UTM OPENCOURSEWARE

CONSTRUCTION SAFETY: 3

HAZARD IN CONSTRUCTION INDUSTRY

SBC 3363

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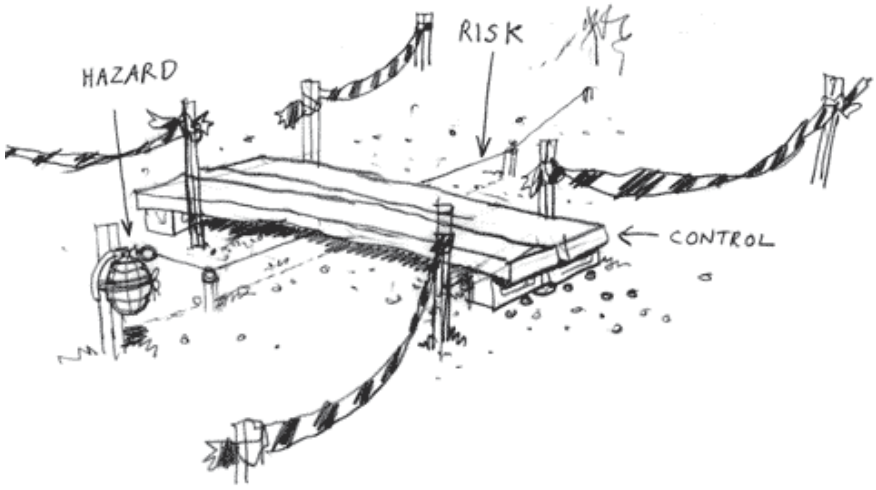

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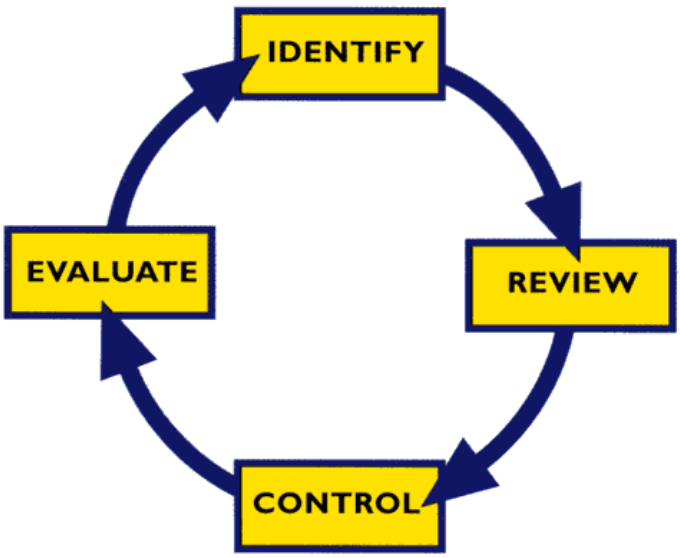
Definitions

- A hazard is **something that has the potential** to cause harm.
- A risk is the **likelihood of the potential hazard** being released and causing damage or injury.
- A control is a recommended or prescribed way of carrying out the work that, if followed, should reduce the risk.



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TYPES OF HAZARDS (GENERAL)

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Classification of Hazards in construction

- Physical
- Electrical
- Mechanical
- Psychosocial
- Biological
- Chemical
- Ergonomics

Recognised your hazards

- There are 6:
  1. Physical hazards
  2. Biological hazards
  3. Chemical hazards
  4. Electrical hazards
  5. Psycsosial hazards
  6. Ergonomic hazards

Physical Hazards

- Are the most common
- Unsafe conditions that can cause injury, illness and death.
- They are typically easiest to spot but, sadly, too often overlooked because of familiarity (there are always cords running across the aisles), lack of knowledge (they aren't seen as hazards), resistance to spending time or money to make necessary improvements or simply delays in making changes to remove the hazards (waiting until tomorrow or a time when "we're not so busy").

Physical Hazards

- None of these are acceptable reasons for workers to be exposed to physical hazards
- Examples of physical hazards include:
  - electrical hazards: frayed cords, missing ground pins, improper wiring
  - unguarded machinery and moving machinery parts: guards removed or moving parts that a worker can accidentally touch
  - constant loud noise

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Physical Hazards

- Examples of physical hazards include:
  - high exposure to sunlight/ultraviolet rays, heat or cold
  - working from heights, including ladders, scaffolds, roofs, or any raised work area
  - working with mobile equipment such as fork lifts (operation of fork lifts and similar mobile equipment in the workplace requires significant additional training and experience)

Physical Hazards

- Examples of physical hazards include:
  - spills on floors or tripping hazards, such as blocked aisle or cords running across the floor.

http://www.worksmartontario.gov.on.ca

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Biological Hazards

- Come from working with animals, people or infectious plant materials.
- Work in day care, hospitals, hotel laundry and room cleaning, laboratories, veterinary offices and nursing homes may expose you to biological hazards

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Biological Hazards

- The types of things you may be exposed to include:
  - blood or other body fluids
  - fungi
  - bacteria and viruses
  - plants
  - insect bites
  - animal

Ergonomic Hazards

- Occur when the type of work, body position and working conditions put strain on your body.
- They are the hardest to spot since you don't always immediately notice the strain on your body or the harm these hazards pose
- Short-term exposure may result in "sore muscles" the next day or in the days following exposure, but long term exposure can result in serious long-term injuries.

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Ergonomic Hazards

- Ergonomic hazards include:
  - poor lighting
  - improperly adjusted workstations and chairs
  - frequent lifting
  - poor posture
  - awkward movements, especially if they are repetitive
  - repeating the same movements over and over
  - having to use too much force, especially if you have to do it frequently.

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Chemical Hazards

- Are present when a worker is exposed to any chemical preparation in the workplace in any form (solid, liquid or gas).
- Some are safer than others, but to some workers who are more sensitive to chemicals, even common solutions can cause illness, skin irritation or breathing problems.

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Chemical Hazards

- Beware of:
  - liquids like cleaning products, paints, acids, solvents especially chemicals in an unlabelled container (warning sign!)
  - vapours and fumes, for instance those that come from welding or exposure to solvents
  - gases like acetylene, propane, carbon monoxide and helium
  - flammable materials like gasoline, solvents and explosive chemicals

HAZARDS IN CONSTRUCTION

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Hazards

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GENERAL TRADES AND THEIR HAZARDS

General Trade and Their Hazards

- Brick layers & stonemason
- Carpenters, joiners, formworkers & wood working machinist
- Painters and decorators
- Plumbers, heating and ventilating engineers, gas services engineers, welder and gas cutters
- Electricians
- Plants operator incl. pile driving operators, slingers

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General Trade and Their Hazards

- Concreters & plasterers
- Glaziers & cladders
- Wall and floor tilers
- Lift engineers
- Others: storekeepers, labourers & general workers

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Bricklayers and allied crafts

- Mostly done on or around scaffold platforms
- They are exposed to:
- Falling, tripping
- Being hit by falling object
- Bruises, contusion and cuts from materials they handle
- Eye injuries from dust and chipping while grinding, cutting and chipping bricks
- Dermatitis and skin ailments from contact with mortar they use

Bricklayers and allied crafts

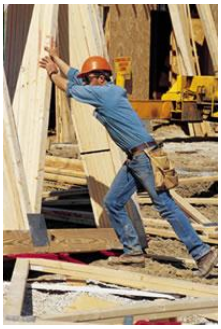
- Slipped disc and other back or muscle injuries from handling heavy and awkward loads, often in cramp or unnatural postures

➢ In spite of this hazards bricklaying appears to be one of the safer trades

Carpenters, joiners and allied craft

- They are exposed to:
- Noise and vibration of using hand and powered woodworking tools
- Wooden splinters, nails and other sharp objects
- Respiratory hazards from the dust of the materials cut (e.g. incl. asbestos and polyurethane plastics and many woods)
- Dermatological hazards from solvent and chemical used in adhesive and treating woods

Carpenters, joiners and allied craft



- (Wood treated against rot, mildew and insect and rodent infestation often contains highly toxic compounds of copper, chromium, zinc, arsenic and tin)
- Wood splinter that enters skin could cause septic wound. More dangerous if it is from poisonous wood
- Wood dust cause pneumoconioses
- Working on scaffolds also exposed to slipping, falling and tripping

Painters and Decorators

- Outside work mostly for maintenance
- They are exposed to:
- Falling from height often from ladders, inadequate scaffold or improvised temporary structures
- Toxic and dermatological hazards both through solvents, pigments and other constituent of their paints and from fumes of the chemical used in removing old paintwork

Painters and Decorators

- Fire and explosion hazard from the use of LPG and other fuel for blow pumps and from flammable solvents and thinners
- Lead-based paint can cause stomach cramps and sickness (the used is quite rare)
- Burning or dry rubbing surfaces treated in the past with paints containing lead, arsenic, chromium and other toxic materials
- Skin and respiratory allergies when handling epoxy or polyurethane

Painters and Decorators

- Eye damage and skin burns when handling rust-inhibiting chemicals
- Skin burns and ulcers (if hydrofluoric is used) when using stone, brick and cement cleaners
- Paint strippers
- Inhaling solvent vapours can cause irritation to the eyes, nose, throat, dizziness and stupor

#painters are more exposed to health hazards than most other construction worker from the materials they use

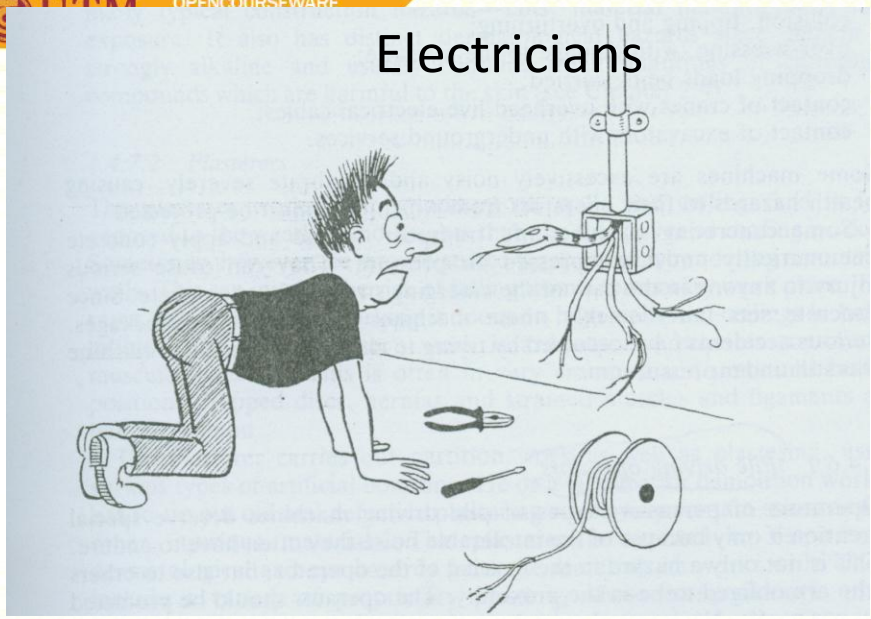
Plumbers and allied crafts

- Work with variety of piping – lead, copper, steel, plastics
- They are exposed to:
- Respiratory hazards of toxic materials e.g. PVC, polyurethanes and the vapors formed from them being heated
- Dermatological hazards from the solvents and jointing compounds he has to use
- Working in confined space making it worst as inadequate ventilation to remove toxic fumes and vapours

Plumbers and allied crafts (welders, gas cutters)

- (generally they are less exposed to the risk of falling although the installation and maintenance of roof guttering and lead flashing on roof wall intersections carried these risk)
- Welder and gas cutter: damage to eye and skin
- Fire hazard and injury from accidental damage to gas cylinders and fittings, gas hoses and electric leads and cable
- (worst if work underwater or for demolition work)
- Cutting steel might release heavy objects which falls to the ground. So must plan and control to prevent such accidents)

Electricians



The electrician must always be prepared for unexpected hazards

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Electricians

- Main hazards of electricians are electric shock and flash burns through contact with, or short-circuiting of, electric cables
- They are exposed:
- Electric shock
- Falling when working on ladders, temporary platform and supports
- A sudden electric shock may cause a man to lose his hold on the ladder

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Plant Operators

- Covers the operation of cranes, trucks, excavators, bulldozers, dumpers, road rollers, fork lift trucks, and other mobile machine used in construction
- Hazards to workers, properties and the operators themselves
- Need training and licence

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Plant Operators

- Main hazard:
- Collision, tipping and overturning
- Over-stressing, with damage to the machine
- Dropping loads being carried
- Contact of cranes with overhead live electrical cables
- Contact of excavators with underground services

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Plant Operators

- Some pneumatic plant e.g. concrete machines lift, spread and apply concrete under compressed air pressure
- Can cause serious injury to anyone in the path of the emerging stream of wet concrete
- Serious accident occurred when workers was trying to clear the blockage while machine was still under pressure

Plant Operators

Pile driving operator

- Pile driving operator have to endure intolerable noise
- Hazard to the hearing of the operator and also to others who are obliged to be in the proximity
- Should be protected by ear muffs

Plant Operators

Slinger

- Exposed to the hazards of falls and falling objects and other injuries arising from the fastening and release of loads from slings, hooks and ropes

Concreters and plasterers

Concreters

- To mix and place concrete
- Also to make and assemble formwork and reinforcement
- Hazards:
- Falls, material handling, vibration exposure
- Dermatological hazards since cement is strongly alkaline and usually contains small quantities of chromium compounds (harmful to skin)

Concreters and plasterers

Plasterers

- Works mainly indoors on wall and ceiling
- Less exposed to the weather and height than bricklayer or roofing worker
- Sometimes rendering work for outside walls
- Hazards:
- Because the work requires continuous muscular exertion (very cramped and unnatural bodily positions), slipped disc, hernias, and strain muscles/ ligaments are common

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Concreters and plasterers

Plasterers

- Demolition worker (strip old plaster) might exposed to respiratory, dermatological and eye hazards from the materials he works with (eye protection is frequently necessary for plasterers)

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Glaziers and Cladders

Glaziers

- Glazier handles, cut and fits glass panes and panels to windows, doors, partition etc
- Hazards:
- Sharp edges and easily broken
- Very deep cuts (into veins and arteries)
- Falling esp when replacing broken windows at first storey or higher (carry and hold large window pane on windy day is dangerous)

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Glaziers and Cladders

Glaziers

- Hazards:
- Toxic hazard through splinters of glass containing lead, arsenic and other toxic elements which may penetrate and lodge in skin
- Dermatological risks from putties he handles
- From the tools he used

Glaziers and Cladders

Cladders

- Fixing panel of concrete, aluminium, asbestos cement, glass stainless steel etc. to the outside walls of a building
- Hazards:
  - Mainly fallings

Wall and Floor Tilers

- Work main indoors with ceramic/ plastic tiles and tile adhesives
- Hazards:
  - Work has to be done in cramped and unnatural body positions so risk of back or muscular disorders
  - Falling risk is low
  - Toxic or dermatological hazards from the materials handled
  - Dust

Lift Engineers

- Hazards:
  - Falling
  - Trap between the lift and counterweight
  - Crushed under the lift

Others

Storekeepers

- Manual handling of different materials, toxic or inflammable

- Hazards:
  - Manhandling loads
  - Struck by falling object while unloading loads from trucks

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Others

Labourers

- Exposed to all hazards they are working on
- Accident rates in developing countries is very high as rarely they are equipped with protective clothing or equipment

General worker

- Odd-job men may be involved from time to time in any of the construction activities and exposed to the same hazards
- Chances of an accidental injury thus higher

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HIGH RISKS AND THEIR HAZARDS

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High Risks and their Hazards

- Steel erection
- Roof work
- Demolition
- Excavation
- Tunnel work

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High Risks and their Hazards

- **Steel erection**

❖ Hazard: can be in 3 broad categories

1. Falling from the structure under erection (or from access ladder)
2. Instability of partially-erected structures
3. Materials being dropped while working at heights

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High Risks and their Hazards

- **Steel erection**

❖ Falling from the structure under erection (or from access ladder)

1. Safety belts (or harnesses) ineffective since they are rarely worn and used due to:
   1. Lack of suitable anchorage point
   2. Not design to carry tools and bolts
   3. Restriction on the mobility of the erector

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High Risks and their Hazards

- **Steel erection**

2. Safety belts or harnesses are now considered as the last means of fall protection

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High Risks and their Hazards

- **Steel erection**

❖ Instability of partially-erected structures

1. Fail to provide rope or props for column hence they collapse due to: high wind; being struck by loads handled by cranes; through men working on ladders leaning against them
2. Structure should be adequately guyed and propped until it is bolted up so as to be stable

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High Risks and their Hazards

- **Steel erection**

❖ Materials being dropped while working at heights

1. Bolts, nuts, spanner or other tools (sometimes sharp and pointed
2. Fall from considerable height onto someone below
3. Even safety helmet caused injury

High Risks and their Hazards

- **Steel erection**

❖ Hazard:

1. Fall over 2m: from steelwork, ladders, platform
2. Fall below 2m
3. Struck by materials
4. Struck by steelwork during erection
5. Strains from handling steelwork

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High Risks and their Hazards

- **Steel erection**

❖ Hazard:

6. Use of tools
7. Trapping
8. Crane/ plant failure
9. Eye injuries
10. Burns
11. Nails (in feet)

High Risks and their Hazards

- **Steel erection**

❖ Precaution and recommendation

1. Assemble on the ground rather than in mid-air
2. Sub-base for mobile cranes must be well-consolidated
3. Placing of ladders
4. Horizontal access (walkways with handrails) should be provided for access to steel structures

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High Risks and their Hazards

- **Steel erection**

❖ Precaution and recommendation

5. Erectors should undergo through pre-selection (medical examination, training and certification)
6. Teamwork and effective communication
7. Safety helmet and safety boots
8. Steel erection should not be carried out in unsuitable weather or bad light (ice or snow)

High Risks and their Hazards

- **Steel erection**

❖ Precaution and recommendation

9. Proper drawings and detailed instructions which cover the order and method of erection

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High Risks and their Hazards

- **Roof work**

❖ Pitch less than 10o = flat

❖ 10o to 30o = shallow slope

❖ 30o to 50o = moderate slope

❖ > 50o = steep slope

❖ Hazard:

1. Fall (most fatal cases)
2. Dermatitis and respiratory infections through handling birds' dropping

High Risks and their Hazards

- **Roof work**

❖ Classes:

1. roof edge fall
2. fall through roofing material (lack or inadequacy of crawling board, roof ladder)
3. falls from internal structure of roofs

❖ Usually through maintenance

High Risks and their Hazards

- **Roof work**

❖ Precaution

1. Edge protection = guardrail (depending on the slope of the roof)
2. Protection around fragile roof areas = protect with barriers or strong covers which is securely fixed
3. Sloping roof = crawling boards or roof ladder
4. Work in adverse weather (rain or wind) = stop work

High Risks and their Hazards

- **Roof work**

❖ Precaution

5. Electric cable = disconnected if necessary

High Risks and their Hazards

- **Demolition**

❖ Dirty, dangerous and unhealthy occupation

❖ Hazards:

1. Falling
2. Being hit of trapped by falling objects
3. Excessive noise
4. Vibration
5. Flying particles
6. Fires and explosion

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High Risks and their Hazards

- **Demolition**

8. Weather (Demolition proceeds in all weather

❖ Difficult and skilled

❖ Workers must know

- ❖ the strength, stability and weak points of partly-demolished structure
- ❖ How and in which direction things will fall
- ❖ Whether the collapse of one wall will cause adjacent wall to collapse

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High Risks and their Hazards

- **Demolition**

1. Demolition by knocking down and taking to pieces

- ❖ Safe working place
- ❖ Work from tops of walls
- ❖ Adjacent ground must be secured before knocking down underground structure
- ❖ Do not undermining structure to avoid premature damage

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High Risks and their Hazards

- **Demolition**

2. Demolition by pulling and pushing down

- ❖ When to pull down (when you cannot knocked it into pieces) (unsafe structure)
- ❖ Rope for pulling down = strong wire
- ❖ Fastening of rope = fasten rope to the building
- ❖ Danger zone evacuation (make sure surroundings is clear)
- ❖ Plant for pushing down

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High Risks and their Hazards

- **Demolition**

3. Demolition by explosives

- ❖ Experience and training of explosives engineer
- ❖ Drilling shot holes (unstable structure use drill instead of pneumatic to avoid vibration)
- ❖ Dangers of cast iron (shatters into shrapnel)
- ❖ Barricading (prevent the entry of unauthorised people)

High Risks and their Hazards

- **Excavation**
- Hazards

❖Falls

❖Collapse of sides of excavation and falls of material onto persons in excavation

❖Collapse of adjacent building

❖Collapse of temporary structure made to support sides of excavation

High Risks and their Hazards

- **Excavation**
- Hazards
  - ❖Persons in excavation struck by parts of machine
  - ❖Striking underground electric cables, gas, water (flooding), sewage (toxic gas) services
  - ❖Fire and explosion from air flammable gasses and vapours
  - ❖Poison from carbon monoxide or hydrogen sulphide

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High Risks and their Hazards

- **Excavation**
- Hazards
  - ❖Toxic and radioactive
  - ❖Flooding with risk of drowning
  - ❖Accidental explosion through the use of explosive
  - ❖Unexploded bomb
  - ❖Fall through bottom of excavation into disused mine shaft or other cavities

High Risks and their Hazards

- **Excavation**
- Hazards

❖Slipped disc or muscular disorder resulting from work in cramped positions

❖Weil's disease, transmitted by rats

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High Risks and their Hazards

- **Tunnel work**
- Hazard

❖Drowning

❖Interment (buried)

❖Injury from falling rock

❖Insufficient oxygen in atmosphere

❖Fire (from methane and timber in tunnel)

❖Poisoning (from toxic gases)

High Risks and their Hazards

- **Tunnel work**
- Hazard
  - ❖ Respiratory diseases (from dusts)
  - ❖ Decompression sickness for workers in compressed air compartments
  - ❖ Explosions (premature firing of explosives charges

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High Risks and their Hazards

- **Tunnel work**
- Hazard
  - ❖ Excessive noise, leading to hearing loss
  - ❖ Vibration (handheld pneumatic rock drills)
  - ❖ Bursitis (knee)
  - ❖ Bronchitis and pneumonia

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HEALTH HAZARDS

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Health Hazards

- Occupational diseases
- Chemical hazards
- Man-made physical health hazards
- Other health hazards

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Health Hazards

- Occupational diseases
- An occupational disease is a health problem caused by exposure to a workplace health hazard.
- These workplace health hazards can cause an occupational disease:
  - dust, gases, or fumes
  - noise
  - toxic substances (poisons)
  - vibration
  - radiation
  - infectious germs or viruses
  - extreme hot or cold temperatures
  - extremely high or low air pressure

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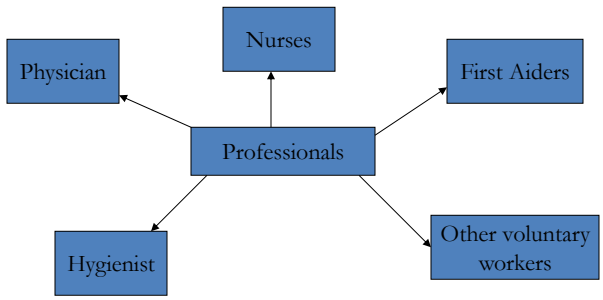
Health Hazards

- Occupational health professionals



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Health Hazards

- Modes of entry and attack

❖Inhale route and respiratory hazards

❖Dermal route and skin hazards

❖Oral route

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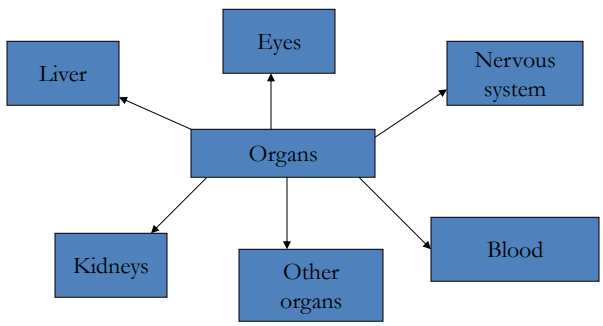
Health Hazards

- Target organs



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Health Hazards

- Allergies
- ❖ Caused by a malfunction of the body's natural defense system due to a number of foreign materials known as allergens
- ❖ Skin disorders: dermatitis, eczema, nettlerash
- ❖ Respiratory disorders: hay fever, asthma, chronic bronchitis, sinusitis
- ❖ Allergic reaction: Gastrointestinal disorders: arising after eating a particular food or taking a particular drug

Health Hazards

- **Allergies**
- ❖ Once a person become sensitise to an allergen, condition is often permanent and so must avoid similar exposure in the future
- ❖ Allergens in construction: Toluene di-isocynate (in polyurethane); cement dust (chromium compounds); coal tar products; some detergents; some dyestufffs; some disinfectants (iodine, lysol and formalin); mineral oils (motor oil); some resins and glues and dusts from tropical woods

Health Hazards

- **Allergies**

❖Construction occupations expose to allergen: carpenters, joiners, formworkers; demolition workers; painters; roof workers; tilers; flooring layers; concreters; asphalters; labourerss

❖Cross sensitisation: one who has become sensitised to a particular chemical may automatically sensitised to other closely related chemical compounds

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Health Hazards

- **Allergies**

❖Photosensitisation: allergen only causes a reaction when the person is exposed to sunlight

❖E.g. creosote (use to preserve wood) where sensitised person who gets a splash of creosote on his skin will only feel the effects when he goes out in the sun when severe inflammation and dermatitis result

CHEMICAL HAZARDS

Chemical Hazards

Chemicals can exist in the form of

- dusts, fumes, fibers (solids)
- liquids, mists
- gases, vapors

Examples of chemical hazards found in construction work:		
	• asbestos • lead • silica • cadmium • carbon monoxide	• welding fumes • spray paints • cutting oil mists • xylene vapor • solvents

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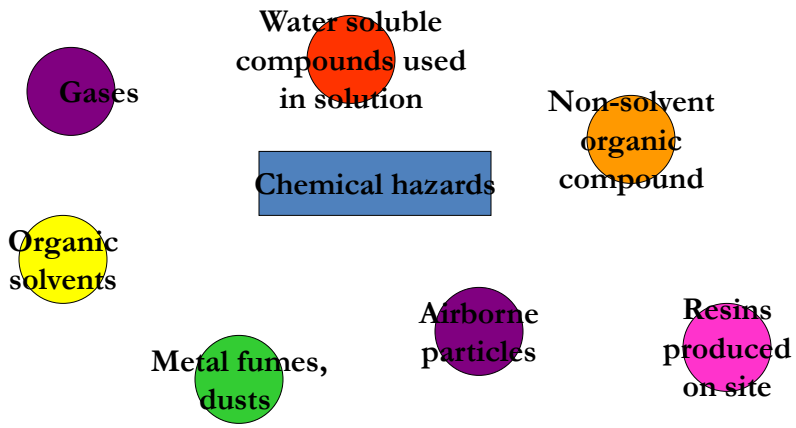
Chemical Hazards

- Chemical hazards (toxic substance)



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Chemical Hazards

Chemicals can enter the body via

- inhalation
  - breathed in

Inhalation is typically the most common way chemicals can enter the body in a work situation.

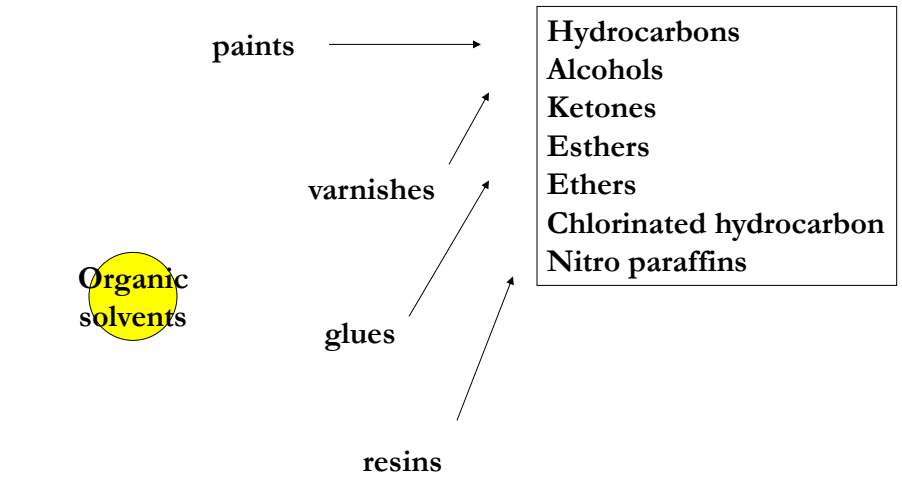
- ingestion
  - accidental swallowing through eating, drinking, or smoking

- absorption
  - absorbed through contact with skin or eyes

Injection, in which a chemical enters the body when the skin is punctured, occurs rarely (e.g., paint from a high-pressure spray gun).

Health Hazards

- Chemical hazards (toxic substance)



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Health Hazards

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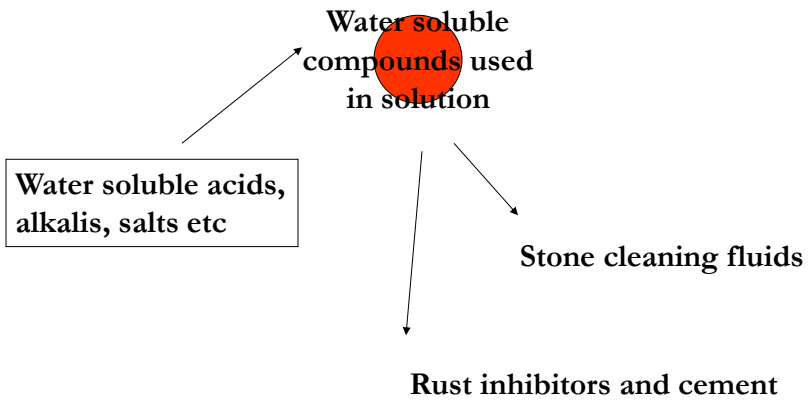

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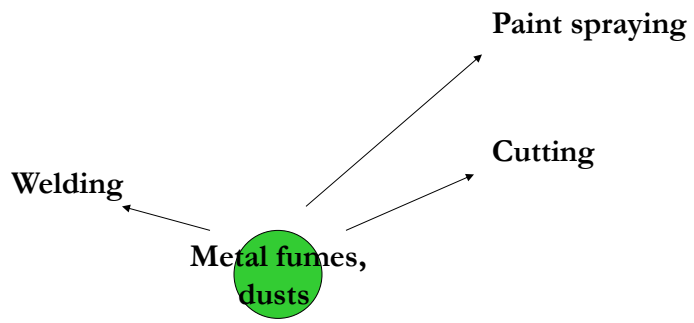

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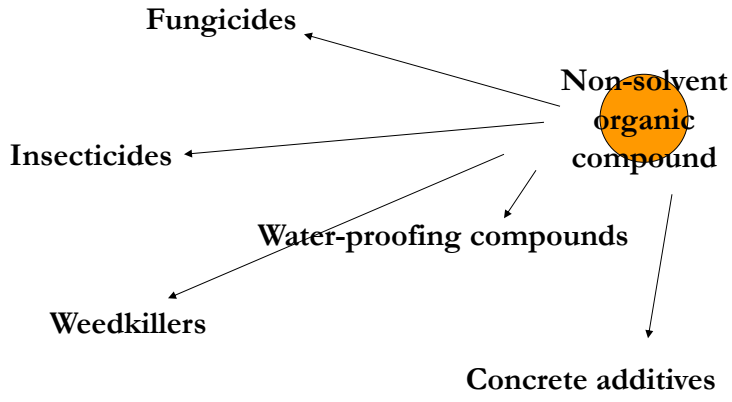

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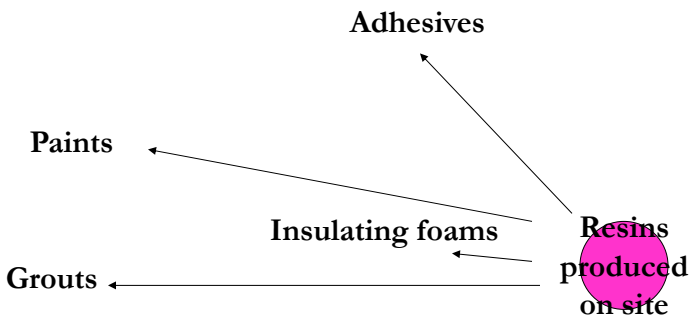
Health Hazards

- Chemical hazards (toxic substance)



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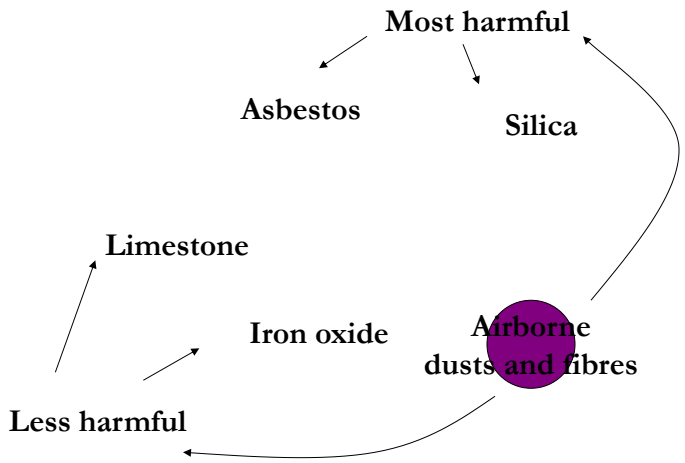
Health Hazards

- Chemical hazards (toxic substance)



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Health Hazards

- Chemical hazards (toxic substance)

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Health Hazards

- **Chemical hazards**

❖ Precautions:

1. Storage
   1. Stored safely and securely
   2. Store should be constructed of non-combustible materials and be dry, well ventilated and secured with adequate lock when not attended
   3. Should be supervised by a trained person with good eyesight and sense of smell
   4. Contents of the store should be check – containers are securely closed and their labels are in good conditions

Health Hazards

- **Chemical hazards**

❖ Precautions:

1. Storage
   5. Chemicals that can react with one another must be kept well apart (acid and alkalis)
   6. Containers or corrosive chemicals should be place in polythene or PVC drip trays, stored in a well ventilated place away from direct sunlight and where they are not knocked over
   7. A washroom with running water should be near the store and should be provided with a first aid box including eye wash bottle

Health Hazards

- **Chemical hazards**

❖ Precautions:

1. Storage
2. Working condition
   1. Train persons handling chemicals substance in their safe usage
   2. Withdraw from store only in minimum amount needed for immediate use
   3. Good ventilation
   4. Necessary personal protective equipment

Health Hazards

- **Chemical hazards**

❖ Precautions:

2. Working condition
   5. Restrict the presence of airborne dusts (wet method or dust extractors)
   6. Wash down any spills of corrosive water soluble liquids
   7. Prohibit eating or drinking or smoking while handling chemicals
   8. Wash exposed skin well with soap and running water at the end of the day before all meals and after immediately effect to skin

Health Hazards

- **Chemical hazards**

❖ Precautions:

3. Disposal of surplus and unused chemical
   1. Should plan for the disposal in advance – make a list of the substance showing how each should be disposed of. (consult with authority)
   2. Do not disposed with the rubbles
   3. Burning of unwanted timber treated is hazardous – far from public present of people working and not on windy days
   4. Water soluble inorganics acids, alkalis, salt and water soluble organic materials of low toxicity (lower alcohol) – well diluted and washed down with large amount of water into surface drain

Health Hazards

- **Chemical hazards**

❖ Precautions:

3. Disposal of surplus and unused chemical
   5. Acids should be neutralised with lime or soda ash
   6. Highly toxic compounds (cyanides), hydrocarbon, chlorinated hydrocarbon, nitroparaffin solvent, herbicides, insecticides should be disposed to an authorised waste disposal site

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Health Hazards

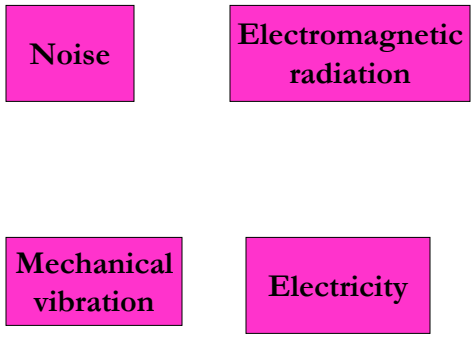
- **Chemical hazards**

❖ Precautions:

4. Protective clothing and equipment
   1. Respiratory protection
   2. Hand protection
   3. Eye protection
   4. Rubber boots and PVC overall

Health Hazards

- Man-made physical health hazards



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Health Hazards

- Man-made physical health hazards
- Noise
  - ➢ Is defined as unwanted sound
  - ➢ Serious hazard – occupational deafness caused by continous exposure to moderately heavy noise levels or relatively short exposure to high levels of impulsive noise e.g. firing of guns
  - ➢ Sudden noise – affect circulation of blood, startle reaction, release of adrenalin into the bloodstream, tightening blood vessels and caused fatigue and headache

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Health Hazards

- Man-made physical health hazards
- Noise
  - ➢ Noise can interferes digestive system and seriously interferes with sleep
  - ➢ Noise interferes with communication (warning shout could not be heard when concrete pumps and vibrators are working nearby)
  - ➢ Partial deafness by previous noise exposure also serious hindrance to communication

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Health Hazards

- Man-made physical health hazards
- Noise
  - ➢ Noise on site must be not more than 90dBA over an 8 hour working day
  - ➢ Ear protector is a must
  - ➢ Sound insulation of the operator cab (seal all gap between the engine compartment and the cab, fitting rubber gaiters round all control levers, lining the cab with acoustic absorbent materials
  - ➢ Resilient engine mounts can also reduce noise and vibration level

Sound insulated operator cab

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Health Hazards

- Man-made physical health hazards
- Noise
  - ➢ For piling – the use of hydraulic rams which apply sufficient force to push the pile into the ground or extract it without impact or ground vibration

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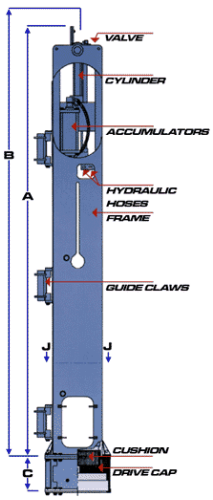

Hydraulic piling

Health Hazards

- Man-made physical health hazards
- Mechanical Vibration
  - ➢ Referred to simply vibration
  - ➢ Exposure to too much vibration is a health hazard and vibrates at certain frequency is more hazardous
  - ➢ From vehicles they drive or operate e.g. seated in a cab – whole body vibration

Health Hazards

- Man-made physical health hazards
- Mechanical Vibration

➢ From power tools they hold in their hands – hand and arm vibration e.g. concrete vibrators, vibratory road rollers, concreter breakers and rock drills

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Health Hazards

- Man-made physical health hazards
- Mechanical Vibration

1. Whole Body vibration

➢ Occurs when subject sits, stands or lies on a vibrating seat, floor, structure, etc

➢ Depending on frequency, acceleration, time of exposure, and other circumstances – the result may be loss of coordination, giddiness, spinal disorders, varicose veins, headaches, constipation, bone damage and nervous disorders

Health Hazards

- Man-made physical health hazards
- Mechanical Vibration

1. Whole Body vibration

➢ Excessive vibration at frequencies of 10-20Hz can damage lungs, cause rectal bleeding, blood in the urine, constipation and heart failure

➢ At 20Hz can cause headache

➢ At 30-40Hz may cause eyes to resonate and affect vision

Health Hazards

- Man-made physical health hazards
- Mechanical Vibration

2. Hand and arm vibration

➢ Within the frequency of 4-2000Hz

➢ Suffered by the users of reciprocating and some rotary hand-held tools e.g. pneumatic drills

Health Hazards

- Man-made physical health hazards
- Mechanical Vibration

2. Hand and arm vibration (HAVS – Hand Arm Vibration Syndrome)

➢ White finger or dead finger disease – aka Raynauds phenomenon usually in cold weather. Loss of circulation leads to loss of feeling and partial loss of the use of fingers. Extreme cases: gangrene and amputation

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Health Hazards

- Man-made physical health hazards
- Mechanical Vibration

2. Hand and arm vibration

➢ Osteoarthritis (Osteoarthritis is a type of arthritis that is caused by the breakdown and eventual loss of the cartilage of one or more joints) of the arm joints esp. elbows. Followed by muscle and nerve disease

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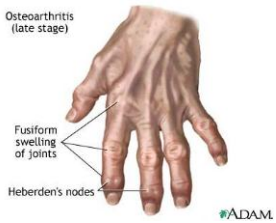
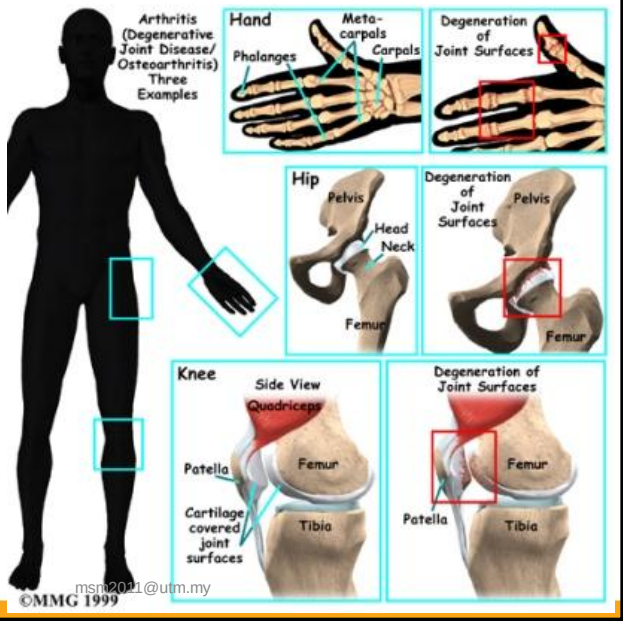


Osteoarthritis



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Health Hazards

- Man-made physical health hazards
- Mechanical Vibration

2. Hand and arm vibration

➢ Hardening of the soft tissues particularly palms of the hands (Callous)

➢ Small areas of decalcification of the bones (osteoporosis-removal of calcium ions)

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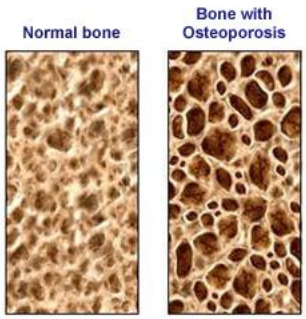
Callous



Bone decalcification

Health Hazards

- Man-made physical health hazards
- Mechanical Vibration

2. Hand and arm vibration

➢ Shock absorbers and the isolation of handles of tools and the supporting of handheld tools reduce level of exposure

➢ Glove cannot reduce the vibration as handlers has to grasp more tightly through the glove but it serves to reduce susceptibility to Vibration-induced White Finger (VWF)

Health Hazards

- Man-made physical health hazards
- Electromagnetic Radiation

1. Ultra Violet radiation – from welding.

- ➢ Severe burns without warning.
- ➢ Also from direct sunshine.
- ➢ Effects eyes and skins
- ➢ Prolong exposure leads to cataract
- ➢ Can also cause skin tumour
- ➢ Approved shields or eye protector is necessary
- ➢ Use skin cream containing UV absorbent

Health Hazards

- Man-made physical health hazards
- Electromagnetic Radiation

2. Visible light

- ➢ Cause eye problem
- ➢ High lighting can cause degeneration of the retina and impaired vision
- ➢ Poor lighting can cause vertigo (balance disorder), headache and sensitivity to bright light

Health Hazards

- Man-made physical health hazards
- Electromagnetic Radiation

3. Infrared radiation

- from welding or other hot operations incl fires, furnace and hot metal
- Mainly affects skin and eyes
- Burning sensation, reddening and discoloration of the skin is early warning or skin injury

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Health Hazards

- Man-made physical health hazards
- Electromagnetic Radiation

3. Infrared radiation

- Eye fatigue, headache is early symptoms of heat cataract
- Safety spectacles with appropriate filter lenses
- Expose to excessive radiation should have their eyes tested

Health Hazards

- Man-made physical health hazards
- Electromagnetic Radiation

4. Laser light beam

- Light Amplification by Stimulated Emission of Radiation = laser
- a special form of intense light of a single frequency – monochromatic used in construction for alignment purposes and for accurate measurement

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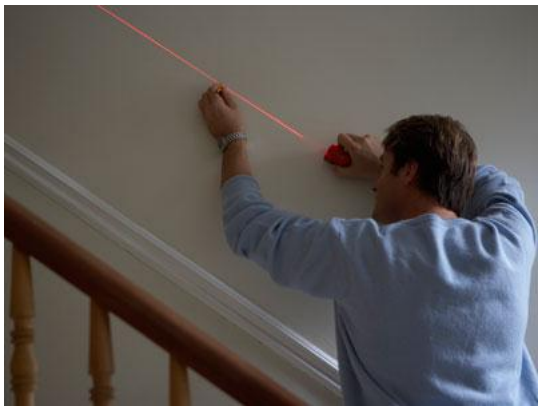

Laser beam

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Health Hazards

- Man-made physical health hazards
- Electromagnetic Radiation

4. Laser light beam

- ➢ Harmful to eyes and can also cause skin damage
- ➢ Heat object in their path is a fire hazard
- ➢ High voltage electrical circuits are potential hazards
- ➢ Eye protection is required

Health Hazards

- Man-made physical health hazards
- Electromagnetic Radiation

5. Ionising radiation from sealed radioactive sources

- ➢ Gamma radiation used in the inspection of welds and in metal thickness gauges
- ➢ Radioactive material are sealed inside special capsule
- ➢ Should be handled by professional, trained inspectors
- ➢ Protection: limited time of exposure, maintaining maximum distance from source, the use of shielding between source and the person exposed which absorbs the radiation

Health Hazards

- Man-made physical health hazards
- Electricity
  - ➢ Main injury type; shock, burns, falls caused by shock or conjunctivitis
  - ➢ The severity depends on:
1. Magnitude of current (in milliamps)
2. Whether the current is alternating current (ac) or direct current (dc)

Health Hazards

- Man-made physical health hazards

3. How long the current flows through the body
4. The path the current through the body; whether it passes near the heart or other nerve centres
5. Personal factors such as the health and mental state of the injured persons

- The magnitude of the current itself depends on the applied voltage and the resistance of the electrical path through body
- The resistance depends on the area of the skin in contact with electricity; the moisture content of the skin

Health Hazards

- Man-made physical health hazards
- Protection
  - Make sure correct fuse fitted in plug
  - Insulating rubber footwear
  - Electrode holders and cables should be insulated (for welders) and should not be changed with bare hands or wet gloves or when standing on wet floors or grounded surfaces
  - Dry gloves and clothing should be worn

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Health Hazards

- Man-made physical health hazards
- Protection
  - Cables must be kept dry and free of oil and grease
  - Welding cables must be kept away from power supply cables and high tension wires
  - Cables must be protected against accidental damage or entanglement

Health Hazards

- Other health hazards

1. Biological Hazards
2. Weather
3. Work in cramped and unnatural positions
4. Living conditions and welfare facilities

Health Hazards

- Biological Hazards

➢ Animal Hazards – wild and captive animal; birds, snake etc

➢ Insect and parasitics hazards- fleas, ticks, lice of various kind, spiders, malarial mosquitoes, flies

➢ Micro-organisms – fungi inc moulds, bacteria and viruse

➢ Poisonous plants

Health Hazards

- Weather
- Temperature
- Windspeed
- Rain, (hail or snow; not in Malaysia)
- Weather forecast and meteorological data; construction supervisor requires reliable weather forecast which gives audible and visual indication of temperature, wind speed and direction. Useful to advise worker to put on weather protection clothing e.g. jacket, etc

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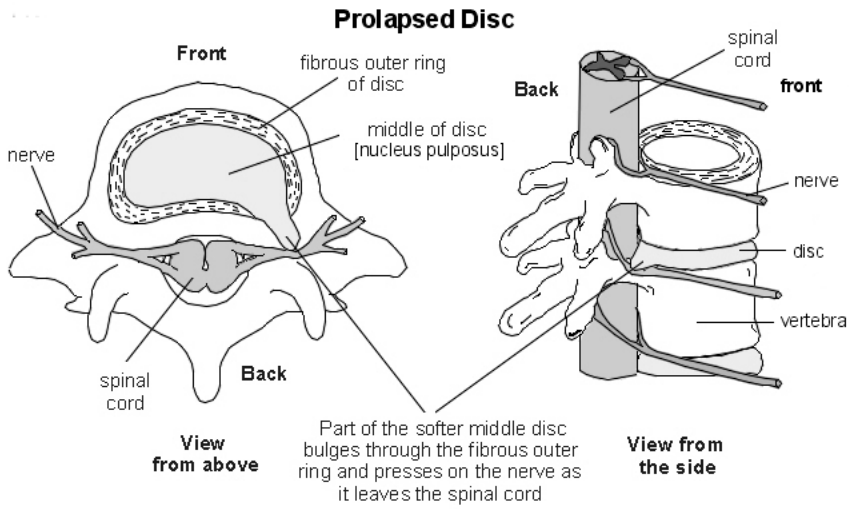
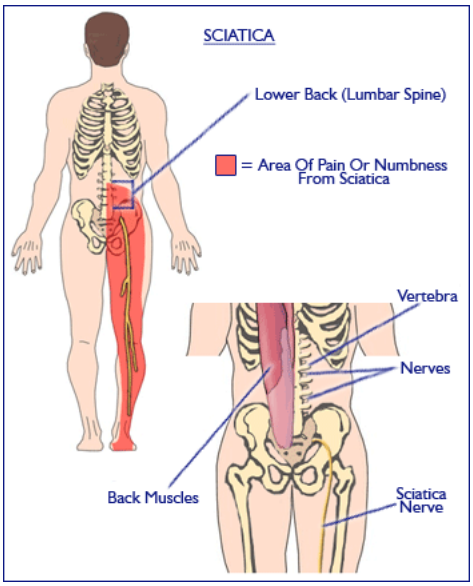
Health Hazards

- Work in cramped and unnatural positions
- The slipped disc - back strain, lumbago (back pain), pulled muscle, sciatica (common form of low back pain), spinal arthritis, disc lesion (disk injury)
- To avoid slipped disc – maintain a good back posture at all time; on bed, sitting, standing etc and avoid activities which impose heavy or sudden impact loads on the back e.g lifting heavy weight or falling heavily on one heals
- Beat conditions bursitis; cause by pressure, friction or repeated blows over a bursa



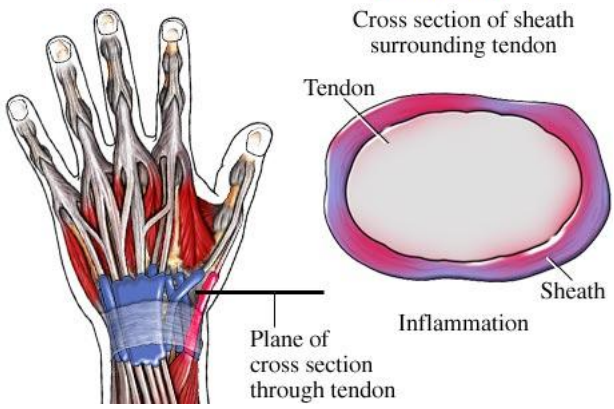
Disk injury



Sciatica (common form of low back pain)

Health Hazards

- Work in cramped and unnatural positions
- ➢ Tenosynovitis (inflammation of a tendon sheath) - affects the wrist and forearms of those involved in rapid repetitive work where twisting and gripping movement are common
- ➢ Common to factory workers
- ➢ Muscle strain, pain, tenderness and swelling are early symptom



Tenosynovitis

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Health Hazards

- Living conditions and welfare facilities
  - Construction camps
  - Food
  - Drinking water
  - Sanitary conveniences

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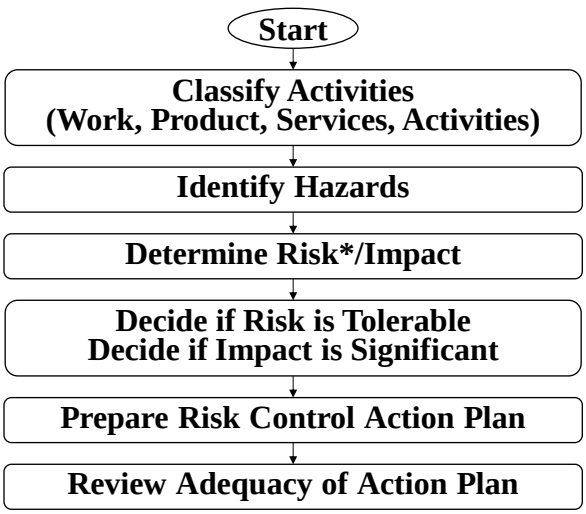
The Process of Safety Risk Management



*Risk =
Harm X Likelihood

Hierarchy of Control

- Elimination
- Constitution
- Isolation
- Management contol
- Engineering control
- PPE

SOURCES OF HAZARDS

Man	Unsafe acts
Machinery	Installation, layout and design of equipment
Materials	Substances such as chemicals and gases use in the workplace
Method	The way people carry out their work
Media	Workplace condition i.e. air quality, ventilation, lighting, noise, vibration etc.

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Classification of Hazards in construction

- Physical
- Electrical
- Mechanical
- Psychosocial
- Biological
- Ergonomics
- Chemical

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Classification and Potential Sources of Hazards

Classification of Hazards	Example of Potential Sources of Hazards
Mechanical	Pinch points, sharp points and edges, overload or force a tool beyond its capabilities and grinding wheel without guard
Electrical	Electrical cord insulation damaged, electrical face plate or cover broken or missing and fan cord insulation pulled loose
Biological	Exposed to airborne and blood borne viruses, bacteria and fungus

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Classification and Potential Sources of Hazards

Classification of Hazards	Example of Potential Sources of Hazards
Chemical	Exposed to carcinogens chemicals, sensitizers and corrosive chemicals.
Ergonomics	Repeated exposure to unnatural postures and unnatural movement, wrong design of workstation, tools and task.
Psychological	Stress, sexual harassment and violent at work.

THANK YOU