

'COSHH' refers to the 'Control of Substances Hazardous to Health' Regulations as updated periodically. This Note replaces the EHSC booklet 'COSHH in Laboratories' (first published in 1989 and revised in 1996). Although primarily intended for RSC members it should also be useful to others who manage or are employed in laboratories. It should be used to supplement HSE's 'COSHH Essentials' and Guidance Notes. It should also be read in conjunction with the relevant Regulations and Approved Codes of Practice.

HSE's COSHH Essentials was built on the RSC booklet. In turn this Note follows the protocol laid out in COSHH Essentials and gives additional guidance on how to apply it in laboratories.

The term 'laboratory' covers a very wide spectrum of function, size and complexity. In general the more complex the work of a laboratory the greater the number of hazardous substances involved (often including those of unknown toxicity) but the greater the level of staff skills available.

1. BACKGROUND

COSHH is designed to protect people against risks to health arising from work-related exposures to hazardous substances. It requires assessment and control of risks before any work is undertaken. Anyone in charge of, or working in a laboratory should be familiar with COSHH and actively involved in implementing it.

COSHH must always be approached in the context of the broader requirements of the Health & Safety at Work etc Act and the Management of Health and Safety at Work Regulations 1999 (MHSW). The latter place a general duty on employers to assess and control the overall risks to health and safety posed by their activities, including any that arise from the use of chemical and biological substances. The health aspects of this duty are covered by COSHH. Further information is given in the EHSC Note on Risk Assessment at Work.

2. ASSESSMENT AND CONTROL OF RISK

The basic requirement of COSHH is to assess the health risks from work activities that involve substances hazardous to health so that appropriate control measures can be identified and provided before work begins. For this purpose risk is the chance of harm occurring and is a function of both hazard and exposure.

Hazard: Substances hazardous to health as defined by COSHH include chemicals classified by the Chemicals (Hazard Information and Packaging for Supply) Regulations 2002 (CHIP) as irritant, harmful, toxic (includes sensitisers and carcinogens) and corrosive. Biological agents and dusts are also included within COSHH, but are not within the scope of this Note. Chemicals classified as flammable, oxidizing, and explosive are not covered by COSHH, but by other legislation such as The Dangerous Substances and Explosive Atmospheres Regulations (2002) (see also the EHSC Notes on Environmental Risk Assessment and Fire Safety in Laboratories for further information).

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Version 4: 290808

Exposure is the extent to which people come into contact with the substance. A highly hazardous substance presents a very low risk if it is securely contained with no likely exposure. Conversely a substance of relatively low hazard may present unacceptable risks if extensive exposure can occur. Both hazard and exposure must be considered before the risk can be adequately assessed and suitable controls defined.

At its simplest, a COSHH assessment seeks to answer four questions:

- What adverse health effects could occur and at what exposure levels? (the hazards)
- What is the likely exposure? (in specific work activities)
- What is the chance of harm? (the magnitude of the risk)
- What needs to be done? (to prevent or control the risk).

3. ASSESSMENT PROCEDURE

Experience shows that adequate assessment of health risks is best achieved by reviewing the principal tasks and considering the associated hazards and likely exposures. The procedure described below uses the steps described in COSHH Essentials. It takes a generic approach to both hazards and exposures, grouping them into broad categories which can then be combined to indicate the degree of risk and thus the appropriate level of control.

Step 1. Getting Started: What Are The Tasks In The Laboratory?

The starting point is to list the laboratory tasks and associated hazards. Tasks should be grouped in general categories depending on the type of work carried out by the laboratory. Typical laboratory tasks include preparation of samples for analysis, preparation of reagent solutions, solvent extraction, cleaning of glassware and maintenance of equipment. Trivial risks can be identified from the nature of the hazard and the likely degree of exposure and the associated tasks omitted from the list.

Ancillary work such as collecting and disposing of laboratory waste, and cleaning and maintenance of buildings and facilities should always be considered. Such activities often give rise to significant risks especially to contractors and visitors who are likely to be less familiar with the work of the laboratory.

All relevant details should also be recorded including the name of the assessor and the date of the assessment.

Step 2. Factors That Decide The Control Approach

What are the chemical hazards involved?

It should be possible to use:

- Risk Phrases from 'CHIP' [the Chemicals (Hazard Information and Packaging for Supply) Regulations] which are given on labels and safety data sheets, and
- the table provided in COSHH Essentials step 2A to assign most substances involved in a task to one of six toxic hazard categories:

A = low (e.g. R36 Irritating to eyes)

B = moderate (e.g. R20 Harmful by inhalation)

C = significant (e.g. R23 Toxic by inhalation)

D = high (e.g. R26 Very toxic by inhalation)

E = special, including substances of extreme hazard (e.g. R45 may cause cancer)

S = substances causing harm in contact with skin and eyes.

For substances and mixtures that don't have CHIP Risk Phrases other sources of information should be used to determine suitable hazard categories. These include:

- in-house and third party experience and data
- advice from suppliers
- technical and scientific literature (books, journals etc.)
- guidance from HSE and other authoritative bodies such as learned societies, professional institutions and trade associations
- specialist occupational health consultants.

For tasks that involve several substances some of which may change from day to day the overall hazard category should be based on the most hazardous component.

Substances of unknown toxicity require careful consideration. They should be treated as 'high' hazard [i.e. category D] unless there is a reason to treat them as 'special' hazards [i.e. category E]. Reasons might include structural analogy with a substance already in category E. Not all substances assigned to Category E will necessarily be rated 'extremely hazardous' but the nature of their hazards (carcinogenicity, mutagenicity, reproductive toxicity, respiratory sensitisation etc.) will always require an individual assessment of any work with them.

What are the likely exposures?

Having rated the hazards it is necessary to consider the likely exposures arising from the tasks. There are many ways of doing this. One approach is to consider how much of a given substance is being used (small, medium or large amounts) and how dusty or volatile the substance is (low, medium or high). Specific task information will also need to be taken into account such as the potential for generating aerosols or dusts, the duration and frequency, the number of people exposed and the workplace or process conditions (e.g. temperature or pressure). In many cases such decisions require only information readily available from suppliers' data sheets. COSHH Essentials gives guidance on making the decision. The exposure of susceptible persons also needs to be considered within the assessment (such as young persons or new and expectant mothers; refer to the relevant RSC Notes).

Step 3. Determine the Control Approach

The aim of COSHH is to eliminate exposure to substances harmful to health so far as reasonably practicable, or where this is not possible "adequate control" is required.

Adequate control is defined under COSHH as:

- (a) The principles in Schedule 2A are applied, in summary these are:
 - Minimise emission and spread
 - Take into account all exposure routes
 - Control by the most effective measures proportionate to health risk
 - Personal protective equipment (PPE) is used where adequate control cannot be achieved by other means
 - Provide information and training
 - Control measures do not increase the overall risk
- (b) The **Workplace Exposure Limit (WEL)** is not exceeded. This is an exposure concentration in air (mg/m^3 or ppm) averaged over either 15 minutes (STEL) or 8 hours (LTEL) which must not be exceeded. Limits are available for commonly used chemicals and solvents only
- (c) Exposure to carcinogens (R45, 46, 49) or asthmagens (R42, 42/43) must be reduced to as low a level as reasonably practicable.

In order to achieve adequate control, the following hierarchy should therefore be considered:

- Eliminate or substitute (e.g. use a less hazardous material or a less hazardous form)
- Reduce (e.g. reduce quantities or reduce the exposure time)
- Isolate (e.g. within a fume cupboard)
- Systems of work (written procedures for safe operation)
- Personal protective equipment (e.g. safety glasses)
- Information, instruction, training and signage

In many laboratory situations elimination or substitution are impracticable and some form of exposure attenuation is required.

This is usually achieved by some form of engineering control supplemented by procedural controls as appropriate. The control approach needed depends on the level of risk associated with the task. This is estimated from the quantities involved and their dustiness or volatility. COSHH Essentials suggests four

control regimes. In laboratories these equate to:

- none (i.e. open bench working with general ventilation, COSHH Essentials Approach 1)
- intermediate (fume cupboard or other exhaust ventilation, Approach 2)
- high (glove box or similar containment, Approach 3)
- special (purpose-designed facility, Approach 4).

Step 4. Which Controls Are Required?

Having decided which control approach is needed, specific control measures can then be selected. Such control measures are intended to provide protection from exposure by inhalation and additional measures may be required to control risks arising from skin contact with substances in hazard group S.

Controlling the risks of skin contact from substances in Hazard Group S in COSHH Essentials may require other measures such as gloves, screens to prevent splashing, or remote handling equipment, together with suitable procedures to mitigate the effects of any accidental exposure (such as instruction on appropriate decontamination and/or antidotes).

Eye protection should always be worn in chemical laboratories. This is particularly important with substances labelled as R34 or R35 (corrosive), R41 (risk of serious damage to eyes) or R36 (irritating to eyes).

The procedure described above is suitable only for tasks involving potential exposure to substances in the low, moderate, significant and high hazard categories (A, B, C and D). Tasks involving substances in the special Category E must always be assessed separately and appropriate controls adopted.

Step 5. Implementation and Review

Assess other chemicals, tasks and unplanned events

Substances to consider when assessing laboratory tasks include reaction intermediates, effluents and wastes in addition to more obvious reagents, products and samples. Risks arising from cleaning materials and substances used in maintenance (such as lubricants, paints and adhesives) should also be assessed, as should substances whose composition may change during use (e.g. oils in vacuum pumps). It is important to remember that the properties of mixtures and preparations may differ from those of their components.

The assessments described above cover risks to health from normal chemical laboratory activities. However the possibility of chemical exposures from unplanned events such as spillages, equipment failure, fire and explosion should also be anticipated and suitable arrangements made.

Planning

Having determined which controls are required they should be compared with what is already available and plans made for appropriate improvement action if required. It is essential to define responsibilities for the implementation of COSHH (and all other relevant legislation) in a particular laboratory. These should be stated clearly in the laboratory safety policy. Persons appointed to carry out specific tasks need to be 'competent' as defined by COSHH, i.e. they should have the necessary skills, knowledge, practical experience and training. They do not need to be experts but must recognise their limitations and know when to call on specialist expert advice from inside or outside the organisation. The RSC EHSC Note 'COSHH, the Competent Person' gives further information.

Safety and environmental risks

Risks from hazards such as high pressure, reactive, flammable or radioactive substances and biological agents also need to be addressed separately and proper provision made, as should risks to the environment outside the laboratory (See EHSC Note on Environmental Risk Assessment, 2008).

Consider other aspects of COSHH

The need for exposure monitoring or health surveillance should be considered as well as whether employees and any others at risk have been given suitable information, instruction and training.

Exposure monitoring

Personal exposure monitoring provides a check on the continued effectiveness of controls and usually involves repeated measurements in an on-going programme. It is of limited value in most laboratories but it is required when shown to be necessary by the assessment.

The need for monitoring [dermal, airborne], number, frequency and type of measurements depend both on the hazards involved and the likely magnitude, frequency and duration of exposure. In general, the greater the risk from a specific chemical in a particular workplace the greater the need for monitoring to ensure the continued effectiveness of control measures. Tasks involving significant potential exposure to substances of high hazard rating are particularly likely to require exposure monitoring (at least until an adequate baseline is obtained).

Measurement of airborne concentrations of hazardous substances in the individual's breathing zone provides an indication of personal exposure by inhalation only. However, such measurements do not show any additional exposure that may occur by other routes such as skin absorption or ingestion which is a potentially significant risk in many laboratories. In such circumstances additional forms of monitoring may be needed (such as biological monitoring described below)

Where monitoring is required, laboratory management is responsible for ensuring that it is carried out properly by competent persons. Monitoring programmes should be established and supervised by suitably qualified persons. Any analysis required should be carried out by validated methods. The results of any monitoring should be reported to both laboratory management (who are responsible for any remedial action) and to the relevant employees or their representatives. Results of atmospheric monitoring are usually compared with workplace exposure limits [WEL's] such as those as listed in HSE Guidance Note EH40.

In order to estimate the total exposure, it may be necessary to carry out some form of biological monitoring. This may involve measurements of agents or their metabolites in biological samples such as blood, urine or exhaled air. Biological monitoring results should be kept confidential to the individuals concerned and their respective managers. Records should be kept as indicated in the COSHH Approved Code of Practice, related as appropriate to records of any health surveillance (see below) and thus capable of contributing to employee work histories.

Any monitoring of biological effects is properly part of health surveillance and all results should be treated as medical in confidence.

Health surveillance is intended to identify the current health status of an individual or group so that suitable control measures can be implemented if necessary.

COSHH requires employers to ensure that employees who may be exposed to substances hazardous to health are placed under suitable health surveillance where the risk assessment indicates that:

- this is appropriate for the protection of their health; and
- appropriate health surveillance methods are available

Advice on the need for health surveillance should be obtained from a suitably qualified health professional, ideally an occupational health physician.

Information, instruction and training

Information, instruction and training is required for all persons who may be exposed to substances hazardous to health so that they know the risks to health and the precautions needed to prevent harmful effects.

Information about hazards, risks and appropriate precautionary measures should be authoritative, understandable and accessible to everyone potentially exposed to the substances, including contractors and visitors to the laboratory.

Instruction means telling people how to use and maintain control measures and what to do in emergency and other unplanned events. Where individual actions are critical in the control of risks, clear instructions should be given, preferably in writing (as approved procedures or standing instructions).

Training involves showing employees and others how they should put information and instruction into practice. It should be carefully targeted at the needs of trainees to ensure that they understand the hazards and risks and are competent to carry out the necessary instructions. It is essential that training is completed before people are exposed to hazardous substances.

All information, instruction and training should be kept up to date and regularly reviewed, revised and provided as necessary.

Use and maintenance of control measures

Management must provide and maintain control measures and ensure they are used. Employees and others at risk must use the controls provided. They must practice a high standard of personal hygiene and inform management of any observed defects in the equipment, facilities or procedures. Management must ensure that any reported defects are investigated promptly and suitable action taken, including advising employees of the outcome of the investigation.

Having identified and installed appropriate control measures, laboratory management must ensure they are properly used and maintained in order to provide adequate protection. All controls (both engineering and procedural) must be checked regularly and maintained or updated to ensure their effectiveness. Maintenance of contaminated equipment itself requires a COSHH assessment.

Routine checks on controls should be part of the normal daily or weekly tasks of designated laboratory staff. To facilitate checking, equipment such as ventilated hoods and fume cupboards should be fitted with simple visual indicators of effective operation (e.g. air flow indicators or differential pressure gauge). Any necessary repairs or maintenance should be initiated immediately and actions recorded.

All engineering controls require thorough examination and testing at least once every fourteen months. This must be carried out by competent persons with appropriate specialist knowledge and suitable records should be kept (the data to be recorded are defined in the COSHH ACoP).

Where respiratory protective equipment (RPE) is required for control of exposure it must also be inspected and maintained and suitable records kept [unless disposable RPE is provided].

It is essential to define responsibilities for the implementation of COSHH and other relevant legislation in a particular laboratory. These should be stated clearly in the laboratory safety policy. Persons appointed to carry out specific tasks need to be 'competent' as defined by COSHH.

Records and Review

Assessments should be recorded and reviewed periodically; at least every two years for high risks and every five years for others. Assessments should also be reviewed after accidents or incidents, when new information is available, or before significant changes are made. Records of assessments should be kept local to the units involved and must be available to people potentially exposed and to their representatives where appropriate.

Employers are required to keep suitable records of any examinations and tests carried out on control measures and of any repairs done as a result of such examinations and tests. Records (or suitable summaries) must be kept available for at least five years.

Employers are required to keep suitable records of any monitoring carried out, and records or summaries must be kept for at least:

- 40 years, where they represent personal exposures of identifiable employees
- 5 years in other cases.

However the RSC recommends that all records should be kept for at least 40 years.

Where health surveillance is required employers must ensure that health records of the employees involved are made and that records or copies are kept for at least 40 years from the date of the last entries made.

The provision of individual information, instruction and training (including the level of competence achieved, retraining and associated schedules) should also be recorded.

4. ACTION CHECKLIST

Step 1 Getting Started – What Are The Tasks In The Laboratory?

- Record scope of assessment (who by, what of, when)
- List significant laboratory tasks
- List substances involved

Step 2 Factors That Decide the Control Approach

- What are the hazard categories (A, B, C, D, E alone or with S) associated with each task?
- What quantity of each substance is being used (small-mg, medium-g or large-kg amounts)? How dusty or volatile is the substance (low, medium or high)? What are the likely exposures? What are the specific task factors that could effect risk (e.g. generation of dusts/aerosols, duration/frequency, process temperature)

Step 3 Determine the Control Approach

- none (i.e. open bench working with general ventilation, COSHH Essentials Approach 1)
- intermediate (fume cupboard or other exhaust ventilation, Approach 2)
- high (glove box or similar containment, Approach 3)
- special (purpose-designed facility, Approach 4)
- if necessary for substances with hazard rating S add personal protective equipment (PPE) for eyes and skin. PPE may also be required for inhalational protection in some situations.

Step 4 Decide the Specific Controls Required

Refer to COSHH Essentials Control Guidance Sheets 100, 200, 300 or 400 series for Control Approaches 1, 2, 3 and 4. Also Control Guidance Sheet S100 and S101 for protection of Skin and Eyes

Step 5 Implement and Review

- Assess other tasks and related risks
- Planning (programme and resources needed)
- Consider safety and environmental risks
- Consider other aspects of COSHH - monitoring, health surveillance and training
- Use and maintenance of control measures (including regular checks and reporting defects)
- Records and review.

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