

Construction Hazard and Risk Control

Lecture Title: Chemical and Biological health hazards and risk control

Lecturer: Josette Cutajar

Date: 14th January 2026



**Undergraduate Diploma in
Occupational Health and Safety**

Chemical and Biological health hazards and risk control

- Outline the forms of, the classification of, and the health risks from exposure to hazardous substances
- Explain the factors to be considered when undertaking an assessment of the health risks from substances commonly encountered in construction workplaces
- Explain the use and limitations of workplace exposure limits (WELs), including the purpose of long-term and short-term exposure limits
- Outline control measures that should be used to reduce the risk of ill-health from exposure to hazardous substances
- Outline the hazards, risks and controls associated with specific agents
- Outline the basic requirements related to the safe handling and storage of waste on construction sites



Forms and classification of, and health risks from exposure to, hazardous substance

Agents

Chemical agents	Biological agents
<ul style="list-style-type: none">▶ Dusts – including respirable dust (fine dust that remains in the lungs)▶ Fibres▶ Gases▶ Vapours – substances very close to their boiling points (e.g. solvents)▶ Liquids▶ Mists – similar to vapours but closer to the liquid phase (e.g. paint sprays)▶ Fume – condensed metallic particles (e.g. welding fume)	<ul style="list-style-type: none">▶ Fungi▶ Moulds▶ Bacteria▶ Viruses

GHS classification of hazardous substances

Globally Harmonized System (GHS) classifications have replaced CHIP 4 ones.

- The health hazard classification combines the CHIP 4 'harmful' and 'irritant' classifications – involves limited health risks and/or repeated contact with skin can cause a sensitised or allergic inflammation.
- The serious health hazard classification replaces CHIP 4 'toxic' – produces serious health risks.
- The corrosive classification is very similar to the CHIP 4 'corrosive' – may destroy living tissue.
- The acute toxicity classification is similar to the 'very toxic' CHIP 4 – very hazardous to health when inhaled, swallowed or in contact with the skin and could be fatal.
- Carcinogenic – may induce cancer.
- Mutagenic – may induce hereditary genetic defects

<https://www.youtube.com/watch?v=KX9qzn8lkl4>



GHS classification of hazardous substances

A hazard statement describes the nature of the hazard in the substance or mixture.

- A precautionary statement describes recommended measure(s) to minimise or prevent adverse effects resulting from exposure to a hazardous substance.
- If the substance has a more severe hazard, the label includes the signal word 'Danger'; in case of less severe hazards, the signal word is 'Warning'.
- **Acute effects** are of short duration, normally reversible and appear shortly after exposure to a hazardous substance (e.g. asthma attacks).
- **Chronic effects** develop over a period of time after repeated exposure to a hazardous substance and are often irreversible.



Assessment of health risks

Health hazards associated with construction activities:

- noise
- vibration
- dust (including asbestos)
- cement dust and wet cement
- solvents, cleaners and paints
- tetanus and other biological agents
- manual handling



Health hazards associated with construction activities:

Categories of health risks	Types of health risk
<ul style="list-style-type: none">○ Chemical – exhaust fumes, paint solvents, asbestos○ Biological – legionella, other pathogens, hepatitis○ Physical – noise, vibration, radiation○ Psychological – stress, violence○ (Ergonomic – musculoskeletal disorders)	<ul style="list-style-type: none">▶ skin contact with irritant substances, leading to dermatitis;▶ inhalation of respiratory sensitisers, triggering immune responses such as asthma;▶ badly designed workstations requiring awkward body postures or repetitive movements, resulting in upper limb disorders, repetitive strain injury and other musculoskeletal conditions;▶ noise levels which are too high, causing deafness and conditions such as tinnitus;▶ too much vibration, for example from hand-held tools leading to hand–arm vibration syndrome and circulatory problems;▶ exposure to ionising and non-ionising radiation, including ultraviolet in the sun's rays, causing burns, sickness and skin cancer;▶ infections ranging from minor sickness to life-threatening conditions, caused by inhaling or being contaminated with microbiological organisms; and▶ stress causing mental and physical disorders

Routes of entry into the bod

- Inhalation via the lungs
- Absorption via the skin
- Ingestion via the stomach
- Injection through the skin

<https://youtu.be/LqfHVWr-r28>

Major human body systems

There are five major functional systems within the body. These are listed together with typical diseases and related hazardous substances

Body system	Illness or disease	Hazardous substance
Respiratory	bronchitis, asthma, fibrosis, cancer	dusts, asbestos
Nervous	anxiety, epilepsy, loss of consciousness	solvents, lead
Cardiovascular	headaches, loss of consciousness	benzene, carbon monoxide
Urinary	cirrhosis, cancer	chlorinated hydrocarbons, mercury
Skin	irritant contact dermatitis and allergic contact dermatitis	detergents, turpentine, epoxy resin

Control of Substances Hazardous to Health Regulation

Requirements of COSHH

- Suitable and sufficient health risk assessment
- Adequate control of exposure of employees
- Proper use of control measures provided
- Maintain control measures
- Monitor employees exposed to hazardous substances (Schedule 5)
- Health surveillance (Schedule 6)
- Information, instruction and training



COSHH assessment

- Identify hazardous substances
- Gather information
- Evaluate the risks
- Decide on control measures
- Record the assessment
- Review the assessment



Sources of information

- Product labels
- Safety data sheets
- HSE Guidance Note EH 40
- Trade association publications
- Industrial codes of practice
- Specialist reference manuals

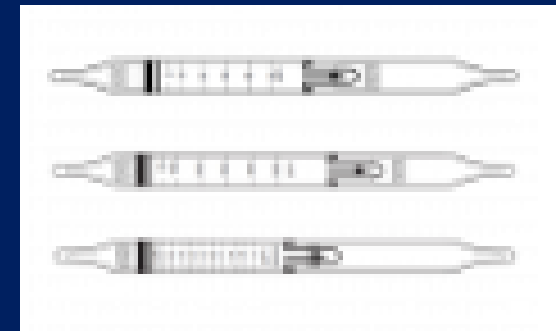


Survey techniques for health risk

Include:

Stain tube detector. The advantages of this technique are that it is quick, relatively simple to use and inexpensive. The disadvantages are:

- it cannot be used to measure concentrations of dust or fume
- the accuracy of the reading is approximately $\pm 25\%$
- it will yield false readings if other contaminants present react with the crystals
- it can only give an instantaneous reading, not an average reading over the working period (TWA)
- the tubes are very fragile with a limited shelf life



Workplace exposure limits (WELs)

Workplace exposure limits (WELs) must not be exceeded.

Category 1 carcinogenic and mutagenic substances – exposure must be reduced as low as is reasonably practicable below the WEL

Category 2 all other hazardous substances – exposure controlled by principles of good practice

There are two time-weighted averages (TWA):

- the long-term exposure limit (LTEL) – over 8 hours
- the short-term exposure limit (STEL) – 15 minute reference period



Limitations of exposure limits

- They are specifically quoted for an 8-hour period (with an additional STEL for many hazardous substances). Adjustments must be made when exposure occurs over a continuous period longer than 8 hours.
- They can only be used for exposure in a workplace and not to evaluate or control non-occupational exposure (e.g. to evaluate exposure levels in a neighbourhood close to the workplace, such as a playground).
- WELs are only approved where the atmospheric pressure varies from 900 to 1100 millibars.
- They should also not be used when there is a rapid build-up of a hazardous substance due to a serious accident or other emergency.
- The fact that a substance has not been allocated a WEL does not mean that it is safe.

Control measures

The general principles of prevention are:

1. the avoidance of risks;
2. the evaluation of unavoidable risks;
3. controlling hazards at source;
4. replacing the dangerous by less or non-dangerous alternatives;
5. adapting work to the individual;
6. adapting to technical progress;
7. developing a coherent prevention policy;
8. giving priority to collective over individual protective measures; and
9. giving appropriate instructions to employees



Principles of Good Practice for the control of exposure to substances hazardous to health

- Design and operate processes and activities to minimise emission, release and spread of substances hazardous to health.
- Take into account all relevant routes of exposure – inhalation, skin absorption and ingestion – when developing control measures.
- Control exposure by measures that are proportionate to the health risk.
- Choose the most effective and reliable control options which minimise the escape and spread of substances hazardous to health.

Principles of Good Practice for the control of exposure to substances hazardous to health

- Where adequate control of exposure cannot be achieved by other means, provide, in combination with other control measures, suitable PPE.
- Check and review regularly all elements of control measures for their continuing effectiveness.
- Inform and train all employees on the hazards and risks from the substances with which they work and the use of control measures developed to minimise the risks.
- Ensure that the introduction of control measures does not increase the overall risk to health and safety.



Hierarchy of control measures

1. eliminate the risks by either designing them out or changing the process;
2. substitution of hazardous substances with others which are less hazardous;
3. isolation, using enclosures, barriers or worker segregation;
4. engineering controls such as guarding, the provision of local exhaust ventilation systems, the use of reduced voltage systems or residual current devices;
5. management controls such as safe systems of work, training, job rotation and supervision; and
6. finally, as a last resort, the provision of personal protective equipment such as ear defenders or respiratory protective equipment



Hence, measures for preventing or controlling exposure to hazardous substances include one or a combination of the following:

1. elimination of the substance
2. substitution of the substance (or reduction in the quantity used)
3. total or partial enclosure of the process
4. local exhaust ventilation
5. dilute or general ventilation
6. reduction of the number of employees exposed to a strict minimum
7. reduced time exposure by task rotation and the provision of adequate breaks
8. good housekeeping
9. training and information on the risks involved
10. effective supervision to ensure that the control measures are being followed
11. personal protective equipment (such as clothing, gloves and masks)
12. welfare (including first-aid)
13. medical records
14. health surveillance.



Preventative control measures

Engineering controls

These include:

segregation of people from the process (fume cupboard)

modification of the process to reduce human contact with the hazardous substances
local exhaust ventilation comprising:

1. a collection hood and intake
2. ventilation ducting
3. a filter or other air cleaning device
4. a fan
5. an exhaust duct
6. dilution or general ventilation.



Supervisory or people controls

Additional supervisory controls when hazardous substances are involved are:

1. reduced time exposure – thus ensuring that workers have breaks in their exposure periods;
2. reduced number of workers exposed – only persons essential to the process should be allowed in the vicinity of the hazardous substance; walkways and other traffic routes should avoid any area where hazardous substances are in use;
3. eating, drinking and smoking must be prohibited in areas where hazardous substances are in use;
4. any special rules, such as the use of personal protective equipment, must be strictly enforced.



Personal protective equipment

Personal protective equipment (PPE) is the control measure of last resort. It is covered by the Personal Protective Equipment at Work Regulations, which require:

1. PPE to be suitable for wearer and task;
2. PPE to be compatible with any other personal protective equipment;
3. a risk assessment to be undertaken to determine best PPE;
4. a suitable PPE maintenance programme;
5. suitable storage arrangements for the PPE;
6. information, instruction and training for the user of the PPE;
7. supervision of the use of PPE; and
8. a system for reporting defects



Personal protective equipment

Types of personal protective equipment	Types of respiratory protective equipment
<ul style="list-style-type: none">▶ hand and skin protection▶ eye protection▶ protective clothing – safety gloves and boots, hard hats, aprons	<ul style="list-style-type: none">▶ filtering half-mask▶ half-mask respirator▶ full-face mask respirator▶ powered respirator

Health surveillance

Health surveillance is important for:

1. detecting ill-health effects at an early stage;
2. providing data to help employers evaluate health risks;
3. enabling employees to raise concerns;
4. highlighting lapses in workplace control measures; and
5. providing an opportunity to reinforce training and education of employees



Health surveillance

Health surveillance is not the same as health monitoring. Types of health surveillance include:

- checking individuals on a regular basis;
- checking individuals as a result of statistical evidence of a potential problem; and
- when a substance listed in Schedule 6 of COSHH is being used. In these cases, health surveillance should take place at intervals not exceeding 12 months and records should be kept for 40 years



Maintenance and emergency controls

Maintenance involves:

- the cleaning, testing and, possibly, the dismantling of equipment;
- the changing of filters in extraction plant or entering confined spaces;
- the handling of hazardous substances and the safe disposal of waste material;
- a permit-to-work procedure may also need to be in place, since the control equipment will be inoperative during the maintenance operations;
- the keeping of records of maintenance for at least 5 years



Maintenance and emergency controls

The following points should be considered when emergency procedures are being developed:

- the possible results of a loss of control (e.g. lack of ventilation);
- dealing with spillages and leakages (availability of effective absorbent materials);
- raising the alarm for more serious emergencies;
- evacuation procedures, including the alerting of neighbours;
- fire-fighting procedures and organisation;
- availability of respiratory protection equipment; and
- information and training



Specific agents-Asbestos

A fine, sharp and hard fibrous dust of respirable dust size which can become lodged in the lungs, causing damage to the lining of the lungs over a period of many years. Asbestos is a possible chronic health risk. It can lead to one of the following diseases:

- asbestosis or fibrosis (scarring) of the lungs;
- diffuse pleural thickening;
- lung cancer;
- mesothelioma – cancer of the lining of the lung.

Duty to manage asbestos

The Control of Asbestos at Work Regulations require:

- the determination of the location and condition of materials likely to contain asbestos (ACMs)
- the presumption that materials contain asbestos unless there is strong counter-evidence
- up-to-date records of the location and condition of the ACMs or presumed ACMs
- an assessment of the risk of anyone being exposed to fibres from ACMs
- a plan to manage the risks from ACMs
- the necessary steps to action the plan
- the periodic review and monitoring of the plan
- provision of information and asbestos awareness training to anyone who is liable to work on ACMs or otherwise disturb them



Types of asbestos survey

- The management survey – the location and assessment of condition of ACMs, used to compile the asbestos register.
- The refurbishment or demolition survey – most invasive and detailed and used to locate and describe, as far as reasonably practicable, all ACMs in the area where the refurbishment work will take place or in the whole building if demolition is planned. Refurbishment and demolition surveys should only be conducted in unoccupied areas to minimise risks to the public or employees on the premises

Stages in the control of asbestos

1. Identification of the presence of asbestos to compile the asbestos register
2. Assessment is an evaluation as to whether the location or the condition could lead to the asbestos being disturbed
3. Removal must only be done by a licensed contractor
4. Control measures during the removal of asbestos to ensure adequate protection of workers and others
5. Medical surveillance in the form of a regular medical examination should be given to any employee who has been exposed to asbestos at levels above the action level.



Stages in the control of asbestos

Awareness training is given to those employees:

- who are or who are liable to be exposed to asbestos or who supervise such employees
- who carry out work in connection with the employer's duties under these Regulations, so that they can carry out that work effectively

Disposal of asbestos waste to an authorised asbestos waste site.

If asbestos is discovered during the performance of a contract, work should cease immediately and the employer should be informed



Asbestos Awareness Training

Awareness training is given to those employees:

- who are or who are liable to be exposed to asbestos or who supervise such employees
- who carry out work in connection with the employer's duties under these Regulations, so that they can carry out that work effectively

Disposal of asbestos waste to an authorised asbestos waste site. If asbestos is discovered during the performance of a contract, work should cease immediately and the employer should be informed



Health hazards of other specific agents

Each agent is followed by a brief description and two possible illnesses.

Organic solvents – sensitisers and irritants that can cause dermatitis and liver failure. The minimum PPE requirements are impermeable overalls, apron, footwear, long gloves or gauntlets and chemically resistant goggles or visor. Respiratory protective equipment is also required if it cannot be demonstrated that exposure is below the appropriate workplace exposure limit (WEL). Organic solvents are often used with painting work



Health hazards of other specific agents

- Carbon dioxide – odourless gas, can cause headaches and loss of consciousness.
- Nitrogen – odourless gas, in liquid form used as a freezing agent, can cause frostbite.
- Isocyanates – sensitisers and irritants, can cause bronchitis and extreme 'asthma attack'. They are often used in paint spraying operations and require good ventilation. Respiratory Protective Equipment (RPE) should be worn.
- Lead – dust can cause headaches, nausea and anaemia. Lead is used in roofing and plumbing work.



Health hazards of other specific agents

- Carbon monoxide – odourless gas, can cause headaches and unconsciousness. Exposure may be prevented by ensuring that any work carried out in relation to gas appliances in domestic or commercial premises is undertaken by a competent Gas Safe Registered engineer.
- Silica dust produced in masonry work can cause fibrosis and silicosis. Prevention is best achieved by the use of good dust extraction systems and respiratory protective equipment.
- Cement dust – irritant and allergenic, can cause dermatitis, inflammation and irritation of the eye, irritation of the nose and throat and, possibly, chronic lung problems. PPE in the form of gloves, overalls with long sleeves, full-length trousers and waterproof boots must be worn.



Health hazards of other specific agents

- Wet cement – irritant and allergenic, can cause dermatitis, serious burns or ulcers.
- Wood dust can be hazardous, particularly from hard woods and composite boards (MDF), and can cause irritation to the eyes, nose and throat, leading to dermatitis, asthma, rhinitis and even cancer. An extraction system is essential and PPE in the form of gloves, respiratory protective equipment, overalls and eye protection.
- Leptospira is a bacterium in rat urine that can cause anaemia and jaundice. Good, impervious protective clothing, particularly wellington boots, and the covering of any skin wounds are essential in these situations

Health hazards of other specific agents

Legionella are bacteria in tepid water that can cause pneumonia and death. Where a plant is at risk of the development of legionella, the following is required:

1. a written 'suitable and sufficient' risk assessment;
2. the preparation and implementation of a written control scheme involving the treatment, cleaning and maintenance of the system;
3. appointment of a named person with responsibility for the management of the control scheme;
4. the monitoring of the system by a competent person; and
5. record keeping and the review of procedures developed within the control scheme

Note: Any potential source of legionella (e.g. cooling towers) must be given a special risk assessment by a competent person and records must be kept

Hepatitis and other blood-borne viruses

Hepatitis and other blood-borne viruses can cause nausea, jaundice and death.

Possible control measures:

- prohibit eating, drinking and smoking in working areas where there is a risk of contamination;
- prevent puncture wounds, cuts and abrasions, especially in the presence of blood and body fluids;
- when possible avoid use of, or exposure to, sharps such as needles, glass or metal, or if unavoidable take care in handling and disposal;
- consider the use of devices incorporating safety features, such as safer needle devices and blunt-ended scissors;
- cover all breaks in exposed skin by using waterproof dressings and suitable gloves;



Hepatitis and other blood-borne viruses

- protect the eyes and mouth by using a visor/goggles/safety spectacles and a mask, where splashing is possible;
- avoid contamination by using water-resistant protective clothing;
- wear rubber boots or plastic disposable overshoes when the floor or ground is likely to be contaminated;
- use good basic hygiene practices, such as hand washing; control contamination of surfaces by containment and using appropriate decontamination procedures; and
- dispose of contaminated waste safely.

Health hazards of other specific agents

Tetanus – a bacterium in soil enters a wound from an infected object and attacks the nerves that supply muscle tissue (lockjaw); can be fatal.

Hydrogen sulphide – poisonous gas with odour of rotten eggs (sewer gas). Causes irritation of the eyes, headaches and dizziness; may result in pulmonary oedema



Health hazards of other specific agents

Generation and control of dust on a construction site

Cement dust – controlled by PPE in the form of gloves, overalls with long sleeves, full-length trousers and waterproof boots.

Wood dust – controlled by a good extraction system and PPE (gloves, respiratory protective equipment, overalls and eye protection).

Silica dust – controlled by a good dust extraction system and respiratory protective equipment.



Safe handling and storage of waste

There are two categories of hazardous waste – absolute hazardous waste, such as fuel and oil, or mirror hazardous waste, such as sawdust.

The principal requirements of the ERA are as follows:

- to handle waste so as to prevent any unauthorised escape into the environment;
- to pass waste only to an authorised person;
- to ensure that a written description accompanies all waste; and
- to ensure that no person commits an offence under the Act.



The hazards associated with waste skips:

- being struck by vehicles;
- falling and slipping;
- failures of lifting equipment;
- striking overhead cables/obstructions;
- vehicle overturns; and
- runaway vehicles.

Requirements for waste skips

- sufficient strength to cope with its load;
- stability while being filled;
- a reasonably uniform load distribution within the skip at all times;
- the immediate removal of any damaged skip from service and the skip inspected after repair before it is used again;
- sufficient space around the skip to work safely at all times;
- the skip should be resting on firm level ground;
- the skip should never be overloaded or overfilled; and there must be sufficient headroom for the safe removal of the skip when it is filled

The control measures for hazards associated with waste disposal

- All workers should wear suitable PPE, such as high-visibility jackets, gloves and suitable footwear.
- Training so that employees segregate hazardous and non-hazardous wastes on site and fully understand the risks and necessary safety precautions to be taken.
- The storage site should be protected against trespassers, fire and adverse weather conditions.
- If flammable or combustible wastes are being stored, adequate fire protection systems must be in place.
- Manual handling issues may need to be considered.
- All lifting equipment, including chains and shackles, must be subject to a periodic statutory examination.
- Separate storage required for incompatible waste streams.
- Finally, for liquid wastes, drains must be protected and bunds used to restrict spreading of the substance as a result of spills



The control measures for hazards associated with waste disposa

The four requirements for the transfer of waste from the site to final treatment or disposal are:

- The waste must be clearly identified.
- The waste must be securely stored with procedures to deal with spillages.
- The waste must only be transferred to an authorised person.
- Adequate records of waste consignments must be kept for at least 2/3 years



**Undergraduate Diploma in
Occupational Health and Safety**