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THE FACTORIES AND OTHER PLACES OF WORK ACT, (CAP. 514)

IN EXERCISE of the powers conferred by section 55 of the Factories and Other Places of Work Act, Cap. 514, the Minister for Labour and Human Resource Development makes the following Rules—

THE FACTORIES AND OTHER PLACES OF WORK (HAZARDOUS SUBSTANCES) RULES, 2007

Citation.

1. These rules may be cited as the factories and other places of work (Hazardous Substances) rules, 2007.

Interpretation.

2. In these rules, except where the context otherwise requires—

"air quality monitor" means any competent person who is authorized by the director, by a certificate in writing, to carry out monitoring and measurements of the substances in the air.

"biological monitoring" means a technique for measuring the presence of a chemical or its metabolites in tissues or excreta or for measuring pathological effects of toxin on the person.

"competent person" in relation to any duty or function, means a person who has adequate training, relevant qualifications and experience to enable him to perform that duty or function;

"Director" means the Director of Occupational Safety and Health Services;
or occupier.

"Engineering Controls Examiner" means any competent person who is authorized by the Director in

writing, to carry out thorough examination and test of engineering control measures for the purposes of these rules.

" guidelines" means the guidelines describing the methodology for implementation of health and safety under these Rules ;

"harmful substance" means any substance whether liquid, solid or gaseous which is hazardous or potentially hazardous to human or the environment and includes objectionable odours, radio-activity, noise and temperature.

"hazardous substances" means any chemical, waste, gas, medicine, drug, plant, animal or microorganism which are likely to be injurious to human health or the environment,

"measurement" means periodic evaluation of workplaces and organizational management systems in a factory or workplace for prevention of accidents, occupational diseases, ill-health or damage to property.

" occupational exposure limit" (OEL) means the levels of exposure or discharge or emissions as set out in Schedule 1 to these Rules;

"worker" includes a person who has entered into or works under a contract of service or apprenticeship, written or oral, express or implied, whether by way of manual labour or otherwise;

"workplace" includes any land, premises, location, vessel or thing at, in, upon or near where an employee is, in the course of employment.

"substance" includes any solid, liquid, vapour, gas or aerosol, or combination thereof;

Application.

3.(1) These Rules shall apply to—

every factory, premises, places, process, operation, or work to which the provisions of the Factories and Other Places of Work Act apply;

(2) Every employer, occupier or owner, agent, self-employed person or employee

Exposure limits.

4. (1). Every employer shall ensure that exposure of hazardous substance does not exceed the exposure limits set out in schedule 1 to these Rules;

(2) Where the exposure limit of a hazardous substance is not provided for in Schedule 1 to these Rules, it shall be the responsibility of a supplier or manufacturer of such substance to provide a provisional exposure limit.

(3) When two or more hazardous substances are present simultaneously in the working atmosphere and their combined effects have to be considered, Schedule 2 to these Rules shall apply.

5. (1) The Minister may by notice in the Gazette, amend the Schedules to—

(a) vary the exposure limit ;

(b) prohibit the use of a hazardous substance that may contaminate the working environment;

(c) specify particular measures of prevention or protection from the effects of a hazardous substance; or

(d) prescribe any other exposure limit of a hazardous substance.

(2) In schedule 2 or prescribe any other exposure limits of air contaminants and emission levels of the chemical substances or prohibit the use of the substances that contaminate working environment or specify particular

measures of prevention or protection.

Control measures.

6. (1) It shall be the duty of every employer to prevent his employees form being exposed to cardous substances.

(2) Where it is not reasonably practical to prevent the exposure, it shall be the duty of every employer to control the exposure of employees from hazardous substances by-

(a) limiting the amount of hazardous substances used which may contaminate the working environment;

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

(c) using a substitute for the hazardous substance;

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

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

(i) process separation, automation or enclosure;

(ii) installation of local extraction ventilation systems to processes, equipment and tools for the control of emission of an air borne hazardous substances;

(iii) use of wet methods;

(iv) separate workplaces for different processes;

(f) 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 a hazardous substance 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 workplaces are kept clean; and

(iv) that early procedures are in place for corrective action.

Personal protective equipment.

7. (1). Where it is not reasonably practical to ensure that the exposure of an employee is adequately controlled as contemplated in Rules 6, the employer shall-

(a) in the case of an air bone hazardous substances, provide the employee with suitable respiratory protective equipment and protective clothing; and

(b) in case of hazardous substances which can be absorbed through the skin, provide the employee with suitable 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 hazardous substances

(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). Every employer shall, -

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

(b) provide separate containers or storage facility for personal protective equipment ; and

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

(4) Every 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 the employer, care shall be taken to prevent contamination during handling, transportation and cleaning;

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

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

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

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

(5) Subject to the provisions of sub rule 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 waste .

(6) Every employer shall, , provide employees using personal protective equipment with : -

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

(b) two separate lockers separately labeled “Protective clothing” and “Personal

clothing", and ensure that the clothing is kept separately in the appropriate locker ; and

(c) separate "clean" and "dirty" changing rooms if the employer uses or processes highly hazardous substances to the extent that the hazardous substances could endanger the health of employees.

Maintenance and testing of engineering controls.

8. Every employer shall ensure:

(1) That all control equipment and facilities provided are maintained in good working order; and

(2) That thorough examinations and tests of engineering control measures are carried out at intervals not exceeding 24 months by an engineering controls examiner and a report issued.

Submission of report.

9. An engineering controls examiner shall submit a signed report to the Director within thirty days following such examination and test.

protection against radioactive and carcinogenic substances.

10.(1) Every employer shall ensure that any processes involving a significant risk of exposure to carcinogenic, radioactive, mutagenic or teratogenic substances shall be performed within an enclosed system so as to prevent any exposure of the workers to the substance.

(2) Where any of the processes may require direct handling of carcinogenic, radioactive, mutagenic or teratogenic substances, every employer shall ensure that such processes are automated or are conducted by use of remote controlled systems.

(3) Every employer shall issue a permit to work certificate to any person carrying out maintenance and service of an enclosed system.

Material Safety Data Sheet.

11.(1).Every manufacturer or agent of hazardous substances shall supply information on the characteristics such substances as regards the health effects of the substances on human health.

(2)Every person who manufactures, imports, sells or supplies any hazardous substance for use at work, shall ensure that the substance is accompanied by a material safety data sheet containing all the information set out in schedule 3 to these Rules:

(3)Every employer who uses any hazardous substance at work shall be in possession of a copy of material safety data sheet for each type of substance in use at his premise.

(4)Every employer shall make the material safety data sheet available for inspection at the request of any person interested or affected.

(5) Every employer shall provide full information on the composition and properties of a product to the Director, when called upon to do so.

Disposal of chemical and other hazardous substances.

12. Every employer shall ensure that the quantity of waste from hazardous substances in his use are kept at reasonable minimum levels and that such waste is disposed of in a manner less harmful to human and the environment, including-

(a) recycling the waste material where applicable;

(b) depositing of hazardous waste substances is placed into containers that will prevent the likelihood of exposure during handling;

(c) ensuring that all vehicles, re-usable containers and covers which have been in contact with hazardous waste chemical

substances are cleaned and decontaminated after use in such a way that the vehicle, containers or covers do not cause a hazard to human and environment.

(d) ensuring that all employees employed in the collection, transportation and disposal of harmful waste chemical substances are not exposed to the harmful waste and are provided with suitable personal protective equipment;

(e) ensuring that all hazardous waste which can cause exposure is disposed of only on sites specifically designated for this purpose.

Labeling of containers.

13. (1) Every manufacturer or supplier of hazardous substances shall ensure that the hazardous substance is marked or labeled in a distinctive manner indicating the nature of their contents, health hazards and instructions for safe handling of the substance .

(2)Every manufacturer or supplier of a hazardous substance shall ensure that the chemical or common name used to identify the chemical on the label shall be the same as that used on the material safety data sheet.

Training and Information.

14.(1) It shall be the duty of every employer to inform the workers of the hazards associated with exposure to chemicals used at the workplace and every employer shall facilitate the training of his worker on safety by-

(a) instructing the workers how to obtain and use the information provided on labels and chemical safety data sheets;

(b) using the chemical safety data sheets, along with information specific to the workplace, as a basis for the preparation of instructions to workers, which should be written if appropriate;

(2) Every employer shall ensure that workers are trained and certified by a competent person, on continuing basis in the practices and procedures to be followed for safety in the use of chemicals at work.

(3) Every employer shall, before any employee is exposed, ensure that the employee is adequately and comprehensively informed and trained, and is thereafter informed and trained at intervals as may be recommended by the health and safety committee or by the Director, with regard to-

(a) the contents and scope of these rules;

(b) the potential source of exposure;

(c) the potential risks to health caused by exposure

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

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

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

(g) the necessary, 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 labeling of the chemical and other hazardous substance 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;

(4) Every employer shall give written instructions to the drivers of vehicles carrying the hazardous substances, the procedures to be followed in the event of spillages, leakages or any similar emergency situation which could take place by accident.

Air monitoring and Measurement.

14. (1) In every workplace where chemicals and other hazardous substances are used the employer shall ensure that measurements of the substances in the air are carried out at least once every twelve months by a certified air quality monitor , in order to determine the prevailing occupational exposure levels.

(2) An Air Quality Monitor shall cause the samples to be analyzed by the Government Chemist or any other laboratory approved by the Director to determine exposure levels and biological exposure indices respectively.

(3) The e costs in connection with such measurements shall be met by the employer.

(4)The results of measurement of the substances in the air shall be recorded and shall specify: -

(a) date, time and period of sampling

(b) nature of work/process evaluated

(c) number of the workers exposed

(d)measuring methods including analytical methods

(e) type of measurements (e.g. dust, fumes, vapors….)

(f) results of measurements

(g) recommendations for remedial measures to be taken

(h)name of the person taking the measurements.

(5) Every employer shall keep a copy of the report of the results of measurements carried out for a period of two years.

(6) An Air Quality Monitor shall submit a signed copy of the report of the results of measurements to the director within a period of thirty days from the date of carrying out the measurements.

(7) Where the Air Quality Monitor is of the opinion that occupational exposure levels pose imminent danger to workers' health he shall immediately and not

later than 48 hours, inform the Occupational Safety and Health officer of the area.

Duty of competent persons.

15.(1) Every Air Quality Monitor shall regularly inspect, calibrate and maintain equipment for measuring air contaminants.

(2) It shall be the duty of a competent person to carry out biological monitoring with the consent of the employee.

(3) A competent person shall inform employees on the scope of biological monitoring and on the significance of the results;

Guidelines on hazardous substances.

16. The director may review and issue guidelines, on how the monitoring of air contaminants shall be carried out.

Duty of Employees.

17. It shall be the duty of every employee-

(a) not to interfere with or misuse any means, appliance, convenience or any other thing provided for securing the health, safety or welfare of him or others at the workplace;

(b) to make use of any means, appliance, convenience or any other thing provided for securing the health, safety or welfare of himself or others at the workplace;

(c) not to, without reasonable cause do anything likely to endanger himself or any other person at the workplace;

(d) to report forthwith to the supervisor or any other person having authority over him, any situation which he has reason to believe would present a hazard; and

(e) to report to his supervisor any accident or injury that arises in the course of or in connection with his work.

Medical examination.

18. In every workplace where hazardous substances are in use, the employer shall ensure that the worker undergoes medical examination in accordance with the requirements of the Factories and Other Places of Work (Medical Examination) Rules, 2005.

Offences and penalties.

19. Any person who contravenes or fails to comply with any provision of these rules shall commit an offence and the provisions of the Act on offences and penalties shall mutatis mutandis apply.

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SCHEDULE 1

TABLE 1

OEL-CL: OCCUPATIONAL EXPOSURE LIMITS – CONTROL LIMITS FOR HAZARDOUS CHEMICAL SUBSTANCES

Substance	Formula	TWA OEL-CL		SHORT TERM OEL-CL		1995
		ppm	mg/m^3	ppm	mg/m^3	Notes
Acryl amide	$CH_2=CHCONH_2$	-	0.3	-	-	Sk
Acrylonitrile	$CH_2=CHCN$	2	4	-	-	Sk
Arsenic & compounds, except arsine (as As)	As	-	0.1	-	-	
Asbestos:m (dee note)						
Benzene	C_6H_6	5	16	-	-	-
Bis (chloromethyl) ether (BCME)	$ClCH_2OCH_2Cl$	0.001	0.005	-	-	
Buta-1,3-diene	$CH_2=CHCH=CH_2$	10	22	-	-	
2-Butoxyethanol	$C_4H_9OCH_2CH_2OH$	25	120	-	-	Sk
Cadmium & cadmium compounds, except cadmium oxide fume and cadmium sulphide pigments (as Cd)	Cd	-	0.05	-	-	
Cadmium oxide fume (as Cd)	CdO	-	0.05	-	0.05	
Cadmium sulphide pigments (respirable dust Cd)	CdS		0.04			
Carbon disulphide	CS_2	10	30	-	-	Sk
Chromium (VI) compounds (as Cr)	Cr	-	0.05	-	-	
1,2-Dibromoethane (ethylene dibromide)	$BrCH_2CH_2Br$	0.5	4	-	-	Sk
Dichloromethane	CH_2Cl_2	100	350	-	-	

2,2'-Dichlor0-4,4' methylene dianiline (MbOCA)	$CH_2.(C_6H_3ClNH_2)_2$.	-	0.005	-	-	Sk
2-Ethoxyethanol	$C_2H_5OCH_2CH_2OH$	10	37	-	-	Sk
2-Ethoxyethyl acetate	$C_2H_5OCH_2OOCCH_3$.	10	54	-	-	Sk
Ethylene oxide	CH_2CH_2O	5	10	-	-	
Formaldehyde	HCHO	2	2.5	2	2.5	
Grain dust		-	10	-	-	Sen
Hydrogen cyanide	HCN	-	-	10	10	Sk
Isocyanates, all (as-NCO)		-	0.02	-	0.07	Sen
Lead and compounds						
2-Methoxyethanol	$CH_3OCH_2CH_2OH$	5	16	-	-	Sk
2-Methoxyethyl acetate	$CH_3COOCH_2CH_2OCH_3$	5	24	-	-	Sk
Nickel	Ni	-	0.5	-	-	
Nickel, inorganic compounds (as Ni)	Ni	-	0.1	-	-	
soluble compounds		-	0.5	-	-	
insoluble compounds						
Rubber process dust	See Annexure 6	-	8	-	-	
Rubber fume		-	0.6	-	-	
Silica, crystalline	$Si0_2$					
respirable dust		-	0.4	-	-	
Styrene	$C_6H_5CH=CH_2$	100	420	250	1050	
1,1,1-Trichloroethane	CH_3CCI_3	350	1900	450	2450	
Trichloroethylene	$CCI_2=CHCI$	100	535	150	802	Sk
..Vinyl chloride	$CH_2=CHCI$	7	-	-	-	
Vinylidene chloride	$CH_2=CCI_2$	10	40	-	-	
Wood dust (hard wood)		-	5	-	-	Sen

**Vinyl chloride is also subject to an overriding annual TWA OEL- CL of 3 ppm.

TABLE 2
OEL-RL: OCCUPATIONAL EXPOSURE LIMIT – RECOMMENDED LIMIT FOR HAZARDOUS CHEMICAL SUBSTANCES

Substance	Formula	TWA OEL-RL	SHORT TERM OEL-RL	1995

		ppm	Mg/m^3	ppm	Mg/m^3	Notes
Acetaldehyde	CH_3=CHO	100	180	150	270	
Acetic acid	CH_3COOH	10	25	15	37	
Acetic anhydride	$(CH_3CO)_2O$	-	-	-	20	
Acetone	CH_3COCH_3	750	1780	1500	3560	
Acetonitrile	CH_3CN	40	70	60	105	
o-Acetylsalicylic acid	$CH_3COOC_6H_4COOH$	-	5	-	-	
AcrylaJdehyde (Acrolein)	CH_2=CHCHO	0.1	0.25	0.3	0.8	
Acrylic acid	CH_2=CHCOOH	10	30	20	60	
Aldrin (ISO)	$C1_2H_8CI_6$	-	0.25	-	0.75	Sk
Allyl alcohol	CH_2=$CHCH_2OH$	2	5	4	10	Sk
Allyl chloride	CH_2=$CHCH_2Cl$	1	3	-	6	
Allyl 2,3-epoxypropyl ether	CH2=$CHCH_2OCH_2CHCH_2O$	5	22	10	44	Sk
Allyl glycidyl ether (AGE)	CH_2=$CHCH_2OCH_2CHCH_2O$	5	22	10	44	Sk
Aluminium alkyl compounds		-	2	-	-	
*Aluminium metal	A1					
total inhalable dust		-	10	-	-	
respirable dust		-	5	-	-	
*Aluminium oxides	$AI_2O_3AI(OH)_3$ and AlOOH					
total inhalable dust		-	10	-	-	
respirable dust		-	5	-	-	
Aluminium salts, soluble		-	2	-	-	
Aminodimethyl-benzene	$(CH_3)_2C_6H_3NH_2$	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, fume	NH_4CI	-	10	-	20	
Ammonium sulphamidate	$NH_2SO_3NH_4$	-	10	-	20	
n-Amyl acetate	$CH_3COOC_5H_{I1}$	100	530	150	800	
sec-Amyl acetate	$CH_3COOCH(CH_3)C_3H_7$	-	-	150	800	

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Aniline	$C_6H_5NH_2$	2	10	5	20	Sk
Anisidines. 0- and 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	
Aspirin	$CH_3COOC_6H_4COOH$	-	5	-	-	
Atrazine (ISO)	$C_8Hl_4ClN_5$	-	10	-	-	
Azinphos-methyl (ISO)	$(CH_3O)_2PSSCH_2.(C_7H_4N_3O)$	-	0.2	0.6	-	Sk
Aziridine	CH_2CH_2NH	-	10	-	-	
y-BHC (ISO)	$C_6H_5C_{l4}$	-	0.5	-	1.5	Sk
Barium compounds, soluble (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-lricarboxylic acid 1,2-anhydride	$C_9H_4O_5$	-	0.04	-	-	San
p-Benzoquinone	$C_9H_4O_2$	0.1	0.4	0.3	1.2	
Benzoyl peroxide	$(C_6H_5CO)_2O_2$	-	5	-	-	
Benzyl butyl phthalate	$C_6H_5CH_2COOC_6H_4$-$COOC_4H_9$	-	5	-	-	
Benzyl chloride	$C_6H_5CH_2Cl$	1	5	-	-	
Beryllium	Be	-	0.002	-	-	
Biphenyl	$(C_6H_5)_2$	0.2	1.5	0.6	4	
2,2-Bis(p-methoxy-phenyl)-1,1,1-trichloroethane	$C_{14}H_9Cl_5$	-	1	-	3	
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-melho-xyphenyl)B1,1,1-Dichloroethane	$C_{16}H_{15}Cl_3O_2$	-	10	-	-	
Boman-Zade	$C_{10}H_{16}O$	2	12	3	18	
Boron oxide	B_2O_3	-	10	-	20	
Bismuth telluride	Bi_2Te_3	-	10	-	20	
Boron tribromide	BBr_3	-	-	1	10	
Bismuth telluride, seleniumdoped	Bi_2Te_3	-	5	1	10	
Boron trifluoride	BF_3	-	5	1	3	
Bromacil (ISO)	$C_9H_{13}BrN_2O_2$	1	10	2	20	
Borates, (tetra) sodium salts	Br_2	0.1	0.7	0.3	2	
Bromine	BrF_5	0.1	0.7	0.3	2	
Bromine pentafluoride	$Na_2B_4O_7$	-	1	-	-	
anhydrous	CH_2BrCl	200	1050	250	1300	
Bromochloromethane	$Na_2B_4O_7.10H_2O$	-	5	-	-	
decahydrate	C_2H_5Br	200	890	250	1110	
Bromoethane	$Na_2B_4O_7.5H_2O$	-	1	-	-	
pentahydrate	$CH_2{=}CHBr$	5	20			
Bromoethylene	$CHBr_3$ 20	0.5	5	-	-	Sk
Brom%rm	CH_3Br	5	20	15	60	Sk
Bromomethane	CF_3Br	1000	6100	1200	7300	
Bromotrifluoromethane						

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Butane	C_4H_{10}	600	1430	750	1780	
But-1-ene	$CH_3CH_2CH=CH_2$	-		50	150	Sk
But-2-ene	$CH_3CH=CHCH_3$	200	590	150	450	
Butan-2-one	CH_3COC_2,H_5	200	590	300	885	
trans-But-2-enal	$CH_3CH=CHCHO$	2	6	6	18	
Butyl acetate	$CH_3COO(CH_2)_3CH_3$	150	710	200	950	
see-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	
Butyl acrelate	$C_7H_{12}O_2$	10	55			
n-Butyl alcohol	$CH_3CH_2CH_2CH_2OH$	-		50	150	Sk
see-Butyl alcohol	$CH_3CH_2CHOHCH_3$	100	300	150	450	Sk
tert-Butyl alcohol	$(CH_3)_3COH$	100	300	150	450	
n-Butylamine	$CH_3CH_2CH_2CH_2NH_2$	-	-	5	15	
Butyl benzyl phthalate	$C_6H_5CH_2COOC_6H_4$-$COOC_4H_9$	-	5	-	-	
n-Butyl chlor%rmate	$ClCO_2C_4H_{10}$	1	5.6	-	-	
ButyI-2,3-epoxy-propyl ether	$C_4H_9OCH_2CHCH_2O$	25	135	-	-	
n-Butyl glycidyl ether (BGE)	$C_4H_9OCH_2CHCH_2O$	25	135	-	-	
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	$CaCO_3$					
total inhalable dust		-	10	-	-	
respirable dust		-	5	-	-	
Calcium cyanamide	CaNC=N	-	0.5	-	1	
Calcium hydroxide	$Ca(OH)_2$	-	5	-	-	
Calcium oxide	CaO	-	2	-	-	
Calcium silicate						
total inhalable dust		-	10	-	-	
respirable dust		-	5	-	-	
Camphor, synthetic	$C_{10}H_{16}O$	2	12	3	18	
.-Caprolactam	$NH(CH_2)_5CO$					
dust		-	1	-	3	
vapour		5	20	10	40	
Captafol (ISO)	$C_{10}H_9Cl_4NO_2S$	-	0.1	-	-	Sk
Captan (ISO)	$C_9H_8Cl_3NO_2S$	-	5	-	15	
Carbaryl (ISO)	$C_{10}H_7OCONHCH_3$	-	5	-	10	
Carbuforan (ISO)	$C_{12}H_{15}NO_3$	-	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	$C_6H4.(OH)_2$	5	20	-	-	
Cellulose						
total inhalable dust		-	10	-	20	
respirable dust		5	-	-	-	
Cement						
total inhalable dust		-	10	-	-	
respirable dust		-	5	-	-	
Chlordane (ISO)	$C_{10}H6Cl_8$	-	0.5	-	2	Sk
Chlorinated biphenyls (42% chlorine)	$C_{12}H_7Cl_3$(approx)	-	1	-	2	Sk Sk
Chlorinated biphenyls (54% chlorine)	$C_6H_2Cl3C_6H_3Cl_2$	-	0.5	-	1	Sk Sk
Chlorine	Cl_2	0.5	1.5	1	3	
Chlorine dioxide	ClO_2	0.1	0.3	0.3	0.9	
Chlorine trifluoride	ClF_3	-	-	0.1	0.4	
ChloroacetaJdehyde	$ClCH_2CHO$	-	-	1	3	
2-Chloroacetophenone	$C_6H_5COCH_2Cl$	0.05	0.3	-		
Chloroacetyi chloride	$ClCH_2COCl$	0.05	0.2		-	
Chlorobenzene	C_6H_5Cl	50	230		-	
Chlorobromomethane	CH_2BrCl	200	1050	250	1300	
2-Chlorobuta-1,3-diene	$CH2=CClCH=CH_2$	10	36	-	-	Sk
Chlorodifluoromethane	$CHCIF_2$	1000	3500	-	-	
1-Chloro-2,3-epoxy-propane	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			-	
Chlorofonn	$CHCl_3$	2	9.8	-		Sk
Chloromethane	CH_3Cl	50	105	100	210	
1-Chlor0-4-niIr0-benzene	$CIC_6H_4NO_2$	-	1	-	2	Sk
Chloropentafluoro-ethane	$CClF_2CF_3$	1000	6320	-	-	

Chloropicrin	CCl_3NO_2	0.1	0.7	0.3	2	
p-Chloroprene	$CH_2=CClCH=CH_2$	10	36	-	-	Sk
3-Chloropropene	$CH_2=CHCH_2Cl$	1	3	2	6	
Chlorosulphonic acid	HSO_3Cl	-	1	-	-	
a.Chlorotoluene	$C_6H_5CH_2Cl$	1	5			
2-Chlorotoluene	C_7H_7Cl	50	250	-	-	
2-Chloro-6-(trichloro-methyl) pyridine	$C_6H_3Cl_4N$	-	10	-	20	
Chlorpyrifos (ISO)	$C_9H_{11}Cl_3NO_3PS$		0.2		0.6	Sk
Chromium	Cr	-	0.5	-	-	
Chromium(lI) compounds (as Cr)	Cr	-	0.5	-	-	
Chromium(lII) compounds (as Cr)	Cr	-	0.5	-	-	
Coal dust respirable dust		-	2	-	-	
Coal tar pitch volatiles (as cyclohexane solubles)		-	0.14	-	-	
Cobalt and compounds (as Co)	Co	-	0.1	-	-	
Copper fume	Cu	-	0.2	-	-	
dusts and mists (as Cu)		-	1	-	2	
Colton dust		-	0.5	-	-	
Cresols, all isomers	$CH_3C_6H_4OH$	5	22	-	-	Sk
Cristobalite, respirable dust	SiO_2	-	-	-	-	
Crotonaldehyde	CH3CH=CHCHO	2	6	6	18	
Cryofluorane (INN)	$CClF_2CClF_2$	1000	7000	1250	8750	
Cumene	$C_6H5CH(CH_3)_2$	25	120	75	370	Sk
Cyanamide	H_2NCN	-	2	-	-	
Cyanides, except hydrogen cyanide, cyanogen & cyanogen chloride, (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	-		
Cyclohexanone	$C_6H_{10}O$	25	100	100	400	

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	
2,4D (ISO)	$C_6H_3Cl_2OCH_2COOH$	-	10	-	20	
DDM	$H_2NC_6H_4CH_2C_6H_4NH_2$	0.1	0.8	0.5	4	
DDT	$C_{14}H_9Cl_5$	-	1	-	3	
DDVP	$(CH_3O)_2POOCH=CCl_2$	0.1	1	-	3	Sk
2,4-DES	$C_8H_7Cl_2NaO_5S$	-	10		20	
DMDT	$C_{16}H_{15}Cl_3O_2$	-	10	-	-	
Dems, commercial	$C_{23}H_{22}O_6$	-	5	-	10	
Diacetone alcohol	$CH_3COCH_2C(CH_3)_2OH$	50	240	75	360	
Dialkyl 79 phthalate	$C_6H_4.(COOC_{7\text{-}9}H_{15\text{-}19})_2$	-	5	-	-	
Dialkyl phthalate	$C_6H_4.(COOCH_2CHCH)_2$	-	5	-		
2,2'-Diaminodi-ethylamine	$(NH_2CH_2CH_2)_2NH$	1	4	-	-	Sk
4-4'-Diaminodiphenyl-methane (DADPM)	$H_2NC_6H_4CH_2C_6H_4NH_2$	0.1	0.8	0.5	4	
1,2-Diaminoethane	$NH_2CH_2CH_2NH_2$	10	25	-	-	
Diammonium peroxodisulphate (measured as (S_2O_8))	$(NH_4)_2S_2O_8$	-	1	-	-	
Diatomaceous earth, natural respirable dust		-	1.5	-	-	
Diazinon (ISO)	$C_{12}H_{21}N_2O_3PS$	-	0.1	-	0.3	Sk
Diazomethane	$CH_2=N_2$	0.2	0.4	-	-	
Dibenzoyl peroxide	$(C_6H_5CO)_2O_2$	-	5	-	-	
Dibismuth tritelluride	Bi_2Te_3	-	10	-	20	
Dibismuth tritelluride, selenium doped	Bi_2Te_3	-	5	-	10	
Diborane	B_2H_6	0.1	0.1	-	-	
Diboron trioxide	B_2O_3	-	.10	-	20	
Dibrom	$C_4H_7Br_2Cl_2O_4P$	-	3	-	6	
1,2-Dibromo-2,2-dichloroethyl dimethyl phosphate	$C_4H_7Br^2Cl_2O_4P$	-	3	-	6	

Dibromodifluoro-methane	CBr_2F_2	100	860	150	1290	
Dibutyl hydrogen phosphate	$(n\text{-}C_4H_9O_2.(OH)PO$	1	5	2	10	
Di-n-butyl phosphate	$(n\text{-}C_4H_9O_2.(OH)PO$	1	5	2	10	
Dibutyl phthalate	$C_6H_4.(CO_2C_4H_9)2$	-	5	-	10	
6,6' -Di-tert-butyl-4,4' -thiodi-m-cresol	$C_{22}H_{30}O_2S$	-	10	-	20	
Dichloroacetylene	ClC=CCl	-	-	0.1	0.4	
1 ,2-Dichlorobenzene	$C_6H_4Cl_2$	-	-	50	300	
1 ,4-Dichlorobenzene	$C_6H_4Cl_2$	25	150	50	300	
Dichlorodifluoro-methane	CCl_2F_2	1000	4950	1250	6200	
1,3-Dichloro-5,5-dimethy lhydantoin	$C_5H_6Cl_2N_2O_2$	-	0.2	-	0.4	
Dichlorodiphenyltrichloro ethane	$C_{14}H_9Cl_2$	-	1		3	
1 , 1-Dichloroethane	CH3CHCl$_2$	200	810	400	1620	
1 ,2-Dichloroethane	CH_2ClCH_2Cl	10	40	15	60	
1 ,1-Dichloroethylene	$CH_2=CCl_2$	10	40	-	-	
1,2-Dichloroethylene, cis:trans isomers 60:40	ClCH=CHCl	200	790	250	1000	
Dichlorofluoromethane	$CHCl_2F$	10	40	-	-	
2,4-Dichlorophenoxyaceti c acid	$C_6H_3Cl2OCH_2COOH$	-	10	-	20	
1,3-Dichloropropene, cis and trans isomers	$CHCl=CHCH_2Cl$	1	5	10	50	Sk
1,2-Dichlorotetra-fluoroet hane	$CClF_2CClF_2$	1000	7000	1250	8750	
Dichlorvos (ISO)	$(CH_3O)_2POOCH=CCl_2$	0.1	1	0.3	3	Sk
Dicyclohexyl phthalate	C6H4.(COOC6H11)2	-	5	-	-	
Dicyclopentadiene	$C_{10}H_{12}$	5	30	-	-	
Dicyclopenta-dienyliron	$C_{10}H_{10}Fe$	-	10	-	20	
Dieldrin (ISO)	$C_{12}H_8Cl_6O$	-	0.25		0.75	Sk
Diethanolamine	$HO(CH_2)_2NH(CH_2)_2OH$	3	15		-	
Diethylamine	$(C_2H_5)_2NH$	10	30	25	75	
2-Diethylaminoethanol	$(C_2H_5)_2NCH_2CH_2OH$	10	50	-	-	Sk
Diethylene glycol	$(HOCH_2CH_2)_2O$	23	100	-	-	

Diethylene triamine	$(NH_2CH_2CH_2)_2OH$	1	4	-	-	Sk
Diethyl ether	$C_2H_5OC_2H_5$	400	1200	500	1500	
Di-(2-ethylhexyl) phthalate	$C_6H_4.(COOCH_2CH(C_2H_5)-C_4H_9)_2$	-	5	-	10	
Diethyl ketone	$C_2H_5COC_2H_5$	200	700	250	875	
Diethyl phthalate	C6H4.(COOC2H5)2	-	5	-	10	
Difluorochloromethane	$CHClF_2$	1000	3500	-	-	
Diglycidyl ether (DGE)	$(OCH_2CHCH_2)_2O$	0.1	0.6	-	-	
o-Dihydroxybenzene	$C_6H_4.(OH)$	5	20	-	-	
m-Dihydroxybenzene	$C_6H_4.(OH)_2$	10	45	20	90	
p-Dihydroxybenzene	$C_6H_4.(OH)_2$	-	2	-	4	
1,2-Dihydroxyethane	CH_2OHCH_2OH	-	-	-	-	
particulate		-	10	-	-	
vapour		-	60	-	125	
Diisobutyl ketone	$[(CH_3)_2CHCH_2]_2CO$	25	150	-	-	
Diisobutyl phthalate	$C_6H_4[COOCH_2CH(CH_3)_2]_2$	-	5	-	-	
Diisodecyl phthalate	$(C_{10}H_{21}CO_2)_2C_6H_4$	-	5	-	-	
Diisononyl phthalate	$C_6H_4.(COOC_9H_{19})_2$	-	5	-	-	
Diisooctyl phthalate	$C_6H_4.(CO_2C_8H_{17})_2$	-	5	-	-	
Diisopropylamine	$(CH_3)_2CHNHCH(CH_3)_2$	5	20	-	-	Sk
Diisoppropyl ether	(CH3)2CHOCH(CH3)2	250	1050	310	1320	
Di-linear 79 phthalate	$C_6H_4.(COOC_{7\text{-}9}H_{15\text{-}19})_2$	-	5	-	-	
Dimethoxymethane	$CH_2.(OCH_3)_2$	1000	3100	1250	3880	
NN-Dimethyl-acetamide	$CH_3CON(CH_3)_2$	10	36	20	71	Sk
Dimethylamine	$(CH_3)_2NH$	10	18	-	-	
NN-Dimethylaniline	$C_6H_5N(CH_3)_2$	5	25	10	50	Sk
1,3-Dimethylbutyt acetate	$CH_3CO_2CH(CH_3)CH_2CH-(CH_3)_2$	50	300	100	600	
NN-Dimethyl-ethylamine	$C_2H5.(CH_3)_2N$	10	30	15	45	
Dimethylformamide	$HCON(CH_3)_2$	10	30	20	60	Sk
2,6-Dimethylheptan-4-one	$[(CH_3)_2CHCH_2]_2CO$	25	150	-	-	
Dimethyl phthalate	$C_6H_4.(COOCH_3)_2$	-	5	-	10	
Dimethyl sulphate	$(CH_3)_2SO_4$.	0.1	0.5	0.1	0.5	Sk
Dinitrobenzene, all isomers	$C_6H_4.(NO_2)_2$	0.15	1	0.5	3	Sk
Dinitro-o-cresol	$CH_3C_6H_2.(OH)(NO_2)_2$	-	0.2	-	0.6	Sk

2,4-Dinitrotoluene	$CH_3C_6H_3.(NO_2)_2$	-	1.5	-	5	Sk
Dinonyl phthalate	$C_6H_4.(COOC_9H_{19})_2$	-	5	-	-	
Di-sec-octy1 phthalate	$C_6H_4[COOCH_2CH(C_2H_5)-C_4H_9]_2$		5	-	10	
1,4-Dioxane, tech. grade	$OCH_2CH_2OCH_2CH_2$	25	90	100	360	Sk
Dioxathion (ISO)	$C_{12}H_{26}O_6P_2S_2$		0.2	-	-	Sk
Diphenyl	$(C_6H_5)_2$	0.2	1.5	0.6	4	
Diphenylamine	$(C_6H_5)_2NH$		10	-	20	
Diphenyl ether (vapour)	$C_6H_5OC_6H_5$	1	7		-	
Diphosphorus pentasulphide	P_2S_5	-	1	-	3	
Dipotassium peroxodisulphate measured as (s.c.)	$K_2S_2O_8$	-	1	-	-	
Diquat dibromide (ISO)	$C_{12}H_{12}Br_2N_2$	-	0.5		1	
Disodium disulphite	$Na_2S_2O_5$	-	5	-	-	
Disodium peroxodisulphate (measured as (S2O8)	$Na_2S_2O_8$	-	1	-	-	
Disodium tetraborate, anhydrous	$Na_2B_4O_7$		1	-	-	
decahydrate	$Na_2B_4O_7.10H_2O$	-	5	-	-	
pentahydrate	$Na_{2B4}O_7.5H._2O$	-	1	-	-	
Disulfoton (ISO)	$(C_2H2O)_2PSCH_2CH_2SC_2H_5$		0.1	-	0.3	
Disulphur dichloride	S_2Cl_5	-	-	1	6	
Disulphur decafluoride	S_2F_{10}	0.025	0.25	0.075	0.75	
2,6-Ditertiary-butyl-paracresol	$(C_4H_9)_2CH_3C_6.H_2OH$	-	10	-	-	
Diuron (ISO)	$C_9H_{10}Cl_2N_2O$	-	10	-	-	
Divanadium pentaoxide (as V)	V_2O_6					
total inhalable dust		-	0.5	-	-	
fume and respirable dust		-	0.05	-	-	
Divinylbenzene	$C_8H_4.(CHCH_2)_2$	10	50	-	-	
Emery						
total inhalable dust		-	10	-	-	
respirable dust		-	5	-	-	

Endosulfan (ISO)	$C_9H_6Cl_6O3S$	-	0.1	-	0.3	Sk
Endrin (ISO)	$C1_2H_8Cl_6O$	-	0.1	-	0.3	Sk
Enflurane	$CHFCl\text{-}CF_2\text{-}O\text{-}CF_2H$	20	150	-	-	
EpichJorohydrin	OCH_2CHCH_2Cl	2	8	5	20	Sk
1,2-Epoxy-4-epoxyethyl-cyclohexane	$C_8H_{12}O_2$	10	60	-	-	
2,3-Epoxypropyl isopropyl ether	$C_3H_7OCH_2CHCH_2O$	50	240	75	360	
Ethane- 1 ,2-diol	CH_2OHCH_2OH					
particulate		-	10	-	--	
vapour		-	60	-	125	
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	C_2H_5OH	1000	1900	-	-	
Ethylamine	$C_2H_5NH_2$	10	18	-	--	
Ethyl amyl ketone	$CH_3CH_2COHCH_2CH_3CHCH_2CH_3$	25	130	-	-	
Ethylbenzene	$C_6H_5C_2H_5$	100	435	-	545	
Ethyl bromide	C_2H_5Br	200	890	-	1110	
Ethyl butyt ketone	$CH_3CH_2COH(CH_2)_3CH_3$	50	230	75	345	
Ethyl chloride	C_2H_5Cl	1000	2600	-	3250	
Ethyl chloroformate	$ClCO_2C_2H_5$	1	4.4	1		
Ethylene chlorohydrin	$ClCH_2CH_2OH$		-		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					
particulate		-	10	-	-	
vapour		-	60	-	125	
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	$C_2H_5OH_2CH_2OH$	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	$ClCO_2CH_2CH(CH_2)_3CH_3\ C_2H_5$	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	-	-	
Fernam (ISO)	$[(CH_3)_2NCSS]_3Fe$		10	-	20	
Ferrocene	$C_{10}H_{10}Fe$	-	10	-	20	
Fluoride (as F)	F	-	2.5	-	-	
Fluorine	F_2	-	-	1	1.5	
Fluorodichloromethane	$CHCl_2F$	10	40	-	-	
Fluorotrichloromethane	CCl_3F	1000	5600	1250	7000	
Formamide	$HCONH_2$	20	30	30	45	
Formic acid	HCOOH	5	9	-	-	
2-Furaldehyde (Furfural)	$C_5H_4O_2$	2	8	10	40	Sk
Furfuryl alcohol	$OCH=CHCH=CCH_2OH$	5	20	15	60	Sk
Germane	GeH_4	0.2	0.6	0.6	1.8	
Germanium tetrahydride	GeH_4	0.2	0.6	0.6	1.8	
Glutaraldehyde	$OCH(CH_2)_3CHO$		-	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	
Graphite	C					
total inhalable dust			10	-	-	
respirable dust		-	5	-	-	

Guthion	$(CH_3O)_2PSSCH_2.(C_7H_4N_3O)$	-	0.2	0.6	-	Sk
Gypsum	$CaSO_4.2H_2O$					
total inhalable dust			10	-	-	
respirable dust		-	5	-	-	
Halothane	$CHBrCl\text{-}CF_3$	10	80	-	-	
y-HCH (ISO)	$C_6H_5Cl_6$	-	0.5	-	1.5	Sk
Hafnium	Hf	-	0.5	-	1.5	
Heptachlor	$C_{10}H_5Cl_7$	-	0.5	-	2	Sk
n-Heptane	C_7H_{16}	400	1600	500	2000	
Heptane-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-Hexachlorocyc1o-hexane	$C_6H_5Cl_6$	-	0.5	-	1.5	
Hexachloroethane	CCl_3CCl_3					
vapour		5	50	-	-	
total inhalable dust		-	10	-	-	
respirable dust		-	5	-	-	
Hexahydro-1,3,5-trinilro-1,3,5-triazine	$C_3H_6N_6O_6$	-	1.5	-	3	Sk
Hexane, all isomers except n-Hexane	C_6H_{14}	500	1800	1000	3600	
n-Hexane	C_6H_{14}	20	70	-	-	
1,6 Hexanolactam	$NH(CH_2)_5CO$					
dust		-	1	-	3	
vapour		5	20	10	40	
Hexan-2-one	$CH_3.(CH_2)_3COCH_3$	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)	NH_3	-	-	0.1	-	
Hydrogen bromide	HBr	-	-	3	10	
Hydrogen chloride	HCl	-	-	5	7	
Hydrogenfluoride (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	$CH_2CHOOCH_2CHOHCH_3$	0.5	3	-	-	Sk
2,2'-lminodiethanol	HO(CH2,)2,NH(CH2)2OH	3	15	-	-	
2,2'-lminodi (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	
lodomethane	CH_3I	5	28	10	56	Sk
Iron oxide, fume (a Fe)	Fe_2O3	-	5	-	10	
Iron pentacarbonyl	$FE(CO)_5$	0.01	0.08	-	-	
Iron salts (as Fe)	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 methyl 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_3-CHCl-O-CHF_2	50	380		-	
lsooctyl 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	
lsophorone diisocyanate (IPDI)		-	0.2	-	0.07	San
Isopropyl acetate	$CH_3COOCH(CH_3)_2$	-	-	200	840	
Isopropyl alcohol	$(CH_3)_2CHOH$	400	980	500	1225	Sk
Isopropyl benzene	$C_6H_5CH(CH_2)_2$	25	120	75	370	Sk

Isopropyl chlorofonnate	$ClCO_2CH(CH_3)_2$	1	5	-	-	
Isopropyl ether	$(CH_3)_2CHOCH(CH_3)_2$	250	1050	310	1320	
Isopropyl glycidyl ether (IGE)	$C_3H_7OCH_2CHCH_2$	50	240	75	360	
Ketene	$CH_2=CO$	0.5	0.9	1.5	3	
Limestone						
total inhalable dust		-	10	-	-	
respirable dust		-	5	-	-	
Lindane	$C_6H_5Cl_6$	-	0.5	-	1.9	Sk
Liquified petroleum 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						
Magnesite						
total inhalable dust		-	10	-	-	
respirable dust		-	5	-	-	
Magnesium oxide (as Mg)	MgO					
fume and respirable dust		-	5	-	10	
respirable dust		-	10	-		
Malathion (ISO)	$C_{10}H_{19}O_6PS_2$	-	10	-	-	Sk
Maleic anhydride	$C_4H_2O_3$	0.25	1	-	-	
Manganese, fume (as Mn)	Mn	-	1	-	3	
Manganese and compounds (as Mn)	Mn	-	5	-	-	
Manganese cyclopentadienyl tricarbonyl	C_5HC_5-$MN(CO)_3$	-	0.1	-	0.3	Sk
Manganese tetroxide	Mn_3O_4	-	1	-	-	
oMan made mineral fibre	See Annexure 3					
Marble						
total inhalable dust		-	10	-	-	
respirable dust		-	5	-	-	
Mequinol (INN)	$CH_3OC_6H_4OH$	-	5	-	-	

Mercaptoacetic acid	$C_2H_4O_2S$	1	5	-	-	
Mercury alkyls (as Hg)		-	0.01	-	0.03	Sk
Mercury & compounds, except mercury alkyls, (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-Methoxypropan-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	-	-	
Methylal	$CH_2.(OCH_3)_2$	1000	3100		3880	
Methyl alcohol	CH_3OH	200	260	250	310	Sk
Methylamine	CH_3NH_2	10	12	-	-	
Methyl-n-amyl-ketone	$CH_3.(CH2)4COCH3$	50	240	-	-	
N-Methylaniline	$C_6H_5NHCH_3$	0.5	2	-	-	Sk
Methyl bromide	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	
2-Methylcyclcrhexanone	$CH_3CHCO(CH_2)3CH_2$	50	230	75	345	Sk
Methylcyclo-pentadienyl	C_5HC_5-$Mn(CO)_3$	-	0.1	-	0.6	Sk
Manganese, tricarbonyl (as Mn)	$(CH_3)C_5H_4$-$Mn(CO)_3$					
2-Methyl-4,6-dinitrophenol	$CH_3C_6H2.(OH)(NO_2)_2$	-	0.2	-	0.6	Sk
4,4' -Methylenebis-2-chloroaniline) (MbOCA)	$CH_2.(C_6H_3ClNH_2)_2$	-	0.005	-	-	Sk
Methylene chloride	CH_2Cl_2	100	350	250	780	

4,4' -Methylene-diphenyl diisocyanate (MDI)		-	0.02	-	0.07	Sen
4,4'-Methylene-dianiline (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 (MEKP)	$C_8H_{16}O_4$ or $C_8H_{18}O_6$.			0.2	1.5	
Methyl formate	$HCOOCH_3$	100	250	150	375	
5-Methylheptan-3-one	$CH_3CH_2COCH_2CH_3$-CHCH$_2$CH$_3$	25	130	-	-	
5-Methylhexan-2-one	$CH_3COCH_2CH_2CH_2.(CH_3)_2$	50	240	75	360	
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	$(CH_3)_2COHCH_2CHOHCH_3$	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-o1	$(CH_3)_2CHCH_2OH$	50	150	75	225	
2-Methylpropan-2-o1	$(CH_3)_3COH$	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	
a-Methylstyrene	$C_6H_5C(CH_3)=CH_2$	-	-	100	480	
Methylstyrenes, all	$CH_3C_6H_4CH=CH_2$	100	480	150	720	

isomers except a-methylstyrene						
N-Methyl-N, 2,4,6-tetranitroaniline	$(NO_2)_3C_6H_2N(NO_2)CH_3$	-	1.5	-	3	Sk
Mevinphos (ISO)	$C_7H_{13}O_6P$	0.01	0.1	0.03	0.3	Sk
Mica						
total inhalable dust		-	10	-	-	
respirable dust		-	1	-	-	
Molybdenum compounds (as Mo)	Mo					
soluble compounds			5		10	
insoluble compounds		-	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	
Naphtalene	$C_{10}H_8$	10	50	15	75	
1,5-Naphtylene diisocyanate		-	0,02	-	0.07	Sen
Nickel carbonyl	$Ni(CO)_4$	-	-	0.1	0.24	
Nickel, organic compounds (as Ni)	Ni	-	1	-	3	
Nicotine	$C_{10}H_{14}N_2$	-	0.5	-	1.5	Sk
Nitrapyrin	$C_6H_3CI_4N$	-	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
Nitromethane	$C_2H_5NO_2$	100	310	-	-	
Nitrogen dioxide	NO_2	3	5	5	9	
Nitrogen monoxide	NO	25	30	35	45	
Nitrogen trifluoride	NF_3	10	30	15	45	
Nitroglycerine	$CH_2NO_2CHNO_3CH_2NO_3$	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	-	-	
Octachloronaphtalene	$C_{10}CI_8$	-	0.1	-	0.3	Sk

n-Octane	$CH3.(CH_2)_6CH_3$	300	1450	375	1800	
Orthophosphoric acid	H_3PO_4	-	1	-	3	
Osmium tetraoxide (as Os)	OsO_4	0.0002	0.0002	0.0006	0.0006	
Oxalic acid	COOHCOOH	-	1	-	2	
Oxalonilrile	$(CN)_2$	10	20	-	-	
2,2'-Oxydiethanol	$(HOCH_2CH_2)_2O$	23	100	-	-	
Ozone	O_3	0.1	0.2	0.3	0.6	
PCBs						
Chlorinated biphenyls (42% chlorine)	$C_{12}H_7C1_3$ (approx)	-	1	-	2	Sk
Chlorinated biphenyls (54% chlorine)	C_6H2Cl_3 $C_6H_3Cl_2$	-	0.5	-	1	Sk
Paraffin wax, fume		-	2	-	6	
Paraquat dichloride (ISO)	$[CH_3.(C_5H_4N_+)_2CH_3]$					
respirable dust	$(Cl-_2)$	-	0.1	-	-	
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	$C(CH_2OH)_4$					
total inhalable dust		-	10	-	20	
respirable dus1		-	5	-	-	
Pentane, all isomers	C_5H_{12}	600	1800	750	2250	
Pentan-2-one	$CH_3COC_3H_7$	200	700	250	875	
Pentan-3-one	$C_2H_5COC_2H_5$	200	700	250	875	
Pentyl acetate	$CH_3COOC_5H_{11}$	100	530	150	800	
Perchloroethylene	$CCl=CCl_2$	50	335	150	1000	
Perchloryl fluoride	ClO_3F	3	14	6	28	
Phenacy1 chloride	$C_6H_5COCH_2Cl$	0.05	0.3	-	-	
Phenol	C_6H_5OH	5	19	10	38	Sk
p-Phenytenediamine	$C_6H_4.(NH_2)_2$	-	0.1	-	-	Sk
Phenyl-2,3-epoxypropyt ether	$C_6H_5OCH_2CHCH_2O$	1	6	-	-	
Phenytethylene	$C_6H_5CH=CH_2$	100	420	250	1050	
Phenythydrazine	$C_6H_5NHNH_2$	5	20	10	45	Sk
2-Phenytpropene	$C_6H_5C(CH_3)=CH_2$	-	-	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	P4	-	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	
Phosporyt trichloride	$POCl_3$	0.2	1.2	0.6	3.6	
Phthalic anhydride	$C_6H_4.(CO)_2O$	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
Plas1er of Paris	$(CaSO_4)_2.H_2O$					
total inhalable dust		-	10	-	-	
respirable dust		-	5	-	-	
Platinum metal	Pt	-	5	-		
Platinum salts, soluble (as PI)	Pt	-	0.002	-	-	Sen
Polychlorinated biphenyts (PCBs)	See PCB's					
Polyvinyt chloride (PVC)						
total inhalable dus1		-	10	-	-	
respirable dust		-	5	-	-	
Portland Cement						
total inhalable dus1		-	10	-	-	
respirable dust		-	5	-	-	
Potassium hydroxide	KOH	-	-	-	2	
Propane-1,2-diol	$CH_3CHOHCH_2OH$					
total (vapour and particulates)		150	470		-	
particulates		-	10	-	-	
n-Propanol	$CH_3CH_2CH_2OH$	200	500	250	625	Sk
Propan-1-o1	$CH_3CH_2CH_2OH$	200	500	250	625	Sk
Propan-2-o1	$(CH_3)_2CHOH$	400	980	500	1225	Sk
Propargyl alcohol	$HC{=}CCH_2OH$	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	$CH_3CHOHCH_2OH$					
total (vapour and particulates)		150	470	-	-	
particulates		-	10	-	-	
Propytene glycol dinitrate (PGDN)	$CH_2NO_3CHNO_3CH_3$	0.2	1.2	0.2	1.2	Sk
Propylene glycol monomethyl ether	$CH_3OCH_2CHOHCH_3$	100	360	300	1080	Sk
Prop-2-yn-1-o1	$HC{\equiv}CCH_2OH$	1	2	3	6	Sk
Pulverised Fuel Ash						
total inhalable dus1	-	10	-	-	-	
respirable dust	-	5	-	-	-	
Pyrethrins (ISO)	-	5	-	10	-	
Pyridine	C_5H_5N	5	15	10	30	
2-Pyridytamine	$NH_2C_5H_4N$	0.5	2	2	8	
Pyrocatechol	$C_6H_4.(OH)_2$	5	20	-	-	
Quartz, crystalline	SiO_2					
respirable dust		-	0.4	-	-	
Quinone	$C_6H_4O_2$	0.1	0.4	0.3	1.2	
RDX	$C_3H_6N_6O_6$	-	1.5	-	3	Sk
Resorcinol	$C_6H_4.(OH)_2$	10	45	20	90	
Rhodium (as Rh),	Rh					
metal fume and dust		-	0.1	-	0.3	
soluble salts		-	0.001	-	0.003	
Ronnel	$(CH_3O)_2PSOC_6H_2Cl_3$	-	10	-	-	
Rosin core solder pyrolysis products as formaldehyde		-	0.1	-	0.3	Sen
Rotenone (ISO)	$C_{23}H_{22}O_6$.	-	5	-	10	
Rouge						
total inhalable dust		-	10	-	-	
respirable dust		-	5	-	-	
Selenium and compounds, except hydrogen selenide (asSe)	Se	-	0.1	-	-	

Silane	SiH_4	0.5	0.7	1	1.5	
Silica, amorphous	SiO_2					
total inhalable dust		-	6	-	-	
respirable dust		-	3	-	-	
Silica, fused	SiO_2					
respirable dust		-	0.1	-	-	
Silicon	Si					
total inhalable dust		-	10	-	-	
respirable dust		-	5	-	-	
Silicon carbide	SiC					
total inhalable dust		-	10	-	-	
respirable dust		-	5	-	-	
Silicon tetrahydride	SiH_4	0.5	0.7	1	1.5	
Silver	Ag	-	0.1	-	-	
Silver compounds (as Ag)	Ag	-	0.01	-	-	
Sodium azide	NaN_3	-	-	-	0.3	
Sodium 2-(2,4-dichloro-phenoxy) ethyl sulphate	$C_8H_7Cl_2NaO_5S$	-	10	-	20	
Sodium fluoroacetate	$CH_2FCOONa$	-	0.05	-	0.15	Sk
Sodium hydrogen-sulphite	$NaHSO_3$	-	5	-	-	
Sodium hydroxide	NaOH	-	-	-	2	
Sodium metabisulphate	$Na_2S_2O_5$	-	5	-	-	
Starch						
total inhalable dust		-	10	-	-	
respirable dust		-	5	-	-	
Stibine	SbH_3	0.1	0.5	0.3	1.5	
Strychnine	$C_{21}H_{22}N_2O_2$	-	0.15	-	0.45	
Styrene	$C_6H_5CH=CH_2$	100	420	250	1050	
Subtilisins (Proteolytic enzymes as 100% pure crystalline enzyme)		-	0.00006	-	0.00006	
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	13	
Sulphur hexafluoride	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 tetrafluoride	SF_4	0.1	0.4	0.3	1	
Sulphuryl difluoride	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	$(C_2H_5)_4P_2S_2O_5$	-	0.2	-		Sk
TEPP (ISO)	$(C_2H_5)_4P_2O_7$	0.004	0.05	0.01	0.2	Sk
TNT	$CH_3C_6H_2.(NO_2)_3$	-	0.5	-	-	Sk
Talc						
total inhalable dust			10	-	-	
respirable dust		-	1	-	-	
Tantalum	Ta	-	5	-	10	
Tellurium & compounds, except hydrogen tellu-						
ride, (as Te)	Te	-	0.1	-	-	
Terphenyls, all isomers	$C_{18}H_{14}$		-	0.5	5	
1,1,2,2-Tetrabromo-ethane	$CHBr_2CHBr_2$	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-difluor oethane	CCl_3CClF_2	100	834	100	834	
1,1 ,2,2- Tetrachloro 1 ,2-difluoroethane	CCl_2FCCl_2F	100	834	100	834	
Tertrachloroethylene	$CCl=CCl_2$	50	335	150	1000	
Tetrachloromethane	CCl_4	2	12.6		-	Sk
Tetrachloro-naphthalenes, all isomers	$C_{10}H_4Cl_4$	-	2	-	4	
O,O,O',O'-Telraethyl 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	
Tetrafluorodichloro-ethan e	$CClF_2CClF_2$	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	-	-	
Tetryl	$(NO_2)_3C_6H_2N(NO_2)CH_3$	-	1.5	-	3	Sk
Thallium, soluble compounds (as Ti)	TI	-	0.1	-	-	Sk
4,4'- Thiobis(6-tert-butyl-m-cresol)	$C_{22}H_{30}O_2S$	-	10	-	20	
Thioglycollic acid	$C_2H_4O_2S$	1	5	-	-	
Thionyt chloride	$SOCl_2$	-	-	1	5	
Thiram (ISO)	$(CH_3)_2NCS_2CS_2N(CH_3)_2$	-	5	-	10	
Tin, compounds, inorganic, except SnH4, (as Sn)	Sn	-	2	-	4	
Tin compounds, organic, except Cyhexatin (ISO), (as Sn)	Sn	-	0.1	-	0.2	Sk
Titanium dioxide	TiO_2					
total inhalable dust		-	10	-	-	
respirable dust		-	5	-	-	
Toluene	$C_6H_5CH_3$	50	188	150	560	Sk
Toluene diisocyanate (TDI)		-	0.2	-	0.07	Sen
p- Toluenesulphonyt 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
Tributyt phosphate, all isomers	$(C_4H_9)_3PO_4$	-	5	-	5	
Tricarbonyt (eta-cyclopentadienyl) manganese (asMn)	(C_5H_5)-$Mn(CO)_3$	-	0.1	-	0.3	Sk

Tricarbonyl(methylcyclopenta-dienyl) manganese (as Mn)	$(CH_3)C_5H_4$-$Mn(CO_3)$	-	0.2	-	0.6	Sk
Trichloroacetic acid	CCI_3COOH	1	5	-	-	
1,2,4-Trichlorobenzene	$C_6H_3Cl_3$	5	40	5	40	
1,1,1-Trichlorobis (chlorophenyt) ethane	$C_{14}H_9Cl_5$	-	1	-	3	
1,1,2-Trichloroethane	$CH_2ClCHCl_2$	10	45	20	90	Sk
Trichlorofluoro-methane	CCl_3F	1000	5600	1250	7000	
Trichloromethane	$CHCl_3$	2	9.8	-	-	
Trichloronitromethane	CCl_3NO_2	0.1	0.7	0.3	2	
2,4,5-Trichlorophenoxyacetic acid	$C_8H_5Cl_3O_3$	-	10	-	20	
1,2,3-Trichloropropane	$CH_2ClCHClCH_2Cl$	50	300	75	450	
1,1,2-Trichloro-trifluoroethane	CCl_2FCCIF_2	1000	7600	1250	9500	
Tri-o-cresyl phosphate	$(CH_3C_6H4O)_3P=O$	-	0.1	-	0.3	
Tricydohexyltin hydroxide	$(C_6H_{11})_3SnOH$	-	5	-	10	
Tridymite, respirable dust	SiO_2	-	0.4	-	-	
Triethylamine	$(C_2H_5)_3N$	10	40	15	60	
Trifluorobromo-methane	CF_3Br	1000	6100	1200	7300	
Trimanganese tetraoxide	Mn_3O_4	-	1	-	-	
Trimellitic anhydride	$C_9H_4O_5$	-	0.04	-	-	Sen
Trimethylamine	$(CH_3)_3N$	10	24	15	36	
Trimethylbenzenes, all isomers or mixtures	$C_6H_3.(CH_3)_3$	25	123	-	-	
3,5,5-Trimethyl-cydohex-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	$CH_3C_6H_2.(NO_2)3$	-	0.5	-	-	Sk
Triphenyt phosphate	$(C_6H_5)_3PO_4$	-	3	-	6	
Tripoli, respirable dust	SiO_2	-	0.4	-	-	
Tri-o-tolyt phosphate	$(CH_3C_6H_4O)_3P=0$	-	0.1	-	0.3	
Tungsten & compounds (as W).	W					
soluble		-	1	-	3	
insoluble		-	5	-	10	

Turpentine	$C_{10}H_{16}$	100	560	150	840	
Uranium compounds, natural,	U					
soluble (as U)		-	0.2	-	0.6	
Vanadium pentoxide	V_2O_5					
total inhalable dust		-	0.5	-	-	
fume and respirable dust		-	0.05	-	-	
Vinyt acetate	$CH_3COOCH=CH_2$	10	30	20	60	
Vinyt benzene	$C_6H_5CH=CH_2$	100	420	250	1050	
Vinyt bromide	$CH_2=CHBr$	5	20	-	-	
4-Vinytcydohexene dioxide	$C_8H_{12}O_2$	10	60	-	-	
Vinyt toluenes, all isomers	$C_6H_5C(CH_3)=CH_2$	-	-	100	480	
Warfarin (ISO)	$C_{19}H_{16}O_4$		0.1		0.3	
White spirit		100	575	125	720	
Xylene,o-,m-,p- or mixed isomers	$C_6H_4.(CH_3)_2$	100	435	150	650	Sk
Xylidine, all isomers	$(CH_3)_2C_6H_3NH_2$	2	10	10	50	Sk
Yitrium	Y	-	1	-	3	
Zinc chloride, fume	Zn Cl_2	-	1	-	2	
Zinc distearate	$Zn(C_{18}H_{35}O_2)_2$					
total inhalable dust		-	10	-	20	
Respirable dust		-	5	-	-	
Zinc oxide, fume	ZnO	-	5	-	10	
Zirconium compounds (as Zr)	Zr	-	5	-	10	

* The OEL-RL for aluminium does not include exposure to aluminium coated with mineral oil or to fume arising from aluminium welding processes.

Abbreviations

1. OEL-CL Occupational Exposure Limit-Control Limit.
2. OEL-RL Occupational Exposure Limit-Recommended Limit.
3. ppm Parts per million.
4. mg/m^3 milligrams per cubic metre.
5. Sk Skin absorption.
6. Sen capable of causing respirable sensitisation.
7. ISO International Standards Organization

Note

(a) The concentration of "respirable dust" shall be determined from the fraction passing a size selector with an efficiency that will allow-

(a) 100% particles of 1 µm aerodynamic diameter,
(ii) 50% particles of 5 µm aerodynamic diameter,
(iii) 20% particles of 6 µm aerodynamic diameter,
(iv) 0% particles of 7 µm aerodynamic diameter.

(b) For asphyxiant substances, see annexure 5.

(c) TLV for asbestos
Amosite 0.5 fiber > 5µm/cc
Chrysolite 2 fibers > 5µm/cc
Crocidolite 0.2 fiber > 55µm/cc
Other forms 2 fiber > 5µm/c

TABLE 3
BIOLOGICAL EXPOSURE INDICES (BEI)

			1995
CHEMICAL DETERMINANT	SAMPLING TIME	BEl	Notation
ANILINE			
Total p-aminophenol in urine	End of shift	50 mg/g creatinine	C
Methemoglobin in blood	During or end of shift	1.5% of hemoglobin	B,C,D
ARSENIC AND SOLUBLE COMPOUNDS INCLUDING ARSINE			
Inorganic arsenic metabolites in urine	End of workweek	50 µg/g creatinine	B
BENZENE			
Total phenol in urine	End of shift	50 mg/g creatinine	B,C
Benzene in exhaled air:	Prior to next shift		
mixed-exhaled		0.08 ppm	D
end-exhaled		0.12 ppm	D
CADMIUM			
Cadmium in urine	Not critical	1 0 µg/g creatinine	B

Cadmium in blood	Not critical	1 0 µg/l	B
CARBON DISULFIDE			
2-Thiothiazolidine-4-carboxylic acid in urine	End of shift	5 mg/g creatinine	
CARBON MONOXIDE			
Carboxyhemaglobin in blood	End of shift	less than 8% of hemoglobin	B,C
Carbon monoxide in end-exhaled air	End of shift	less than 40 ppm	B,C
CHLOROBENZENE			
Total 4-chlorocatechol in urine	End of shift	150 mg/g creatinine	C
Total p-clorophenol in urine	End of shift	25 mg/g creatinine	C
CHROMIUM (VI),			
Water soluble fume	Increase during shift	1 0µ*g/g* creatinine	B
Total chromium in urine	End of shift at end of workweek	30 µ*g/g* creatinine	B
N,N-DIMETHYLFORMAMIDE (DMF)			
N-Methylformamide in urine	End of shift	40 mg/g creatinine	B
ETHYL BENZENE			
Mandelic acid in urine	End of shift at end of workweek	*1.5* g/g creatinine	A
Ethyl benzene in end-exhaled air			D
FLUORIDES			
Fluorides in urine	Prior to shift	3 mg/g creatinine	B,C
	End of shift	10 mg/g creatinine	B,C
FURFURAL			
Total furoic acid in urine	End of shift	200 mglg creatinine	B,C
n-HEXANE			
2,5-Hexanedione in urine	End of shift	5 mg/g creatinine	C
n-Hexane in end-exhaled air			D
MERCURY			
Total inorganic mercury in urine	Prior to shift	35 µg/g creatinine	B
Total inorganic mercury in blood	End of shift at end of workweek	15 µg/l	B
METHEMOGLOBIN INDUCERS			
Methemoglobin in blood	During or end of shift	1.5% of hemoglobin	B,C,D
METHANOL			
Methanol in urine	End of shift	15 mg/l	B,C
Formic acid in urine	Before shift at	80 mg/g creatinine	B,C

	end of workweek		
METHYL CHLOROFORM			
Methyl chloroform in end-exhaled air	Prior to the last shift of workweek	40 ppm	
Trichloroacetic acid in urine	End of workweek	10 mg/l	C,D
Total trichloroethanol in urine	End of shift at end of workweek	30 mg/l	C,D
Total trichloroethanol in blood	End of shift at end of workweek	1 mg/*l*	C
METHYlETHYlKETONE			
MEK in urine	End of shift	2 mg/l	-
METHYL ISOBUTYL KETONE			
MIBK in urine	End of shift	2mg/l	-
NITROBENZENE			
Total p-nitrophenol in urine	End of shift at end of workweek	5 mg/g creatinine	C
Methemoglobin in urine	End of shift	1.5% of hemoglobin	B,C,D
ORGANOPHOSPHORUS CHOLINESTERASE INHIBITORS			
Cholinesterase activity in red cells	Discretionary	70% of individual's baseline	B,C,D
PARATHION			
Total p-nitrophenol in urine	End of shift	0.5 mg/g creatinine	C,D
Cholinesterase activity in red cells	Discretionary	70% of individual's baseline	B,C,D
PENTACHLOROPHENOL			
Total PCP in urine	Prior to the last shift of workweek	2 mg/g creatinine	B
Free PCP in plasma	End of shift	5 mg/l	B
PERCHlOROETHYlENE			
Perchloroethylene in end-exhaled air	Prior to the last shift of workweek	10ppm	
Perchloroethylene in blood	Prior to the last shift of workweek	1 mg/l	
Trichlorocetic acid in urine	End of workweek	7 mg/l	C,D

PHENOL			
Total phenol in urine	End of shift	250 mg/g creatinine	B,C
STYRENE			
Mandelic acid in urine	End of shift	800 mg/g creatine	C
	Prior to next shift	300 mg/g creatinine	C
Phenylglyoxylic acid in urine	End of shift	240 mg/g creatinine	B,C
	Prior to next shift	100 mg/g creatinine	B,C
Styrene in venous blood	End of shift	0.55 mg/l	D
	Prior to next shift	0.02 mg/l	D
TOLUENE			
Hippuric acid in urine	End of shift	2.5 gig creatinine	B,C
Toluene in venous blood	End of shift	1 mg/l	D
o-Cresol in urine	End of shift	1 mg/g creatinine	C
TRICHLOROETHYLENE			
Trichloroacetic acid in urine	End of workweek	100 mg/g creatinine	C
Trichloroacetic acid and trichloroethanol in urine	End of shift at end of workweek	300 mg/g creatinine	C
Free trichloroethanol in blood	End of shift at end of workweek	4 mg/l	C
Trichloroethylene in end-exhaled air		D	
XYLENE			
Methylhippuric acid in urine	End of shift	1.5 g/g creatinine	
	last four hours of shift	2 mg/min	-

Notations

"A" notation: This notation indicates that an identifiable population group might have an increased susceptibility to the effect of the chemical, thus leaving it unprotected by the recommended BEI.

"B" notation: This notation indicates that the determinant is usually present in a significant amount in biological specimens collected from subjects who have not been occupationally exposed. Such background levels are included in the BEI value.

"C" notation: This notation indicates that the determinant is non-specific, since it is observed after exposure to some other chemicals. These non-specific tests are preferred because they are easy to use and usually

offer a better correlation with exposure than specific tests. In such instances a BEI for a specific, less quantitative biological determinant is recommended as a confirmatory test.

"D" notation: This notation indicates that the biological determinant is an indicator of exposure to the chemical, but the quantitative interpretation of the measurement is ambiguous (semi-quantitative). These biological determinants should be used as a screening test if a quantitative test is not practical or a confirmatory test if the quantitative test is not specific and the origin of the determinant is in question.

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SCHEDULE 3

MATERIAL SAFETY DATE 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 ctothing:
6. Accidental Release Measures:
Personal precautions:
Environmental precautions:
Small spills: Large spills:
7. Handling and Storage:
Suitable material: Handling/storage precautions:
8. Exposure ControlslPersonal 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: Autoflammability: Explosive properties: Oxidizing properties: Vapour pressure: Density: Solubility - water: Solubility - solvent: Solubility - coefficient:

Neurotoxicity:
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 identity no. ADR/RID class: ADR/RID item no. ADR/RID hazard identity no.: IMDG - shipping name: IMDG - class: IMDG - packaging group: IMDG- marine pollutant IMDG- EMS no.: IMDG- MFAG label no.: lATA - shipping name: lATA - class: lATA - 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:

SCHEDULE 2

Applying occupational exposure limits

1. General

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

2 *Units of measurement*

(2.1) In occupational exposure limits, concentrations of gases and vapour in air are usually expressed in parts per million (ppm), a measure of concentration by volume, as well as in milligrams per cubic meter of air (mg/m^3), a measure of concentration by mass.

(2.2) 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. i.e. ppm = $\frac{24.45}{\text{Molecular of the substance}}$ mg/m^3

or

$$mg/m3 = \frac{\text{molecular weight of the substance}}{24.45} \text{ ppm}$$

(2.3) 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.

(2.4) In the case of a man-made mineral fiber, the limit is expressed as fibers per milliliter of air (fibres/ml^1).

3. *Occupational exposure limits- control limits: OEL-CL (Table I)*

(3.1) 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.

(3.2) Rule 5 of these rules, 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.

4 *Occupational exposure limits – Recommended limit OEL-RL Table 2*

(4.1) 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.

(4.2) For a substance, which has been assigned an OEL-RL, exposure by inhalation should be reduced to that standard.

(4.3) Control of an OEL-RL as prescribed in regulation 5(1) can always be regarded as adequate control of that substance for the purposes of these rules, 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 so 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 5 (1) should discourage the further application of good occupational hygiene principles in order to reduce exposure below the OEL-RL.

5 *Long-term and short-term exposure limits*

(5.1) 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.

(5.2) 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 work shifts. Other effects may be seen after brief exposures, which have occurred once or repeatedly.

(5.3) 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.

(5.4) With some other substances, brief exposure may be critical and the exposure limit necessary to prevent these excursions will also controls any other effects. A separate long-term limit is not considered necessary in such cases and the short-term limit applies throughout the shift.

(5.4) 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.

6 Limitations to the application of exposure limits

(6.1) 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. The OEL-RL for cotton dust is not a personal exposure standard, but a static air standard.

(6.2) The limits cannot readily be extrapolated to evaluate or control non-occupational exposure, e.g. levels of contamination in the neighborhood dose to an industrial plant. OELs only apply to persons at work. Employers should also take into account their duties under the Environmental Management and co-ordination Act (EMCA).

(6.3) 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 pressurized workplaces such as cleaning rooms, but not the higher pressures that may be encountered in, for example, tunneling or underwater hyperbaric chambers. Such situations require special assessments.

(6.4).Occupational exposure limits, as set out in Tables 1 and 2 are intended to be used for normal working conditions in workplaces. 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.

(6.5) Over and above the employers' responsibilities to ensure that the requirements of these rules are met, they 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 minimize the effect of any such unplanned events.

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

7 Pesticides

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.

8 Dusts

The general approach necessary to control occupational exposure to dusts is as follows:

(8.1) 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.

(8.2) Where there is no indication of the need for a lower value, personal exposure should be kept below both 10 mg/m^3 8-hour time-weighted average total inhalable dust and 5 mg/m^3 time weighted average respirable dust. Such, or greater, dust concentrations should be taken as the *substantial concentrations.*

(8.3) A *substantial* concentration of dust should be taken as a concentration of 10 mg/m^3, 8-hour time weighted average, of total inhalable dust or 5 mg/m^3, 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.*

9. Total inhalable dust and respirable dust

(9.1) *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.

(9.2) *Respirable dust* approximates to the fraction, which penetrates to the gas exchange region of the lung.

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

10 *Fume*

(10.1) 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 alter volatilization from melted substances.

(10.2) The generation of fume is often accompanied by a chemical reaction such as oxidation or thermal breakdown.

11 *Absorption through the skin*

(11.1) 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.

(11.2) 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.

(11.3) Absorption through the skin can result from localized contamination, for example from a splash on the skin or clothing, or in certain cases from exposure to high atmospheric concentrations of vapour.

(11.4) 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.

(11.5) 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.

12 *Sensitizers*

(12.1) Certain substances may cause sensitization of the respiratory tract if inhaled or skin contact occurs.

(12.2) Respiratory sensitizers can cause asthma, rhinitis, or extrinsic allergic alveolitis.

(12.3) Skin sensitizers cause allergic contact dermatitis. Substances, which cause skin sensitizations, are not necessarily respiratory sensitizers or vice-versa.

(12.4) Only a proportion of the exposed population will become sensitized, and those who do become sensitized, will not have been identified in advance. Individuals who become sensitized may produce symptoms of ill health after exposure even to minute concentrations of the sensitizer.

(12.5) Where it is reasonably practicable, exposure to sensitizers 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 sensitizers to other working areas should also be prevented, as far as is reasonably practicable.

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

13. *Other factors*

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 effects of these factors.

14. *Mixed exposures General*

(14.1) The majority of OELs listed in Tables 1 and 2 are for single compounds or for substances containing a common element or radical, e.g. *tungsten and compounds, and isocyanides.* A few of the limits relate to substances commonly encountered as complex mixtures or compounds e.g. *white spirit, rubber fume,* and *welding fume.*

(14.2) However, workers are frequently subjected 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 work shift.

(14.3) 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.

15 *Effects of mixed exposures*

(15.1) 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 toxicological mechanisms, these various effects being independent of each other.

(15.2) 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.

16 Assessment and control

(16.1) 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.

(16.2) Where mixed exposure occurs, 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 reasonable practicable to reduce exposure to a substance subject to an OEL-CL.

(16.3) 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.

(16.4) 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.

(16.5) The various types should be considered in the following order:

16.5.1 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;

16.5.2 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

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

where C_1, C_2, etc are the time-weighted average (TWA) concentrations of constituents in air and L_1, L_2, etc are the corresponding exposure limits. The use of this formula is only applicable where the additive substances have been assigned OELs, and L_1, L_2, 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 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

16.5.3 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.

(16.6) The above steps provide basic protocol for assessment of mixed exposures. It is open to persons responsible for control of exposure to treat all nonsynergistic systems as though they were additive. This avoids the need to distinguish additive and independent systems and can be regarded as the more

prudent course, particularly where the toxicity data are scarce or difficult to assess.

17 *Monitoring mixed exposure*

(17.1) 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.

(17.2) 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 16.5.1 and 16.5.2.

(17.3) 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.

(17.4) If this approach is to be used, it should take place under the guidance of suitable specialist advice.

(17.5) Rules 13 imposes a duty on the employer to monitor the exposure of employees to substances hazardous to health.

18 *Complicating factors*

18.1. 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-

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

18.1.2 the relevance of factors such as alcohol, medication, smoking and additional stresses;

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

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

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