Construction OS&H

Personal protective clothing & equipment (PPE)

Preliminary discussion

What common HAZARDS may a human body be exposed to on a construction site?

Individually:

Spend a few minutes considering this and make a list of items, giving brief reasons

As a group:

Be prepared to explain your assessment in a discussion

Some common personal physical hazards

- Struck by falling objects
- Eyes endangered by sharp objects, particles, chemicals
- Skin damaged by sharp objects, chemicals
- Limbs or body crushed by heavy objects
- Struck by moving plant and equipment
- Hearing damaged by excessive noise
- Respiration impaired by poor air supply, particles, chemicals
- Physical damage caused by heat, cold, weather
- Physical damage caused by falls, trips, slips

Point to remember

It is safer and in most cases cheaper to eliminate hazards

rather than to provide personal protective equipment.

Preliminary discussion

A worker is using a heavy pneumatic breaker to break up a concrete slab on the pavement beside a city street next to a building under construction. What protective clothing and equipment should he be wearing?

Individually:

Spend a few minutes considering this and make a list of items, giving brief reasons

As a group:

Be prepared to explain your assessment in a discussion

From the ILO Code of Practice

Where adequate protection against the risk of accident or injury to health, including exposure to adverse conditions, cannot be ensured by other means, suitable personal protective equipment and protective clothing, having regard to the type of work and risks, should be provided and maintained by the employer, without cost to the workers, as may be prescribed by national laws or regulations.

Personal protective equipment and protective clothing should comply with standards set by the competent authority, taking into account, as far as possible, ergonomic principles.

From the ILO Code of Practice

Employers should provide the workers with the appropriate means to enable them to use the individual protective equipment and should require and ensure its proper use.

A competent person having a full understanding of the nature of the hazard and the type, range and performance of the protection required should:

(a) select suitable items of personal protective equipment and protective clothing;

(b) arrange that they are properly stored, maintained, cleaned and, if necessary for health reasons, disinfected or sterilised at suitable intervals.

From the ILO Code of Practice

Workers should be required to make proper use of and to take good care of the personal protective equipment and protective clothing provided for their use.

Workers should be instructed in the use of personal protective equipment and protective clothing.

Workers working alone on construction sites in confined spaces, enclosed premises or in remote or inaccessible places should be provided with an appropriate alarm and the means of rapidly summoning assistance in an emergency.

Safety helmets

"Where necessary, workers should be provided with and wear the following personal protective equipment and protective clothing:

Safety helmets or hard hats to protect the head from injury due to falling or flying objects, or due to striking against objects or structures"

Falling objects

Falling objects, overhead loads and sharp projections are to be found everywhere on construction sites.

A small tool or bolt falling from 10 or 20m high can cause serious injuries or even death if it strikes an unprotected head.

Head injuries often occur when moving and working in a bent position, or when arising from such a position.

“Hard hat areas”

Safety helmets protect the head effectively against most of these hazards, and should be worn whenever a person is on site and particularly when in an area where overhead work is going on.

These areas, known as “hard-hat areas”, should be clearly marked with safety signs at entrances and other suitable places.

The rule applies to all: managers, supervisors, workers and visitors.

“Hard hat areas”

Safety helmets are easy to obtain and relatively cheap. This example is a typical design.

It has reinforced ribs on top for impact strength, a rain gutter round the side and rear to guide water away, and can be fitted with a chin-strap. This helmet also has a built-in safety visor, which can be easily pushed up out of the way if required. The whole helmet is light and quite comfortable.

Safety helmets

There are many different designs available, made for specific purposes.

For example, many trades - such as scaffolders - find that helmets with a very short peak are easier to wear because they do not get in the way.

Some helmets contain Kevlar fibres giving them great resilience and resistance to impact.

Point to remember

Your safety helmet protects you only if you have it on.

Eye & face protection

Point to remember

Ninety per cent of all eye injuries can be prevented by suitable eye protection.

Eye & face protection

Where necessary, workers should be provided with and wear the following personal protective equipment and protective clothing:

Clear or coloured goggles, a screen, a face shield or other suitable device when likely to be exposed to eye or face injury from airborne dust or flying particles, dangerous substances, harmful heat, light or other radiation, and in particular during welding, flame cutting, rock drilling, concrete mixing or other hazardous work.

Eye protection must be suitable, comfortable and available to encourage workers to wear it.

Eye & face protection

Many eye injuries occur as a result of flying material, dust or radiation when the following jobs are being carried out:

•Breaking, cutting, drilling, dressing or laying of stone, concrete and brickwork with hand or power tools

•Chipping and dressing painted or corroded surfaces

•Cutting off or cutting out cold rivets and bolts

•Dry grinding of surfaces with power grinders

•Welding and cutting of metals

Eye & face protection

In some industrial processes there may also be a risk from the spillage, leakage or splashing of hot or corrosive liquids.

Some of these hazards can be removed permanently by proper machine guarding, exhaust ventilation or work design. For many hazards, for example, stone cutting or dressing, personal eye protection (goggles, safety glasses or shields) is the only practical solution.

From the United States Department of Labor Occupational Safety and Health Administration

Hazard Assessment		
Hazard type	**Examples of Hazard**	**Common Related Tasks**
Impact	Flying objects such as large chips, fragments, particles, sand, and dirt.	Chipping, grinding, machining, masonry work, wood working, sawing, drilling, chiseling, powered fastening, riveting, and sanding.
Heat	Anything emitting extreme heat.	Furnace operations, pouring, casting, hot dipping, and welding.
Chemicals	Splash, fumes, vapors, and irritating mists.	Acid and chemical handling, degreasing, plating.
Dust	Harmful Dust.	Woodworking, buffing, and general dusty conditions.
Optical Radiation	Radiant energy, glare, and intense light	Welding, torch-cutting, brazing, soldering, and laser work.

A classification of eye and face protection equipment

Safety spectacles – can protect eyes from low energy impacts and depending on the lens characteristics glare, UV and IR radiation. Lenses usually made of toughened glass or polycarbonate. Available in a range of styles and most frames have adjustment, so that they can be matched to the wearer. Most manufacturers can supply safety spectacles with prescription lenses.

A classification of eye and face protection equipment

Goggles – can protect eyes against medium impacts and depending on design and marking against droplets and coarse dust, as they form a seal around the entire periphery of the face. The lenses are usually made of antifog coated polycarbonate or toughened glass.

A classification of eye and face protection equipment

Face shields – Can protect eyes and face against impacts, liquid splash and hazards like molten metal splash or electric arcs etc. Usually have adjustable headband or harness fitted with either a one piece ear shield protecting the entire face, a metal mesh screen or an opaque shield into which lenses are fitted. Some designs integrate head, eye and respiratory protective in one unit.

Eyesight is an absolutely prime human sensory ability.

Loss of sight can destroy a person's life, so all measures must be taken to protect it.

As the examples above show, there is a huge range of items of equipment available, most of them reasonably priced, so there can be no reason for employers not to provide them.

Helmets, eye protection, gloves, but noise ..?

Noise

Noise which is continuous at a level of 85-90 decibels (dB(A)) or more is injurious to hearing.

Use appropriate earmuffs or ear plugs if you work with or near a noisy machine and make sure they fit properly and are comfortable.

Wear them all the time you are in a noisy part of the site. It is not true that ear protectors make it more difficult to understand speech or hear warning signals, as they also reduce unwanted noise; the signal can actually be heard more easily.

Noise

Keep your hearing protection clean and in a safe place when you are not using it and insert ear plugs with clean hands.

Look out for damage: if the earmuffs no longer fit properly or the seals have become hard or damaged, ask for a replacement.

Noise

Point to remember

If you have to shout to make yourself heard by someone about 1m away

there is a noise problem requiring action.

Hearing protection

A good example of advanced design.

This is a very strong helmet, the Kevlar fibres giving it great resilience and resistance to impact.

The addition of the ear and eye protection provide the wearer with comprehensive protection for one item of PPE.

This kit offers ear and eye protection that snaps into standard hard hat and helmet attachment slots.

What is missing?

What is missing?

Everything!

There is no PPE at all, but

let us focus on GLOVES

He needs a pair of these:

Heavyweight coated glove

Good abrasion and chemical resistance

Hand protection

Hands are extremely vulnerable to accidental injury, and in construction more injuries are caused to hands and wrists than to any other part of the body.

Open wounds, abrasions, fractures, dislocations, strains, amputations and burns occur.

They are largely preventable by better manual handling techniques and equipment, and by wearing suitable hand protection such as protective gloves and gauntlets.

Hazardous hand tasks

Operations involving contact with rough, sharp or jagged surfaces;

Contact with or splashes from hot, corrosive or toxic substances such as bitumen and resins;

Working with vibratory machines such as pneumatic drills where some cushioning of the vibrations is desirable;

Electrical work in humid and cold weather.

Gloves

Gloves are one of the cheapest and most obvious items of PPE yet they can serve an important function in OS&H. Nevertheless, many workers are not supplied with gloves so they have to work with their bare hands.

Gloves

Gloves with a thin plastic coating, can be used for work requiring dexterity, such as bricklaying and component assembly

Gloves

Thicker latex coated palm giving exceptional grip, dexterity and durability.

Excellent abrasion and tear resistance.

Some gloves have an anti-bacterial treatment to reduce odours.

Use of heavy duty gloves for steel-fixing

What is missing?

What is missing?

Everything!

There is no PPE at all, but let us focus on BOOTS.

The photo shows how necessary it is to wear protective footwear even for simple tasks.

The column cramps are quite heavy and could cause broken bones in the feet if dropped.

A lovely photo of a hod carrier but she is wearing footwear that is totally unsuitable for working on a construction site.

But can she get safety footwear in her size?

And if she could, would she be happy to wear footwear that has essentially been designed for men?

Footwear

Foot injuries fall into two broad types:

1.Those due to penetration of the sole by sharp objects such as nails which have not been knocked down or removed.

2.Those due to crushing by falling materials, which can be minimized by wearing protective footwear.

The type of safety shoes or boots to be used will depend on the nature of the work (e.g. the presence of ground water on construction sites), but all safety footwear should have an impenetrable sole and uppers with a steel toe-cap.

Footwear

There are many types of safety footwear now available such as:

- Light, low-cut leather safety shoes for climbing jobs;
- Normal safety shoes or boots for heavy-duty work;
- Rubber or plastic safety wellingtons or gumboots which provide protection against corrosive substances, chemicals and water.

Safety boots

The two main requirements of a safety boot:

1.Resistant to crushing and penetration through the sole.

2.Boots should have labels to identify their specification.

Waterproof and Hi-Viz clothing

The ILO Code requires:

(h) waterproof clothing and head coverings when working in adverse weather conditions
and
(k) distinguishing clothing or reflective devices or otherwise conspicuously visible material when there is regular exposure to danger from moving vehicles

Provision of waterproof clothing makes economic sense to the employer because it allows work to continue in wet conditions (assuming of course that workers are not forced to work in these conditions anyway).

Waterproof and Hi-Viz clothing

Modern fabrics ‘breathe’ so allowing moisture to escape and avoid condensation.

Modern fabrics are also light and strong, so they are much easier to work in than those available a couple of decades ago.

Modern waterproof clothing is also usually high visibility (‘hi-viz’).

Waterproof and Hi-Viz clothing

Hi-viz jacket with reflective tape

Waterproof and Hi-Viz clothing

A lightweight hi-viz waistcoat for use in warm weather

Happy to be visible!

So, to return to our preliminary discussion

A worker is using a heavy pneumatic breaker to break up a concrete slab on the pavement beside a city street next to a building under construction.

What protective clothing and equipment should he be wearing?

Helmet*

Gloves

Boots

Hi-Viz clothing*

Ear defenders*

Goggles*

Work wear (eg overalls)

Waterproofs if needed

* *May be combined in one item*

Respiratory equipment

On construction sites there are often tasks where harmful dust, mist or gas may be present, such as:

- Rock crushing and handling
- Sandblasting
- Dismantling buildings containing asbestos insulation
- Welding or cutting materials with coatings containing zinc, lead, nickel or cadmium
- Paint spraying
- Blasting

Respiratory equipment

Whenever there is doubt about the presence of toxic substances in the atmosphere, a respirator must be worn.

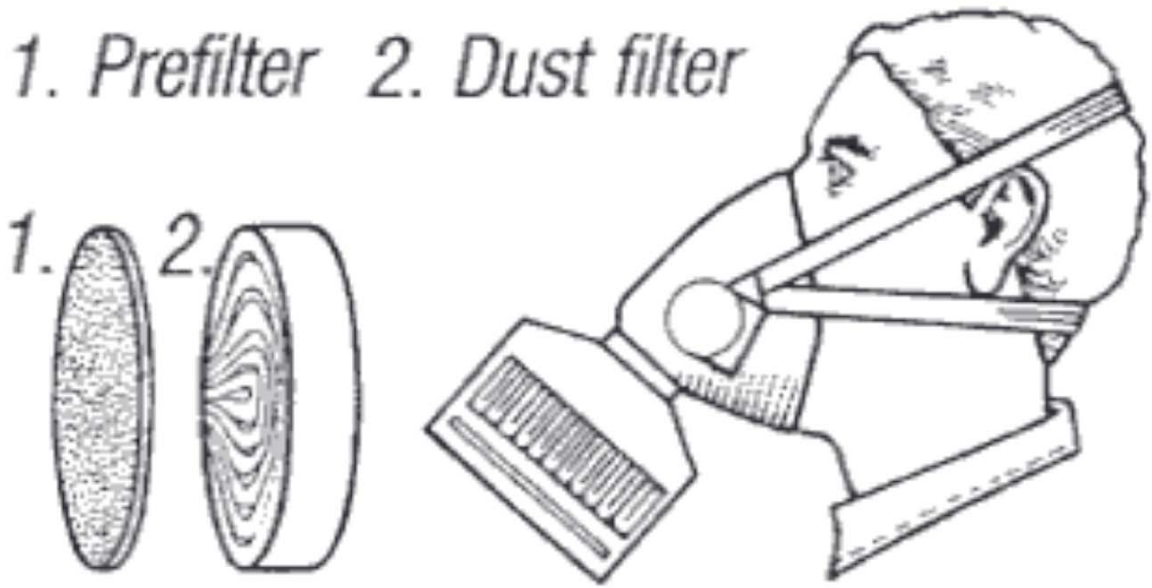
The correct type of respirator will depend upon the hazard and the work conditions, and you need to be trained in its use, cleaning and maintenance.

Advice on suitable types of respirator and filter should be sought from appropriate safety and health authorities.

The simplest masks are disposable paper types. Remember that these are only effective against nuisance dusts.

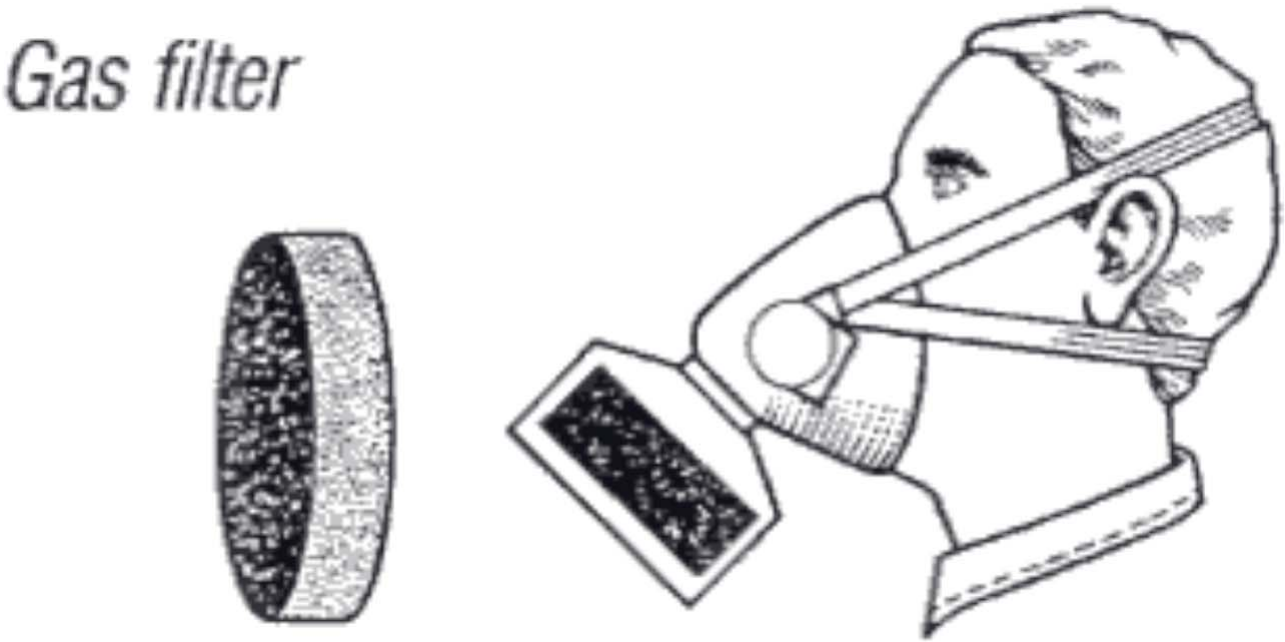
Three types of half-face mask with filters: 1

For protection against airborne particles, e.g. stone dust, with a coarse filter fitted in the cartridge (note, these filters have a specific lifetime and should be changed as necessary).



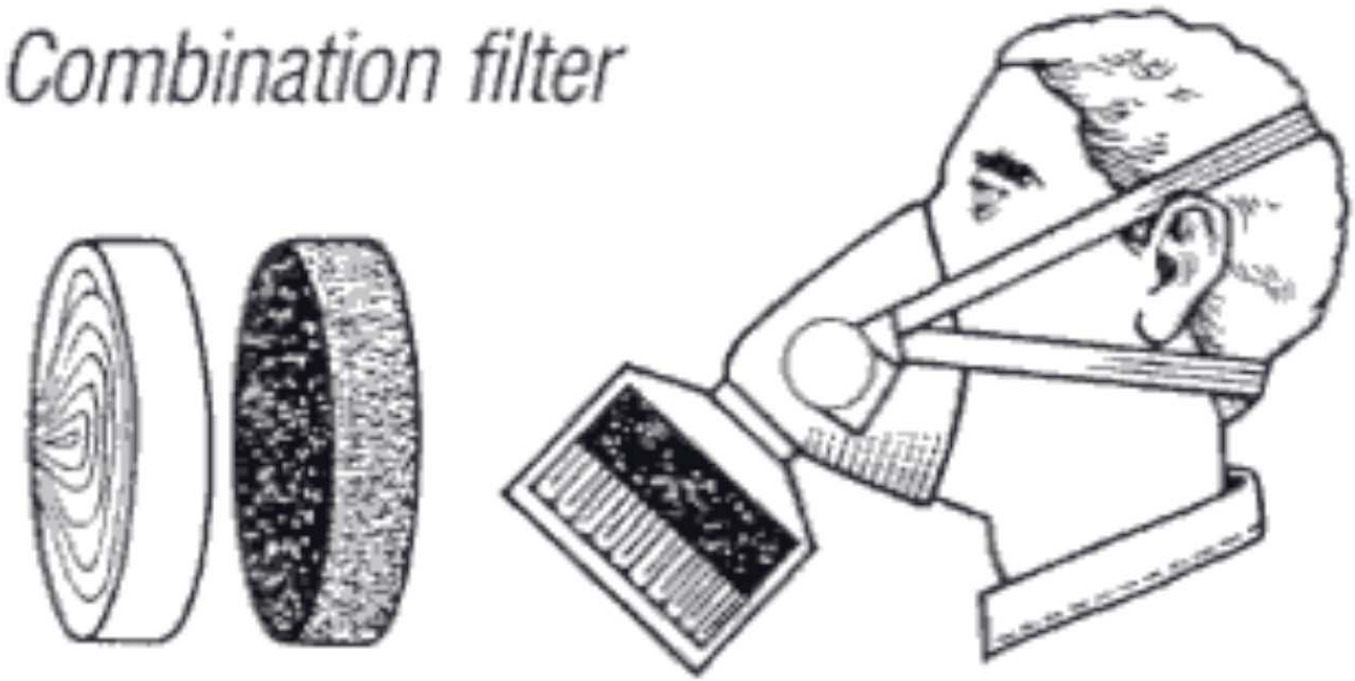
Three types of half-face mask with filters: 2

For protection against gases and fumes, e.g. when using paints containing solvents, with a filter containing activated carbon.

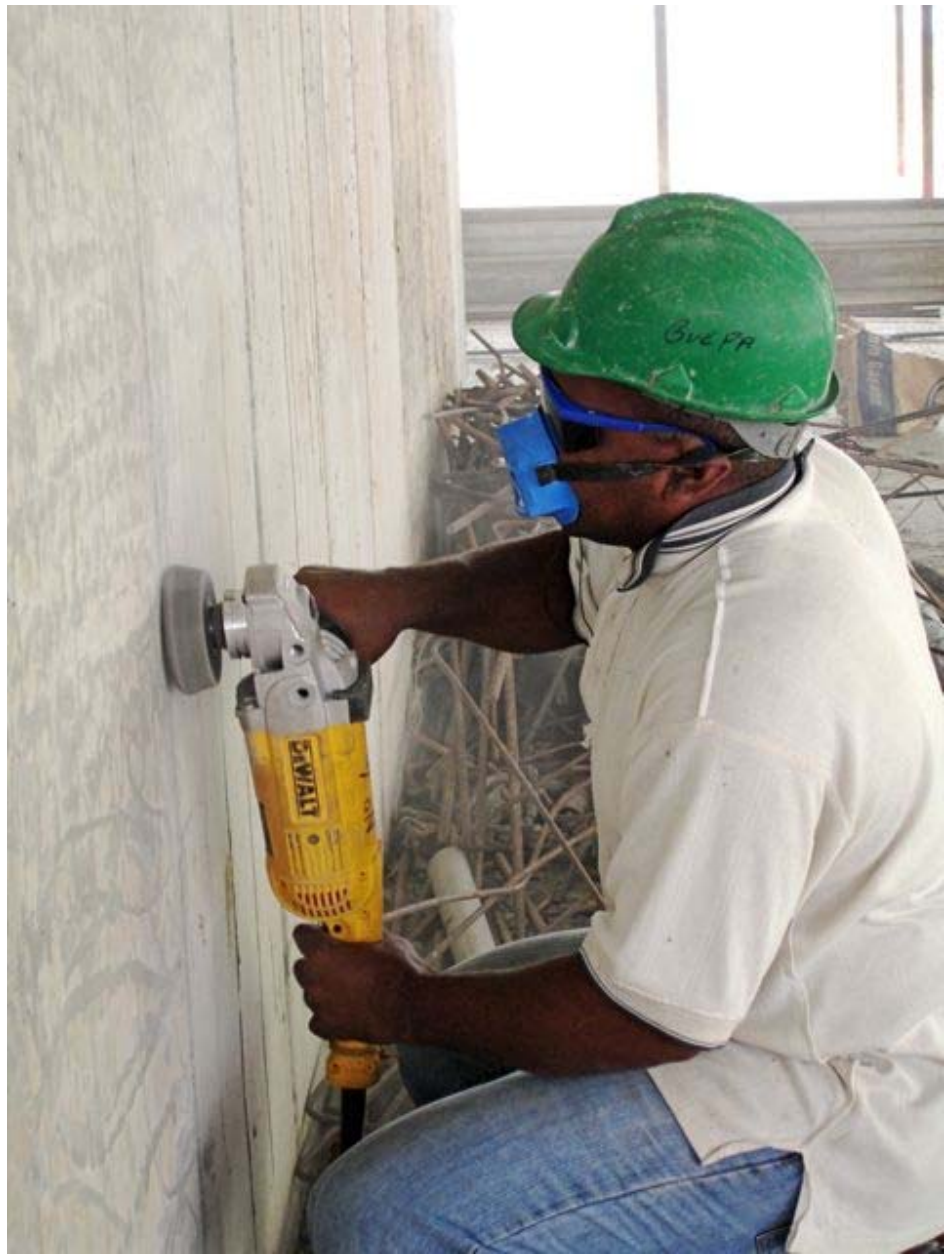


Three types of half-face mask with filters: 3

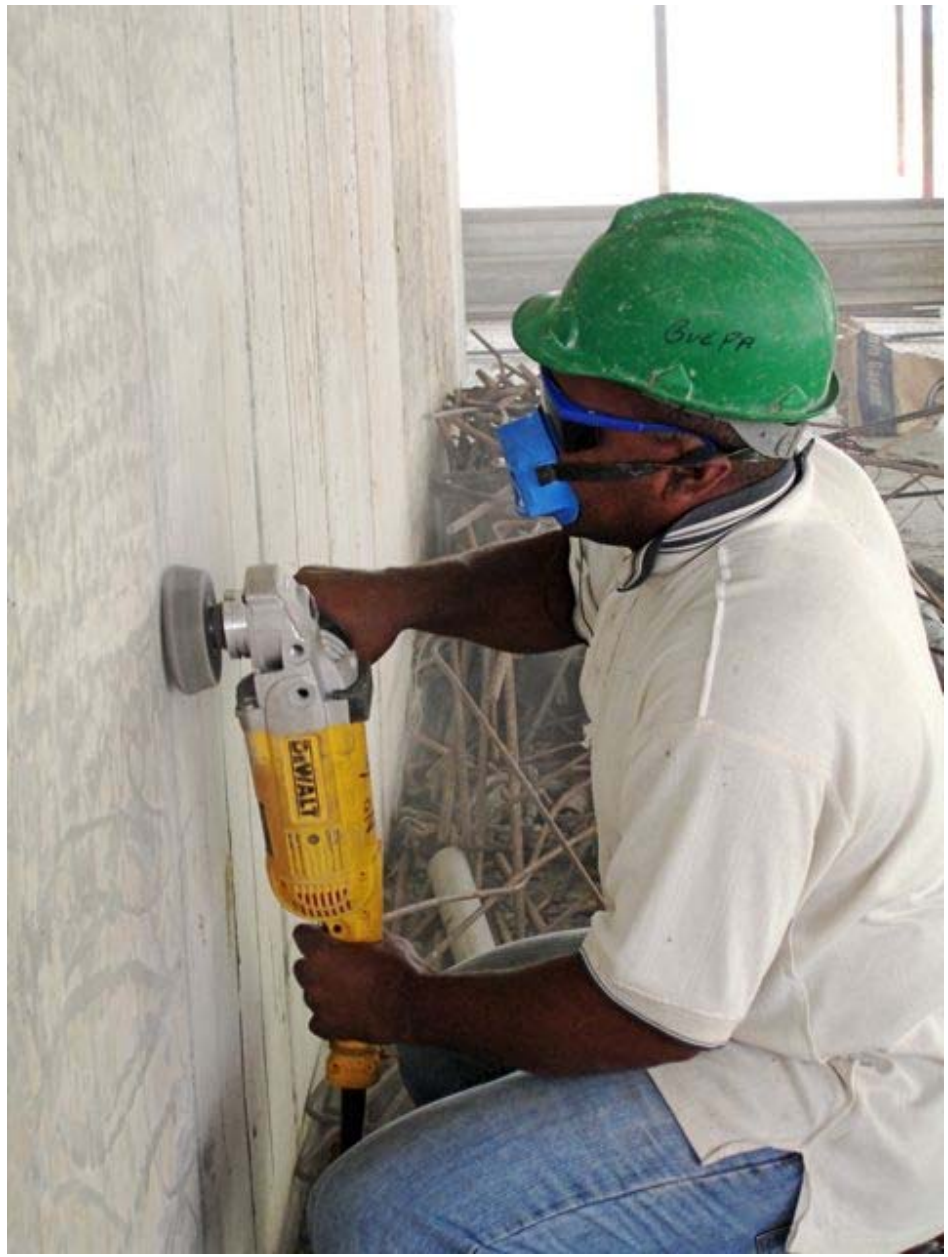
A combination filter containing both a dust and a gas filter. Cartridges must be replaced regularly.



Is this worker suitably protected?



No. He has eye and respiratory protection, but no hearing protection or hand protection



Harnesses and similar devices

From the ILO Code

Where necessary, workers should be provided with and wear the following personal protective equipment and protective clothing:

(i) safety harnesses with independently secured lifelines where protection against falls cannot be provided by other appropriate means;

The majority of fatal accidents in construction are due to falls from heights. Where work cannot be done from a scaffold or ladder, or from a mobile access platform, the wearing of a safety harness may be the only way to prevent serious injury or death.

Harnesses and similar devices

Another common situation in which a safety harness may be used – sometimes supplemented by the use of a safety net – is maintenance work on steel structures such as bridges and pylons.

There are many types of safety belt and safety harness available.

The manufacturer or supplier should be asked for advice on suitable types for the intended purpose and for instructions on use and maintenance.

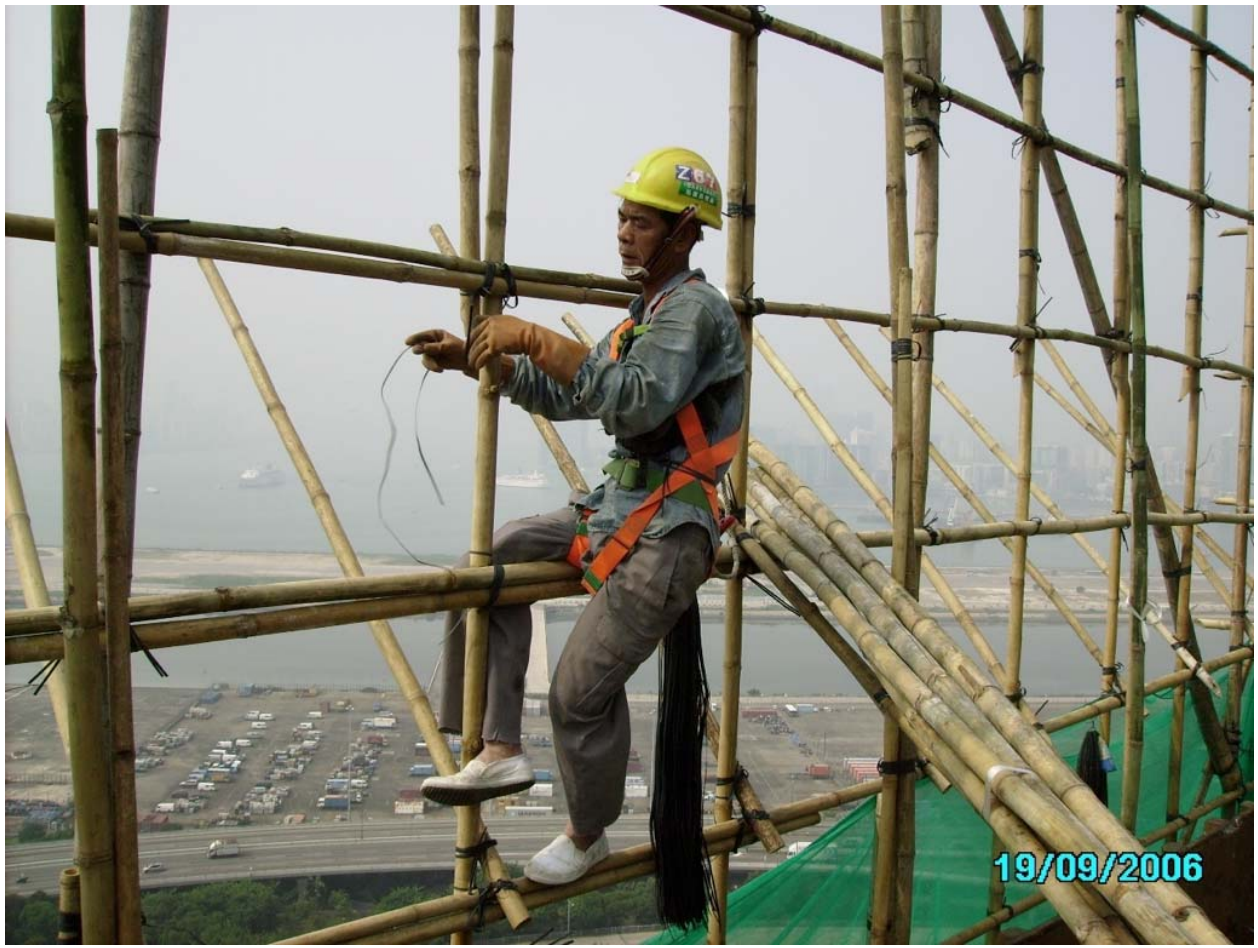
A full safety harness should always be used in preference to a safety belt.

Harnesses and similar devices

A safety harness and its lanyard must:

- Limit a fall to a drop of not more than 2m by means of an inertia device.
- Be strong enough to support a person’s weight.
- Be attached to a strong structure through a firm anchorage point above the person.

An example of the use of a harness is shown below, although this remains a highly dangerous operation. Note also helmet with chin-strap and gloves.



A typical safety harness or ‘fall arrester’

A huge range of safety harnesses (sometimes called ‘fall arresters’) is available and expert advice is required to select the most suitable. A typical example is shown in this photo and the next one below.

The photo shows an alternative form of harness, attached at the back.

Specific characteristics of individuals

One of the real problems with currently available PPE is that most of it seems to have been designed for quite strongly built males. Smaller people are not well provided for; to give an example, safety boots size Eu 36 are difficult to obtain, and safety clothing and especially safety harness are often unsuitable for women's physique.

Summary photos of safe working

The photo shows a worker properly provided with PPE: helmet, boots, gloves and hi-viz waterproof clothes, using handling equipment to move a heavy concrete paving slab.

Public and workforce are separated by a substantial fence.

(Source of image: photo by Richard Neale of a worker paving a street in Cardiff UK. Skanska is the contractor)

A group of well-equipped workers

If you are wearing a harness, attach it to something!

Photo shows workers in a hazardous position with their harnesses simply looped into their belts.

Concluding discussion

What factors may limit the widespread use of PPE?

Individually:

Spend a few minutes considering this and make a list of items, giving brief reasons.

As a group:

Be prepared to explain your assessment in a discussion.

What factors may limit the widespread use of PPE?

Common arguments

Cost

But there are also economic benefits from the avoidance of injuries and more efficient working.

Gets in the way of working

But modern designs and materials have overcome many of these problems.

Only suitable for well-built males

This is an issue, especially with female workers, but it is slowly being addressed.

Not suitable for hot and/or humid climates

But modern designs and materials can mitigate this problem, but more development is needed.

Must wear PPE!