5 Safety and Health in Construction

1. Introduction

The construction industry has a poor record in safety. No matter counted in terms of number of accidents, or in term of accident rate, the construction industry is one the most dangerous industry in Hong Kong. All site personnel should therefore aware the potential hazards on site and be conversant the preventive measures.

2. Legislation related to safety on sites

2.1 Factories and Industrial Undertakings Ordinance (Cap. 59)

2.1.1 The Ordinance

Construction site safety is mainly governed by the Factories and Industrial Undertakings Ordinance and its subsidiary Regulations. This Ordinance controls safety and health at work relating to industrial undertakings (including construction sites).

2.1.2 The Subsidiary Regulations

The following subsidiary Regulations of the Factories and Industrial Undertakings Ordinance are relevant to safety of construction works:

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<thead>
<tr>
<th>Ordinance Code</th>
<th>Regulations Description</th>
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<td>59A</td>
<td>Factories and Industrial Undertakings Regulations</td>
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<td>59C</td>
<td>Factories and Industrial Undertakings (Blasting by Abrasives) Special Regulations</td>
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<td>59D</td>
<td>Factories and Industrial Undertakings (First Aid in Notifiable Workplaces) Regulations</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
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<td>Factories and Industrial Undertakings (Notification of Occupational Diseases) Regulations</td>
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<td>Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations</td>
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<td>59L</td>
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<td>59M</td>
<td>Factories and Industrial Undertakings (Work in Compressed Air) Regulations</td>
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<tr>
<td>59N</td>
<td>Factories and Industrial Undertakings (Spraying of Flammable Liquids) Regulations</td>
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<tr>
<td>59O</td>
<td>Factories and Industrial Undertakings (Good Lifts) Regulations</td>
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<td>59Q</td>
<td>Factories and Industrial Undertakings (Guarding and Operation of Machinery) Regulations</td>
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<td>59R</td>
<td>Factories and Industrial Undertakings (Cartridge-Operated Fixing Tools) Regulations</td>
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<td>59S</td>
<td>Factories and Industrial Undertakings (Protection of Eyes) Regulations</td>
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<td>59T</td>
<td>Factories and Industrial Undertakings (Noise at Work) Regulations</td>
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<td>59W</td>
<td>Factories and Industrial Undertakings (Electricity) Regulations</td>
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<td>59Z</td>
<td>Factories and Industrial Undertakings (Safety Officers and Safety Supervisors) Regulations</td>
</tr>
<tr>
<td>59AA</td>
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<td>59AB</td>
<td>Factories and Industrial Undertakings (Dangerous Substances) Regulations</td>
</tr>
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<td>59AC</td>
<td>Factories and Industrial Undertakings (Suspended Working Platforms) Regulation</td>
</tr>
<tr>
<td>59AD</td>
<td>Factories and Industrial Undertakings (Asbestos) Special Regulations</td>
</tr>
<tr>
<td>59AE</td>
<td>Factories and Industrial Undertakings (Confined Spaces) Regulations</td>
</tr>
</tbody>
</table>
2.2 Other ordinances relevant to construction works

- The Dangerous Goods Ordinance (Cap 295)
- Electricity Ordinance (Cap 406)
- Fire Services Ordinance (Cap 95)
- Waste Disposal Ordinance (Cap 354)
- Boilers and Pressure Vessels Ordinance (Cap 56: Air Receiver)
- Gas Safety Ordinance (Cap 51)
- Occupational Safety and Health Ordinance (Cap 509)

2.3 Code of Practice

The government of Hong Kong (particularly the Labour Department) has prepared a series of Code of Practice to provide guidance on safe practices to protect the workers:

- Code of Practice - Safety and Health at Work with Asbestos;
- Code of Practice for Safe Use of Mobile Crane and Tower Cranes;
- Code of Practice - Safety and Health at Work for Industrial Diving;
- Code of Practice for Safety at Work (Lift and Escalator);
- Code of Practice for the Control of Lead at Work;
- Code of Practice for Protection of Quarry and Construction Workers from Silicosis;
- Code of Practice for Scaffolding Safety;
3. Potential hazards of various construction activities and preventive measures

3.1 Hazardous nature of construction site

a. Variable nature of construction sites (a construction site changes everyday).
b. Construction activities involves different trades, they have different characteristics but work in the same area and influence each other.
c. High turnover of labours so that to build up a general safety consciousness on site is difficult to carry out.
d. Large working frontage within a construction site where unsafe conditions often exist.
e. Requiring to work on high level, under poor working conditions or in places where access is difficult to provide.
f. Requiring to handle very bulky or heavy materials (e.g. soil, concrete, timber, steel, prefabricated components, etc.)
g. Temporary nature of site facilities and site works (e.g. electricity, scaffoldings).

3.2 Working at height

3.2.1 Risks of working on scaffolds/working platforms:
- fall of persons from height
- struck by objects falling from scaffolds or working platform
- collapse of scaffolds or working platform.

3.2.2 Prevention of falls:

a. Take adequate steps to prevent any person on a construction site from falling a height of 2 m or more.
b. Adequate steps include the provision, use and maintenance of:
- working platforms,
- guard-rails, barriers, toe-boards and fences;
- coverings for openings;
- gangways and runs.

### 3.2.3 Safety requirements for working platforms and gangways

| Width of working platforms, gangways and runs | not less than 400 mm
|                                            | not less than 650 mm for gangway or run used for movement of materials |
| Construction of working platforms, gangways and runs | close boarded or planked
|                                                      | (a working platform, gangway or run -
|                                                      |   a. consisting of open metal work having interstices none of which exceeds 4000 mm²;
|                                                      |   b. the boards or planks forming it are secured to prevent movement and the space between adjacent boards or planks does not exceed 25mm
|                                                      | need not be closely boarded or planked if there is no risk of persons below it from being struck by materials or articles falling through the platform, gangway or run) |
| boards or planks forming platforms etc.: | - of sound construction, adequate strength and free from defect
<p>|                                                      | - not less than 200 mm in width and not less than 25 mm in thickness, or not less than 150 mm in width when the board or plank exceeds 50 mm in |</p>
<table>
<thead>
<tr>
<th>Topic</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>thickness</td>
<td>- not protruding beyond its end support to a distance exceeding 150 mm</td>
</tr>
<tr>
<td></td>
<td>- rest securely and evenly on its supports</td>
</tr>
<tr>
<td></td>
<td>- rest on at least 3 supports</td>
</tr>
<tr>
<td>Coverings for opening</td>
<td>• so constructed as to prevent the fall of persons, materials and articles</td>
</tr>
<tr>
<td></td>
<td>• clearly and boldly marked as to show its purpose or securely fixed in position</td>
</tr>
<tr>
<td>Height of toe-boards</td>
<td>• not less than 200 mm in height</td>
</tr>
<tr>
<td></td>
<td>(toe-boards are not required for stairs)</td>
</tr>
<tr>
<td>Height of guard rails</td>
<td>The height of a guard-rail above any place of work on a working platform, gangway, run or stairway shall be:</td>
</tr>
<tr>
<td></td>
<td>• top guard-rail: not less than 900 mm and not more than 1150 mm</td>
</tr>
<tr>
<td></td>
<td>• intermediate guard-rail: not less than 450 mm and not more than 600 mm</td>
</tr>
</tbody>
</table>

3.2.4 Use of safety Harness

a. In special circumstances where it is impractical to provide the above means of fall prevention, safety nets and safety harnesses/belts shall be provided.

b. Wear safety harness or belt and attach it to a suitable anchor point; the lanyard shall be left with the minimum free length.
**Proper Installation of Scaffolding / Working Platform**

- TOP GUARD RAIL (900-1150 HIGH)
- INTERMEDIATE GUARD RAIL (450-600 HIGH)
- TOE BOARD (200 HIGH)
- TRANSOMS
- LEDGER
- DOUBLE COUPLER
- SWIVEL COUPLER
- BRACE
- BASE PLATE

**Safe Use of Ladder**

- PLATFORM WIDTH: MIN. 400 (MIN. 650 FOR MATERIALS) CLOSELY BOARDED
- WINDOW TIE
- CROSS OR WIND BRACES
- SOLE PLATE

N.B.

- ACCESS LADDER NOT SHOWN
- SAFE MEANS OF ACCESS MUST BE PROVIDED

**Full Body Harness (Recommended)**

**Safety Harness and Safety Belt**

(Source: Works Bureau)
3.3 Using of electricity

Quite a number of tools and plants on site require electricity. Remind that electricity can kill.

3.3.1 Precautions

a. Portable and hand-held tools and temporary site lighting shall be of 110V or less.

b. Before using an electric tools / equipment, its wire and plug should be checked. Frayed wires and loose plug should not be used.

c. Use approved type weatherproof socket/adaptor for extension of power cable. Makeshift connections and taped joints are not permitted.

d. Never overload the circuit by using a multi-socket adaptor.

e. Never use portable equipment without earth protection unless it is identified to be double-insulated.

f. Never handle equipment, power points, switches and plugs with wet hands.

g. Inspect /maintain the electric tools / equipment regularly by a competent electrician.

Safe Use of Electricity

(Source: Works Bureau)
3.4 Using powered tools / machinery

Powered tools / machinery are often used to carry out construction works, such as woodworking machinery, abrasive wheels, welding machines, etc.

3.4.1 Common accidents caused by powered tools / equipment:

a. Hurt by the blade or drill bit of certain machines.
b. Caught / hurt by moving parts of the machine.
c. Hit by flying objects / fragments from the materials being cut / machined.
d. Hit by flying fragments of broken blade, drill bit, abrasive wheel, etc.
e. Twisted of wrist / hit by the machine in case of failing to grip the hand-held machine.
f. Electrocution.

3.4.2 Precaution

a. Examine and maintain the machines regularly by a competent person
b. Check the machine before use.
c. When using hand-held machine, select the correct type, weight, size of machine for the job.
d. Ensure the operator is trained to operate the machine.
e. Ensure the operator is physically fit to operate the machine.
f. Ensure the moving parts of the machine are covered with safety shields.
g. Wear appropriate protective clothing such as goggles, gloves, ear muffs, etc.
h. Do not wear gloves if there is a risk of being caught by the rotating blades, drill bits, etc.
i. Never use undue pressure on the blade / drill bit while operating.
(Refer to Safe Use of Electricity.)
3.5 Using heavy mechanical plants (other than lifting appliance)

Construction sites often employ a great number of mechanical plants in carrying out the works, for example:

- earthwork plants
- piling plants

3.5.1 Common accidents caused by using the plants

a. stuck by moving plants;
b. overturning of plants when work on slopes or near excavation sides;
c. injury caused by moving parts of the plants

3.5.2 Precautions

a. Ensure the plants are operated by competent persons who have been adequately trained.
b. Ensure that roll over protection structure (ROPS) and seat belts are provided and used.
c. Before slewing the plant, the operator shall check that the slewing path is clear of persons.
d. When reversing or in case the operator's view is restricted, banksman shall be provided.
e. Avoid operating the machine too close to excavation sides, overhangs, openings or on steep slopes,
f. Do not use an excavation plants to carry passengers or use as a crane.
g. Inspect and maintain the plants regularly by a competent person.
3.6 Manual Lifting

3.6.1 Potential Hazards

a. Back injury (the most common accident)
b. Injury of hands, arms and/or feet
c. Other persons stuck by the moving load.

3.6.2 Precautions

a. Use mechanical equipment in place of manual handling as far as possible.
b. Assess the weight of the object to be handled. Get help if it is beyond your ability to lift it safely.
c. Always use proper protective equipment such as gloves, safety shoes, etc.
d. Ensure the route of removal is not obstructed.
e. Keep correct posture while lifting.
f. When moving long objects, consider the presence of other persons as well.

3.6.3 Correct procedures of manual lifting

a. Stand close to the object. Have a firm footing with feet spread on either side of the load;
b. Bend the knees and keep your back as straight as you can;
c. Grasp object firmly. Be sure grip will not slip;
d. Breath-in and throw shoulder backward;
e. Straighten the legs, continuing to keep the back as straight as you can;
f. Hold object firmly close to the body;
g. Always lift smoothly. Avoid jerky motions.
h. Turn with feet instead of twisting back.
3.7 Lifting operation using lifting appliance and gears

3.7.1 Common accidents

a. Injury caused by the falling off of the transporting materials.
b. Persons stuck by moving loads.
c. Accidents caused by defective/overloaded sling.
d. Breaking of jib / overturning of the machine due to overloading / out-rigger not properly supported.
e. Poorly maintained machine that causes break down or accident.

3.7.2 Safe use of sling and slinging

a. Ensure that the slings be examined every 6 months by a competent examiner.
b. Inspect the condition of the slings before use and do not use defective slings.
c. Never overload a sling. Before lifting, find out the weight of the load and the safe working load of the sling.
d. Secure the load safely.
e. Fence off the working area to prevent persons enter/stay under the suspended load.
3.7.3 Safe use of cranes and lifting appliances

a. Cranes/lifting appliances shall be periodically examined by a competent examiner.
b. The crane shall be equipped with an automatic safe load indicator and it shall be inspected at least once a week by the operator.
c. The operator must be competent and hold a valid certificate to operate the crane.
d. Beware of overhead power lines. Keep the jib a distance of at least 6 m from the power line.
e. The outriggers for the supporting the crane shall be fully extended and secure on sleepers resting on firm ground before any lifting work.
f. Provide banksman if the view of the crane operator is restricted.
g. When there are more than one crane with operating spaces overlap with each other, special operating system shall be arranged to prevent crashing.
3.8 Excavations

3.8.1 Hazards in excavations
a. Soil is bulky and falling soil can produce great momentum and damage.
b. Behaviour of soil varies with its water content.
c. Behaviour of soil varies when under load.
d. Soil pressure increases with the depth of excavation increased.

3.8.2 Safety precautions
a. Inspect the excavations by a competent person weekly.
b. Ensure the timbering and shoring are properly installed.
c. Provide suitable ladder for access into /egress from the excavated trench.
d. Ensure that the stacked spoils, plants or loads are not placed near the edge of excavation.
e. Locate and mark out all underground services before the commencement of excavation.

f. The underground services encountered should be carefully unearthed and securely supported and protected once they are exposed.

g. Erect adequate fencing and warnings at the edge of excavation when the depth is greater than 2 m.

h. Provide stop blocks for vehicles at edge of excavation.

**Protection of Excavation**

**Work Near Excavation Side**
(Source: Works Bureau)

3.8 Gas welding and arc welding

3.8.1 Potential hazards

1. Electrocution
2. Skin burn by flying sparks
3. Eyes or skin burn by strong glare
4. Inhalation of fumes
5. Catching fire

**Safety on Welding** (Source: Works Bureau)
3.8.2 Preventive measures

1. Wear suitable face shield with filter to protect the face and eyes.
2. Wear thick and long gloves to protect the hands and forearms against sparks and heated metal.
3. Screen off the workplace to shield the strong glare.
4. The workplace must be well ventilated.
5. Ensure that there is no flammable material in vicinity.
6. Ensure suitable and adequate fire extinguishers are available in the workplace.
7. In case of welding at height, the flying sparks shall be well shielded to prevent them from falling beneath.
8. Place air hoses and welding cables in such positions that others will not trip over them.
9. Check to ensure the tools, welding cable or gas hose are in good condition before use.
10. Inspect the welding machine, gas valves etc. by competent person regularly.

3.9 Work in Confined Spaces

A confined space is an enclosed place which arises a reasonably foreseeable risk. Examples of confined spaces: chamber, tank, vat, pit, well, sewer, tunnel, pipe, flue, boiler, pressure receiver, hatch, caisson, shaft or silo.

3.9.1 Risks in confined spaces:

a. fire or explosion;
b. loss of consciousness arising from an increase in body temperature;
c. asphyxiation arising from gas, fume, or lack of oxygen; vapour
d. drowning arising from an increase in level of liquid;
e. asphyxiation arising from a free flowing solid.

**Safety Precautions for Work in Confined Spaces**
(Source: Works Bureau)

3.9.2 Precautions of working in confined spaces

a. Obtain “permit-to-work” issued by an Authorised Person
b. Carry out a risk assessment by a competent person before works.
c. Only employ certified workers in confined space.
d. Employ a banksman to guard the opening and keep a close watch at the entrance.
e. Ventilate the space and keep ventilation continuous until the work is finished.
f. Equip with the following equipment:
   - breathing apparatus,
   - safety lamp or torch,
• safety harnesses and lifelines,
• stretcher and reviving apparatus, and
• walkie talkie, etc.
g. Provide audio and visual alarm for alerting others outside confined space.
h. Keep emergency breathing apparatus available.
i. Check with a multi-gas detector for oxygen content and hazardous/combustible gases.
j. Do not smoke or lit a fire in confined space.
k. All electrical equipment used in confined spaces shall be either of explosion-proof type or intrinsically safe type.

3.10 **Work under noisy environment**

Some kind of construction works produce tremendous noise, e.g.:
a. breaking of rock or concrete using pneumatic drill
b. sawing, blasting or using abrasive machines
c. testing of building services (especially in plant rooms /confined spaces)

3.10.1 Hazards

a. Cause disturbance to adjacent residents.
b. Workers work in noisy environment may have some side effect, such as:
   • easily getting tired;
   • headache;
   • loathing;
   • loss of concentration;
   • disrupt accuracy of judgement,
as a result, this may increase the chance of accidents.

c. When exposed to continual noisy environment, permanent damage of hearing would be caused. (Exposure to 90 dB(A) for eight hours per day for thirty years would result in hearing damage to approx. 25%).

d. The following tables gives a general guide on noise levels and exposure time:

### Permissible Noise Exposure

<table>
<thead>
<tr>
<th>Sound level dB(A)</th>
<th>Duration (hours/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
<td>8</td>
</tr>
<tr>
<td>92 (air compressor)</td>
<td>5</td>
</tr>
<tr>
<td>95 (air drill)</td>
<td>2.5</td>
</tr>
<tr>
<td>97</td>
<td>1.6</td>
</tr>
<tr>
<td>100 (machine shop)</td>
<td>0.8</td>
</tr>
<tr>
<td>102</td>
<td>0.5</td>
</tr>
<tr>
<td>105 (circular saw)</td>
<td>0.25</td>
</tr>
<tr>
<td>115 (diesel engine)</td>
<td>0.025</td>
</tr>
</tbody>
</table>

e. When exposed to tremendous noise:
   - noise exceeding 100 dB will cause hearing discomfort,
   - noise exceeding 120 dB will cause pain,
   - noise exceeding 140 dB will cause immediate damage to hearing.

### 3.10.2 Precaution

a. Carry a noise assessment for noisy workplaces and plants by a competent person.

b. Whenever possible, reduce noise at sources such as replacing noisy machines with quieter ones, screening the noise with insulating materials, making changes to the construction processes, etc.

c. Workers shall wear ear protectors when work in noisy environment
3.11 Work in dusty environment

Some kind of works may produce a great amount of dust, such as:

a. cutting of stone, brick or concrete
b. batching of concrete
c. working with bentonite
d. plastering
e. demolition works

3.11.1 Hazards

Continuously exposed to dusty environment may suffer from certain respiratory decease, such as Pneumoconiosis.
3.11.2 Precautions

a. Workers work in dusty environments shall wear appropriate respiratory protection equipment. (Nevertheless, respirators are not an effective means of protection for persons doing heavy manual work.)

b. Dust control:
   - having material precut off-site;
   - isolating dusty works;
   - removing the dust at sources using vacuum cleaner/watering;
   - clean up mud and slurry spills before they dry up and become airborne;
   - use vacuum instead of an airline to clean out formwork;
   - screen or cover loose materials.
   - spray water on soils or dusty materials

3.12. Fire Prevention

3.12.1 Common causes of outbreak of fire on site:

1. Short circuit, overload or poor contact of electric circuit.
2. Damaged electric tools, equipment or wire.
3. Keeping too much or improper storage of flammable liquid.
4. Accumulating debris or waste materials.
5. Smoking or improper use of fire.

3.12.2 Preventive Measures

1. Keep flammable materials in Dangerous Goods Store which complied with the fire regulation.
2. All flammable liquids should be labeled and marked with the words ‘FLAMMABLE LIQUID’ and ‘易燃液體’.

3. Display the ‘No Smoking’ and ‘不准吸烟’ sign where flammable material exist and personnel must strictly comply with at all times.

4. The use of flammable liquids in the workplace should be done in a well-ventilated environment.

5. Any work process that will generate sparks or make use of naked flame should not be done in the same room in which flammable liquids are being used.

6. Clear accumulated debris and waste materials to prevent them from catching fire.

7. All electrical tools and equipment, wire, sockets and switches must be checked by competent personnel regularly.

8. Switch all electric tools or equipment before finishing work, never leave any energized parts being unattended.

9. Keep suitable and adequate fire fighting equipment in the workplace for emergency use, and they must be kept in proper condition.

10. Post sufficient escape route maps prominently on workplaces.

11. Inspect regularly to ensure the fire escape routes are unobstructed.

12. Provide sufficient exit signs at prominent locations for directing people to the escape staircases and routes.

13. Provide sufficient and appropriate fire extinguishers on site.
4 Personal Protective Equipment

4.1 General

a. Consider the provision of personal protective equipment only after all measures for removing or controlling safety or health hazards have been proved reasonably impracticable.

b. Employers shall provide sufficient personal protective equipment.

c. The personal protective equipment shall provide adequate protection and comfort for continuous use.

d. Provide instruction and training in the proper use of any specific protective equipment where necessary.

e. Where personal protective equipment is provided, do not willfully and without reasonable cause remove personal protective equipment to endanger yourself or others.

f. Keep the protective equipment issued in good condition. Report immediately any damage to the management for replacement.
Ear Protectors

Eye Protectors

Masks

Breathing Apparatus

(Source: Works Bureau)
### 4.2 Personal Protective Equipment

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye protection</td>
<td>Safety spectacles, goggles, face shields</td>
</tr>
<tr>
<td>Head protection</td>
<td>Safety helmets</td>
</tr>
<tr>
<td>Hearing protection</td>
<td>Ear plugs, ear muffs</td>
</tr>
<tr>
<td>Fall protection</td>
<td>Safety belts, safety harness</td>
</tr>
<tr>
<td>Respiratory protective</td>
<td>Facemask - for dust and non-toxic sprays</td>
</tr>
<tr>
<td>equipment</td>
<td>Cartridge respirator - for low concentration of certain relatively non-toxic gases</td>
</tr>
<tr>
<td></td>
<td>Canister respirator - for low concentration of certain toxic gases</td>
</tr>
<tr>
<td></td>
<td>Breathing apparatus - for toxic gases and in an oxygen deficient environment</td>
</tr>
<tr>
<td>Foot protection</td>
<td>Safety shoes with steel toe caps, non-slip and penetration resistant soles.</td>
</tr>
<tr>
<td>Hand protection</td>
<td>Wear suitable gloves when appropriate (Do not wear gloves where there is a risk of them becoming entangled in moving parts of machinery.)</td>
</tr>
<tr>
<td>Body protection</td>
<td>Overalls, aprons, etc.</td>
</tr>
</tbody>
</table>

### Reference

4. Safety Manual, Vocational Training Council