GUIDELINES ON THE CONTROL OF CHEMICALS HAZARDOUS TO HEALTH

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DEPARTMENT OF OCCUPATIONAL SAFETY AND HEALTH
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PREFACE

These guidelines may be cited as the Guidelines on Control of Chemicals Hazardous to Health (hereinafter referred to as "the guidelines").

The purpose of the Guidelines is to elaborate on and explain the requirements of Regulation 14 to Regulation 19 of the Occupational Safety and Health (U se and Standard of Exposure of Chemicals Hazardous to Health) Regulations 2000 (hereinafter referred to as "the Regulations") which stipulates the duty of employer to take action to control chemicals hazardous to health, through progressive application of control measures in the order of elimination, substitution, isolation, process modification, engineering control, safe work procedure and personal protective equipment which can reduce the exposure level of employees to the lowest practicable level. The Guidelines also recommend, some method of control that have been used widely by the industries world wide.

Employers are advised to follow closely in taking action to control employee's exposure to chemicals hazardous to health. When there is any conflict or inconsistency between the Guidelines and the Regulations, the provisions of the Regulations shall prevail. Employer may choose to interpret the requirements of the Regulations differently but in such a case he has to prove to the Director General of Occupational Safety and Health that his interpretation is in effect, at least on a par with the interpretation given in the Guidelines. The Guidelines must be read in conjunction with the Regulations, the Guidelines on the Inspection, Examination and Testing of Local Exhaust Ventilation System and the Guidelines on Personal Protective Equipment.

These Guidelines will be reviewed from time to time. Employers are welcome to respond with feedback to the Department in writing with a view to making the Guidelines more comprehensive and user-friendly.

Director General
Department of Occupational Safety and Health
Malaysia
2001

GLOSSARY

Approved	Means approved in writing by the Director General.
Assessors	Means an employee or any other person appointed by the employer and registered with the Director General to carry out assessment of risk to health arising from the use of chemicals at work as required by Part IV of the Regulations. Further information please refer to Guidelines on Registration of Assessor, Hygiene Technician and Occupational Health Doctor
Chemical hazardous to health	Means any chemical which is: to health (a) Listed in Schedule I or II, of the Occupational Safety and Health (Use and Standard of Exposure of Chemical Hazardous to Health) Regulations 2000 (b) Possesses any of the properties categorised in Part B of Schedule I of the Occupational Safety and Health (Classification, Packaging and Labelling of Hazardous Chemicals) Regulations 1997; (c) Comes within the definition of "pesticide" under the Pesticides Act 1974; (d) Is listed in the First Schedule of the Environmental Quality (Scheduled Wastes) Regulations 1989.
Engineering Control Equipment	Means any equipment, which is used to control exposure of employees to chemicals hazardous to health and include local exhaust ventilation equipment, water spray or any other airborne chemical removal and containment equipment
Hygiene Technician	Means an employee or any other person appointed by the employer and registered with the Director General to carry out any inspection, examination, or test on engineering control equipment installed in a place of work or to carry out chemical exposure monitoring
Personal Protective Equipment (ppe)	Means all equipment, which is intended to be worn or held by a person at work, which protects him against one or more risks to his health or safety and any addition or accessory designed to meet the objective

TWA	Means an average airborne concentration over a specified period of time
Ceiling limit	Means the airborne concentration that should not be exceeded during any part of the working day
Maximum exposure limit	Means a fifteen-minute time-weighted average airborne concentration which is three times the eight-hour time-weighted average airborne concentration of the chemicals specified in Schedule I
Use	Means production, processing, handling, storage, transport, disposal and treatment

1. INTRODUCTION

The Guidelines provides further information on how to comply with the Occupational Safety and Health (Use and Standard of Exposure of Chemicals Hazardous to Health) Regulations 2000 so as to control chemicals hazardous to health and to eliminate or reduce the actual or potential exposure of employees to chemicals hazardous to health.

Regulation 14 (1) stipulates the duty of the employer to take actions required to eliminate or reduce the actual or potential exposure of an employee to chemicals hazardous to health. These include changes to work processes, practices, procedures, plant or engineering control equipment, within one month after receiving the chemical health risk assessment report from the assessor.

Regulation 14 (2) stipulates the duty of employer to ensure that all control measures implemented under sub regulation (1) reduce the exposure level of employees to chemical hazardous to health to the lowest practicable level. The concentration of chemicals, which have been assigned with permissible exposure limits, have to be reduced below the limits.

The employer shall ensure that all safe work systems and practices are documented, implemented and reviewed whenever there is significant change to the process, equipment, materials or control measures installed.

2. PRINCIPLE OF HEALTH RISK CONTROL

Control measures in occupational health comprise a set of measures and techniques, which aim at the elimination, or reduction of exposures to harmful agents in the working environment. The ultimate objective is the prevention of occupational diseases, illnesses, and adverse health effects and discomfort among workers.

The recognition of occupational hazards involves the determination of potentially harmful agents and associated health effects. The evaluation of occupational hazards involves the determination of the degree and conditions of exposure, as well as the comparison of such data with associated health effects and accepted standards.

Standards for occupational exposure to many common chemicals have been established. It is most appropriate that such standards are translated into control measures at the place of work. To be effective the control of risk must be “practicable” and the exposure be reduced to below the stipulated “permissible exposure limits” or to a level as low as reasonably achievable for those without such limits.

There are four principles that relate to the method that can be used to control hazards:

First principle: all hazards can be controlled in some manner and to some degree.

Second principle: there are usually many alternate methods of control.

Third principle: some methods are better than others

Fourth principle: some situations will require more than one control method to obtain optimum results.

3. "PRACTICABLE"

The term "Practicable" have been used in Regulation 14 with regard to the reduction of exposure to the lowest practicable level. OSH Act 1994 has explained that whether something is "practicable" or not will depend on four factors:

(a) the severity of the hazard or risk in question;

(b) the state of knowledge about the hazard or risk and any way of removing or mitigating the hazard or risk;

(c) the availability and suitability of ways to remove or mitigate the hazard or risk; and

(d) the cost of removing or mitigating the hazard or risk.

4. PERMISSIBLE EXPOSURE LIMIT

Regulation 6 (1) Part III stipulates that an employer shall ensure that the exposure of any person to any chemical hazardous to health listed in Schedule I at no time exceeds the ceiling limit specified for that chemical in that Schedule. Whether a particular permissible exposure limit is exceeded or not should be determined by measurement over an appropriate period of time. The Regulation defined "permissible exposure limit" as a ceiling limit or an eight-hour time-weighted average airborne concentration or maximum exposure limit.

Compliance with a ceiling limit can be assessed by instantaneous monitoring. If instantaneous monitoring is not feasible, then the assessment can be made by sampling over a 15 minutes period except for those substances that may cause immediate irritation when exposures are short.

Excursions above the TLV-TWA should be controlled even where the 8 hour TLV-TWA is within recommended limits. Here the regulations stipulate a maximum exposure limit of three time the TLV-TWA.

Permissible exposure limits do not represent safe levels at which every worker can be guaranteed protection. Therefore it is a good general policy to keep the level of exposure to any chemical as low as is practicable. In the case of carcinogens on which limited epidemiological and animal studies have been done at very low dosage, "no effect" levels of exposure cannot be confidently identified at the present time.

Compliance with the permissible exposure limit should not preclude further efforts to reduce exposure. The absence of a specific permissible exposure limit for a hazardous substance should not be considered an indication that exposure need not be controlled. Where there is no permissible exposure limit, exposure should be controlled to the lowest practicable level. What constitutes the lowest practicable level should be determined during the assessment process and should take into account the factors discussed under paragraph 3.

5. CONTROL MEASURES UNDER REGULATION 15

Application of the hierarchy of control measures involves firstly assessing whether a hazardous chemical or process can be eliminated. Where this is not practicable, consideration should be given to each of the other control measures (isolation, engineering control, safe work practices and use of personal protective equipment) in turn, until a control measure or combination of control measures is identified which can achieve the required reduction in exposure.

5.1 Elimination of Hazard or Risks

Where a work activity or process involves the use of a hazardous chemical that is not essential, the hazardous chemical should be eliminated wherever practicable. Examples of elimination include:

- using a physical process rather than a chemical process to clean an object, for example, ultrasonic cleaning;
- using clips, clamps or bolts instead of an adhesive; and
- purchasing supplies of material in already cut and sized form rather than carrying out dust producing cutting process on site.

5.2 Substitution

Substitution includes substituting a less hazardous chemical for a hazardous one; using chemical, the same chemical in a less hazardous form; or using the same chemical in a less hazardous process. Substitution should be strongly considered for substances that are carcinogenic, toxic to reproduction, allergenic or neurotoxic. This is because there are problems with safe limits, and the traditional control methods of prevention such as personal protective equipment (PPE), industrial ventilation or encapsulation which are currently in practice are not sufficient.

Substitution can take two forms:

- Substitution of materials
- Substitution of process or equipment.

Any one or combination of these forms of substitution may provide a method of control for a given hazard. To obtain optimum result both forms of substitution can be utilised.

Examples of substitution include:

a) Substitution of materials

- replacing a chlorinated degreasing solvent with a detergent;
- using a water-based paint in place of an organic solvent-based paint;.
- using a chemical in paste or pallet form rather than a dusty powder.

b) Substitution of process or equipment

- brush application of paint rather than aerosol application.
- dipping in a paint bath rather than spray painting.

Other examples of substitution are listed in Appendix I.

5.3. Isolation

Isolation involves removing the source of hazard exposure from the workers' environment. This isolation can be accomplished by a number of ways:

- Placing the source in another location where the workers are unlikely to come in contact with it.
- Enclosing or shielding the source with physical barriers.
- Automating the process so that it operates within a closed system or separation of the process from people by distance or the use of barriers to prevent exposure.
- Removal and storage of these materials in a separate location.

Example of isolation techniques that have been used in industry:

- Tank farms that are used for storing toxic or flammable materials in areas separated from the process area.
- Automated processes used in chemical processing and petroleum refining.
- Heat barriers and soundproof enclosures.
- Removal of worker to a control room that is separate from the processing area.

5.4. Engineering Controls

Engineering controls are plant, processes or equipment that minimise the generation of hazardous substances, suppress or contain hazardous substances, or which limit the area of contamination in the event of spill s or leaks. Types of engineering control include enclosure or partial enclosure, ventilation (see details on various categories of ventilation in Appendix II), automation of process, water spray, etc. Some examples of engineering controls are:

- ventilated booths for spray painting or fibre glassing;
- robot welding
- local extraction systems attached to grinding machines;
- automation of the removal of objects from degreasing baths; and
- closed reaction vessels.

Local exhaust ventilation system. Please refer to clause 5.8 for further explanation on this topic.

5.5 Safe Work System and Practices

5.5.1 Safe Work System

Safe work system is a formal work procedure that results from systematic examination of a task in order to identify all hazards. It defines safe methods to ensure that hazards are eliminated or risks are minimised. Safe work systems are integration of men, machinery and materials in the correct environment to produce the safest possible conditions in a specific work area. In a workplace a safe work system shall comprise fully documented hazard precautions and safe working conditions that is used in job training. Safe system of work is part of the employer's general duties under Section 15 of OSH Act.

5.5.2 Steps to safe system of work

i Assess the task
ii Identify the hazards
iii Define safe methods
iv Implement the system
v Monitor the system

5.5.3 Assessing the task

i What is used
ii Who does what
iii Where the task is carried out
iv How the task is done

5.5.4 Component of safe system of work

i People
ii Machinery, Plant, Equipment
iii Materials
iv Environment
v Place of work

5.5.5 Defining safe methods

i Consider the preparation and authorisation needed at the start of the job
ii Ensure clear planning of job sequence
iii Specify safe work methods
iv Include mean of access and escape if relevant
v Consider the task of dismantling, disposal etc. at the end of the job

5.5.6 Monitoring the system

Monitoring means periodically checking:

i That employees continue to find the system workable
ii That the procedure laid down in your system of work are being carried out and are effective
iii That any changes in circumstances, which require alteration to the system of work, are taken into account.

5.5.7 Forms of safe work system according to risk situation

Safe work system can be in the form of verbal instructions for low risk situations or it may be in the form of a formalised permit to work system for high-risk situations. Below is the hierarchy of control according to the level of risk encountered:

Permit to work
Locking off/Locked out
Safe operating procedure
Rules and procedures
Verbal instructions

High risk
↑
↓
Low risk

a) Permit to work

Permit to work system is a safety control system designed to prevent injury or damage when undertaking work of foreseeable high hazard content. It is a written system detailing out the work to be done and the precautions to be taken. This permit to work system is used for work to be done in the following situations:

i Confined Spaces
ii Hazardous Areas
iii Hot Work
iv Interrupting Supplies
v Isolated location or at depth of height

Permit to work should

i Define the work to be done
ii Say how to make the work area safe
iii Identify any remaining hazards and the precautions to be taken
iv Describe checks to be carried out before normal work can be resumed
v Name the person responsible for controlling the job

Jobs likely to need a permit to work system

i Working in confined spaces
ii Hot work on plant containing flammable material or residue of these
iii Cutting into pipe work containing hazardous substances
iv Work on electrical equipment

b) Locking off/Locked out

Locking off means machine is put to a safe condition by a person or persons about to make adjustments or perform certain maintenance functions.

c) Safe operating procedure

Safe operating procedure is a written system, detailing step-by-step instruction on how to perform a task safely.

Component of safe operating procedure

i Work procedure to carry out task.
ii Precautionary measures to be taken before. during and after performing the task.
iii Emergency procedure e.g durig spills and leak of chemical what are the actions to be taken.
iv PPE and safety equipment to be used when carrying out the task.

5.5.8 Safe Work Practices

Safe work practices are administered practices, which require people to work in a safer ways. Examples of safe work practices include:

- Good housekeeping and personal hygiene;
- Reducing the period of exposure for employees, through reducing exposure time and reducing the number of workers exposed;
- Regular cleaning of contamination from walls and surfaces;

- Providing means of safe storage and disposal of hazardous chemicals;
- Prohibiting eating, drinking and smoking in contaminated areas;
- Vacuuming dust from areas where dust generating processes take place;
- Keeping lids on containers when not in used; and
- Providing and using facilities for effective decontamination.

For further examples of good work practices please refer to OSHA Technical Manual, Section V: Chapter 3 website: http://www.osha-slc-.gov/dts/osta/otm/otm_v/otm_v_3.html

5.6 Provision of Personal Protective Equipment (PPE)

Minimisation of risks through the provision and use of PPE is usually seen as a "last resort" or "last line of defence" approach in that they are least preferred over the other control methods due to problems associated with workers' compliance and co-operation. For personal protective equipment to be effective in protecting the worker from a specific chemical substance, it must be properly worn continuously when work involving the chemical is being carried out. Brief lapse in wearing the protectors will result in exposure or contact with the hazardous chemical. Regulation 16 (1) stipulates the use of PPE under the following conditions:

- The application of control measures in sub-paragraph 5.3to 5.5 would be impractical; or
- As an interim measure while other preferred control measures are being designed and installed; or
- The measures taken to comply with the Regulation do not adequately control an employee's exposure to chemicals hazardous to health.

The use of PPE as a control measure shall be limited to situations where other control measures are not practicable or where PPE is used in conjunction with other measures to increase protection.

Situations where use of suitable personal protective equipment may be necessary include:

i. Where it is not technically feasible to achieve adequate control by other means. In these cases, exposure shall be reduced as far as practicable by other measures and then, in addition, suitable personal protective equipment should be used to secure adequate control;

ii. Where PPE is necessary to safeguard health until such time as adequate control is achieved by other means, for example, where urgent action is required because of plant failure; or

iii. During routine maintenance operations where the infrequency and small number of people involved any take other control measures practicable.

The basic categories of PPE that are available are:

i Protection from inhalation of hazardous materials.

ii Protection from skin contact.

iii Protection of the eyes from contact with hazardous materials.

iv Protection of ears from hazardous exposure.

v Protection from traumatic injury to a body part.

vi Protection from thermal.

vii Protection from traumatic injury to a body part.

Where PPE is used employers should ensure that it is:

i. Properly selected for the individual and task;

ii. Readily available;

iii. Clean and functional;

iv. Correctly used when required; and

v. Maintained by appropriately trained staff in accordance with PPE maintenance and servicing program.

vi. Employees are given training on the use and shelf life of PPE. Emphasis should be given to the most critical part of the respiratory and dermal protection i.e the shelf life of chemical cartridge respirators, maintenance, servicing and proper storage procedure.

PPE shall be chosen from the list approved by the Department which are categorized as follows:

i. Respiratory protection, including air-purifying respirators, air-supplied respirators, and self contained breathing units. Respiratory protection for processes related to asbestos process, lead process and mineral dust process shall be selected under JKJ IH 127/12/2-1- "Senarai Kelengkapan Perlindungan Pernafasan Yang Di Luluskan Di Bawah Peraturan-Peraturan Kilang dan Jentera (Habuk Galian) 1989, (Proses Asbestos) 1984, (Proses Timah Hitam) 1986" .

ii. Ear protection including plugs and ear muffs shall be selected under JKJ IH 127/12/1 - "Senarai Perlindungan Pendengaran Yang Di Luluskan Di Bawah Peraturan- Peraturan Kilang Dan Jentera (Pendedahan Bising) 1989".

iii. Eye protection including safety glasses, goggles, face shields and hoods shall comply with internationally acceptable standard.

iv. Skin protection including gloves, suits and apron shall comply with internationally acceptable standard.

v. Head protection shall comply with MS 183:1983 Specification for Industrial Safety Helmets.

vi. Other protection including safety shoes, diving suits and environmental control suits and in some emergency situations more speciallised PPE may be required. These PPE shall comply with internationally acceptable standard.

Employers and supplier of PPE are adviced to make reference to "Panduan Mengemukakan Permohonan Bagi Kelulusan Alat-Alat Mengukur Bising, Kelengkapan Pelindung Pendengaran dan Kelengkapan Perlindungan Pernafasan" – JKKP:GP(BM)5/98 for approved PPE intended for mineral dust, asbestos and lead exposure.

5.7 Maintenance of Effective Control

5.7.1 The employer shall ensure that all control measures perform as originally intended and continue to prevent or adequately control exposure of employees to hazardous substances. Maintenance on a regularly scheduled basis for a potentially hazardous operation is a must. If the worker is to be protected, the system must operate as it was designed to operate. A properly maintained equipment will avoid the exposure of a worker to hazard.

5.7.2 Regulation 17 (1) (a) stipulates that engineering control provided shall be inspected at an appropriate interval by the employer which shall not be longer than one month.

5.7.3 Where engineering control measures are used to control exposure, they should be thoroughly examined and tested at specified intervals to ensure effective performance. Regulation 17 (1) (b) stipulate that examined and tested for its effectiveness by a hygiene technician at an appropriate interval which shall not be longer than twelve months.

5.7.3 In the case of PPE usage, it shall be well maintained and cleaned, as well as routinely inspected. There must be facilities for cleaning and disinfecting PPE. If the equipment become deteriorated (e.g. crack, missing pieces, etc.) it shall be totally or partially replaced.

5.8 Local Exhaust Ventilation (LEV) System

5.8.1 General

Ventilation is a useful method for controlling the air quality and the thermal exposure that the workers encounters. Ventilation can be used to remove air pollutants from the breathing zone of the workers. It can also be used to condition the air for worker comfort. In addition, ventilation systems can be designed to supply air to assure the proper operation of any local exhaust system in used.

LEV is used to remove contaminants that are generated at a local source. Air is drawn from a source at a rate capable of removing any air contaminants generated at that source before they can be dispersed into the work environment. It generally

include as components the hood, duct, an air mover, an a vent or outlet. It also must provide the necessary control of the contaminant -laden air at the source. Because air is drawn into the hood from all points around the hood face, the hood must be relatively close to the source.

5.8.2 Design, Construction and Commissioning of LEV

Legal Requirements

Any local exhaust ventilation equipment installed shall be:

- designed according to an approved standard by a professional engineer and constructed according to the design specifications; and

- tested by a professional engineer after construction and installation to demonstrate that the equipment meets the design specification.

Design and Construction of Exhaust Hood

The initial point of entry of the contaminant into the local exhaust ventilation system is at the hood. The exhaust hood which may consist of only a simple round or rectangular opening or which may be specially designed to provide the necessary velocity of air at the point of contamination to control the contaminant and draw it into the system. Proper design of exhaust hood is crucial in the operation of a local exhaust ventilation system. If the contaminant is not initially controlled, then the local exhaust system will not perform its desired function.

There are basically three types of exhaust hoods that can be installed (see Figure 1, Appendix II)

a) Enclosure hood - the source is either totally or partially enclosed, and adequate velocity is supplied to prevent the escape of the contaminant from the enclosure.

b) Capture hood - the hood is installed exterior to and away from the source of contaminant. Adequate velocity is provided to capture the contaminant at its farthest distance from the hood and draw the contaminant into the hood. The velocity is called the “capture velocity” of the hood.

c) Receiving hood - as the name applies, the receiving hood receives the contaminant that is generated at the source. The contaminant has a motion that has been imparted upon it by the process. In order for the receiving hood to function properly, it must provide an adequate rate of flow to remove the contaminant from the hood as it is received to assure that the spillover of the contaminant does not occur. In addition, a receiving hood must also provide the capture velocity that is required to control contaminants not directed at the hood itself.

Capture Velocity

The capture velocity is the velocity that is necessary to control the contaminant at its farthest distance from the hood is determined by considering the following:

i The velocity and direction of release of the contaminant.
ii The quantity of contaminant that is released in a given period of time.
iii Secondary air currents that will affect the capture of the contaminant.
iv The toxicity of the contaminant.
v The size of the exhaust hood that can be used.
vi The potential points of the contaminant escape.

Practical experience has identified certain guidelines that can be set for determining the capture velocity in a given situation. These guidelines are summerised in Table 1, Appendix II.

5.8.3 Testing, Inspection, Examination and Maintenance

A hygiene technician is to conduct examination and testing on LEV installed in a place of work at an appropriate interval, which shall not be longer than twelve months. For details please refer to the Guidelines on the Inspection, Examination and Testing of Exhaust System.

5.8.4 Records of Design, Construction, Testing, Inspection, Examination and Maintenance

Records regarding the design, construction, testing, inspection, examination, testing and maintenance of LEV equipment shall be maintained by the employer and shall be produced for inspection when so directed by the Director General. LEV shall be inspected at an appropriate interval by the employer which shall not be longer than one month.

5.9 Control of Carcinogens

5.9.1 General

Chemical substances which have been identified as suspected or established carcinogens, or substances associated with industrial processes which have been identified as suspected or established carcinogens, Schedule II Regulation 27(2) and classified as carcinogens in Classification Packaging and Labelling (CPL) of Hazardous Chemicals Regulations 1997.

5.9.2 Prevention or control of exposure to carcinogens

Where assessment shows that it is not reasonably practicable to prevent exposure to a carcinogen by using an alternative substance or process, adequate control of exposure to the carcinogen shall be achieved by the application of the following measures:

a) the total enclosure of the process and handling systems unless this is not reasonably practicable;

b) plant, processes and systems of work which minimise the generation of, or supress and contain, spills, leaks, dust, fumes and vapours of carcinogens;

c) limitation of quantities of a carcinogen at the place of work;

d) keeping the number of persons who might be exposed to a carcinogen to a minimum;

e) prohibiting eating, drinking and smoking in areas that might be contaminated by carcinogens;

f) the provision of hygiene measures including adequate washing facilities and regular cleaning of walls and surfaces;

g) the designation of those areas and installations which may be contaminated by carcinogens, and the use of suitable and sufficient warning signs;

h) the safe storage, handling and disposal of carcinogens and use of closed and clearly labelled containers.

5.9.3 Provision of PPE

Where the measures taken in accordance with a) to h) do not prevent, or provide adequate control of, exposure to carcinogens to which those paragraphs apply, then in addition to taking those measures, the employer shall provide those employees with such suitable personal protective equipment as will adequately control their exposure to carcinogens. PPE supplied shall be in accordance to clause 5.6.

5.9.4 Administrative measures

In the event of failure of a control measure which might result in the escape of carcinogens in the workplace, the employer shall ensure that;

a) only those persons who are responsible for carrying out of repairs and other necessary work permitted in the affected area and they are provided with suitable respiratory protective equipment and protective clothing; and

b) employees and other persons who may be affected are informed of the failure forthwith.

6 OTHER CONTROL MEASURES

6.1 Monitoring

6.1.1 General

Monitoring involves the use of valid and suitable techniques to derive a quantitative estimate of exposure of employees to hazardous substances. For airborne contaminants, monitoring involves the periodic and/or continuous

sampling of workplace atmospheres to derive quantitative measures of exposure to hazardous substance through inhalation. For this sort of monitoring to be of value in risk assessment, there must be a relevant exposure standard against which to compare the results obtained. For the purpose of monitoring a standard method of analysis which is approved by the Department.shall be used.

Monitoring may be required as part of the assessment of risk where it is necessary to obtain a quantitative estimate of exposure or to determine the effectiveness of measures introduced to control exposure.

6.1.2 Legal Requirement

Regulation 26 (1) stipulates where an assessment of risk to health indicates that monitoring of exposure is required or it is requisite for ensuring the maintenance of adequate control of the exposure of employees to chemicals hazardous to health, the employer shall ensure that the exposure of the employees to chemicals hazardous to health is monitored in accordance with an approved method of monitoring and analysis.

If the level of atmospheric contamination routinely approaches the relevant exposure standard, there should be a review of the control measures to ensure that exposure is controlled as far as practicable. Regulation 26 (2) stipulates that if an employee is exposed or likely to be exposed to chemicals hazardous to health listed in Schedule II of the Regulations and is engaged in a process specified therein, the monitoring of exposure of employees shall be repeated at interval of not more than six months or at such shorter intervals as determined by the assessor and the monitoring of exposure shall continue at this frequency until such time the assessor is satisfied that further monitoring of exposure is no longer required.

A competent person who has sufficient knowledge, skills and experience in the appropriate techniques and procedures detailed in clause 6.1.4 of this Guidelines shall carry out the monitoring works. Regulation 26 (3) stipulates that the monitoring of exposure shall be conducted by a hygiene technician unless the monitoring is confined to checking the presence of toxic or flammable gases and the level of oxygen in the confined space before entry. Reference shall be made to The Guidelines on Registration Hygiene Technician (draft) published by the Department of Occupational Safety and Health.

Regulation 26 (4) stipulates that the employer shall maintain in good order and condition any record or summary of record of any monitoring carried out for the purpose of these Regulations and shall be kept available:

a) Where the record is representative of the personal exposure of a person exposed to any chemical hazardous to health, for at least 30 years; and
b) In any other case, for at least 5 years.

6.1.4 Procedure for monitoring should detail:

a) when and how the monitoring is to be done;
b) the sampling procedures and analytical methods to be used;
c) the sites and frequency of sampling; and
d) how the results are to be interpreted.

6.1.5 Record of monitoring result

The results of monitoring shall be recorded. The records should contain sufficient detail to determine:

a. The hazardous substances concerned, what the result were and when the monitoring was done;
b. What monitoring procedures were adopted, including the duration of sampling;
c. The location where the samples were taken, the operating in progress at the time and , in the case of personal samples, the name of those individual concerned;
d. Whether the results were interpreted; and
e. The effectiveness of control.

The records may be kept in any form, but in all cases the information should be readily retrievable and in an easily understood form. Records should be kept in such a way that the results can be compared with any health records required under the health surveillance requirements of the Regulations.

6.2 HEALTH SURVEILLANCE

6.2.1 General

Health surveillance, which includes biological monitoring, can assist in minimising the risk to health from hazardous substances for which there are known an acceptable health surveillance procedures by ;

i Confirming that the absorbed dose are below the acceptable level;
ii Indicating biological effects requiring cessation or reduction of exposure; or
iii Collecting data to evaluate the effects of exposure.

The employer shall provide health surveillance for an employee, who has been identified in the workplace assessment process as having being exposed to a hazardous substance where:

a) There is a significant risk to the health of the employee from one of the hazardous substances listed in Schedule II;
b) The exposure of the employee to a hazardous substance is such that :

i. an identifiable disease or health effect may be related to the exposure ,

ii. there is a reasonable likelihood that the disease or health effect may occur under the particular conditions of work, and
iii. there are valid techniques for detecting indications of the disease or health effect;

or

c) where there is a valid biological monitoring procedure available and a reasonable likelihood that accepted values might be exceeded.

Health surveillance shall be performed under the supervision of a registered medical practitioner adequately trained in the requisite testing or medical examinations for the hazardous substances in question and where appropriate as specified by the DOSH.

Health surveillance should not be used as an alternative to maintenance of control measures. Further information on medical surveillance can be referred to the Guidelines on Medical Surveillance.

6.2.2 Legal Requirements

Where it is appropriate for the protection of the health of his employees who are , or are liable to be exposed to a substance hazardous to health , the employer shall ensure that such employees are under suitable health surveillance. Regulations 27 (1) stipulates that Where an assessment indicates that health surveillance is necessary for the protection of the health of employees exposed or likely to be exposed to chemicals hazardous to health, the employer shall carry out a health surveillance programme.

Regulation 27 (2) stipulates that if an employee is exposed or likely to be exposed to chemicals hazardous to health, listed in Schedule II, and is engaged in a process specified therein, the health surveillance required under subregulation (1) shall include medical surveillance conducted by an occupational health doctor at intervals or not more than 12 months or at such shorter intervals as determined by the occupational health doctor or an occupational safety and health officer who is also a medical practitioner.

6.3 INFORMATION, INSTRUCTION AND TRAINING

6.3.1 General

The primary tools needed to achieve the goal of reducing occupational injuries and illnesses and promoting occupational safety and health is engineering, enforcement and education. The overall rationale for training and education is to improve awareness of safety and health hazards, to expand the knowledge of the causes of occupational illness and injury and to promote the implementation of effective preventive measures.

The information to be given to the employees shall include:

(a) The nature and degree of the risks to health arising as a consequence of

exposure, including any factors that may influence that risk, such as the substance involved and factors that may increase the risk, eg smoking;

(b) The control measures adopted, the reasons for these, and how to use them properly;

(c) The reasons for personal protective equipment and clothing, and the jobs where there are necessary;

(d) Monitoring procedures; including arrangement for access to results and notification if a maximum exposure limits is exceeded;

(e) The role of health surveillance, their duty to attend for health surveillance procedures, and arrangements for access to individual health records and the collective results of health surveillance.

The employer shall also provide information which include:

(a) Information on the results of any monitoring of exposure at the place of work and

(b) Information on the collective results of any health surveillance programme and presented in a manner which prevent them from being identified as relating to any particular person.

Instruction must be such as to ensure that persons at work on the premises do not endanger themselves or other through exposure to substances hazardous to health . In particular, the instruction must be sufficient and suitable to them to:

(a) Know what they should do, what precautions they should take and when they should take them;

(b) Know what cleaning, storage and disposal procedures required, why they are required and when they are to be carried out:

(c) Know the procedures to be followed in an emergency.

Training must be such as to ensure that persons at work on the premises can effectively apply and use:

(a) The method of control;

(b) The personal protective equipment;

(c) The emergency measures.

6.3.2 Legal Requirements

Regulation 22 (1) stipulates that an employer who undertakes work which may expose or is likely to expose his employees to chemicals hazardous to health shall provide the employees with such information, instruction and training as may be necessary to enable them to know:

(a) The risk to health created by such exposure; and

(b) The precautions which should be taken.

Regulation 22 (4) stipulates that all training programme shall be documented and kept for inspection by any occupational safety and health officer.

Regulation 23 stipulates that every employer shall ensure that any person who carries out any work in connection with the employer's duties under the Regulations has the necessary information, instruction and supervision to carry out such duties.

Regulation 22 (3) stipulates that the employer shall review and conduct the training programme:

(a) At least once in two years;
(b) If there is a change in the hazard information on chemicals hazardous to health, safe work practices or control measures; or
(c) Each time employees are assigned to new tasks or new work areas where they are exposed or likely to be exposed to chemicals hazardous to health.

6.4 LABELLING AND RELABELLING

6.4.1 Labelling

The purpose of labelling is to ensure that the contents of a container can be readily identified by product name, and to draw attention of a person who is handling or using a hazardous chemical to the significant hazards involved.Regulation 20 (1) stipulate that an employer shall ensure that all chemicals hazardous to health supplied or purchased by him and used in the place of work are labelled and that the labels are not removed, defaced modified or altered. Containers of hazardous chemicals shall be labelled in accordance with the Occupational Safety and Health (Classification Packaging and Labelling of Hazardous Chemical) Regulations 1997. Containers of hazardous chemical shall be labelled in accordance with the Guidelines on the Labelling of Hazardous Chemical 1998.

6.4.2 Relabelling

When the labels are removed, defaced , modified or altered while the chemical hazardous to health is being used at the place of work, the employer shall relabel the chemical container. Where a chemical is transferred to another container, other than the originally supplied container, the type of relabelling required shall depend on whether the substance is consumed immediately or over a longer period of time.

(a) If the contents of the container are used within a normal shift the employer shall ensure that the container is relabelled with the chemical name or the trade name as written on the original label. This is also applies to chemicals used in the testing chemical laboratory whether or not contents are used within a normal workshift. The container need not be relabelled if the chemical is used immediately.

(b) Containers containing pesticide shall be relabelled in accordance with the requirements of the Pesticide Act 1974; and in the case of schedule waste shall be relabelled in accordance with the requirements of the Environmental Quality (Schedule Wastes) Regulations 1989.

6.5 PROVISION OF CHEMICAL SAFETY DATA SHEETS (CSDS)

Chemical safety data sheets provide the information needed to allow the safe handling of hazardous chemical used at work. Regulation 24 stipulates that an employer who received a supply of chemicals hazardous to health for which the chemicals are not labelled or the Chemical Safety Data Sheets have not been provided, shall obtain the relevent information from the supplier and shall not use the chemicals until such information is obtained.

At each workplace, employees and employees representative shall have ready access to CSDS for the hazardous chemicals used. Regulation 25 stipulates that in any place of work where chemical hazardous to health is used, the current CSDS for that chemical or a copy thereof shall be kept in a conspicious place close to each location where the chemical is used, and shall be readily accesible to the employees.

Copies shall be readily accessible to employees who are required to use or handle the hazardous substance, as well as to employees who are supervising others working with the hazardous substance.

CSDS may be provided in a number of ways including;

i. Paper copy collections of CSDS;
ii. Microfiche copy collections of CSDS with microfiche readers open to use by all employees; and
iii. Computerised CSDS databases.

Depending on the needs of the workplace, any of the method above may be used. In each case, the employer shall ensure that:

i. The current CSDS are available;
ii. Any storage or retrieval equipment is kept in good working order;
iii. Employees are trained in how to access the information; and
iv. Where information is displayed on a screen, there shall be means of obtaining a paper copy of that information.

6.6 WARNING SIGN

6.6.1 General

Employer shall ensure that warning signs are posted at any area where a chemical hazardous to health may be or likely to be at risk to the health of any person who may be or is likely to be at risk of being exposed to hazardous chemicals. When posting warning signs employer shall ensure that the following conditions are adhered to:

i The warning signs shall be posted at a conspicuous place at every entrance of the area to warn persons entering the area of the hazards.

ii Other relevant information are given to persons who may be or are likely to be at risk of being affected by the chemicals hazardous to health.

iii Warning signs shall be illuminated and cleaned as necessary so that the legend is readily visible.

6.6.2 Warning signs shall have the following features:

i Give warning of the hazards
ii Written in National and English language.
iii Attract attention so as to afford a rapid interaction of dangers, and to facilitate their identification.

6.6.3 Mandatory warning sign can be complimented with safety signs and colours such as :

a. MS 980 - Specification for Safety Signs and Colours – Colorimeteric and Photometric of Materials.
b. MS 981 - Specification for Safety Signs and Colours – Colours and Design.
c. MS 982 - Specification for Fire Safety Signs, Notices and Grafic Symbols.
d. MS 983 - Specification for "KELUAR" Signs First Revision.

7. REFERENCES

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c) Occupational Safety and Health (Use and Standard of Exposure of Chemicals Hazardous to Health) Regulations 2000.
d) National Occupational Health and Safety Commision, National Code of Practice for the Control of Workplace Hazardous Substance, Australian Government Publishing Service, Canberra, 1993.
e) Forde Sorensen and Hans Jorgen Styhr Petersen, Substitution of Hazardous Chemicals and the Danish Experience, draft article to Occupational Hygiene Risk Management of Occupational Hazards, Department of Chemical Engineering, Technical University of Denmark, 13 September 1993.
f) Industrial Ventilation Manual, American Conference of Govermental Industrial Hygienist (ACGIH), 1974
g) Encyclopedia of Occupational Health and Safety, Jeanne Mager Stellman Fourth Edition, International Labour Office Geneva, 1998.
h) OSHA Technical Manual, Section V : Chapter 3 website : http://www.osha-slc-.gov/dts/osta/otm/otm v/otm v3.html

Appendix 1

Examples of Control Measures Using Substitution

1. Substitution of organic solvents to water -based degreasing agent in a metal degreasing process. The change from nearly 100% organic solvent, e.g trichloroethylene to a-ready-for-use aqueous solution containing 99% water and different chemicals from 0.1% to 0.01%.

2. Bonding with adhesives, the use of organic solvents (1,1,1 - trichloroethane, toluene, dichloromethane, ethanol, xylene, methyl methacrylate, styrene, MEK, acetone) and hazardous binders (polyester (styrene), acrylates, epoxy resin, polyurathane (isocyanates) can be substituted by using:

    a) less hazardous type of adhesives:
    b) water-based adhesives, hot-melt or silicone adhesives,
    c) adhesive film or double-sided adhesive tape,
    d) mechanical joining or
    e) by a design or construction which avoid joining.

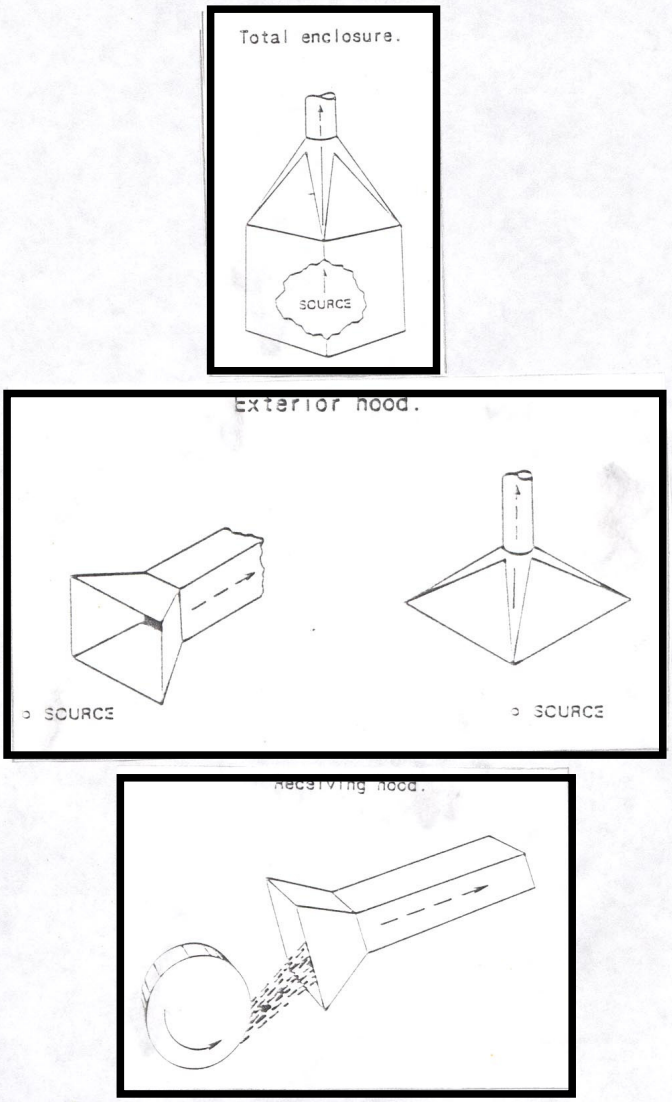
3. Painting of iron and metal surfaces for corrosion protection

4. Solvent-based paints can be replaced with water-based paints (or precoated sheets). Solvent-based paints contains normally about 60% organic solvents - frequently xylene, toulene, mixture of hydrocarbons

Appendix 2-1

Appendix II-1

FIGURE 1 - HOOD TYPES



Source: Industrial Ventilation Manual, ACGIH, 1974.

Appendix 2-2

Table 1 - Hood Design Data - range of capture velocity

CONDITION OF DISPERSION OF CONTAMINANT	EXAMPLES	CAPTURE VELOCITY Fpm
Released with practically no velocity into quiet air.	Evaporation from tanks degreasing, etc.	50 – 100
Released at low velocity into moderately still air.	Spray booths: intermittent container filling; low-speed conveyor transfers; welding; plating; pickling	100 – 200
Active generation into zone of rapid air motion.	Spray painting in shallow booths; barrel filling; conveyor loading; crushers.	200 – 500
Released at high initial velocity into zone at very rapid air motion.	Grinding; abrasive blasting ; tumbling.	500 – 2000

Source: Industrial Ventilation Manual, ACGIH, 1974.