UTM OPENCOURSEWARE

CONSTRUCTION SAFETY: 7

PERSONAL PROTECTIVE EQUIPMENT (PPE)

SBC 3363

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The requirements

Do you still remember the requirements stated in Act 139 and 514 regarding PPE?.

FIND OUT BEFORE THE EXAM STARTS!!!

Objectives

- To define what is personal protective equipment (PPE)
- To state the position of PPE in the hierarchy of hazard control
- To describe the management and legal issues of PPE
- To select appropriate body protection equipments
- To demonstrate the PPE equipments

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What Is Personal Protective Equipment?

- Devices and garments to protect workers from injuries.
- Designed to protect
  - Eyes, Face, Head, Ears, Feet, Hands and Arms, Respiratory System and Whole body.
- PPE includes:
  - Goggles, Face shields, Safety glasses, Hard hats, Safety shoes, Gloves, Vests, Respirators, Earplugs and Earmuffs.

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Personal Protective Equipment (PPE)

- Warning!
- PPE SHOULD BE A HAZARD PROTECTION OF LAST RESORT
  - Not to be used permanently as a substitute for maintaining a safe and healthy work environment
  - Use only when the work environment cannot be made safer

    E.g. through hazard elimination engineering, administration or by limiting work exposure

Problem With PPE

- If PPE is used as the first option without reducing hazard at source:
  - Risk to workers if PPE fails and failure not detected.
  - Cause employees to believe they are "safe" and may take higher risks.
  - Result in worse consequences if people fail or forget to wear equipment.
  - Will shift the responsibility for safe working condition from the employer to the employee.

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What To Protect From?

- Any insult to the external (surface) or internal part of the body

1. Impact (e.g. flying & falling objects, knocks & bumps)
2. Chemicals hazardous to health (gases and liquid)
3. Radiation (IR & NIR) (e.g. heat, high intensity light, noise)
4. Dust (e.g. mineral dust)
5. Wet (e.g. slip)
6. Sharp objects
7. Falling from heights

Considerations in the Selection Of PPE

- Selection of PPE is dependent on the hazard identification, risk assessment and control measures implemented
- PPE is used to complement/combination of other control measure
- PPE selected must be carried out under a PPE programme
- PPE must be certified products to ensure acceptable level of protection from hazards
- Limitations of PPE must be identified adhered to

Ensuring Employee Compliance

- Make it easy for employee to comply
- Factors to consider:
  - Understand the necessity to wear the PPE
  - Easy and comfortable with minimum interference to work
  - Pre-purchase employee feedback on equipment
  - Psychological: employee vanity, virility
  - Incentives and Disincentives on wearing the PPE

Training On PPE

- Hazard recognition in the work environment.
- What control measures can be taken.
- The type of PPE suitable for use.
- The limitations of PPE.
- Demonstration of correct use.
- Practicing using the PPE.
- Cleaning, maintaining and repairing PPE.
- Use of PPE in dealing with emergencies.

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PPE IS PERSONAL!

- **FIT**
  - PPE must be properly fitted to ensure reliable protection.
- **Care**
  - Issued on a personal basis.
  - Individuals responsible for the day to day use, handling, cleaning, storage and maintenance, reporting of defects.

MULTIPLE USER PPE

- Should be correctly used, handled, stored, cared for and maintained.
- Appropriate procedures on suitable cleaning and sterilisation must be provided.
- Above must be observed at all times.

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Legal Requirements

- Factories And Machinery (Safety, Health And Welfare Regulation, 1970
  - Regulation 32
    - Clothing
    - Safety helmets
    - Gloves
    - Eye protection
- OSHA:1994 (USECHH) Regulations 2000
  - PART V - Action To Control Exposure
    - 16. (1) Approved personal protective equipment shall be used

Introducing of PPE to Workplace

- If PPE is to be used, then:
  1. Write in the OSH policy on usage of PPE and communicate it to employees and visitors.
  2. Select the proper type of PPE.
  3. Implement a thorough training programme.
  4. Make certain the employees know the correct use and maintenance of the equipment.
  5. Enforce its use.

PPE MANAGEMENT

Unless required by the law, PPE should be opted as the last line of defence after due considerations have been given to other alternative controls – elimination, substitution, isolation, engineering and administrative control.

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PPE MANAGEMENT

Every employer must be aware of:

a) the need for provision of personal protective equipment;
b) training in the use of personal protective equipment;
c) standards which apply to personal protective equipment;
d) signs to inform persons about personal protective equipment;
e) the system of control over the supply allocation, maintenance and repair of personal protective equipment, and documentation.

PPE MANAGEMENT - SELECTION

1. Every employer should assess the need for personal protective equipment on the basis of risk.
2. Once risk has been assessed, personal protective equipment can be selected according to availability, appropriateness and suitability for the wearer.

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PPE MANAGEMENT - SELECTION

3. When selecting personal protective equipment for a particular work process or series of tasks, consider the following general principles:
   a. Be familiar with the risks of the work process - involve evaluating the nature of the risk, circumstances and restrictions of the tasks to be performed.
   b. Be aware of the acceptable level of risk to which the worker may be exposed and hence the performance requirement of the chosen equipment.
   c. Compare performance requirements with the capability of different types of personal protective equipment.

PPE MANAGEMENT - SELECTION

d) Make sure that the item chosen is appropriate to the risk.
e) Where several types of personal protective equipment are required to control multiple risks presented by the one work process, make sure that the items are compatible.
f) Make sure that the item will fit properly, as 'inadequate fit' can limit an item's protective capability.

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PPE MANAGEMENT - SELECTION

g) Consider workers' medical conditions, which can influence whether they can use certain items of equipment.
h) Consider the comfort of the item when choosing equipment.
i) Make sure that the item is worn correctly.
j) Consult with those workers and others who must wear the equipment when choosing the items.
k) Give preference to items of personal protective equipment, which comply with the relevant standards

PPE MANAGEMENT - MAINTENANCE & STORAGE

1. Store personal protective equipment in a clean and fully operational condition.
2. Storage arrangements should ensure that the equipment is safe from interference and damage, and easily accessible when needed.
3. Items of personal protective equipment should also be checked regularly, as specified by the manufacturer or supplier.
4. Repair or discard damaged or defective personal protective equipment.
5. Institute a program to ensure that personal protective equipment is being properly maintained

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PPE MANAGEMENT - MAINTENANCE & STORAGE

6. As part of the maintenance program, determine and record:

a) maintenance duties and responsibilities.
b) designation of personnel;
c) storage procedures;
d) cleaning procedures.
e) checking procedures.
f) information about the duration of protection from gloves, respiratory canisters, etc; and
g) criteria for replacement.

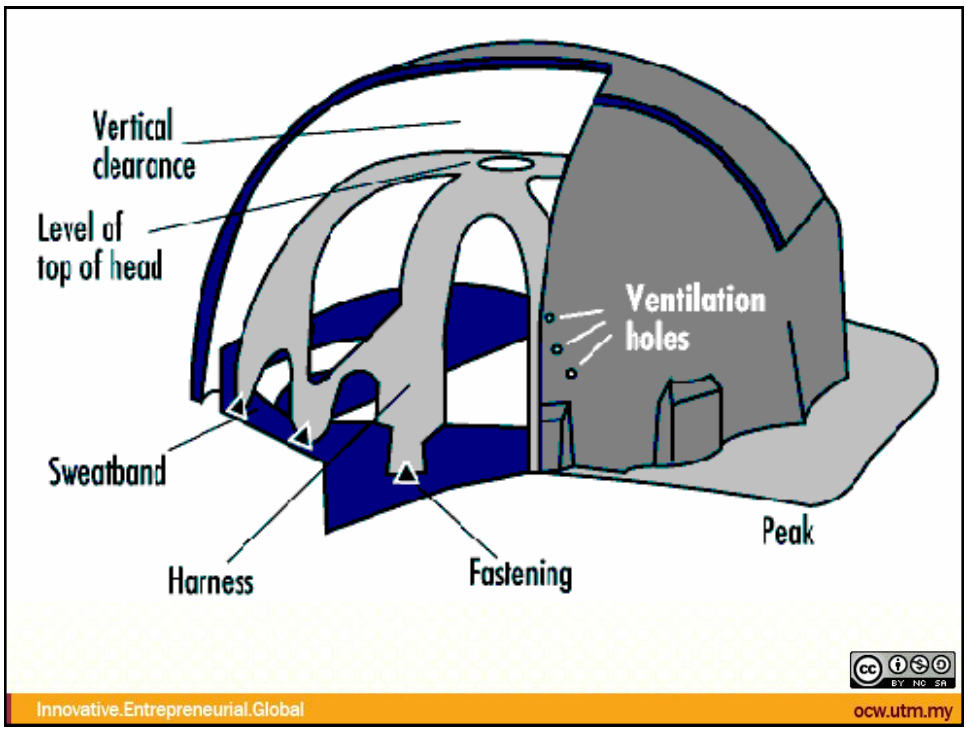
Head Protection
Helmets and Bump Caps

- Protective helmets are intended to:
  - Protect the head from the force of impact of falling objects or from electric shock
  - Shield the head and hair from entanglement in machinery or exposure to environments
- Examples:
  - Construction work, logging, mining, metal or chemical production, congested multi-storied process area or areas with low slung pipes or headroom, etc.

Headwear Care And Maintenance

- Helmets should be inspected for cracks (even hairline cracks), signs of impact or rough treatment, and wear before use.
- Prolonged exposure to ultraviolet rays (sunlight) and chemicals can shorten the life expectancy of thermoplastic helmets.
- Solvents can damage the shell. Be careful when using them for cleaning.


HEAD PROTECTION
SAFETY HELMET


Vertical clearance
Level of top of head
Ventilation holes
Sweatband
Peak
Harness
Fastening
Innovative.Entrepreneurial.Global
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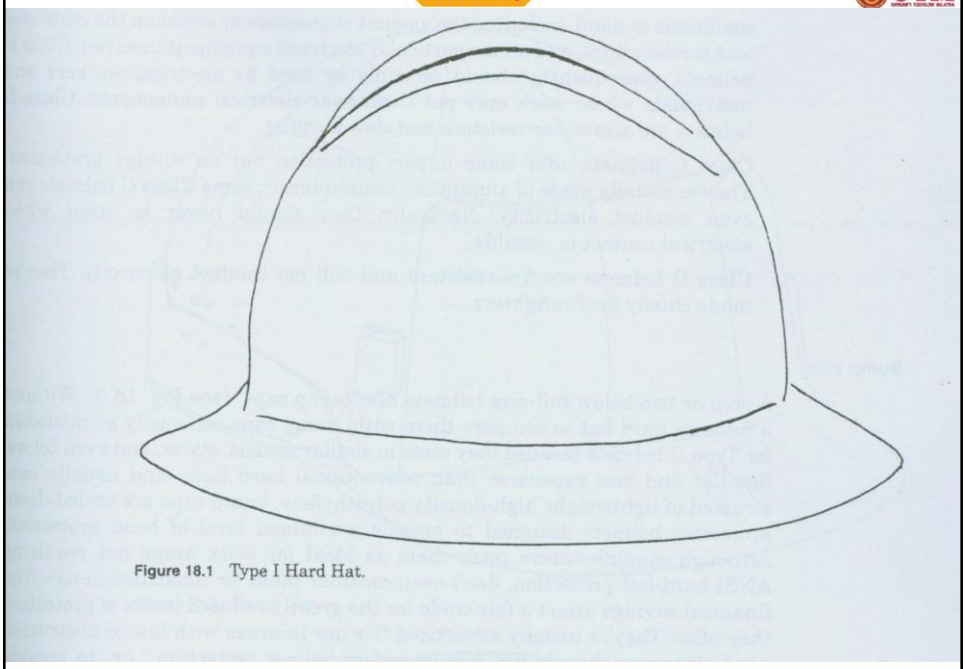

Figure 18.1 Type I Hard Hat.

ITSO Industrial Safety Helmet

Full-Brim Hard Hat

AO XLR8 Hard Hat

V-Gard Protecticve Hard Hat

AO Bump Cap

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Head protection

- The main goal of protective helmets or hard hats is to minimise the rate and level at which impact forces are transmitted to the brain, neck and spine
- Secondary goal is partially to protect the head, face and neck from electrical current and from other environmental hazards e.g. sun rays, rain, wind and extreme temperatures

Head protection

- Two types: Type I and Type II
- Type I: have a full brim not less than 1 ½ inches wide around the entire helmet
- Type II: without brims but having a bill or peak in the front to help protect the eyes and face
- Four classes: Class A, B, C and D
- Class A: for general service and protection against impact hazards and low voltage electrical current

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Head protection

- Class B: Similar to A plus some defense against high voltage electrical current
- Class C: some impact protection, but no voltage protection (made of aluminium)
- Class D: impact protection, fire resistant and will not conduct electricity (for firefighters)

Head protection

- On site: Type I and II, Class A or B
- Hard hats consist of a shell and a suspension system (to absorb impact)

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Head protection

- Inspection on helmet is necessity, do it periodically
- Check for damage and get a replacement
- Helmet should be taken care of by cleaning it periodically

Visorama Face Shield (3800G)

Tuffmaster Clear Face Shield
Helmet Attachment WP96X

Welding Hand Shield

HCP8 Standard Headgear with
Chin Protector

Tuffmaster Green Face Shield
WP96XB

EYE PROTECTION

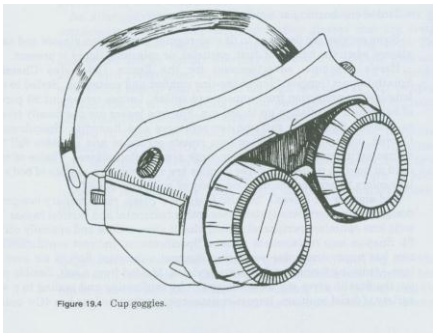

Figure 19.4 Cup goggles.

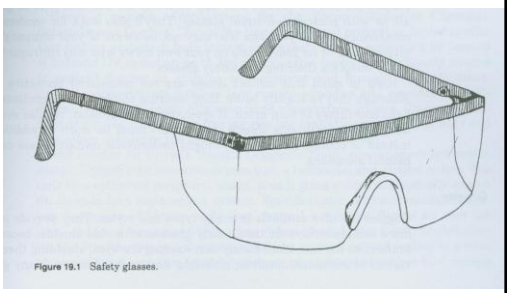

Figure 19.1 Safety glasses.

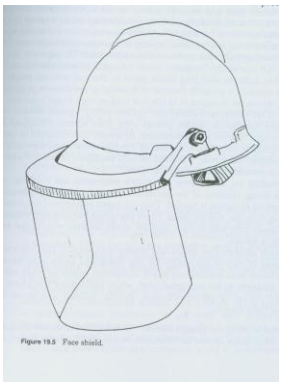

Figure 19.5 Face shield.

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AOSafety
QX3000 Safety Eywear

QUEBEE
5010 Sfety Eyewear

AOSafety
Centurion Goggle

AOSafety
Nassau RAVE Safety Eyewear

Eye, face and respiratory protection

Respirator

- Types:
  1. air purifying respirators
  2. supplied-air respirator
  3. self-contained breathing apparatus
- Can protect against asbestos, paint sprays, welding fumes, wood dust, organic vapors, acid gases, solvents, lead

Protective Footwear
Protection For Feet And Toes

- Options:
  - Safety boots and shoes with steel toe caps, gaiters, leggings, spats and clogs. conductive shoe.
- Patterns:
  - Anti-slip, anti-static, electrically conductive or insulating.
- Hazards:
  - Wet, electrostatic build-up; cuts and punctures; falling objects, heavy loads; metal and chemical splash; vehicles.

Body and foot protection

- Workers should wear close-fitting or medium-fitting jeans or durable trousers.
- Recommend long sleeved work shirts or sleeved no less than 4".
- Safety work shoes or boots are a must.
- Worn out boots must be discarded and replaced.
- Insist workers to maintain their shoelace.

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King's
Safety Ankle Boots
Premium Range

King's
Safety Rigger Boots

King's
Safety PVC Miner Ankle Boots

King's
Safety Boots Premium Range

Wayne
Egoli Black Safety
PVC/Nitrile Boots

Wayne
Egoli Yellow Safety
PVC/Nitrile Boots

Hands And Arms

Gloves, Gauntlets, Mitts, Wrist Cuffs, Armlets

- **Hazards:**
  - Abrasion; temperature extremes; cuts and punctures; impact; chemicals; electric shock; skin irritation, disease or contamination; vibration; risk of product contamination.
- **Materials**
  - Leather Abrasion protection, heat resistance
  - PVC Abrasion protection, water and limited chemical resistance
  - Rubber Degreasing, paint spraying
  - Cloth/nylon Hand grip
  - Latex Electrical insulation work

Hand protection

- Hand injuries: abrasion (scrape: loss of surface skins), cuts, puncture wounds, sprains, fracture. Crushing or pinch injury, contact injury (electrical burn, chemical burn, dermatitis, rashes), repetitive-motion injuries or illnesses

Gloves: made of canvas, leather, rubber, cloth or man-made materials with trectured palms and fingers for better grabbing

- Types:
  - Chemical resistant gloves (protect against chemical)

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Hand protection

  - General purpose gloves protect against cuts, abrasion etc)
  - Product-protection or cleanroom gloves (design to protect hand from product)
  - Special purpose gloves (designed for hot and cold temperature)
- Protective skin cream
  - Grease guard (protect agains grease)
  - Cream to protect from crack and bleeding in harsh climates
  - Solvent resistant cream: prevent dirt, paints, oil, inks
  - Water resistant cream: protect skin from water soluble irritants e.g. acids, alkalis

Ansell
Chemi-Pro Neoprene Over Natural Rubber Latex Glove

Ansell
Solvex Nitrile Chemical Resistant Glove

Ansell
GoldKnit 100% Kevlar Cut Resistant Glove

Ansell
Crusader Flex Nitrile Coated Hot Mill Glove

Ansell
Hyflex Ultra Lightweight Nitrile Foam Coated Glove

Ansell
Hycron Heavy Duty Nitrile Coated Working Glove

RESPIRATORY PROTECTION

Eye, face and respiratory protection

- Why eye protection?
- People on site should wear safety glasses with side shield
- Safety glasses 1] without side shields 2] with detachable half side shields 3] with integral or built-in half side shields
- Face shield: clear polycarbonate, acetate and plastic face shields protects face and eyes from impact, dust, particles and splash hazards

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Eye, face and respiratory protection

- Eyewear training, care and maintenance are important

Respiratory Protection

- A respirator is a protective face piece, hood or helmet.
- Designed to protect the wearer against:
  - To protect employees from breathing contaminated and / or
  - Protection against particulates, vapours,
  - Oxygen-deficient air
  - Or combination of the three above

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Kinds Of Respirators

- Air-purifying Respirators
  - Have filters, cartridges, or canisters that remove contaminants from the air
  - Types: Particulate, Gas & Vapour, Combination
- Atmosphere-supplying Respirators
  - Supply clean air directly to the user from a source other than the air surrounding the user
  - Types: Air-Supplied, Combination, Self-Contained Breathing Apparatus

Selection And Fitting Of Respirators

- Selection depends on:
  (a) The contaminant
  (b) Task
  (c) Operator
- Protection factors depends on:
  (i) Face mask (1/2 face, full face)
  (ii) Filter efficiency (particulates)
- Fit testing important:
  – Individual variation
  – Determines the level of protection

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Problems With Respirators

- Good only if properly fitted and worn
- Protect only those who are wearing them
- Uncomfortable, cumbersome and interfere with communication
- Costs are substantial require
  – Regular medical examinations, fit testing, training, and the proper purchasing of equipment
  – Maintenance and storage

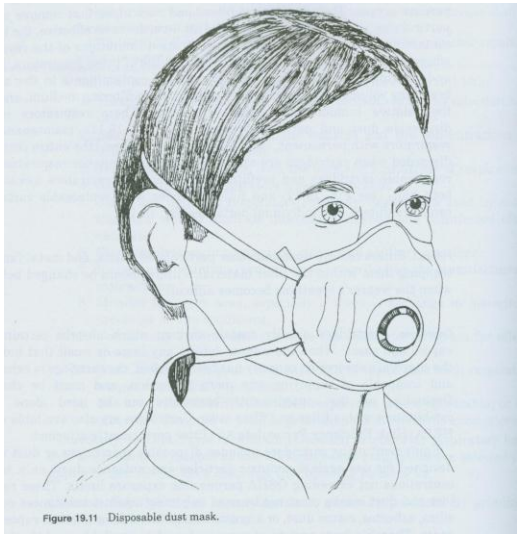

Figure 19.11 Disposable dust mask.

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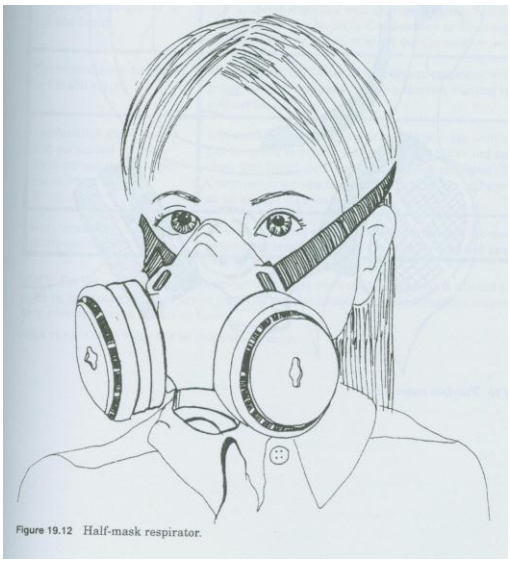
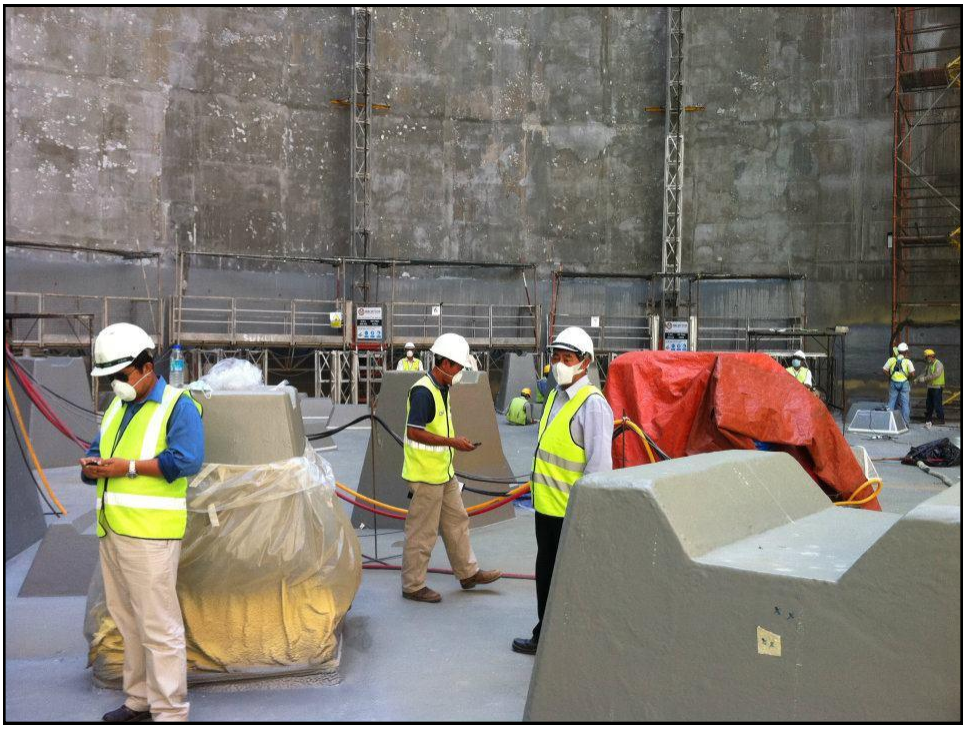


Figure 19.12 Half-mask respirator.

Figure 19.13 Full-face respirator.



AOSafety
Quicklatch Half Mask Respirator with p100 Filter

AOSafety
Full Face Respirator with Ammonia Cartridge

Hearing Protection

Ear muffs, Ear plugs, Helmets

- **Hazard:**
  - Machining, grinding, pneumatic equipment, rock drilling. piling work, hammering, generators, ventilation fans, motors, punch and brake presses.
- **Selection of hearing protection:**
  - (i) The characteristics of the noise
  - (ii) Frequency of exposure
  - (iii) Comfort of the user
  - (iv) Communication needs
  - (vi) Medical conditions

Face and Eye Protection

- Goggles, spectacles and face shields are used for protection from injury by
  - Physical (flying or falling objects)
  - Chemical agents
  - Radiation
- Has the widest use and the widest range of styles, models and types
- Face shields must be used in combination with basic eye protection

Hearing protection

- Noise causes hearing loss
- Three types: Earmuffs, premolded earplugs canal cap protector
- Earmuff:
  - Easier to fit, easily monitored, can be reused
  - More expensive, usually bulky, heavy and hot, require tight seal so might feel uncomfortable, not effective when worn with glasses or a hard hat

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Peltor
H7F Foldable Earmuff

Peltor
Worktune AM/FM Headband
Hearing Protector

3M
1271 Reusable Earplug

EAR
Earsoft Superfit Foam Earplug

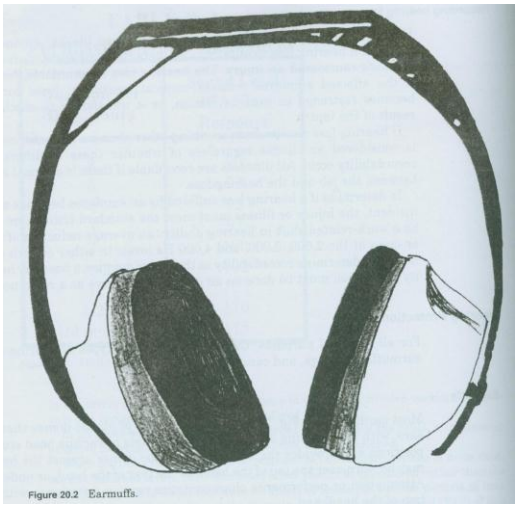

Figure 20.2 Earmuffs.

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Hearing protection

- Premolded earplug
  - Less expensive than muff, less cumbersome to wear, carry and store, can be worn with hard hbat and glasses, comfortable in hot, humid workplace
  - Require tight seal of the ear that may be uncomfortable, easily loss and hard to monitor, require sizing for each ear
  - (figure how to wear)

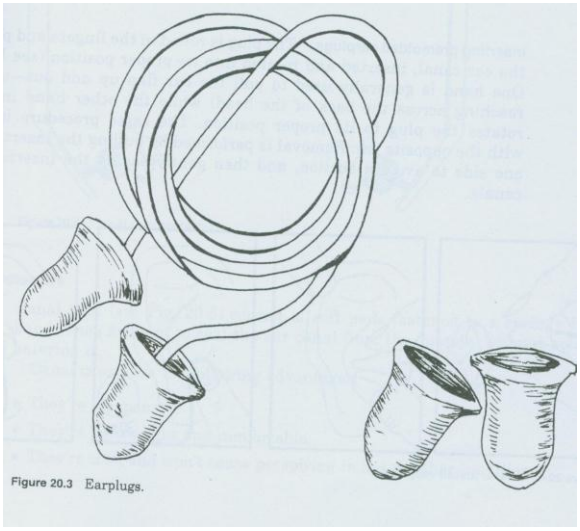

Figure 20.3 Earplugs.

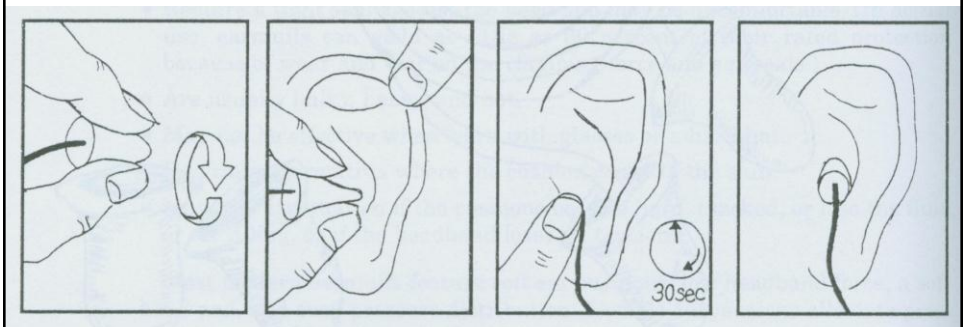

Figure 20.4 How to install earplugs.

Hearing protection

- Canal cap protectors
  - Consist of soft pad fastened to a springy headband
  - Inexpensive, light weight and comfortable, will not cause perspiring in hot weather conditions
  - They are not reliable nor as effective as earplugs or earmuffs, sometimes twisted out of place and temporarily lose their seal

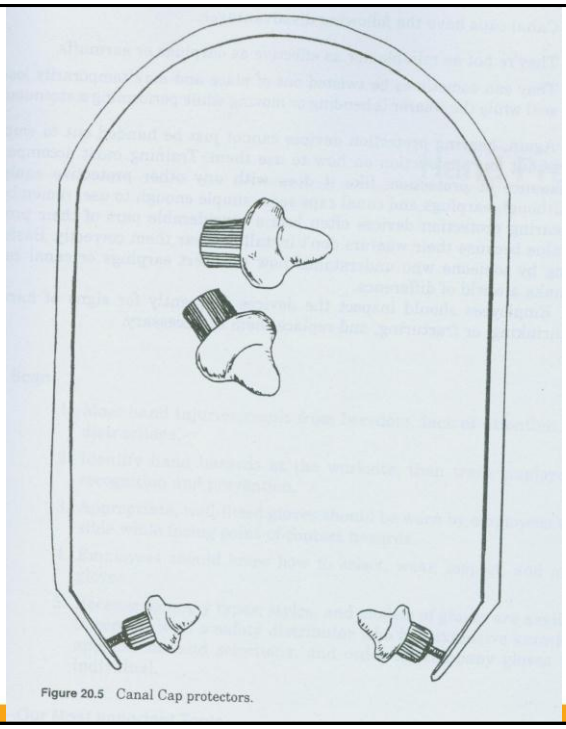

Figure 20.5 Canal Cap protectors.

Alpha Solway
Chemical Suit

Stephen Itex
Coldroom Apparel

Ansell
Vinyl Coat Apron

Ansell
Vinyl Chemical
Resistant Apron

Safeware
Reflective Safety
Vest Yellow

Safeware
Reflective Safety
Vest Orange

QUEBEE
Rain Wear

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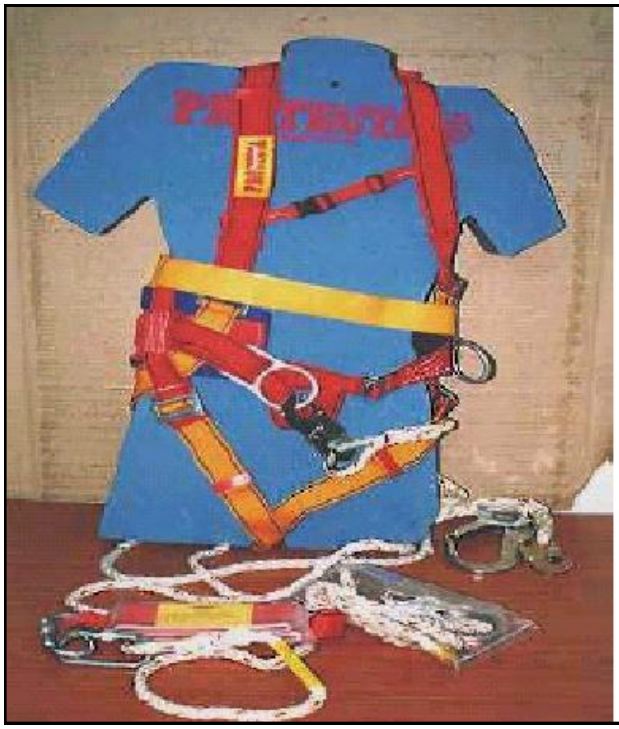
Special Work Clothing

- Selection factors
- Materials:
  - Impervious clothing
  - Protection against heat, flame and hot metal
  - Others



FALL ARRESTOR & SAFETY HARNESS

Fall Protection Systems
Personal lifelines

- Body support
- Lifelines
- Construction of body support
- Inspection and testing

Fall protection

- A major safety concern
- Fall hazards exist in unprotected leading edges (floors, roofs, building components), edges of trenches and excavations, roofs of all pitches, finished and unfinished skylights, stairways, ladders, scaffold, platforms, wall opening

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Fall protection

Fall protection equipment

- Full body harnesses and belts (figure)
- Shock-absorbing lanyards
  - One end to body harness and another end to an anchor point
- Self-retracting lifelines
  - Fall arrest devices
  - Manufacturer check only (once a year)
  - Worn by trained workers

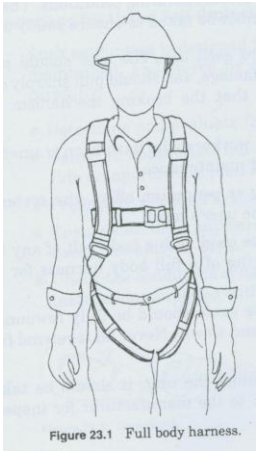
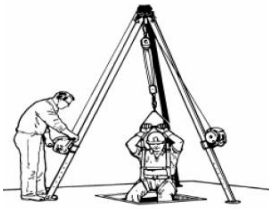


Figure 23.1 Full body harness.



QUEBEE
PN-361 1.5 Meter Twin Webbing
Lanyard with Energy Absorber

QUEBEE
14 mm Flexible Anchorage Line

QUEBEE
PN-309 1.5 Meter Single Rope
Lanyard with Energy Absorber

QUEBEE
PN-2000 Fall Arrestor

QUEBEE
PN-23 Three "D" Ring
Full Body Harness

QUEBEE
PN-11 Single "D" Ring
Full Body Harness

Fall protection

- Recommendation for using fall protection equipment
  - Determine and evaluate fall risks on the jobsite
  - Define an appropriate fall-arrest system for the job to be performed
  - Preferably select all system components from the same manufacturer
  - Ensure that the equipment is compliance with the laws and standard
  - Check the conditions of the use system by reading and complying with the instruction supplied with the components

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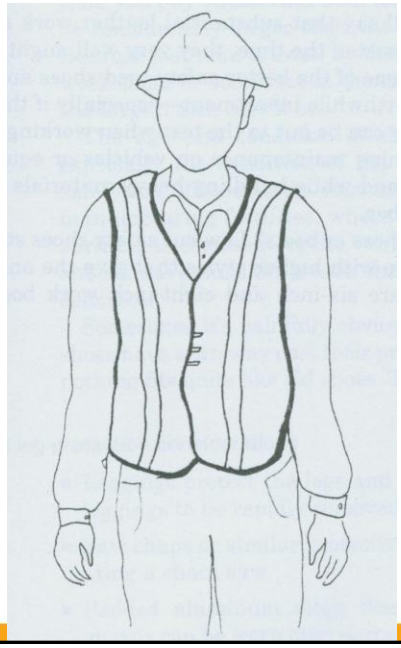
Fall protection

- Train users
- Select reliable anchorage points located as close as possible to the user and above users head
- Check equipment before use
- Avoid users working alone
- Store properly
- Prevent any modification without prior agreement from the manufacturer
- Report any defect



Summary

- PPE is protection of last resort.
- PPE should be selected appropriately.
- PPE use is required by law in some situations.
- Employees must be consulted, trained, supervised in the use of PPE and must be aware of hazards.
- PPE must be properly fitted, tested, cleansed, maintained and stored.
- Comfortable PPE will ensures its use.

THANK YOU