

COSHH AS LABORATORY SAFETY STANDARDS IN CONTROL OF SUBSTANCES HAZARDOUS TO HEALTH

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ABSTRACT:

COSHH is the law that requires employers to control substances that are hazardous to health. You can prevent or reduce workers exposure to hazardous substances by: finding out what the health hazards are, deciding how to prevent harm to health, providing control measures to reduce harm to health, making sure they are used, keeping all control measures in good working order, providing information, instruction and training for employees and others, providing monitoring and health surveillance in appropriate cases, planning for emergencies. Most businesses use substances, or products that are mixtures of substances. Some processes create substances. These could cause harm to employees, contractors and other people. Sometimes substances are easily recognised as harmful. Common substances such as paint, bleach or dust from natural materials may also be harmful. Laboratory Safety Standards are in use in clinical and chemical labs, testing labs and research and development labs in industry and educational facilities. Lab safety standards pertain to clothing and equipment as well as procedures and lab design. Standards are obtained from International Organization of Standardization (ISO); International Safety Equipment Association (ISEA); ASTM International (ASTM); International Electro technical Commission (IEC); British Standards Institution (BSI); Laser Institute of America (LIA); Clinical and Laboratory Standards Institute (CLSI); Standards Australia (SAI); and American Industrial Hygiene Association (AIHA). There are many new laboratory safety standards introduced each year. Many important laboratory safety standards have been categorized below. There are many other laboratory safety standards that can be found by using a keyword or document number search: Protective Clothing, Hand/Eye Protection, Equipment Safety, Laser Safety, Laboratory Testing and Management and Laboratory Design and Procedures.

KEYWORDS: Toxic, Very Toxic, Harmful, Irritant, Highly Flammable, Extremely Flammable, Explosive, Environmental pollutant, Oxidizing, Corrosive

INTRODUCTION:

The Control of Substances Hazardous to Health Regulations 2002 is a United Kingdom Statutory Instrument that states general requirements on employers to protect employees and other persons from the hazards of substances used at work by risk assessment, control of exposure, health surveillance and incident planning. There are also duties on employees to take care of their own exposure to hazardous substances and prohibitions on the import of certain substances into the European Economic Area. The regulations reenacted with amendments the Control of Substances Hazardous to Work Regulations 1999 and implement several European Union Directions. Breach of the regulations by an employer or employee is a crime, punishable on summary conviction with a fine of up to £400. If convicted on indictment in the Crown Court, an

offender can be sentenced to an unlimited fine. Either an individual or a corporation can be punished and sentencing practice is published by the Sentencing Guidelines Council. Enforcement is the responsibility of the Health & Safety Executive or in some cases, local authorities.

Where a person suffers damage caused by a breach of a dot imposed by regulations, they have a cause of action in tort against the offender.



Figure-1: COSHH

The **regulations** are complementary to the Chemicals (Hazard Information and Packaging for Supply) Regulations 2002 (CHIPs) which require labeling of hazardous substances by suppliers. There are other regulations concerning the labeling and signage of pipes and containers and from 2008 a further level of control mechanism on dangerous chemicals will be added by the EU regulation on Registration, Evaluation and Authorization of Chemicals (REACH). The Control of Substances Hazardous to Health (COSHH) regulations have been in place for more than 20 years and the scientific evidence suggests that over this time industry has, in general, been consistently reducing exposure to hazardous substances.¹



Figure 2: Symbols of safety in laboratory

EUROPEAN LEGISLATION IMPLEMENTED:

The **regulations** implement the following European Union (EU) directives:

- Council directive 78/610/EEC, on the approximation of the laws, regulations and administrative provisions of EU member states on the protection of the health of workers exposed to vinyl chloride monomer;
- Council Directive 89/677/EEC, art.1(3) the importation, supply or use of benzene and substances containing benzene, amending the Marketing and Use Directive, 76/796/EEC;

- In part, Commission directive 96/55/EC, the second adaptation to technical progress of the Marketing and Use Directive;

- Individual directives under 89/391/EEC, Art.16(1):
 - Council Directive 90/394/EEC, on the protection of workers from risks related to exposure to carcinogens at work, insofar as it relates to carcinogens other than asbestos;
 - Council Directive 98/24/EC, on the protection of the health and safety of workers from risks related to chemical agents at work, insofar as it relates to risks to health from exposure to substances other than asbestos or lead; and
 - European Parliament and Council Directive 2000/54/EC, on the protection of workers from risks related to exposure to biological agents at work.

The **regulations** are consistent with Commission Directive 91/322/EEC requirements on indicative limit values. Import is prohibited into the UK, other than from another EU member state or member of the European Economic Area:

- 2-naphthylamine, benzidine, 4-aminodiphenyl, 4-nitrodiphenyl, their salts and any substance containing any of those compounds in a total concentration equal to or greater than 0.1% by mass;
- Matches made with white phosphorus.

Contravention is an offence under the Customs and Excise Management Act 1979 rather than health and safety regulations.²

Supply prohibited

Supply is prohibited, during the course of work or for use at work:

- Any of the substances whose import is prohibited;
- Benzene and any substance containing benzene in a concentration equal to or greater than 0.1% by mass, but excluding:
 - Motor fuels covered by Council Directive 85/210/EEC;
 - Waste covered by Council Directive 75/442/EEC.

Prohibited for specified purposes

Use of the following substances is prohibited for the purposes specified:

Substance	Prohibited for specified purposes
<ul style="list-style-type: none"> • 2-naphthylamine; • Benzidine; • 4-aminodiphenyl; 4-nitrodiphenyl; —their salts and any substance containing any of those compounds, in a total concentration equal to or greater than 0.1% by mass.	Manufacture and use for all purposes, including any manufacturing process in which such a substance is formed.
Sand or other substance containing free silica.	Use as an abrasive for blasting articles in any blasting apparatus.

<p>A substance: Containing compounds of silicon calculated as silica to the extent of more than 3% by weight of dry material, other than natural sand, zirconium silicate, calcined china clay, calcined aluminous fireclay, sillimanite, calcined or fused alumina, olivine; or Composed of, or containing, dust or other matter deposited from a fettling or blasting process.</p>	<p>Use as a parting material in connection with the making of metal castings.</p>
<p>Carbon disulphide</p>	<p>Use in the cold-cure process of vulcanisation in the proofing of cloth with rubber.</p>
<p>Oils other than white oil, or oil of entirely animal or vegetable, or mixed animal-vegetable, origin.</p>	<p>Use for oiling the spindles of self-acting spinning mules.</p>
<p>Ground or powdered flint or quartz other than natural sand.</p>	<p>Certain uses in the manufacture and decoration of pottery (slops or pastes permitted for some purposes).</p>
<p>Dust or powder of a refractory material containing not less than 80% of silica other than natural sand.</p>	<p>Use for sprinkling the moulds of silica bricks, namely bricks or other articles composed of refractory material and containing not less than 80 per cent of silica.</p>
<p>White phosphorus</p>	<p>Manufacture of matches</p>
<p>Hydrogen cyanide</p>	<p>Fumigation except where certain specified precautions are taken.</p>
<p>Benzene and any substance containing benzene in a concentration equal to or greater than 0.1% by mass, but excluding: Motor fuels covered by Council Directive 85/210/EEC; Waste covered by Council Directive 75/442/EEC.</p>	<p>Use for all purposes except: Industrial processes; and Research and Development or for the purpose of chemical analysis.</p>
<p>Chloroform (CAS No. 67-66-3); Carbon tetrachloride (CAS No. 56-23-5); 1,1,2-Trichloroethane (CAS No. 79-00-5); 1,1,2,2-Tetrachloroethane (CAS No. 79-34-5); 1,1,1,2-Tetrachloroethane (CAS No. 630-20-6);</p>	<p>Supply for use at work in diffusive applications such as in surface cleaning and the cleaning of fabrics except for the purposes of research and development or for the purpose of analysis.</p>
<p>Pentachloroethane (CAS No. 76-01-7); Vinylidene chloride (CAS No. 75-35-4); 1,1,1-Trichloroethane (CAS No. 71-55-6); — and any substance containing one or more of those substances in a concentration equal to or greater than 0.1% by mass, other than: Medicinal products; Cosmetic products.</p>	

Table 1: List of hazardous materials

Exceptions

The following are excluded from the operation of regulations 6 to 13 concerning the general process for management and control of hazardous substances:

- Circumstances covered by the:
 - Coal Mines (Respirable Dust) Regulations 1975;
 - Control of Lead at Work Regulations 2002;

- Control of Asbestos Regulations 2012;
- Substances hazardous to health solely by virtue of their radioactive, explosive or flammable properties, or solely because they are at high or low temperature or high pressure;
- Risks arising solely from medical or dental treatment.³



Figure 3: COSHH awareness

REQUIREMENTS OF RISK ASSESSMENT:

Regulation 6 requires that an employer not carry out work liable to expose employees and non-employees, such as members of the public to a substance hazardous to health without a risk assessment and implementation of the steps necessary to comply with the **regulations**. The assessment must include consideration of any information provided by the supplier of a substance (CHIPS) and must be reviewed regularly and also when there is reason to think the assessment is no longer valid, if the system of work is changed or if necessary because of the results of health monitoring. The assessment must also consider any occupational exposure limit, in particular, those mandated by the HSE.⁴

PREVENTION OR CONTROL OF EXPOSURE:

Regulation 7 requires that an employer prevent exposure to hazardous substances or, if this is not reasonably practicable, that he adequately controls exposure.

USE OF CONTROL MEASURES:

Employers must take all reasonable steps to ensure that control measures and any necessary equipment of facilities, are properly used or applied. Employees must use the control measures properly, return them after use and report any defective equipment.

MAINTENANCE AND TESTING OF CONTROL MEASURES:

Regulation 9 requires that employers maintain control measures in efficient working order and in good repair.

MONITORING EXPOSURE:

Where the risk assessment indicates that workplace monitoring of exposure is necessary, the employer must perform such monitoring unless he can demonstrate another means of preventing or controlling exposure. Monitoring must be at regular intervals in addition to when a change occurs that may affect exposure.⁵ There is mandatory monitoring:

Substance or process	Minimum frequency
Vinyl chloride monomer	Continuous or in accordance with a procedure approved by the HSE
Spray given off from vessels at which an electrolytic chromium process is carried on, except trivalent chromium	Every 14 days

Table 2: Organic hazards

EXPOSURE MONITORING:

There are many methods for monitoring a person’s exposure to inhalation risks; the most common is to use personal air sampling pumps. These are usually flow controlled, rechargeable pumps worn by the operator, which pull a known volume of air through a sampling media such as filters or charcoal tubes. Pumps are generally worn for 8 hours or for a full working shift. The sample media is then sent for weighing if sampling for simple dusts, or for more in depth analysis via accredited laboratory.⁶

Regulation 11 requires that health surveillance of employees is carried out where:

- An identifiable disease or adverse health effect may be related to the exposure;
- There is a "reasonable likelihood" that the disease or health effect may occur under the particular conditions of work;
- Valid techniques exist for detecting indications of the disease or health effect; and
- The technique presents a low risk to the employee; or where there is exposure to any of the following substances in the specified occupations:

HEALTH SURVEILLANCE:

Substance	Process
Vinyl chloride monomer	Manufacture, production, reclamation, storage, discharge, transport, use or polymerisation
Nitro or amino derivatives of phenol and of benzene or its homologues	Manufacture of nitro or amino derivatives of phenol and of benzene or its homologues, and the making of explosives with the use of any of these substances
Potassium chromate, potassium dichromate, sodium chromate or sodium dichromate	Manufacturing
Ortho-tolidine, dianisidine and dichlorobenzidine, and their salts	Manufacturing
Auramine and magenta	Manufacturing
Carbon disulphide, disulphur dichloride, benzene, including benzol, carbon tetrachloride and trichlorethylene	Processes in which these substances are used, or given off as vapour, in the manufacture of India rubber or of articles or goods made wholly or partially of India rubber
Pitch	Manufacture of blocks of fuel consisting of coal, coal dust, coke or slurry with pitch as a binding substance

Table 3: Hazardous chemicals in pilot plant use

INFORMATION, INSTRUCTION AND TRAINING:

Regulation 12 demands that all employees liable to exposure to hazardous substances are provided with suitable and sufficient information, instruction and training, including:

- Details of the hazardous substances including:
 - Names of substances and the risk that they present to health;
 - Any relevant occupational exposure standard, maximum exposure limit or similar occupational exposure limit;
 - Access to any relevant safety data sheet;
- Other legislative provisions which concern the hazardous properties of those substances;
- Significant findings of risk assessment;
- Appropriate precautions and actions to be taken by the employee in order to safeguard himself and other employees at the workplace;

- Results of any monitoring of exposure and, in particular, in the case of a substance hazardous to health for which a maximum exposure limit has been approved, the employee or his representatives shall be informed forthwith, if the results of such monitoring show that the maximum exposure limit has been exceeded; and
- Collective results of any health surveillance undertaken in a form calculated to prevent those results from being identified as relating to a particular person.

Some biological agents can cause severe human disease and be a serious hazard to employees. Further diseases may be likely to spread to the community and there may be no effective prophylaxis or treatment available. Where employees are working with such an agent, or material that may contain such an agent, they must be provided with written instructions and, if appropriate, notices must be displayed that outline the procedures for handling such an agent or material.⁷

ACCIDENTS, INCIDENTS AND EMERGENCIES:

Regulation 13 requires that employers prepare for possible accidents, incidents and emergencies involving hazardous substances by:

- Preparing emergency procedures, including provision of first aid;
- Making available technical information on possible accidents and hazards and bringing it to the attention of the emergency services; and
- Installing alarms and other warnings and communication systems.

FUMIGATION:

Regulation 14 requires that appropriate warning notices are affixed to premises that are to be fumigated with hydrogen cyanide, phosphine or methyl bromide. In most cases, notice must be given to any harbour authority in whose area the fumigation is to take place.⁸

EXEMPTIONS:

The HSE may issue certificates of exemption to certain employers so long as they are satisfied that the health and safety of workers will not be compromised. The Secretary of State for Defence may issue certificates of exemption on the grounds of national security to the UK and visiting armed forces.

RECORD KEEPING:

An employer with five or more employees must record the results of the risk assessment.

REGULATIONS ON LABELLING OF CONTAINERS AND PIPES:

- Chemicals (Hazard Information and Packaging for Supply) Regulations 2002 (CHIP)(SI 2002/1689);
- Health and Safety (Safety Signs and Signals) Regulations 1996 (SI 1996/341);
- Radioactive Material (Road Transport) Regulations 2002 (SI 2002/1093);
- Carriage of Dangerous Goods by Rail Regulations 1996 (SI 1996/2089);
- Packaging, Labeling and Carriage of Radioactive Material by Rail Regulations 2002 (SI 2002/2099);
- Carriage of Dangerous Goods (Classification, Packaging and Labeling) and Use of Transportable Pressure Receptacles Regulations 1996 (SI 1996/2092);
- Carriage of Explosives by Road Regulations 1996 (SI 1996/2093);
- Carriage of Dangerous Goods by Road Regulations 1996 (SI 1996/2095); and
- Good Laboratory Practice Regulations 1999 (SI 1999/3106).⁹

LABORATORY SAFETY:

All students must read and understand the information in this document with regard to laboratory safety and emergency procedures prior to the first laboratory session. **Your personal laboratory safety depends mostly on YOU.** Effort has been made to address situations that may pose a hazard in the lab but the information and instructions provided cannot be considered all-inclusive.

Students must adhere to written and verbal safety instructions throughout the academic term. Since additional instructions may be given at the beginning of laboratory sessions, it is important that all students arrive at each session on time.

With good judgement, the chance of an accident in this course is very small. Nevertheless, research and teaching workplaces (labs, shops, etc.) are full of potential hazards that can cause serious injury and or damage to the equipment. Working alone and unsupervised in laboratories is forbidden if you are working with hazardous substances or equipment. With prior approval, at least two people should be present so that one can shut down equipment and call for help in the event of an emergency. Safety training and/or information should be provided by a faculty member, teaching assistant, lab safety contact, or staff member at the beginning of a new assignment or when a new hazard is introduced into the workplace.¹⁰

EMERGENCY RESPONSE:

1. It is your responsibility to read safety and fire alarm posters and follow the instructions during an emergency.
2. Know the location of the fire extinguisher, eye wash, and safety shower in your lab and know how to use them.
3. Notify your instructor immediately after any injury, fire or explosion, or spill.
4. Know the building evacuation procedures.

COMMON SENSE:

Good common sense is needed for safety in a laboratory. It is expected that each student will work in a responsible manner and exercise good judgement and common sense. If at any time you are not sure how to handle a particular situation, ask your Teaching Assistant or Instructor for advice. **DO NOT TOUCH ANYTHING WITH WHICH YOU ARE NOT COMPLETELY FAMILIAR!!!** It is always better to ask questions than to risk harm to yourself or damage to the equipment.¹¹

PERSONAL AND GENERAL LABORATORY SAFETY:

1. Never eat, drink, or smoke while working in the laboratory.
2. Read labels carefully.

3. Do not use any equipment unless you are trained and approved as a user by your supervisor.
4. Wear safety glasses or face shields when working with hazardous materials and/or equipment.
5. Wear gloves when using any hazardous or toxic agent.
6. Clothing: When handling dangerous substances, wear gloves, laboratory coats, and safety shield or glasses. Shorts and sandals should not be worn in the lab at any time. Shoes are required when working in the machine shops.
7. If you have long hair or loose clothes, make sure it is tied back or confined.
8. Keep the work area clear of all materials except those needed for your work. Coats should be hung in the hall or placed in a locker. Extra books, purses, etc. should be kept away from equipment that requires air flow or ventilation to prevent overheating.
9. Disposal - Students are responsible for the proper disposal of used material if any in appropriate containers.
10. Equipment Failure - If a piece of equipment fails while being used, report it immediately to your lab assistant or tutor. Never try to fix the problem yourself because you could harm yourself and others.
11. If leaving a lab unattended, turn off all ignition sources and lock the doors.
12. Never pipette anything by mouth.
13. Clean up your work area before leaving.
14. Wash hands before leaving the lab and before eating.

ELECTRICAL SAFETY:

1. Obtain permission before operating any high voltage equipment.
2. Maintain an unobstructed access to all electrical panels.
3. Wiring or other electrical modifications must be referred to the Electronics Shop or the Building Coordinator.
4. Avoid using extension cords whenever possible. If you must use one, obtain a heavy-duty one that is electrically grounded, with its own fuse, and install it safely. Extension cords should not go under doors, across aisles, be hung from the ceiling, or plugged into other extension cords.
5. Never, ever modify, attach or otherwise change any high voltage equipment.
6. Always make sure all capacitors are discharged (using a grounded cable with an insulating handle) before touching high voltage leads or the "inside" of any equipment even after it has been turned off. Capacitors can hold charge for many hours after the equipment has been turned off.
7. When you are adjusting any high voltage equipment or a laser which is powered with a high voltage supply, USE ONLY ONE HAND. Your other hand is best placed in a

pocket or behind your back. This procedure eliminates the possibility of an accident where high voltage current flows up one arm, through your chest, and down the other arm.

MECHANICAL SAFETY:

1. When using compressed air, use only approved nozzles and never directs the air towards any person.
2. Guards on machinery must be in place during operation.
3. Exercise care when working with or near hydraulically- or pneumatically-driven equipment. Sudden or unexpected motion can inflict serious injury.

CHEMICAL SAFETY:

1. Treat every chemical as if it were hazardous.
2. Make sure all chemicals are clearly and currently labelled with the substance name, concentration, date, and name of the individual responsible.
3. Never return chemicals to reagent bottles. (Try for the correct amount and share any excess.)
4. Comply with fire regulations concerning storage quantities, types of approved containers and cabinets, proper labelling, etc. If uncertain about regulations, contact the building coordinator.
5. Use volatile and flammable compounds only in a fume hood. Procedures that produce aerosols should be performed in a hood to prevent inhalation of hazardous material.
6. Never allow a solvent to come in contact with your skin. Always use gloves.
7. Never "smell" a solvent!! Read the label on the solvent bottle to identify its contents.
8. Dispose of waste and broken glassware in proper containers.
9. Clean up spills immediately.
10. Do not store food in laboratories.

LASERS SAFETY:

1. NEVER, EVER LOOK INTO ANY LASER BEAM, no matter how low power or "eye safe" you may think it is.
2. Always wear safety goggles if instructed by your Instructor or Teaching Assistant.
3. The most common injury using lasers is an eye injury resulting from scattered laser light reflected off of mountings, sides of mirrors or from the "shiny" surface of an optical table. The best way to avoid these injuries is to always wear your goggles and NEVER LOWER YOUR HEAD TO THE LEVEL OF THE LASER BEAM! The laser beam should always be at or below chest level.
4. Always use "beam stops" to intercept laser beams. Never allow them to propagate into the laboratory. Never

walk through a laser beam. Some laser beams of only a few watts can burn a hole through a shirt in only a few seconds.

5. If you suspect that you have suffered an eye injury, notify your instructor or teaching assistant IMMEDIATELY! Your ability to recover from an eye injury decreases the longer you wait for treatment.

ADDITIONAL SAFETY GUIDELINES:

- Never do unauthorized experiments.
- Never work alone in laboratory.
- Keep your lab space clean and organized.
- Do not leave an on-going experiment unattended.
- Always inform your instructor if you break a thermometer. Do not clean mercury yourself!!
- Never taste anything. Never pipette by mouth; use a bulb.
- Never use open flames in laboratory unless instructed by TA.
- Check your glassware for cracks and chips each time you use it. Cracks could cause the glassware to fail during use and cause serious injury to you or lab mates.
- Maintain unobstructed access to all exits, fire extinguishers, electrical panels, emergency showers, and eye washes.
- Do not use corridors for storage or work areas.
- Do not store heavy items above table height. Any overhead storage of supplies on top of cabinets should be limited to lightweight items only. Also, remember that a 36" diameter area around all fire sprinkler heads must be kept clear at all times.
- Areas containing lasers, biohazards, radioisotopes, and carcinogens should be posted accordingly. However, do not post areas unnecessarily and be sure that the labels are removed when the hazards are no longer present.
- Be careful when lifting heavy objects. Only shop staff may operate forklifts or cranes.
- Clean your lab bench and equipment, and lock the door before you leave the laboratory.¹²

CONCLUSION:

COSHH, known as the Control of Substances Hazardous to Health Regulations, are intended to protect people from ill health caused by exposure to hazardous substances. The Regulations require employers to: assess the risks to health and safety, decide what precautions are needed to prevent ill health, prevent or control exposure, make sure that the control measures are used and maintained monitor exposure and carry out health surveillance if appropriate, ensure that all employees are properly informed, trained and supervised.

WHAT IS A HAZARDOUS SUBSTANCE?:

Chemicals - classified under 'Chemicals (Hazard Information and Packaging for Supply) Regulations' and are identified by orange hazard warning symbols on the container e.g. very toxic, toxic, harmful, corrosive etc. Be careful with containers that are not marked! Any substance that has been assigned a workplace exposure limit (previously Occupational Exposure Standard - OES's and Maximum Exposure Limit - MEL's), Dusts can become hazardous in concentrations in air greater than 10 mg/m³ inhaled dust, or 4 mg/m³ of respirable dust. Biological agents such as bacteria, viruses, fungi and parasites, Asphyxiants such as carbon dioxide and nitrogen, Carcinogens such as tobacco smoke or radon gas.

ROUTES OF ENTRY INTO THE BODY:

Inhalation - breathing in vapours, gasses, dusts and fumes, Ingestion - eating or drinking substances or foods, contaminated by hazardous substances, On or through the skin - contact with the skin can cause harm to the skin or substances can be absorbed into the body through the skin causing harm to internal organs, Eyes - contact with the eyes by fumes, vapours, liquids and dusts, Injection - liquids, solids or gasses through the skin either by puncture wounds or through cuts.

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