



OVERSEAS INDUSTRIAL
TECHNICAL INSTITUTE

PROFESSIONAL REQUIRED TODAY. LET'S MOVE AHEAD WITH US.

1

NEBOSH

INTERNATIONAL GENERAL CERTIFICATE IN OCCUPATIONAL HEALTH AND SAFETY

Element 7: Chemical and biological agents



LEARNING
PARTNER

GOLD 1584



SCOPE OF LEARNING

- 7.1 Hazardous substances
- 7.2 Assessment of health risks
- 7.3 Occupational exposure limits
- 7.4 Control measures
- 7.5 Specific agents



**OVERSEAS INDUSTRIAL
TECHNICAL INSTITUTE**

PROFESSIONAL REQUIRED TODAY.. LET'S MOVE AHEAD WITH US.

3

7.1 HAZARDOUS SUBSTANCES

Overseas Industrial Technical Institute
version 1.3



**LEARNING
PARTNER**

GOLD

1584



FORMS OF CHEMICAL AGENTS

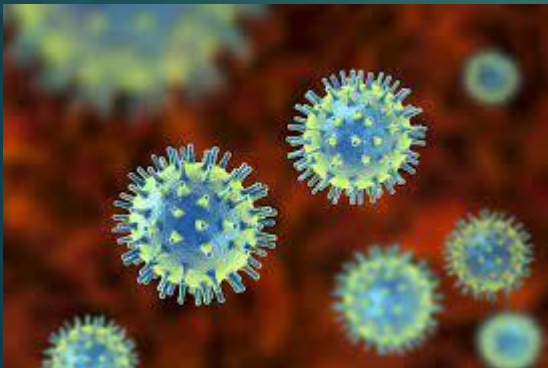
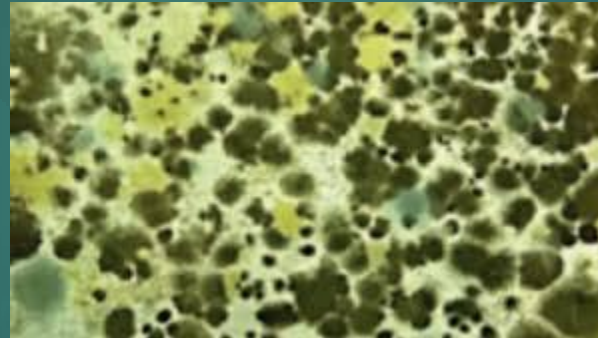
- Dust
- Fume
- Mist
- Vapour
- Gas
- Aerosol
- Liquid
- Fibres





FORMS OF BIOLOGICAL AGENTS

- Bacteria
- Fungus
- Viruses





ACUTE AND CHRONIC HEALTH EFFECTS

The effects on health of hazardous substances may be either acute or chronic

Acute: short duration, appear rapidly after short term exposure & usually reversible e.g. nausea & vomiting

Chronic: long duration, develop over a long period of time which may take many years, produced by prolonged exposure to hazardous substances resulting in gradual, usually irreversible illness e.g. cancer.



HEALTH HAZARD CLASSIFICATION

Classification of Chemicals Hazardous to Health

Harmful: Substance, which if swallowed, inhaled or penetrates the skin, causes limited health risks. Risks can be minimized or removed by following the instruction provided with the substance.

Irritant: **Non-corrosive** substance, which can cause skin or lung inflammation after, repeated contact. People who react that way to a substance are sensitized or allergic to that substance.

Corrosive: Substances that will cause chemical burns to human tissue. Usually strong acid or alkali e.g. sulphuric acid.

Toxic: Poisonous substance which will prevent the function of one or more organs within the body e.g. liver, kidney... etc. The effect on health depends on the concentration & the toxicity of the substance, the frequency of exposure & the effectiveness of controls in place.

Carcinogenic: Substances suspected to promote abnormal development of cancer cells e.g. Asbestos.

Mutagenic: Substance that damage genetic material causing abnormal changes that can be passed on from one generation to another



**OVERSEAS INDUSTRIAL
TECHNICAL INSTITUTE**

PROFESSIONAL REQUIRED TODAY.. LET'S MOVE AHEAD WITH US.

8

7.2 ASSESSMENT OF HEALTH RISKS

Overseas Industrial Technical Institute
version 1.3



**LEARNING
PARTNER**

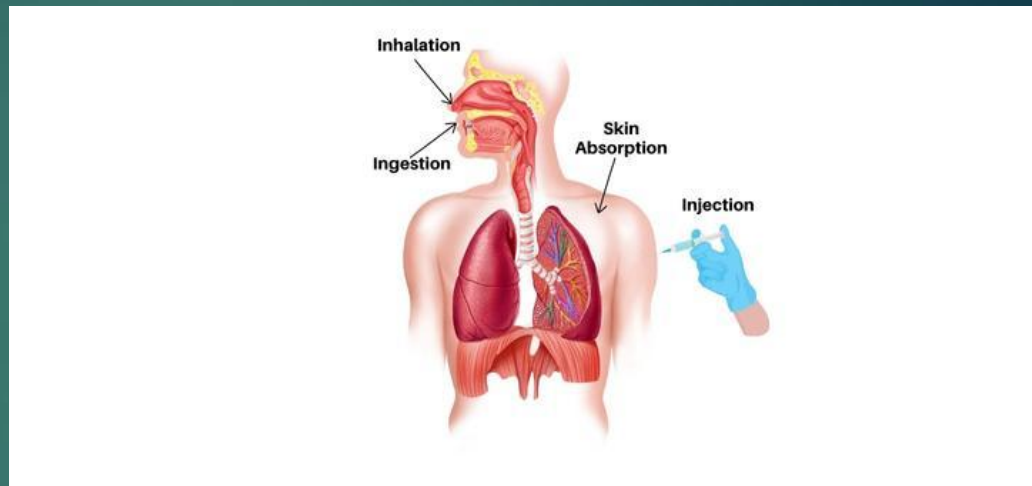
GOLD

1584



ROUTES OF ENTRY INTO THE BODY

- Inhalation
- Absorption
- Ingestion
- Injection



DEFENCE MECHANISMS OF THE BODY

- ❑ Skin
- ❑ Mucous Membrane
- ❑ Tears
- ❑ Earwax
- ❑ Stomach Acids
- ❑ The Blood





ASSESSING HEALTH RISKS

- ❑ Assessing Health Risks
- ❑ Identify the hazards
- ❑ Decide who might be harmed and how
- ❑ Evaluate the risks and decide on precautions





IMPLEMENTING A HAZARD COMMUNICATION PROGRAM

- An inventory of all hazardous chemicals
- Labelling procedures
- Procedures for maintaining Safety Data Sheets
- Procedures for providing employees with relevant information





PRODUCT LABELS

Labels must include:

- Product identifier
- Signal word
- Pictograms
- Hazard statements
- Precautionary statement
- Contact information for manufacturer/distributor/importer





MATERIAL SAFETY DATA SHEETS (MSDS)

- 1.Product and Company Identification
- 2.Hazard(s) identification
- 3.Composition/information on ingredients
- 4.First-aid measures
- 5.Fire-fighting measures
- 6.Accidental release measures
- 7.Handling and storage
- 8.Exposure controls/personal protection
- 9.Physical and chemical properties
- 10.Stability and reactivity
- 11.Toxicological information
- 12.Ecological information
- 13.Disposal considerations
- 14.Transport information
- 15.Regulatory information
- 16.Other information.

MATERIAL SAFETY DATA SHEET - 9 SECTIONS	
SECTION 1 - PRODUCT INFORMATION	
Product Name Product Use Manufacturer's Name Physical and Mailing Address Emergency Contact Phone Number	WHMIS Classification (optional) Supplier's Name Physical and Mailing Address Emergency Contact Phone Number
SECTION 2 - HAZARDOUS INGREDIENTS	
Hazardous Ingredients (very specific)	
SECTION 3 - PHYSICAL DATA	
Physical State (What does it look like? Is it a liquid, gas, or solid?) What happens to it under a variety of circumstances? (i.e. heat, freezing, dropping, etc.) Flammability and how to extinguish. Includes a wide variety of details concerning how easily this product	
SECTION 4 - FIRE AND EXPLOSION DATA	
will ignite / explode and how to deal with it. How stable is this product?	How it reacts under various conditions.
SECTION 5 - REACTIVITY DATA	
Incompatibility with other substances. Information about how the product affects and enters the body.	Hazardous Decomposition Products Immediate affect. Long term toxic affect.
SECTION 6 - TOXICOLOGICAL PROPERTIES	
Exposure limits. In summery, immediate and long term affects to the human body.	
SECTION 7 - PREVENTIVE MEASURES	
Personal Protective Gear; ventilation, etc.; leak and spill info; waste disposal; handling and storage; special shipping instructions	
SECTION 8 - FIRST AID MEASURES	
Information for immediate first aid treatment. Usually always ends with "contact a Doctor"	
SECTION 9 - PREPARATION INFORMATION. / Who prepared this and contact info	



ROLE OF HAZARDOUS SUBSTANCE MONITORING AT THE WORKPLACE

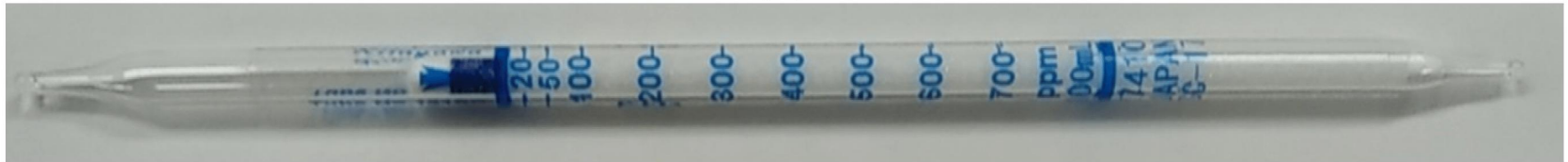
The aims of this programme should be:

- (a) To ensure that the health of the workers is efficiently protected;
- (b) To ensure that the preventive actions which have been taken are still effective;
- (c) To ensure that the levels, as measured previously, remain unchanged or fall;
- (d) To ensure that any changes made in manufacturing processes or work practices will not lead to an excessive exposure to hazardous chemicals;
- (e) To promote the implementation of more efficient preventive measures.

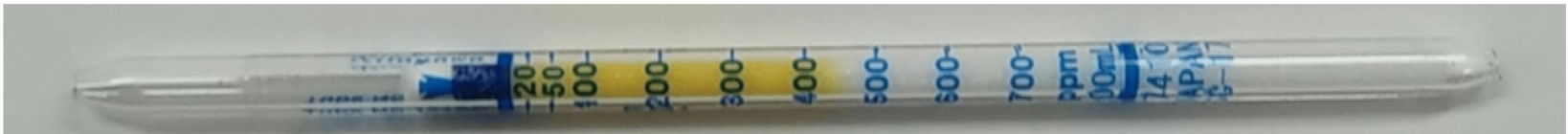


ACTIVE SAMPLER STAIN TUBE DETECTORS

(a)



(b)





ACTIVE SAMPLER MULTI-GAS DETECTOR



Overseas Industrial Technical Institute
version 1.3





PASSIVE SAMPLER BADGE SAMPLER

PASSIVE SAMPLING IS AN ENVIRONMENTAL MONITORING TECHNIQUE INVOLVING THE USE OF A COLLECTING MEDIUM, SUCH AS A MAN-MADE DEVICE OR BIOLOGICAL ORGANISM, TO ACCUMULATE CHEMICAL POLLUTANTS IN THE ENVIRONMENT OVER TIME



Overseas Industrial Technical Institute
version 1.3



7.3 OCCUPATIONAL EXPOSURE LIMITS



THE ROLE AND FUNCTIONS OF OELS

- They are used as reference tools for monitoring the systematic management of chemical risks
- This is crucial in industries where hazardous chemicals are used, where substitute is not available, and where gear and process specifications do not eliminate the necessity for monitoring performance criteria
- Their use in these circumstances may have some benchmarking value for other workplaces
- While it may be difficult to monitor airborne exposures, the existence of OELs places significant pressure on suppliers to give information on the safe use of hazardous chemical items
- They may play a useful role in setting specification standards that can be used to determine risk management issues related to the procurement and installation of new plant



LIMITATIONS OF OCCUPATIONAL EXPOSURE LIMITS

- Limitations of Exposure Limits
- Being below a limit does not prove it is safe:
- Only concerned with inhalation
- No account of individual sensitivity or susceptibility
- Many developed on male physiology
- No account of synergistic or combined effects
- Invalid if normal environmental conditions change
- Organisation may not realise that controls are no longer effective and limits are not adhered to
- Monitoring equipment may become inaccurate • Some limits are only “guidelines”
- Non-inhalation effects, e.g. Dermatitis, aren't considered



**OVERSEAS INDUSTRIAL
TECHNICAL INSTITUTE**

PROFESSIONAL REQUIRED TODAY.. LET'S MOVE AHEAD WITH US.

22

7.4 CONTROL MEASURES

Overseas Industrial Technical Institute
version 1.3



**LEARNING
PARTNER**

GOLD

1584



CHOOSING CONTROL MEASURES

In order of priority:

- 1 Eliminate the use of a harmful product or substance and use a safer one.
- 2 Use a safer form of the product, eg paste rather than powder.
- 3 Change the process to emit less of the substance.
- 4 Enclose the process so that the product does not escape.
- 5 Extract emissions of the substance near the source.
- 6 Have as few workers in harm's way as possible.
- 7 Provide personal protective equipment (PPE) such as gloves, coveralls and a respirator. PPE must fit the wearer.



CONTROL EQUIPMENT

Control equipment comes in numerous types. It consists of ventilation to extract dust, mist, and fumes; glove boxes and fume cabinets; spray booths and refuges; and fume hoods (clean rooms in dirty work areas). In addition, technologies for sanitising cooling water and the use of water to decrease dust are included. Your provider must supply a "user handbook" for every control equipment. If you do not have one, request one. And if this is not possible, you may want professional assistance. The user manual should provide schedules for inspections, maintenance, and replacement of parts.



Overseas Industrial Technical Institute
version 1.3





CHECKING AND MAINTAINING

Once you've got control, you need to keep it. As the employer, you must make sure that the control measures (equipment and the way of working) keep working properly.

You should choose someone to oversee the monitoring and maintenance of control measures. It could be you or someone you appoint, so long as they understand their responsibilities and are capable of carrying them out. Specifically, they are "capable" to:

- check that the process isn't emitting uncontrolled contaminants;
- Check that the control equipment continues to work as it was designed;
- check that workers follow the right way of working.

Two of the most common control measures where maintenance is critical are local exhaust ventilation (LEV) and personal protective equipment (PPE).



LOCAL EXHAUST VENTILATION (LEV)

- Captor Hoods
- Receptor hoods
- Fume Cupboards
- Glove Box

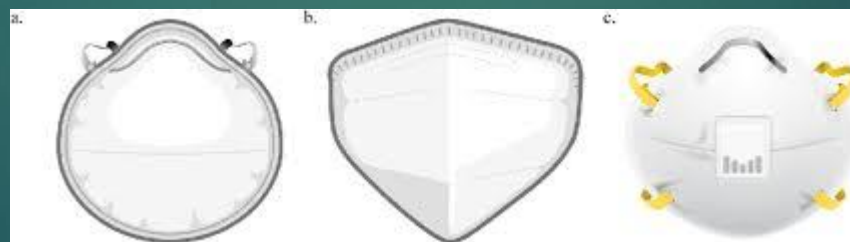




PERSONAL PROTECTIVE EQUIPMENT (PPE)

Respiratory Protective Equipment-

(i) **Respirators-** Filtering face piece respirator, Half mask single/twin cartridge type respirator, Full Face Canister Respirator





PERSONAL PROTECTIVE EQUIPMENT (PPE)

Respiratory Protective Equipment-

(ii) **Breathing Apparatus-** Fresh Air-hose Breathing Apparatus, Compressed Airline Apparatus, Self-Contained Breathing Apparatus (SCBA)





PERSONAL PROTECTIVE EQUIPMENT (PPE)

- Eye Protection- Safety spectacles/ Safety Goggles
- Full body Coveralls, Aprons
- Foot Protection- Safety Gumboots
- Hands and Fingers- Vinyl or Nitrile Gloves or Gauntlets
- Face Protection- Face Shields





**OVERSEAS INDUSTRIAL
TECHNICAL INSTITUTE**

PROFESSIONAL REQUIRED TODAY.. LET'S MOVE AHEAD WITH US.

30

7.5 SPECIFIC AGENTS

Overseas Industrial Technical Institute
version 1.3



**LEARNING
PARTNER**

GOLD

1584



ASBESTOS

Asbestos fibres can cause **scarring, inflammation** and eventually lead to **genetic damage**. One of the most common ways asbestos fibres can enter our body is through breathing.

Sources

- asbestos cement roofs
- ceiling tiles
- fire break walls
- floor tiles
- downpipes
- pipe lagging





HEALTH EFFECTS OF ASBESTOS

The adverse consequences of long-term asbestos exposure on human health are widely recognised. Asbestos fibres are easily inhaled and transported to the lower lung areas, where they can induce **fibrotic lung disease (asbestosis)** and alterations in the chest cavity lining (**pleura**). These conditions can result in diminished respiratory function and mortality. Asbestos fibre inhalation also raises the risk of **lung cancer** and **mesothelioma**.

Enlargement of the heart can also occur as an indirect effect from the increased resistance of blood flow through the lungs.



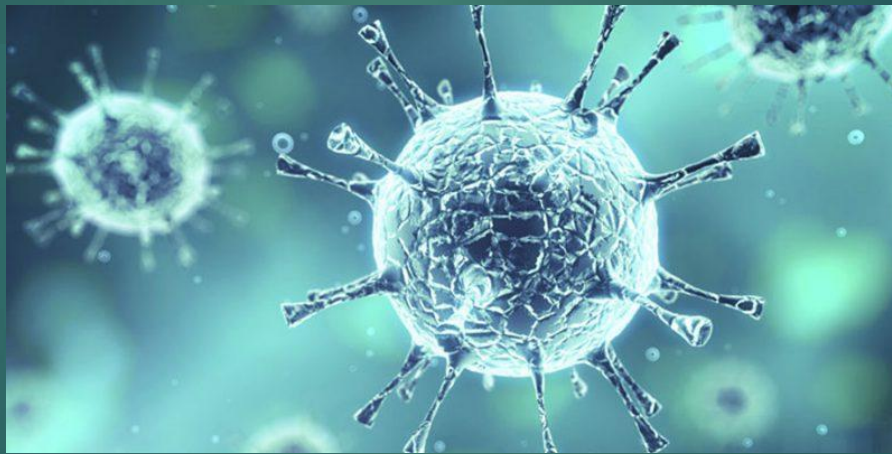
ASBESTOS CONTROL PROGRAM

- Containment of asbestos operations.
- Location, type, friability (how easily it crumbles), and condition of ACM in the workplace.
- Controlling of the release of asbestos fibres.
- Reporting procedures for suspected ACM.
- The engineering controls, work practices, hygiene practices, and facilities necessary to control the exposure of a worker to asbestos.
- Providing workers with task-specific work instructions that address both the hazards and the necessary controls.
- Providing, using and maintaining appropriate personal protective equipment and clothing.
- The methods and procedures needed to monitor the concentration of airborne asbestos and the exposure of a worker.
- The methods needed to decontaminate workers clothes, etc.
- The removal and clean up of asbestos waste and related material.



BLOOD-BORNE VIRUSES (BBVS)

- Hepatitis B, C and D viruses which cause the liver disease hepatitis.
- Human Immunodeficiency Virus (HIV) which causes AIDS (Acquired Immune Deficiency Syndrome) which affects the immune system of the body.





BLOOD-BORNE VIRUSES (BBVS)

WHO ARE AT RISK?

- Workers in the refuse and recycling industry,
- laundry workers, laboratory workers,
- vehicle recovery and repair workers,
- correctional officers,
- emergency responders,
- morticians,
- hair stylists,
- beauticians,
- dentists,
- needle exchange service workers,
- plumbers,
- local authority workers,
- tattooists,
- and healthcare personnel may be at risk



BLOOD-BORNE VIRUSES (BBVS)

PREVENTING INFECTION

- Avoid all contact with blood or body fluids where possible. Cover breaks in exposed skin by means of waterproof dressings and/or gloves.
- Treat all blood or blood products as if it were infectious.
- Use engineering controls e.g. needle safe systems.
- Use safe work practices e.g. have documented safe practices for handling and disposing of contaminated sharps, handling specimens, handling contaminated laundry, items and surfaces etc.
- Wear appropriate Personal Protective Equipment (PPE) to avoid contamination e.g. gloves, goggles or visor, disposable clothing protection such as aprons.
- Make hepatitis B vaccinations available to those at risk.
- Ensure emergency procedures and post-exposure plans are in place for those who experience an exposure incident e.g. needlestick injury.
- Follow good basic hygiene practices such as hand washing before and after glove use and avoid hand to mouth or eye contact.



CARBON MONOXIDE (CO)

Sources

- In locations where there is faulty or inefficient fuel-burning equipment, for example, heaters, furnaces, vehicles, engines, generators, leaking chimneys or vents.
- You are most at risk from carbon monoxide exposure if you are working in a place where there is a petrol or diesel driven generator or other engine driven appliance, gas heater or other unflued appliance;
- In the vicinity of appliances which have poorly maintained, damaged, blocked or sealed flues. Heavy condensation in the area and / or staining of the flue is a sign of possible carbon monoxide exposure;
- With fuel burning powered appliances and tools which generate carbon monoxide.
- Workers using gasoline, diesel, or gas-powered tools/appliances such as concrete cutting saws, power floats, floor grinders, small mobile plant, diesel forklift trucks, compressors, and generators in poorly ventilated places or enclosed spaces are susceptible to carbon monoxide poisoning;
- In the cab of vehicles with defective exhaust systems;
- Directly with carbon monoxide gas in industrial applications.



HEALTH EFFECTS OF CARBON MONOXIDE

The effect is proportional to the amount and duration of exposure to the petrol. **Carbon monoxide poisoning** is reversible if detected in time. Long-term exposure to low concentrations of carbon monoxide may cause heart disease and nerve damage.

Carbon monoxide is a reproductive poison of category 1. This indicates that the material is recognised to be hazardous to human reproduction; exposure of pregnant women to carbon monoxide may result in reduced birth weight, cardiomegaly (enlarged heart), delays in behaviour development in neonates, and damage to children's nervous systems. The normal concentration of carbon monoxide in the air we breathe is unlikely to be harmful.



HOW TO PREVENT CARBON MONOXIDE EXPOSURE?

- You can reduce the chances of carbon monoxide exposure in your workplace if you:
 - Check your workplace to see if you have any equipment, tools or appliances that produce carbon monoxide.
 - Do not use petrol / diesel powered engines or tools in poorly ventilated areas, inside buildings or in partially enclosed areas unless:
 - The engines can be located outside with at least a metre of clear space all around, in order to ensure adequate ventilation. Ensure that the engine is also situated away from air intakes, for instance air conditioning intakes and air vents;
 - An effective ventilation system that will remove carbon monoxide from work areas has been installed.
 - Ensure appropriate hazard warning labels are placed on any equipment, tools or appliances likely to produce carbon monoxide.
 - Change from petrol / diesel powered equipment to equipment powered by electricity, batteries or compressed air, provided it can be used safely.
 - Maintain and service equipment and appliances. Ensure that equipment is installed and maintained by a competent person.
 - Ensure that existing vents are working and are not blocked.



CEMENT

Sources

- Construction Activities
- Repairing activities
- Demolition Activities



Overseas Industrial Technical Institute
version 1.3



**LEARNING
PARTNER**

GOLD

1584



HEALTH EFFECTS FROM CEMENT EXPOSURE

- major skin issues like dermatitis and burns.
- skin or allergy issues
- The nature of wet cement is rather alkaline. If it is pressed up against the skin, a severe burn or ulcer
- Chemical burns to the eyes
- Dermatitis is also brought on by cement
- Due to sensitization, this can result in allergic contact dermatitis



CONTROL MEASURES

Train: Workers need to know how to use the controls properly. They also need to be aware of the signs and symptoms of dermatitis. Finding skin problems early can stop them from getting too bad.

Supervise: Ensure that controls such as work methods, PPE and welfare are effective and used by the workers.

Monitor: To ensure that your controls are successfully preventing dermatitis, appropriate health surveillance is required. A "responsible person," who can be an employee with the proper training, could carry out this task.

They should:

- assess the condition of a new worker's skin before, or as soon as possible after, they start work and then periodically check for early signs of skin disease after this
- keep secure health records of these checks
- tell the employer the outcome of these checks and any action needed



SILICA

Silica is a naturally occurring material present in variable proportions in the majority of rocks, sand, and clay. For instance, sandstone has around 70% silica, but granite may have between 15% and 30%. Moreover, construction materials such as bricks, tiles, concrete, and mortar contain significant amounts of silica.

You generate dust from these materials during many common construction tasks. These include cutting, drilling, grinding and polishing. Some of this dust is fine enough to get deep into your lungs. The fine dust is known as respirable crystalline silica (RCS) and is too fine to see with normal lighting. It is commonly called silica or silica dust.



Overseas Industrial Technical Institute
version 1.3



HEALTH EFFECTS

- After asbestos, silica poses the greatest risk to construction workers. Lung cancer and other dangerous respiratory conditions can be brought on by prolonged and heavy exposure to RCS. Almost 500 construction workers died in 2005, according to figures ordered by HSE. Silica is connected to a number of significant lung conditions in addition to the risk of lung cancer:
- **Silicosis** raises the risk of lung infections and can lead to serious breathing difficulties. RCS exposure often results in silicosis over a number of years, while acute silicosis can develop relatively quickly from excessively high exposures.
- Bronchitis and emphysema are among the lung disorders that make up chronic obstructive pulmonary disease. It causes chronic impairment, severe dyspnea, and protracted coughing. It is a leading cause of death and can be severely disabling. According to estimates, COPD caused by prior job exposures results in about 4000 annual fatalities. Within this, construction workers represent a sizable at-risk category.
- **Lung cancer:** RCS exposure that is severe and sustained can result in lung cancer. Lung cancer risk is higher for those who already have silicosis. When dust exposure is appropriately regulated, the health hazards from RCS can almost fully be avoided; you do not need to get sick while performing work-related duties.



CONTROL MEASURES

Employers must comply with The Control of Substances Hazardous to Health Regulations 2002 (COSHH) (as amended) and need to:

- assess the risks to your health – this is called a 'risk assessment';
- keep a written record of the risk assessment if they employ more than five people;
- tell you anything significant about the risk assessment;
- consider where practicable substituting material with a lower RCS content;
- prevent or control exposures to RCS by:

— Implementing adequate control measures – more advice can be found in HSE's COSHH essentials ;

— for RCS, control measures must be effective in keeping exposure below the Workplace Exposure Limit (WEL) (0.1 mg/m³ respirable dust, averaged over 8 hours);

- where necessary, provide you with personal protective equipment, including respiratory protective equipment (RPE), when the risk cannot be controlled by engineering controls alone;
- maintain all equipment used as control measures in good working order;
- instruct and train you to use equipment properly, and tell you about health risks;
- monitor to ensure that controls are effective and that the WEL for RCS is not exceeded, (this may include measurement of the dust levels in your work area);
- where appropriate arrange health surveillance.



WOOD DUST

Dusts made from hardwood or softwood during work procedures can be harmful to your health. Sanding machines, for example, can produce unusually high volumes of dust. Some materials used in processing, such as preservatives, adhesives, or surface coatings containing formaldehyde, solvents, or heavy metals like arsenic, may produce aerosols and/or vapours when employed in woodworking.





HEALTH EFFECTS

- Exposure to wood dusts may lead to irritation or inflammation of the respiratory tract (e.g. rhinitis or runny nose, sneezing), asthma or cancer (particularly sino-nasal).
- Allergic reactions and irritation can lead to dermatitis from exposure to fine wood dust of certain species.



CONTROL MEASURES

It is the employer's responsibility to assess the risks and level of protection necessary in the workplace. Various different levels of protection may be required depending on the scenario. The following precautions could be taken:

- No consumption of food or drink where work is being carried out.
- Do not launder any protective clothing or PPE at home.
- Engineering control measures such as automating timber treatment processes.
- Good personal hygiene should be practiced and separate storage areas to prevent the contamination of work clothing to regular clothing
- The work environment should be well ventilated - dust control equipment should be used such as local exhaust ventilation (LEV) for effective control of dust at source.
- Use a suitable vacuum system/cleaner to clear up dust regularly.
- Particulate respirators won't offer protection against gases and vapours; a combination filter would be needed to provide sufficient protection if such substances are present. Respiratory protective equipment (RPE) should have at least a P2 particulate filter fitted to a half or full face mask in order to provide effective protection and be CE marked.
- Any RPE worn should be properly fit tested



END OF SESSION QUIZ

1. Which of the following defines a 'Carcinogen'?

(Choose the correct option)

1. Exposure to which can lead to genetic changes
2. Exposure to which can lead to Cancer



END OF SESSION QUIZ

Which of the following is a chemical Agent?

(Choose the correct answer)

1. Legionella
2. Cement dust



END OF SESSION QUIZ

What does LEV stand for?

(Choose the correct option)

1. Local Exit Vent
2. Local Exhaust Ventilation



END OF SESSION QUIZ

Which of the following is an example of LEV system?
(choose the correct option)

1. Captor hoods
2. Windows and vents



END OF SESSION QUIZ

'Asbestos dust' is a Carcinogen

(Choose the correct answer)

1. True
2. False