Guidance for Working with Hazardous Substances

Hazardous substances are those that present:

- Health hazards - chemical or biological
- Physical hazards - fire, explosion, radiation
- Environmental hazards - harmful effect to the environment, e.g. to plants or animals, watercourses etc.

There is a considerable range of legislation applying to hazardous substances.

Legislation concerning hazardous substances

General
Management of health and safety at work regulations 1999 - requirement for risk assessment.

Health hazards

- COSHH
- Asbestos
- Lead

Physical hazards

- Ionising Radiation
- Highly Flammable Liquids and Liquefied Petroleum Gasses
- Petroleum Consolidation Act

Supply/transport

- CHIP (Chemicals - Hazard Information and Packaging)
- Carriage of Dangerous Goods by Road
- Carriage of Dangerous Goods (Classification, Packaging and labelling)…
- Carriage of Dangerous Goods by Road (Driver Training)
- Transport of Dangerous Goods (Safety Advisor)

Environmental hazards

- Food and Environmental Protection Act
- Control of Pesticides
- Environment Protection Act

As a user of hazardous substances the principal legislation to be complied with is the Control of Substances Hazardous to Health Regulations 2002 (amended 2004). The intention behind these regulations is that work processes using hazardous substances are examined to identify whether the substance is sufficiently controlled to prevent those

exposed to it (the workers, passers by, cleaners) from suffering harm. This is in effect a chemical, or more correctly a substance (since things wider than just chemicals are covered), risk assessment.

The COSHH regulations were first introduced in 1988 and were the first set of regulations to bring risk assessment to a wide section of employment (there were similar requirements under lead and asbestos regulations introduced shortly before COSHH but these covered a narrow section of employers).

COSHH focuses on the health aspect of substances hazardous properties. It must be remembered that substances may also pose other hazards such as high flammability or radioactive emissions. The general duty under the Management of Health and Safety at work regulations requires that these aspects are also assessed for risk. It is not necessary to carry out more than one set of assessments so the COSHH aspects can be incorporated into the overall process risk assessment.

Duties on suppliers of hazardous substances

The starting point for controlling the safe use is the information known about the nature of the hazards associated with the substances. Suppliers of hazardous substances are subject to the Chemicals (Hazard Information & Packaging) Regulations. These regulations require suppliers of chemicals, including preparations such as commercial cleaning materials, to:

- Identify the hazards of the substances i.e. classification.
- Provide information to the recipient on these hazards
- Package the substances safely - i.e. secure package and packaging, hazard labelling.

The above requirements are called the "supply requirements". There are also "carriage requirements" that relate to how the substances are transported by road or rail (Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2004).

The CHIP Regulations require that package labels should contain the following information:

- Hazard warning symbols (maximum of two);
- Risk and Safety phrases (up to 4 of each);
- The names of high hazard ingredients;

The hazard and risk phrases are standardised and give simple information about the hazards and safety precautions appropriate to the chemical. The classification process outlined in the regulations leads to the selection of the relevant phrases. Many commonly substances have already been classified and appear in the Approved Supply List – an extensive listing that is regularly updated. This directs the supplier to labelling information that must be used. Where substances or preparations (i.e. mixtures) do not appear in the Approved Supply List then the material must be classified in accordance with the specified procedure.

Recipients of hazardous substances should be provided with safety data sheets on the occasion of the first supply of the product. Suppliers are also obliged to provide further copies on request. The content of the safety data sheets is prescribed in the regulations, hence their standard format.

The duties on suppliers under the CHIP Regulations apply to substances that are to be used in a work activity where these are either:

a. Sold/purchased
b. Commercial samples
c. Transferred from one site to another, whether or not in the same ownership. Substances moved around within any site are outside the scope of the regulations.

The key aspects are the arrangements for ensuring safe use, i.e. identification of hazards and controls under COSHH and risk assessment. For purchased chemicals the use of original containers and copies of the data sheet would suffice. For research products risk assessment and liaison between the parties is essential to ensure that sufficient information and a suitable package is used.

Safe use of hazardous substances
The CHIP Regulations should ensure that the user of the material is aware of its hazardous properties. The Control of Substances Hazardous to Health Regulations (COSHH) relate to the way in which the substance is to be used and requires interpretation of the information obtained under CHIP in the context of the way the substance is to be used.

COSHH requires the health risks for the work activity to be assessed to enable the right controls to be put into place before the work commences. Although COSHH only relates to the health risks the risk assessment requirement under the Management Regulations will extend this to considering the physical risks and it is appropriate to consider all these as part of an assessment for the use of a hazardous substance.

The regulations define a substance (including any preparation) hazardous to health as:

- A substance listed in the Approved Supply List, under the CHIP regulations, as dangerous for supply and which is indicated in that list as either very toxic, toxic, harmful, corrosive or irritant.
- A substance that is subject to a workplace exposure limit (these are published by the HSE)
- A biological agent, i.e. micro-organism, cell culture, human endoparasite (including genetically modified variants) that might cause ill health including through infection, allergy or toxicity.
- Any dust present at a substantial concentration in air,
- Any other substance not covered by the above but that may present similar hazards.

A substance is defined as any natural or artificial substance whether solid, liquid, gaseous or as a vapour.

Hazardous substances therefore include those used directly in the process (chemical reagents, adhesives, paints, cleaning agents etc), substances generated during the process (welding or soldering fumes, gaseous reaction products given off, dust form machining processes, and naturally occurring substances such as grain dust.

The health effects arising from hazardous substances include:

- Skin irritation or dermatitis form skin contact,
- Asthma as a result of developing an allergy to airborne sensitising agents,
- Loss of consciousness from exposure to toxic fume,
- Cancer (long lag time),
- Infection,
- Poisoning,
- Chronic damage to particular organs e.g. liver or lungs through solvent exposure.

The key requirements under COSHH are as follows:

Assessment of health risks created by work involving substances hazardous to health (regulation 6)
An assessment of the health risks must be carried out before the work commences and the assessment must be reviewed regularly or if it seems that it may no longer be valid or the process has changed significantly.

The purpose of the assessment is to enable a valid decision to be made about:

- the measures needed to control exposure and to demonstrate (to staff, HSE etc) that a logical and sufficiently extensive evaluation has been made and appropriate conclusions drawn as to the risks,
- the adequacy of existing controls and the need for additional controls,
- any requirements for routine monitoring and
- The need for health surveillance.

The assessment must be carried out by someone competent, i.e. the right amount of knowledge and experience of the process and the substances' hazardous properties. It may be necessary to involve more than one person in the assessment process or consult with specialists.

The assessment should consider:

- Which substances or types of substance those working with it may be exposed to (including the consequences of possible failures of control measures),
- What effects those substances can have on the body,
- Where the substances are likely to be present and in what form,
- The ways in which exposure might occur and the extent of such exposure.
- The way in which the work is done and the implications arising from deterioration in, or reasonably forseeable failure of, control measures needs to be taken into account,
- Estimation of exposure given existing procedural and engineering controls, Comparison of the estimates of exposure and the performance of controls against recognised standards.

- Identify additional measures that need to be taken to achieve a satisfactory level of control.
- The issuing of personal protective equipment is a measure of last resort having implemented all reasonably practical engineering solutions.

The rules for the assessment are:

1. Assess the procedure not the substance;
2. Identify those steps with a potential for harmful exposures;
3. Justify the use of the substance – is a lower hazard alternative available?
4. Evaluate the precautions in place;
5. Identify further measures needed;

It is possible to assess on the basis of generic hazards, i.e. groups of substances used in a process that have similar hazardous properties (corrosive liquid; carcinogenic dust).

Health risks could occur through inhalation, ingestion, inoculation or skin absorption. Processes creating airborne exposures will require greatest consideration since the control measures may be more complex and the extent of potential exposure more difficult to evaluate. When in doubt it is often easier to assume a risk and look to controlling that rather than attempting to assess quantitatively the exposure levels. Other exposure routes are easy to identify and protect against, e.g. chance of spillage and skin contact with controls being use of protective clothing and good hygiene practice.

Recording of assessments
In the simplest and most obvious cases that can be repeated and explained at any time, an assessment need not be recorded. Where the assessment is difficult and/or complex, written assessments are required. Examples would include processes where sampling of dust, vapour etc. levels were needed; a lot of background information was collated to support an evaluation as to whether a risk was or was not involved or a systematic approach was needed due to:

- the complexity of the procedure;
- the range of substances used;
- the range of hazards posed by a substance;
- the number of different controls involved;
- the range of persons who could be affected.

Written assessments are not needed for many simple operations since these can easily be repeated and explained, e.g. single stage with a single substance or operation. However, written safety instructions will be needed. The aim is that the assessment should demonstrate how the hazards from the process have been controlled and where these controls are procedural then written protocols need to be available. These define the hazards of the activity, the key hazard stages and the precautions to be followed. They can be incorporated into the operating procedure or experimental protocol.

By taking an activity-based approach and targeting the generic risks associated with that risk, it should be sufficient for there to be a small number of procedures-specific assessments and protocols for any section/work area. One problem encountered in the early days of the regulations (and by no means totally corrected even now!) was to carry

out a vast range of substance assessments and believe that this had dealt with the requirement. In fact these were often a regurgitation of the material safety data sheets and failed to address the risks arising from the substances actual use, i.e. relating the hazardous properties to exposure routes, taking into account the relative harm based on the amount and duration of exposure.

The protocol format should identify:

1. The hazardous substances involved by generic hazard;
2. How exposures could arise;
3. How exposure is prevented - containment, local exhaust ventilation, personal protective equipment;
4. What adverse situations could arise and how to deal with them;
5. What checks and maintenance of equipment or PPE is needed, i.e. how often, by whom, availability of replacements;
6. Where health surveillance is necessary this should be indicated.

Pre-purchase checks
Since it is the intention of the COSHH Regulations and risk assessment requirements of the Management Regulations that any controls have been identified before work commences, then an important check can be made prior to obtaining the substance. The ordering procedure can include evidence of a COSHH assessment to check that the necessary safeguards are available before the material is obtained.

Prevention or control of exposure to substances hazardous to health (Regulation7)
The exposure of those working with substances hazardous to health is required to be prevented, or where this is not reasonably practicable, adequately controlled.

The first priority is prevention of exposure, for example by;

- changing the method of work so that operations that give rise to the exposure no longer occur,
- modifying the process so that the generation of hazardous by-products or waste is eliminated,
- substituting a hazardous substance with one of no, or less, hazard. Care is needed as a potential substitute may be much less toxic but considerably more flammable so the overall risk needs to be considered.

If prevention cannot be achieved then control, other than through the issue of PPE, must be achieved. The range of measures includes;

- Total enclosure of the process,
- Plant, processes or procedures that minimise the creation of, or suppress or contain the substance (gas, fume, dust etc),
- Partial enclosure with local exhaust ventilation (LEV),
- LEV,
- Good general ventilation,
- Restriction of access, reduce the number of people exposed,
- Reduce exposure time,

- Contamination control, e.g. regular cleaning,
- Safe storage and disposal arrangements,
- Good personal hygiene, i.e. washing facilities; clothes changing and storage; laundering of contaminated clothes; no eating, drinking etc.; eating facilities.

Adequate control against inhalation
Where the substance has a Workplace Exposure Limit (WEL) then this limit must not be exceeded, and in the case of carcinogens, respiratory sensitisers (asthmagens) or specific substances or processes (a small number listed in the Regulations), exposure must be as far below this as it is reasonably practicable to achieve. Limits are usually given as an 8-hour time-weighted average or a short term (15 minutes) time-weighted average.

Workplace Exposure Limits replace the previous terms of Maximum Exposure Limit (MEL) and Occupational Exposure Limit (OEL) in 2005, in effect carrying the numerical values for the limits over.

Adequate control against exposure by other routes
Exposure via skin absorption or ingestion should be controlled to a standard such that nearly all of the population can be repeatedly exposed without any adverse health effect. The potential for exposure via this route is easier to identify. Controls include the design of the plant, contamination control, working practices, hygiene facilities and use of PPE.

Use of Personal Protective Equipment
PPE is acceptable as a last resort only after considering engineering solutions etc. PPE would be appropriate;

- To supplement other controls where these alone are not technically capable of providing sufficient control.
- As an interim measure pending control via other means,
- For "emergency" use such as following plant failure.
- During routine maintenance operations. Exposure should be restricted in terms of those affected and duration minimal.

PPE includes respiratory protective equipment (RPE), clothing, footwear, gloves and eye protection. It needs to be selected on the basis of its resistance to penetration by the substance concerned (some solvents can very quickly pass through some types of rubber but not others hence glove manufacturers have selection charts; different filters are needed in respirators depending upon the chemical characteristics of the substance to be filtered out), the environment in which it is to be worn and its compatibility with other equipment that will also be worn. The Personal Protective Equipment (EC Directive) Regulations 1992 place duties on PPE suppliers to produce equipment that meets specified performance standards and this information is useful in selecting the appropriate items.

RPE with a tight fitting face-piece requires matching to the wearer to ensure a good fit to the face, hence a good seal. The Approved Code of Practice to the COSHH Regulations describes how fit-testing should be carried out.

Use of control measures (regulation 8)
Where control measures are needed they must be used and employees have a duty to correctly use it and report any defects.

Maintenance, examination and testing of control measures (regulation 9)
Measures provided to achieve effective control must be maintained in "an effective state, in efficient working order and in good repair" [N.B. this is the legal definition of properly maintained]. PPE must be kept clean.

Local Exhaust Ventilation (LEV) must be thoroughly examined by a competent person at least once every 14 months. Other engineering controls at appropriate intervals e.g. checks for leakage. Records of these must be kept for 5 years. Aspects to be examined for LEV include:

- Enclosures/hoods – the maximum number in use at any one time; location/position; static pressure behind each hood or extraction point; face velocity,
- Ducting – dimensions; transport velocity; volume flow,
- Filter/collector – specification; volume flow; static pressures at inlet, outlet and across the filter,
- Fan or air mover – specification; volume flow; static pressures at inlet; direction of rotation,
- Recirculating systems – filter efficiency; concentration of contaminant in the return air.

RPE, other than one-shift disposable respirators, is required to be examined at periods of at least once a month, more frequently under severe conditions. However where it is used infrequently against low toxicity substances than the interval may be extended to every 3 months.

Monitoring for exposure at the workplace (regulation 10)
This type of monitoring, for example for airborne concentrations of harmful substances, is required where:

- Failure of the control mechanisms could result in a serious health effect,
- An exposure limit might be exceeded.
- As an additional check on the effectiveness of any controls.
- The process is specified in the schedules to the regulations (vinyl chloride monomer or some types of chromium plating processes.

The records need to be retained for 5 years, or 40 years if they relate to individual personal exposures.

Health Surveillance (regulation 11)
This is required if the process is one of a very small number of prescribed processes, or;

- Exposure is such that an identifiable disease or ill-health effect may be related to the exposure,
- There is a reasonable likelihood that the diseases or effect may occur under the working conditions;

- There are valid means for detecting the effect.

Examples include skin and examinations for ulceration in chrome-plating occupations, or for asthma amongst those working with respiratory sensitisers.

The purpose is to detect illness at an early stage where it is readily amenable to treatment and to assist in evaluating the effectiveness of the control measures. Under some circumstances biological monitoring may be involved e.g. analysing blood or urine samples as an indicator of substance uptake by the body.

Information, instruction and training (regulation 12)
Employees need to be provided with information concerning the risks arising from exposure to the substances being used and the precautions to be taken. The information should also include the findings from workplace monitoring or the collective results from health surveillance.