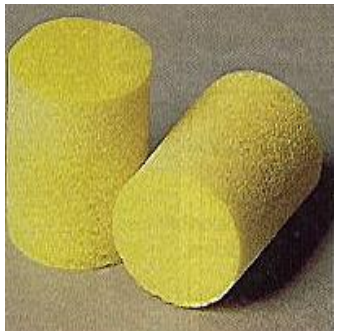
Hearing Protection

Ear Defenders (muffs)

- Encase the ear and bones surrounding the ear

Ear plugs

- Fit into the ear canal



Hearing Protection

Ear defenders or muffs

Advantages	Limitations
Easy to supervise and enforce use as visible	Uncomfortable
Less chance of ear infections	Efficiency affected by long hair, spectacles etc
Higher level of protection possible	Must inspected, cleaned and maintained
Can integrate with other PPE	
Reusable	

Hearing Protection

Ear plugs

Advantages	Limitations
Cheap and easy to use	Difficult to see when fitted, supervision and enforcement difficult
Disposable	Risk of infection if dirty or if cross-contaminated when inserted
More comfortable, range of designs	Need to be correctly sized for individual
Do not interfere with other PPE	Effectiveness decreases with usage

Effects of Exposure to Vibration

Hand-Arm Vibration Syndrome (HAVS)

- Vibration white finger (blanching)
- Nerve damage
- Muscle weakening
- Joint damage

- Whole-Body Vibration
- Damage to spinal discs
- Dizziness

Typical vibration white finger
(Source: HSE Guidance)

Control of Vibration

Source:

- Eliminate
- Substitute
- Change work method
- Maintenance

Pathway:

- Isolate

Duration:

- Limit time exposed
- Job rotation

Person:

- PPE

Ergonomics

- Ergonomics is the science of fitting workplace conditions and job demands to the workers

Display Screen Equipment

Risks:

- WRULDs
- Eye strain
- Back pain
- Fatigue and stress

D.S.E. Assessment

Organisation:

Job rotation, Breaks, Work load, welfare

Individual:

Competency, Physical Characteristics, Training, Ability

Environmental:

Noise, Lighting, Glare, Temperature, Space etc.

Equipment:

Height/position of keyboard and screen, seating posture, design of chair, screen definition and colour, adjustability of equipment

DSE Control Measures

- Work station risk assessment
- Provide basic DSE workstation equipment
- Provide (free) eyesight tests and spectacles if required
- Job rotation
- Regular breaks
- Medical surveillance
- Assessment of individuals for the task
- Provide information and training

DSE Standards

Health and Safety effects of inadequate lighting

- Eye strain
- Headaches
- Poor posture
- Slip & Trip
- Increased likelihood of error
- Increased time to evacuate

Factors to consider in the provision of adequate lighting

The tasks being undertaken
The layout and size of work area
The equipment being used
Availability of natural lighting
Suitability of artificial lighting
The shift patterns
Glare from computer screens
Areas in shadow
Maintenance/replacement of faulty lighting
Requirement for emergency lighting

Work Environment - Minimum Standards

Seating	• Appropriate seating • Stable, backrest and footrest where appropriate
Ventilation	• Sufficient supply of fresh or purified air
Heating	• Reasonable temperature indoors
Lighting	• Adequate lighting
Space	• Adequate to perform task safely
Noise	• Controls to reduce noise may be needed

Extremes of Temperature

Group Syndicate Exercise

What are the health issues associated with working in:

- Hot environment?
- Cold environment?

Effects of Exposure

Hot environments:

- Dehydration
- Muscle cramps
- Heat stress
  - Lethargy
  - Headaches
  - Fainting
- Heat exhaustion
- Heat stroke
- Heat Burns

Cold environments:

- Hypothermia
- Lethargy
- Frostbite
- Slip hazards
- Freeze burns injuries

Control Measures

Hot environments:

- Ventilation
- Insulate/shield heat sources
- Provide cool refuges
- Drinking water
- Frequent breaks
- Job rotation
- Appropriate clothing

Cold environments:

- Hot air circulation
- Shield/lag cold surfaces
- PPE - insulating
- Provide warm refuges
- Frequent breaks
- Job rotation
- Access to warm food and drinks
- Treat icy floors

Hazards to Pedestrians

- Slips, trips and falls on the same level
- Falls from height
- Collision with moving vehicles
- Striking by moving, flying or falling objects
- Striking against fixed or stationary objects

Group Syndicate Exercise

What is the difference between a:

- Slip hazard?
- Trip hazard?

Give examples of each

Factors contributing to slips, trips and falls

The floor surface: Slippery surface, holes, uneven surface etc.

Contamination: Spillages, Leaks

Obstructions: Rubbish, trailing cables, rugs etc.

The Task: Carrying loads, space to work

Environment: Poor Lighting

Footwear: Unsuitable footwear

The People: Unaware of the dangers

Slips and Trips Precautions

- No obstacles in the walkway
- Non-slip flooring
- Level walkways
- Marked walkways
- Good lighting
- Risk assessment
- Spillage control
- Guarding and fencing off designated areas
- Appropriate footwear
- Information, instruction, supervision and training

Housekeeping

Hazards

- Someone could trip or fall
- Increased risk of fire
- Fire exits could be blocked
- There is a risk of infection
- Chemicals are being used
- Infestation (that allows breeding of rats, cockroaches, etc.)
- Vehicle Collisions
- Falling materials

Precautions

- Identify housekeeping requirements
- Responsibilities for housekeeping
- Resources for good housekeeping
- Train staff in use of equipment
- Regular inspections
- Material Arrangement
- Cable arrangement
- Marking and labelling

Physical Forms of Chemicals

- The physical form greatly affects the hazard presented and the route of entry into the body

- **Solids** (Lead ingot)
- **Liquids** (Solvents)
- **Gases** (Co)
- **Vapour** (toluene)
- **Mists & aerosols** (deodorant)
- **Smoke** (coal burning)
- **Fumes** (welding)
- **Dusts** (Pharma dust)

HAZARDS AND HAZARD MANAGEMENT

Hazardous Substances Symbols(1)

Irritant:

Inflammation on contact with skin, eyes or tissue may cause inflammation e.g. adhesives and detergents

Corrosive:

Destroys living tissue at point of contact (skin) strong acids or alkalis i.e. H2SO4 (Sulphuric Acid), Caustic, ammonia

HAZARDS AND HAZARD MANAGEMENT

Hazardous Substances Symbols (2)

Harmful: Larger doses cause death or serious illness

e.g. Trichloroethylene

Toxic: Small doses cause death or serious illness

e.g. cyanide

HAZARDS AND HAZARD MANAGEMENT

Hazardous Substances Symbols (3)

Carcinogenic:

Substances which cause disorders in cell growth that may lead to cancer or increase its incidence e.g. Benzene

Acute and Chronic Health Effects

- Acute
  - High levels of exposure
  - Short exposure time
  - Quick effect
    e.g. high concentration of chlorine gas
- Chronic
  - Lower levels of exposure
  - Longer exposure time
  - Long term effect
    e.g. repeated exposure to solvents

Biological Agents

- Fungi

  e.g. Farmer's lung
- Bacteria

  e.g. legionnaire's disease, Leptospira Bacteria

  Viruses

  e.g. HIV, Hepatitis B

HAZARDS AND HAZARD MANAGEMENT

Biological Hazards Control Measures

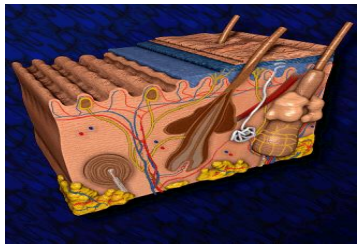
1) **Cleaning / Disinfecting**
2) **Water treatment programmes**
3) **Vermin control** A pest animal prohibited, controlled
4) **Procedures for handling, containment & disposal**
5) **Personal hygiene**
6) **Immunisation** to build resistance to specific infections
7) **Health surveillance** strategies and methods to detect and assess systematically the adverse effects of work on the health of workers.
8) **Specific training**
9) **PPE**

TOXICOLOGY - Routes of Entry

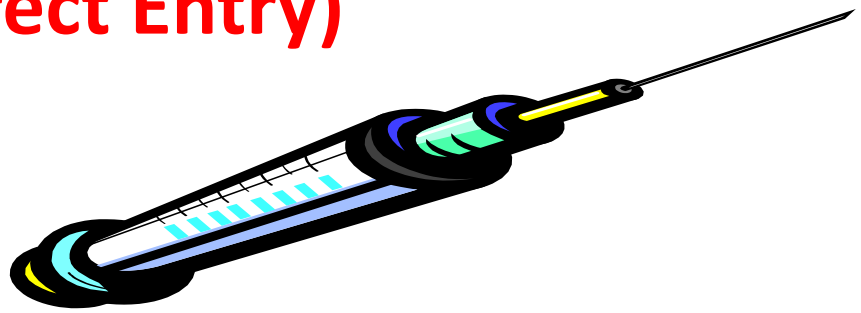
a) Inhalation

b) Ingestion

c) Absorption



d) Injection (Direct Entry)



TOXICOLOGY - Routes of Entry

Inhalation

- most important route of entry
- substances can directly attack lung tissue
- responsible for 90% of all cases of industrial poisoning

Ingestion

- via the mouth
- often accidental
- poor hygiene

Absorption

- through the skin
- solvents may penetrate unbroken skin

Injection

- when skin is damaged
- puncture of the skin
- contact with liquid or gas under pressure

Factors to Consider When Assessing Health Risk

- Hazardous nature of substance
- Potential ill-health effects
- Physical forms
- Routes of entry
- Quantity
- Concentration
- Number of people
- Frequency of exposure
- Duration of exposure
- Existing control measures

Personal Hygiene

- Hand-washing routines
- Careful removal and disposal of PPE to prevent cross-contamination to normal clothes
- Prohibition of eating, drinking and smoking in work areas
- Washing facilities
- Changing facilities
- Rest areas

Health Surveillance

- Health monitoring
  - signs of disease
  - symptoms of chronic conditions,
    e.g. flour workers have lung function tests to check for asthma
- Biological monitoring
  - checks for contaminants
    e.g. Virus
- Pre-employment screening
  - establishes a ‘baseline’

ody,

HAZARDS AND HAZARD MANAGEMENT

AIRBORNE DUST

Respirable dust:
Airborne dust of such a size about 0.5 microns that it is able to enter the lungs during normal breathing

Respiratory diseases:

- Asbestosis
- Silicosis
- Asthma
- Bronchitis
- Lung Cancer
- Farmer’s lung

Assessing levels of dust

- Visual examination
- Sampling for dust
- Personal samplers
- Fixed samplers
- Sample for a fixed time
- Dust lamps
- Dust accumulation

Control Measures to Reduce Exposure to Dust

- ❑ Eliminate at source
- ❑ Substitute with pellets
- ❑ Change process
- ❑ Use liquid process
- ❑ Enclose the complete process
- ❑ Ventilation
- ❑ Control by suppression
- ❑ Housekeeping
- ❑ Maintenance

Common Methods of Control

- Elimination or substitution
- Process change
- Reduce exposure times
- Enclosure or segregation
- Local Exhaust Ventilation
- PPE
- Personal hygiene and protection
- Health Surveillance/monitoring

Respiratory Protective Equipment (RPE)

Two types:

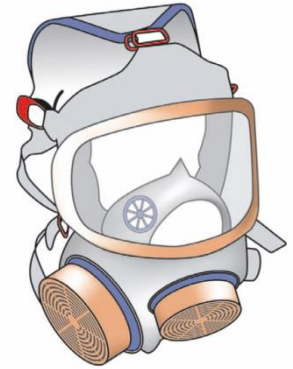
- Respirators
  - filter contaminated air

- Breathing apparatus (BA)
  - oxygen depleted atmospheres
  - provide clean source of air

Filter Face-piece Respirators/Dust mask

Half Mask Respirator

Full Face Respirator



Fresh Air Hose BA

- Air demanded by user
- Pumped

Compressed Air BA

- Air under pressure

Self-contained BA

- Pressurised cylinder

Waste

Waste is:

“Something that is discarded or is going to be discarded”

General hierarchy of control

- Prevent
- Reduce
- Reuse
- Recycle
- Recover energy
- Responsible disposal

Waste

Hazardous waste is a **waste** with properties that make it potentially dangerous or harmful to human health or the environment.
examples of **hazardous waste**
Paints, batteries, solvents, cleaning agents and pesticides.

Non-hazardous waste
is a **waste** with properties that make it not potentially dangerous or harmful to. human health or the environment.
Household waste, paper, wood, biodegradable materials

Safe Handling and Storage

Factors to consider – solid wastes:

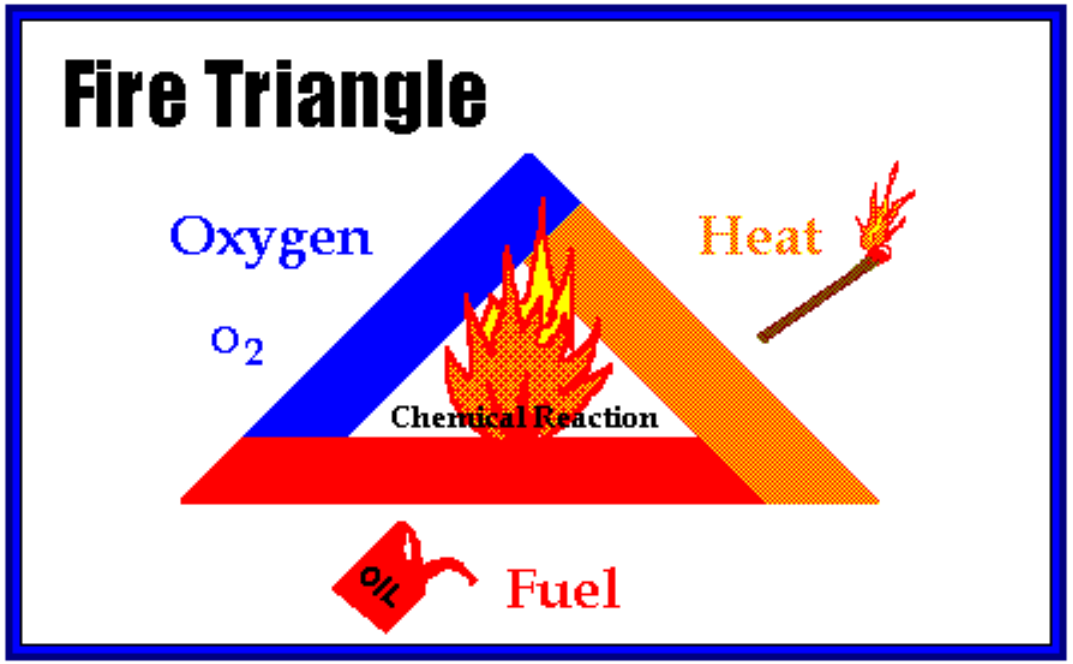
- The hazardous nature of the waste
- Manual handling risks
- Safe access to skips, bins, etc.
- Don’t store on unmade ground
- Moving parts of compactors
- Vehicle hazards, e.g. skip lorries
- Security of the waste
- Segregation
- Documentation

Safe Handling and Storage

Factors to consider – liquid wastes:

- Containers located in bund, away from walls
- Bunds have sufficient capacity of largest container
- Provision for rainwater
- Transfer points, e.g. pumps bunded
- Protect bund from damage
- Bunds checked and maintained

The Fire Triangle



Fire Safety, at its most basic, is based upon the principle of keeping fuel sources and ignition sources separate.

Fire Extinguishment Theory

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

1. Enough **OXYGEN**
2. Enough **HEAT**
3. Some **FUEL**
4. Together, they produce the **CHEMICAL REACTION** that is fire

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

EXTINGUISHING METHODS

STARVATION ..... TO REMOVAL OF FUEL

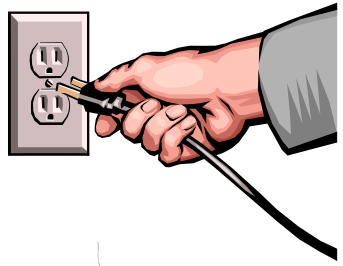
SMOTHERING ..... TO REMOVEL OF OXYGEN

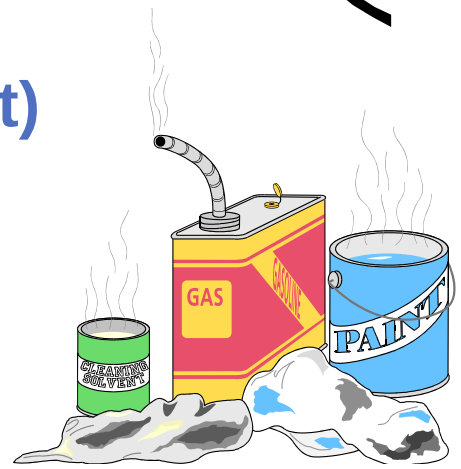
COOLING ..... TO REMOVAL OF HEAT

HAZARDS AND HAZARD MANAGEMENT

SOURCES OF IGNITION

- Naked flames
- Electricity (Overheating/Arcing)
- Smoking materials
- Hot work (Welding, burning)
- Chemical reactions (Giving off heat)
- Heating appliances (Hot surfaces)
- Friction (Inadequate lubrication)
- Static electricity
- Lightning
- Improper storage of flammable materials
- Lack of inspection and supervision





HAZARDS AND HAZARD MANAGEMENT

Harm to persons from fire

Main effects

- Being burnt
- Inhaling toxic fumes
- Effects of smoke inhalation
- Depletion of oxygen supply

Other effects

- Collapse of building
- Crush or other injury sustained while escaping

METHODS OF HEAT TRANSFER

- **CONDUCTION**

HEAT TRANSFER THROUGH A MEDIUM OF SOLID BODY.

- **CONVECTION**

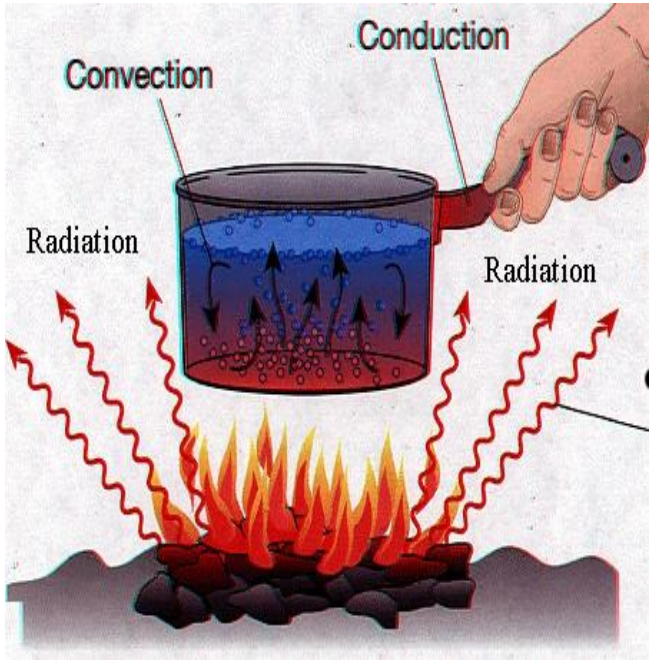
HEAT TRANSFER THROUGH UPWORD MOTION OF HEATED MATTERS.

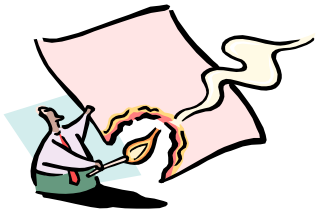
- **RADIATION**

HEAT TRANSFER THROUGH AIR HEAT WAVE.

- **DIRECT BURNING**

COMBUSTIBLE MATERIALS IN CONTACT WITH NAKED FLAME





HAZARDS AND HAZARD MANAGEMENT

CAUSES OF FIRE

- Deliberate (Arson)
- Electrical faults
- Misuse of electrical equipment
- Smokers materials
- Smoking in prohibited areas
- Loss of control burning rubbish
- Heating equipment
- Unsafe storage of materials
- Flammable liquids/gases
- Welding/hot work
- Mechanical heat (Friction)

Classification of Fires

Class	Type of fuel	Examples
A	Combustible solids	Paper, Wood
B	Flammable liquids	Petrol, Diesel
C	Flammable gases	LPG, Acetylene
D	Flammable metals	Sodium, Potassium
F	Combustible cooking media	Kitchen Fire
electrical equipment	Electrical - classified according to the source of ignition rather than fuel source	Electrical equipment

Extinguishing Agents

Class	Type of Extinguisher
A	Water, Dry powder
B	Foam, CO2 , Dry powder
C	Dry Powder,CO2
D	Special type DCP
F	The foam congeals on the top of the oil
Electrical	CO2, Dry Powder

Outline key stage of Fire Risk Assessment?

1) **Identify hazards:**

   The three elements of the triangle of fire

   Fuel, Oxygen and Heat

2) **Identify who could be harmed:**

   Persons at risk particularly the disabled etc.

3) **Evaluate the risks and adequacy of precautions:-**

   Considering prevention, protection and precautions

4) **Record findings:**

   Prepare an emergency plan

5) **Review:**

   Annually , changes in process, Equipment's

HAZARDS AND HAZARD MANAGEMENT

Factors To Consider In Fire Risk Assessment

- **Construction and use of building**
- **Flammable materials**
- **Sources of ignition**
- **Work activities generating heat**
- **Methods of control**
- **Means of fire detection**
- **Means of raising the alarm**
- **Means of fighting fire/maintenance of equipment**
- **Evacuation routes/Protection of routes**
- **Numbers of persons at risk**
- **Fire prevention training/fire drills**

HAZARDS AND HAZARD MANAGEMENT

Identify the factors that should be addressed in the fire plan.

Factors that should be addressed in the fire plan include:

- The action workers should take if they discover a fire;
- The system for raising the alarm
- The system of notifying the fire service;
- The escape routes and travel distances
- The provision of fire exit route signs;
- The provision of emergency lighting;
- The provision and siting of fire fighting equipment;
- The identification of an assembly point and the procedures for taking a roll call;
- The appointment of and delegation of specific responsibilities to marshals and wardens;
- The arrangements for workers with disabilities and for non-workers;
- The location of service shut down switches and valves
- The arrangements for stopping and isolating machinery and plant in the event of a fire;
- The training required for all workers and that for those with special responsibilities
- Coordination and cooperation with other employers who might be affected if a fire occurred.

Prevention, Protection & Precautions

1) **Fire Prevention**
   Control measures to reduce the risk of fire
   Starting

2) **Fire Protection**
   Structural measures to reduce the risk of fire
   Spreading

3) **Fire Precautions**
   Measures taken to reduce the risk in the
   Event of fire

HAZARDS AND HAZARD MANAGEMENT

Fire Prevention

Aim to keep the three sides of the fire triangle apart:

- ❑ Eliminate or reduce the storage of flammable materials
- ❑ Control of ignition sources
- ❑ Control smoking materials
- ❑ Good housekeeping
- ❑ Lubrication of machinery to prevent friction
- ❑ No overloading of electrical systems
- ❑ Regular inspections of electrical systems
- ❑ Ventilation outlets not obstructed
- ❑ Controlling hot work with permits etc.
- ❑ Proper storage of flammable materials
- ❑ Segregation of incompatible chemicals
- ❑ Security to prevent arson
- ❑ Regular Inspection and supervision

FIRE PROTECTION

Compartmentation

Splitting a building into separate sealed areas made of fire-resisting materials

Restricts the spread of fire and smoke within a building

Depends upon:

- **the use of the building**
- **building height**
- **floor area**
- **compartment volume**

Fire Protection

Fire resistant materials

- Primary construction: the main “fabric” of the building – walls, floors , roofs and internal walls
- Secondary construction: internal partitioning
- internal walls & Ceiling lines
- Bricks
- Concrete
- Structural steel

Fire Precautions

a) Fire/smoke detection

b) Fire alarms

c) Means of escape

d) Means of fighting the fire

e) Emergency evacuation procedures