DEPARTMENT OF LABOUR

Government Notice. R: 1179 **25 August 1995**

Hazardous Chemical Substances Regulations, 1995

The Minister of Labour has under section 43 of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), after consultation with the Advisory Council for Occupational Health and Safety, made the regulations in the Schedule.

SCHEDULE

Definitions

1. In this Schedule a word or expression to which a meaning has been assigned in the Act shall bear the meaning so assigned to it and unless the context otherwise indicates -

"air monitoring" means the monitoring of the concentrations of airborne hazardous chemical substances;

"Asbestos Regulations" means the Asbestos Regulations published by Government Gazette No. R.773 of 10 April 1987 under section 43(5) of the Act;

"assessment" means a programme to determine any risk from exposure to a hazardous chemical substance associated with any hazard thereof at the workplace in order to identify the steps needed to be taken to remove, reduce or control such hazard;

"BEI" or "biological exposure index" is a reference value intended as a guideline for the evaluation of potential health hazards as listed in Table 3 of Annexure 1 hereby as revised from time to time and listed in the Government Gazette;

"engineering control measures" means control measures that remove or reduce the exposure of persons at the workplace by means of engineering methods;

"exposed" means exposed to a hazardous chemical substance whilst at the workplace and "exposure" has a corresponding meaning;

"EH 42" means the Guidance Note EH 42 of the Health and Safety Executive of the United Kingdom: Monitoring Strategies for Toxic Substances 1989 HSE ISBN 0 11885412 7 as revised from time to time and published in the Government Gazette;

"Facilities Regulations" means the Facilities Regulations published by Government Notice No. R.2362 of 5 October 1990 under section 43(5) of the Act;

“General Administrative Regulations” means the General Administrative Regulations published by Government Notice No. R.2206 of 5 October 1984 under section 43(5) of the Act;

“HSC” or “hazardous chemical substance” means any toxic, harmful, corrosive, irritant or asphyxiant substance, or a mixture of such substances for which –

(a) an occupational exposure limit is prescribed; or

(b) an occupational exposure limit is not prescribed; but which creates a hazard to health;

“intake” includes inhalation, ingestion or absorption through the skin or mucous membranes;

“Lead Regulations” means the Lead Regulations published by Government Notice No. R.586 of 22 March 1991 under section 43(5) of the Act;

“measurement programme” means a programme according to the monitoring strategy as contemplated in EH 42;

“monitoring” means the planning, carrying out and recording of the results of a measurement programme;

“OEL” or “occupational exposure limit” means a limit value set by the Minister for a stress factor in the workplace as revised from time to time by notice in the Government Gazette;

“OEL-CL” or “occupational exposure limit-control limit” means the occupational exposure limit for a hazardous chemical substance as listed in Table 1 of Annexure 1 hereby and “control limit” has a corresponding meaning;

“OEL-RL” or “occupational exposure limit-recommended limit” means the occupational exposure limit for a hazardous chemical substance as listed in Table 2 of Annexure 1 hereby and “recommended limit” has a corresponding meaning;

“OESSM” means the Occupational Exposure Sampling Strategy Manual, published by the National Institute for Occupational Safety and Health (NIOSH), Publication No. 77-173 of 1977, United States of America: Department of Health, Education and Welfare;

“regional director” means the regional director as defined in regulation 1 of the General Administrative Regulations;

“respiratory protective equipment” means a devise which is worn over at least the mouth and nose to prevent the inhalation of airborne hazardous chemical substances and which is of a type, or conforms to a standard approved by the Minister;

“respirator zone” means an area where the concentration of an airborne hazardous chemical substance exceeds the recommended limit for that substance;

“SABS 072” the Code of Practice for the Safe Handling of Pesticides, SABS 072, published by the South African Bureau of Standards (SABS);

“SABS 0228” the Code of Practice for the Identification and Classification of Dangerous Substances and Goods, SABS 0228, published by the South African Bureau of Standards (SABS);

“SABS 0229” the Code of Practice for Packaging of Dangerous Goods for Road and Rail Transportation in South Africa, SABS 0229, published by the South African Bureau of Standards (SABS);

Scope of application

2. (1) Subject to the provisions of sub-regulation (2), these regulations shall apply to an employer or a self employed person who carries out work at a workplace which may expose any person to the intake of an HCS at the workplace.

(2) The provisions of regulations 3(1), 6 and 7 shall not apply to:

(a) a self employed person; or

(b) a person who visits a workplace as contemplated in subregulation (1).

(3) The provisions of these regulations shall not apply in the case where the Lead Regulations and Asbestos Regulations apply .

Information and training

3. (1) An employer shall, before any employee is exposed or may be exposed, after consultation with the health and safety committee established for that section of the workplace, ensure that the employee is adequately and comprehensively informed and trained, as well as thereafter informed and trained at intervals as may be recommended by that health and safety committee, with regard to:

(a) the contents and scope of these regulations;

(b) the potential source exposure;

(c) the potential risks to health caused by exposure;

(d) the potential detrimental effect of exposure on his or her reproductive ability;

(e) the measures to be taken by the employers to protect an employee against any risk from exposure;

(f) the precautions to be taken by an employee to protect himself against the health risks associated with such exposure, including the wearing and use of protective clothing and respiratory protective equipment.

(g) the necessity, correct use, maintenance and potential of safety equipment, facilities and engineering control measures provided;

(h) the necessity of personal air sampling and medical surveillance;

(i) the importance of good housekeeping at the workplace and personal hygiene;

(j) the safe working procedures regarding the use, handling, storage and labelling of the HCS at the workplace; and

(k) procedures to be followed in the event of spillages, leakages or any similar emergency situation which could take place by accident.

(2) An employer or self-employed person shall give written instructions of the procedures contemplated in paragraph (k) of subregulation (1) to the drivers of vehicles carrying the HCS.

(3) An employer or a self employed person shall ensure that he himself or she herself or any other person who in any manner assists him or her in the carrying out or the conducting of his or her business, have the necessary information and has undergone sufficient training in order for him or her to identify the potential risks and precautions which should be taken.

Duties of persons who may be exposed to hazardous chemical substances

4. Every person who is or may be exposed, shall obey a lawful instruction given by or on behalf of the employer or a self employed person, regarding:

(a) the prevention of an HCS from being released;

(b) the wearing of personal protective equipment;

(c) the wearing of monitoring equipment to measure personal exposure;

(d) the reporting for health evaluations and biological tests as required by these regulations;

(e) the cleaning up and disposal of materials containing HCS;

(f) housekeeping at the workplace, personal hygiene and environmental and health practices; and

(g) information and training as contemplated in regulation 3.

Assessment of potential exposure

5. (1) An employer or self employed person shall after consultation with the relevant health and safety representative or relevant health and safety committee, cause an immediate assessment to be made and thereafter at intervals not exceeding two years, to determine if any employee may be exposed by any route of intake.

(2) The employer shall inform the relevant health and safety representative or relevant health and safety committee in writing of the arrangements made for the assessment contemplated in subregulation (1), give them reasonable time to comment thereon and ensure that the results of the assessment are made available to the relevant representatives or committees who may comment thereon.

(3) When making the assessment, the employer or self employed person shall keep a record of the assessment and take into account such matters as:

(a) the HCS to which an employee may be exposed;

(b) what effects the HCS can have on an employee;

(c) where the HCS may be present and in what physical form it is likely to be;

(d) the route of intake by which and the extent to which an employee can be exposed; and

(e) the nature of the work, process and any reasonable deterioration in, or failure of, any control measures.

(4) If the assessment made in accordance with subregulation (3) indicates that any employee may be exposed, the employer shall ensure that monitoring is carried out in accordance with the provisions of regulations 6 and 7 and that the exposure shall be controlled as contemplated in regulation 10.

(5) An employer shall review the assessment required by subregulation (1) forthwith if:

(a) there is reason too suspect that the previous assessment is no longer valid; or

(b) there has been a change in a process involving an HCS or in the methods, equipment or procedures in the use, handling, control or processing of the HCS, and the provisions of subregulations (2) and (3) shall apply.

Air monitoring

6. (1) Where the inhalation of an HCS is concerned, an employer contemplated in regulation 5(4) shall ensure that the measurement programme of the airborne concentrations of the HCS to which an employee is exposed, is:

(a) carried out in accordance with the provisions of these regulations;

(b) carried out only after the relevant health and safety representative or relevant health and safety committee has been informed thereof and given a reasonable opportunity to comment thereon;

(c) carried out by an approved inspection authority or by a person whose ability to do the measurements is verified by an approved inspection authority;

(d) representative of the exposure of employees to the airborne HCS in accordance with the provisions of subregulation (2); and

(e) verified in accordance with the provisions of subregulation (3) if the measurements are carried out by a person who is not an approved inspection authority.

(2) In order to comply with the provisions of subregulation (1).(d) an employer shall;

(a) ensure that the measurement programme, in the case of a group measurement, makes provision for the selection of the number of persons for a sample to be done as contemplated in chapters 3 and 4 and Technical Appendix A of the OESSM: Provided that such sample size shall be chosen for the top 10% of the group at the 95% confidence level for an HCS with a control limit and for the top 10% of the group at th 90% confidence level for an HCS with a recommended limit; and

(b) carry out the representative measurements at least every 12 months for an HCS with a control limit and at least every 24 months for an HCS with a recommended limit: Provided that whenever the control limit or recommended limit which has been prescribed for an HCS is exceeded, the provisions of regulation 10 shall apply.

(3) In order to comply with the provisions of subregulation (1).(e), an employer shall obtain the service of an approved inspection authority who shall, at intervals not exceeding 24 months:

(a) verify, by examining the measurement and analysis equipment of the employer and questioning the person referred to in subregulation (1).(c), regarding the carrying out of the measurement programme;

(b) carry out the measurements prescribed by subregulations (1) and (2) for any one group; and

(c) enter the results of the investigation and measurements as contemplated in paragraphs (a) and (b) respectively in the record required by regulation 9.

Medical surveillance

7. (1) An employer shall ensure that an employee is under medical surveillance if:

(a) the employee may be exposed to a substance listed in Table 3 of Annexure 1;

(b) the exposure of the employee to any substance hazardous to his or her health is such that an identifiable disease or adverse effect to his or her health may be related to the exposure, there is a reasonable likelihood that the disease or effect may occur under the particular conditions of his or her work and there are techniques to diagnose indications of the disease or the effect as far as is reasonably practicable; or

(c) the occupational health practitioner recommends that the relevant employee should be under medical surveillance in which case the employer may call on an occupational medicine practitioner to ratify the appropriateness of such recommendation.

(2) In order to comply with the provisions of subregulation (1) the employer shall, as far as is reasonably practicable, ensure:

(a) that an initial health evaluation is carried out by an occupational health practitioner immediately before or within 14 days after a person commences employment, where any exposure exists or may exist, which comprises:

(i) an evaluation of the employees medical and occupational history;

(ii) a physical examination; and

(iii) any other essential examination which in the opinion of the occupational health practitioner is desirable in order to enable the practitioner to do a proper evaluation.

(b) that subsequent to the initial health evaluation contemplated in paragraph (a) the relevant employee undergoes examinations as contemplated in paragraph (a)(ii) and (iii), at intervals not exceeding two years, or at intervals specified by an occupational medical practitioner.

(3) An employer shall not permit an employee who has been certified unfit for work by an occupational medicine practitioner to work in a workplace or part of a workplace in which he or she would be exposed: Provided that the relevant employee may be permitted to return to work which will expose him or her if he or she is certified fit for that work beforehand by an occupational medicine practitioner.

(4) The employer shall record and investigate the incident contemplated in subregulation (3) in compliance with regulation 8 of the General Administrative Regulations.

Respirator zone

8. An employer shall ensure:

(a) that any workplace or part of a workplace under his or her control, where the concentration of an HCSHCS in the air is. or may be, such that the exposure of employees working in that workplace exceeds the recommended limit without the wearing of respiratory protective equipment, is zoned as a respirator zone;

(b) that a respirator zone is clearly demarcated and identified by notice indicating that the relevant area is a respirator zone and that personal protective equipment as contemplated in regulation 11 must be worn there; and

(c) that no person enters or remains in a respirator zone unless he or she is wearing the required personal protective equipment.

Records

9. (1) An employer shall:

(a) keep records of the results of all assessments, air monitoring, and medical surveillance reports required by regulations 5 , 6 and 7, respectively: Provided that personal medical records shall only be made available to an occupational health practitioner;

(b) subject to the provisions of paragraph (c), make the records contemplated in paragraph (a), excluding personal medical records, available for inspection by an inspector.

(c) allow any person subject to personal written consent of an employee, to peruse the records with respect to that particular employee;

(d) make the records of all assessments and air monitoring available for perusal by the relevant health and safety representatives or relevant health and safety committee;

(e) keep all records of assessments and air monitoring for a minimum period of 30 years;

(f) keep all medical surveillance records for a minimum period of 30 years and if the employer ceases activities, all those records shall be handed over or forwarded by registered post to the relevant regional director; and

(g) keep a record of the investigations and tests carried out in terms of regulation 12(1)(b) and of any repairs resulting from these investigations and tests, and the records shall be kept for at least three years.

Handling of hazardous chemical substances

9A (1) Subject to section 10(3) of the Act, every person who manufactures, imports, sells or supplies any hazardous chemical substance for use at work, shall, as far as is reasonably practicable, provide the person receiving such substance, free of charge, with a material safety data sheet in the form of Annexure 1, containing all the information as contemplated in either ISO 1 1014 or ANSIZ400.1.1993 with regard to-

(a) product and company identification;

(b) composition/information on ingredients;

(c) hazards identification;

(d) first-aid measures;

(e) fire-fighting measures;

(f) accidental release measures;

(g) handling and storage;

(h) exposure control/personal protection;

(i) physical and chemical properties;

(j) stability and reactivity;

(k) toxicological information;

(l) ecological information;

(m) disposal considerations;

(n) transport information;

(o) regulatory information; and

(p) other information:

Provided that, where it is not reasonably practicable to provide a material safety data sheet, the manufacturer, importer, seller or supplier shall supply the receiver of any hazardous chemical substance with sufficient information to enable the user to take the necessary measures as regards the protection of health and safety.

(2) Every employer who uses any hazardous chemical substance at work, shall be in possession of a copy of Annexure 8 or a copy of sufficient information, as contemplated in subregulation (1).

(3) Every employer shall make Annexure 8 or sufficient information, as contemplated in subregulation (1), available at the request of any interested or affected person.

Control of exposure to HCS

10 (1) An employer shall ensure that the exposure of an employee is either prevented or, where this is not reasonably practicable, adequately controlled: Provided that

(a) where there is exposure for which there is a recommended limit, the control of the exposure shall be regarded as adequate if the level of exposure is below that limit or if the relevant area is zoned and the level of exposure is reduced to below that recommended limit by means of adequate personal protective equipment only after the level has been reduced to as low as is reasonably practicable by any other means than personal protective equipment; or

(b) where there is exposure for which there is a control limit, the control of the exposure shall be regarded as adequate if the exposure is at a a level as low as is reasonably practicable below that control limit: Provided that in the case of temporary excursions above the control limit, the employer shall ensure:

(i) that the excursion is without a significant risk from exposure;

(ii) that the excursion is not indicative of a failure to maintain adequate control;

(iii) that during the excursion, the area is temporarily demarcated as prescribed in regulation 8(b) ; and

(iv) the provisions of regulation 11 are complied with.

(2) Where reasonably practicable, the employer shall control the exposure of an employee:

(a) by limiting the amount of an HCS used which may contaminate the working environment;

(b) by limiting the number of employees who will be exposed or may be exposed;

(c) by limiting the period during which an employee will be exposed or may be exposed;

(d) by using a substitute for an HCS;

(e) by introducing engineering control measures for the control of exposure, which may include the following:

(i) Process separation, automation or enclosure;

(ii) the installation of local extraction ventilation systems to processes, equipment and tools for the control of emissions of an airborne HCS;

(iii) use of wet methods; and

(iv) separate workplaces for different processes;

(f)by introducing appropriate work procedures which an employee must follow where materials are used or processes are carried out which could give rise to exposure of an employee and that procedures shall include written instructions to ensure:

(i) that an HCS is safely handled, used and disposed of;

(ii) that process machinery, installations, equipment, tools and local extraction and general ventilation systems are safely used and maintained;

(iii) that machinery and work areas are kept clean; and

(iv) that early corrective action can be readily identified.

(3) An employer shall ensure that the emission of an HCS into the atmosphere comply with the provisions of the Atmospheric Pollution Prevention Act, 1965 (Act No. 45 of 1965).

Personal protective equipment and facilities

11. (1) If it is not reasonably practicable to ensure that the exposure of an employee is adequately controlled as contemplated in regulation 10, the employer shall:

(a) in the case of an airborne HCS, provide the employee with suitable respiratory protective equipment and protective clothing; and

(b) in the case of an HCS which can be absorbed through the skin, provide the employee with suitable non-HCS impermeable protective equipment.

(2) Where respiratory protective equipment is provided, the employer shall ensure:

(a) that the relevant equipment is capable of controlling the exposure to below the OEL for the relevant HCS;

(b) that the relevant equipment is correctly selected and properly used;

(c) that information, instructions, training and supervision which is necessary with regard to the use of the equipment is known to the employees; and

(d) that the equipment is kept in good condition and efficient working order.

(3) An employer shall, as far as is reasonably practicable:

(a) issue no used personal protective equipment to an employee, unless the relevant protection equipment is decontaminated and sterilised;

(b) provide separate containers or storage facilities for personal protective equipment when not in use; and

(c) ensure that all personal protective equipment not in use is stored only in the place provided therefor.

(4) An employer shall as far as is reasonably practicable, ensure that all contaminated personal protective equipment is cleaned and handled in accordance with the following procedures:

(a) where the equipment is cleaned on the premises of an employer, care shall be taken to prevent contamination during handling, transport and cleaning;

(b) where the equipment is sent off the premises to a contractor for cleaning purposes:

(c) the equipment shall be packed in impermeable containers;

(d) the containers shall be tightly sealed and have clear indication thereon that the contents thereof are contaminated; and

(e) the relevant contractor shall be fully informed of the requirements of these regulations and the precautions to be taken for the handling of the contaminated equipment.

(5) Subject to the provisions of subregulation (4)(b) an employer shall ensure that no person removes dirty or contaminated personal protective equipment from the premises: Provided that where contaminated personal protective equipment has to be disposed of, it shall be treated as HCS waste as contemplated in regulation 15.

(6) Subject to the provisions of the Facilities Regulations, an employer shall, where reasonably practicable, provide employees using personal protective equipment as contemplated in subregulation (1), with:

(a) adequate washing facilities which are readily accessible and located in an area where the facilities will not become contaminated, in order to enable the employees to meet a standard of personal hygiene consistent with the adequate control of exposure, and to avoid the spread of an HCS;

(b) two separate lockers separately labelled 'protective clothing' and 'personal clothing', and ensure that the clothing is kept separately in the locker concerned;

(c) separate 'clean' and 'dirty' changerooms if the employer uses or processes an HCS to the extent that the HCS could endanger the health of persons outside of the workplace.

Maintenance of control measures

12. An employer shall ensure:

(a) that all control equipment and facilities provided in terms of regulations 10 and 11 are maintained in good working order; and

(b) that thorough examinations and tests of engineering control measures are carried out at intervals not exceeding 24 months by an approved inspection authority or by a person whose ability to do such measurements and tests is verified by an approved inspection authority.

Prohibitions

13. No person shall as far as is reasonably practicable:

(a) use compressed air or permit the use of compressed air to remove particles of an HCS from any surface or person; and

(b) smoke, eat, drink or keep food or beverages in a respirator zone or permit any other person to smoke, eat, drink or keep food or beverages in that zone.

Labelling, packaging, transportation and storage

14. An employer shall, in order to avoid the spread of contamination of an HCS, take steps, as far as is reasonably practicable, to ensure:

(a) that the HCS in storage or distributed are property identified, classified and handled in accordance with SABS 072 and SABS 0228;

(b) that a container or a vehicle in which an HCS is transported is clearly identified, classified and packed in accordance with SABS 0228 and SABS 0229; and

(c) that any container into which an HCS is decanted, is clearly labelled with regard to the contents thereof.

Disposal of hazardous chemical substances

15. An employer shall, as far as is reasonably practicable:

(a) recycle all HCS waste;

(b) ensure that all collectable HCS waste is placed into containers that will prevent the likelihood of exposure during handling;

(c) ensure that all vehicles, re-usable containers and covers which have been in contact with HCS waste are cleaned and decontaminated after use in such a way that the vehicles, containers or covers do not cause a hazard inside or outside the premises concerned;

(d) ensure that all HCS waste which can cause exposure, is disposed of only on sites specifically designated for this purpose in terms of the Environmental Conservation Act, 1989 (Act No. 73 of 1989), in such a manner that it does not cause a hazard inside or outside the site concerned;

(e) ensure that all employees occupied in the collection, transport and disposal of HCS waste, who may be exposed to that waste, are provided with suitable personal protective equipment; and

(f) ensure that if the services of a waste disposal contractor are used, a provision is incorporated into the contract stating that the contractor shall also comply with the provisions of these regulations.

Offences and Penalties

16. Any person who contravenes or fails to comply with any provision of regulation 3,4,5,6,7,8,9,9A, 10, 11, 12, 13,14 or 15 shall be guilty of an offence and liable on conviction to a fine or to imprisonment for a period not exceeding

six months and, in the case of a continuous offence, to an additional fine of R200 for each day on which the offence continues or additional imprisonment of one day for each day on which the offence continuous: Provided that the period of such additional imprisonment shall in no case exceed 90 days.

Short title

17. These regulations shall be called the Regulations for Hazardous Chemical Substances, 1995.

ANNEXURE 1

HAZARDOUS CHEMICAL SUBSTANCES GUIDELINES

Prevention and control of exposure

1. Exposure of employees to substances hazardous to health should be prevented or, where this is not reasonably practicable, adequately controlled. This is a fundamental requirement of the Regulations for Hazardous Chemical Substances (HCS), 1995. Exposure can occur by inhalation, ingestion or absorption through the skin, but inhalation is usually the main route of entry into the body. Tables 1 and 2 of Annexure 1 list the occupational exposure limits, which should be used in determining the adequacy of control of exposure by inhalation, as required by the HCS Regulations.

2. The advice in this document should be taken in the context of the requirements of the HCS Regulations, especially regulation 5 (Assessment of potential exposure) regulation 10 (Control of exposure), regulation 12 (Maintenance of control measures) and regulation 6 (Air monitoring). Substances hazardous to health are defined in regulation 1. There is separate legislation for lead and asbestos and these substances are not covered in detail in this document. This document also does not apply to exposure below ground in mines or exposure to micro-organisms.

3. Adequate control of exposure (when prevention is not reasonably practicable) should be achieved by one or more of a range of control measures described in regulation 10 of the HCS Regulations. Control by personal protective equipment should be applied only when other means are not reasonably practicable.

Medical surveillance

4. Medical surveillance of employees is often an important addition to the control measures in the workplace, regulation 7(1) of the HCS Regulations specifies where medical surveillance is appropriate for the protection of the health of employees.

4.1 Medical surveillance is defined in the Regulations to cover the spectrum of potential effects of an HCS on an employee, from absorption of the substances through to clinical disease. Medical surveillance may be grouped broadly into-

(a) biological monitoring, to measure the extent of absorption of an HCS by the employee.

(b) medical screening, to detect any adverse affects of an HCS on the employee.

4.2 Biological monitoring of exposure

4.2.1 Objectives

Biological monitoring of exposure can be divided into two types of testing:

(a) Biological monitoring: Measures the bio-chemical concentrations of HCSs and/or their metabolites in biological samples of exposed individuals, e.g. blood lead for inorganic lead exposure, or urinary arsenic for inorganic arsenic exposure. The aim is to measure the degree of absorption into the body by measuring indicators in representative biological samples, typically urine or blood (usually nor related to the target organ).

(b) Biological effect monitoring: Determines the intensity of biochemical or physiological change due to exposure, e.g. red cell cholinesterase for exposure to organosphosphate pesticides, or zinc protoporphyrin (ZPP) for exposure to inorganic lead.

4.2.2 Uses of biological monitoring

Biological monitoring tests are indices of an individuals exposure and they may be a useful tool for the occupational health and safety team. They give information on the overall level of exposure, regardless of whether an HCS has been absorbed by the respiratory, oral, or cutaneous route. Cutaneous absorbtion can play a significant role in the case of some organic compounds. The amounts absorbed through the skin may be comparable to or even higher than those absorbed via the respiratory tract.

Where appropriate, environmental control measures may thus be supplemented, with biological monitoring. Knowledge of the real individual exposure permits targeted applications of preventive measures.

4.2.3 Important considerations in biological monitoring

(a) In choosing a test to meet the above objectives, it is important to have an understanding of the relationship between environmental exposure and the concentration of an HCS in biological samples. This includes an understanding of the principles of absorption, biotransformation, distribution and excretion of an HCS.

(b) In addition, there should be analytical methods available of sufficient sensitivity and specificity to detect concentrations of the substance in urine, blood or exhaled air in the range likely to be encountered in industry.

(c) The HCSs listed in Table 3 of Annexure 1 are those for which the above criteria have a reasonable chance of being met.

4.2.4 Biological Exposure Indices (BEIs)

BEIs are reference values intended as guidelines for the evaluation of potential health hazards in the practice of industrial hygiene. A BEI represents in theory the level of an HCS or metabolite most likely to be observed in a specimen collected from a healthy worker who has been exposed to an HCS to the same extent as the worker with inhalation exposure to an OEL-TWA. BEIs do not represent a sharp distinction between hazardous and non-hazardous exposures. For example, owing to biological variability, it is possible that an individuals measurements can exceed the BEI without incurring an increased health risk. Conversely, there may be some susceptible individuals who may be harmed at effects below the BEI.

If measurements in specimens obtained from a worker on different occasions persistently exceed the BEI, or if the majority of measurements in specimens obtained from a group of workers at the same workplace exceed the BEI, the cause of the excessive values must be investigated and proper action be taken to reduce the exposure.

BEIs apply to eight-hour exposures, five days a week. However, BEIs for differing work schedules may be extrapolated on pharmacokinetic grounds. BEIs should not be applied either directly or through a conversion factor, in the determination of safe levels for non-occupational exposure to air and water pollutants, or food contaminants. The BEIs are not intended for use as a measure of adverse effects or for diagnosis of occupational illness.

4.3.1 Objectives

(a) The principle of general medical screening is to detect a disease at an early subclinical or presymptomatic stage in order to take action to reverse these effects or to slow progression of the disease. The abnormalities sought, include pathophysiological or histopathological changes. Such tests are well-established in general preventative medicine, e.g. PAP smears for cervical cancer, cholesterol screening, feacal occult blood for lower bowel cancer, etc.

(b) In medical surveillance in industry one is interested not only in detecting adverse effects in the individual, but also in the implication of the findings for the effectiveness of workplace control measures., Medical surveillance is thus directed not only at early adverse effects but also at established disease.

4.3.2 Types of examination

(a) The number of validated screening tests with regard to HCSs is smaller than in general preventive medicine, but is likely to grow in the future. Examples of subclinical tests include urinary cytology for bladder cancer among workers exposed to potential bladder carcinogens, or full blood counts for employees exposed to an HCS toxic for the bloodforming organs.

(b) Medical surveillance may include simple clinical examination, such as examination of the skin of employees exposed to contact irritants or allergens, or of the nasal septum of employees exposed to chromates.

(c) Chest X-rays for silicosis are an example of screening for irreversible (although potentially progressive) disease. Lung function testing is well established as a non-specific test for the possible effect of respiratory irritants, sensitisers and fibrogenic agents.

4.4 Designing and implementing a programme of medical surveillance

4.4.1 The following steps should be included in any programme:

(a) Risk assessment to determine the potential exposure to and routes of absorption of an HCS, as required by regulation 5.

(b) Identification of target-organ toxicity, so as to direct medical screening.

(c) Selection of appropriate tests and testing schedule. Tests should have the desirable operating characteristics of high sensitivity, specificity, reliability and predictive value. The frequency of testing is laid down in general terms by

regulation 7(2) , but should in any case be based on an understanding of the nature of the hazard and the natural history of any adverse effects.

(d) Development of action criteria. These are provided for some HCSs in the form of BEIs in Table 3 of Annexure 1. Criteria for interpreting lung function testing have also been published in the medical literature. However, in many cases, the occupational health practitioners will have to develop pragmatic criteria in the context of the specific workplace.

(e) Standardisation of test process. Quality control needs to be exercised both in the testing site and in the laboratory contracted to carry out analyses. Consistency over time should be sought so as to make longitudinal measurements comparable.

(f) Ethical considerations. Information and training of employees as required by regulation 3(1) should include the rationale for doing medical surveillance, and the consequence of abnormal findings. An employee must be notified of the results and interpretation of his/her tests and any recommendations made. The confidentiality of personal medical records is laid down by regulation 9.

(g) Determination of employees fitness to remain in that job. [Regulation 7(3)]. Results may be compared against the action criteria (BEI if relevant), and preferably also the employees previous results to determine whether individual action needs to be taken. Action may include repeating the test, further medical examination, removal of the employee from further exposure, and notification of the employer. Co-operation of employees can be best secured by a policy of protection of conditions of service in case of medical removal from a particular job.

(h) Evaluation of control. An abnormal finding in an employee, or a pattern of findings in a group of employees, may point to inadequate primary control of exposure. In such cases the employer needs to be notified of such details of the medical findings as are necessary to evaluate the workplace problem and take remedial action.

(i) Record keeping. This includes both medical records and exposure information for every employee. While the employer is responsible for record keeping in terms of regulation 9, the contents of personal medical records may be accessible to the occupational medicine practitioner, the employee, and any person nominated by the employee in writing.

4.4.2 The onus is on the occupational health practitioner carrying out medical surveillance to be familiar with the latest scientific information regarding the HCS and tests that might be useful. The aim should be to design a programme that is rational, ethical and effective. This may have to be done in the face of incomplete information of uncertainty regarding exposures, toxicity and test performance.

Legal background to exposure limits

5. Two types of occupational exposure limits are defined in regulation 1 of the HCS Regulations. The two types are occupational exposure limit - control limit (OEL-CL), and occupational exposure limit - recommended limit (OEL-RL), as listed in Tables 1 and 2 of Annexure 1 (Table 1) (Table 2). The key difference between the two types of limits is that one OEL-RL is set at a level at which there is no indication of a risk to health; for an OEL-CL, a residual risk may exist and the level set, takes socio-economic factors into account. Further details are given in paragraphs 8 to 16.

6. Regulation 10 of the HCS Regulations lays down the requirements for the use of an OEL-CL and an OEL-RL for HCS for the purpose of achieving adequate control. Regulation 10(1) requires that, where there is exposure to a substance for which an OEL-CL is specified in Table 1 of Annexure 1, the control of exposure shall, so far as inhalation of that substance is concerned, be treated as adequate only if the level of exposure is reduced so far as is reasonably practicable and in any case below the OEL-CL.

7. Regulation 10(1) of the HCS Regulations requires that, where there is exposure to a substance for which an OEL-RL has been approved, the control of exposure shall, so far as inhalation of that substance is concerned, be treated as adequate if-

(a) that OEL-RL is not exceeded; or

(b) where that OEL-RL is exceeded, the employer identifies the reasons for the exceeding of the standard and takes appropriate action to remedy the situation as soon as is reasonably practicable.

Setting occupational exposure limits

Advisory Council and Standing Technical Committee

8. OEL-RL and OEL-CL are set by the chief inspector on recommendation of the Advisory Council for Occupational Health and Safety (the Advisory Council), following assessment by the Standing Committee No. 7 (TC7) of the Advisory Council for Occupational Health and Safety.

9. TC 7 must first consider what type of limit is appropriate, OEL-RL, or OEL-CL, and secondly, at what concentration the limit should be set. Setting an OEL-RL is the first option to be considered and TC 7 comes to a decision based on a scientific judgment of the available information on health effects. If, however, TC 7 decides that an OEL-CL is more appropriate, consideration of the level at which to set the limit passes to the Advisory Council, since it involves socio-economic judgments, balancing risk to health against the cost and effort of reducing exposure. Following public consultation, new OEL-CLs and OEL-RLs are listed in Table 1 and Table 2 of Annexure 1 respectively with the approval of the chief inspector.

The indicative criteria

10. An OEL-RL can be assigned to a substance, if all three of the following criteria are complied with:

There is a no-risk at the exposure limit

Criterion 1: The available scientific evidence allows for the identification, with reasonable certainty, of a concentration averaged over a reference period, at which there is no indication that the substance is likely to be injurious to employees if they are exposed by inhalation day after day to that concentration.

Likely excursions above the exposure limit are unlikely

Criterion 2: Exposure to concentrations higher than that derived under criterion 1 and which could reasonably occur in practice, is unlikely to produce serious short or long-term effects on health over the period of time it might reasonably be expected to take to identify and remedy the cause of excessive exposure.

Compliance is reasonably practicable

Criterion 3: The available evidence indicates that compliance with an OEL-RL, as derived under criterion 1, is reasonably practicable.

11. A substance which does not meet criteria 1, 2 and 3, can be assigned an OEL-CL and must meet either of the following criteria:

Criterion 4: The available evidence on the substance does not satisfy criterion 1 and/or 2 for an OEL-RL and exposure to the substance has, or is liable to have, serious health implications for workers; or

Criterion 5: Socio-economic factors indicate that although the substance meets criteria 1 and 2 for an OEL-RL, a numerically higher value is necessary if the controls associated with certain uses are to be regarded as reasonably practicable.

Setting an OEL-RL

12. Criterion 1 sets out the fundamental basis for establishing such a limit: The existence of a threshold above which there may be evidence of significant effects on health but below which, on existing knowledge, there are thought to be no adverse effects.

13. Criterion 2 is necessary in order to take account of HCS Regulation 10(1) of the HCS Regulations whereby exposures above an OEL-RL are allowed provided the employer identifies the reasons for exceeding the standard and takes steps to reduce exposure to that OEL-RL as soon as is reasonably practicable. Clearly, it is necessary to take account of the likelihood and probable extent of cases in deciding whether an OEL-RL is appropriate. The health effects to be taken into account include sensory and other effects such as the slowing of reflexes which might result in the impairment of safety.

14. Criterion 3 takes account of whether industry can reasonably comply with the exposure limit derived under the first criterion. There is no purpose in setting an OEL-RL which plainly cannot be achieved in practice. Note that industry's ability to comply, influences the decision of whether to set an OEL-RL, but does not influence the level at which that OEL-RL is set.

Setting an OEL-CL

15. To be assigned an OEL-RL, a substance must meet all the first three criteria; if it does not, then it can be considered for an OEL-CL. To be assigned an OEL-CL, there should be serious implications for the health of workers exposed to the substance. Serious health implications include both the risk of serious health effects to a small population of workers and the risk of relatively minor health effects to a large population. In practice, an OEL-CL has been most often allocated to carcinogens and to other substances for which no threshold of effect can be identified and about which there is no doubt about the seriousness of the effects of exposure.

16. An OEL-CL and an OEL-RL, therefore, differ not only in their legal status, but also in the way in which they are set. For an OEL-RL the only consideration in setting the limits is the protection of the health of the employee; for an OEL-CL this is still the primary consideration but socio-economic factors are also taken into account.

17. The indicative criteria, than, provide the framework within which the discussions at the various stages of limit-setting can be conducted.

Applying occupational exposure limits

General

18. The lists of occupational exposure limits given in Table 1 and Table 2 of Annexure 1, unless otherwise stated, relate to personal exposure to substances hazardous to health in the air of the workplace.

Units of measurement

19. In occupational exposure limits, concentrations of gases and vapours in air are usually expressed in parts per million (ppm), a measure of concentration by volume, as well as in milligrams per cubic metre of air (mg/m^3), a measure of concentration by mass. In converting from ppm to mg/m^3 a temperature of 25°C and an atmospheric pressure of 101.325 kPa are used. Concentrations of airborne particles (fume, dust, etc.) are usually expressed in mg/m^3. In the case of dust, the limits in the tables refer to the total inhalable fraction unless specifically indicated as referring to the respirable fraction (see paragraph 36). In the case of a man-made mineral fibre, the limit is expressed as fibres per millilitre of air (fibres/ml).

Occupational exposure limits - control limits: OEL-CL (table 1)

20. An OEL-CL is the maximum concentration of an airborne substance, averaged over a reference period, to which employees may be exposed by inhalation under any circumstances, and is specified together with the appropriate reference period in Table 1 of Annexure 1.

21. Regulation 19(1) of the HCS Regulations, when read in conjunction with the Act, imposes a duty on the employer to take all reasonable precautions and to exercise all due diligence to ensure that exposure is kept as far below an OEL-CL as is reasonably practicable.

22. To comply with this duty, in the case of substances with a 8-hour reference period, employers should undertake a programme of monitoring in accordance

with regulation 6 so that they can show (if it is the case), that an OEL-CL is not exceeded. Such a monitoring programme need not be undertaken if the assessment carried out in accordance with regulation 5 shows that the level of exposure is most unlikely ever to exceed an OEL-CL. For substances assigned a short-term limit, such value should never be exceeded.

23. The assessment should also be used to determine the extent to which it is reasonably practicable to reduce exposure further below an OEL-CL as required by regulation 10(1) In assessing reasonable practicability, the nature of the risk presented by the substance in question should be weighed against the cost and the effort involved in taking measures to reduce the risk. (Also see the definition of reasonably practicable as defined in the Act.)

Occupational exposure limit-recommended limit: OEL-RL (Table 2)

24. An OEL-RL is the concentration of an airborne substance, averaged over a reference period, at which, according to current knowledge, there is no evidence that it is likely to be injurious to employees if they are exposed by inhalation, day after day, to that concentration.

25. For a substance, which has been assigned an OEL-RL, exposure by inhalation should be reduced to that standard. However, if exposure by inhalation exceeds the OEL-RL, then control will still be deemed to be adequate provided that the employer has identified why the OEL-RL has been exceeded and is taking appropriate steps to comply with the OEL-RL as soon as reasonably practicable. In such a case, the employers objective must be to reduce exposure to the OEL-RL, but the final achievement of this objective may take some time. The assessment under regulation 5 will determine the urgency of the necessary action, taking into account the extent and cost of the required measures in relation to the nature and degree of exposure involved.

26. Control of an OEL-RL as prescribed in regulation 10 (1) (a) can always be regarded as adequate control of that substance for the purpose of the HCS Regulations, so far as exposure from inhalation is concerned. However, due to the variations in process control and the fluctuations in substance concentrations in the workplace, it will be prudent for employers to reduce exposure below an OEL-RL as to ensure that the exposure of all employees does not exceed that OEL-RL. Similarly, it is not intended that the statutory requirements under regulation 10 (1) should discourage the further application of good occupational hygiene principles in order to reduce exposure below the OEL-RL.

Long-term and short-term exposure limits

27. The pattern of effects due to exposure to substances hazardous to health varies considerably depending on the nature of the substance and the exposure. Some effects require prolonged or accumulated exposure. The long-term (8-hour time weighted average) exposure limit is intended to control such effects by restricting the total intake by inhalation over one or more workshifts. Other effects may be seen after brief exposures which have occurred once or repeatedly. Short-term limits (usually 15 minute) may be applied to such substances. Where long-term limits also apply, the short-term limits restrict the magnitude of excursion above the average concentration during longer exposures. For those

substances for which no short-term limit is specified, it is recommended that a figure of three times the long-term limit be used as a guideline for controlling short-term excursions in exposure. With some other substances, brief exposure may be critical and the exposure limit necessary to prevent these excursions will also control any other effects. A separate long-term limit is not considered necessary in such cases and the short-term limit applies throughout the shift.

28. Exposure limits are expressed as airborne concentrations averaged over a specified period of time. The period for the long-term limit is normally eight hours. When a different period is used, this is stated. The averaging period for the short-term exposure limit is normally 15 minutes. Such a limit applies to any 15 minute period throughout the working shift.

Limitations to the application of exposure limits

29. The exposure limits relate to personal exposure with the exception of the annual OEL-CL for vinyl chloride which should be recorded as the time-weighted average of vinyl chloride in the atmosphere of a working place over a period of one year (see Annexure 2) and the OEL-RL for cotton dust is not a personal exposure standard, but a static air standard (see Annexure 4).

30. The limits cannot readily be extrapolated to evaluate or control non-occupational exposure, e.g. levels of contamination in the neighbourhood close to an industrial plant. OELs only apply to persons at work. Employers should also take into account their duties under the Environmental Protection Act. The OELs are also only approved for use where the atmospheric pressure is between 85 kPa and 101.325 kPa. This covers the normal range of meteorological variations and slightly pressurised workplaces such as cleaning rooms, but not the higher pressures that may be encountered in, for example, tunnelling or underwater hyperbaric chambers. Such situations require special assessments.

31. Occupational exposure limits, as set out in Tables 1 and 2 of Annexure 1, are intended to be used for normal working conditions in workplaces. Employers should also take into account their duties and the provisions of the Environmental Conservation Act. OELs are not, however, designed to deal with serious accidents or emergencies, particularly where employees may be exposed to rapidly rising concentrations of gas, as may arise from a major escape due to plant failure. Over and above their responsibilities to ensure that the requirements of the HCS Regulations are met, employers also have a clear responsibility to ensure that the plant is designed, operated and maintained in a way that avoids accidents and emergencies. Where appropriate, detection, alarm and response measures should be used in order to minimise the effect of any such unplanned events.

32. To help maintain adequate operational control, employers may find it helpful to select their own indicators of control when undertaking investigations or corrective action.

Exposure in mines

33. The HCS Regulations and the occupational exposure limits in this publication do not apply to exposure to substances hazardous to health in mines.

Lead and asbestos

34. Work with asbestos or lead is not subject to the HCS Regulations. The exposure limits for various types of asbestos and lead are specified in the Asbestos Regulations and the Lead Regulations.

Pesticides

35. Substances used as active ingredients in pesticides are listed under their chemical names and/or their common (ISO) names. These names may sometimes be used as parts of the names of proprietary pesticide formulations. In all cases the exposure limit applies to the specific active ingredients and not to the formulation as a whole.

Dusts

36. The general approach necessary to control occupational exposure to dusts is as follows: not all dusts have been assigned occupational exposure limits but the lack of such limits should not be taken to imply an absence of hazard. In the absence of a specific exposure limit for a particular dust, exposure should be adequately controlled. Where there is no indication of the need for a lower value, personal exposure should be kept below both 10 mg/m³ 8-hour time-weighted average total inhalable dust and 5 mg/m³ time-weighted average respirable dust. Such, or greater, dust concentrations should be taken as the substantial concentrations. A substantial concentration of dust should be taken as a concentration of 10 mg/m³, 8-hour time-weighted average, of respirable dust, where there is no indication of the need for a lower value, and as such they are referred to as substances hazardous to health.

Total inhalable dust and respirable dust

37. Total inhalable dust approximates to the fraction of airborne material that enters the nose and mouth during breathing and is therefore available for deposition in the respiratory tract. Respirable dust approximates to the fraction which penetrates to the gas exchange region of the lung. A fuller definition is given at the end of Table 2 of Annexure 1 (Abbreviations).

38. Where dusts contain components which have their own assigned occupational exposure limits, all the relevant limits should be complied with.

Fume

39. Where a separate OEL has been set for fume, it should normally be applied to solid particles generated by chemical reactions or condensed from the gaseous state, usually after volatilisation from melted substances. The generation of fume is often accompanied by a chemical reaction such as oxidation or thermal breakdown.

Absorption through the skin

40. In general, for most substances the main route of entry into the body is by inhalation. The OELs given in these regulations solely relate to exposure by this route. Certain substances such as phenol, aniline and certain pesticides (marked in the Tables with an SK notation) have the ability to penetrate the intact skin and thus become absorbed into the body. Absorption through the skin can result from localised contamination, for example, from a splash on the skin or clothing, or in certain cases from exposure to high atmospheric concentrations of vapour.

Serious effects can result in little or no warning and it is necessary to take special precautions to prevent skin contact when handling these substances. Where the properties of the substances and the methods of use provide a potential exposure route via skin absorption, these factors should be taken into account in determining the adequacy of the control measures.

Sensitisers

41. Certain substances may cause sensitisation of the respiratory tract if inhaled or skin contact occurs. Respiratory sensitisers can cause asthma, rhinitis, or extrinsic allergic alveolitis. Skin sensitisers cause allergic contact dermatitis. Substances which cause skin sensitations are not necessarily respiratory sensitisers or vice-versa. Only a proportion of the exposed population will become sensitised, and those who do become sensitised, will not have been identified in advance. Individuals who become sensitised may produce symptoms of ill health after exposure even to minute concentrations of the sensitiser.

42. Where it is reasonably practicable, exposure to sensitisers should be prevented. Where this cannot be achieved, exposure should be kept as low as is reasonably practicable and activities giving rise to short-term peak-concentrations should receive particular attention. As with other substances, the spread of contamination by sensitisers to other working areas should also be prevented, as far as is reasonably practicable.

43. The Sen notation (marked in the Tables with a Sen notation) has been assigned only to those sensitisers that may cause sensitisation by inhalation. Remember that other substances not contained in these Tables can act as respiratory sensitisers.

Other factors

44. Working conditions which impose additional stress on the body, such as exposure to ultra-violet radiation, high temperatures, pressures and humidity, may increase the toxic response to a substance. In such cases, specialist advice may be necessary to evaluate the effect of these factors.

Mixed Exposures

General

45. The majority of OELs listed in Tables 1 and 2 of Annexure 1 are for single compounds or for substances containing a common element or radical, e.g. tungsten and compounds, and isocyanates. A few of the limits relate to substances commonly encountered as complex mixtures or compounds e.g. white spirit, rubber fume, and welding fume. However, workers are frequently subject to other mixed exposures involving solids, liquids, aerosols or gases. These exposures can arise as a result of work with materials containing a mixture of substances, or from work with several individual substances, simultaneously or successively, in a workshift. Mixed exposures require careful assessment of their health effects and the appropriateness of control standards. The following paragraphs provide a brief summary of the advice on the

application of exposure limits in these circumstances. In all cases of doubt, specialist advice should be sought.

Effects of mixed exposures

46. The ways in which the constituent substances of a mixed exposure interact, vary considerably. Some mixed exposures involve substances that act on different body tissues or organs, or by different toxilogical mechanisms, these various effects being independent of each other. Other mixtures will include substances that act on the same organs, or by similar mechanisms, so that the effects reinforce each other and the substances are additive in their effect. In some cases the overall effect is considerably greater than the sum of the individual effects and the system is synergistic. This may arise from mutual enhancement of the effects of the constituents or because one substance potentiates another, causing it to act in a way which it would not do alone.

Assessment and control

47. With All types of mixed exposures, it is essential that assessments be based on the concentrations of each of the constituents in air to which workers are exposed. Depending on the nature of the constituents and the circumstances of use, the relative concentrations of the constituents in air may differ considerably from those in the liquid or solid source material. The composition of the bulk material should not be relied on for assessment unless there is good evidence for doing so.

48. Where mixed exposures occur, the first step is to ensure adequate control of exposure for each individual substance. However, the nature and amount of the other substances in a mixture can influence the level to which it is reasonably practicable to reduce exposure to a substance subject to an OEL-CL. When limits for specific mixtures have been established, they should be used only where they are applicable, and in addition to any relevant individual limits. They should not be extended to inappropriate situations. It is then necessary to assess whether further control is needed to counteract any increased risk from the substances acting in conjunction. Expert assessments for some particular mixed exposures may be available and can be used as guidelines in similar cases. In other cases, close examination of the toxicological data will be necessary to determine which of the main types of interaction (if any) are likely for the particular combination of substances concerned. The various types should be considered in the following order:

(a) **Synergistic substances:** Known cases of synergism and potentiation are considerably less common than the other types of behaviour in mixed exposures. However, they are the most serious in their effects and require the most strict control. They are also the most difficult to assess and wherever there is reason to suspect such interaction, specialist advice should be obtained;

(b) **Additive substances:** Where there is reason to believe that the effects of the constituents are additive, and where the exposure limits are based on the same health effects, the mixed exposure should be assessed by means of the formula-

$$C_1/L_1 + C_2/L_2 + C_3/L_3 \ldots < 1$$

here C1, C2, etc. are the time-weighted average (TWA) concentrations of constituents in air and L1, L2, etc are the corresponding exposure limits. The use of this formula is only applicable where the additive substances have been assigned OELs, and L1, L2, etc. relate to the same reference period in the list of approved OELs. Where the sum of the C/L fractions does not exceed one, the exposure is considered not to exceed the national OELs. If one of the constituents has been assigned an OEL-CL, then the additive effect should be taken into account in deciding the extent to which it is reasonably practicable to further reduce exposure; and

(c) **Independent substances:** Where no synergistic or additive effects are known or considered likely, the constituents can be regarded as acting independently. It is then sufficient to ensure compliance with each of the OELs individually.

49. The above steps provide basic protocol for assessment of mixed exposures. It is open to persons responsible for control of exposure to treat all non-synergistic systems as though they were additive. This avoids the need to distinguish additive and independent systems and can be regarded as the most prudent course, particularly where the toxicity data are scarce or difficult to assess.

Monitoring mixed exposure

50. Further information on monitoring airborne contaminants is given in paragraphs 52 and 53. The number of components of a mixed exposure for which routine air monitoring is required, can be reduced if their relative concentrations can be shown to be constant. This involves the selection of a key or marker, which may be one of the constituents, as a measure of the total contamination. Exposure to the marker is controlled at a level selected so that exposures to all components will be controlled in accordance with the criteria in paragraphs 48(a) and (b). However, if one of the components has been assigned an OEL-CL, the level of the exposure to that substance should always be reduced as far as is reasonably practicable. If this approach is to be used, it should take place under the guidance of suitable specialist advice.

Complicating factors

51. Several factors that complicate the assessment and control of exposure to individual substances will also affect cases of mixed exposures and will require similar special consideration. Such factors include-

(a) exposure to a substance for which there is no established limit or for which an OEL-CL has been set;

(b) the relevance of factors such as alcohol, medication, smoking and additional stresses;

(c) exposure of the skin to one or more substances that can be absorbed by this route, as well as by inhalation; and

(d) substances in mixture may mutually affect the extent of their absorption, as well as their health effects, at a given level of exposure.

Monitoring exposure

52. Regulation 5 (4) of the HCS Regulations imposes a duty on the employer to monitor the exposure of employees to substances hazardous to health.

53. Details of routine sampling strategies for individual substances are outside the scope of this document. However, advice is available in EH 42, which provides practical guidance on monitoring substances hazardous to health in air.

Biological Exposure Indices

Acetone

Determinant	Acetone in urine
Sampling Time	End of shift
BEI	100 mg/l
Notation	B , C

Aniline

Determinant	Total p-aminophenol in urine
Sampling Time	End of shift
BEI	50 mg/g creatinine
Notation	C

Determinant	Methemoglobin in blood
Sampling Time	During or end of shift
BEI	1.5% of hemoglobin
Notation	B, C , D

Arsenic and soluble compounds, including Arsine

Determinant	Inorganic arsenic metabolites in urine
Sampling Time	End of workweek
BEI	50 ug/g creatinine
Notation	B

Benzene

Determinant	Total phenol in urine
Sampling Time	End of shift
BEI	50 mg/g

	creatinine
Notation	B, C

Benzene in exhaled air:

Determinant	Mixed exhaled
Sampling Time	Prior to next shift
BEI	0.08 ppm
Notation	D

Determinant	End exhaled
BEI	0.12 ppm

Cadmium

Determinant	Cadmium in urine
Sampling Time	Not critical
BEI	10 ug/g creatinine
Notation	B

Determinant	Cadmium in blood
Sampling Time	Not critical
BEI	10 ug/l
Notation	B

Carbon Disulphide

Determinant	2-Thiothiazolidine-4-carboxylic acid (TTCA) in urine
Sampling Time	End of shift
BEI	5 mg/g creatinine

Carbon Monoxide

Determinant	Carboxyhemoglobin in blood

Sampling Time	End of shift
BEI	< 8 % of hemoglobin
Notation	B, C

Determinant	CO in end exhaled air
Sampling Time	End of shift
BEI	< 40 ppm
Notation	B, C

Chlorobenzene

Determinant	Total 4-chlorocatechol in urine
Sampling Time	End of shift
BEI	150 mg/g creatinine
Notation	C

Determinant	Total p-chlorophenol in urine
Sampling Time	End of shift
BEI	25 mg/g creatinine
Notation	C

Chromium (VI)

Determinant	Water soluble fume
Sampling Time	Increase during shift
BEI	10 ug/g creatinine
Notation	B

Determinant	Total chromium in urine
Sampling Time	End of shift at end of workweek
BEI	30 ug/g creatinine
Notation	B

N,N-Dimethylformamide (DMF)

Determinant	N-Methylformamide in urine
Sampling Time	End of shift
BEI	40 mg/g creatinine
Notation	B

2-Ethoxyethanol (EGEE)

Determinant	2-Ethoxyacetic acid in urine
Sampling Time	End of shift at end of workweek
BEI	100 mg/g creatinine

2-Ethoxyethylacetate (EGEEA)

Determinant	2-Ethoxyacetic acid in urine
Sampling Time	End of shift at end of workweek
BEI	100 mg/g creatinine

Ethyl Benzene

Determinant	Mandelic acid in urine
Sampling Time	End of shift at end of workweek
BEI	1.5 g/g creatinine
Notation	A

Determinant	Ethyl benzene in end exhaled air
Notation	D

Flourides

Determinant	Flourides in urine
Sampling Time	Prior to shift
BEI	3 mg/g creatinine
Notation	B, C

Sampling Time	End of shift
BEI	10 mg/g creatinine
Notation	B, C

Furfural

Determinant	Total furoic acid in urine
Sampling Time	End of shift
BEI	200 mg/g creatinine
Notation	B, C

n-Hexane

Determinant	2,5-Hexanedione in urine
Sampling Time	End of shift
BEI	5 mg/g creatinine
Notation	C

Determinant	n-Hexane in end-exhaled air
Notation	D

Lead

Determinant	Lead in blood
Sampling Time	Not critical
BEI	50 ug/100 ml
Notation	B

Determinant	Lead in urine
Sampling Time	Not critical
BEI	150 ug/g creatinine
Notation	B

Determinant	Zinc protoporphyrin in blood
Sampling Time	After 1 month exposure
BEI	250 ug/100 ml erythrocytes or 100 ug/100ml blood
Notation	B

Mercury

Determinant	Total inorganic mercury in urine
Sampling Time	Preshift
BEI	35 ug/g creatinine
Notation	B

Determinant	Total inorganic mercury in blood
Sampling Time	End of shift at end of workweek
BEI	15 ug/l
Notation	B

Methanol

Determinant	Methanol in urine
Sampling Time	End of shift
BEI	15 mg/l
Notation	B, C

Determinant	Formic acid in urine
Sampling Time	Prior to last shift of workweek
BEI	80 mg/g creatinine
Notation	B, C

Methemoglobin inducers

Determinant	Methemeglobin in blood
Sampling	During or end of

Time	shift
BEI	1.5% of hemoglobin
Notation	B, C , D

Methyl Chloroform

Determinant	Methyl chloroform in end exhaled air
Sampling Time	Prior to last shift of workweek
BEI	40 ppm

Determinant	Trichloroacetic acid in urine
Sampling Time	End of workweek
BEI	10 mg/l
Notation	C , D

Determinant	Total trichloroethanol in urine
Sampling Time	End of shift at end of workweek
BEI	30 mg/l
Notation	C , D

Determinant	Total trichloroethanol in blood
Sampling Time	End of shift at end of workweek
BEI	1 mg/l
Notation	C

Methyl Ethyl Ketone (MEK)

Determinant	MEK in urine
Sampling Time	End of shift
BEI	2 mg/l

Methyl isobutyl ketone (MIBK)

Determinant	MIBK in urine
Sampling Time	End of shift
BEI	2 mg/l

Nitrobenzene

Determinant	Total p-nitrophenol in urine
Sampling Time	End of shift at end of workweek
BEI	5 mg/g creatinine
Notation	C

Determinant	Methemoglobin in blood
Sampling Time	End of shift
BEI	1.5% of hemoglobin
Notation	B, C , D

Organophosphorus Cholinesterase Inhibitors

Determinant	Cholinesterase activity in red cells
Sampling Time	Discretionary
BEI	70% of individual's baseline
Notation	B, C , D

Parathion

Determinant	Total p-nitrophenol in urine
Sampling Time	End of shift
BEI	0.5 mg/g creatinine
Notation	C , D

Determinant	Cholinesterase activity in red cells
Sampling	Discretionary

Time	
BEI	70% of individuals baseline
Notation	B, C , D

Pentachlorophenol

Determinant	Total PCP in urine
Sampling Time	Prior to the last shift of workweek
BEI	2 mg/g creatinine
Notation	B

Determinant	Free PCP in plasma
Sampling Time	End of shift
BEI	5 mg/l
Notation	B

Perchloroethylene

Determinant	Perchloroethylene in end-exhaled air
Sampling Time	Prior to the last shift of workweek
BEI	10 ppm
Determinant	Perchloroethylene in blood
Sampling Time	Prior to the last shift of workweek
BEI	1 mg/l
Determinant	Trichloroacetic acid in urine
Sampling Time	End of workweek
BEI	7 mg/l
Notation	C , D

Phenol

Determinant	Total phenol in urine
Sampling Time	End of shift
BEI	250 mg/g

	creatinine
Notation	B, C

Styrene

Determinant	Mandelic acid in urine
Sampling Time	End of shift
BEI	800 mg/g creatinine
Notation	C
Sampling Time	Prior to next shift
BEI	300 mg/g creatinine
Notation	C
Determinant	Phenolglyoxylic acid in urine
Sampling Time	End of shift
BEI	240 mg/g creatinine
Notation	B, C
Sampling Time	Prior to next shift
BEI	100 mg/g creatinine
Notation	B, C
Determinant	Styrene in venous blood
Sampling Time	End of shift
BEI	0.55 mg/l
Notation	D
Sampling Time	Prior to next shift
BEI	0.02 mg/l
Notation	DD

Toluene

Determinant	Hippuric acid in urine
Sampling Time	End of shift Last 4 hours of shift
BEI	2.5 g/g creatinine
Notation	B, C

Determinant	Toluene in venous blood
Sampling Time	End of shift
BEI	1 mg/l
Notation	D

Determinant	o-Cresol in urine
Sampling Time	End of shift
BEI	1 mg/g creatinine
Notation	C

Trichloroethylene

Determinant	Trichloroacetic acid in urine
Sampling Time	End of workweek
BEI	100 mg/g creatinine
Notation	C

Determinant	Trichloroacetic acid and trichloroethanol in urine
Sampling Time	End of shift at end of workweek
BEI	300 mg/g creatinine
Notation	C

Determinant	Free trichloroethanol in blood
Sampling Time	End of shift at end of workweek
BEI	4 mg/l
Notation	C

Determinant	Trichloroethylene in end-exhaled air
Notation	D

Xylenes

Determinant	Methylhippuric acid in urine
Sampling Time	End of shift Last 4 hours of shift
BEI	1.5 g/g creatinine
Notation	2 mg/min

Carcinogenic Compounds

Substance	Carcinogenicity
Acetaldehyde CH3CHO	Animal Carcinogen
Acrylamide CH2=CHCONH2	Suspected Human Carcinogen
Acrylonitrile CH2=CHCN	Suspected Human Carcinogen
Aldrin C12H8Cl6	Suspected Human Carcinogen
Allyl Chloride CH2=CHCH2Cl	Suspected Human Carcinogen
4-Aminodiphenyl	Confirmed Human Carcinogen
Amitrole	Suspected Human Carcinogen
Aniline and homologues C6H5NH2	Suspected Human Carcinogen
Anisidine (o & p) isomers NH2C6H4OCH3	Suspected Human Carcinogen
Antimony compounds - as Sb Sb	Suspected Human Carcinogen
Arsenic and compounds except Arsine (as As) As	Confirmed Human Carcinogen
Arsine AsH3	Suspected Human Carcinogen
Asbestos - all forms	Confirmed Human Carcinogen
Asphalt - petroleum fumes	Suspected Human Carcinogen
Benz(a)anthracene	Suspected Human Carcinogen
Benzene C6H6	Confirmed Human Carcinogen
Benzidine	Confirmed Human Carcinogen
Benzo(b)flouranthene	Suspected Human Carcinogen

Benzo(a)pyrene	Suspected Human Carcinogen
Benzyl acetate	Animal Carcinogen
Benzyl Chloride C6H5CH2Cl	Suspected Human Carcinogen
Beryllium and compounds - as Be Be	Suspected Human Carcinogen
1,3-Butadiene (Buta-1,3-diene) CH2=CHCH=CH2	Suspected Human Carcinogen
tert-Butyl Chromate - as CrO3	Suspected Human Carcinogen
Cadmium compounds Cd	Suspected Human Carcinogen
Calcium Chromate	Suspected Human Carcinogen
Captafol (ISO) C10H9Cl4NO2S	Suspected Human Carcinogen
Captan (ISO) C9H8Cl3NO2S	Suspected Human Carcinogen
Carbon Black C	Suspected Human Carcinogen
Carbon Tetrachloride CCl4	Animal Carcinogen
Chlordane (ISO) C10H6Cl8	Suspected Human Carcinogen
Chlorinated Camphene (Toxaphene)	Suspected Human Carcinogen
Chlorodiphenyl (42% Chlorine)	Suspected Human Carcinogen
Chlorodiphenyl (54% Chlorine)	Suspected Human Carcinogen
Chloroform CHCl3	Suspected Human Carcinogen
bis(Chloromethyl) ether	Confirmed Human Carcinogen
Chloromethyl methyl ether	Suspected Human Carcinogen
beta-Chloroprene CH2=CClCH=CH2	Suspected Human Carcinogen

Chromite Ore processing - as Cr	Confirmed Human Carcinogen
Chromium IV compounds	Confirmed Human Carcinogen
Chromyl Chloride	Suspected Human Carcinogen
Chrysene	Suspected Human Carcinogen
Coal Tar pitch volatiles - as cyclohexane solubles	Confirmed Human Carcinogen
Cobalt metal - dust and fumes Co	Animal Carcinogen
Crotonaldehyde CH3CH=CHCHO	Suspected Human Carcinogen
DDT (Dichlorodiphenyltrichloroethane) C14H9Cl5	Suspected Human Carcinogen
Diazomethane CH2N2	Suspected Human Carcinogen
Dichloroacetylene ClCCCl	Suspected Human Carcinogen
p-Dichlorobenzene C6H4Cl2	Animal Carcinogen
3,3'-Dichlorobenzidine	Suspected Human Carcinogen
1,4-Dichloro-2-butene	Suspected Human Carcinogen
Dichloroethyl ether	Suspected Human Carcinogen
1,3-Dichloropropene CHClCHCH2Cl	Suspected Human Carcinogen
Dieldrin (ISO) C12H6Cl6O	Suspected Human Carcinogen
Diglycidyl ether (DGE) (OCH2CHCH2)2O	Suspected Human Carcinogen
Dimethyl carbamoyl chloride	Suspected Human Carcinogen
1,1-Dimethyl hydrazine	Suspected Human Carcinogen
Dimethyl sulphate (CH3)2SO4	Suspected Human Carcinogen

Dinitrotoluene CH3C6H3(NO2)2	Suspected Human Carcinogen
Dioxane OCH2CH2OCH2CH2	Suspected Human Carcinogen
Di-sec-octyl phthalate	Suspected Human Carcinogen
Epichlorohydrin OCH2CHCH2Cl	Suspected Human Carcinogen
Ethyl acrylate CH2=CHCOOC2H5	Suspected Human Carcinogen
Ethyl bromide C2H5Br	Suspected Human Carcinogen
Ethylene dibromide BrCH2CH2Br	Suspected Human Carcinogen
Ethylene dichloride ClCH2CH2Cl	Suspected Human Carcinogen
Ethylene imine CH2CH2NH	Suspected Human Carcinogen
Ethylene oxide	Suspected Human Carcinogen
Formaldehyde	Suspected Human Carcinogen
Gasoline	Suspected Human Carcinogen
Heptachlor and heptachlor epoxide C10H5Cl7	Suspected Human Carcinogen
Hexachlorobenzene - Skin	Suspected Human Carcinogen
Hexachlorobutadiene	Suspected Human Carcinogen
Hexachloroethane CCl3CCl3	Suspected Human Carcinogen
Hexamethyl phosphoramide	Suspected Human Carcinogen
Hydrazine NH2NH2	Suspected Human Carcinogen
Lead - inorganic dusts and fumes - as Pb	Suspected Human Carcinogen
Lead Chromate	Suspected Human Carcinogen
Lindane	Suspected Human Carcinogen

C6H5Cl6	
Methoxychlor (ISO) C16H15Cl3O2	Suspected Human Carcinogen
Methyl bromide - Skin CH3Br	Suspected Human Carcinogen
Methyl chloride CH3Cl	Suspected Human Carcinogen
Methylene chloride (Dichloromethane) CH2Cl2	Suspected Human Carcinogen
4,4'-Methylene bis(2-chloroaniline) (MOCA)	Suspected Human Carcinogen
4,4'-Methylene dianiline H2NC6H4CH2C6H4NH2	Suspected Human Carcinogen
Methyl hydrazine	Suspected Human Carcinogen
Methyl iodide CH3I	Suspected Human Carcinogen
beta-Naphthylamine	Confirmed Human Carcinogen
Nickel metal and insoluble compounds	Confirmed Human Carcinogen
Nickel, soluble compounds as Ni	Confirmed Human Carcinogen
p-Nitrochlorobenzene	Suspected Human Carcinogen
4-Nitrodiphenyl	Confirmed Human Carcinogen
2-Nitropropane CH3CH(NO2)CH3	Suspected Human Carcinogen
N-Nitrosodimethylamine	Suspected Human Carcinogen
Oil mist, mildly refined cont. benzene	Confirmed Human Carcinogen
Pentachlorophenol C6Cl5OH	Suspected Human Carcinogen
Perchloroethylene (Tetrachloroethylene) CCl2=CCl2	Animal Carcinogen
N-Phenyl-beta-naphthylamine	Suspected Human Carcinogen
o-Phenylenediamine C6H4(NH2)2	Suspected Human Carcinogen

Phenylglycidylether (Phenyl-2,3-epoxypropylether) C6H5OCH2CHCH2O	Suspected Human Carcinogen
Phenylhydrazine C6H5NHNH2	Suspected Human Carcinogen
Propane sultone	Suspected Human Carcinogen
beta-Propiolactone	Suspected Human Carcinogen
Propylene dichloride	Suspected Human Carcinogen
Propylene imine	Suspected Human Carcinogen
Propylene oxide	Suspected Human Carcinogen
Rosin, core solder pyro products - formaldehyde	Sensitiser, reduce exposure as much as possible
Strontium chromate as Cr	Suspected Human Carcinogen
Styrene, monomer C6H5CHCH2	Suspected Human Carcinogen
1,1,2,2-Tetrachloroethane	Suspected Human Carcinogen
Tetranitromethane	Suspected Human Carcinogen
o-Tolidine	Suspected Human Carcinogen
o-Toluidine	Suspected Human Carcinogen
p-Toluidine	Suspected Human Carcinogen
1,1,2-Trichloroethane CH2ClCHCl2	Suspected Human Carcinogen
Trichloroethylene	Not Suspected as a Human Carcinogen
1,2,3-Trichloropropane CH2ClCHClCH2Cl	Suspected Human Carcinogen
2,4,6-Trinitrotoluene (TNT) CH3C6H2(NO2)3	Suspected Human Carcinogen
Uranium, all compounds - as U	Suspected Human Carcinogen

U

Vinyl acetate CH3COOCHCH2	Animal Carcinogen
Vinyl bromide CH2CHBr	Suspected Human Carcinogen
Vinyl chloride	Confirmed Human Carcinogen
4-Vinyl cyclohexene	Suspected Human Carcinogen
Vinyl cyclohexene dioxide C6H12O2	Suspected Human Carcinogen
Vinylidene chloride	Suspected Human Carcinogen
Welding fumes	Suspected Human Carcinogen
Wood dust (certain hardwoods)	Suspected Human Carcinogen
Soft wood dusts	Suspected Human Carcinogen
Xylidene, mixed isomers (CH3)2C6H3NH2	Suspected Human Carcinogen
Zinc chromates	Confirmed Human Carcinogen

Occupational Exposure Limits - Control Limits

Substance	TWA OEL-CL ppm	TWA OEL-CL mg/m³	Short Term OEL-CL ppm	Short Term OEL-CL mg/m³	1995 Notes
Acrylamide CH2=CHCONH2	-	0.3	-	-	Sk
Acrylonitrile CH2=CHCN	2	4			Sk
Arsenic and compounds As	-	0.1	-	-	except Arsine (as As)
Asbestos - all forms					See Asbestos Regulations
Benzene C6H6	5	16			
Bis-(chloromethyl) ether (BCME) ClCH2OCH2Cl	0.001	0.005			New
Buta-1,3-diene CH2=CHCH=CH2	10	22			
2-Butoxyethanol (EGBE) C4H9OCH2CH2OH	25	120			Sk
Cadmium compounds except CdO fumes and CdS Cd	-	0.05	-	-	
Cadmium Oxide fumes CdO		0.05		0.05	
Cadmium Sulphide pigments (respirable dust Cd) CdS		0.04			
Carbon Disulphide CS2	10	30			Sk
Chromium IV compounds		0.05			
1,2 Dibromoethane (ethylene dibromide) BrCH2CH2Br	0.5	4			Sk
Dichloromethane	100	350			

CH2Cl2					
2,2'Dichloro-4,4'methylene dianiline (MbOCA) CH3(C6H3ClNH2)2		0.005			Sk
2-Ethoxyethanol C2H5OCH2CH2OH	10	37			Sk
2-Ethoxyethyl acetate C2H5OCH2CH2OOCCH3	10	54			Sk
Ethylene oxide	5	10			
Formaldehyde	2	2.5	2	2.5	
Grain dust See Annexure 7		10			Sen
Hydrogen cyanide			10	10	Sk
Isocyanate (all isomers) as NCO		0.02		0.07	Sen
Lead and compounds- as Pb					See the Lead Regulations
2-Methoxyethanol CH3OCH2CH2OH	5	16			Sk
2-Methoxyethyl acetate CH3COOCH2CH2OCH3	5	24			Sk
Nickel Ni		0.05			
Nickel compounds as Ni		0.1 0.5			soluble insoluble
Rubber process dust		8			See Annexure 6
Rubber fume		0.6			
Silica crystalline SiO2		0.4			respirable dust
Styrene C6H5CHCH2	100	420	250	1050	
1,1,1-Trichloroethane CH3CCl3	350	1900	450	2450	
Trichloroethylene CCl2=CHCl	100	535	150	802	Skin
Vinyl chloride	7				annual TWA

CH2=CHCl			OEL-CL of 3 ppm
Vinylidene chloride CH2=CCl2	10	40	
Wood dust (hard wood)		5	Sen

Occupational Exposure Limits - Recommended Limits

Substance	TWA OEL-RL ppm	TWA OEL-RL mg/m³	Short Term OEL-RL ppm	Short Term OEL-RL mg/m³	1995 Notes
Acetaldehyde CH_3CHO	100	180	150	270	
Acetic acid CH_3COOH	10	25	15	37	
Acetic anhydride $(CH_3CO)_20$	-	-	5	20	
Acetone CH_3COCH_3	750	1780	1500	3560	
Acetonitrile CH_3CN	40	70	60	105	
o-Acetyl Salicylic Acid (Aspirin) $CH_3COOC_6H_4COOH$	-	5	-	-	
Acrolein (Acrylaldehyde) $CH_2=CHCHO$	0.1	0.25	0.3	0.8	
Acrylic acid $CH_2=CHCOOH$	10	30	20	60	
Aldrin (ISO) $C_{12}H_8Cl_6$	-	0.25	-	0.75	Sk
Allyl Alcohol $CH_2=CHCH_2OH$	2	5	4	10	Sk
Allyl Chloride $CH_2=CHCH_2Cl$	1	3	2	6	
1-Allyl-2,3-epoxypropyl ether $CH_2=CHCH_2OCH_2CHCH_2O$	5	22	10	44	Sk
Allyl glycidyl ether (AGE) $CH_2CHCH_2OCH_2CHCH_2O$	5	22	10	44	Sk
Aluminium - Alkyls	-	2	-	-	
Aluminium - Metal Dust	-	10, 5	-	-	[total inhalable dust] {respirable dust}
Aluminium Oxides Al_2O_3, $Al(OH)_3$, AlOOH	-	10, 5	-	-	[total inhalable dust] {respirable dust}
Aluminium - Soluble salts	-	2	-	-	
Aminodimethylbenzene $(CH_3)_2C_6H_3NH_2$	2	10	10	50	Sk
2-Aminoethanol $NH_2CH_2CH_2OH$	3	8	6	15	
2-Aminopyridine $NH_2C_5H_4N$	0.5	2	2	8	
Ammonia NH_3	25	17	35	24	

Ammonium Chloride - Fumes NH_4Cl	-	10	-	20	
Ammonium Sulphamidate $NH_2SO_3NH_4$	-	10	-	20	
n-Amyl Acetate $CH_3COOC_5H_{11}$	100	530	150	800	
sec-Amyl Acetate $CH_3COOCH(CH_3)C_3H_7$	-	-	150	800	
Aniline and homologues $C_6H_5NH_2$	2	10	5	20	Sk
Anisidine (o & p) isomers $NH_2C_6H_4OCH_3$	0.1	0.5	-	-	Sk
Antimony compounds - as Sb Sb	-	0.5	-	-	
Arsine AsH_3	0.05	0.2	-	-	
Asphalt - petroleum fumes	-	5	-	10	
Asprin $CH_3COOC_6H_4COOH$	-	5	-	10	
Atrazine (ISO) $C_8H_4ClN_5$	-	10	-	-	
Azinphos-methyl (ISO) $(CH_3O)_2PSSCH_2(C_7H_4N_3O)$	-	0.2	0.6	-	Sk
Azincine	0.5	1	-	-	Sk
Aziridine CH_2CH_2NH	-	10	-	-	

y-BHC (ISO) $C_6H_5Cl_6$	-	0.5	-	1.5	Sk
Barium soluble compounds as Ba Ba	-	0.5	-	-	
Barium Sulphate (respirable dust) $BaSO_4$	-	2	-	-	
Benomyl (ISO) $C_{14}H_{18}N_4O_3$	-	10	-	15	
Benzenethiol C_6H_5SH	0.5	2	-	-	
Benzene-1,2,4-tricarboxylic acid 1,2 anhydride $C_9H_4O_5$	-	0.04	-	-	Sen
p-Benzoquinone $C_6H_4O_2$	0.1	0.4	0.3	1.2	
Benzoyl Peroxide $(C_6H_5CO)_2O_2$	-	5	-	-	
Benzyl butyl phthalate $C_6H_5CH_2COOC_6H_4COOC_4H_9$	-	5	-	-	
Benzyl Chloride $C_6H_5CH_2Cl$	1	5	-	-	
Beryllium and compounds - as Be Be	-	0.002	-	-	
Biphenyl $(C_6H_5)_2$	0.2	1.5	0.6	4	
Bis (2,3-epoxypropyl) ether $(OCH_2CHCH_2)_2O$	0.1	0.6	-	-	
Bis-(2-ethylhexyl) phthalate $C_6H_4(COOCH_2CH(C_2H_5)C_4H_9)_2$	-	5	-	10	
2,2 Bis (p-methoxyphenyl)-1,1,1-	-	10	-	-	

trichloroethane $C_{16}H_{15}Cl_3O_2$					
Bismuth Telluride (Di-Bismuth Tri-Telluride) Bi_2Te_3	-	5	-	10	
Bismuth Telluride - Se doped Bi_2Te_3	-	-	-	10	
Bornan-2-one $C_{10}H_{16}O$	2	12	3	18	
Borates, tetra, Sodium salts $Na_2B_4O_7$ (.10H_2O) (.5H_2O)	-	1, 5, 1	-	-	anhydrous, decahydrate, pentahydrate
Boron Oxide (Diboron Trioxide) B_2O_3	-	10	-	20	
Boron Tribromide BBr_3	-	-	1	10	
Boron Triflouride BF_3	-	-	1	3	
Bromacil (ISO) $C_9H_{13}BrN_2O_2$	1	10	2	20	
Bromine Br_2	0.1	0.7	0.3	2	
Bromine Pentaflouride BrF_5	0.1	0.7	0.3	2	
Bromochloromethane CH_2BrCl	200	1050	250	1300	
Bromoethane C_2H_5Br	200	890	250	1110	
Bromoethylene CH_2=CHBr	5	20	-	-	
Bromoform $CHBr_3$	0.5	5	-	-	Sk
Bromomethane CH_3Br	5	20	15	60	Sk
Bromotriflouromethane CF_3Br	1000	6100	1200	7300	
Butane C_4H_{10}	600	1430	750	1780	
Butan-1-ol C_4H_9OH	-	-	50	150	Sk
Butan-2-ol $C_3H_6OHCH_3$	100	300	150	450	
Butan-2-one $CH_3COC_2H_5$	200	590	300	885	
trans But-2-enal CH_3CH=CHCHO	2	6	6	18	
n-Butyl Acetate $CH_3COO(CH_2)_3CH_3$	150	710	200	950	
sec-Butyl Acetate $CH_3COOCH(CH_3)CH_2CH_3$	200	950	250	1190	
tert-Butyl Acetate $CH_3COOC(CH_3)_3$	200	950	250	1190	
n-Butyl Acrylate $C_7H_{12}O_2$	10	55	-	-	
n-Butyl Alcohol C_4H_9OH	-	-	50	150	Sk
sec-Butyl Alcohol $CH_3CH_2CHOHCH_3$	100	300	150	450	
tert-Butyl Alcohol $(CH_3)_3COH$	100	300	150	450	
n-Butylamine $C_4H_9NH_2$	-	-	5	15	Sk
Butyl benzyl phthalate $C_6H_5CH_2COOC_6H_4COOC_4H_9$	-	5	-	-	
n-Butyl chloroformate $ClCO_2C_4H_{10}$	1	5.6	-	-	
n-Butyl Glycidyl Ether (BGE) $C_4H_9OCH_2CHCH_2O$	25	135	-	-	
Butyl-2,3-epoxypropyl ether $C_4H_9OCH_2CHCH_2O$	25	135	-	-	

n-Butyl Lactate $C_7H_{14}O_3$	5	25	-	-	
2-sec-Butylphenol $C_2H_5(CH_3)CHC_6H_4OH$	5	30	-	-	Sk
Caesium hydroxide CsOH	-	2	-	-	
Calcium Carbonate $CaCO_3$	-	10, 5	-	-	total inhalable dust, respirable dust
Calcium Cyanamide CaNCN	-	0.5	-	1	
Calcium Hydroxide $Ca(OH)_2$	-	5	-	-	
Calcium Oxide CaO	-	2	-	-	
Calcium Silicate	-	10, 5	-	-	total inhalable dust, respirable dust
Camphor - synthetic $C_{10}H_{16}O$	2	12	3	18	
Caprolactam dust $NH(CH_2)_5CO$	-	1	-	3	
Caprolactam vapour $NH(CH_2)_5CO$	5	20	10	40	
Captafol (ISO) $C_{10}H_9Cl4NO_2S$	-	0.1	-	-	Sk
Captan (ISO) $C_9H_8Cl_3NO_2S$	-	5	-	15	
Carbaryl (ISO) $C_{10}H_7OCONHCH_3$	-	5	-	10	
Carbofuran (ISO) $C_{12}H1_5NO_3$	-	0.1	-	-	
Carbon Black C	-	3.5	-	7	
Carbon Dioxide CO_2	5000	9000	15000	27000	
Carbon Monoxide CO	50	55	300	330	
Carbon tetrabromide CBr_4	0.1	1.4	0.3	4	
Carbon Tetrachloride CCl_4	2	12.6	-	-	Sk
Carbonyl Chloride $COCl_2$	-	0.4	-	-	Sk
Catechol $C_6H_4(OH)_2$	5	20	-	-	
Cellulose	-	10, 5	-	20	total inhalable dust, respirable dust
Cement	-	10, 5	-	-	total inhalable dust, respirable dust
Chlordane (ISO) $C_{10}H_6Cl_8$	-	0.5	-	2	Sk
Chlorinated biphenyls $C_{12}H_7Cl_3$ (approx) $C_6H_2Cl_3C_6H_3Cl_2$	-	1, 0.5	-	2, 1	42% Cl, 54% Cl
Chlorine Cl_2	0.5	1.5	1	3	
Chlorine Dioxide ClO_2	0.1	0.3	0.3	0.9	
Chlorine Triflouride ClF_3	-	-	0.1	0.4	
Chloroacetaldehyde $ClCH_2CHO$	-	-	1	3	
2-Chloroacetophenone $C_6H_5COCH_2Cl$	0.05	0.3	-	-	
Chloroacetyl Chloride $ClCH_2COCl$	0.05	0.2	-	-	
Chlorobenzene C_6H_5Cl	50	230	-	-	

Chlorobromomethane CH_2BrCl	200	1050	250	1300	
2-Chloro-1,3-butadiene $CH_2=CClCH=CH_2$	10	36	-	-	Sk
Chlorodiflouromethane $CHClF_2$	1000	3500	-	-	
1-Chloro-2,3-epoxypropane OCH_2CHCH_2Cl	2	8	5	20	Sk
Chloroethane C_2H_5Cl	1000	2600	1250	3250	
2-Chloroethanol $ClCH_2CH_2OH$	-	-	1	3	Sk
Chloroethylene $CH_2=CHCl$	7	-	-	-	
Chloroform $CHCl_3$	2	9.8	-	-	Sk
Chloromethane CH_3Cl	50	105	100	210	
1-Chloro-4-nitrobenzene $ClC_6H_4NO_2$	-	1	-	2	Sk
Chloropentaflouroethane $CClF_2CF_3$	1000	6320	-	-	
Chloropicrin CCl_3NO_2	0.1	0.7	0.3	2	
beta-Chloroprene $CH_2=CClCH=CH_2$	10	36	-	-	Sk
3-Chloropropene $CH_2=CHCH_2Cl$	1	3	2	6	
Chlorosulphonic acid HSO_3Cl	-	1	-	-	
alpha-Chlorotoluene $C_6H_5CH_2Cl$	1	5	-	-	
2-Chlorotoluene C_7H_7Cl	50	250	-	-	
2-Cl-6-trichloromethyl pyridine $C_6H_3Cl_4N$	-	10	-	20	
Chloropyrifos (ISO) $C_9H_{11}Cl_3NO_3PS$	-	0.2	-	0.6	Sk
Chromium Cr	-	0.5	-	-	
Chromium II compounds - as Cr Cr	-	0.5	-	-	
Chromium III compounds - as Cr Cr	-	0.5	-	-	
Coal Dust	-	2	-	-	Respirable dust
Coal Tar pitch volatiles - as cyclohexane solubles	-	0.14	-	-	
Cobalt metal - dust and fumes Co	-	0.1	-	-	
Copper fumes Cu	-	0.2	-	-	
Copper dusts and mists - as Cu Cu	-	1	-	2	
Cotton Dust - raw	-	0.5	-	-	See Annexure 4
Cresol - all isomers $CH_3C_6H_4OH$	5	22	-	-	Sk
Cristobalite, respirable dust SiO_2					
Crotonaldehyde $CH_3CH=CHCHO$	2	6	6	18	
Cryofluorane (INN) $CClF_2CClF_2$	1000	7000	1250	8750	
Cumene $C_6H_5CH(CH_3)_2$	25	120	75	370	Sk
Cyanamide H_2NCN	-	2	-	-	
Cyanides - as CN	-	5	-	-	Sk
Cyanogen $(CN)_2$	10	20	-	-	

Cyanogen Chloride ClCN	-	-	0.3	0.6	
Cychlohexane C_6H_{12}	100	340	300	1030	
Cyclohexanol $C_6H_{11}OH$	50	200	-	-	Sk
Cyclohexanone $C_6H_{10}O$	25	100	100	400	Sk
Cyclohexene C_6H_{10}	300	1015	-	-	
Cyclohexylamine $C_6H_{11}NH_2$	10	40	-	-	Sk
Cyclonite (RDX) $C_3H_6N_6O_6$	-	1.5	-	3	Sk
Cyhexatin (ISO) $(C_6H_{11})_3SnOH$	-	5	-	10	

2,4-D C6H3Cl2OCH2COOH	-	10	-	20	
DDM H2NC6H4CH2C6H4NH2	0.1	0.8	0.5	4	
DDT (Dichlorodiphenyltrichloroethane) C14H9Cl5	-	1	-	3	
DDVP (CH3O)2POOCHCCl2	0.1	1	-	3	Sk
2,4 DES C8H7Cl2NaO5S	-	10	-	20	
DMDT C16H15Cl3O2	-	10	-	-	
Derris, commercial C23H22O6	-	5	-	10	
Diacetone Alcohol CH3COCH2C(CH3)2OH	50	240	75	360	
Dialkyl 7-9 phthalate C6H4(COOC7-9H15-19)2	-	5	-	-	
Dialkyl phthalate C6H4(COOCH2CHCH)2	-	5	-	-	
2,2'-Diaminodiethylamine (NH2CH2CH2)2NH	1	4	-	-	Sk
4,4'-Diaminodiphenylmethane (DADPM) H2NC6H4CH2C6H4NH2	0.1	0.8	0.5	4	
1,2-Diaminoethane NH2CH2CH2NH2	10	25	-	-	
Diammonium peroxodisulphate (as S2O8) (NH4)2S2O8	-	1	-	-	
Diatomaceous earth, respirable dust	-	1.5	-	-	
Diazinon - (ISO) C12H21N2O3PS	-	0.1	-	0.3	Sk
Diazomethane CH2N2	0.2	0.4	-	-	
Dibenzoyl peroxide (C6H5CO)2O2		5	-	-	
Diborane B2H6	0.1	0.1	-	-	
Dibrom 1,2-Dibromo-2,2-dichloroethyldimethyl P	-	3	-	6	

C4H7Br2Cl2O4P					
Dibromodiflouromethane CBr2F2	100	860	150	1290	
Dibutyl Hydrogen Phosphate Di-n-butyl phosphate (n-C4H9O)2(OH)PO	1	5	2	10	
Dibutyl Phthalate C6H4(CO2C4H9)2	-	5	-	10	
6,6'Di-tert-butyl-4,4'thiodi-m-cresol C22H30O2S	-	10	-	20	
Dichloroacetylene ClCCCl	-	-	0.1	0.4	
1,2-Dichlorobenzene C6H4Cl2	-	-	50	300	
1,4-Dichlorobenzene C6H4Cl2	25	150	50	300	
Dichlorobenzene	75	450	-	-	
Dichloro diflouro methane CCl2F2	1000	4950	1250	6200	
1,3-Dichloro 5,5-dimethyl hydantoin C5H6Cl2N2O2	-	0.2	-	0.4	
Dichlorodiphenyltrichloroethane C14H9Cl5	-	1	-	3	
1,1-Dichloroethane CH3CHCl2	200	810	400	1620	
1,2-Dichloroethane CH2ClCH2Cl	10	40	15	60	
1,1-Dichloroethylene CH2CCl2	10	40	-	-	
1,2-Dichloroethylene cis:trans isomers 60:40 ClCH=CHCl	200	790	250	1000	
Dichloroflouromethane CHCl2F	10	40	-	-	
2,4-Dichlorophenoxyacetic acid C6H3Cl2OCH2COOH	-	10	-	20	
1,3-Dichloropropene cis and trans isomers CHClCHCH2Cl	1	5	10	50	Sk
Dichlorotetraflouroethane CClF2CClF2	1000	7000	1250	8750	
Dichlorvos (ISO) (CH3O)2POOCH=CCl2	0.1	1	0.3	3	Sk
Dicyclohexyl phthalate C6H4(COOC6H11)2	-	5	-	-	
Dicyclopentadiene C10H12	5	30	-	-	
Dicyclopentadienyl iron C10H10Fe	-	10	-	20	
Dieldrin (ISO) C12H8Cl6O	-	0.25	-	0.75	Sk
Diethanolamine HO(CH2)2NH(CH2)2OH	3	15	-	-	

Diethylamine (C2H5)2NH	10	30	25	75	
2-Diethylaminoethanol (C2H5)2NCH2CH2OH	10	50	-	-	Sk
Diethylene glycol (HOCH2CH2)2O	23	100	-	-	
Diethylamine triamine (NH2CH2CH2)2NH	1	4	-	-	Sk
Diethyl ether C2H5OC2H5	400	1200	500	1500	
Di-(2-ethylhexyl) phthalate (dioctyl phthalate) C6H4(COOCH2CH(C2H5)-C4H9)2	-	5	-	10	
Diethyl ketone C2H5COC2H5	200	700	250	875	
Diethyl phthalate C6H4(COOC2H5)2	-	5	-	10	
Diflourochloromethane CHClF2	1000	3500	-	-	
Diglycidyl ether (DGE) (OCH2CHCH2)2O	0.1	0.6	-	-	
o-Dihydroxybenzene C6H4(OH)2	5	20	-	-	
m-Dihydroxybenzene C6H4(OH)2	10	45	20	90	
p-Dihydroxybenzene C6H4(OH)2	-	2	-	4	
1,2-Dihydroxyethane CH2OHCH2OH	-	10	-	60, 125	particulate, vapour
Diisobutyl ketone ((CH3)2CHCH2)2CO	25	150	-	-	
Diisobutyl phthalate C6H4(COOCH2CH(CH3)2)2	-	5	-	-	
Diisodecyl phthalate (C10H21CO2)2C6H4	-	5	-	-	
Diisononyl phthalate C6H4(COOC9H19)2	-	5	-	-	
Diisooctyl phthalate C6H4(CO2C8H17)2	-	5	-	-	
Diisopropylamine (CH3)2CHNHCH(CH3)2	5	20	-	-	Sk
Diisopropyl ether (CH3)2CHOCH(CH3)2	250	1050	310	1320	
Di-linear 79 phthalate C6H4(COOC7-9H15-19)2	-	5	-	-	
Dimethoxymethane CH2(OCH3)2	1000	3100	1250	3880	
N,N-Dimethyl acetamide	10	36	20	71	Sk

CH3CON(CH3)2					
Dimethylamine (CH3)2NH	10	18	-	-	
NN-Dimethylaniline C6H5N(CH3)2	5	25	10	50	Sk
1,3-Dimethylbutyl acetate CH3CO2CH(CH3)CH2CH-(CH3)2	50	300	100	600	
NN-Dimethylethylamine C2H5(CH3)2N	10	30	15	45	
Dimethylformamide HCON(CH3)2	10	30	20	60	Sk
2,6-Dimethylheptan-4-one ((CH3)2CHCH2)2CO	25	150	-	-	
Dimethyl phthalate C6H4(COOCH3)2	-	5	-	10	
Dimethyl sulphate (CH3)2SO4	0.1	0.5	0.1	0.5	Sk
Dinitolmide	-	5	-	-	
Dinitrobenzene all isomers C6H4(NO2)2	0.15	1	0.5	3	Sk
Dinitro-o-cresol CH3C6H2(OH)(NO2)2	-	0.2	-	0.6	Sk
2,4-Dinitrotoluene CH3C6H3(NO2)2	-	1.5	-	5	Sk
Dinonyl phthalate C6H4(COOC9H19)2	-	5	-	-	
Di-sec-octyl phthalate C6H4(COOCH2CH(C2H5)-C4H9)2	-	5	-	10	
1,4-Dioxane, tech. grade OCH2CH2OCH2CH2	25	90	100	360	Sk
Dioxathion (ISO) C12H26O6P2S2	-	0.2	-	-	Sk
Diphenyl (C6H5)2	0.2	1.5	0.6	4	
Diphenylamine (C6H5)2NH	-	10	-	20	
Diphenyl ether (vapour) C6H5OC6H5	1	7	-	-	
Diphosphorus pentasulphide P2S5	-	1	-	3	
Dipotassium peroxodisulphate as S2O8 K2S2O8	-	1	-	-	
Diquat dibromide (ISO) C12H12Br2N2	-	0.5	-	1	
Disodium disulphite Na2S2O5	-	5	-	-	
Disodium peroxodisulphate (measured as S2O8) Na2S2O8	-	1	-	-	
Disodium tetraborate Na2B4O7 (.10H2O) (.5H2O)	-	1, 5, 1	-	-	anhydrous, decahydrate, pentahydrate
Disulfoton (ISO)	-	0.1	-	0.3	

(C2H5O)2PSCH2CH2SC2H5					
Disulphur dichloride S2Cl2	-		1	6	
Disulphur decafluoride S2F10	0.025	0.25	0.075	0.75	
2,6-Di-tert-butyl-p-cresol (C4H9)2CH3C6H2OH	-	10	-	-	
Diuron (ISO) C9H10Cl2N2O	-	10	-	-	
Divanadium pentoxide (as V) V2O5	-	0.5, 0.05	-	-	total inhalable dust, fume & respirable dust
Divinyl benzene C8H4(CHCH2)2	10	50	-	-	
Dusts	-	-	-	-	see paragraph 36 of Annexure 1
Emery	-	10, 5	-	-	total inhalable dust, respirable dust
Endosulfan (ISO) $C_9H_6Cl_6O_3S$	-	0.1	-	0.3	Sk
Endrin (ISO) $C_{12}H_8Cl_6O$	-	0.1	-	0.3	Sk
Enflurane $CHFClCF_2OCF_2H$	20	150	-		
Epichlorohydrin OCH_2CHCH_2Cl	2	8	5	20	Sk
1,2-Epoxy-4-epoxyethyl cyclohexane $C_6H_{12}O_2$	10	60	-	-	
2,3-Epoxypropyl isopropyl ether $C_3H_7OCH_2CHCH_2O$	50	240	75	360	
Ethane-1,2-diol CH_2OHCH_2OH	-	10, 60	-	125	particulate, vapour
Ethanethiol C_2H_5SH	0.5	1	2	3	
Ethanol C_2H_5OH	1000	1900	-	-	
Ethanolamine $NH_2CH_2CH_2OH$	3	8	500	1500	
Ether $C_2H_5OC_2H_5$	400	1200	-	-	
Ethyl acetate $CH_3COOC_2H_5$	400	1400	-	-	
Ethyl acrylate $CH_2=CHCOOC_2H_5$	5	20	15	60	Sk
Ethyl alcohol C2H5OH	1000	1900	-	-	
Ethylamine $C_2H_5NH_2$	10	18	-	-	
Ethyl amyl ketone $CH_3CH_2COCH_2CH_3CHCH_2CH_3$	25	130	-	-	
Ethyl benzene $C_6H_5C_2H_5$	100	435	125	545	
Ethyl bromide C_2H_5Br	200	890	250	1110	
Ethyl butyl ketone $CH_3CH_2CO(CH_2)_3CH_3$	50	230	75	345	
Ethyl chloride C_2H_5Cl	1000	2600	1250	3250	

Ethyl chloroformate $ClCO_2C_2H_5$	1	4.4	-	-	
Ethylene					
Ethylene chlorohydrin $ClCH_2CH_2OH$	-	-	1	3	Sk
Ethylenediamine $NH_2CH_2CH_2NH_2$	10	25	-	-	
Ethylene dibromide $BrCH_2CH_2Br$	0.5	4	-	-	Sk
Ethylene dichloride CH_2ClCH_2Cl	10	40	15	60	
Ethylene dinitrate $CH_2NO_3CH_2NO_3$	0.2	1.2	0.2	1.2	Sk
Ethylene glycol CH_2OHCH_2OH	-	10, 60	-	125	particulate, vapour
Ethylene glycol dinitrate (EGDN) $CH_2NO_3CH_2NO_3$	0.2	1.2	0.2	1.2	Sk
Ethylene glycol monobutyl ether $C_4H_9OCH_2CH_2OH$	25	120	-	-	Sk
Ethylene glycol monoethyl ether $C_2H_5OCH_2CH_2OH$	10	37	-	-	Sk
Ethylene glycol monoethyl ether acetate $C_2H_5OCH_2CH_2OOCCH_3$	10	54	-	-	Sk
Ethylene glycol monomethyl ether acetate $CH_3COOCH_2CH_2OCH_3$	5	24	-	-	Sk
Ethylene glycol monomethyl ether $CH_3OCH_2CH_2OH$	5	16	-	-	Sk
Ethyleneimine CH_2CH_2NH	0.5	1	-	-	Sk
Ethylene oxide CH_2CH_2O	5	10	-	-	
Ethyl ether $C_2H_5OC_2H_5$	400	1200	500	1500	
Ethyl formate $HCOOC_2H_5$	100	300	150	450	
2-Ethylhexyl chloroformate $ClCO_2(C_2H_5)CH_2CH(CH_2)_3CH_3$	1	7.9	-	-	
Ethylidene dichloride CH_3CHCl_2	200	810	400	1620	
Ethyl mercaptan C_2H_5SH	0.5	1	2	3	
4-Ethylmorpholine $C_6H_{13}NO$	5	23	20	95	Sk
Ethyl silicate $Si(OC_2H_5)_4$	10	85	30	255	

Fenchlorphos (ISO) $(CH_3O)_2PSOC_6H_2Cl_3$	-	10	-	-
Ferbam (ISO) $((CH_3)_2NCSS)_3Fe$	-	10	-	20
Ferrocene $C_{10}H_{10}Fe$	-	10	-	20
Flourides as F F	-	2.5	-	-
Flourine F_2	-	-	1	1.5
Flourodichloromethane $CHCl_2F$	10	40	-	-
Flourotrichloromethane CCl_3F	1000	5600	1250	7000
Formamide $HCONH_2$	20	30	30	45
Formic Acid $HCOOH$	5	9	-	-

Furfural (2-Furaldehyde) $C_5H_4O_2$					2	8	10	40	Sk
Furfuryl alcohol OCH=CHCH=CCH$_2$OH					5	20	15	60	Sk
Germanium tetrahydride (Germane) GeH_4	0.2	0.6	0.6	1.8					
Glutaraldehyde OCH$(CH_2)_3$CHO	-	-	0.2	0.7					
Glycerol mist $CH_2OHCHOHCH_2OH$	-	10	-	-					
Glycerol trinitrate $CH_2NO_3CHNO_3CH_2NO_3$	0.2	2	0.2	2	Sk				
Glycol monoethyl ether $C_2H_5OCH_2CH_2OH$	10	37	0.2	2	Sk				
Graphite C	-	10, 5	-	-	total inhalable dust, respirable dust				
Guthion $(CH_3O)_2PSSCH_2(C_7H_4N_3O)$	-	0.2	0.6	-	Sk				
Gypsum $CaSO_4$-$2H_2O$	-	10, 5	-	-	total inhalable dust, respirable dust				
Halothane CHBrCl-CF_3	10	80	-	-					
y-HCH (ISO) $C_6H_5Cl_6$	-	0.5	-	1.5	Sk				
Hafnium Hf	-	0.5	-	1.5					
Halothane CHBrClCF_3	10	80	-	-					
Heptachlor and heptachlor epoxide $C_{10}H_5Cl_7$	-	0.5	-	2	Sk				
n-Heptane C_7H_{16}	400	1600	500	2000					
Heptan-2-one $CH_3(CH_2)_4COCH_3$	50	240	-	-					
Heptan-3-one $CH_3CH_2CO(CH_2)_3CH_3$	50	230	75	345					
y-Hexachlorocyclohexane (y-HCH) $C_6H_5Cl_6$	-	0.5	-	1.5	Sk				
Hexachloroethane CCl_3CCl_3	5	50, 10, 5	-	-	vapour, total inhalable dust, respirable dust				
Hexahydro-1,3,5-trinitro-1,3,5-triazine $C_3H_6N_6O_6$	-	1.5	-	3	Sk				
Hexane isomers other than n-Hexane C_6H_{14}	500	1800	1000	3600					
n-Hexane C_6H_{14}	20	70	-	-					
1,6-Hexanolactam $NH(CH_2)_5CO$	5	20, 1	10	40, 3	vapour, dust				
Hexan-2-one $C_3H_9COCH_3$	5	20	-	-	Sk				
Hexone $(CH_3)_2CHCH_2COCH_3$	50	205	75	300	Sk				
Hexylene glycol $(CH_3)_2COHCH_2CHOHCH_3$	25	125	25	125					
Hydrazine NH_2NH_2	0.1	0.1	-	-	Sk				

Hydrazoic acid (as vapour) HN_3	-	-	0.1	-	
Hydrogen bromide HBr	-	-	3	10	
Hydrogen chloride HCl	-	-	5	7	
Hydrogen flouride (as F) HF	-	-	3	2.5	
Hydrogen peroxide H_2O_2	1	1.5	2	3	
Hydrogen selenide (as Se) H_2Se	0.05	0.2	-	-	
Hydrogen sulphide H_2S	10	14	15	21	
Hydroquinone $C_6H_4(OH)_2$	-	2	-	4	
4-Hydroxy-4-methyl-pentan-2-one $CH_3COCH_2C(CH_3)_2OH$	50	240	75	360	
2-Hydroxypropyl acrylate $CH_2CHCOOCH_2CHOHCH_3$	0.5	3	-	-	Sk

2,2'-Iminodiethanol $HO(CH_2)_2NH(CH_2)_2OH$	3	15	-	-	
2,2'-Iminodi(ethylamine) $(NH_2CH_2CH_2)_2NH$	1	4	-	-	Sk
Indene C_9H_8	10	45	15	70	
Indium compounds - as In In	-	0.1	-	0.3	
Iodine I_2	-	-	0.1	1	
Iodoform CHI_3	0.6	10	1	20	
Iodomethane CH_3I	5	28	10	56	Sk
Iron Oxide fumes - as Fe Fe_2O_3	-	5	-	10	
Iron pentacarbonyl - as Fe $Fe(CO)_5$	0.01	0.08	-	-	
Iron salts soluble - as Fe	-	1	-	2	
Isoamyl acetate $CH_3COOCH_2CH_2CH(CH_3)_2$	100	525	125	655	
Isoamyl alcohol $(CH_3)_2CHCH_2CH_2OH$	100	360	125	450	
Isoamyl ethyl ketone $CH_3COCH_2CH_2CH(CH_3)_2$	50	240	75	360	
Isobutyl acetate $CH_3COOCH_2CH(CH_3)_2$	150	700	187	875	
Isobutyl alcohol $(CH_3)_2CHCH_2OH$	50	150	75	225	
Isobutyl methyl ketone $(CH_3)_2CHCH_2COCH_3$	50	205	75	300	Sk
Isoflurane $CF_3CHClOCHF_2$	50	380	-	-	
Isooctyl alcohol (mixed isomers) $C_8H_{17}OH$	50	270	-	-	
Isopentyl acetate $CH_3COOCH_2CH_2CH(CH_3)_2$	100	525	125	655	
Isophorone $C_9H_{14}O$	-	-	5	25	
Isophorone diisocyanate (IPDI)	-	0.2	-	0.7	Sen
Isopropyl acetate $CH_3COOCH(CH_3)_2$	-	-	200	840	
Isopropyl alcohol $(CH_3)_2CHOH$	400	960	500	1225	Sk
Isopropyl benzene $C_6H_5CH(CH_3)_2$	25	120	75	370	
Isopropyl chloroformate $ClCO_2CH(CH_3)_2$	1	5	-	-	
Isopropyl ether $(CH_3)_2CHOCH(CH_3)_2$	250	1050	310	1320	
Isopropyl glycidyl ether (IGE) $C_3H_7OCH_2OCHCH_2$	50	240	75	360	

Ketene CH_2CO				0.5	0.9	1.5	3
Limestone	-	10, 5	-	-	total inhalable dust, respirable dust		
Lindane $C_6H_5Cl_6$	-	0.5	-	1.9	Sk		
Liquified pettroleum gas (LPG) Mixture: C_3H_6 : C_3H_8 : C_4H_8 : C_4H_{10}	1000	1800	1250	2250			
Lithium hydride LiH	-	0.025	-	-			
Lithium Hydroxide LiOH	-	-	-	1			
MbOCA $CH_2(C_6H_3ClNH_2)_2$		-	0.005	-	-	Sk	
MDA $H_2NC_6H_4CH_2C_6H_4NH_2$		0.1	0.8	0.5	4		
MDI		-	0.02	-	0.07	Sen	
Magnesite		-	10, 5	-	-	total inhalable dust, respirable dust	
Magnesium oxide (as Mg) MgO		-	5, 10	-	10	fume and respirable dust, respirable dust	
Malathion (ISO) $C_{10}H_{19}O_6PS_2$		-	10	-	-	Sk	
Maleic anhydride $C_4H_2O_3$		0.25	1	-	-		
Manganese dust and compounds Mn		-	5	-	-		
Manganese fumes Mn		-	1	-	3		
Manganese cyclopentadienyl tricarbonyl C_5HC_5-$Mn(CO)_3$		-	0.1	-	0.3	Sk	
Manganese tetroxide Mn_3O_4		-	1	-	-		
Man made mineral fibre		-		-	-	See Annexure 3	
Marble		-	10, 5	-	-	Total inhalable dust, respirable dust	
Mequinol (INN) $CH_3OC_6H_4OH$		-	5	-	-		
Mercaptoacetic acid $C_2H_4O_2S$		1	5	-	-		
Mercury - Alkyl compounds as Hg Hg		-	0.01	-	0.03	Sk	
Mercury all other forms - as Hg Hg		-	0.05	-	0.15		
Mesityl oxide $CH_3COCH=C(CH_3)_2$		15	60	25	100		
Methacrylic acid $CH_2=C(CH_3)COOH$		20	70	40	140		
Methacrylonitrile $CH_2=C(CH_3)CN$		1	3	-	-	Sk	
Methanethiol CH_3SH		0.5	1	-	-		
Methanol CH_3OH		200	260	250	310	Sk	
Methomyl (ISO) $C_5H_{10}N_2O_2S$		-	2.5	-	-	Sk	

Methoxychlor (ISO) $C_{16}H_{15}Cl_3O_2$	-	10	-	-	
1-Methoxy propan-2-ol $CH_3OCH_2CHOHCH_3$	100	360	300	1080	Sk
Methyl acetate CH_3COOCH_3	200	610	250	760	
Methyl acrylate $CH_2=CHCOOCH_3$	10	35	-	-	Sk
Methylal $CH_3(OCH_3)_2$	1000	3100	1250	3880	
Methylal alcohol CH_3OH	200	260	250	310	Sk
Methylamine CH_3NH_2	10	12	-	-	
Methyl n-amyl ketone $CH_3(CH_2)_4COCH_3$	50	240	-	-	
N-Methyl aniline $C_6H_5NHCH_3$	0.5	2	-	-	Sk
Methyl bromide - Skin CH_3Br	5	20	15	60	Sk
3-Methylbutan-1-ol $(CH_3)_2CHCH_2CH_2OH$	100	360	125	450	
1-Methylbutyl acetate $CH_3COOCH(CH_3)C_3H_7$	-	-	150	800	
Methyl n-butyl ketone $CH_3(CH_2)_3COCH_3$	5	20	-	-	Sk
Methyl chloride CH_3Cl	50	105	100	210	
Methyl chloroform CH_3CCl_3	350	1900	450	2450	
Methyl 2-cyanoacrylate $CH_2=C(CN)COOCH_3$	2	8	4	16	
Methylcyclohexane C_7H_{14}	400	1600	500	2000	
Methylcyclohexanol $CH_3C_6H_{10}OH$	50	235	75	350	Sk
2-Methylcyclohexanone $CH_3CHCO(CH_2)_3CH_2$	50	230	75	345	Sk
Methylcyclopentadienyl manganese tricarbonyl (as Mn)	-	0.1	-	0.6	
2-Methyl-4,6-dinitrophenol $CH_3C_6H_2(OH)(NO_2)_2$	-	0.2	-	0.6	Sk
4,4'-Methylene bis(2chloroaniline) (MbOCA) $CH_2(C_6H_3ClNH_2)_2$	-	0.005	-	-	Sk
Methylene chloride (Dichloromethane) CH_2Cl_2	100	350	250	780	
4,4'-Methylene-diphenyl diisocyanate (MDI)	-	0.02	-	0.07	Sen
4,4'-Methylenedianiline (MDA) $H_2NC_6H_4CH_2C_6H_4NH_2$	0.1	0.8	0.5	4	
Methyl ethyl ketone (MEK) $CH_3COC_2H_5$	200	590	300	885	
Methyl ethyl ketone peroxides $C_8H_{16}O_4$ or $C_8H_{18}O_6$	-	-	0.2	1.5	
Methyl formate $HCOOCH_3$	100	250	150	375	
5-Methyl heptan-3-one $CH_3CH_2COCH_2CH_3CHCH_2CH_3$	25	130	-	-	

5-Methyl hexan-2-one $CH_3COCH_2CH_2CH(CH_3)_2$	50	240	75	360	
Methyl hydrazine	0.2	0.35	0.2	0.35	Sk
Methyl iodide CH_3I	5	28	10	56	Sk
Methyl isoamyl ketone $CH_3COCH_2CH_2CH(CH_3)_2$	50	240	75	360	
Methyl isobutyl carbinol $CH_3CHOHCH_2CH(CH_3)_2$	25	100	40	160	Sk
Methyl isobutyl ketone (MIBK) $(CH_3)_2CHCH_2COCH_3$	50	205	75	300	Sk
Methyl isocyanate	-	0.02	-	0.07	Sen
Methyl mercaptan CH_3SH	0.5	1	-	-	
Methyl methacrylate $CH_2=C(CH_3)COOCH_3$	100	410	125	510	
Methyl parathion $C_8H_{10}NO_5PS$	-	0.2	-	0.6	Sk
2-Methylpentane-2,4-diol $(CH_3)_2COHCH_2CH)HCH_3$	25	125	25	125	
4-Methylpentan-2-ol $CH_3CHOHCH_2CH(CH_3)_2$	25	100	40	160	Sk
4-Methylpentan-2-one $(CH_3)_2CHCH_2COCH_3$	50	205	75	300	Sk
4-Methylpent-3-and-2-one $CH_3COCH=C(CH_3)_2$	15	60	25	100	
4-Methyl-m-phenylene diisocyanate	-	0.02	-	0.07	Sen
2-Methylpropan-1-ol $(CH_3)_2CHCH_2OH$	50	150	75	225	
2-Methylpropan-2-ol $(CH_3)_3COH$	100	300	150	450	
Methyl propyl ketone $CH_3COC_3H_7$	200	700	250	875	
1-Methyl-2-pyrrolidone $CH_3N(CH_2)_3CO$	100	400	-	-	
Methyl silicate $(CH_3O)_4Si$	1	6	5	30	
alpha Methyl styrene $C_6H_5C(CH_3)=CH_2$	-	-	100	480	
Methyl styrene (all isomers) $CH_3C_6H_4CH=CH_2$	100	480	150	720	
n-Methyl-n,2,4,6-tetranitro aniline $(NO_2)_3C_6H_2N(NO_2)CH_3$	-	1.5	-	3	Sk
Mevinphos (ISO) $C_7H_{13}O_6P$	0.01	0.1	0.03	0.3	Sk
Mica	-	10, 1	-	-	total inhalable dust, respirable dust
Molybdenum, soluble compounds as Mo	-	5	-	10	
Molybdenum, insoluble compounds, as Mo	-	10	-	20	

Monochloroacetic acid $ClCH_2CO_2H$	0.3	1	-	-	Sk				
Morpholine C_4H_9NO	20	70	30	105	Sk				
Naled (ISO) $C_4H_7Br_2Cl_2O_4P$			-	3	-	6	Sk		
Naphthalene $C_{10}H_8$			10	50	15	75			
1,5-Napthylene diisocyanate			-	0.02	-	0.07	Sen		
Nickel carbonyl $Ni(CO)_4$			-	-	0.1	0.24			
Nickel, organic compounds (as Ni)			-	1	-	3			
Nicotine $C_{10}H_{14}N_2$			-	0.5	-	1.5	Sk		
Nitrapyrin $C_6H_3Cl_4N$			-	10	-	20			
Nitric acid HNO_3			2	5	4	10			
Nitric oxide NO			25	30	35	45			
4-Nitroaniline $NO_2C_6H_4NH_2$			-	6	-	-	Sk		
Nitrobenzene $C_6H_5NO_2$			1	5	2	10	Sk		
Nitroethane $C_2H_5NO_2$			100	310	-	-			
Nitrogen dioxide NO_2			3	5	5	9			
Nitrogen monoxide NO			25	30	35	45			
Nitrogen triflouride NF_3			10	30	15	45			
Nitroglycerin $CH_2NO_2CHNO_3CH_2NO_3$			0.2	2	0.2	2	Sk		
Nitromethane CH_3NO_2			100	250	150	375			
1-Nitropropane $C_3H_7NO_2$			25	90	-	-			
2-Nitropropane $CH_3CH(NO_2)CH_3$			10	36	20	72			
Nitrotoluene (all isomers) $CH_3C_6H_4NO_2$			5	30	10	60	Sk		
Nitrous oxide N_2O			100	180	-	-			
Octachloronaphthalene $C_{10}Cl_8$			-	0.1	-	0.3	Sk		
n-Octane $CH_3(CH_2)_6CH_3$			300	1450	375	1800			
Orthophosphoric acid H_3PO_4			-	1	-	3			
Osmium tetroxide - as Os OsO_4			0.0002	0.002	0.0006	0.006			
Oxalic acid COOHCOOH			-	1	-	2			
Oxalonitrile $(CN)_2$			10	20	-	-			
2,2'-Oxydiethanol $(HOCH_2CH_2)_2O$			23	100	-	-			
Ozone O_3			0.1	0.2	0.3	0.6			
PCB's	-	-	-	-	see chlorinated biphenyls				
Paraffin wax fumes	-	2	-	6					
Paraquat dichloride $(CH_3(C_5H_4N_+)_2CH_3)$-(Cl_{-2})	-	0.1	-	-	Respirable dust				
Parathion (ISO) $(C_2H_5O)_2PSOC_6H_4NO_2$	-	0.1	-	0.3	Sk				

Parathion-methyl (ISO) $C_8H_{10}NO_5PS$	-	0.2	-	0.6	Sk
Pentacarbonyliron (as Fe) $Fe(CO)_5$	0.01	0.08	-	-	
Pentachlorophenol C_6Cl_5OH	-	0.5	-	1.5	Sk
Pentaerythritol $C(CH_2OH)_4$	-	10, 5	-	20	total inhalable dust, respirable dust
Pentane C_5H_{12}	600	1800	750	2250	
2-Pentanone, 3-Pentanone $CH_3COC_2H_7$	200	700	250	875	
Pentyl acetate $CH_3COOC_5H_{11}$	100	530	150	800	
Perchloroethylene (Tetrachloroethylene) $CCl_2=CCl_2$	50	335	150	1000	
Perchloryl flouride ClO_3F	3	14	6	28	
Phenacyl chloride $C_6H_5COCH_2Cl$	0.05	0.3	-	-	
Phenol C_6H_5OH	5	19	10	38	Sk
p-Phenylenediamine $C_6H_4(NH_2)_2$	-	0.1	-	-	Sk
Phenyl-2,3-epoxypropyl ether $C_6H_5OCH_2CHCH_2O$	1	6	-	-	
Phenylethylene $C_6H_5CH=CH_2$	100	420	250	1050	
Phenylhydrazine $C_6H_5NHNH_2$	5	20	10	45	Sk
2-Phenylpropene $C_6H_5C(CH_3)=CH_2$	-	-	100	480	
Phorate (ISO) $C_7H_{17}O_2PS_3$	-	0.05	-	0.2	Sk
Phosdrin $C_7H_{13}O_6P$	0.01	0.1	0.03	0.3	Sk
Phosgene $COCl_2$	0.1	0.4	-	-	
Phosphine PH_3	-	-	0.3	0.4	
Phosphorus (yellow) P_4	-	0.1	-	0.3	
Phosphorus pentachloride PCl_5	0.1	1	-	-	
Phosphorus pentasulphide P_2S_5	-	1	-	3	
Phosphorus trichloride PCl_3	0.2	1.5	0.5	3	
Phosphoryl trichloride $POCl_3$	0.2	1.2	0.6	3.6	
Phthallic anhydride $C_6H_4(CO_2)O$	1	6	4	24	Sen
Picloram (ISO) $C_6H_3Cl_3N_2O_2$	-	10	-	20	
Picric acid $HOC_6H_2(NO_2)_3$	-	0.1	-	0.3	Sk
Piperazine dihydrochloride $C_4H_{10}N_2.2HCl$	-	5	-	-	
Piperidine $C_5H_{11}N$	1	3.5	-	-	Sk
Plaster of Paris (Calcium sulphate) $(CaSO_4)2H_2O$	-	10, 5	-	-	total inhalable dust, respirable dust
Platinum metal Pt	-	5	-	-	
Platinum, soluble salts - as Pt Pt	-	0.002	-	-	Sen
Polychlorinated biphenyls	-		-	-	See chlorinated biphenyls

Polyvinyl chloride (PVC)	-	10, 5	-	-	total inhalable dust, respirable dust
Portland cement	-	10, 5	-	-	total inhalable dust, respirable dust
Potassium hydroxide KOH	-	-	-	2	
Propane-1,2-diol $CH_3CHOHCH_2OH$	150	470, 10	-	-	vapour + particulates, particulates
n-Propanol $CH_3CH_2CH_2OH$	200	500	250	625	Sk
Propan-1-ol $CH_3CH_2CH_2OH$	200	500	250	625	Sk
Propan-2-ol $(CH_3)_2CHOH$	400	980	500	1225	Sk
Propargyl alcohol $HCCCH_2OH$	1	2	3	6	Sk
Propionic acid CH_3CH_2COOH	10	30	15	45	
Propoxur (ISO) $H_3CNHCOOC_6H_4OCH\text{-}(CH_3)_2$	-	0.5	-	2	
n-Propyl acetate $CH_3COOC_3H_7$	200	840	250	1050	
Propylene dinitrate $CH_2NO_3CHNO_3CH_3$	0.2	1.2	0.2	1.2	Sk
Propylene glycol $CH_3CHOHCH_2OH$	-	-	-	-	See Propane-1,2-diol above
Propylene glycol dinitrate $CH_2NO_3CHNO_3CH_3$	-	-	-	-	See Propylene dinitrate above
Propylene glycol monomethyl ether $CH_3OCH_2CHOHCH_3$	100	360	300	1080	Sk
Prop-2-yn-1-ol $HC{=}CCH_2OH$	1	2	3	6	Sk
Pulverised Fuel Ash	-	10, 5	-	-	total inhalable dust, respirable dust
Pyrethrum (Pyrethrins) (ISO)	-	5	-	10	
Pyridine C_5H_5N	5	15	10	30	
2-Pyridylamine $NH_2C_5H_4N$	0.5	2	2	8	
Pyrocatechol $C_6H_4(OH)_2$	5	20	-	-	
Quartz, crystalline SiO_2	-	0.4	-	-	respirable dust
Quinone $C_6H_4O_2$	0.1	0.4	0.3	1.2	
RDX $C_3H_6N_6O_8$	-	1.5	-	3	Sk
Resorcinol $C_6H_4(OH)_2$	10	45	20	90	
Rhodium metal and insoluble compounds - as Rh Rh	-	0.1	-	0.3	metal fumes and dust
Rhodium, soluble compounds as Rh Rh	-	0.001	-	0.003	soluble salts
Ronnel $(CH_3O)_2PSOC_6H_2Cl_3$	-	10	-	-	
Rosin, core solder pyro products -	-	0.1	-	0.3	Sen

formaldehyde					
Rotenone (commercial) (ISO) $C_{23}H_{22}O_6$	-	5	-	10	
Rouge		- 10, 5	-	-	total inhalable dust, respirable dust
Selenium and compounds - as Se Se	-	0.1	-	-	
Silane SiH_4	0.5	0.7	1	1.5	
Silica, amourphous SiO_2	-	6, 3	-	-	total inhalable dust, respirable dust
Silica, fused SiO_2	-	0.1	-	-	respirable dust
Silicon Si	-	10, 5	-	-	Total inhalable dust, respirable dust
Silicon carbide SiC	-	10, 5	-	-	Total inhalable dust, respirable dust
Silicon tetrahydride - Silane SiH_4	0.5	0.7	1	1.5	
Silver metal Ag	-	0.1	-	-	
Silver, soluble compounds - as Ag Ag	-	0.01	-	-	
Sodium azide NaN_3	-	-	-	0.3	
Sodium 2,4-dichlorophenoxyethyl sulphate $C_8H_7Cl_2NaO_3S$	-	10	-	20	
Sodium flouroacetate $CH_2FCOONa$	-	0.05	-	0.15	Sk
Sodium hydrogen sulphite $NaHSO_3$	-	5	-	-	
Sodium hydroxide NaOH	-	-	-	2	
Sodium metabisulphite $Na_2S_2O_5$	-	5	-	-	
Starch	-	10, 5	-	-	total inhalable dust, respirable dust
Stibine SbH_3	0.1	0.5	0.3	1.5	
Strychnine $C_{21}H_{22}N_2O_3$	-	0.15	-	0.45	
Styrene, monomer $C_6H_5CHCH_2$	100	420	250	1050	
Subtilisins (proteolytic enzymes)	-	0.00006	-	0.00008	
Sucrose $C_{12}H_{22}O_{11}$	-	10	-	20	
Sulfotep (ISO) $(C_2H_5)_4P_2S_2O_5$	-	0.2	-	-	Sk
Sulphur dioxide SO_2	2	5	5	15	
Sulphur hexaflouride SF_6	1000	6000	1250	7500	

Sulphuric acid H_2SO_4	-	1	-	-	
Sulphur monochloride S_2Cl_2	-	-	1	6	
Sulphur pentachloride S_2F_{10}	0.025	0.25	0.075	0.75	
Sulphur tetraflouride SF_4	0.1	0.4	0.3	1	
Sulphuryl flouride (Sulphuryl diflouride) SO_2F_2	5	20	10	40	
2,4,5-T (ISO) $C_8H_5Cl_3O_3$		-	10	-	20
TDI		-	0.02	-	0.07 Sen
TEDP (Tetraethyl dithiopyrophosphate) $(C_2H_5)_4P_2S_2O_5$		-	0.2	-	- Sk
TEPP (ISO) (Tetraethyl pyrophosphate) $(C_2H_5)_4P_2O_7$	0.004	0.05	0.01	0.2	Sk
Talc (containing no asbestos fibers)		-	10, 1	-	- total inhalable dust, respirable dust
Tantalum metal and oxide dusts - as Ta Ta		-	5	-	10
Tellurium and compounds - as Te Te		-	0.1	-	- except Hydrogen Telluride
Terphenyls, all isomers $C_{18}H_{14}$		-	-	0.5	5
1,1,2,2-Tetrabromoethane $CHBr_2CHBr_2$	0.5	7	-	-	Sk
Tetrabromomethane CBr_4	0.1	1.4	0.3	4	
Tetracarbonylnickel (as Ni) $Ni(CO)_4$		-	-	0.1	0.24
1,1,1,2-Tetrachloro-2,2-diflouroethane CCl_3CClF_2	100	834	100	834	
1,1,2,2-Tetrachloro-1,2-diflouroethane CCl_2FCCl_2F	100	834	100	834	
Tetrachloroethene CCl_2CCl_2	50	335	150	1000	
Tetrachloromethane CCl_4	2	12.6	-	-	Sk
Tetrachloronaphthalene, all isomers $C_{10}H_4Cl_4$		-	2	-	4
O,O,O',O'-Tetraethyl dithiopyrophosphate $(C_2H_5)_4P_2S_2O_5$		-	0.2	-	- Sk
O,O,O',O'-Tetraethyl pyrophosphate $(C_2H_5)_4P_2O_7$	0.004	0.05	0.01	0.2	Sk
Tetraethyl orthosilicate $Si(OC_2H_5)_4$	10	85	30	255	
Tetraflourodichloroethane $CClF_2CClF_2$	1000	7000	1250	8750	
Tetrahydrofuran $(C_2H_4)_2O$	200	590	250	735	
Tetramethyl orthosilicate $(CH_3O)_4Si$	1	6	5	30	
Tetramethyl succinonitrile $C_8H_{12}N_2$	0.5	3	2	9	Sk
Tetrasodium pyrophosphate $Na_4P_2O_7$		-	5	-	- Sk

Tetryl $(NO_2)_3C_6H_2N(NO_2)CH_3$	-	1.5	-	3	Sk
Thallium, soluble compounds Tl	-	0.1	-	-	Sk
4,4'-Thio bis(6-tert butyl-m-cresol) $C_{22}H_{30}O_2S$	-	10	-	20	
Thioglycolic acid $C_2H_4O_2S$	1	5	-	-	
Thionyl chloride $SOCl_2$	-	-	1	5	
Thiram (ISO) $(CH_3)_2NCS_2CS_2N(CH_3)_2$	-	5	-	10	
Tin, oxide and inorganics except SnH4 Sn	-	2	-	4	
Tin, organic compounds as Sn except Cyhexatin Sn	-	0.1	-	0.2	Sk
Titanium dioxide TiO_2	-	10, 5	-	-	total inhalable dust, respirable dust
Toluene $C_6H_5CH_3$	50	188	150	560	Sk
Toluene, 2,4 diisocyanate (TDI)	-	0.02	-	0.07	Sen
p-Toluenesulphonyl chloride $CH_3C_6H_4SO_2Cl$	-	-	-	5	
1,4,7-Tri-(aza)-heptane $(NH_2CH_2CH_2)_2OH$	1	4	-	-	Sk
Tribromomethane $CHBr_3$	0.5	5	-	-	Sk
Tributyl phosphate, all isomers $(C_4H_9)_3PO_4$	-	5	-	5	
Tricarbonyl (eta-cyclopentadienyl) manganese (as Mn) (C_5H_5)-$Mn(CO)_3$	-	0.1	-	0.3	Sk
Tricarbonyl (methylcyclopentadienyl) manganese (as Mn) $(CH_3)C_5H_4$)-$Mn(CO)_3$	-	0.2	-	0.6	Sk
Trichloroacetic acid CCl_3COOH	1	5	-	-	
1,2,4-Trichlorobenzene $C_6H_3Cl_3$	5	40	5	40	
1,1,1-Trichlorobis (chlorophenyl) ethane $C_{14}H_9Cl_5$	-	1	-	3	
1,1,2-Trichloroethane $CH_2ClCHCl_2$	10	45	20	90	Sk
Trichloroflouromethane $CClF_3$	1000	5600	1250	7000	
Trichloromethane $CHCl_3$	2	9.8	-	-	
Trichloronitromethane CCl_3NO_2	0.1	0.7	0.3	2	
2,4,5-Trichlorophenoxy acetic acid $C_8H_5Cl_3O_3$	-	10	-	20	
1,2,3-Trichloropropane $CH_2ClCHClCH_2Cl$	50	300	75	450	Sk
1,1,2-Trichloro-1,2,2-triflouroethane CCl_2FCClF_2	1000	7600	1250	9500	
Tri-o-Cresyl phosphate $(CH_3C_6H_4O)_3PO$	-	0.1	-	0.3	
Tricyclohexyl tin hydroxide $(C_6H_{11})_3SnOH$	-	5	-	10	

Tridymite SiO_2	-	0.4	-	-	respirable dust
Triethylamine $(C_2H_5)_3N$	10	40	15	60	
Triflourobromomethane CF_3Br	1000	6100	1200	7300	
Trimanganese tetraoxide Mn_3O	-	1	-	-	
Trimellitic anhydride $C_9H_4O_5$	-	0.04	-	-	Sen
Trimethylamine $(CH_3)_3N$	10	24	15	36	
Trimethylbenzene all isomers and mixtures $C_6H_3(CH_3)_3$	25	123	-		
3,5,5-Trimethylcyclohex-2-enone $C_9H_{14}O$	-	-	5	25	
Trimethyl phosphite $(CH_3O)_3P$	2	10	-	-	
2,4,6-Trinitrophenol $HOC_6H_2(NO_2)_3$	-	0.1	-	0.3	Sk
2,4,6-Trinitrotoluene (TNT) $CH_3C_6H_2(NO_2)_3$	-	0.5	-	-	Sk
Triphenyl phosphate $(C_6H_5)_3PO_4$	-	3	-	6	
Tripoli, respirable dust SiO_2	-	0.4	-	-	
Tri-o-tolyl phosphate $(CH_3C_6H_4O)_3PO$	-	0.1	-	0.3	
Tungsten, insoluble compounds - as W W	-	5	-	10	
Tungsten, soluble compounds - as W W	-	1	-	3	
Turpentine $C_{10}H_{16}$	100	560	150	840	
Uranium, all compounds - as U U	-	0.2	-	0.6	
Vanadium pentoxide V_2O_5	-	0.5, 0.05	-	-	total inhable, fume and respirable dust
Vinyl acetate $CH_3COOCHCH_2$	10	30	20	60	
Vinyl benzene $C_6H_5CH=CH_2$	100	420	250	1050	
Vinyl bromide CH_2CHBr	5	20	-	-	
Vinyl chloride	5	15	-	-	
4-Vinyl cyclohexene	0.1	0.4	-	-	
Vinyl cyclohexene dioxide $C_6H_{12}O_2$	10	60	-	-	
Vinyl toluene $C_6H_5C(CH_3)CH_2$	-	-	100	480	
Warfarin (ISO) $C_{19}H_{16}O_4$	-	0.1	-	0.3	
White spirit	100	575	125	720	
Xylene, all and mixed isomers $C_6H_4(CH_3)_2$	100	435	150	650	Sk
Xylidene, mixed isomers $(CH_3)_2C_6H_3NH_2$	2	10	10	50	Sk

Yttrium, as metal and compounds	Y	-	1 - 3	
Zinc chloride fumes	$ZnCl_2$	-	1 - 2	
Zinc di-stearate	$Zn(C_{18}H_{35}O_2)_2$	-	10, 5 - 20	total inhalable dust, respirable dust
Zinc oxide fumes	ZnO	-	5 - 10	
Zirconium and compounds - as Zr	Zr	-	5 - 10	

Annexure 2
Calculation of exposure with regard to the specified reference periods

This Annexure reproduces the approved method for the calculation of exposure in relation to the 8-hour, short-term and one-year reference periods.

1. The 8-hour reference period

1.1. The term '8-hour reference period' relates to the procedure whereby the occupational exposures in any 24-hour period are treated as equivalent to a single uniform exposure for 8 hours [the 8-hour time weighted average (TWA) exposure].

1.2. The 8-hour TWA may be represented mathematically by:

$$\frac{C_1T_1 + C_2T_2 + .. + C_nT_n}{8}$$

where C(1) is the occupational exposure value (concentration) and T(1) is the associated exposure time in hours in any 24-hour period.

Examples

(a) The operator works for 7h20 min. on a process in which he is exposed to a substance hazardous to health. The average exposure during that period is measured as 0.12 mg/m³.

The 8-hour TWA therefore is- 7h20min (7.33h) at 0.12mg/m³
40 min (0.67h) at 0mg/m³

That is-

$$\frac{(0.12 \times 7.33) + (0 \times 0.67)}{8}$$

$= 0.11$ mg/m³

(b) The operator works for eight hours on a process in which he is exposed to a substance hazardous to health. The average exposure during that period is measured as 0,15mg/m³.

The 8-hour TWA therefore is -

$$\frac{0.15 \times 8}{8}$$

$= 0.15$ mg/m³

(c) Working periods may be split into several sessions for the purpose of sampling to take account of rest and meal breaks, etc. This is illustrated by the following example:

Exposure is assumed to be zero during the period 10:30 to 10:45, 12:45 to 13:30 and 15:30 to 15:45.

Working period	Exposure {mg/m³)	Duration of sampling (h)
08:00 - 10:30	0.32	2.5
10:45 - 12:45	0.07	2
13:30 - 1 5:30	0.20	2
15:45 - 17:15	0.10	1.5

The 8-hour TWA therefore is -

$$\frac{(0.32 \times 2.5) + (0.07 \times 2) + (0.20 \times 2) + (0.10 \times 1.5) + (0 \times 1.25)}{8}$$

$= 0.19\ mg/m^3$

(d) An operator works for eight hours during the night shift on a process in which he is intermittently exposed to a substance hazardous to health. The operators work pattern during the working period should be known and the best available data relating to each period of exposure should be applied in calculating the 8-hour TWA. This data should be based on direct measurement, estimates based on data already available or reasonable assumptions.

Working period	Task	Exposure (mg/m³)
22:00 - 24:00	Helping in workshop	1. 10 (known to be the exposure of full-time group in the workshop)
24:00 - 01:00	Cleaning elsewhere in factory	0 (assumed)
1.00 - 04:00	Working in canteen	0 (assumed)
04:00 - 06:00	Cleaning up after breakdown in workshop	0.21 (assumed)

The 8-hour TWA therefore is -

$$\frac{(0.10 \times 2) + (0.21 \times 2) + (0 \times 4)}{8}$$

$= 0.78\ mg/m^3$

2. The short-term reference period

Exposure should be recorded as the average over the specified short-term reference period and should normally be determined by sampling over that period.

Example where the short-term reference period is 15 minutes

(a) Exposure period is less than 15 minutes:

The sampling result should be averaged over 15 minutes. For example, if a 5-minute sample produces a level of 600 ppm and is immediately followed by a period of zero exposure, then the 15-minute average exposure will be 200 ppm:

(b) Exposure period is 15 minutes or longer

Measurements should be taken over a 15-minute period and the result is the 15-minute average exposure. Measurements for periods greater than 15 minutes should not be used to calculate a 15-minute average exposure, but if the average exposure over the longer period exceeds the 15-minute exposure limit, then this limit must have been exceeded over some 1 5-minute period.

3. The one-year reference period for vinyl chloride

Exposure should be recorded as the time-weighted average of vinyl chloride in the atmosphere of a work-ing area over a period of one year. At enclosed vinyl chloride polymerisation plants, continuous or permanent sequential sampling methods must be used. Where discontinuous measurements are made, the frequency of measurements and the number per year should be such that it is possible to state with a statistical confidence coefficient of at least 95% that the true mean annual concentration did not exceed the annual maximum exposure limit. Only periods of plant operation including, where necessary, maintenance time should be taken into account.

Annexure 3

Methods of measurement and calculation for determining fibre concentrations of manmade mineral fibre

1. The method must determine the exposure of employees by sampling in the breathing zone of the employee exposed.
2. 'Fibre' means a particle with a length > 5 μm, an average diameter < 3 μm, and a ratio of length to diameter > 3 to 1, which can be seen using the system specified in paragraph 3.
3. Fibres shall be counted in accordance with AIA RTM1.
4. The results shall be regularly tested by quality assurance procedures to ensure that the results are in satisfactory agreement with the average of results, obtained by approved inspection authorities (AIA) participating in a national quality assurance scheme, using the method specified in paragraphs 1 to 3 above.

Annexure 4
Cotton Dust

1. The OEL for cotton dust is 0.5 mg/m³ total dust less fly, 8-hour TWA. This figures is not a personal exposure limit but a background air standard determined by using static samplers. This OEL-RL applies to dust from the processing and handling of raw and waste cotton, including blends containing raw or waste cotton, with the following exceptions:
    (a) dust from weaving, knitting, braiding and subsequent processes; and
    (b) dust from bleached or dyed cotton.
2. Under the HCS Regulations, assessors must satisfy themselves that the assessment takes account of people who work intensively with the material e.g. at bale opening, waste handling, maintenance of dust extraction equipment and cleaning procedures, and who are therefore likely to be exposed to dust.
3. Where the OEL-RL does not apply, exposure should be kept below both 10 mg/m³ 8-hour TWA total inhalable dust and 5 mg/m³ 8-hour TWA respirable dust, determined by a personal sampling method.

Annexure 5
Asphyxiants

1. Some gases and vapours, when present at high concentration in air, act as simple asphyxiants by reducing the oxygen content by dilution to such an extent that life cannot be supported. Many asphyxiants are odourless, colourless and not readily detectable. Monitoring the oxygen content of the air is often the best means of ensuring safety. The oxygen content of air in the workplace should never be allowed to fall below a minimum of 18% by volume under normal atmospheric pressure. Particular care is necessary when dense asphyxiants, e.g. argon, are used, since very high localised concentrations can arise owing to their collecting in pits, confined spaces and other low-lying areas where ventilation is likely to be poor.
2. Many asphyxiants present a fire or explosion risk. The concentration at which these risks can arise are liable to be well below those levels at which asphyxiation is likely to occur and should be taken into account when assessing the hazards.
3. Although asphyxiants are listed in Table 2 of Annexure 1, they are not substances hazardous to health for the purpose of the HCS Regulations.

Annexure 6
Rubber fume and rubber process dust

1. Rubber fume is fume evolved in the mixing, milling and blending of natural rubber or synthetic elastomers, or of natural rubber and synthetic polymers combined with chemicals, and in the processes which convert the resultant blends into finished products or parts thereof, and including any inspection procedures where fume continues to be evolved.
2. The limit relates to cyclohexane soluble material determined by the method described in 'Rubber fume in air, measured as total particulates and cyclohexane soluble material'.
3. Rubber process dust is evolved during the manufacture of intermediates or articles from natural rubber and/or synthetic elastomers. This definition does not include dusts, which, for occupational purposes, can be dealt with individually. In each case the relevant OEL will apply. Otherwise, where a substance with an OEL is present in a mixed dust, the OEL for that substance will apply, in addition to the rubber process dust limit.
4. Methods for personal sampling and measurement of total inhalable dusts are available in 'General method for the gravimetric determination of respirable and total inhalable dust' and 'Rubber fume in air measures as total particulates and cyclohexane soluble material'.

Annexure 7
The definition of Grain Dust

1. Grain dust is taken to be dust arising from the harvesting, drying, handling, storage or processing of barley, wheat, oats, maize and rye, including contaminants.

Acknowledgement to
HER BRITANNIC MAJESTY'S STATIONERY OFFICE

The Department of Labour hereby acknowledges the permission given by the Controller of HER BRITANNIC MAJESTY'S STATIONERY OFFICE (HMSO) for the reproduction of the Crown Copyright material listed below, or part thereof.

The conditions under which this permission was granted, are subject to the following;

- The source of the material must be acknowledged; and
- It must be mentioned that permission for the reproduction of such material was given by the Controller of HMSO.

List of material

1.	Guidance note S20	9	EH22
2.	HS(G)61	10	EH23
3.	MDHS 14	11	EH25
4.	MDHS 47	12	EH28
5.	INDG(G)64-L	13	EH40
6.	COSSH assessments	14	EH42
7.	Pesticides: Code of Practice	15	EH44
8.	EH14	16	EH56

Annexure 8
Material safety data sheet

MATERIAL SAFETY DATA SHEET	No: Date issued: Page of
COMPANY DETAILS	
Name: Address: Tel:	Emergency telephone no.: Telex: Fax:
1) Product and Company Identification: **(Page 1 may be used as an emergency safety data sheet)**	
Trade name : Chemical family : Chemical name: Synonyms:	Chemical abstract no. : NIOSH no.: Hazchem code: UN no.:
2) Composition	
Hazardous components: EEC classification: R Phrases:	
3) Hazards Identification	
Main hazard: Flammability: Chemical hazard Biological hazard:	

Reproductive hazard:

Eye effects: eyes:

Health effects - skin:

Health effects - ingestion:

Health effects - inhalation:

Carcinogenicity:

Mutagenicity:

Neurotoxicity:

4) First-aid Measures

Product in eye:

Product on skin:

Product ingested:

Product inhaled:

5) Fire-fighting Measures

Extinguishing media:

Special hazards:

Protective clothing:

6) Accidental Release Measures

Personal precautions:

Environmental precautions:

Small spills:

Large spills:

7) Handling and Storage

Suitable material:

Handling/storage precautions:

8) Exposure Control/Personal Protection

Occupational exposure limits:

Engineering control measures:

Personal protection - respiratory:

Personal protection - hand:

Personal protection - eye:

Personal protection - skin:

Other protection:

9) Physical and Chemical Properties

Appearance:

Odour:

pH:

Boiling point:

Melting point:

Flash point:

Flammability:

Auto flammability:

Explosive properties:

Oxidizing properties:

Vapour pressure:

Density:

Solubility - water:

Solubility - solvent:

Solubility - coefficient

10) Stability and Reactivity

Conditions to avoid:

Incompatible materials:

Hazardous decomposition products:

11) Toxicological Information

Acute toxicity:

Skin and eye contact:

Chronic toxicity:

Carcinogenicity:

Mutagenicity:

Neurotoxicity:

Reproductive hazards:

12) Ecological Information

Aquatic toxicity - fish:

Aquatic toxicity - daphnia

Aquatic toxicity - algae

Biodegradability:

Bio-accumulation:

Mobility:

German wgk:

13) Disposal Considerations

Disposal methods:

Disposal of packaging:

14) Transport Information

UN no.

Substance indentity no.

ADR/RID class:

ADR/RID item no.

ADR/RID hazard identity no.:

IMDG - shipping name:

MDG - class:

IMDG - packaging group:

IMDG - marine pollutant:

IMDG - EMS no.

IMDG - WAG tabel no.:

IATA - shipping name:

IATA - class:

IATA - subsidiary risk(s):

ADNR - class:

UK - description:

UK - emergency action class:

UK - classification:

Tremcard no.:

15) Regulatory Information.

EEC hazard classification:

Risk phases:

Safety phases:

National legislation:

16) Other Information