



EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT

**Guidance Note
[NOHSC:3008(1995)]**

**National Exposure Standards
[NOHSC:1003(1995)]**

MAY 1995

POLICY STATEMENT ON THE USE OF EXPOSURE STANDARDS

These exposure standards are guides to be used in the control of occupational health hazards. They should not be used as fine dividing lines between safe and dangerous concentrations of chemicals. They are not a measure of relative toxicity and should not be applied in the control of community air pollution. Interpretation of the exposure standards should be undertaken by an appropriately qualified and experienced person.

The guidance note included in this publication contains the fundamental philosophy and principles for the application of these exposure standards. However, as the criteria for establishing an exposure standard vary for different substances, it is essential that the relevant documentation¹⁻³ be consulted before the exposure standards are used.

The National Commission recognises that the Commonwealth, State and Territory governments or other organisations may incorporate the exposure standards into their own occupational health and safety programs. The National Commission does not oppose their use as such. However, these organisations should take into consideration the foregoing principles and the acknowledged limitations of individual exposure standards.

1. American Conference of Governmental Industrial Hygienists (ACGIH), *Documentation of the Threshold Limit Values and Biological Exposure Indices*, 5th Edition, ACGIH, Cincinnati, Ohio, 1986.
2. American Conference of Governmental Industrial Hygienists (ACGIH), *Documentation of the Threshold Limit Values and Biological Exposure Indices*, 6th Edition, ACGIH, Cincinnati, Ohio, 1991.
3. National Occupational Health and Safety Commission, *Documentation of the Exposure Standards* [NOHSC:10003(1995)], Australian Government Publishing Service, Canberra, 1995.

The National Occupational Health and Safety Commission has declared *Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment* and has adopted a *Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment*.

National standards declared by the National Commission under s.38(1) of the *National Occupational Health and Safety Commission Act 1985* (Cwth) are documents which prescribe preventive action to avert occupational deaths, injuries and diseases. Most national standards deal with the elimination/reduction or management of specific workplace hazards. In appropriate circumstances, national standards may take the form of national model regulations.

The expectation of the Commonwealth Government and the National Commission is that national standards will be suitable for adoption by Commonwealth, State and Territory governments. Such action will increase uniformity in the regulation of occupational health and safety throughout Australia and contribute to the enhanced efficiency of the Australian economy.

The expectation of the National Commission is that guidance notes will provide detailed information for use by unions, employers, management, health and safety committee representatives, safety officers, occupational health and safety professionals and others requiring guidance.

It should be noted that National Commission documents are instruments of an advisory character, except where a law, other than the *National Occupational Health and Safety Commission Act*, or an instrument made under such a law, makes them mandatory. The application of any National Commission document in any particular State or Territory is the prerogative of that State or Territory.

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT

**Guidance Note
on the Interpretation of
Exposure Standards
for Atmospheric Contaminants
in the Occupational Environment
[NOHSC:3008(1995)]**

**Adopted National Exposure Standards
for Atmospheric Contaminants
in the Occupational Environment
[NOHSC:1003(1995)]**

MAY 1995

© Commonwealth of Australia 1995

ISBN 0 644 45147 5

First Edition May 1990

First Edition with corrections September 1990

Second Edition October 1991

Third Edition May 1995

This work is copyright. Apart from any use as permitted under the *Copyright Act 1968*, no part may be reproduced by any process without prior written permission from the Australian Government Publishing Service. Requests and inquiries concerning reproduction and rights should be addressed to the Manager, Commonwealth Information Services, Australian Government Publishing Service, GPO Box 84, Canberra ACT 2601.

12169
263-7372
845

Produced by the Australian Government Publishing Service

FOREWORD

The National Occupational Health and Safety Commission is a tripartite body established by the Commonwealth Government to develop, facilitate and implement a national occupational health and safety strategy.

This strategy includes standards development, the development of hazard-specific and industry-based preventive strategies, research, training, information collection and dissemination and the development of common approaches to occupational health and safety legislation.

The National Commission comprises representatives of the peak employee and employer bodies — the Australian Council of Trade Unions and the Australian Chamber of Commerce and Industry — as well as the Commonwealth, State and Territory governments.

Consistent with the National Commission's philosophy of consultation, tripartite standing committees have been established to deal with issues relating to standards development, research and the mining industry. Expert groups have been established to provide advice to the standing committees on those items with which the National Commission is concerned.

POLICY STATEMENT ON THE USE OF EXPOSURE STANDARDS

FOREWORD

iii

PREFACE

vii

**GUIDANCE NOTE ON THE INTERPRETATION OF EXPOSURE
STANDARDS FOR ATMOSPHERIC CONTAMINANTS
IN THE OCCUPATIONAL ENVIRONMENT**

1

**ADOPTED NATIONAL EXPOSURE STANDARDS FOR
ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL
ENVIRONMENT**

65

PREFACE

While supporting the concept that exposure to chemical agents should be kept as low as practicable, the National Occupational Health and Safety Commission recognises that, in practice, guidance in the form of exposure standards may be used by occupational health and safety practitioners, employers and employees or their representatives, and regulatory agencies to assist them in ensuring that workers are adequately protected from substances that may impair health or cause undue annoyance.

To this end, the Exposure Standards Expert Working Group, under the auspices of the Standards Development Standing Committee (SDSC), has been charged with the task of reviewing and recommending occupational exposure standards for individual chemical substances following consideration of the best available technical data from Australian and a range of overseas sources. The terms of reference of the Exposure Standards Expert Working Group are detailed at Appendix 1 of the National Commission's *Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment* [NOHSC:3008(1995)]. Membership of the Exposure Standards Expert Working Group is given at Appendix 2 of the guidance note. All requests for interpretations of exposure standards should be made in writing and directed to the Secretary of the Exposure Standards Expert Working Group.

The exposure standards listed in this publication represent airborne concentrations of individual chemical substances which, according to current knowledge, should neither impair the health of, nor cause undue discomfort to, nearly all workers. The exposure standards serve as guides only, and have no legal status unless they are specifically incorporated into Commonwealth, State or Territory legislation. In recommending appropriate exposure standards, the National Commission has been guided by the standards and experience of a number of Australian and overseas organisations.¹⁻⁶

A great number of the adopted exposure standards have been obtained from the American Conference of Governmental Industrial Hygienists' list of threshold limit values.² These values have been considered by the National Commission and those found to be acceptable were adopted. A smaller number of substances have been reviewed in detail by the Exposure Standards Expert Working Group and appropriate values assigned.

This third edition of the *Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment* [NOHSC:1003(1995)] replaces the second edition which was published in October 1991. This current edition incorporates exposure standards declared by the National Commission in March 1994 and March 1995 pursuant to section 38(1) of the *National Occupational Health and Safety Commission Act 1985* (Cwlth).

Among the adopted exposure standards, there are a number of substances which the Exposure Standards Expert Working Group has identified as requiring further review. These substances are listed in Appendix 3 of the guidance note. To assist the Exposure Standards Expert Working Group in its consideration of these substances, interested parties are encouraged to submit any relevant information on these substances. Such submissions should ideally be accompanied by actual exposure data and a description of any observed health effects. An indication of whether the monitoring data refers to an eight-hour time-weighted average or short term exposure, and a brief description of the work procedures involved, would also be useful.

Proposed changes and additions to the National Commission's *Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment* [NOHSC:1003(1995)] are not included in this publication but have been published separately.⁷ The notation 'Ch' in the final column of the adopted national exposure standards indicates those substances for which the Exposure Standards Expert Working Group has proposed additions/changes to the existing standards.

1. National Health and Medical Research Council, *Approved Occupational Health Guide: Threshold Limit Values (1983-84)*, Commonwealth Department of Health, Canberra, 1983.
2. American Conference of Governmental Industrial Hygienists (ACGIH), *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices 1994-1995*, ACGIH, Cincinnati, Ohio, 1994.
3. Health and Safety Executive (UK), *Occupational Exposure Limits 1995*, Guidance Note EH40, HMSO, London, 1995.
4. Swedish National Board of Occupational Safety and Health, *Occupational Exposure Limit Values*, Ordinance AFS 1990:13, Sweden, 1990.
5. Deutsche Forschungsgemeinschaft (DFG), *List of MAK and BAT Values 1994*, Report No. 30, Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area, VCH Verlagsgesellschaft mbH, Weinheim, Federal Republic of Germany, 1994.
6. Ministerie van Sociale Zaken en Werkgelegenheid, *De Nationale MAC-lijst 1992*, P 145, Ministerie van Sociale Zaken en Werkgelegenheid, Den Haag, Netherlands, 1993.
7. National Occupational Health and Safety Commission, *Proposed National Exposure Standards for Atmospheric Contaminants in the Occupational Environment*, Australian Government Publishing Service, Canberra, 1995.

**GUIDANCE NOTE
ON THE INTERPRETATION OF
EXPOSURE STANDARDS
FOR ATMOSPHERIC CONTAMINANTS
IN THE OCCUPATIONAL ENVIRONMENT
[NOHSC:3008(1995)]**

| | | |
|------------|--|-----------|
| 1. | INTRODUCTION | 5 |
| 2. | UNLISTED SUBSTANCES | 6 |
| 3. | PROHIBITION OF THE USE OF SUBSTANCES | 7 |
| 4. | WORKLOAD CONSIDERATIONS | 8 |
| 5. | EXPOSURE DURATION | 9 |
| 6. | EXCURSION LIMITS | 10 |
| | Peak Limitation | 10 |
| | Short Term Exposure Limit | 10 |
| | Guidance on General Excursion | 11 |
| 7. | MONITORING OF EXPOSURE | 12 |
| 8. | BIOLOGICAL MONITORING | 13 |
| 9. | ODOUR THRESHOLDS | 14 |
| 10. | SIMPLE ASPHYXIANTS | 15 |
| 11. | EFFECTS ON THE SKIN | 16 |
| | Skin Absorption | 16 |
| | Other Effects on the Skin | 16 |
| 12. | SENSITISERS | 17 |
| 13. | CARCINOGENS | 18 |
| 14. | AIRBORNE PARTICULATES | 21 |
| | Particle Size | 21 |
| | Silica | 24 |
| | Asbestos | 25 |
| | Synthetic Mineral Fibres | 26 |
| | Exposure Standards for Dusts not Otherwise Classified | 26 |
| 15. | MIXTURES OF SUBSTANCES | 27 |
| | Independent Effects | 27 |
| | Additive Effects | 27 |
| | Synergism and Potentiation | 28 |

| | | |
|------------|---|----|
| 16. | REFINED PETROLEUM SOLVENT MIXTURES | 29 |
| 17. | FUMES AND GASES FROM WELDING AND CUTTING PROCESSES | 30 |
| 18. | THERMAL DECOMPOSITION PRODUCTS OF PLASTICS | 31 |
| 19. | EXPRESSION OF EXPOSURE STANDARDS | 32 |
| | Chemical Nomenclature | 32 |
| | CAS Number | 32 |
| | Units for Exposure Standards | 32 |
| APPENDIXES | | |
| 1. | TERMS OF REFERENCE OF THE EXPOSURE STANDARDS EXPERT WORKING GROUP | 35 |
| 2. | MEMBERSHIP OF THE EXPOSURE STANDARDS EXPERT WORKING GROUP | 36 |
| 3. | ISSUES AND SUBSTANCES UNDER REVIEW | 37 |
| 4. | LIST OF SYNONYMS | 40 |
| 5. | SUBSTANCES INDEX SORTED BY CAS NUMBER | 49 |
| 6. | CHEMICAL SYMBOLS | 56 |
| | GLOSSARY OF TERMS | 57 |
| | REFERENCED DOCUMENTS | 59 |

1. INTRODUCTION

1.1 The air inhaled at work should not contain chemical agents at concentrations which produce adverse effects on health, safety or well-being. To assist occupational health and safety practitioners, employers and employees or their representatives, and regulatory agencies to secure workplace atmospheres which are as free as practicable from hazardous contaminants, the National Commission has produced *Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment* [NOHSC:1003(1995)], which is included in this publication.

1.2 The exposure standards detailed in this publication represent airborne concentrations of individual chemical substances which, according to current knowledge, should neither impair the health of nor cause undue discomfort to nearly all workers. Additionally, the exposure standards are believed to guard against narcosis or irritation which could precipitate industrial accidents.

1.3 Except where modified by consideration of excursion limits, exposure standards apply to long term exposure to a substance over an eight-hour day, for a five-day working week, over an entire working life.

1.4 The exposure standards do not represent 'no-effect' levels which guarantee protection to every worker. Given the nature of biological variation and the range of individual susceptibility, it is inevitable that a very small proportion of workers who are exposed to concentrations around or below the exposure standard may suffer mild and transitory discomfort. An even smaller number may exhibit symptoms of illness.

1.5 It follows from the foregoing that the exposure standards are not fine dividing lines between satisfactory and unsatisfactory working conditions, but rather that they are best used to assess the quality of the working environment and indicate where appropriate control measures are required.

1.6 The exposure standards listed in this publication only consider absorption via inhalation and are valid only on the condition that significant skin absorption cannot occur.

1.7 For a few substances, usually the more potent probable and established human carcinogens, it is not currently possible to assign an appropriate exposure standard. For these substances, exposure should be controlled to the lowest practicable level. Biological monitoring may provide a more reliable indication of workplace exposure for these substances.

1.8 The evaluation of hazards posed by atmospheric contaminants in the working environment is often a complex task, requiring the consideration of a large number of variables which determine the magnitude of a particular hazard. For this reason, it is essential that those persons responsible for such assessments are fully aware of all of the issues canvassed in this document and have appropriate qualifications and experience in occupational hygiene.

1.9 The relationship between various exposure standards should not be used as a general measure of their relative toxicity. This is because, among other things, the values for different substances are often established with regard to different biological effects such as irritation or systemic toxicity. Similarly, the exposure standards should not be used as a basis for the evaluation of community air quality, or for long term, non-occupational exposures.

1.10 Note: Exposure standards for micro-organisms or radioactive substances are not detailed in this publication. However, practical guidance for these substances is available.¹⁻⁴

2. UNLISTED SUBSTANCES

2.1 Most substances used in industry have not been assigned exposure standards. This does not imply that these substances are safe or non-hazardous.

2.2 In many cases there is insufficient information on the health effects of these unlisted substances to allow the National Commission to assign an exposure standard, even on a tentative basis. In other instances, the use of the substance does not lead to significant airborne levels of contaminant, or its use is so restricted that an exposure standard is not warranted.

2.3 It is a good general policy to keep the exposure to any substance as low as is practicable, irrespective of whether present information indicates it is hazardous or not. Some substances previously thought to be comparatively safe have subsequently been found to pose serious long term health risks.

2.4 All substances should therefore be handled with care, whatever their nature, partly in case future experience shows them to present a hazard which could have been prevented or limited by the application of sensible control measures, and partly because insufficient information may be known about their effects in the presence of other substances.

2.5 Appendix 4 of this guidance note is a list of synonyms and trade names, and should be consulted when a first attempt to locate a chemical in the list of adopted national exposure standards is unsuccessful.

2.6 Appendix 5 of this guidance note is a substance index sorted by the Chemical Abstracts Service Registry Number (CAS No.).

3. PROHIBITION OF THE USE OF SUBSTANCES

3.1 There are a number of substances whose industrial use has resulted in considerable and serious occupational disease. Accordingly, the risk to health associated with the use of these substances is such that their continued use cannot be justified, especially where suitable substitutes exist. For this reason, the direct use of the following substances or their salts should be prohibited:

| Substance | Reason |
|-----------------------------|-----------------|
| 4-Aminodiphenyl | Carcinogenicity |
| Amosite (brown asbestos) | Carcinogenicity |
| Benzidine | Carcinogenicity |
| bis(Chloromethyl) ether | Carcinogenicity |
| Crocidolite (blue asbestos) | Carcinogenicity |
| 2-Naphthylamine | Carcinogenicity |
| 4-Nitrodiphenyl | Carcinogenicity |

3.2 These substances should not be mined, or manufactured or incorporated into new products or processes, and should not be used for any purpose other than for bona fide research. Where these substances occur as a contaminant or by-product in an industrial process, such a process should be strictly controlled to prevent worker exposure.

3.3 In some instances, exposure standards have been assigned to these substances because of their existence as a result of past use or because of their occurrence as trace contaminants in process materials. Safe handling practices applicable to some of these materials have been detailed in National Commission guidance notes or codes of practice.^{5,6}

4. WORKLOAD CONSIDERATIONS

4.1 The exposure standards have been established on the premise of an eight-hour exposure, during work of normal intensity, under normal climatic conditions and where there is a sixteen-hour period between shifts to permit elimination of any absorbed contaminants.

4.2 Heavy or strenuous work increases lung ventilation, thereby increasing the uptake of airborne contaminants.⁷ Similarly, heavy physical work under adverse climatic conditions, such as excessive humidity or heat, or work at high altitudes, may lead to an increased uptake of contaminants. It is therefore of particular importance that any evaluation of the working environment considers the lung ventilation rate where there is a significant airborne concentration of contaminant.

5. EXPOSURE DURATION

5.1 Except for short term exposure limits, or where a peak value has been assigned, the exposure standards for airborne contaminants are expressed as a time-weighted average (TWA) concentration of that substance over an eight-hour working day, for a five-day working week. During periods of continuous daily exposure to an airborne contaminant, these TWA exposures permit excursions above the exposure standard provided they are compensated for by equivalent excursions below the standard during the working day.

5.2 However, it is not necessarily acceptable to expose workers to concentrations significantly higher than the exposure standard solely because the exposure is for less than an eight-hour day or because the exposure occurs only occasionally. Permissible variations in the exposure standard for such situations are dependent on such factors as the acute effects of short term exposures, or on the relationship between accumulation and elimination of the body burden of the material or its metabolites, and should only be accepted in the light of expert advice.

5.3 Where workers have a working day longer than eight hours or unusual shift rotations are in effect, the TWA exposure standard may need to be reduced by a suitable factor to ensure adequate worker protection. Such factors require specialist consideration and expert advice should be sought in the specification of modified exposure standards.⁸⁻¹²

6. EXCURSION LIMITS

6.1 The exposure standards for airborne contaminants are expressed as a TWA concentration over an entire eight-hour working day. However, during this eight-hour averaging period, excursions above the TWA exposure standard are permitted providing these excursions are compensated for by equivalent excursions below the standard during the working day. However, because some substances can give rise to acute health effects even after brief exposures to high concentrations, it is evident that excursions above the TWA concentration should be restricted.

6.2 The permissible frequency of these excursions, their magnitude and duration should be based upon a number of factors such as the nature of the contaminant, its cumulative effects and whether brief exposures can produce acute effects.

PEAK LIMITATION

6.3 For some rapidly acting substances and irritants, the averaging of the airborne concentration over an eight-hour period is inappropriate. These substances may induce acute effects after relatively brief exposure to high concentrations and so the exposure standard for these substances represents a maximum or peak concentration to which workers may be exposed. Although it is recognised that there are analytical limitations to the measurement of some substances, compliance with these 'peak limitation' exposure standards should be determined over the shortest analytically practicable period of time, but under no circumstances should a single determination exceed 15 minutes.

SHORT TERM EXPOSURE LIMIT

6.4 Some substances can cause intolerable irritation or other acute effects upon brief overexposure, although the primary toxic effects may be due to long term exposure through accumulation of substances in the body or through gradual health impairment with repeated exposures. Under these circumstances, exposure should be controlled to avoid both acute and chronic health effects.

6.5 Short term exposure limits (STELs) provide guide-lines for the control of short term exposure. These are important supplements to the eight-hour TWA exposure standards which are more concerned with the total intake over long periods of time. Generally, STELs are established to minimise the risk of the occurrence in nearly all workers of:

- intolerable irritation;
- chronic or irreversible tissue change; and
- narcosis to an extent that could precipitate industrial accidents,

provided the TWA exposure standards are not exceeded. STELs are recommended for those substances only when there is evidence either from human or animal studies that adverse health effects can be caused by high short term exposure.

6.6 STELs are expressed as airborne concentrations of substances, averaged over a period of 15 minutes. This short term TWA concentration should not be exceeded at any time during a normal eight-hour working day. Workers should not be exposed at the STEL concentration continuously for longer than 15 minutes, or for more than four such periods per working day. A minimum of 60 minutes should be allowed between successive exposures at the STEL concentration.

GUIDANCE ON GENERAL EXCURSION

6.7 In practice, the actual concentration of an airborne contaminant arising from a particular industrial process may fluctuate widely with time, with some of the major excursions giving rise to a significant proportion of the overall exposure.

6.8 Even where the TWA exposure standard is not exceeded, there should be some control of concentration excursions. A practical approach to control has been developed, based on observations of the variability in concentrations observed in industrial environments. A process is not considered to be under reasonable control^{13,14} if short term exposures exceed three times the TWA exposure standard for more than a total of 30 minutes per eight-hour working day, or if a single short term value exceeds five times the TWA exposure standard. It should be emphasised that guidance of this type, aimed at placing some restraint on concentration excursions, is not directly health-based and does not supersede any STEL or peak limitation set.

6.9 Where adequate toxicological or epidemiological data allows the assignment of a STEL, the STEL will supersede this guidance on general excursion.

7. MONITORING OF EXPOSURE

7.1 The exposure standards detailed in this publication refer to airborne concentrations of chemical substances in the breathing zone of the worker, determined by 'personal sampling'.

7.2 The airborne concentration of contaminants may vary considerably at different times and from place to place. Air samples taken at fixed locations in the working environment, that is, 'static samples', are only of limited use in assessing the risks posed to workers from a particular contaminant. Static samples may be essential in the design of, or when assessing the effectiveness of, control measures. In some cases, fixed continuous monitors in suitable positions may also be provided to give early warning of leaks or other generators of high concentrations which could subsequently lead to worker exposures exceeding the standard. However, such fixed position monitoring should not be regarded as indicative of actual worker exposure.

7.3 The proper evaluation of worker exposures may require a substantial commitment of personnel, sampling equipment and analytical resources,¹⁵ the optimum use of which may be achieved with an appropriate sampling strategy. To protect the health of workers, exposure measurements should be made from unbiased and representative samples of actual worker exposure. Such a sampling strategy usually encompasses selection of workers for personal monitoring as well as sampling times. The strategy should also address issues such as sampling and analysis errors, statistical analysis of exposure data and the determination of the need for regular exposure measurement. Detailed routine sampling strategies for individual substances are a complex subject and a complete discussion of the theory and characteristics is beyond the scope of this guidance note. However, practical guidance is available in *Monitoring Strategies for Toxic Substances*¹⁶ and *Occupational Exposure Sampling Strategy Manual*.¹⁷

7.4 The assessment of received dose may require that personal monitoring be complemented by biological monitoring of exhaled breath or other body fluids in order to take full account of such factors as absorption by routes other than inhalation (for example, by skin contamination or ingestion), biological variations and personal habits.

8. BIOLOGICAL MONITORING

8.1 The assessment of the airborne concentration of a particular contaminant and the subsequent comparison with the appropriate exposure standard(s) is usually the primary technique in the evaluation of the working environment. However, in some situations this approach may be complemented by the use of biological monitoring techniques which measure the levels of the substance or its metabolite(s) in body fluids, such as sweat, urine or blood, or in exhaled breath.

8.2 Workers differ from each other in size, fitness, personal hygiene, work practices, smoking habits, alcohol and drug usage, and nutritional status. There are thus differences between individuals in uptake, metabolism and excretion of toxic substances, and in response to a particular toxic hazard.¹⁸ Biological monitoring has the specific advantage that it can take account of these differences, enabling individual risk assessments to be made. As such, in certain circumstances, biological monitoring serves as a useful adjunct to atmospheric monitoring in assessing actual occupational exposure.

8.3 For a limited number of substances, the application of biological monitoring can be particularly useful in suggesting the degree of skin absorption and, in some cases, can identify unknown or unexpected exposures which cannot be predicted from atmospheric monitoring alone. However, biological monitoring does have limitations, particularly in regard to the collection and preservation of samples and the interpretation of results. There is limited knowledge of suitable and definitive biological tests for most substances.

8.4 As this publication is primarily concerned with exposure standards for atmospheric contaminants, values for biological indices for individual substances have not been included, although some values may be included in a later edition. There are, however, a number of useful documents which address both the individual biological values^{19,20} and the techniques by which they are determined.²¹⁻²⁷

9. ODOUR THRESHOLDS

9.1 Many chemical substances have a distinctive odour which indicates the presence of the substance in the working environment. While this odour perception serves as a useful warning signal, in most instances this perception may convey little information about the potential hazard associated with the atmospheric contaminant.

9.2 While a large number of odour thresholds have been determined,²⁸ there are a number of problems associated with their use. These problems include:

- the threshold of odour perception varies over many orders of magnitude between individuals and among different substances;
- the presence or absence of an odour may bear no relationship to the harmful biological effects of the substance;
- there may be interference from other substances; and
- a strongly pronounced odour which is observed on initial contact with the substance may completely disappear on repeated or continued exposure or fluctuation of the concentration.

9.3 For these reasons, odour thresholds should be treated with caution. The absence of an odour may not indicate a 'safe' environment; conversely, the presence of an odour may not indicate a hazard to health.

9.4 Odour perception may be useful as a warning signal, however, its use is limited and should not replace the objective measurement of the airborne concentration of the particular substance.

10. SIMPLE ASPHYXIANTS

10.1 Simple asphyxiants are gases which, when present in an atmosphere in high concentrations, lead to a reduction of oxygen concentration by displacement or dilution. It is not appropriate to recommend an exposure standard for each simple asphyxiant, rather it should be required that a sufficient oxygen concentration be maintained.

10.2 The minimum oxygen content in air should be 18 per cent by volume under normal atmospheric pressure. This is equivalent to a partial pressure of oxygen (PO_2) of 18.2 kPa (137 mm Hg). At pressures significantly higher or lower than the normal atmospheric pressure, expert guidance should be sought.

10.3 Atmospheres deficient in oxygen do not provide adequate sensory warning of danger and most simple asphyxiants are odourless. Unconsciousness and death can rapidly ensue in an environment which is deficient in oxygen. There have been a considerable number of deaths among inappropriately protected workers who have entered confined spaces or tanks before these spaces were adequately vented or gas-tested. Australian Standard AS 2865-1995 *Safe Working in a Confined Space* details precautions which should be observed in such environments.²⁹

10.4 Many of the simple asphyxiants can also present an explosion hazard and this should be taken into account in limiting the concentration of the asphyxiant. The tables below give specific examples of simple asphyxiants, although they are not meant to be all-inclusive lists.

10.5 Examples of asphyxiants which may present an explosion hazard:

| Substance | CAS No. |
|-----------|-------------|
| Acetylene | [74-86-2] |
| Ethane | [74-84-0] |
| Ethylene | [74-85-1] |
| Hydrogen | [1333-74-0] |
| Methane | [74-82-8] |
| Propane | [74-98-6] |
| Propylene | [115-07-1] |

10.6 Examples of asphyxiants which are not expected to present an explosion hazard:

| Substance | CAS No. |
|-----------|-------------|
| Argon | [7440-37-1] |
| Helium | [7440-59-7] |
| Neon | [7440-01-9] |
| Nitrogen | [7727-37-9] |

10.7 The most common asphyxiant is carbon dioxide. It gives no warning of its presence in asphyxiating concentrations. Carbon dioxide can have toxic effects at concentrations which do not cause asphyxiation.

11. EFFECTS ON THE SKIN

SKIN ABSORPTION

11.1 For most substances in the occupational setting, the main route of entry into the body is via inhalation. However, certain chemical substances such as aniline, nitrobenzene, phenols and certain pesticides can readily penetrate the intact skin and thus become absorbed into the body. Frequently, there will be no accompanying skin damage. In some instances this dermal absorption can pose a far greater danger than inhalation exposure.

11.2 The adopted national exposure standards listed in this publication only consider absorption via inhalation, and are valid only on the condition that significant skin absorption cannot occur. In some instances, special measures may be required to prevent absorption through the skin. Chemical compounds requiring such precautions are specified by the notation 'Sk' in column 6 of the listing of the adopted national exposure standards.

11.3 Skin absorption can result from local contamination, for example, from a splash onto the skin or clothing, or, in some rare cases, from exposure to very high atmospheric concentrations of vapour. In addition, some vehicles, such as solvents, can accelerate or alter the rate of skin absorption. Serious effects can result with little or no warning and it is necessary to take special precautions to prevent skin contact when handling these substances.

11.4 Where biological monitoring methods are available for such materials, it may be important to employ these for personnel surveillance in addition to any air monitoring program. Biological monitoring is discussed in more detail in Chapter 8.

OTHER EFFECTS ON THE SKIN

11.5 Many substances can be injurious by their direct effect on the skin and mucous membranes, whether or not they are also absorbed in significant amounts. Solvents degrease the skin, thereby rendering the individual more vulnerable to the effects of the solvents and other substances. Some corrosive substances cause particularly serious injuries to the eyes and skin. Other substances, for example, derivatives of coal tar and certain dyes and drugs, by either coming into direct contact with the skin or reaching there by the systemic circulation, may react with selected wavelengths of natural or artificial light to cause dermatitis or other health effects.

11.6 Substances which may cause physical damage to the skin or eyes are not noted in this publication. However, it is good practice to avoid any unnecessary contact with all chemical substances.

11.7 Note: An initiative of the National Commission which addresses occupational skin disorders may lead to more detailed advice on this issue.³⁰

12. SENSITISERS

12.1 Some substances such as western red cedar, toluene diisocyanate (TDI) and formaldehyde can cause a specific immune response in some people. Such substances are called sensitisers and the development of a specific immune response is termed 'sensitisation'. Exposure to a sensitiser, once sensitisation has occurred, may manifest itself as a skin rash or inflammation or as an asthmatic condition, and in some individuals this reaction can be extremely severe.

12.2 Following the induction of a sensitised state, an affected individual may subsequently react to exposure to minute levels of that substance. Although low values have been assigned to strong sensitising agents, compliance with the recommended exposure standard may not provide adequate protection for a hypersensitive individual.^{31,32} Persons who are sensitised to a particular substance should not be further exposed to that substance.

12.3 Substances which are known to act as sensitisers are designated by the notation 'Sen' in column 6 of the list of adopted national exposure standards. Such a designation indicates that caution should be exercised in the industrial use of these substances.

13. CARCINOGENS

13.1 Unlike most chronic toxic effects, which usually manifest themselves sometime during the period of exposure, a carcinogenic process, from the initiating event to clinical expression of the disease, may take from a few to many years to complete. A diagnosis of cancer may not be made until long after cessation of exposure.

13.2 The incidence of cancer is usually dose related; the greater the exposure to the chemical carcinogen the higher the risk of developing the cancer associated with that chemical. Accordingly, the smaller the exposure the lower the probability of a cancer developing.

13.3 Because of the limitations of both epidemiological and animal studies at very low dosage, 'no effect' levels of exposure cannot be confidently identified for carcinogenic substances at the present time. Nevertheless, there do appear to be practical thresholds for most carcinogens at which the effects cannot be distinguished against the natural background,³³ although for some of the more potent carcinogens elimination of exposure is the only recommendable goal.

13.4 Since some carcinogenic substances are unavoidable in particular industrial processes, and to some extent also occur in nature, it may be impossible to eliminate exposure to these substances completely. For this reason the following general guide-lines should be observed:

- Substances which have been identified as carcinogens should be replaced, where possible, by substances which are not carcinogenic and are less hazardous.
- Engineering controls, such as exhaust ventilation, process enclosure and/or improved work practices, should be implemented to eliminate or minimise worker exposure. As skin absorption can be a significant source of exposure for some carcinogens, particular attention may need to be given to plant hygiene and the selection of appropriate skin protection.
- Routine air monitoring, or biological monitoring where appropriate, should be employed in the workplace to ensure exposure is being maintained at the minimum which can be practically achieved, and in all cases below the appropriate exposure standard. Because the levels of exposure may be very low, analytical methods of appropriate sensitivity should be employed. The frequency at which monitoring is undertaken is determined by the magnitude of the potential exposure and the reliability of the process controls.
- Where exposure to these substances cannot be eliminated by the use of process control techniques, the use of personal protective equipment may be required. The selection of appropriate protective equipment will be determined not only by the nature and magnitude of the potential exposure, but also by the particular chemical and physical characteristics of the substance and the nature and magnitude of its carcinogenic effect.
- All personnel likely to be exposed to carcinogenic substances should receive adequate information regarding the hazards, and training in minimisation of risk.

13.5 Although exposure to potentially carcinogenic substances should be eliminated or reduced to as low a level as is practicable, the use of exposure standards can, in many cases, act as a useful guide to the efficiency of engineering controls and the work practices which have, or need to be, implemented to reduce worker exposure.

13.6 To this end, where there is sufficient information to allow the assignment of exposure standards, these are given as a guide to good practice. However, because of the incompleteness of our knowledge of carcinogens, it is at present not possible to reliably estimate the risk posed by some carcinogenic substances. Therefore, compliance with these exposure standards should not preclude further efforts to reduce worker exposure.

13.7 Chemical substances which have been identified as suspected or established carcinogens, or substances associated with industrial processes which have been identified as suspected or established carcinogens, have been highlighted in the list of adopted exposure standards. The Commission of the European Communities (EEC) system of classification of carcinogenic substances³⁴ is used to indicate the strength of the causal association between these substances and the development of cancer. (Note: The categorisation of individual substances by the Exposure Standards Expert Working Group may vary from the EEC assignment in some instances.) A detailed description of the criteria used in this classification system is available in *A Guide to the Classification of Carcinogens, Mutagens and Teratogens under the Sixth Amendment*,³⁵ which is based on the interpretation, for human exposure at the workplace, of the findings of the International Agency for Research on Cancer on carcinogenesis. The three categories, with the appropriate levels of control required, are described below.

(a) Category 1

Established human carcinogens are those substances known to be carcinogenic to humans. There is sufficient evidence to establish a causal association between human exposure to these substances and the development of cancer.

Under the circumstances where substitution of less hazardous materials is technically not feasible, the use of these carcinogenic substances should be controlled to the highest practicable standard by the application of effective engineering control techniques and, where necessary, complemented by the use of appropriate personal protective equipment. Routine monitoring of the workplace is essential for indication of control performance. In some cases, health surveillance and biological monitoring can indicate exposure and thus reveal the need for re-assessment of the control measures and work practices. For some substances, specific control measures have been detailed in codes of practice.^{5,6,36}

(b) Category 2

Probable human carcinogens are those substances for which there is sufficient evidence to provide a strong presumption that human exposure might result in the development of cancer. This evidence is generally based on appropriate long term animal studies, limited epidemiological evidence or other relevant information.

These substances should be treated as if they are carcinogenic to humans. Under the circumstances where substitution of less hazardous materials is not possible, exposures to these substances should be minimised to the lowest practicable levels. This should be achieved by the application of effective engineering control measures, revised work practices and, where necessary, complemented by the use of appropriate personal protective equipment. A program of routine air monitoring should be implemented to ensure that the process controls and work practices implemented are effective in minimising exposure. In some cases, health surveillance and biological monitoring can indicate exposure and thus reveal the need for re-assessment of the control measures and work practices.

(c) Category 3

Substances suspected of having carcinogenic potential are those substances which have possible carcinogenic effects on humans but in respect of which the available information is not adequate for making a satisfactory assessment. There is some evidence from appropriate animal or epidemiological studies, but this is insufficient to place the substance in Category 2.

Because these substances may be re-assigned to a more stringent category in the light of future research, their use should be reviewed and they should be used with caution. Exposures should be kept as low as practicable and in no cases should they exceed the established exposure standards.

14. AIRBORNE PARTICULATES

14.1 Airborne contaminants that can be inhaled directly into the lungs can be classified on the basis of their physical properties as gases, vapours or particulate matter. Airborne particulates consist of discrete particles and may be further characterised as dusts, fumes, smokes or mists depending on the nature of the particle and its size. Definitions for each of these terms are given in the Glossary of Terms. In common usage, the terms 'dust' and 'particulates' are often used interchangeably. There are four factors which determine the degree of hazard associated with a specific airborne particulate, namely:

- the type of particulate involved and its biological effect;
- the concentration of airborne particulates in the breathing zone of the worker;
- the size of particles present in the breathing zone; and
- the duration of the exposure (possibly in years).

14.2 The chemical composition and physical characteristics of the particulate determine the biological effect of the substance. The biological effects associated with an airborne particulate may be:

- systemic toxic effects caused by the absorption of the toxic material into the blood, for example, lead, manganese, cadmium and zinc;
- allergic and hypersensitivity reactions caused by the inhalation of dusts from materials such as flour, grains, some woods and some organic and inorganic chemicals;
- bacterial and fungal infections associated with the inhalation of dusts containing viable organisms and/or spores;
- fibrogenic reactions in the gas exchange regions of the lung due to the presence of materials such as asbestos and quartz;
- carcinogenic response due to the presence of, for example, chromates and asbestos; and
- irritation of the mucous membranes of the nose and throat caused by acid, alkali or other irritating particulates, especially mists.

PARTICLE SIZE

14.3 Most industrial dusts contain particles of widely ranging size. The behaviour, deposition and fate of any individual particle after entry into the human respiratory system and the response that it elicits depends on the nature and size of the particle.

14.4 Only part of the total quantity of dust which is present in the worker's breathing zone is inhaled. This part is designated as the 'inspirable fraction' of dust and is governed by the flow rates in the nose and mouth areas, as well as the airflow around the head. Practically all of the smaller particles will be inhaled, while the inhalability of the larger particles decreases rapidly as a function of increasing aerodynamic diameter.

14.5 The larger particles in the inspirable fraction of dust are deposited in the nose, pharynx and larynx. Some of the smaller particles reach the tracheobronchial tree or even the alveolar region of the lung where gas exchange occurs.

14.6 The deposition of particles can occur during either inhalation or exhalation. Deposited particles may be transported to the digestive tract by means of the mucociliary clearing mechanism of the respiratory tract and, in some cases, subsequently absorbed into the body.

Inspirable Dust

14.7 At present there is intense debate concerning size-selective sampling of airborne dusts.

14.8 In 1983 the International Organization for Standardization (ISO)³⁷ proposed definitions for both 'respirable' and 'inspirable' dust. In 1985 the American Conference of Governmental Industrial Hygienists (ACGIH)³⁸ recommended a different set of criteria for size-selective aerosol sampling. The following tables give values for the classification of inspirable particles into mass fractions according to the ISO definition and the nominal inspirable particulate mass (IPM) sampling efficiency criteria adopted by ACGIH.

Inspirable Mass Fraction (ISO TR 7708)

| <i>Particle equivalent aerodynamic diameter (μm)</i> | <i>Inspirability (per cent)</i> |
|--|-------------------------------------|
| 0 | 100 |
| 10 | 73 |
| 30 | 52 |
| 60 | 34 |
| 100 | 20 |
| 185 | 0 |

Inspirable Mass Sampling Efficiency (ACGIH)

| <i>Particle equivalent aerodynamic diameter (μm)</i> | <i>IPM sampling efficiency (per cent)</i> |
|--|---|
| 0 | 100 |
| 10 | 77 |
| 30 | 58 |
| 60 | 51 |
| 100 | 50 |
| 185 | not defined |

14.9 Taking into account the approximations and uncertainties inherent in standardising human inhalation and deposition curves and the practicalities involved in workplace sampling, it is believed that the difference between the two sets of recommendations is relatively small compared with their general agreement in approach.

14.10 However, it is important to realise that different types of currently available sampling devices conforming to these definitions can give significantly different results if a predominance of very large particles, that is, $>30\text{--}50\text{ }\mu\text{m}$ aerodynamic diameter, is present in the atmosphere being sampled. In other words, under these conditions a device which samples in accordance with the ACGIH definition may give higher results than the device which samples in accordance with the ISO definition.

14.11 In its recent publication on sampling methods for inspirable dust, Standards Australia³⁹ has addressed these issues and this document should be consulted for more detail on these techniques and appropriate sampling devices.

14.12 'Inspirable' dust as measured by the method described in the above-mentioned document³⁹ derives from 'inspirability' and 'inspirable mass fraction' as defined by ISO or from 'inspirable particulate mass fraction' as defined by ACGIH. Some authorities use the terms 'inhalable' or 'total inhalable'.

Respirable Dust

14.13 The inspirable fraction of dust entering the respiratory tract may be further divided into 'respirable' and 'non-respirable' fractions. The respirable fraction is composed of the very fine dust which is able to reach the lower bronchioles and alveolar regions of the lung.

14.14 The definition of 'respirable' dust is that detailed by Standards Australia⁴⁰ and conforms with the definition adopted by the British Medical Research Council (BMRC) and the recommendation of the Pneumoconiosis Conference held in Johannesburg in 1959.⁴¹ This recommendation states that the respirable fraction is defined by a sampling efficiency curve which depends on the settling velocity of the particle and which passes through the points indicated in the following table.

Respirable Mass Fraction

| <i>Particle equivalent aerodynamic diameter (μm)</i> | <i>Respirability (per cent)</i> |
|--|-------------------------------------|
| 0 | 100 |
| 1 | 98 |
| 2 | 92 |
| 3 | 82 |
| 4 | 68 |
| 5 | 50 |
| 6 | 28 |
| 7 | 0 |

14.15 The above sampling efficiency curve is known as the 'Johannesburg curve' and practical devices exist which sample according to this curve.⁴⁰

SILICA

14.16 Silica is a name which collectively describes various forms of silicon dioxide, including both the crystalline and non-crystalline (amorphous) forms of silica. While amorphous silica can be transformed into crystalline forms such as tridymite and cristobalite by heating to high temperatures (approximately 870°C and 1470°C respectively),⁴² it is generally only the crystalline forms of silica which are fibrogenic.* The temperature at which amorphous silica can be converted to crystalline forms such as tridymite and cristobalite is very dependent upon pressure and chemical environment. For instance, significant quantities of cristobalite can be formed at temperatures as low as 450°C in the presence of sodium carbonate or sodium chloride flux, that is, calcining.⁴³

14.17 Note: An Expert Working Group on Crystalline Silica has been established under the auspices of the Standards Development Standing Committee (SDSC) to review the exposure standards for different forms of crystalline silica. At present, no values have been recommended by the SDSC and exposure should be kept as low as practicable.

14.18 The forms of crystalline silica which are under review are shown in the following table.

| Type of Crystalline Silica | CAS No. | Respirable Fraction |
|----------------------------|--------------|---------------------|
| Quartz | [14808-60-7] | Under review |
| Cristobalite | [14464-46-1] | Under review |
| Silica flour† | [14808-60-7] | Under review |
| Tridymite | [15468-32-3] | Under review |
| Fused silica | [60676-86-0] | Under review |
| Tripoli | [1317-95-9] | Under review |

14.19 The airborne concentration of crystalline silica should be determined in the manner specified in *Methods for Measurement of Quartz in Respirable Airborne Dust by Infra-red Spectroscopy and X-ray Diffractometry*.⁴⁵

* A fibrogenic dust is a dust, for example, crystalline silica and asbestos which, after deposition in the gas exchange region of the lung, causes increase of fibrotic (scar) tissue. With dust of this kind, only particles which are capable of penetrating to this region of the lung are of concern in determining the hazard to health.

† Some extremely fine grades of silica sand (crystalline silica) are marketed as 'silica flours' and have trade names such as Min-U-Sil.⁴⁴

14.20 Different types of amorphous silica, with their respective exposure standards, are shown in the following table.

| Type of Amorphous Silica | CAS No. | Respirable Fraction | Inspirable Fraction |
|------------------------------------|--------------|---------------------|----------------------|
| Diatomaceous earth (uncalcined)* | [61790-53-2] | - | 10 mg/m ³ |
| Fumed silica† | [7631-86-9] | 2 mg/m ³ | - |
| Precipitated silica | - | - | 10 mg/m ³ |
| Silica fume† (thermally generated) | - | Under review | (see Appendix 3) |
| Silica gel | - | - | 10 mg/m ³ |

ASBESTOS

14.21 Asbestos is the generic name used for the fibrous form of a group of naturally occurring mineral silicates of the serpentine and amphibole series⁴⁶ including the fibrous serpentine mineral, chrysotile (white asbestos), and the amphiboles known in fibrous forms as actinolite, amosite (brown asbestos), anthophyllite, crocidolite (blue asbestos) and tremolite.

14.22 The average fibre concentration of the air breathed by a worker throughout a working shift, as calculated from measurements made in accordance with the National Commission's *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Dust*⁴⁷ [NOHSC:3003(1988)], over a sampling period of not less than four hours, during which one or more samples may be taken, should not exceed the values in the following table.

| Type of Asbestos | CAS No. | TWA Exposure Standard |
|---|--------------|--------------------------|
| Crocidolite (blue asbestos) | [12001-28-4] | 0.1 fibres per mL of air |
| Amosite (brown asbestos) | [12172-73-5] | 0.1 fibres per mL of air |
| Chrysotile (white asbestos) | [12001-29-5] | 1.0 fibres per mL of air |
| Other forms | [1332-21-4] | 0.1 fibres per mL of air |
| Any mixture of these, or where the composition is unknown | | 0.1 fibres per mL of air |

* Commercial diatomite products are marketed in many grades. Diatomite for filtering is typically 'calcined' and therefore may contain a significant proportion of crystalline silica.⁴⁴

† Fumed silica is produced synthetically by a vapour phase hydrolysis of silicon tetrachloride. Silica fume is the by-product of a high temperature process when elemental silicon is produced by reacting coke and silica sand (crystalline) in an electric arc furnace.

SYNTHETIC MINERAL FIBRES

14.23 Synthetic mineral fibres (SMF), described in international literature as man-made mineral fibres (MMMMF), is a collective term used to describe fibres such as fibreglass, rockwool and ceramic fibres. The biological effects of these fibres are determined by the fibre diameter and length and chemical nature.

14.24 For respirable fibres, the National Commission has adopted a TWA exposure standard of 0.5 fibres per mL of air be applied to synthetic mineral fibres (ceramic fibres, glassfibre and rockwool).⁴⁸ The airborne concentration of SMF should be determined in accordance with the National Commission's *Guidance Note on the Membrane Filter Method for the Estimation of Airborne Synthetic Mineral Fibres*⁴⁹ [NOHSC:3006(1989)].

14.25 For non-respirable fibres, in situations where almost all the airborne material is fibrous, a secondary, yet complementary, TWA exposure standard of 2 mg/m³ (inspirable dust) is proposed. This proposed secondary standard is established to minimise upper respiratory tract irritation from non-respirable fibres. It is not to take precedence over the respirable fibre standard.

EXPOSURE STANDARDS FOR DUSTS NOT OTHERWISE CLASSIFIED

14.26 Not all dusts have assigned exposure standards. However, it should not be assumed that this indicates that these unlisted dusts do not represent a hazard to health.

14.27 In addition to any specific physiological effect related to the unique properties of an individual particulate, high concentrations of dust in the workplace may cause unpleasant deposition of dust in the ears, eyes and upper respiratory tract and reduce visibility in the workplace. In addition, the mechanical action of these dusts, or the cleaning procedures necessary for their removal, may cause injury to the skin or mucous membranes.

14.28 Where no specific exposure standard has been assigned and the substance is both of inherently low toxicity and free from toxic impurities, the recommended exposure standard for dust in general should be 10 mg/m³, measured as inspirable dust. However, this general exposure standard should not be applied where the particulate material contains other substances which may in themselves be toxic or cause physiological impairment at lower concentrations. In such circumstances, the exposure standard for the more toxic components should be applied. For example, where a dust contains asbestos or more than one per cent crystalline silica, such as quartz, cristobalite or tridymite, the exposure to these materials should not exceed the appropriate value for these substances.

14.29 Providing the airborne particulate does not contain other hazardous components, compliance with the exposure standard for dusts in general should prevent impairment of respiratory function even over many years of exposure.

15. MIXTURES OF SUBSTANCES

15.1 The exposure standards listed in this publication are applicable to airborne concentrations of single pure substances. In practice, however, a working environment may contain a number of airborne contaminants and exposure to these additional substances, either simultaneously or sequentially, could give rise to an increased hazard to health.

15.2 Although the following proposals have been made to deal with mixtures, in several specific cases, the application of exposure standards to environments containing mixtures of contaminants requires considerable caution. The interaction of any particular mixture of substances should be assessed by either toxicologists, occupational hygienists or physicians after specific toxicological consideration of all substances involved.

INDEPENDENT EFFECTS

15.3 Where there is clear toxicological evidence to indicate that two or more contaminants have totally distinct mechanisms of effect on the body, then each substance may be separately evaluated against its appropriate exposure standard. For example, since crystalline silica affects the lungs, and inhaled ethanol vapour acts upon the liver and central nervous system, each of these substances may be assessed individually against its appropriate exposure standard. If neither standard is exceeded, the atmosphere within the working environment is deemed to be satisfactory.

ADDITIVE EFFECTS

15.4 When the body is exposed to two or more contaminants, an additive effect is obtained when contaminants have the same target organ or the same mechanism of action. In this situation, the total effect upon the body equals the sum of effects from the individual substances. For substances which are purely additive, conformity with the standard results when

$$\frac{C_1}{L_1} + \frac{C_2}{L_2} + \dots + \frac{C_n}{L_n} \leq 1 \quad (1)$$

Where $C_1, C_2 \dots C_n$ are the average measured airborne concentrations of the particular substances 1, 2...n and $L_1, L_2 \dots L_n$ are the appropriate exposure standards for the individual substances.

15.5 For example, consider an atmosphere containing:

- 35 ppm toluene (exposure standard 100 ppm),
- 25 ppm xylene (exposure standard 80 ppm), and
- 20 ppm 1,1,1-trichloroethane (exposure standard 125 ppm).

As all of these substances act primarily on the central nervous system, equation (1) can be applied. The resultant aggregate effect is:

$$\frac{35}{100} + \frac{25}{80} + \frac{20}{125} = 0.8$$

15.6 Since the sum of the contribution from each substance does not exceed one, the exposure standard for the airborne mixture is not exceeded.

15.7 When assessing the hazard from a mixture of airborne contaminants, it is important to identify and quantify all components in the airborne mixture as a number of factors, such as particle size distribution or solvent vapour pressure, can give rise to substantial variations between the concentration of each component in the parent mixture and that which occurs in air.

15.8 Although an example of an additive effect is the general effect of organic solvents on the central nervous system (narcotic or anaesthetic effect), the exposure standard for a number of solvents, such as benzene and carbon tetrachloride, have been assigned on the basis of effects other than those on the central nervous system. Therefore, it is essential to refer to the documentation^{19,50} for the specific substances to ascertain the basis of the standard and any potential interactions.

SYNERGISM AND POTENTIATION

15.9 Sometimes the combined effect of multiple exposure is considerably greater than the sum of the effects from the individual components. This phenomenon can be one of synergism or potentiation. Synergism* occurs when both chemicals have an effect individually and a more than additive effect when together. Potentiation* is when one chemical has an effect but the second chemical does not but enhances the effect of the former chemical on combined exposure.

15.10 An example of a synergistic effect is the combined effect of solvents such as n-hexane and methyl ethyl ketone (MEK) on the nervous system.^{51,52} In combination, the damage caused by simultaneous high concentrations of both these solvents is far greater than the sum of either of these substances acting alone.

15.11 Interaction can also arise from exposures via routes other than inhalation. For example, imbibed alcohol increases the narcotic effects of inhaled trichloroethylene. Interaction effects may also occur in connection with exposure to entirely different environmental factors such as simultaneous exposure to chemical agents and physical factors, such as light, heat and noise.^{53,54} Smoking of tobacco is known to have a synergistic effect in combination with, for example, inhaled particulates.

15.12 At present the understanding of interaction effects is incomplete. The knowledge that such effects can occur is reason to maintain the concentrations of individual substances as low as is practicable under complex exposure conditions.

* As an aid to memory, *synergism* can be thought of as $2 + 2 = 6$; *potentiation* as $2 + 0 = 6$.

16. REFINED PETROLEUM SOLVENT MIXTURES

16.1 Petroleum products consist of complex mixtures of hydrocarbon compounds which share similar chemical and physical properties. Petroleum solvents are often distinguished on the basis of the boiling range of the mixture, while the actual composition of the product is determined by the crude feed stock from which the product is derived and the subsequent processing and blending.

16.2 Refined petroleum solvents are usually mixtures of straight and branched-chain alkanes (paraffins), cyclic alkanes (naphthenes), alkenes (olefins) and the aromatics (for example, benzene and its homologues). Due to different manufacturing processes, and the complexity of the mixtures, detailed information on the exact solvent composition may not be available from the manufacturers nor may it be necessary for assessment of occupational exposure.

16.3 While the components of these petroleum products share some similar physical and chemical characteristics, the toxicological properties of these components can be quite different. For this reason, where generic standards are not available or when toxic components are known to be present, it is usually necessary to determine the atmospheric concentration of each of the major or toxic components and compare these with the appropriate individual exposure standard.

16.4 The volatility of the various components in the liquid solvent mixture will determine the relative concentrations of these components found in the vapour state. For this reason, it is necessary when determining the airborne concentration for solvent mixtures to measure the concentration of those individual toxic components, for example, benzene and n-hexane, which more strongly influence the toxicological properties of the solvent mixture. In most instances it will be the proportion of these components which will determine whether the applicable exposure standards have been exceeded. Information regarding the concentrations of toxicologically significant components of the solvent mixture can be obtained from the supplier or refining company.

16.5 The petroleum solvent mixtures which have been assigned exposure standards are listed in the following table. These values were derived from typical compositional data of samples supplied to the Australian Institute of Petroleum Occupational Hygiene Committee by Australian manufacturers. Users should recognise that these are only approximate values. These values should only be used as guidance for the control of exposure on condition that toxic components, such as benzene and n-hexane, are not present, and detailed solvent composition data are not available.

| Substance | CAS No. | TWA Exposure Standards (mg/m ³) |
|--------------------|-------------|---|
| Mineral turpentine | - | 480 (R) |
| Petrol (gasoline) | - | 900 (R) |
| White spirits | [8052-41-3] | 790 (R) |

(R) indicates value requiring review

16.6 Rubber solvent is not included in this table because its composition can vary widely from supplier to supplier.

17. FUMES AND GASES FROM WELDING AND CUTTING PROCESSES

17.1 The fumes and gases arising from welding and cutting processes may contain a number of contaminants, the composition and quantity of which are determined by the metals being welded or cut, the nature of the processes, and the fluxes, shield gases, or electrode coatings, if any, being used. In addition, the welding/cutting arc may cause reactions which produce oxides of nitrogen, carbon monoxide and other gaseous contaminants. The intense ultraviolet radiation emitted from some arcs may also give rise to significant quantities of ozone.

17.2 Therefore, when assessing a particular welding process, consideration should be given not only to the airborne concentration of toxic metals, such as chromium and nickel, which may arise from the parent metal or electrode, but also to the concentration of toxic gases which may be generated by the process. In addition to complying with these individual exposure standards for specific contaminants, where current manual welding processes are used, the fume concentration inside the welder's helmet should not exceed 5 mg/m^3 when collected in accordance with the appropriate Australian Standard.³⁹

18. THERMAL DECOMPOSITION PRODUCTS OF PLASTICS

18.1 When subject to the normal melt processing temperatures, usually 200-300°C, most plastics would produce complex mixtures of small quantities of toxic vapours, usually at concentrations considerably below their exposure standards.⁵⁵⁻⁵⁸ However, irritant aerosols and gases can also be produced which may cause complaints of sensory irritation if the process is not controlled properly.

18.2 All plastics emit toxic and irritant fumes with increasing temperatures. However, the evolution rate and composition of the fumes emitted vary for different plastics and are strongly temperature dependent. Some common examples include thermoplastics such as polyvinylchloride (PVC), polyethylene (PE), polypropylene (PP), polystyrene (PS), acrylonitrile-butadiene-styrene (ABS) copolymer, and polytetrafluoroethylene (PTFE).

18.3 Pyrolysis products, given off at higher temperatures,⁵⁹ require special consideration. The health effects of hot-wire cutting of PS foams and PVC and PE films have been studied.⁶⁰⁻⁶² Polymer fume fever has been shown to be caused by the pyrolysis products of PTFE (teflon).⁶³

18.4 This issue is being considered by the Exposure Standards Expert Working Group (see Appendix 3). At present, no exposure standard has been recommended and exposure should be kept as low as practicable.

19. EXPRESSION OF EXPOSURE STANDARDS

19.1 The following sections refer to the data presented in the National Commission's *Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment* [NOHSC:1003(1995)].

CHEMICAL NOMENCLATURE

19.2 The chemical names used in this publication conform with the nomenclature rules of the International Union of Pure and Applied Chemistry (IUPAC) or with common usage. In some cases, abbreviations may be used. An agent will only be listed under one name, and some of its other names, that is, its generic, chemical, common and trade names, will be cross-referenced in the index of synonyms which appears at Appendix 4. This appendix should be consulted when a first attempt to locate a chemical is unsuccessful.

19.3 With the exception of 'iso' and 'cyclo', all prefixes, for example, o-, m-, p-, bis, n-, sec-, tert-, N-, are disregarded when listing the main entries in alphabetical order.

CAS NUMBER

19.4 The CAS No. is a unique numerical identifier which is assigned to each individual chemical entity. This number, which has the format [xxxxxx-xx-x], consisting of up to nine digits, has no chemical significance other than to unambiguously identify a particular substance, particularly in computerised literature retrieval systems.

19.5 Most substances in the exposure standard listing are quoted with their CAS No. However, this number is not usually assigned to mixtures of unknown or varying composition, to broad classes of compounds or to the various physical forms of a particular substance.

19.6 Appendix 5 lists substances addressed in this publication sorted by CAS No.

UNITS FOR EXPOSURE STANDARDS

19.7 In the lists of exposure standards in this publication, the airborne concentrations of gases, vapours and particulate contaminants are expressed gravimetrically as milligrams of substance per cubic metre of air, (mg/m^3). For gases and vapours the concentration is also, with a few exceptions, indicated in parts per million (ppm) by volume. Where both gravimetric and volumetric values are given, the volumetric (ppm) value is exact and should be used as it is not affected by changes in temperature and pressure.

19.8 Because the gravimetric units of mg/m^3 are affected by temperature and pressure variations, all exposure standards are expressed relative to standard conditions of 25°C and 1 atmosphere pressure (101.3 kPa).

19.9 The following conversion formula can be used to convert from ppm to mg/m^3 :

$$\text{Concentration in } \text{mg}/\text{m}^3 = \frac{\text{molecular weight} \times \text{concentration in ppm}}{24.4}$$

Where 24.4 = molar volume in litres at 25°C and 101.3 kPa.

19.10 In some instances, especially with organo-metallic compounds, the exposure standard is expressed in terms of the major elemental component of the substance or the chemical species upon which the analytical determination is based. An explanation of the chemical symbols used in the list of adopted exposure standards appears at Appendix 6. For example, the exposure standard for tin oxide or inorganic tin is considerably higher than that for organo-tin compounds, although both are expressed in terms of an elemental tin concentration.

**TERMS OF REFERENCE OF THE EXPOSURE STANDARDS
EXPERT WORKING GROUP**

A1.1 The terms of reference of the Exposure Standards Expert Working Group were determined by the National Commission's Executive at its 17th meeting on 29 September 1988. These terms of reference are:

Consider and recommend options to the Standards Development Standing Committee on occupational exposure standards for atmospheric contaminants based on consideration of the best available technical data from Australian and overseas sources.

Note: The terms of reference are currently under review.

MEMBERSHIP OF THE EXPOSURE STANDARDS EXPERT WORKING GROUP

A2.1 Membership of the Exposure Standards Expert Working Group at January 1995 comprised the following members.

| | |
|------------------------------|---|
| Ms L Onyon (Chairperson) | Manager, Existing Chemicals, Chemical Assessment Division, Worksafe Australia |
| Dr A Bonin | Head, Toxicology Unit, Research, Science and Statistics Division, Worksafe Australia |
| Dr S Corbett | Manager, Environmental Health Section, Epidemiology Branch, New South Wales Health Department |
| Dr C Grygorcewicz | Senior Occupational Hygienist, Occupational Health Division, Department for Industrial Affairs (South Australia) |
| Mr G Odgers | Research Officer, URCOT (Victoria) |
| Mr A Rogers | Head, Occupational Hygiene and Safety Unit, Research, Science and Statistics Division, Worksafe Australia |
| Mr G Saunders | Coordinator, Chemical Safety Unit, WorkCover Authority (New South Wales) |
| Dr N Stacey | Executive Director, Research, Science and Statistics Division, Worksafe Australia |
| Mr N Wendt | Occupational Health and Safety Coordinator, BHP Australia Coal Limited (Queensland) |
| Ms D Wilcocks (Secretary) | Senior Professional Officer, Chemical Regulatory Instruments, Chemical Assessment Division, Worksafe Australia |

A2.2 Individual members were nominated to the Exposure Standards Expert Working Group on the basis of their expertise in specific occupational health and safety areas. The recommendations of the Exposure Standards Expert Working Group are subject to review by the tripartite Standards Development Standing Committee and the National Commission, where the social, economic and technological implications of these recommendations are considered.

A2.3 All requests for interpretations of exposure standards should be made in writing and directed to the Secretary of the Exposure Standards Expert Working Group.

A2.4 The provisions of this publication may not necessarily reflect the views of individual members of the Exposure Standards Expert Working Group.

ISSUES AND SUBSTANCES UNDER REVIEW

ISSUES

A3.1 The following issues have been identified by the Exposure Standards Expert Working Group as requiring further review.

| Issue | Details |
|-----------------------|---|
| Altered work shifts | How should exposure standards be adjusted for working schedules markedly different from the normal eight-hour day, five-day working week? |
| Approach on excursion | The toxicological basis and analytical practicability limits of various approaches. |
| Thermal decomposition | Patterns of thermal decomposition and the products of plastics toxicology of products thereof. |

SUBSTANCES

A3.2 Substances listed in the following table have been identified by the Exposure Standards Expert Working Group as requiring further review.

A3.3 The Exposure Standards Expert Working Group will be collecting and evaluating relevant occupational health data on these substances. Draft documentation will be prepared to assist the Exposure Standards Expert Working Group in its consideration of these substances.

A3.4 Interested parties are encouraged to submit any relevant information on these substances. Ideally such submissions should be accompanied by actual exposure data and a description of any observed health effects. An indication of whether the monitoring data refers to an eight-hour time-weighted average or short term exposure, and a brief description of the work procedures involved would be useful. Submissions on these substances should be sent to the following address:

The Chief Executive Officer
National Occupational Health and Safety Commission
GPO Box 58
SYDNEY NSW 2001
Attention: Secretary
Exposure Standards Expert Working Group
Chemical Assessment Division

SUBSTANCES REQUIRING REVIEW

| Substance | Reason for Review |
|---|---|
| Acetaldehyde | Sensory irritation |
| Atrazine | Chronic systemic effects |
| Benzene | Carcinogenicity |
| 2-Butoxyethanol | Reproductive and haemolytic effects |
| Cadmium (respirable particulate mass) | Establishment of exposure standard |
| Carbaryl | Study of skin absorption |
| Carbon disulphide | Neurological and cardiovascular effects |
| Chromium (VI) compounds, certain water insoluble | Carcinogenicity |
| Chromium (VI) compounds, water soluble | Respiratory irritation and effects of the kidneys |
| Epichlorohydrin | Unreviewed new data |
| Ethyl benzene | Study of skin absorption |
| Ethylene dichloride | Carcinogenic potential |
| Fluorine | Irritant effects |
| Formaldehyde | Irritant effects |
| Heptachlor | Carcinogenicity |
| Isopropyl alcohol | Sensory irritation |
| Lead, inorganic | Chronic intoxication |
| Mercury, aryl | Effects on central nervous system |
| Mercury, inorganic | Effects on central nervous system |
| 4,4'-Methylene bis(2-chloroaniline) | Suitability for an exposure standard |
| Methyl hydrazine | Review of exposure standard |
| Methyl isobutyl ketone | Study of skin absorption |
| Methyl n-butyl ketone | Study of skin absorption |
| 1-Methyl-2-pyrrolidone | Establishment of exposure standard |
| Methylene chloride | Study of skin absorption |
| Mica | Pneumoconiotic potential |
| Mineral turpentine | Typical composition of the solvent |
| Nickel and compounds | Carcinogenic potential |
| Niobium/rare earths | Establishment of exposure standard |
| Nitrogen dioxide | Respiratory effects |
| Paraquat | Study of skin absorption |
| PCBs | Carcinogenicity |
| Petrol (gasoline) | Typical composition of the solvent |
| Phosphine | Respiratory effects |
| Propylene glycol monomethyl ether | Study of skin absorption |
| Propylene oxide | Carcinogenicity |
| Rubber fumes and dust | Establishment of exposure standard |
| Talc | Health effects of talc containing no asbestos fibres |

Toluene
Triethanolamine
Turpentine (wood)
Viny chloride, monomer
Vinylidene chloride
White spirits
Wood dust
Xylene

Study of skin absorption
Carcinogenicity
Study of skin absorption
Carcinogenicity
Carcinogenic potential
Typical composition of the solvent
Health effects from dust of Australian woods
Study of skin absorption

ACT Government
LIBRARY

LIST OF SYNONYMS

A4.1 This list of synonyms and trade names should be consulted when a first attempt to locate a chemical in the National Commission's *Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment* [NOHSC:1003(1995)] is unsuccessful.

| Synonym | Substance | [CAS No.] |
|--|--------------------------|--------------|
| Abate® | Temephos | [3383-96-8] |
| Acetic acid ethyl ester | Ethyl acetate | [141-78-6] |
| Acetic ester | Ethyl acetate | [141-78-6] |
| Acetylene dichloride | 1,2-Dichloroethylene | [540-59-0] |
| Acetylene tetrabromide | 1,1,2,2-Tetrabromoethane | [79-27-6] |
| Acrylaldehyde | Acrolein | [107-02-8] |
| Acrylic acid, ethyl ester | Ethyl acrylate | [140-88-5] |
| Acrylic acid, methyl ester | Methyl acrylate | [96-33-3] |
| Acrylic acid, n-butyl ester | Butyl acrylate | [141-32-2] |
| AGE | Allyl glycidyl ether | [106-92-3] |
| Allyl-2,3-epoxypropyl ether | Allyl glycidyl ether | [106-92-3] |
| Aminocyclohexane | Cyclohexylamine | [108-91-8] |
| Aminodimethyl benzene | Xylidine | [1300-73-8] |
| 2-Aminoethanol | Ethanolamine | [141-43-5] |
| 2-Aminopropane | Isopropylamine | [75-31-0] |
| 3-Amino-1,2,4-triazole | Amitrole | [61-82-5] |
| Ammate® | Ammonium sulphamate | [7773-06-0] |
| Anone | Cyclohexanone | [108-94-1] |
| Araldite PT 810® | Triglycidylisocyanurate | [2451-62-9] |
| Arprocarb | Propoxur | [114-26-1] |
| Asphalt (petroleum) | Bitumen | [8052-42-4] |
| Aspirin | Acetyl salicylic acid | [50-78-2] |
| Aziridine | Ethylenimine | [151-56-4] |
| Azodrin® | Monocrotophos | [6923-22-4] |
| Baygon® | Propoxur | [114-26-1] |
| Baytex® | Fenthion | [55-38-9] |
| Benlate® | Benomyl | [17804-35-2] |
| 1,2-Benzenediamine | o-Phenylenediamine | [95-54-5] |
| 1,3-Benzenediamine | m-Phenylenediamine | [108-45-2] |
| 1,4-Benzenediamine | p-Phenylenediamine | [106-50-3] |
| Benzenethiol | Phenyl mercaptan | [108-98-5] |
| Benzene-1,2,4-tricarboxylic acid-1,2-anhydride | Trimellitic anhydride | [552-30-7] |
| 1,2-Benzophenanthrene | Chrysene | [218-01-9] |
| p-Benzoquinone | Quinone | [106-51-4] |
| BGE | n-Butyl glycidyl ether | [2426-08-6] |
| Y-BHC (ISO) | Lindane | [58-89-9] |
| Bidrin® | Dicrotophos | [141-66-2] |

| | | |
|--|--|--------------|
| Bolstar® | Sulprofos | [35400-43-2] |
| Borax | Borates, tetra sodium salts, decahydrate | [1303-96-4] |
| Bornan-2-one | Camphor, synthetic | [76-22-2] |
| Bromochloromethane | Chlorobromomethane | [74-97-5] |
| Bromoethane | Ethyl bromide | [74-96-4] |
| Bromoethylene | Vinyl bromide | [593-60-2] |
| Bromomethane | Methyl bromide | [74-83-9] |
| Bromotrifluoromethane | Trifluorobromomethane | [75-63-8] |
| Butanethiol | Butyl mercaptan | [109-79-5] |
| tert-Butanol | tert-Butyl alcohol | [75-65-0] |
| iso-Butanol | Isobutyl alcohol | [78-83-1] |
| sec-Butanol | sec-Butyl alcohol | [78-92-2] |
| n-Butanol | n-Butyl alcohol | [78-36-3] |
| Butan-2-ol | sec-Butyl alcohol | [78-92-2] |
| 2-Butanone | Methyl ethyl ketone (MEK) | [78-93-3] |
| 1-Butoxy-2,3-epoxypropane | n-Butyl glycidyl ether | [2426-08-6] |
| Butyl cellosolve® | 2-Butoxyethanol | [111-76-2] |
| trans-But-2-enal | Crotonaldehyde | [4170-30-3] |
| Butyl-2,3-epoxypropyl ether | n-Butyl glycidyl ether | [2426-08-6] |
| Butyl glycol | 2-Butoxyethanol | [111-76-2] |
| Calcium carbimide | Calcium cyanamide | [156-62-7] |
| Camphechlor | Chlorinated camphene | [8001-35-2] |
| Carbonyl chloride | Phosgene | [75-44-5] |
| Cellosolve | 2-Ethoxyethanol | [110-80-5] |
| Cellosolve acetate® | 2-Ethoxyethyl acetate | [111-15-9] |
| Cesium hydroxide | Caesium hydroxide | [21351-79-1] |
| Chloroacetic acid chloride | Chloroacetyl chloride | [74-04-9] |
| Y-Chloroallyl chloride | Dichloropropene | [542-75-6] |
| Chlorobiphenyl | PCBs (54% Chlorine) | [11097-69-1] |
| Chlorobiphenyl | PCBs (42% Chlorine) | [53469-21-9] |
| 2-Chloro-1,3-butadiene | B-Chloroprene | [126-99-8] |
| 1-Chloro-2,3-epoxy-propane | Epichlorohydrin | [106-89-8] |
| Chloroethane | Ethyl chloride | [75-00-3] |
| 2-Chloroethanol | Ethylene chlorohydrin | [107-07-3] |
| Chloroethylene | Vinyl chloride | [75-01-4] |
| bis-(2-Chloroethyl)-ether | Dichloroethyl ether | [111-44-4] |
| Chloromethane | Methyl chloride | [74-87-3] |
| p-Chloronitrobenzene | p-Nitrochlorobenzene | [100-00-5] |
| 2,2-Bis(p-Chlorophenyl)-1,1,1-trichloroethane | DDT (Dichlorodiphenyl trichloroethane) | [50-29-3] |
| 3-Chloro-1-propene | Allyl chloride | [107-05-1] |
| a-Chlorotoluene | Benzyl chloride | [100-44-7] |
| 2-Chloro-6-(trichloromethyl)pyridine | Nitrapyrin | [1929-82-4] |
| 2-Chloro-1,1,2-trifluoroethyl-difluoromethyl ether | Enflurane | [13838-16-9] |

| | | |
|---|---|-------------|
| Chromic acid | see Chromium (VI) compounds, water soluble in main table | |
| Chromium trioxide | see Chromium (VI) compounds, water soluble in main table | |
| Coyden® | Clopidol | [2971-90-6] |
| Crag herbicide® | Sesone | [136-78-7] |
| Cryofluorane | Dichlorotetrafluoroethane | [76-14-2] |
| DADPM | 4,4'-Methylene dianiline | [101-77-9] |
| Dalapon | 2,2-Dichloropropionic acid | [75-99-0] |
| Dasanit® | Fensulfothion | [115-90-2] |
| DDM | 4,4'-Methylene dianiline | [101-77-9] |
| DDVP | Dichlorvos | [62-73-7] |
| Delnav® | Dioxathion | [78-34-2] |
| Demeton-S-methyl | Methyl demeton | [8022-00-2] |
| Derris, commercial | Rotenone (commercial) | [83-79-4] |
| 2,4-DES | Sesone | [136-78-7] |
| DGE | Diglycidyl ether | [2238-07-5] |
| Diamine | Hydrazine | [302-01-2] |
| 1,2-Diaminoethane | Ethylenediamine | [107-15-3] |
| 2,2'-Diaminodiethylamine | Diethylene triamine | [111-40-0] |
| 4,4'-Diaminodiphenyl | Benzidine | [92-87-5] |
| p,p'-Diaminodiphenylmethane | 4,4'-Methylene dianiline | [101-77-9] |
| Dibenzoyl peroxide | Benzoyl peroxide | [94-36-0] |
| Dibismuth tritelluride | Bismuth telluride | [1304-82-1] |
| Diboron trioxide | Boron oxide | [1303-86-2] |
| Dibrom® | Naled | [300-76-5] |
| Dibromodifluoromethane | Difluorodibromomethane | [75-61-6] |
| 1,2-Dibromoethane | Ethylene dibromide | [106-93-4] |
| 1,2-Dibromoethylene | Acetylene tetrabromide | [79-27-6] |
| N,N-Di-n-butylaminoethanol | 2-N-Dibutylaminoethanol | [102-81-8] |
| Dibutyl hydrogen phosphate | Dibutyl phosphate | [107-66-4] |
| 6,6'-Di-tert-butyl-4,4'- thiodi-m-cresol | 4,4'-Thiobis(6-tert, butyl-m-cresol) | [96-69-5] |
| p,p-Dichlorodiphenyl trichloroethane | DDT (Dichlorodiphenyl trichloroethane) | [50-29-3] |
| 1,2-Dichloroethane | Ethylene dichloride | [107-06-2] |
| 1,1-Dichloroethylene | Vinylidene chloride | [75-35-4] |
| Dichloromethane | Methylene chloride | [75-09-2] |
| 2,2'-Dichloro-4,4'- methylenedianiline | 4,4'-Methylene bis(2-chloroaniline) | [101-14-4] |
| 2,4-Dichlorophenoxyacetic acid | 2,4-D | [94-75-7] |
| 1,2-Dichloropropane | Propylene dichloride | [78-87-5] |
| Diethyl ether | Ethyl ether | [60-29-7] |
| Diethylene dioxide | Dioxane | [123-91-1] |
| Di-(2-ethylhexyl) phthalate | Di-sec-octyl phthalate | [117-81-7] |
| Difluorochloromethane | Chlorodifluoromethane | [75-45-6] |
| Difluorochloromethane | Dichlorodifluoromethane | [75-71-8] |
| Difolatan® | Captafol | [2425-06-1] |

| | | |
|---|---|--------------|
| m-Dihydroxybenzene | Resorcinol | [108-46-3] |
| o-Dihydroxybenzene | Catechol | [120-80-9] |
| p-Dihydroxybenzene | Hydroquinone | [123-31-9] |
| Diisopropyl ether | Isopropyl ether | [108-20-3] |
| Dimethoxymethane | Methylal | [109-87-5] |
| Dimethylaminobenzene | Xylidine | [1300-73-8] |
| Dimethylbenzene | Xylene (o-, m-, p-isomers) | [1330-20-7] |
| 3,3'-Dimethylbenzidine | o-Tolidine | [119-93-7] |
| 1,3-Dimethyl butyl acetate | sec-Hexyl acetate | [108-84-9] |
| Dimethyl-1,2-dibromo -2-dichloroethylphosphate | Naled | [300-76-5] |
| 2,6-Dimethyl-4-heptanone | Diisobutyl ketone | [108-83-8] |
| N,N-Dimethylnitrosamine | N-Nitrosodimethylamine | [62-75-9] |
| Dinitrogen monoxide | Nitrous oxide | [10024-97-2] |
| 3,5-Dinitro-o-toluamide | Dinitolmide | [148-01-6] |
| Diphenyl | Biphenyl | [92-52-4] |
| Diphenyl ether | Phenyl ether | [101-84-8] |
| Diphenylmethane diisocyanate | Methylene bisphenyl isocyanate (MDI) | [101-68-8] |
| Diphosphorous pentasulphide | Phosphorous pentasulphide | [1314-80-3] |
| Diquat dibromide (ISO) | Diquat | [85-00-7] |
| Disodium tetraborate decahydrate | Borates, tetra, sodium salts, decahydrate | [1303-96-4] |
| Disodium tetraborate anhydrous | Borates, tetra, sodium salts anhydrous | [1303-96-4] |
| Disodium tetraborate pentahydrate | Borates, tetra, sodium salts, pentahydrate | [1303-96-4] |
| Disulphur decafluoride | Sulphur pentafluoride | [5714-22-7] |
| Disulphur dichloride | Sulphur monochloride | [10025-67-9] |
| Disodium disulphite | Sodium metabisulphite | [7681-57-4] |
| Disyston® | Disulfoton | [298-04-4] |
| DMDT | Methoxychlor | [72-43-5] |
| DNOC | Dinitro-o-cresol | [534-52-1] |
| DOP | Di-sec-octyl phthalate | [117-81-7] |
| Dursban® | Chlorpyrifos | [2921-88-2] |
| Dyfonate® | Fonofos | [944-22-9] |
| EDB | Ethylene dibromide | [106-93-4] |
| EGDN | Ethylene glycol dinitrate | [628-96-6] |
| 1,2-Epoxy-4(epoxy- ethyl)-cyclohexane | Vinyl cyclohexene dioxide | [106-87-6] |
| 1,2-Epoxypropane | Propylene oxide | [75-56-9] |
| 2,3-Epoxy-1-propanol | Glycidol | [556-52-5] |
| bis(2,3-Epoxy propyl) ether | Diglycidyl ether (DGE) | [2238-07-5] |
| 2,3-Epoxypropyl isopropyl ether | Isopropyl glycidyl ether (IGE) | [4016-14-2] |
| Ethane-1,2-diol | Ethylene glycol | [107-21-1] |
| Ethanethiol | Ethyl mercaptan | [75-08-1] |
| Ethanol | Ethyl alcohol | [64-17-5] |
| Ethene | Ethylene | [74-85-1] |

| | | |
|--|---------------------------------------|-------------|
| Ethylene dinitrate | Ethylene glycol dinitrate | [628-96-6] |
| Ethylene glycol, monobutyl ether | 2-Butoxyethanol | [111-76-2] |
| Ethylene glycol, monoethyl ether | 2-Ethoxyethanol | [110-80-5] |
| Ethylene glycol, monoethyl ether acetate | 2-Ethoxyethyl acetate | [111-15-9] |
| Ethylene glycol monomethyl ether | 2-Methoxyethanol | [109-86-4] |
| Ethylene glycol monomethyl ether acetate | 2-Methoxyethyl acetate | [110-49-6] |
| Ethyl glycol | 2-Ethoxyethanol | [110-80-5] |
| Ethyl glycol acetate | 2-Ethoxyethyl acetate | [111-15-9] |
| Bis(2-Ethylhexyl) phthalate ² | Di-sec-octyl phthalate | [117-81-7] |
| Ethylidene chloride | 1,1-Dichloroethane | [75-34-3] |
| o-Ethyl-o-(4-nitrophenyl)-phenyl-thiophosphonate | EPN | [2104-64-5] |
| Ethyne | Acetylene | [74-86-2] |
| Fenchlorphos | Ronnel | [299-84-3] |
| Ferrocene | Dicyclopentadienyl iron | [102-54-5] |
| Fluorocarbon 11 (Freon 11) | Trichlorofluoromethane | [75-69-4] |
| Fluorocarbon 12 (Freon 12) | Dichlorodifluoromethane | [75-71-8] |
| Fluorocarbon 21 (Freon 21) | Dichlorofluoromethane | [75-43-4] |
| Fluorocarbon 22 (Freon 22) | Chlorodifluoromethane | [75-45-6] |
| Fluorocarbon 113 (Freon 113) | 1,1,2-Trichloro-1,2,2-trifluoroethane | [76-13-1] |
| Fluorocarbon 114 (Freon 114) | Dichlorotetrafluoroethane | [76-14-2] |
| Fluorocarbon 115 (Freon 115) | Chloropentafluoroethane | [76-15-3] |
| Fluorocarbon 13B1 | Trifluorobromomethane | [75-63-8] |
| Fluorodichloromethane | Dichlorofluoromethane | [75-43-4] |
| Fluorotrichloromethane | Trichlorofluoromethane | [75-69-4] |
| Formic acid, ethyl ester | Ethyl formate | [109-94-4] |
| Formic acid, methyl ester | Methyl formate | [107-31-3] |
| Furadan® | Carbofuran | [1563-66-2] |
| 2-Furaldehyde | Furfural | [98-01-1] |
| Gammexane® | Lindane | [58-89-9] |
| Gasoline | Petrol | |
| Germane | Germanium tetrahydride | [7782-65-2] |
| Glass, fibrous or dust | Synthetic mineral fibres | |
| Glycol trinitrate | Nitroglycerin (NG) | [55-63-0] |
| Glycol dinitrate | Ethylene glycol dinitrate | [628-96-6] |
| Glycol, monobutyl ether | 2-Butoxyethanol | [111-76-2] |
| Glycol, monoethyl ether | 2-Ethoxyethanol | [110-80-5] |
| Glycol, monoethyl ether acetate | 2-Ethoxyethyl acetate | [111-15-9] |
| Glycol monomethyl ether | 2-Methoxyethanol | [109-86-4] |
| Glycol monomethyl ether acetate | 2-Methoxyethyl acetate | [110-49-6] |
| Guthion® | Azinphos-methyl | [86-50-0] |
| Gypsum | Calcium sulphate | [7778-18-9] |
| Y-HCH | Lindane | [58-89-9] |
| HDI | 1,6-Hexamethylene diisocyanate | [822-06-0] |

| | | |
|--|---|--------------|
| HEMPA | Hexamethyl phosphoramidate | [680-31-9] |
| 2-Heptanone | Methyl n-amyl ketone | [110-43-0] |
| 3-Heptanone | Ethyl butyl ketone | [106-35-4] |
| 4-Heptanone | Dipropyl ketone | [123-19-3] |
| Y-Hexachlorocyclohexane | Lindane | [58-89-9] |
| Hexahydro-1,3,5-trinitro -1,3,5-triazine | Cyclonite | [121-82-4] |
| 2-Hexanone | Methyl n-butyl ketone | [591-78-6] |
| Hexone | Methyl isobutyl ketone | [108-10-1] |
| Hydrochloric acid | Hydrogen chloride | [7647-01-0] |
| Hydrocyanic acid | Hydrogen cyanide | [74-90-8] |
| 4-Hydroxy-4-methyl -2-pentanone | Diacetone alcohol | [123-42-2] |
| IGE | Isopropyl glycidyl ether | [4016-14-2] |
| Isoamyl methyl ketone | Methyl isoamyl ketone | [110-12-3] |
| 2,2'-Iminodiethanol | Diethanolamine | [111-42-2] |
| Iodomethane | Methyl iodide | [74-88-4] |
| IPDI | Isophorone diisocyanate | [4098-71-4] |
| Isopentyl acetate | Isoamyl acetate | [123-92-2] |
| Isopropyl benzene | Cumene | [98-82-8] |
| Lannate® | Methomyl | [16752-77-5] |
| Laughing gas | Nitrous oxide | [10024-97-2] |
| Lebaycid® | Fenthion | [55-38-9] |
| Limestone | Calcium carbonate | [1317-65-3] |
| Maldison | Malathion | [121-75-5] |
| Man-made mineral fibres | Synthetic mineral fibres | |
| Manganese tetroxide | see Manganese (fume) in main table | [7439-96-5] |
| Marble | Calcium carbonate | [1317-65-3] |
| MBOCA | 4,4'-Methylene bis (2-chloroaniline) | [101-14-4] |
| MDA | 4,4'-Methylene dianiline | [101-77-9] |
| MDI | Methylene bisphenyl isocyanate | [101-68-8] |
| MEK | Methyl ethyl ketone (MEK) | [78-93-3] |
| MEKP | Methyl ethyl ketone peroxide | [1338-23-4] |
| Mequinol (INN) | 4-Methoxyphenol | [150-76-5] |
| Mercaptoacetic acid | Thioglycolic acid | [68-11-1] |
| Metasystox | Methyl demeton | [8022-00-2] |
| Methacrylic acid, methyl ester | Methyl methacrylate | [80-62-6] |
| Methanethiol | Methyl mercaptan | [74-93-1] |
| Methanol | Methyl alcohol | [67-56-1] |
| Methoxyaniline | Anisidine (o-,p-isomers) | [29191-52-4] |
| 2,2-bis(p-Methoxyphenyl) -1,1,1-trichloroethane | Methoxychlor | [72-43-5] |
| 1-Methoxypropan-2-ol | Propylene glycol monomethyl ether | [107-98-2] |
| bis-(2-Methoxypropyl) ether | Dipropylene glycol, methyl ether | [34590-94-8] |
| Methyl amyl alcohol | Methyl isobutyl carbinol | [108-11-2] |

| | | |
|------------------------------------|---|--------------|
| 3-Methylbutan-1-ol | Isoamyl alcohol | [123-51-3] |
| 3-Methyl-2-butanone | Methyl isopropyl ketone | [563-80-4] |
| 1-Methylbutyl acetate | sec-Amyl acetate | [626-38-0] |
| Methyl cellosolve® | 2-Methoxyethanol | [109-86-4] |
| Methyl cellosolve acetate® | 2-Methoxyethyl acetate | [110-49-6] |
| Methyl chloroform | 1,1,1-Trichloroethane | [71-55-6] |
| 2-Methyl-4,6-dinitrophenol | Dinitro-o-cresol | [534-52-1] |
| Methyl glycol | 2-Methoxyethanol | [109-86-4] |
| Methyl glycol acetate | 2-Methoxyethyl acetate | [110-49-6] |
| 5-Methylheptan-3-one | Ethyl amyl ketone | [541-85-5] |
| 5-Methyl-2-hexanone | Methyl isoamyl ketone | [110-12-3] |
| 2-Methylpentane-2,4-diol | Hexylene glycol | [107-41-5] |
| 4-Methylpent-3-en-2-one | Mesityl oxide | [141-79-7] |
| 2-Methylpropan-1-ol | Isobutyl alcohol | [78-83-1] |
| 2-Methylpropan-2-ol | tert-Butyl alcohol | [75-65-0] |
| 4-Methyl-2-pentanone | Methyl isobutyl ketone | [108-10-1] |
| Methyl styrene | Vinyl toluene | [25013-15-4] |
| N-Methyl-N-2,4,6-tetranitroaniline | | |
| MIBK | Teteryl | [479-45-8] |
| MOCA | Methyl isobutyl ketone | [108-10-1] |
| | 4,4'-methylene bis (2-chloroaniline) | [101-14-4] |
| 2-naphthyl thiourea | ANTU | [86-88-4] |
| Nemacur® | Fenamiphos | [22224-92-6] |
| NG | Nitroglycerin (NG) | [55-63-0] |
| Nialate® | Ethion | [563-12-2] |
| Nitroglycol | Ethylene glycol dinitrate | [628-96-6] |
| Nitrogen monoxide | Nitric oxide | [10102-43-9] |
| Octafluoroisobutylene | Perfluoroisobutylene | [382-21-8] |
| Orthophosphoric acid | Phosphoric acid | [7664-38-2] |
| Oxalonitrile | Cyanogen | [460-19-5] |
| Oxirane | Ethylene oxide | [75-21-8] |
| Paraquat dichloride (ISO) | Paraquat | [4685-14-7] |
| 1,5-Pentanedial | Glutaraldehyde | [111-30-8] |
| 2-Pentanone | Methyl propyl ketone | [107-87-9] |
| 3-Pentanone | Diethyl ketone | [96-22-0] |
| Pentyl acetate | n-Amyl acetate | [628-63-7] |
| PGE | Phenyl glycidyl ether | [122-60-1] |
| PHC | Propoxur | [114-26-1] |
| Phenacyl chloride | a-Chloroacetophenone | [532-27-4] |
| Phenylbenzene | Biphenyl | [92-52-4] |
| Phenyl-2,3-epoxypropyl ether | Phenyl glycidyl ether | [122-60-1] |
| Phenylethylene | Styrene, monomer | [100-42-5] |
| 4-Phenyl-nitrobenzene | 4-Nitrodiphenyl | [92-93-3] |
| 2-Phenylpropene | a-Methyl styrene | [98-83-9] |
| Phosdrin | Mevinphos | [7786-34-7] |
| Phosphoryl trichloride | Phosphorous oxychloride | [10025-87-3] |
| Pival® | Pindone | [83-26-1] |

| | | |
|--|---------------------------|--------------|
| 2-Pivalyl-1,3-indandione | Pindone | [83-26-1] |
| Plaster of Paris | Calcium sulphate | [7778-18-9] |
| Plictran® | Cyhexatin | [13121-70-5] |
| Polychlorinated biphenyls | PCBs | [53469-21-9] |
| Polychlorobiphenyls | PCBs | [53469-21-9] |
| Propan-1-ol | Propyl alcohol | [71-23-8] |
| Propan-2-ol | Isopropyl alcohol | [67-63-0] |
| Propene | Propylene | [115-07-1] |
| Propyne | Methyl acetylene | [74-99-7] |
| Prop-2-yn-1-ol | Propargyl alcohol | [107-19-7] |
| Pyrethrins (ISO) | Pyrethrum | [8003-34-7] |
| 2-Pyridylamine | 2-Aminopyridine | [504-29-0] |
| Pyrocatechol | Catechol | [120-80-9] |
| R-114 | Dichlorotetrafluoroethane | [76-14-2] |
| RDX | Cyclonite | [121-82-4] |
| Sencor | Metribuzin | [21087-64-9] |
| N-Serve® | Nitrapyrin | [1929-82-4] |
| Sevin | Carbaryl | [63-25-2] |
| Silane | Silicon tetrahydride | [7803-62-5] |
| Sodium 2,4-dichloro -phenoxyethyl sulfate | Sesone | [136-78-7] |
| Sodium hydrogen sulphite | Sodium bisulphite | [7631-90-5] |
| Stoddard solvent | White Spirit | [8052-41-3] |
| Systox | Demeton | [8065-48-3] |
| TDI | Toluene-2,4-diisocyanate | [584-84-9] |
| TEDP | Sulfotep | [3689-24-5] |
| 1,1,2,2-Tetrabromoethane | Acetylene tetrabromide | [79-27-6] |
| Tetrabromomethane | Carbon tetrabromide | [558-13-4] |
| Tetracarbonyl nickel | Nickel carbonyl | [13463-39-3] |
| Tetrachloroethylene | Perchloroethylene | [127-18-4] |
| Tetrachloromethane | Carbon tetrachloride | [56-23-5] |
| 0,0,0',0'-Tetraethyl dithiopyrophosphate | Sulfotep | [3689-24-5] |
| Tetraethyl orthosilicate | Ethyl Silicate | [78-10-4] |
| 0,0,0',0'-Tetraethyl pyrophosphate | TEPP | [107-49-3] |
| Tetraethyl thiuram disulphide | Disulfiram | [97-77-8] |
| Tetrafluoro dichloroethane | Dichlorotetrafluoroethane | [76-14-2] |
| Tetramethyl orthosilicate | Methyl Silicate | [681-84-5] |
| Tetramethyl thiuram disulphide | Thiram | [137-26-8] |
| TGIC | Triglycidylisocyanurate | [2451-62-9] |
| Thimet® | Phorate | [298-02-2] |
| Thiodan® | Endosulfan | [115-29-7] |
| TNT | 2,4,6-Trinitrotoluene | [118-96-7] |
| Tordon® | Picloram | [1918-02-1] |
| 1,4,7-Tri-(aza)-heptane | Diethylene triamine | [111-40-0] |
| Tribromomethane | Bromoform | [75-25-2] |

| | | |
|---|---|--------------|
| Tricarbonyl (eta-cyclopentadienyl) manganese | Manganese cyclopentadienyl tricarbonyl | [12079-65-1] |
| Tricarbonyl (methylcyclopentadienyl)- manganese | Methylcyclopentadienyl manganese tricarbonyl | [12108-13-3] |
| 1,1,1-Trichlorobis (chlorophenyl) ethane | DDT (Dichlorodiphenyl trichloroethane) | [50-29-3] |
| Trichloromethane | Chloroform | [67-66-3] |
| Trichloronitromethane | Chloropicrin | [76-06-2] |
| 2,4,5-Trichloro phenoxyacetic acid | 2,4,5-T | [93-76-5] |
| Tricyclohexyltin hydroxide | Cyhexatin | [13121-70-5] |
| 1,1,1-Trifluoro-2-chloro-2- bromoethane | Halothane | [151-67-7] |
| 3,5,5-Trimethylcyclohex -2-enone | Isophorone | [78-59-1] |
| 2,4,6-Trinitrophenol | Picric acid | [88-89-1] |
| 2,4,6-Trinitro phenylmethylnitramine | Tetryl | [479-45-8] |
| Tri-o-tolylphosphate | Triorthocresyl phosphate | [78-30-8] |
| Turpentine | Turpentine (wood) | [8006-64-2] |
| Turps | Mineral turpentine | |
| Vinyl benzene | Styrene, monomer | [100-42-5] |
| Vinyl cyanide | Acrylonitrile | [107-13-1] |
| Whiting | Calcium carbonate | [1317-65-3] |
| Zinc stearate | see Stearates in main table | |
| Zoalene® | Dinitolmide | [148-01-6] |

® Registered Trade Name.

(ISO) International Organization for Standardization.

SUBSTANCES INDEX SORTED BY CAS NUMBER

A5.1 This appendix, sorted by CAS number, contains substances for which national exposure standards have been adopted.

| [CAS No.] | Substance | [CAS No.] | Substance |
|-----------|------------------------|-----------|------------------------|
| [50-00-0] | Formaldehyde | [72-20-8] | Endrin |
| [50-29-3] | DDT | [72-43-5] | Methoxychlor |
| [50-32-8] | Benzo(a)pyrene | [74-82-8] | Methane |
| [50-78-2] | Acetylsalicylic acid | [74-83-9] | Methyl bromide |
| [54-11-5] | Nicotine | [74-84-0] | Ethane |
| [55-38-9] | Fenthion | [74-85-1] | Ethylene |
| [55-63-0] | Nitroglycerin (NG) | [74-86-2] | Acetylene |
| [56-23-5] | Carbon tetrachloride | [74-87-3] | Methyl chloride |
| [56-38-2] | Parathion | [74-88-4] | Methyl iodide |
| [56-81-5] | Glycerin mist | [74-89-5] | Methylamine |
| [57-14-7] | 1,1-Dimethylhydrazine | [74-90-8] | Hydrogen cyanide |
| [57-24-9] | Strychnine | [74-93-1] | Methyl mercaptan |
| [57-50-1] | Sucrose | [74-96-4] | Ethyl bromide |
| [57-57-8] | B-Propiolactone | [74-97-5] | Chlorobromomethane |
| [57-74-9] | Chlordane | [74-98-6] | Propane |
| [58-89-9] | Lindane | [74-99-7] | Methyl acetylene |
| [60-29-7] | Ethyl ether | [75-00-3] | Ethyl chloride |
| [60-34-4] | Methyl hydrazine | [75-01-4] | Vinyl chloride |
| [60-57-1] | Dieldrin | [75-04-7] | Ethylamine |
| [61-82-5] | Amitrole | [75-05-8] | Acetonitrile |
| [62-53-3] | Aniline and homologues | [75-07-0] | Acetaldehyde |
| [62-73-7] | Dichlorvos (DDVP) | [75-08-1] | Ethyl mercaptan |
| [62-74-8] | Sodium fluoroacetate | [75-09-2] | Methylene chloride |
| [62-75-9] | N-Nitrosodimethylamine | [75-12-7] | Formamide |
| [63-25-2] | Carbaryl | [75-15-0] | Carbon disulphide |
| [64-17-5] | Ethyl alcohol | [75-21-8] | Ethylene oxide |
| [64-18-6] | Formic acid | [75-25-2] | Bromoform |
| [64-19-7] | Acetic acid | [75-31-0] | Isopropylamine |
| [67-56-1] | Methyl alcohol | [75-34-3] | 1,1-Dichloroethane |
| [67-63-0] | Isopropyl alcohol | [75-35-4] | Vinylidene chloride |
| [67-64-1] | Acetone | [75-43-4] | Dichlorofluoromethane |
| [67-66-3] | Chloroform | [75-44-5] | Phosgene |
| [67-72-1] | Hexachloroethane | [75-45-6] | Chlorodifluoromethane |
| [68-11-1] | Thioglycolic acid | [75-47-8] | Iodoform |
| [68-12-2] | Dimethylformamide | [75-50-3] | Trimethylamine |
| [71-23-8] | Propyl alcohol | [75-52-5] | Nitromethane |
| [71-36-3] | n-Butyl alcohol | [75-55-8] | Propylene imine |
| [71-43-2] | Benzene | [75-56-9] | Propylene oxide |
| [71-55-6] | 1,1,1-Trichloroethane | [75-61-6] | Difluorodibromomethane |

| | | | |
|-----------|--|------------|--------------------------------------|
| [75-63-8] | Trifluorobromomethane | [83-26-1] | Pindone |
| [75-65-0] | tert-Butyl alcohol | [83-79-4] | Rotenone (commercial) |
| [75-69-4] | Trichlorofluoromethane | [84-66-2] | Diethyl phthalate |
| [75-71-8] | Dichlorodifluoromethane | [84-74-2] | Dibutyl phthalate |
| [75-74-1] | Tetramethyl lead | [85-00-7] | Diquat |
| [75-99-0] | 2,2-Dichloropropionic acid | [85-44-9] | Phthalic anhydride |
| [76-03-9] | Trichloroacetic acid | [86-50-0] | Azinphos-methyl |
| [76-06-2] | Chloropicrin | [86-88-4] | ANTU |
| [76-11-9] | 1,1,1,2-Tetrachloro-2,2-difluoroethane | [87-68-3] | Hexachlorobutadiene |
| [76-12-0] | 1,1,2,2-Tetrachloro-1,2-difluoroethane | [87-86-5] | Pentachlorophenol |
| [76-13-1] | 1,1,2-Trichloro-1,2,2-trifluoroethane | [88-89-1] | Picric acid |
| [76-14-2] | Dichlorotetrafluoroethane | [89-72-5] | o-sec-Butylphenol |
| [76-15-3] | Chloropentafluoroethane | [91-20-3] | Napthalene |
| [76-22-2] | Camphor, synthetic | [91-59-8] | 2-Naphthylamine |
| [76-44-8] | Heptachlor | [91-94-1] | 3,3'-Dichlorobenzidine |
| [77-47-4] | Hexachlorocyclopentadiene | [92-52-4] | Biphenyl |
| [77-73-6] | Dicyclopentadiene | [92-67-1] | 4-Aminodiphenyl |
| [77-78-1] | Dimethyl sulphate | [92-84-2] | Phenothiazine |
| [78-00-2] | Tetraethyl lead | [92-87-5] | Benzidine |
| [78-10-4] | Ethyl silicate | [92-93-3] | 4-Nitrodiphenyl |
| [78-30-8] | Triorthocresyl phosphate | [93-76-5] | 2,4,5-T |
| [78-34-2] | Dioxathion | [94-36-0] | Benzoyl peroxide |
| [78-59-1] | Isophorone | [94-75-7] | 2,4-D |
| [78-83-1] | Isobutyl alcohol | [95-13-6] | Indene |
| [78-87-5] | Propylene dichloride | [95-49-8] | o-Chlorotoluene |
| [78-92-2] | sec-Butyl alcohol | [95-50-1] | o-Dichlorobenzene |
| [78-93-3] | Methyl ethyl ketone | [95-53-4] | o-Toluidine |
| [78-95-5] | Chloroacetone | [95-54-5] | o-Phenylenediamine |
| [79-00-5] | 1,1,2-Trichloroethane | [96-18-4] | 1,2,3-Trichloropropane |
| [79-01-6] | Trichloroethylene | [96-22-0] | Diethyl ketone |
| [79-04-9] | Chloroacetyl chloride | [96-33-3] | Methyl acrylate |
| [79-06-1] | Acrylamide | [96-69-5] | 4,4'-Thiobis(6-tert, butyl-m-cresol) |
| [79-09-4] | Propionic acid | [97-77-8] | Disulfiram |
| [79-10-7] | Acrylic acid | [98-00-0] | Furfuryl alcohol |
| [79-20-9] | Methyl acetate | [98-01-1] | Furfural |
| [79-24-3] | Nitroethane | [98-51-1] | p-tert-Butyltoluene |
| [79-27-6] | 1,1,2,2-Tetrabromoethane | [98-82-8] | Cumene |
| [79-34-5] | 1,1,2,2-Tetrachloroethane | [98-83-9] | a-Methyl styrene |
| [79-41-4] | Methacrylic acid | [98-95-3] | Nitrobenzene |
| [79-44-7] | Dimethyl carbamoyl chloride | [99-08-1] | Nitrotoluene |
| [79-46-9] | 2-Nitropropane | [99-65-0] | m-Dinitrobenzene |
| [80-62-6] | Methyl methacrylate | [100-00-5] | p-Nitrochlorobenzene |
| [81-81-2] | Warfarin | [100-01-6] | p-Nitroaniline |
| [82-68-8] | Pentachloronitrobenzene | [100-25-4] | p-Dinitrobenzene |
| | | [100-37-8] | 2-Diethylaminoethanol |
| | | [100-41-4] | Ethyl benzene |
| | | [100-42-5] | Styrene, monomer |

| | | | |
|------------|---|------------|------------------------|
| [100-44-7] | Benzyl chloride | [108-18-9] | Diisopropylamine |
| [100-61-8] | N-Methyl aniline | [108-20-3] | Isopropyl ether |
| [100-63-0] | Phenylhydrazine | [108-21-4] | Isopropyl acetate |
| [100-74-3] | N-Ethylmorpholine | [108-24-7] | Acetic anhydride |
| [101-14-4] | 4,4'-Methylene bis (2-chloroaniline) | [108-31-6] | Maleic anhydride |
| [101-68-8] | Methylene bisphenylisocyanate (MDI) | [108-44-1] | m-Toluidine |
| [101-77-9] | 4,4'-Methylene dianiline | [108-45-2] | m-Phenylenediamine |
| [101-84-8] | Phenyl ether | [108-46-3] | Resorcinol |
| [102-54-5] | Dicyclopentadienyl iron | [108-83-8] | Diisobutyl ketone |
| [102-81-8] | 2-N-Dibutylaminoethanol | [108-84-9] | sec-Hexyl acetate |
| [105-46-4] | sec-Butyl acetate | [108-87-2] | Methylcyclohexane |
| [105-60-2] | Caprolactam | [108-88-3] | Toluene (toluol) |
| [106-35-4] | Ethyl butyl ketone | [108-90-7] | Chlorobenzene |
| [106-46-7] | p-Dichlorobenzene | [108-91-8] | Cyclohexylamine |
| [106-49-0] | p-Toluidine | [108-93-0] | Cyclohexanol |
| [106-50-3] | p-Phenylenediamine | [108-94-1] | Cyclohexanone |
| [106-51-4] | Quinone | [108-95-2] | Phenol |
| [106-87-6] | Vinyl cyclohexene dioxide | [108-98-5] | Phenyl mercaptan |
| [106-89-8] | Epichlorohydrin | [109-59-1] | Isopropoxyethanol |
| [106-92-3] | Allyl glycidyl ether | [109-60-4] | n-Propyl acetate |
| [106-93-4] | Athylene dibromide | [109-66-0] | Pentane |
| [106-97-8] | Butane | [109-73-9] | Butylamine |
| [106-99-0] | 1,3-Butadiene | [109-79-5] | Butyl mercaptan |
| [107-02-8] | Acrolein | [109-86-4] | 2-Methoxyethanol |
| [107-05-1] | Allyl chloride | [109-87-5] | Methylal |
| [107-06-2] | Ethylene dichloride | [109-89-7] | Diethylamine |
| [107-07-3] | Ethylene chlorohydrin | [109-94-4] | Ethyl formate |
| [107-13-1] | Acrylonitrile | [109-99-9] | Tetrahydrofuran |
| [107-15-3] | Ethylenediamine | [110-12-3] | Methyl isoamyl ketone |
| [107-18-6] | Allyl alcohol | [110-19-0] | Isobutyl acetate |
| [107-19-7] | Propargyl alcohol | [110-43-0] | Methyl n-amyl ketone |
| [107-20-0] | Chloroacetaldehyde | [110-49-6] | 2-Methoxyethyl acetate |
| [107-21-1] | Ethylene glycol | [110-54-3] | Hexane (n-Hexane) |
| [107-30-2] | Chloromethyl methylether | [110-62-3] | n-Valeraldehyde |
| [107-31-3] | Methyl formate | [110-80-5] | 2-Ethoxyethanol |
| [107-41-5] | Hexylene glycol | [110-82-7] | Cyclohexane |
| [107-49-3] | TEPP | [110-83-8] | Cyclohexene |
| [107-66-4] | Dibutyl phosphate | [110-86-1] | Pyridine |
| [107-87-9] | Methyl propyl ketone | [110-91-8] | Morpholine |
| [107-98-2] | Propylene glycolmonomethyl ether | [111-15-9] | 2-Ethoxyethyl acetate |
| [108-03-2] | 1-Nitropropane | [111-30-8] | Glutaraldehyde |
| [108-05-4] | Vinyl acetate | [111-40-0] | Diethylene triamine |
| [108-10-1] | Methyl isobutyl ketone | [111-42-2] | Diethanolamine |
| [108-11-2] | Methyl isobutyl carbinol | [111-44-4] | Dichloroethyl ether |
| | | [111-65-9] | Octane |
| | | [111-76-2] | 2-Butoxyethanol |
| | | [111-84-2] | Nonane |

| | | | |
|------------|---|------------|----------------------------|
| [114-26-1] | Propoxur | [141-66-2] | Dicrotophos |
| [115-07-1] | Propylene | [141-78-6] | Ethyl acetate |
| [115-29-7] | Endosulfan | [141-79-7] | Mesityl oxide |
| [115-77-5] | Pentaerythritol | [142-64-3] | Piperazine dihydrochloride |
| [115-86-6] | Triphenyl phosphate | [142-82-5] | Heptane (n-Heptane) |
| [115-90-2] | Fensulfothion | [144-62-7] | Oxalic acid |
| [117-81-7] | Di-sec-octyl phthalate | [148-01-6] | Dinitolmide |
| [118-52-5] | 1,3-Dichloro-5,5- dimethyl hydantoin | [150-76-5] | 4-Methoxyphenol |
| [118-96-7] | 2,4,6-Trinitrotoluene | [151-50-8] | Cyanides |
| [119-93-7] | o-Tolidine | [151-56-4] | Ethylenimine |
| [120-80-9] | Catechol | [151-67-7] | Halothane |
| [120-82-1] | 1,2,4-Trichlorobenzene | [156-62-7] | Calcium cyanamide |
| [121-14-2] | 2,4-Dinitrotoluene | [218-01-9] | Chrysene |
| [121-44-8] | Triethylamine | [287-92-3] | Cyclopentane |
| [121-45-9] | Trimethyl phosphite | [298-00-0] | Methyl parathion |
| [121-69-7] | Dimethylaniline N,N- Dimethylaniline | [298-02-2] | Phorate |
| [121-75-5] | Malathion | [298-04-4] | Disulfoton |
| [121-82-4] | Cyclonite | [299-84-3] | Ronnel |
| [122-39-4] | Diphenylamine | [299-86-5] | Crufomate |
| [122-60-1] | Phenyl glycidyl ether | [300-76-5] | Naled |
| [123-19-3] | Dipropyl ketone | [302-01-2] | Hydrazine |
| [123-31-9] | Hydroquinone | [309-00-2] | Aldrin |
| [123-42-2] | Diacetone alcohol | [314-40-9] | Bromacil |
| [123-51-3] | Isoamyl alcohol | [330-54-1] | Diuron |
| [123-86-4] | n-Butyl acetate | [333-41-5] | Diazinon |
| [123-91-1] | Dioxane | [334-88-3] | Diazomethane |
| [123-92-2] | Isoamyl acetate | [353-50-4] | Carbonyl fluoride |
| [124-38-9] | Carbon dioxide | [382-21-8] | Perfluoroisobutylene |
| [124-40-3] | Dimethylamine | [409-21-2] | Silicon carbide |
| [126-73-8] | Tributyl phosphate | [420-04-2] | Cyanamide |
| [126-98-7] | Methylacrylonitrile | [460-19-5] | Cyanogen |
| [126-99-8] | B-Chloroprene | [463-51-4] | Ketene |
| [127-18-4] | Perchloroethylene | [479-45-8] | Tetryl |
| [127-19-5] | Dimethyl acetamide | [504-29-0] | 2-Aminopyridine |
| [128-37-0] | 2,6-Di-tert-butyl-p-cresol | [506-77-4] | Cyanogen chloride |
| [131-11-3] | Dimethylphthalate | [509-14-8] | Tetranitromethane |
| [133-06-2] | Captan | [528-29-0] | o-Dinitrobenzene |
| [135-88-6] | N-Phenyl-beta- naphthylamine | [532-27-4] | a-Chloroacetophenone |
| [136-78-7] | Sesone | [534-52-1] | Dinitro-o-cresolnone |
| [137-05-3] | Methyl 2-cyanoacrylate | [540-59-0] | 1,2-Dichloroethylene |
| [137-26-8] | Thiram | [540-88-5] | tert-Butyl acetate |
| [138-22-7] | n-Butyl lactate | [541-85-5] | Ethyl amyl ketone |
| [140-88-5] | Ethyl acrylate | [542-75-6] | Dichloropropene |
| [141-32-2] | Butyl acrylate | [542-88-1] | bis(Chloromethyl) ether |
| [141-43-5] | Ethanolamine | [542-92-7] | Cyclopentadiene |
| | | [546-93-0] | Magnesite |
| | | [552-30-7] | Trimellitic anhydride |

| | | | |
|-------------|--------------------------------|-------------|-----------------------------------|
| [556-52-5] | Glycidol | [1317-65-3] | Calcium carbonate |
| [558-13-4] | Carbon tetrabromide | [1317-95-9] | Tripoli |
| [563-12-2] | Ethion | [1319-77-3] | Cresol, all isomers |
| [563-80-4] | Methyl isopropyl ketone | [1321-64-8] | Pentachloronaphthalene |
| [583-60-8] | o-Methylcyclohexanone | [1321-65-9] | Trichloronaphthalene |
| [584-84-9] | Toluene-2,4-diisocyanate (TDI) | [1321-74-0] | Divinyl benzene |
| [591-78-6] | Methyl n-butyl ketone | [1327-53-3] | Arsenic trioxide |
| [593-60-2] | Vinyl bromide | [1330-20-7] | Xylene |
| [594-42-3] | Perchloromethyl mercaptan | [1332-21-4] | Asbestos |
| [594-72-9] | 1,1-Dichloro-1-nitroethane | [1333-74-0] | Hydrogen |
| [598-78-7] | 2-Chloropropionic acid | [1333-86-4] | Carbon black |
| [600-25-9] | 1-Chloro-1-nitropropane | [1335-87-1] | Hexachloronaphthalene |
| [603-34-9] | Triphenyl amine | [1335-88-2] | Tetrachloronaphthalene |
| [624-83-9] | Methyl isocyanate | [1338-23-4] | Methyl ethyl ketone peroxide |
| [626-17-5] | m-Phthalodinitrile | [1344-28-1] | Aluminium oxide |
| [626-38-0] | sec-Amyl acetate | [1344-95-2] | Calcium silicate |
| [627-13-4] | n-Propyl nitrate | [1395-21-7] | Subtilisins |
| [628-63-7] | n-Amyl acetate | [1477-55-0] | m-Xylene a,a'-diamine |
| [628-96-6] | Ethylene glycol dinitrate | [1563-66-2] | Carbofuran |
| [630-08-0] | Carbon monoxide | [1912-24-9] | Atrazine |
| [638-21-1] | Phenylphosphine | [1918-02-1] | Picloram |
| [680-31-9] | Hexamethyl phosphoramidate | [1929-82-4] | Nitrapyrin |
| [681-84-5] | Methyl silicate | [2039-87-4] | o-Chlorostyrene |
| [684-16-2] | Hexafluoroacetone | [2104-64-5] | EPN |
| [768-52-5] | N-Isopropylaniline | [2179-59-1] | Allyl propyl disulfide |
| [822-06-0] | 1,6-Hexamethylene diisocyanate | [2234-13-1] | Octachloronaphthalene |
| [944-22-9] | Fonofos | [2238-07-5] | Diglycidyl ether (DGE) |
| [999-61-1] | 2-Hydroxypropyl acrylate | [2425-06-1] | Captafol |
| [1120-71-4] | Propane sultone | [2426-08-6] | n-Butyl glycidyl ether |
| [1189-85-1] | tert-Butyl chromate | [2451-62-9] | Triglycidylisocyanurate |
| [1300-73-8] | Xylidine | [2551-62-4] | Sulphur hexafluoride |
| [1302-74-5] | Emery | [2698-41-1] | o-Chlorobenzylidene malononitrile |
| [1303-86-2] | Boron oxide | [2699-79-8] | Sulphuryl fluoride |
| [1303-96-4] | Borates | [2921-88-2] | Chlorpyrifos |
| [1304-82-1] | Bismuth telluride | [2971-90-6] | Clopidol |
| [1304-82-1] | Bismuth telluride, Se-doped | [3333-52-6] | Tetramethyl succinonitrile |
| [1305-62-0] | Calcium hydroxide | [3383-96-8] | Temephos |
| [1305-78-8] | Calcium oxide | [3687-31-8] | Lead arsenate |
| [1309-37-1] | Iron oxide | [3689-24-5] | Sulfotep |
| [1309-48-4] | Magnesium oxide | [3825-26-1] | Ammonium perfluorooctanoate |
| [1309-64-4] | Antimony trioxide | [4016-14-2] | Isopropyl glycidyl ether (IGE) |
| [1310-58-3] | Potassium hydroxide | [4098-71-9] | Isophorone diisocyanate |
| [1310-73-2] | Sodium hydroxide | [4170-30-3] | Crotonaldehyde |
| [1314-13-2] | Zinc oxide | [4685-14-7] | Paraquat |
| [1314-62-1] | Vanadium | | |
| [1314-80-3] | Phosphorus penta sulphide | | |

| | | | |
|-------------|---------------------------------------|--------------|---------------------------|
| [5124-30-1] | Methylene bis(4-cyclohexylisocyanate) | [7681-57-4] | Sodium metabisulphite |
| [5714-22-7] | Sulphur pentafluoride | [7697-37-2] | Nitric acid |
| [6423-43-4] | Propylene glycol dinitrate | [7719-09-7] | Thionyl chloride |
| [6923-22-4] | Monocrotophos | [7719-12-2] | Phosphorus trichloride |
| [7429-90-5] | Aluminium, metal | [7722-84-1] | Hydrogen peroxide |
| [7439-92-1] | Lead, inorganic | [7722-88-5] | Tetrasodium pyrophosphate |
| [7439-96-5] | Manganese | [7723-14-0] | Phosphorus (yellow) |
| [7439-97-6] | Mercury | [7726-95-6] | Bromine |
| [7439-98-7] | Molybdenum | [7727-37-9] | Nitrogen |
| [7440-01-9] | Neon | [7727-43-7] | Barium sulphate |
| [7440-02-0] | Nickel, Metal | [7758-97-6] | Lead chromate |
| [7440-06-4] | Platinum | [7773-06-0] | Ammonium sulphamate |
| [7440-16-6] | Rhodium, Metal | [7782-41-4] | Fluorine |
| [7440-21-3] | Silicon | [7782-42-5] | Graphite |
| [7440-22-4] | Silver | [7782-49-2] | Selenium compounds |
| [7440-25-7] | Tantalum | [7782-50-5] | Chlorine |
| [7440-28-0] | Thallium | [7782-65-2] | Germanium tetrahydride |
| [7440-31-5] | Tin, Metal | [7783-06-4] | Hydrogen sulphide |
| [7440-33-7] | Tungsten | [7783-07-5] | Hydrogen selenide |
| [7440-36-0] | Antimony | [7783-41-7] | Oxygen difluoride |
| [7440-37-1] | Argon | [7783-54-2] | Nitrogen trifluoride |
| [7440-38-2] | Arsenic | [7783-60-0] | Sulphur tetrafluoride |
| [7440-39-3] | Barium | [7783-79-1] | Selenium hexafluoride |
| [7440-41-7] | Beryllium | [7783-80-4] | Tellurium hexafluoride |
| [7440-43-9] | Cadmium | [7784-42-1] | Arsine |
| [7440-47-3] | Chromium | [7786-34-7] | Mevinphos |
| [7440-48-4] | Cobalt | [7789-30-2] | Bromine pentafluoride |
| [7440-50-8] | Copper | [7790-91-2] | Chlorine trifluoride |
| [7440-58-6] | Hafnium | [7803-51-2] | Phosphine |
| [7440-59-7] | Helium | [7803-52-3] | Stibine |
| [7440-61-1] | Uranium | [7803-62-5] | Silicon tetrahydride |
| [7440-65-5] | Yttrium | [8001-35-2] | Chlorinated camphene |
| [7440-67-7] | Zirconium | [8002-74-2] | Paraffin wax |
| [7440-74-6] | Indium | [8003-34-7] | Pyrethrum |
| [7446-09-5] | Sulphur dioxide | [8006-64-2] | Turpentine (wood) |
| [7553-56-2] | Iodine | [8012-95-1] | Oil mist, mineral |
| [7572-29-4] | Dichloroacetylene | [8022-00-2] | Methyl demeton |
| [7580-67-8] | Lithium hydride | [8052-41-3] | White spirits |
| [7616-94-6] | Perchloryl fluoride | [8052-42-4] | Asphalt (petroleum) |
| [7631-90-5] | Sodium bisulphite | [8065-48-3] | Demeton |
| [7637-07-2] | Boron trifluoride | [9004-34-6] | Cellulose (paper fiber) |
| [7646-85-7] | Zinc chloride | [9005-25-8] | Starch |
| [7647-01-1] | Hydrogen chloride | [10024-97-2] | Nitrous oxide |
| [7664-38-2] | Phosphoric acid | [10025-67-9] | Sulphur monochloride |
| [7664-39-3] | Hydrogen fluoride | [10025-87-3] | Phosphorus oxychloride |
| [7664-41-7] | Ammonia | [10026-13-8] | Phosphorus pentachloride |
| [7664-93-9] | Sulphuric acid | [10028-15-6] | Ozone |

[10035-10-6] Hydrogen bromide
 [10049-04-4] Chlorine dioxide
 [10102-43-9] Nitric oxide
 [10102-44-0] Nitrogen dioxide
 [10210-68-1] Cobalt carbonyl
 [10294-33-4] Boron tribromide
 [11097-69-1] PCBs (54% Chlorine)
 [11103-86-9] Zinc chromate
 [12001-26-2] Mica
 [12001-28-4] n Crocidolite
 [12001-29-5] Chrysotile
 [12079-65-1] Manganese
 cyclopentadienyl
 tricarbonyl
 [12108-13-3] Methylcyclopentadienyl
 manganese tricarbonyl
 [12125-02-9] Amonium chloride (fume)
 [12172-73-5] Amosite
 [12604-58-9] Ferrovandium dust
 [13121-70-5] Cyhexatin
 [13463-40-6] Iron pentacarbonyl
 [13463-39-3] Nickel carbonyl
 [13463-67-7] Titanium dioxide
 [13494-80-9] Tellurium
 [13530-65-9] Zinc chromate
 [13838-16-9] Enflurane
 [14464-46-1] Cristobalite
 [14484-64-1] Ferbam
 [14807-96-6] Talc
 [14808-60-7] Quartz
 [15468-32-3] Tridymite
 [16219-75-3] Ethylidene norbornene

[16752-77-5] Methomyl
 [16842-03-8] Cobalt hydrocarbonyl
 [17702-41-9] Decaborane
 [19287-45-7] Diborane
 [19624-22-7] Pentaborane
 [20816-12-0] Osmium tetroxide
 [21087-64-9] Metribuzin
 [21351-79-1] Caesium hydroxide
 [22224-92-6] Fenamiphos
 [25013-15-4] Vinyl toluene
 [25321-14-6] Dinitrotoluene
 [25551-13-7] Trimethyl benzene
 [25639-42-3] Methylcyclohexanol
 [26140-60-3] Terphenyls
 [26628-22-8] Sodium azide
 [26952-21-6] Isooctyl alcohol
 [29191-52-4] Anisidine(o-, p- isomers)
 [31242-93-0] Chlorinated diphenyl oxide
 [34590-94-8] Dipropylene glycol, methyl
 ether
 [37275-59-5] Hydrogenated terphenyls
 [37300-23-5] Zinc chromate
 [53469-21-9] PCBs (42% Chlorine)
 [60676-86-0] Silica, fused
 [61790-53-2] Diatomaceous earth
 [65996-93-2] Coal tar pitch volatiles
 [65997-15-1] Portland cement
 [68476-85-7] LPG (liquified petroleum
 gas)
 [93763-70-3] Perlite dust
 [112926-00-8] Precipitated silica
 [112926-00-8] Silica gel

CHEMICAL SYMBOLS

A6.1 This appendix provides an explanation of the chemical symbols used in the National Commission's *Adopted Exposure Standards for Atmospheric Contaminants in the Occupational Environment* [NOHSC:1003(1995)].

| | | | |
|--------------------------------|-------------------------------------|--|--------------------|
| Al | Aluminium | Mo | Molybdenum |
| Al ₂ O ₃ | Aluminium oxide | N | Nitrogen |
| Ag | Silver | NCO | Isocyanate |
| As | Arsenic | Ni | Nickel |
| Ba | Barium | O | Oxygen |
| C | Carbon | Os | Osmium |
| Cd | Cadmium | Pb | Lead |
| CN | Cyanide | Pb ₃ (AsO ₄) ₂ | Lead arsenate |
| Co | Cobalt | Pt | Platinum |
| CO | Carbon monoxide | Rh | Rhodium |
| CO ₂ | Carbon dioxide | Sb | Antimony |
| Cr | Chromium | Se | Selenium |
| CrO ₃ | Chromium trioxide (Chromic acid) | Sn | Tin |
| Cu | Copper | Te | Tellurium |
| F | Fluoride | Tl | Thallium |
| Fe | Iron | U | Uranium |
| Fe ₂ O ₃ | Iron (III) oxide | V | Vanadium |
| H | Hydrogen | V ₂ O ₅ | Vanadium pentoxide |
| Hg | Mercury | W | Tungsten |
| In | Indium | Y | Yttrium |
| Mg | Magnesium | Zn | Zinc |
| Mn | Manganese | Zr | Zirconium |

GLOSSARY OF TERMS

Airborne contaminant

An airborne contaminant is a potentially harmful substance that is either naturally absent from air or is present in an unnaturally high concentration, and to which workers may be exposed in their working environment.

Biological exposure index*

The index provides a warning level of biological response to a substance or agent, or warning levels of the substance or agent or its metabolite(s) in the tissues, fluids or exhaled air of an exposed worker.

Breathing zone

The worker's breathing zone is described by a hemisphere of 300 mm radius extending in front of their face and measured from the midpoint of an imaginary line joining the ears.

Dusts

Dusts are solid particles generated and dispersed into the air by, for example, handling, crushing and grinding of organic or inorganic materials such as rock, ore, metal, coal, wood and grain.

Equivalent aerodynamic diameter (EAD)

The EAD of a particle of any shape or density is defined as the diameter of a sphere of unit density, that is, 1.0 g/cm^3 , which exhibits the same aerodynamic behaviour as the particle in question.

Exposure standard

An exposure standard represents an airborne concentration of a particular substance in the worker's breathing zone, exposure to which, according to current knowledge, should not cause adverse health effects nor cause undue discomfort to nearly all workers. The exposure standard can be of three forms; time-weighted average (TWA), peak, or short term exposure limit (STEL).

Exposure standards - general excursion

Where a 'peak' or STEL is not specified for an exposure standard, and provided that the eight-hour TWA exposure standard is not exceeded, short term exposures should not exceed three times the TWA exposure standard for more than a total of 30 minutes per eight-hour working day and under no circumstances should the short term values exceed five times the exposure standard.

Exposure standard - peak

A maximum or peak airborne concentration of a particular substance determined over the shortest analytically practicable period of time which does not exceed 15 minutes.

Exposure standard - short term exposure limit (STEL)

A 15 minute TWA exposure which should not be exceeded at any time during a working day even if the eight-hour TWA average is within the TWA exposure standard. Exposures at the STEL should not be longer than 15 minutes and should not be repeated more than four times per day. There should be at least 60 minutes between successive exposures at the STEL.

Exposure standard - time-weighted average (TWA)

The average airborne concentration of a particular substance when calculated over a normal eight-hour working day, for a five-day working week.

* This index is to be used only in conjunction with designated exposure standards or codes of practice and not as a sole method for exposure control.

Fumes

Fumes are formed when the material from a volatilised solid condenses in cool air. Fumes are extremely fine - usually less than 1.0 micrometer in diameter. In most cases the hot vapour reacts with the air to form an oxide. Fumes are often associated with molten metals, especially in processes such as welding. At high fume concentrations, agglomeration of particles may result in particles with much larger dimensions.

Gases

Gases are formless fluids that expand to occupy the space or enclosure in which they are confined. Examples are nitrogen, oxygen and carbon dioxide of the air.

Mists

Mists are suspended liquid droplets generated by condensation of vapour back to the liquid state or by breaking up as a liquid into a dispersed state, such as by splashing or atomising. Mist is the term applied to a finely divided liquid suspended in the atmosphere. Examples are an oil mist produced during cutting and grinding operations, acid mists from electroplating, acid or alkali mists from pickling operations, paint spray mist in painting operations and the condensation of water vapour to form a fog.

Personal samples

Atmospheric samples collected within the breathing zone of the worker are called personal samples.

Physical agents

Physical agent refers to energy-related agents such as heat and cold, vibration, noise and electromagnetic radiations of all kinds and their associated fields.

Practicable

Practicable has the same meaning as 'practicable' in Victoria, Queensland, Western Australia and the Northern Territory 'reasonably practicable' in New South Wales, South Australia and the Australian Capital Territory and 'a reasonable precaution' in Tasmania.

Smoke

Smoke consists of carbon or soot particles or tarry droplets less than 0.1 micrometer in size, and suspended in air, which results from the incomplete combustion of carbonaceous materials such as coal or oil.

Static samples

For the purpose of this document, static samples are samples taken at fixed locations, commonly between 1 and 2 metres above floor level.

Threshold limit value (TLV)

TLV is a proprietary name registered by the American Conference of Governmental Industrial Hygienists (ACGIH) and refers to airborne concentrations of substances or levels of physical agents to which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect.

Vapour

Vapour is the gaseous form of a substance which is normally in the solid or liquid state at room temperature and pressure.

REFERENCED DOCUMENTS

1. Lacey, J. and Crook, B., 'Fungal and actinomycete spores as pollutants of the workplace and occupational allergens', *Annals of Occupational Hygiene*, vol. 32, pp. 515-33, 1988.
2. American Conference of Governmental Industrial Hygienists (ACGIH), *Guidelines for the Assessment of Bioaerosols in the Indoor Environment*, ACGIH Committee on Bioaerosols, ACGIH pub. no. 3180, ACGIH, Cincinnati, Ohio, 1990.
3. National Health and Medical Research Council (NHMRC), *Recommended Radiation Protection Standards for Individuals Exposed to Ionising Radiation*, Commonwealth Department of Health, Canberra, June 1980.
4. International Commission on Radiological Protection (ICRP), *Recommendations of the International Commission on Radiological Protection*, ICRP Publication 26, *Annals of the ICRP*, vol. 1, no. 3, 1977.
5. National Occupational Health and Safety Commission, 'Guide to the Control of Asbestos Hazards in Buildings and Structures' [NOHSC:3002(1988)], in *Asbestos: Code of Practice and Guidance Notes*, Australian Government Publishing Service, Canberra, 1988.
6. National Occupational Health and Safety Commission, 'National Code of Practice for the Safe Removal of Asbestos' [NOHSC:2002(1988)], in *Asbestos: Code of Practice and Guidance Notes*, Australian Government Publishing Service, Canberra, 1988.
7. Astrand, I., 'Effect of physical exercise on uptake, distribution and elimination of vapours in man', in Fiserova-Bergerova, V. ed., *Modelling of Inhalation Exposure to Vapours: Uptake, Distribution and Elimination*, vol. 2, chapter 5, CRC Boca Raton, Florida, 1983.
8. Roach, S.A., 'A most rational basis for air sampling programs', *Annals of Occupational Hygiene*, vol. 20, pp. 65-84, 1977.
9. Roach, S.A., 'Threshold Limit Values for Extraordinary Work Schedules', *American Industrial Hygiene Association Journal*, vol. 39, pp. 345-48, April 1978.
10. Koizumi, A., et al, 'Evaluation of the Time-Weighted-Average of Air Contaminants with Special Reference to Concentration Fluctuation and Biological Half-time', *American Industrial Hygiene Association Journal*, vol. 41, pp. 693-99, October 1980.
11. Hickey, J.L.S. and Reist, P.C., 'Application of occupational exposure limits to unusual work schedules', *American Industrial Hygiene Association Journal*, vol. 38, pp. 613-21, November 1977.
12. Rappaport, S.M., Spear, R.C. and Solvin, S., 'The influence of exposure variability on dose-response relationships', presented at Inhaled Particles Conference, Cambridge, 1985.
13. Leidel, N.A., Busch, K.A. and Crouse, W.E., *Exposure Measurement, Action Level and Occupational Environment Variability*, pub. no. 76-131, NIOSH, Cincinnati, Ohio, 1975.
14. American Conference of Governmental Industrial Hygienists (ACGIH), *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices 1994-1995*, ACGIH, Cincinnati, Ohio, 1994.

15. National Institute for Occupational Safety and Health (USA), *NIOSH Manual of Analytical Methods*, 4th Edition, DHHS (NIOSH) pub. no. 94-113, August 1994.
16. Health and Safety Executive (UK), *Monitoring Strategies for Toxic Substances*, Environmental Hygiene 42, HMSO, January 1989.
17. National Institute for Occupational Safety and Health (USA), *Occupational Exposure Sampling Strategy Manual*, DHEW (NIOSH), pub. no. 77-173, 1977.
18. Gompertz, D., 'Assessment of Risk by Biological Monitoring', *British Journal of Industrial Medicine*, vol. 38, pp. 198-201, 1981.
19. American Conference of Governmental Industrial Hygienists (ACGIH), *Documentation of the Threshold Limit Values and Biological Exposure Indices*, 6th Edition, ACGIH, Cincinnati, Ohio, 1991.
20. Deutsche Forschungsgemeinschaft (DFG), *List of MAK and BAT Values 1994*, Report No. 30, Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area, VCH Verlagsgesellschaft mbH, Weinheim, Germany, 1994.
21. Health and Safety Executive (UK), *Health Surveillance by Routine Procedures*, Guidance Note MS 18, HMSO, London, 1981.
22. Health and Safety Executive (UK), *Laboratory Methods for Biological Monitoring*, 2nd edn., HMSO, London, 1985.
23. Wilson, J.K., 'Breath analysis - physiological basis and sampling technique', *Scandinavian Journal of Work, Environment and Health*, vol. 12, no. 3, pp. 174-192, June 1986.
24. Commission of the European Communities, *Biological Indicators for the Assessment of Human Exposure to Industrial Chemicals*, Commission of the European Communities, vol. 1, 1983, vol. 2., 1984, vol. 3, 1986, Brussels.
25. Deutsche Forschungsgemeinschaft (DFG), *Analyses of Hazardous Substances in Biological Materials*, vols. 1 and 2, Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area, VCH Verlagsgesellschaft mbH, Weinheim, Germany, 1985.
26. Halperin, W., Schulte, P.A. and Greathouse, D.G., eds., 'Conference on medical screening and biological monitoring for the effects of exposure in the workplace, July 1984, Part I', *Journal of Occupational Medicine*, vol. 28, no. 8, pp. 543-782, August 1986.
27. Mason T.J., Prorok P.C. and Costlow R.D. eds., 'Conference on medical screening and biological monitoring for the effects of exposure in the workplace, July 1984, Part II', *Journal of Occupational Medicine*, vol. 28, no.10, pp. 901-1124, October 1986.
28. Ruth, J.H., 'Odour thresholds and irritation levels of several chemical substances: a review', *American Industrial Hygiene Association Journal*, vol. 47, pp. 142-151, 1986.
29. Standards Australia AS 2865-1995 *Safe Working in a Confined Space*, Standards Australia, Sydney, 1995.
30. National Occupational Health and Safety Commission, *National Strategy for the Prevention of Occupational Skin Disorders* [NOHSC:4002(1989)], Australian Government Publishing Service, Canberra, 1989.

31. de Silva, P., 'Nearly all workers', *Annals of the American Conference of Governmental Industrial Hygienists*, vol. 12, pp. 161-66, 1985.
32. Lewis, T.R., 'Identification of sensitive subjects not adequately protected by TLVs', *Annals of the American Conference of Governmental Industrial Hygienists*, vol. 12, pp. 167-172, 1985.
33. Doll, R. and Peto, R., *The Causes of Cancer: Quantitative Estimates of Avoidable Risks of Cancer in the United States Today*, Oxford University Press, Oxford, United Kingdom, 1981.
34. Commission of the European Communities, *Classification and Labelling of Dangerous Substances*, Council Directive 79/831/EEC, Sixth Amendment, Brussels, 1986.
35. European Chemical Industry Ecology and Toxicology Centre, *A Guide to the Classification of Carcinogens, Mutagens and Teratogens under the Sixth Amendment*, technical report no. 21, Brussels, February 1986.
36. National Occupational Health and Safety Commission, *National Code of Practice for the Safe Use of Vinyl Chloride* [NOHSC:2004(1990)], Australian Government Publishing Service, Canberra, 1990.
37. International Organization for Standardization (ISO), *Air Quality - Particle Size Fraction Definitions for Health Related Sampling*, ISO TR 7708, Switzerland, 1983.
38. American Conference of Governmental Industrial Hygienists (ACGIH), *Particle Size-selective Sampling in the Workplace*, ACGIH, Cincinnati, Ohio, 1985.
39. Standards Australia, AS 3640-1989 *Workplace Atmospheres - Method for Sampling and Gravimetric Determination of Inspirable Dust*, Standards Australia, Sydney, 1989.
40. Standards Australia, AS 2985-1987 *Workplace Atmospheres: Method for Sampling and Gravimetric Determination of Respirable Dust*, Standards Australia, Sydney, 1987.
41. Orenstein, A.J., ed., *Proceedings of the 1959 Pneumoconiosis Conference*, Johannesburg, Churchill, London, 1960.
42. Frondel, C., *Systems of Mineralogy*, vol. 3 (silica minerals), John Wiley and Sons Inc, New York, pp. 3-5, 1962.
43. Abrams, H. K., 'Diatomaceous earth silicosis', *American Journal of Industrial Medicine*, vol. 18, pp. 591-597, 1990.
44. International Agency for Research on Cancer (IARC), *IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans — Silica and Some Silicates*, vol. 42, pp. 41-42, IARC, Lyon, 1987.
45. National Health and Medical Research Council (NHMRC), *Methods for Measurement of Quartz in Respirable Airborne Dust by Infra-red Spectroscopy and X-ray Diffractometry*, NHMRC, Canberra, 1984.
46. World Health Organization (WHO), International Agency for Research on Cancer (IARC), *IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man: Asbestos*, vol. 14, p. 14, IARC, Lyon, 1977.

47. National Occupational Health and Safety Commission, 'Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Dust' [NOHSC:3003(1988)], in *Asbestos: Code of Practice and Guidance Notes*, Australian Government Publishing Service, Canberra, 1988.
48. National Occupational Health and Safety Commission, 'National Standard for Synthetic Mineral Fibres' [NOHSC:1004(1990)], in *Synthetic Mineral Fibres: National Standard and National Code of Practice*, Australian Government Publishing Service, Canberra, 1990.
49. National Occupational Health and Safety Commission, 'Guidance Note on the Membrane Filter Method for the Estimation of Airborne Synthetic Mineral Fibres' [NOHSC:3006(1989)], in *Technical Report on Synthetic Mineral Fibres and Guidance Note on the Membrane Filter Method for the Estimation of Airborne Synthetic Mineral Fibres*, Australian Government Publishing Service, Canberra, 1989.
50. National Occupational Health and Safety Commission, *Documentation of the Exposure Standards* [NOHSC:10003(1995)], Australian Government Publishing Service, Canberra, 1995.
51. Holmberg, B. and Lundberg, P., 'Exposure Standards for Mixtures', *Annals of the American Conference of Governmental Industrial Hygienists*, vol. 12, pp. 111-18, 1985.
52. Vouk, V.B. et al, 'Methods for assessing the affects of chemicals', scope 30 IPCS Joint Symposia 6, John Wiley and Sons Inc, New York, 1987.
53. Fechter, L.D., 'Interactions between noise exposure and chemical asphyxiants: evidence for potentiation of noise induced hearing loss', *Proceedings of the 5th International Congress on Noise as a Public Health Problem*, Stockholm, August 21-25 1988.
54. Paran'ko, N.M. and Belitskaya, E.N. 'Experimental study of the combined effect of chromium trioxide aerosol and noise on the cardiovascular system', *Proceedings of the 5th International Congress on Noise as a Public Health Problem*, Stockholm, August 21-25 1988.
55. Rigby, L.J., 'The collection and identification of toxic volatiles from plastics under thermal stress', *Annals of Occupational Hygiene*, vol. 24, no. 4, pp. 331-45, 1981.
56. Sangha, G.K., Matijak, M. and Alarie, Y., 'Toxicologic evaluation of thermoplastic resin at and above processing temperatures', *American Industrial Hygiene Association Journal*, vol. 42, pp. 481-5, 1981.
57. Barrow, C.S., Alarie, Y. and Stock, M.F., 'Sensory irritation and incapacitation evoked by thermal decomposition products of polymers and comparisons with known sensory irritants', *Archives of Environmental Health*, vol. 33, March/April, pp. 79-88, 1978.
58. Hoff, A. et al, 'Degradation products of plastics - polyethylene and styrene-containing thermoplastics - analytical, occupational and toxicologic aspects', *Scandinavian Journal of Work Environment and Health*, vol. 8, Suppl. 2, 1982.
59. Hilado, C.J. and Cumming, H.J., 'Relative toxicity of pyrolysis gases from materials: effects of chemical composition and test conditions', *Fire and Materials*, vol. 2, no. 2, pp. 68-76, 1978.
60. Cook, W.A., 'Industrial hygiene evaluation of thermal degradation products from PVC films in meat-wrapping operations', *American Industrial Hygiene Association Journal*, vol. 41, pp. 508-12, 1980.

61. Boettner, E.A. and Ball, G.L., 'Thermal degradation products from PVC film in food-wrapping operations', *American Industrial Hygiene Association Journal*, vol. 41, pp. 513-522, 1980.
62. Hofmann, H. and Oettel, H., 'Experiments on toxicity hazards with expanded polystyrene', *Fire International*, vol. 25, pp. 20-28, July 1969.
63. Arito, H. and Soda, R., 'Pyrolysis products of tetrafluoroethylene and polyfluoroethylenepropylene with reference to inhalation toxicity', *Annals of Occupational Hygiene*, vol. 20, pp. 247-55, December 1977.

**ADOPTED NATIONAL EXPOSURE STANDARDS
FOR ATMOSPHERIC CONTAMINANTS
IN THE OCCUPATIONAL ENVIRONMENT
[NOHSC:1003(1995)]**

| | | |
|----|--|-----|
| 1. | BASIS FOR EXPOSURE STANDARDS | 69 |
| 2. | INTERPRETATION | 70 |
| 3. | COLUMN HEADINGS, ABBREVIATIONS AND FOOTNOTES USED IN THE LIST OF ADOPTED NATIONAL EXPOSURE STANDARDS | 71 |
| 4. | EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT | 74 |
| | REFERENCED DOCUMENTS | 105 |

1. BASIS FOR EXPOSURE STANDARDS

1.1 Substances listed in this document have exposure standards based on health effects for most workers. However, there are a number of instances where other considerations, such as, economic, social or technological implications, or sampling and analytical limitations, have also been taken into account, especially for those substances with the notation 'A*' in the Reference column of the list of adopted national exposure standards. No standard should be applied without reference to the related documentation.

1.2 Documentation for the majority of substances can be found in the American Conference of Governmental Industrial Hygienists' (ACGIH) documentation of the threshold limit values and biological exposure indices.^{1,2} An 'H' in the Reference column of the adopted national exposure standards indicates that the reader should refer to the ACGIH documentation for further information. Entries carrying the notation 'A' in the final column of the list of adopted national exposure standards, have been reviewed in detail by the Exposure Standards Expert Working Group and documentation supporting the adopted national values is available in National Commission's *Documentation of the Exposure Standards*³ [NOHSC:10003(1995)].

1.3 Partial documentation is provided where the major part of the adopted exposure standard is supported by the documentation of the ACGIH but the adopted national standard differs from that recommended by the ACGIH in one or more details.

1.4 The notation 'R' in the final column of the list of exposure standards indicates those substances which require further review by the Exposure Standards Expert Working Group (see Appendix 3 of the National Commission's *Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment*⁴ [NOHSC:3008(1995)]). In most cases the ACGIH documentation^{1,2} should be consulted for these substances.

1.5 The notation 'Ch' in the Reference column of the list of adopted exposure standards indicates those substances for which the Exposure Standards Expert Working Group has proposed additions/changes to the existing standards.

1.6 Proposed changes or additions to the National Commission's *Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment* [NOHSC:1003(1995)] have been published separately.⁵

1.7 The list of synonyms, which appears as Appendix 4 of the National Commission's *Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment*⁴ [NOHSC:3008(1995)], should be consulted if the required substances cannot be identified in the list of adopted national exposure standards.

2. INTERPRETATION

2.1 In this national standard:

'Exposure standard' means an airborne concentration of a particular substance in the worker's breathing zone, exposure to which, according to current knowledge, should not cause adverse health effects nor cause undue discomfort to nearly all workers. The exposure standard can be of three forms; time-weighted average (TWA), peak limitation, or short term exposure limit (STEL).

'Exposure standard - peak' means a maximum or peak airborne concentration of a particular substance determined over the shortest analytically practicable period of time which does not exceed 15 minutes.

'Exposure standard - short term exposure limit (STEL)' means a 15 minute TWA exposure which should not be exceeded at any time during a working day even if the eight-hour TWA average is within the TWA exposure standard. Exposures at the STEL should not be longer than 15 minutes and should not be repeated more than four times per day. There should be at least 60 minutes between successive exposures at the STEL.

'Exposure standard - time-weighted average (TWA)' means the average airborne concentration of a particular substance when calculated over a normal eight-hour working day, for a five-day working week.

'Practicable' means 'practicable' in Victoria, Queensland, Western Australia and the Northern Territory, 'reasonably practicable' in New South Wales, South Australia, the Australian Capital Territory and Commonwealth jurisdiction and 'a reasonable precaution' in Tasmania.

3. COLUMN HEADINGS, ABBREVIATIONS AND FOOTNOTES USED IN THE LIST OF ADOPTED NATIONAL EXPOSURE STANDARDS

3.1 Chapter, section and appendix numbers refer to the National Commission's *Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment*⁴ [NOHSC:3008(1995)].

COLUMN HEADINGS AND ABBREVIATIONS

(1) Substance

The description of the atmospheric contaminant
(see Section 19.2-3)

(2) CAS

Chemical Abstracts Service Registry Number
(see Section 19.4-19.6)

(3) TWA

Exposure standard - time weighted average
(see Chapters 5 and 6)

ppm

Parts of vapour or gas per million parts of
contaminated air by volume
(see Section 19.7)

mg/m³

Milligrams of substance per cubic metre
of air at 25°C and one atmosphere
pressure. When entry is in this column
only, the value is exact: when listed with
a ppm value, it is approximate.
(see Section 19.7-8).

f/mL

Fibres per millilitre of air as determined
by the membrane filter method^{6,7}

P

Prohibition recommended
(see Chapter 3)

(4) STEL

Exposure standard - short term exposure limit.
Where the words 'peak limitation'
appear in this column the exposure standard
- peak should be applied to the value listed
in Column 3.
(see Chapter 6)

ppm and mg/m³

(see above)

(5) Carcinogen Category

1

Established human carcinogen
(see Chapter 13)

2

Probable human carcinogen
(see Chapter 13)

3

Substances suspected of having
carcinogenic potential
(see Chapter 13)

(6) Notices

Indicates whether the contaminant can be
absorbed through the skin and/or is a
sensitiser.

Sk

Absorption through the skin may be a
significant source of exposure
(see Chapter 11)

Sen

Sensitiser
(see Chapter 12)

(7) Reference (Ref)

Indicates the source of documentation,
whether the standard is under review or
whether a change to the standard has been
proposed.⁷

A

National Commission documentation³
available for these values

A*

National Commission documentation³
available for these values, see 'Basis for
Exposure Standards' earlier in this
document

Ch

Change to exposure standard has been
proposed, see the National Commission's
*Proposed National Exposure Standards
for Atmospheric Contaminants in the
Occupational Environment*⁵

(7) Reference (Ref)/continued

H

ACGIH^{1,2} is the documentation source

R

Substance requiring review
(see Appendix 3)

FOOTNOTES

- (a) This value is for inspirable dust containing no asbestos and < 1% crystalline silica (see Chapter 14)
- (b) Fibres longer than 5 μm , width less than 3 μm and with an aspect ratio of not less than 3:1, as measured by the membrane filter method, at 400-650X magnification phase contrast illumination.
- (c) Lint free dust as measured by the vertical elutriator — cotton dust sampler described in the *Transactions of the National Conference on Cotton Dust and Health 1970*, North Carolina University Press, Chapel Hill, pp. 33-43, 1971.
- (d) For a few substances, usually the more potent probable and established human carcinogens, it is not currently possible to assign an appropriate exposure standard. For these substances, exposure should be controlled to the lowest practicable level.
- (e) The Exposure Standards Expert Working Group has recommended guidelines to control short term excursions above the TWA. The guidelines have been developed based on the toxicokinetic properties of carbon monoxide. A guidance table for the control of short term excursions above the TWA is available at page 23 of the National Commission documentation³ for carbon monoxide.
- (f) For the three substances marked with this footnote (Benomyl, Caprolactam vapour, and Sodium azide), the exposure standards are established as gravimetric (mg/m^3) values and converted into volumetric values (see Section 19.9).
- (g) Containing no asbestos and < 1% crystalline silica (see Chapter 14).
- (h) Documentation for the substances with this footnote can be found in the 5th Edition of the ACGIH documentation of the threshold limit values and biological exposure indices.¹ For all other substances with 'H' in Column 7 the documentation can be found in the 6th Edition of the ACGIH documentation of the threshold limit values and biological exposure indices.²

4. EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA | | (4) STEL | | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|---|----------------|------------|-----------------------|------------------|-------------------|-------------------------------|----------------|------------|
| | | ppm | mg/m ³ | ppm | mg/m ³ | | | |
| Acetaldehyde (h) | [75-07-0] | 100 | 180 | 150 | 270 | - | - | H;R |
| Acetic acid | [64-19-7] | 10 | 25 | 15 | 37 | - | - | H |
| Acetic anhydride | [108-24-7] | 5 | 21 | Peak limitation | | - | - | H |
| Acetone | [67-64-1] | 500 | 1,185 | 1,000 | 2,375 | - | - | A |
| Acetonitrile | [75-05-8] | 40 | 67 | 60 | 101 | - | Sk | H |
| Acetylene | [74-86-2] | Asphyxiant | (see Chapter 10) | | | - | - | - |
| Acetylsalicylic acid | [50-78-2] | - | 5 | - | - | - | - | H |
| Acrolein | [107-02-8] | 0.1 | 0.23 | 0.3 | 0.69 | - | - | H |
| Acrylamide | [79-06-1] | - | 0.03 | - | - | 2 | Sk | H |
| Acrylic acid | [79-10-7] | 2 | 5.9 | - | - | - | Sk | H |
| Acrylonitrile | [107-13-1] | 2 | 4.3 | - | - | 2 | Sk | H |
| Aldrin | [309-00-2] | - | 0.25 | - | - | 3 | Sk | A |
| Allyl alcohol | [107-18-6] | 2 | 4.8 | 4 | 9.5 | - | Sk | H |
| Allyl chloride | [107-05-1] | 1 | 3 | 2 | 6 | - | - | H |
| Allyl glycidyl ether (AGE) | [106-92-3] | 5 | 23 | 10 | 47 | - | Sk;Sen | H |
| Allyl propyl disulfide | [2179-59-1] | 2 | 12 | 3 | 18 | - | - | H |
| α-Alumina (Al ₂ O ₃) | [1344-28-1] | - | (see Aluminium oxide) | | | | | |
| Aluminium (metal dust) | [7429-90-5] | - | 10 | - | - | - | - | H |
| Aluminium (welding fumes) (as Al) | [7429-90-5] | - | 5 | - | - | - | - | H |
| Aluminium oxide (a) | [1344-28-1] | - | 10 | (see Chapter 14) | | - | - | H |
| Aluminium, alkyls (NOC+) (as Al) | [7429-90-5] | - | 2 | - | - | - | - | H |
| Aluminium, pyro powders (as Al) | [7429-90-5] | - | 5 | - | - | - | - | H |
| Aluminium, soluble salts (as Al) | [7429-90-5] | - | 2 | - | - | - | - | H |
| 4-Aminodiphenyl | [92-67-1] | (P) | - | - | - | 1 | Sk | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA ppm | mg/m ³ | (4) STEL ppm | mg/m ³ | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|--|-----------------|-----------------------------|-------------------|--------------------|-------------------|-------------------------------|----------------|------------|
| 2-Aminopyridine | [504-29-0] | 0.5 | 2 | - | - | - | - | H |
| Amitrole | [61-82-5] | - | 0.2 | - | - | 3 | - | A |
| Ammonia | [7664-41-7] | 25 | 17 | 35 | 24 | - | - | H |
| Ammonium chloride (fume) | [12125-02-9] | - | 10 | - | 20 | - | - | H |
| Ammonium perfluorooctanoate (h) | [3825-26-1] | - | 0.1 | - | - | - | - | H |
| Ammonium sulphamate | [7773-06-0] | - | 10 | - | - | - | - | H |
| Amosite | [12172-73-5] | - | (see Asbestos) | - | - | - | - | - |
| n-Amyl acetate | [628-63-7] | 100 | 532 | - | - | - | - | H |
| sec-Amyl acetate | [626-38-0] | 125 | 665 | - | - | - | - | H |
| Aniline & homologues | [62-53-3] | 2 | 7.6 | - | - | - | Sk | H |
| Anisidine(o-, p- isomers) | [29191-52-4] | 0.1 | 0.5 | - | - | - | Sk | H |
| Antimony & compounds (as Sb) | [7440-36-0] | - | 0.5 | - | - | - | - | H |
| Antimony trioxide, handling and use (as Sb) | [1309-64-4] | - | 0.5 | - | - | - | - | H |
| Antimony trioxide, production (d) | [1309-64-4] | - | - | - | - | 2 | - | H |
| ANTU | [86-88-4] | - | 0.3 | - | - | - | - | H |
| Argon | [7440-37-1] | Asphyxiant (see Chapter 10) | - | - | - | - | - | - |
| Arsenic & soluble compounds (as As) | [7440-38-2] | - | 0.05 | - | - | 1 | - | A |
| Arsenic trioxide production (as As) (d) | [1327-53-3] | - | - | - | - | 1 | - | H |
| Arsine | [7784-42-1] | 0.05 | 0.16 | - | - | - | - | H |
| Asbestos (b) | [1332-21-4] | - | (see Chapter 14) | - | - | - | - | - |
| Amosite (b) | [12172-73-5] | 0.1 f/mL (P) | - | - | - | 1 | - | A* |
| Chrysotile (b) | [12001-29-5] | 1 f/mL | - | - | - | 1 | - | A |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA ppm | (3) mg/m ³ | (4) STEL ppm | (4) mg/m ³ | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|--|-----------------|-------------------|--------------------------|--------------------|--------------------------|-------------------------------|----------------|------------|
| Crocidolite (b) | [12001-28-4] | 0.1 f/mL (P) | - | - | - | 1 | - | A* |
| Other forms (b) | [-] | 0.1 f/mL | - | - | - | 1 | - | A* |
| Any mixture of these, or where the composition is unknown (b) | [-] | 0.1 f/mL | - | - | - | 1 | - | A* |
| Atrazine | [1912-24-9] | - | 5 | - | - | - | - | H;R |
| Azinphos-methyl | [86-50-0] | - | 0.2 | - | - | - | Sk | H |
| Barium sulphate (a) | [7727-43-7] | - | 10 (see Chapter 14) | - | - | - | - | H |
| Barium, soluble compounds (as Ba) | [7440-39-3] | - | 0.5 | - | - | - | - | H |
| Benomyl (f) | [17804-35-2] | 0.84 | 10 | - | - | - | - | H |
| Benzene | [71-43-2] | 5 | 16 | - | - | 1 | - | A;R |
| Benzidine | [92-87-5] | -(P) | - | - | - | 1 | Sk | H |
| Benzo(a)pyrene (d) | [50-32-8] | - | - | - | - | 2 | - | H |
| Benzoyl peroxide | [94-36-0] | - | 5 | - | - | - | - | H |
| Benzyl chloride | [100-44-7] | 1 | 5.2 | - | - | - | - | H |
| Beryllium & compounds | [7440-41-7] | - | 0.002 | - | - | 2 | - | H |
| Biphenyl | [92-52-4] | 0.2 | 1.3 | - | - | - | - | H |
| Bismuth telluride | [1304-82-1] | - | 10 | - | - | - | - | H |
| Bismuth telluride, Se-doped | [1304-82-1] | - | 5 | - | - | - | - | H |
| Bitumen fumes | [8052-42-4] | - | 5 | - | - | - | - | H |
| Borates, tetra, sodium salts (anhydrous) | [1303-96-4] | - | 1 | - | - | - | - | H |
| Borates, tetra, sodium salts (decahydrate) | [1303-96-4] | - | 5 | - | - | - | - | H |
| Borates, tetra, sodium salts (pentahydrate) | [1303-96-4] | - | 1 | - | - | - | - | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA | | (4) STEL | | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|--|-----------------|------------|-------------------|-----------------|-------------------|-------------------------------|----------------|------------|
| | | ppm | mg/m ³ | ppm | mg/m ³ | | | |
| Boron oxide | [1303-86-2] | - | 10 | - | - | - | - | H |
| Boron tribromide | [10294-33-4] | 1 | 10 | Peak limitation | - | - | - | H |
| Boron trifluoride | [7637-07-2] | 1 | 2.8 | Peak limitation | - | - | - | H |
| Bromacil | [314-40-9] | 1 | 11 | - | - | - | - | H |
| Bromine | [7726-95-6] | 0.1 | 0.66 | 0.3 | 2 | - | - | H |
| Bromine pentafluoride | [7789-30-2] | 0.1 | 0.72 | - | - | - | - | H |
| Bromoform | [75-25-2] | 0.5 | 5.2 | - | - | - | Sk | H |
| 1,3-Butadiene (h) | [106-99-0] | 10 | 22 | - | - | 2 | - | H |
| Butane | [106-97-8] | 800 | 1,900 | - | - | - | - | H |
| 2-Butoxyethanol | [111-76-2] | 25 | 121 | - | - | - | Sk | H;R |
| n-Butyl acetate | [123-86-4] | 150 | 713 | 200 | 950 | - | - | H |
| sec-Butyl acetate | [105-46-4] | 200 | 950 | - | - | - | - | H |
| tert-Butyl acetate | [540-88-5] | 200 | 950 | - | - | - | - | H |
| Butyl acrylate | [141-32-2] | 10 | 55 | - | - | - | Sen | A |
| n-Butyl alcohol | [71-36-3] | 50 | 152 | Peak limitation | - | - | Sk | H |
| sec-Butyl alcohol | [78-92-2] | 100 | 303 | - | - | - | - | H |
| tert-Butyl alcohol | [75-65-0] | 100 | 303 | 150 | 455 | - | - | H |
| Butylamine | [109-73-9] | 5 | 15 | Peak limitation | - | - | Sk | H |
| tert-Butyl chromate (as CrO ₃) | [1189-85-1] | - | 0.1 | Peak limitation | - | - | Sk | H |
| n-Butyl glycidyl ether (BGE) | [2426-08-6] | 25 | 133 | - | - | - | Sen | H |
| n Butyl lactate | [138-22-7] | 5 | 30 | - | - | - | - | H |
| Butyl mercaptan | [109-79-5] | 0.5 | 1.8 | - | - | - | - | H |
| o-sec-Butylphenol | [89-72-5] | 5 | 31 | - | - | - | Sk | H |
| p-tert-Butyltoluene (h) | [98-51-1] | 10 | 61 | 20 | 121 | - | - | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA ppm | (4) STEL mg/m ³ ppm | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|-------------------------------|-----------------|-------------------|---|-------------------------------|----------------|------------|
| Cadmium and compounds (as Cd) | [7440-43-9] | - | - | 2 | - | A |
| Caesium hydroxide | [21351-79-1] | - | - | - | - | H |
| Calcium carbonate (a) | [1317-65-3] | - | (see Chapter 14) | - | - | H |
| Calcium cyanamide | [156-62-7] | - | - | - | - | H |
| Calcium hydroxide | [1305-62-0] | - | - | - | - | H |
| Calcium oxide | [1305-78-8] | - | - | - | - | H |
| Calcium silicate (a) | [1344-95-2] | - | (see Chapter 14) | - | - | H |
| Calcium sulphate (a) | [7778-18-9] | - | (see Chapter 14) | - | - | H |
| Camphor, synthetic | [76-22-2] | 2 | 12 | - | - | H |
| Caprolactam (dust) | [105-60-2] | - | 1 | - | - | H |
| Caprolactam (vapour) (f) | [105-60-2] | 4.3 | 20 | - | - | H |
| Captafol | [2425-06-1] | - | 0.1 | - | Sk | H |
| Captan | [133-06-2] | - | 0.5 | - | Sk; Sen | A |
| Carbaryl | [63-25-2] | - | 5 | - | - | H; R |
| Carbofuran | [1563-66-2] | - | 0.1 | - | - | H |
| Carbon black | [1333-86-4] | - | 3 | - | - | A |
| Carbon dioxide | [124-38-9] | 5,000 | 9,000 | - | - | H |
| Carbon dioxide in coal mines | [124-38-9] | 12,500 | 22,500 | - | - | A* |
| Carbon disulphide | [75-15-0] | 10 | 31 | - | Sk | H; R |
| Carbon monoxide (e) | [630-08-0] | 30 | 34 (see footnote (e)) | - | - | A |
| Carbon tetrabromide | [558-13-4] | 0.1 | 1.4 | - | - | H |
| Carbon tetrachloride | [56-23-5] | 5 | 31 | - | Sk | H; Ch |
| Carbonyl fluoride | [353-50-4] | 2 | 5.4 | - | - | H |
| Catechol | [120-80-9] | 5 | 23 | - | - | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA ppm | (4) STEL mg/m ³ ppm | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|--------------------------------------|-----------------|-------------------|---|-------------------------------|----------------|------------|
| Cellulose (paper fibre) (a) | [9004-34-6] | - | 10 (see Chapter 14) | - | - | A |
| Ceramic fibres | [-] | - | 0.5 f/ml (see Chapter 14, Synthetic mineral fibres) | - | - | A |
| Chlordane | [57-74-9] | - | 0.5 | 3 | Sk | A |
| Chlorinated camphene | [8001-35-2] | - | 0.5 | - | Sk | H |
| Chlorinated diphenyl oxide | [31242-93-0] | - | 0.5 | - | - | H |
| Chlorine | [7782-50-5] | 1 | 3 | Peak limitation | - | A |
| Chlorine dioxide | [10049-04-4] | 0.1 | 0.28 | 0.3 0.83 | - | H |
| Chlorine trifluoride | [7790-91-2] | 0.1 | 0.38 | Peak limitation | - | H |
| Chloroacetaldehyde | [107-20-0] | 1 | 3.2 | Peak limitation | - | H |
| Chloroacetone | [78-95-5] | 1 | 3.8 | Peak limitation | Sk | H |
| a-Chloroacetophenone | [532-27-4] | 0.05 | 0.32 | - | - | H |
| Chloroacetyl chloride | [79-04-9] | 0.05 | 0.23 | 0.15 0.69 | Sk | H |
| Chlorobenzene | [108-90-7] | 10 | 46 | - | - | H |
| o-Chlorobenzylidene malononitrile | [2698-41-1] | 0.05 | 0.39 | Peak limitation | Sk | H |
| Chlorobromomethane | [74-97-5] | 200 | 1,060 | - | - | H |
| Chlorodifluoromethane | [75-45-6] | 1,000 | 3,540 | - | - | H |
| Chloroform | [67-66-3] | 10 | 49 | 3 | - | H |
| Chloromethyl methyl ether (d) | [107-30-2] | - | - | 2 | - | H |
| bis(Chloromethyl) ether | [542-88-1] | .001(P) | 0.005 | 1 | - | A* |
| 1-Chloro-1-nitropropane | [600-25-9] | 2 | 10 | - | - | H |
| Chloropentafluoroethane | [76-15-3] | 1,000 | 6,320 | - | - | H |
| Chloropicrin | [76-06-2] | 0.1 | 0.67 | - | - | H |
| β-Chloroprene | [126-99-8] | 10 | 36 | - | Sk | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA ppm | (4) STEL mg/m ³ ppm | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|---|-----------------|-------------------|---|-------------------------------|----------------|------------|
| 2-Chloropropionic acid | [598-78-7] | 0.1 | 0.44 | - | Sk | H |
| o-Chlorostyrene | [2039-87-4] | 50 | 283 | 75 | 425 | H |
| o-Chlorotoluene | [95-49-8] | 50 | 259 | - | - | H |
| Chlorpyrifos | [2921-88-2] | - | 0.2 | - | - | H |
| Chromium (metal) | [7440-47-3] | - | 0.5 | - | - | H |
| Chromium (II) compounds (as Cr) | [-] | - | 0.5 | - | - | H |
| Chromium (III) compounds (as Cr) | [-] | - | 0.5 | - | - | H |
| Chromium (VI) compounds (as Cr), certain water insoluble (h) | [-] | - | 0.05 | - | 1 | H;R |
| Chromium (VI) compounds (as Cr), water soluble | [-] | - | 0.05 | - | - | H;R |
| Chrysene (d) | [218-01-9] | - | - | - | 3 | H |
| Chrysotile | [12001-29-5] | - | (see Asbestos) | - | - | H |
| Clopidol | [2971-90-6] | - | 10 | - | - | H |
| Coal dust (containing < 5% quartz) | [-] | - | 3 (respirable dust) | - | - | A |
| Coal tar pitch volatiles (as benzene solubles) | [65996-93-2] | - | 0.2 | - | 1 | H |
| Cobalt, metal dust & fume (as Co) (h) | [7440-48-4] | - | 0.05 | - | - | H |
| Cobalt carbonyl (as Co) | [10210-68-1] | - | 0.1 | - | - | H |
| Cobalt hydrocarbonyl (as Co) | [16842-03-8] | - | 0.1 | - | - | H |
| Copper, dusts & mists (as Cu) | [7440-50-8] | - | 1 | - | - | H |
| Copper (fume) | [7440-50-8] | - | 0.2 | - | - | H |
| Cotton dust, raw (c) | [-] | - | 0.2 | - | - | H |
| Cresol, all isomers | [1319-77-3] | 5 | 22 | - | - | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA ppm | mg/m ³ | (4) STEL ppm | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|--|-----------------|----------------------------|-------------------|--------------------|-------------------------------|----------------|------------|
| Cristobalite | [14464-46-1] | (see Silica - Crystalline) | | | | | |
| Crocidolite | [12001-28-4] | (see Asbestos) | | | | | |
| Crotonaldehyde | [4170-30-3] | 2 | 5.7 | - | - | - | H |
| Crufomate | [299-86-5] | - | 5 | - | - | - | H |
| Cumene | [98-82-8] | 50 | 246 | - | - | Sk | H |
| Cyanamide | [420-04-2] | - | 2 | - | - | - | H |
| Cyanides (as CN) | [151-50-8] | - | 5 | - | - | Sk | H |
| Cyanogen | [460-19-5] | 10 | 21 | - | - | - | H |
| Cyanogen chloride | [506-77-4] | 0.3 | 0.75 | Peak limitation | - | - | H |
| Cyclohexane | [110-82-7] | 300 | 1,030 | - | - | - | H |
| Cyclohexanol | [108-93-0] | 50 | 206 | - | - | Sk | H |
| Cyclohexanone | [108-94-1] | 25 | 100 | - | - | Sk | H |
| Cyclohexene | [110-83-8] | 300 | 1,010 | - | - | - | H |
| Cyclohexylamine | [108-91-8] | 10 | 41 | - | - | - | H |
| Cyclonite | [121-82-4] | - | 1.5 | - | - | Sk | H |
| Cyclopentadiene | [542-92-7] | 75 | 203 | - | - | - | H |
| Cyclopentane | [287-92-3] | 600 | 1,720 | - | - | - | H |
| Cyhexatin | [13121-70-5] | - | 5 | - | - | - | H |
| 2,4-D | [94-75-7] | - | 10 | - | - | - | H |
| DDT (Dichlorodiphenyl- trichloroethane) | [50-29-3] | - | 1 | - | - | - | A |
| Decaborane | [17702-41-9] | 0.05 | 0.25 | 0.15 | 0.75 | Sk | H |
| Demeton | [8065-48-3] | 0.01 | 0.11 | - | - | Sk | H |
| Diacetone alcohol | [123-42-2] | 50 | 238 | - | - | - | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA ppm | (4) STEL mg/m ³ ppm | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|--|----------------|-------------------|---|-------------------------------|----------------|------------|
| Diatomaceous earth (uncalcined) | [61790-53-2] | | | (see Silica - Amorphous) | | |
| Diazinon | [333-41-5] | - | 0.1 | - | Sk | H |
| Diazomethane | [334-88-3] | 0.2 | 0.34 | 3 | - | A |
| Diborane | [19287-45-7] | 0.1 | 0.11 | - | - | H |
| 2-N-Dibutylaminoethanol (h) | [102-81-8] | 2 | 14 | - | Sk | H |
| Dibutyl phenyl phosphate | [2528-78-7] | 0.3 | 3.5 | - | Sk | H |
| Dibutyl phosphate | [107-66-4] | 1 | 8.6 | 2 | - | H |
| Dibutyl phthalate | [84-74-2] | - | 5 | - | - | H |
| Dichloroacetylene | [7572-29-4] | 0.1 | 0.39 | Peak limitation 3 | - | A |
| o-Dichlorobenzene | [95-50-1] | 50 | 301 | Peak limitation | - | H |
| p-Dichlorobenzene (h) | [106-46-7] | 75 | 451 | 110 | - | H |
| 3,3'-Dichlorobenzidine (d) | [91-94-1] | - | - | - | 2 | Sk |
| Dichlorodifluoromethane | [75-71-8] | 1,000 | 4,950 | - | - | H |
| 1,3-Dichloro-5,5-dimethyl hydantoin | [118-52-5] | - | 0.2 | 0.4 | - | H |
| 1,1-Dichloroethane (h) | [75-34-3] | 200 | 810 | 250 | 1,010 | H |
| Dichloroethyl ether | [111-44-4] | 5 | 29 | 10 | 58 | Sk |
| 1,2-Dichloroethylene | [540-59-0] | 200 | 793 | - | - | H |
| Dichlorofluoromethane | [75-43-4] | 10 | 42 | - | - | H |
| 1,1-Dichloro-1-nitroethane | [594-72-9] | 2 | 12 | - | - | H |
| Dichloropropene | [542-75-6] | 1 | 4.5 | - | 3 | Sk |
| 2,2-Dichloropropionic acid | [75-99-0] | 1 | 5.8 | - | - | H |
| Dichlorotetrafluoroethane | [76-14-2] | 1,000 | 6,990 | - | - | H |
| Dichlorvos (DDVP) | [62-73-7] | 0.1 | 0.9 | - | Sk | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA ppm | mg/m ³ | (4) STEL ppm | mg/m ³ | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|---------------------------------|-----------------|-------------------|-------------------|--------------------|-------------------|-------------------------------|----------------|------------|
| Dicrotophos | [141-66-2] | - | 0.25 | - | - | - | Sk | H |
| Dicyclopentadiene | [77-73-6] | 5 | 27 | - | - | - | - | H |
| Dicyclopentadienyl iron | [102-54-5] | - | 10 | - | - | - | - | H |
| Dieldrin | [60-57-1] | - | 0.25 | - | - | - | Sk | H |
| Diethanolamine (h) | [111-42-2] | 3 | 13 | - | - | - | - | H |
| Diethylamine (h) | [109-89-7] | 10 | 30 | 25 | 75 | - | - | H |
| 2-Diethylaminoethanol (h) | [100-37-8] | 10 | 48 | - | - | - | Sk | H |
| Diethylene triamine | [111-40-0] | 1 | 4.2 | - | - | - | Sk | H |
| Diethyl ketone | [96-22-0] | 200 | 705 | - | - | - | - | H |
| Diethyl phthalate | [84-66-2] | - | 5 | - | - | - | - | H |
| Difluorodibromomethane | [75-61-6] | 100 | 858 | - | - | - | - | H |
| Diglycidyl ether (DGE) | [2238-07-5] | 0.1 | 0.53 | - | - | - | - | H |
| Diisobutyl ketone | [108-83-8] | 25 | 145 | - | - | - | - | H |
| Diisopropylamine | [108-18-9] | 5 | 21 | - | - | - | Sk | H |
| Dimethyl acetamide | [127-19-5] | 10 | 36 | - | - | - | Sk | H |
| Dimethylamine (h) | [124-40-3] | 10 | 18 | - | - | - | - | H |
| N,N-Dimethylaniline | [121-69-7] | 5 | 25 | 10 | 50 | - | Sk | H |
| Dimethyl carbamoyl chloride (d) | [79-44-7] | - | - | - | - | 2 | - | H |
| Dimethylformamide | [68-12-2] | 10 | 30 | - | - | - | Sk | H |
| 1,1-Dimethylhydrazine | [57-14-7] | 0.01 | 0.025 | - | - | 2 | Sk | A |
| Dimethylphthalate | [131-11-3] | - | 5 | - | - | - | - | H |
| Dimethyl sulphate | [77-78-1] | 0.1 | 0.52 | - | - | 2 | Sk | H |
| Dinitolmide | [148-01-6] | - | 5 | - | - | - | - | H |
| m-Dinitrobenzene | [99-65-0] | 0.15 | 1 | - | - | - | Sk | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA ppm | mg/m ³ | (4) STEL ppm | mg/m ³ | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|-------------------------------------|-----------------|-------------------|-------------------|--------------------|-------------------|-------------------------------|----------------|------------|
| o-Dinitrobenzene | [528-29-0] | 0.15 | 1 | - | - | - | Sk | H |
| p-Dinitrobenzene | [100-25-4] | 0.15 | 1 | - | - | - | Sk | H |
| Dinitro-o-cresol | [534-52-1] | - | 0.2 | - | - | - | Sk | H |
| Dinitrotoluene (h) | [25321-14-6] | - | 1.5 | - | - | - | Sk | H |
| Dioxane | [123-91-1] | 25 | 90 | - | - | - | Sk | H |
| Dioxathion | [78-34-2] | - | 0.2 | - | - | - | Sk | H |
| Diphenylamine | [122-39-4] | - | 10 | - | - | - | - | H |
| Dipropylene glycol, methyl ether | [34590-94-8] | 100 | 606 | 150 | 909 | - | Sk | H |
| Dipropyl ketone | [123-19-3] | 50 | 233 | - | - | - | - | H |
| Diquat | [85-00-7] | - | 0.5 | - | - | - | - | H |
| Di-sec-octyl phthalate | [117-81-7] | - | 5 | - | 10 | - | - | H |
| Disulfiram | [97-77-8] | - | 2 | - | - | - | - | H |
| Disulfoton | [298-04-4] | - | 0.1 | - | - | - | - | H |
| 2,6-Di-tert-butyl-p-cresol | [128-37-0] | - | 10 | - | - | - | - | H |
| Diuron | [330-54-1] | - | 10 | - | - | - | - | H |
| Divinyl benzene | [1321-74-0] | 10 | 53 | - | - | - | - | H |
| Emery (dust) (a) | [1302-74-5] | - | 10 | (see Chapter 14) | - | - | - | H |
| Endosulfan | [115-29-7] | - | 0.1 | - | - | - | Sk | H |
| Endrin | [72-20-8] | - | 0.1 | - | - | - | Sk | H |
| Enflurane | [13838-16-9] | 0.5 | 3.8 | - | - | - | - | A* |
| Epichlorohydrin | [106-89-8] | 2 | 7.6 | - | - | 2 | Sk | A;R |
| EPN (h) | [2104-64-5] | - | 0.5 | - | - | - | Sk | H |
| Ethane | [74-84-0] | Asphyxiant | (see Chapter 10) | - | - | - | - | - |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA ppm | (3) mg/m ³ | (4) STEL ppm | (4) mg/m ³ | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|---------------------------|-----------------|-----------------------------|--------------------------|--------------------|--------------------------|-------------------------------|----------------|------------|
| Ethanolamine | [141-43-5] | 3 | 7.5 | 6 | 15 | - | - | H |
| Ethion | [563-12-2] | - | 0.4 | - | - | - | Sk | H |
| 2-Ethoxyethanol | [110-80-5] | 5 | 18 | - | - | - | Sk | H |
| 2-Ethoxyethyl acetate | [111-15-9] | 5 | 27 | - | - | - | Sk | H |
| Ethyl acetate | [141-78-6] | 400 | 1,440 | - | - | - | - | H;Ch |
| Ethyl acrylate | [140-88-5] | 5 | 20 | Peak limitation | - | - | Sen | A |
| Ethyl alcohol | [64-17-5] | 1,000 | 1,880 | - | - | - | - | H |
| Ethylamine (h) | [75-04-7] | 10 | 18 | - | - | - | - | H |
| Ethyl amyl ketone | [541-85-5] | 25 | 131 | - | - | - | - | H |
| Ethyl benzene | [100-41-4] | 100 | 434 | 125 | 543 | - | - | H;R |
| Ethyl bromide | [74-96-4] | 5 | 22 | - | - | 3 | Sk | A |
| Ethyl butyl ketone | [106-35-4] | 50 | 234 | - | - | - | - | H |
| Ethyl chloride | [75-00-3] | 1,000 | 2,640 | - | - | - | - | H |
| Ethylene | [74-85-1] | Asphyxiant (see Chapter 10) | - | - | - | - | - | - |
| Ethylene chlorohydrin | [107-07-3] | 1 | 3.3 | Peak limitation | - | - | Sk | H |
| Ethylenediamine | [107-15-3] | 10 | 25 | - | - | - | Sen | H |
| Ethylene dibromide (d) | [106-93-4] | - | - | - | - | 2 | Sk | H |
| Ethylene dichloride | [107-06-2] | 10 | 40 | - | - | - | - | H;R |
| Ethylene glycol (vapour) | [107-21-1] | - | 60 | - | 120 | - | - | A |
| Ethylene glycol dinitrate | [628-96-6] | 0.05 | 0.31 | - | - | - | Sk | H |
| Ethylene oxide | [75-21-8] | 1 | 1.8 | - | - | 2 | - | H |
| Ethylenimine | [151-56-4] | 0.5 | 0.88 | - | - | 3 | Sk | A |
| Ethyl ether | [60-29-7] | 400 | 1,210 | 500 | 1,520 | - | - | H |
| Ethyl formate | [109-94-4] | 100 | 303 | - | - | - | - | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA | | (4) STEL | | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|------------------------|-----------------|------------|--------------------------|--------------------------------|-------------------|-------------------------------|----------------|------------|
| | | ppm | mg/m ³ | ppm | mg/m ³ | | | |
| Ethylidene norbornene | [16219-75-3] | 5 | 25 | Peak limitation | - | - | - | H |
| Ethyl mercaptan | [75-08-1] | 0.5 | 1.3 | - | - | - | - | H |
| N-Ethylmorpholine | [100-74-3] | 5 | 24 | - | - | - | Sk | H |
| Ethyl silicate | [78-10-4] | 10 | 85 | - | - | - | - | H |
| Fenamiphos | [22224-92-6] | - | 0.1 | - | - | - | Sk | H |
| Fensulfothion | [115-90-2] | - | 0.1 | - | - | - | - | H |
| Fenthion | [55-38-9] | - | 0.2 | - | - | - | Sk | H |
| Ferbam | [14484-64-1] | - | 10 | - | - | - | - | H |
| Ferrovandium dust | [12604-58-9] | - | 1 | - | 3 | - | - | H |
| Fluorides (as F) | [- -] | - | 2.5 | - | - | - | - | H |
| Fluorine | [7782-41-4] | 1 | 1.6 | 2 | 3.1 | - | - | H;R |
| Fonofos | [944-22-9] | - | 0.1 | - | - | - | Sk | H |
| Formaldehyde (h) | [50-00-0] | 1 | 1.2 | 2 | 2.5 | 2 | Sen | H;R |
| Formamide | [75-12-7] | 10 | 18 | - | - | - | Sk | H |
| Formic acid | [64-18-6] | 5 | 9.4 | 10 | 19 | - | - | H |
| Fumed silica | [7631-86-9] | - | (see Silica - Amorphous) | - | - | - | - | - |
| Furfural | [98-01-1] | 2 | 7.9 | - | - | - | Sk | H |
| Furfuryl alcohol | [98-00-0] | 10 | 40 | 15 | 60 | - | Sk | H |
| Germanium tetrahydride | [7782-65-2] | 0.2 | 0.63 | - | - | - | - | H |
| Glasswool | [- -] | - | 0.5 f/ml | (see Synthetic mineral fibres) | - | - | - | - |
| Glutaraldehyde | [111-30-8] | 0.2 | 0.82 | Peak limitation | - | - | Sen | H;Ch |
| Glycerin mist (a) | [56-81-5] | - | 10 | (see Chapter 14) | - | - | - | H |
| Glycidol | [556-52-5] | 25 | 76 | - | - | - | - | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA | | (4) STEL | | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|---|--------------------------------------|------------------------|-------------------|------------------|-------------------|-------------------------------|----------------|------------|
| | | ppm | mg/m ³ | ppm | mg/m ³ | | | |
| Grain dust (oats, wheat, barley) | [-] | - | 4 | - | - | - | - | H |
| Graphite (all forms except fibres) (respirable dust) (g) | [7782-42-5] (natural & synthetic) | - | 3 | (see Chapter 14) | - | - | - | A |
| Hafnium | [7440-58-6] | - | 0.5 | - | - | - | - | H |
| Haloethane | [151-67-7] | 0.5 | 4.1 | - | - | - | - | A* |
| Helium | [7440-59-7] | Asphyxiant | (see Chapter 10) | - | - | - | - | - |
| Heptachlor (h) | [76-44-8] | - | 0.5 | - | - | - | Sk | H;R |
| Heptane (n-Heptane) | [142-82-5] | 400 | 1,640 | 500 | 2,050 | - | - | H |
| Hexachlorobutadiene | [87-68-3] | 0.02 | 0.21 | - | - | 3 | Sk | H |
| Hexachlorocyclopentadiene | [77-47-4] | 0.01 | 0.11 | - | - | - | - | H |
| Hexachloroethane | [67-72-1] | 1 | 9.7 | - | - | 3 | - | A |
| Hexachloronaphthalene | [1335-87-1] | - | 0.2 | - | - | - | Sk | H |
| Hexafluoroacetone | [684-16-2] | 0.1 | 0.68 | - | - | - | Sk | H |
| Hexamethyl phosphoramide (d) | [680-31-9] | - | - | - | - | 2 | Sk | H |
| Hexamethylene diisocyanate | [822-06-0] | (see Isocyanates, all) | - | - | - | - | - | - |
| Hexane (n-Hexane) | [110-54-3] | 50 | 176 | - | - | - | - | H |
| Hexane, other isomers | [-] | 500 | 1,760 | 1,000 | 3,500 | - | - | H |
| sec-Hexyl acetate | [108-84-9] | 50 | 295 | - | - | - | - | H |
| Hexylene glycol | [107-41-5] | 25 | 121 | Peak limitation | - | - | - | H |
| Hydrazine | [302-01-2] | 0.01 | 0.013 | - | - | 2 | Sk;Sen | A |
| Hydrogen | [1333-74-0] | Asphyxiant | (see Chapter 10) | - | - | - | - | - |
| Hydrogenated terphenyls | [37275-59-5] | 0.5 | 4.9 | - | - | - | - | H |
| Hydrogen bromide | [10035-10-6] | 3 | 9.9 | Peak limitation | - | - | - | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA ppm | mg/m ³ | (4) STEL ppm | mg/m ³ | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|--|-----------------|------------------------|-------------------|--------------------|-------------------|-------------------------------|----------------|------------|
| Hydrogen chloride | [7647-01-0] | 5 | 7.5 | Peak limitation | - | - | - | H |
| Hydrogen cyanide (h) | [74-90-8] | 10 | 11 | Peak limitation | - | - | Sk | H |
| Hydrogen fluoride (as F) | [7664-39-3] | 3 | 2.6 | Peak limitation | - | - | - | H |
| Hydrogen peroxide | [7722-84-1] | 1 | 1.4 | - | - | - | - | H |
| Hydrogen selenide (as Se) | [7783-07-5] | 0.05 | 0.16 | - | - | - | - | H |
| Hydrogen sulphide | [7783-06-4] | 10 | 14 | 15 | 21 | - | - | H |
| Hydroquinone | [123-31-9] | - | 2 | - | - | - | - | H |
| 2-Hydroxypropyl acrylate | [999-61-1] | 0.5 | 2.8 | - | - | - | Sk | H |
| Indene | [95-13-6] | 10 | 48 | - | - | - | - | H |
| Indium & compounds (as In) | [7440-74-6] | - | 0.1 | - | - | - | - | H |
| Iodine | [7553-56-2] | 0.1 | 1 | Peak limitation | - | - | - | H |
| Iodoform | [75-47-8] | 0.6 | 10 | - | - | - | - | H |
| Iron oxide fume (Fe ₂ O ₃) (as Fe) | [1309-37-1] | - | 5 | (see Chapter 17) | - | - | - | H |
| Iron pentacarbonyl (as Fe) | [13463-40-6] | 0.1 | 0.23 | 0.2 | 0.45 | - | - | H |
| Iron salts, soluble (as Fe) | [- -] | - | 1 | - | - | - | - | H |
| Isoamyl acetate | [123-92-2] | 100 | 532 | - | - | - | - | H |
| Isoamyl alcohol | [123-51-3] | 100 | 361 | 125 | 452 | - | - | H |
| Isobutyl acetate | [110-19-0] | 150 | 713 | - | - | - | - | H |
| Isobutyl alcohol | [78-83-1] | 50 | 152 | - | - | - | - | H |
| Isocyanates, all (as-NCO) | [- -] | - | 0.02 | - | 0.07 | - | Sen | A |
| Isocetyl alcohol | [26952-21-6] | 50 | 266 | - | - | - | Sk | H |
| Isophorone | [78-59-1] | 5 | 28 | Peak limitation | - | - | - | H |
| Isophorone diisocyanate | [4098-71-9] | (see Isocyanates, all) | - | - | - | - | - | - |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA ppm | (4) mg/m ³ | (5) mg/m ³ | (6) STEL ppm | (7) CARCINOGEN CATEGORY | (8) NOTICES | (9) REF |
|--|-----------------|-------------------|--------------------------|--------------------------------|--------------------|-------------------------------|----------------|------------|
| Isopropoxyethanol | [109-59-1] | 25 | 106 | - | - | - | - | H |
| Isopropyl acetate | [108-21-4] | 250 | 1040 | 310 | 1,290 | - | - | H |
| Isopropyl alcohol | [67-63-0] | 400 | 983 | 500 | 1,230 | - | - | H;R |
| Isopropylamine | [75-31-0] | 5 | 12 | 10 | 24 | - | - | H |
| N-Isopropylaniline | [768-52-5] | 2 | 11 | - | - | - | Sk | H |
| Isopropyl ether | [108-20-3] | 250 | 1,040 | 310 | 1,300 | - | - | H |
| Isopropyl glycidyl ether (IGE) | [4016-14-2] | 50 | 238 | 75 | 356 | - | - | H |
| Kaolin (a) | [1322-58-7] | - | 10 | (see Chapter 14) | - | - | - | H |
| Ketene | [463-51-4] | 0.5 | 0.86 | 1.5 | 2.6 | - | - | H |
| Lead, inorganic dusts & fumes (as Pb) | [7439-92-1] | - | 0.15 | - | - | - | - | H;R |
| Lead arsenate (as Pb ₃ (AsO ₄) ₂) | [3687-31-8] | - | 0.15 | - | - | - | - | H |
| Lead chromate (as Cr) (h) | [7758-97-6] | - | 0.05 | - | - | 2 | - | H |
| Lindane | [58-89-9] | - | 0.5 | - | - | - | Sk | H |
| Lithium hydride | [7580-67-8] | - | 0.025 | - | - | - | - | H |
| LPG (liquefied petroleum gas) | [68476-85-7] | 1,000 | 1,800 | - | - | - | - | H |
| Magnesite (a) | [546-93-0] | - | 10 | (see Chapter 14) | - | - | - | H |
| Magnesium oxide (fume) | [1309-48-4] | - | 10 | - | - | - | - | H |
| Malathion | [121-75-5] | - | 10 | - | - | - | Sk | H |
| Maleic anhydride | [108-31-6] | 0.25 | 1 | - | - | - | Sen | H |
| Man-made mineral fibres | [- -] | - | 0.5 f/ml | (see Synthetic mineral fibres) | - | - | - | A |
| Manganese, dust & compounds (as Mn) | [7439-96-5] | - | 1 | - | - | - | - | A |
| Manganese, fume (as Mn) | [7439-96-5] | - | 1 | - | 3 | - | - | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA | | (4) STEL | | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|--|-----------------|-----------------------------|-------------------|-------------|-------------------|-------------------------------|----------------|------------|
| | | ppm | mg/m ³ | ppm | mg/m ³ | | | |
| Manganese cyclopenta-dienyl tricarbonyl (as Mn) | [12079-65-1] | - | 0.1 | - | - | - | Sk | H |
| Mercury, elemental vapour (as Hg) | [7439-97-7] | - | 0.05 | - | - | - | - | A |
| Mercury, alkyl compounds (as Hg) | [7439-97-6] | - | 0.01 | - | 0.03 | - | Sk | H |
| Mercury, aryl & inorganic compounds (as Hg) | [7439-97-6] | - | 0.1 | - | - | - | Sk | H;R |
| Mesityl oxide | [141-79-7] | 15 | 60 | 25 | 100 | - | - | H |
| Methacrylic acid | [79-41-4] | 20 | 70 | - | - | - | - | H |
| Methane | [74-82-8] | Asphyxiant (see Chapter 10) | | - | - | - | - | - |
| Methomyl | [16752-77-5] | - | 2.5 | - | - | - | - | H |
| Methoxychlor | [72-43-5] | - | 10 | - | - | - | - | H |
| 2-Methoxyethanol | [109-86-4] | 5 | 16 | - | - | - | Sk | H |
| 2-Methoxyethyl acetate | [110-49-6] | 5 | 24 | - | - | - | Sk | H |
| 4-Methoxyphenol | [150-76-5] | - | 5 | - | - | - | - | H |
| Methyl acetate | [79-20-9] | 200 | 606 | 250 | 757 | - | - | H |
| Methyl acetylene | [79-99-7] | 1,000 | 1,640 | - | - | - | - | H |
| Methyl acetylene-propadiene mixture (MAPP) | [-] | 1,000 | 1,640 | 1,250 | 2,050 | - | - | H |
| Methyl acrylate | [96-33-3] | 10 | 35 | - | - | - | Sk;Sen | A |
| Methylacrylonitrile | [126-98-7] | 1 | 2.7 | - | - | - | Sk | H |
| Methylal | [109-87-5] | 1,000 | 3,110 | - | - | - | - | H |
| Methyl alcohol | [67-56-1] | 200 | 262 | 250 | 328 | - | Sk | H |
| Methylamine (h) | [74-89-5] | 10 | 13 | - | - | - | - | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA | | (4) STEL | | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|---|-----------------|------------------------|-------------------|-----------------|-------------------|-------------------------------|----------------|------------|
| | | ppm | mg/m ³ | ppm | mg/m ³ | | | |
| Methyl n-aryl ketone | [110-43-0] | 50 | 233 | - | - | - | - | H |
| N-Methyl aniline | [100-61-8] | 0.5 | 2.2 | - | - | - | Sk | H |
| Methyl bromide | [74-83-9] | 5 | 19 | - | - | - | Sk | H |
| Methyl n-butyl ketone | [591-78-6] | 5 | 20 | - | - | - | - | H;R |
| Methyl chloride | [74-87-3] | 50 | 103 | 100 | 207 | - | - | H |
| Methyl 2-cyanoacrylate | [137-05-3] | 2 | 9.1 | 4 | 18 | - | - | H |
| Methylcyclohexane | [108-87-2] | 400 | 1,610 | - | - | - | - | H |
| Methylcyclohexanol | [25639-42-3] | 50 | 234 | - | - | - | - | H |
| o-Methylcyclohexanone | [583-60-8] | 50 | 229 | 75 | 344 | - | Sk | H |
| Methylcyclopentadienyl manganese tricarbonyl (as Mn) | [12108-13-3] | - | 0.2 | - | - | - | Sk | H |
| Methyl demeton | [8022-00-2] | - | 0.5 | - | - | - | Sk | H |
| 4,4'-Methylene bis(2-chloroaniline) (h) | [101-14-4] | 0.02 | 0.22 | - | - | 2 | Sk | H;R |
| Methylene bis(4-cyclo-hexylisocyanate) | [5124-30-1] | (see Isocyanates, all) | | | | | | |
| Methylene bisphenyl isocyanate (MDI) | [101-68-8] | (see Isocyanates, all) | | | | | | |
| Methylene chloride | [75-09-2] | 50 | 174 | - | - | 3 | - | H;R |
| 4,4'-Methylene dianiline | [101-77-9] | 0.1 | 0.81 | - | - | 2 | Sk | H |
| Methyl ethyl ketone (MEK) | [78-93-3] | 150 | 445 | 300 | 890 | - | - | A |
| Methyl ethyl ketone peroxide | [1338-23-4] | 0.2 | 1.5 | Peak limitation | | - | - | H |
| Methyl formate | [107-31-3] | 100 | 246 | 150 | 368 | - | - | H |
| Methyl hydrazine | [60-34-4] | 0.2 | 0.38 | Peak limitation | | 3 | Sk | H;R |
| Methyl iodide | [74-88-4] | 2 | 12 | - | - | 3 | Sk | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA | | (4) STEL | | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|---|-----------------|------------------------|-------------------|------------------|-------------------|-------------------------------|----------------|------------|
| | | ppm | mg/m ³ | ppm | mg/m ³ | | | |
| Methyl isoamyl ketone | [110-12-3] | 50 | 234 | - | - | - | - | H |
| Methyl isobutyl carbinol | [108-11-2] | 25 | 104 | 40 | 167 | - | Sk | H |
| Methyl isobutyl ketone | [108-10-1] | 50 | 205 | 75 | 307 | - | - | H;R |
| Methyl isocyanate | [624-83-9] | (see Isocyanates, all) | | - | - | - | - | H |
| Methyl isopropyl ketone | [563-80-4] | 200 | 705 | - | - | - | - | H |
| Methyl mercaptan | [74-93-1] | 0.5 | 0.98 | - | - | - | - | H |
| Methyl methacrylate | [80-62-6] | 100 | 410 | - | - | - | Sk;Sen | A |
| Methyl parathion | [298-00-0] | - | 0.2 | - | - | - | Sk | H |
| Methyl propyl ketone | [107-87-9] | 200 | 705 | 250 | 881 | - | - | H |
| Methyl silicate | [681-84-5] | 1 | 6 | - | - | - | - | H |
| α-Methyl styrene | [98-83-9] | 50 | 242 | 100 | 483 | - | - | H |
| Metribuzin | [21087-64-9] | - | 5 | - | - | - | - | H |
| Mevinphos | [7786-34-7] | 0.01 | 0.092 | 0.03 | 0.27 | - | Sk | H |
| Mica | [12001-26-2] | - | 2.5 (inspirable) | - | - | - | - | A*;R |
| Mineral turpentine | [- -] | - | 480 | (see Chapter 16) | - | - | - | R |
| Molybdenum, insoluble compounds (as Mo) | [7439-98-7] | - | 10 | - | - | - | - | H |
| Molybdenum, soluble compounds (as Mo) | [7439-98-7] | - | 5 | - | - | - | - | H |
| Monocrotophos | [6923-22-4] | - | 0.25 | - | - | - | - | H |
| Morpholine | [110-91-8] | 20 | 71 | - | - | - | Sk | H |
| Naled | [300-76-5] | - | 3 | - | - | - | Sk | H |
| Naphthalene | [91-20-3] | 10 | 52 | 15 | 79 | - | - | H |
| 2-Naphthylamine | [91-59-8] | -(P) | - | - | - | 1 | - | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) CAS # | (3) TWA ppm | (3) mg/m ³ | (4) STEL ppm | (4) mg/m ³ | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|--|--------------|-------------------|--------------------------|--------------------|--------------------------|-------------------------------|----------------|------------|
| Neon | [7440-01-9] | Asphyxiant | (see Chapter 10) | - | - | - | - | - |
| Nickel, metal | [7440-02-0] | - | 1 | - | - | - | Sen | H;R |
| Nickel, soluble compounds (as Ni) | [7440-02-0] | - | 0.1 | - | - | - | Sen | H;R |
| Nickel carbonyl (as Ni) | [13463-39-3] | 0.05 | 0.12 | - | - | - | - | H;R |
| Nickel sulphide roasting (fume & dust) (as Ni) | [-] | - | 1 | - | - | 1 | Sen | H;R |
| Nicotine | [54-11-5] | - | 0.5 | - | - | - | Sk | H |
| Nitrapyrin | [1929-82-4] | - | 10 | - | 20 | - | - | H |
| Nitric acid | [7697-37-2] | 2 | 5.2 | 4 | 10 | - | - | H |
| Nitric oxide | [10102-43-9] | 25 | 31 | - | - | - | - | H |
| p-Nitroaniline | [100-01-6] | - | 3 | - | - | - | Sk | H |
| Nitrobenzene | [98-95-3] | 1 | 5 | - | - | - | Sk | H |
| p-Nitrochlorobenzene | [100-00-5] | 0.1 | 0.64 | - | - | - | Sk | H |
| 4-Nitrodiphenyl | [92-93-3] | -(P) | - | - | - | 1 | - | H |
| Nitroethane | [79-24-3] | 100 | 307 | - | - | - | - | H |
| Nitrogen | [7727-37-9] | Asphyxiant | (see Chapter 10) | - | - | - | - | - |
| Nitrogen dioxide | [10102-44-0] | 3 | 5.6 | 5 | 9.4 | - | - | H;R |
| Nitrogen trifluoride | [7783-54-2] | 10 | 29 | - | - | - | - | H |
| Nitroglycerin (NG) | [55-63-0] | 0.05 | 0.46 | - | - | - | Sk | H |
| Nitromethane | [75-52-5] | 20 | 50 | - | - | - | - | H |
| 1-Nitropropane | [108-03-2] | 25 | 91 | - | - | - | - | H |
| 2-Nitropropane | [79-46-9] | 10 | 36 | - | - | 2 | - | H |
| N-Nitrosodimethylamine (d) | [62-75-9] | - | - | - | - | 2 | Sk | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA | | (4) STEL | | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|-----------------------------|-----------------------------------|------------|-------------------|------------------|-------------------|-------------------------------|----------------|------------|
| | | ppm | mg/m ³ | ppm | mg/m ³ | | | |
| Nitrotoluene | [88-72-2; 99-08-1; 99-99-0] | 2 | 11 | - | - | - | Sk | H |
| Nitrous oxide | [10024-97-2] | 25 | 45 | - | - | - | - | A* |
| Nonane | [111-84-2] | 200 | 1,050 | - | - | - | - | H |
| Octachloronaphthalene | [2234-13-1] | - | 0.1 | - | 0.3 | - | Sk | H |
| Octane | [111-65-9] | 300 | 1,400 | 375 | 1,750 | - | - | H |
| Oil mist, refined mineral | [8012-95-1] | - | 5 | - | - | - | - | A |
| Osmium tetroxide (as Os) | [20816-12-0] | 0.0002 | 0.0016 | 0.0006 | 0.0047 | - | - | H |
| Oxalic acid | [144-62-7] | - | 1 | - | 2 | - | - | H |
| Oxygen difluoride | [7783-41-7] | 0.05 | 0.11 | Peak limitation | - | - | - | H |
| Ozone | [10028-15-6] | 0.1 | 0.2 | Peak limitation | - | - | - | H |
| Paraffin wax (fume) | [8002-74-2] | - | 2 | - | - | - | - | H |
| Paraquat (respirable sizes) | [4685-14-7] | - | 0.1 | - | - | - | - | H;R |
| Parathion | [56-38-2] | - | 0.1 | - | - | - | Sk | H |
| PCBs (42% Chlorine) | [53469-21-9] | - | 1 | - | 2 | 2 | Sk | A;R |
| PCBs (54% Chlorine) | [11097-69-1] | - | 0.5 | - | 1 | 2 | Sk | A;R |
| Pentaborane | [19624-22-7] | 0.005 | 0.013 | 0.015 | 0.039 | - | - | H |
| Pentachloronaphthalene | [1321-64-8] | - | 0.5 | - | - | - | - | H |
| Pentachloronitrobenzene | [82-68-8] | - | 0.5 | - | - | - | - | H |
| Pentachlorophenol | [87-86-5] | - | 0.5 | - | - | - | Sk | H |
| Pentaerythritol (a) | [115-77-5] | - | 10 | (see Chapter 14) | - | - | - | H |
| Pentane | [109-66-0] | 600 | 1,770 | 750 | 2,210 | - | - | H |
| Perchloroethylene | [127-18-4] | 50 | 340 | 150 | 1,020 | 3 | - | A |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA ppm | mg/m ³ | (4) STEL ppm | mg/m ³ | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|---------------------------------|-----------------|-------------------|-------------------|--------------------|-------------------|-------------------------------|----------------|------------|
| perchloromethyl mercaptan | [594-42-3] | 0.1 | 0.76 | - | - | - | - | H |
| perchloryl fluoride | [7616-94-6] | 3 | 13 | 6 | 25 | - | - | H |
| perfluoroisobutylene | [382-21-8] | - | - | - | - | - | - | Ch |
| perlite dust (a) | [93763-70-3] | - | 10 | (see Chapter 14) | - | - | - | H |
| Petrol (gasoline) | [-] | - | 900 | (see Chapter 16) | - | - | - | R |
| Phenol | [108-95-2] | 1 | 4 | - | - | - | Sk | A |
| Phenothiazine | [92-84-2] | - | 5 | - | - | - | Sk | H |
| n-Phenyl-beta-naphthylamine (d) | [135-88-6] | - | - | - | - | 2 | - | H |
| m-Phenylenediamine | [108-45-2] | - | 0.1 | - | - | - | Sk;Sen | A |
| o-Phenylenediamine | [95-54-5] | - | 0.1 | - | - | 3 | Sen | A |
| p-Phenylenediamine | [106-50-3] | - | 0.1 | - | - | - | Sen | H |
| Phenyl ether (vapour) | [101-84-8] | 1 | 7 | 2 | 14 | - | - | H |
| Phenyl glycidyl ether (PGE) | [122-60-1] | 1 | 6.1 | - | - | - | Sen | H |
| Phenylhydrazine | [100-63-0] | 0.1 | 0.44 | - | - | 2 | Sk;Sen | A |
| Phenyl mercaptan | [108-98-5] | 0.5 | 2.3 | - | - | - | - | H |
| Phenylphosphine | [638-21-1] | 0.05 | 0.23 | - | Peak limitation | - | - | H |
| Phorate | [298-02-2] | - | 0.05 | - | 0.2 | - | Sk | H |
| Phosgene | [75-44-5] | 0.1 | 0.4 | - | - | - | - | H |
| Phosphine | [7803-51-2] | 0.3 | 0.42 | 1 | 1.4 | - | - | H;R |
| Phosphoric acid | [7664-38-2] | - | 1 | - | 3 | - | - | H |
| phosphorus (yellow) | [7723-14-0] | - | 0.1 | - | - | - | - | H |
| Phosphorus oxychloride | [10025-87-3] | 0.1 | 0.63 | - | - | - | - | H |
| Phosphorus pentachloride | [10026-13-8] | 0.1 | 0.85 | - | - | - | - | H |
| Phosphorus pentasulphide | [1314-80-3] | - | 1 | - | 3 | - | - | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA | | (4) STEL | | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|---------------------------------|-----------------|--------------------------|-------------------|------------------|-------------------|-------------------------------|----------------|------------|
| | | ppm | mg/m ³ | ppm | mg/m ³ | | | |
| Phosphorus trichloride | [7719-12-2] | 0.2 | 1.1 | 0.5 | 2.8 | - | - | H |
| Phthalic anhydride | [85-44-9] | 1 | 6.1 | - | - | - | Sen | H |
| m-Phthalodinitrile | [626-17-5] | - | 5 | - | - | - | - | H |
| Picloram | [1918-02-1] | - | 10 | - | - | - | - | H |
| Picric acid | [88-89-1] | - | 0.1 | - | - | - | - | H |
| Pindone | [83-26-1] | - | 0.1 | - | - | - | - | H |
| Piperazine dihydrochloride | [142-64-3] | - | 5 | - | - | - | - | H |
| Platinum, metal | [7440-06-4] | - | 1 | - | - | - | - | H |
| Platinum, soluble salts (as Pt) | [7440-06-4] | - | 0.002 | - | - | - | Sen | H |
| Portland cement (a) | [65997-15-1] | - | 10 | (see Chapter 14) | - | - | - | H |
| Potassium hydroxide | [1310-58-3] | - | 2 | Peak limitation | - | - | - | H |
| Precipitated silica | [112926-00-8] | (see Silica - Amorphous) | - | - | - | - | - | - |
| Propane | [74-98-6] | Asphyxiant | (see Chapter 10) | - | - | - | - | - |
| Propane sultone (d) | [1120-71-4] | - | - | - | - | 2 | - | H |
| Propargyl alcohol | [107-19-7] | 1 | 2.3 | - | - | - | Sk | H |
| β-Propiolactone | [57-57-8] | 0.5 | 1.5 | - | - | 2 | - | H |
| Propionic acid | [79-09-4] | 10 | 30 | - | - | - | - | H |
| Propoxur | [114-26-1] | - | 0.5 | - | - | - | - | H |
| n-Propyl acetate | [109-60-4] | 200 | 835 | 250 | 1,040 | - | - | H |
| Propyl alcohol | [71-23-8] | 200 | 492 | 250 | 614 | - | Sk | H |
| Propylene | [115-07-1] | Asphyxiant | (see Chapter 10) | - | - | - | - | - |
| Propylene dichloride | [78-87-5] | 75 | 347 | 110 | 508 | - | - | H |
| Propylene glycol dinitrate | [6423-43-4] | 0.05 | 0.34 | - | - | - | Sk | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA ppm | mg/m ³ | ppm | (4) STEL mg/m ³ | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|--|-----------------|----------------------------|-------------------|--------------------------------|----------------------------------|-------------------------------|----------------|------------|
| Propylene glycol monomethyl ether | [107-98-2] | 100 | 369 | 150 | 553 | - | - | H;R |
| Propylene imine | [75-55-8] | 2 | 4.7 | - | - | 2 | Sk | H |
| Propylene oxide | [75-56-9] | 20 | 48 | - | - | 2 | - | A;R |
| n-Propyl nitrate | [627-13-4] | 25 | 107 | 40 | 172 | - | - | H |
| Pyrethrum | [8003-34-7] | - | 5 | - | - | - | Sen | H |
| Pyridine | [110-86-1] | 5 | 16 | - | - | - | - | H |
| Quartz | [14808-60-7] | (see Silica - Crystalline) | | | | | | |
| Quinone | [106-51-4] | 0.1 | 0.44 | - | - | - | - | H |
| Resorcinol | [108-46-3] | 10 | 45 | 20 | 90 | - | - | H |
| Rhodium, metal | [7440-16-6] | - | 1 | - | - | - | - | H |
| Rhodium, insoluble compounds (as Rh) | [7440-16-6] | - | 1 | - | - | - | - | H |
| Rhodium, soluble compounds (as Rh) | [7440-16-6] | - | 0.01 | - | - | - | - | H |
| Rockwool | [- -] | - | 0.5 f/ml | (see Synthetic mineral fibres) | | | | |
| Ronnel | [299-84-3] | - | 10 | - | - | - | - | H |
| Rosin core solder pyrolysis products (as formaldehyde) | [- -] | - | 0.1 | - | - | - | - | H |
| Rotenone (commercial) | [83-79-4] | - | 5 | - | - | - | - | H |
| Rouge dust (a) | [- -] | - | 10 | (see Chapter 14) | | - | - | H |
| Selenium compounds (as Se) excluding hydrogen selenide | [7782-49-2] | - | 0.2 | - | - | - | - | H |
| Selenium hexafluoride (as Se) | [7783-79-1] | 0.05 | 0.16 | - | - | - | - | H |
| Sesone | [136-78-7] | - | 10 | - | - | - | - | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA ppm | mg/m ³ | (4) STEL ppm mg/m ³ | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|---|-----------------|----------------------------|---------------------------------|---|-------------------------------|----------------|------------|
| Silica - Amorphous | | | (see Chapter 14) | | | | |
| Diatomaceous earth (uncalcined) (a) | [61790-53-2] | - | 10 | - | - | - | H |
| Fume (thermally generated) (respirable dust) (g) | [-] | - | 2 | (see Chapter 14) | - | - | A |
| Fumed silica (respirable dust) | [7631-86-9] | - | 2 | (see Chapter 14) | - | - | A |
| Precipitated silica (a) | [112926-00-8] | - | 10 | - | - | - | H |
| Silica gel (a) | [112926-00-8] | - | 10 | - | - | - | H |
| Silica - Crystalline | | | (see Chapter 14) | | | | |
| Cristobalite | [14464-64-1] | No interim value | (under review - see Chapter 14) | | | | |
| Quartz | [14808-60-7] | No interim value | (under review - see Chapter 14) | | | | |
| Silica, fused | [60676-86-0] | No interim value | (under review - see Chapter 14) | | | | |
| Tridymite | [15468-32-3] | No interim value | (under review - see Chapter 14) | | | | |
| Tripoli | [1317-95-9] | No interim value | (under review - see Chapter 14) | | | | |
| Silica gel | [112926-00-8] | (see Silica - Amorphous) | | | | | |
| Silica, fused | [60676-86-0] | (see Silica - Crystalline) | | | | | |
| Silicon (a) | [7440-21-3] | - | 10 | (see Chapter 14) | - | - | H |
| Silicon carbide (a) | [409-21-2] | - | 10 | (see Chapter 14) | - | - | H |
| Silicon tetrahydride | [7803-62-5] | 5 | 6.6 | - | - | - | H |
| Silver, metal | [7440-22-4] | - | 0.1 | - | - | - | H |
| Silver, soluble compounds (as Ag) | [7440-22-4] | - | 0.01 | - | - | - | H |
| Soapstone (a) | [-] | - | 6 | - | - | - | H |
| (respirable dust) | | - | 3 | - | - | - | H |
| Sodium azide (f) | [26628-22-8] | 0.11 | 0.3 | Peak limitation | - | - | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA | | (4) STEL | | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|---|-----------------|------------|-------------------|--------------------------------|-------------------|-------------------------------|----------------|------------|
| | | ppm | mg/m ³ | ppm | mg/m ³ | | | |
| Sodium bisulphite | [7631-90-5] | - | 5 | - | - | - | - | H |
| Sodium fluoroacetate | [62-74-8] | - | 0.05 | - | 0.15 | - | Sk | H |
| Sodium hydroxide | [1310-73-2] | - | 2 | Peak limitation | - | - | - | H |
| Sodium metabisulphite | [7681-57-4] | - | 5 | - | - | - | - | H |
| Starch (a) | [9005-25-8] | - | 10 | (see Chapter 14) | - | - | - | H |
| Stearates (a) (d) | [- -] | - | 10 | (see Chapter 14) | - | - | - | H |
| Stibine | [7803-52-3] | 0.1 | 0.51 | - | - | - | - | H |
| Strychnine | [57-24-9] | - | 0.15 | - | - | - | - | H |
| Styrene, monomer | [100-42-5] | 50 | 213 | 100 | 426 | - | - | H |
| Subtilisins (Proteolytic enzymes as 100% pure crystalline enzyme) | [1395-21-7] | - | 0.00006 | Peak limitation | - | - | Sen | H |
| Sucrose (a) | [57-50-1] | - | 10 | (see Chapter 14) | - | - | - | H |
| Sulfotep | [3689-24-5] | - | 0.2 | - | - | - | Sk | H |
| Sulphur dioxide | [7446-09-5] | 2 | 5.2 | 5 | 13 | - | - | H |
| Sulphur hexafluoride | [2551-62-4] | 1,000 | 5,970 | - | - | - | - | H |
| Sulphuric acid | [7664-93-9] | - | 1 | - | 3 | - | - | H |
| Sulphur monochloride | [10025-67-9] | 1 | 5.5 | Peak limitation | - | - | - | H |
| Sulphur pentafluoride | [5714-22-7] | 0.01 | 0.1 | Peak limitation | - | - | - | H |
| Sulphur tetrafluoride | [7783-60-0] | 0.1 | 0.44 | Peak limitation | - | - | - | H |
| Sulphuryl fluoride | [2699-79-8] | 5 | 21 | 10 | 42 | - | - | H |
| Sulprofos | [35400-43-2] | - | 1 | - | - | - | - | H |
| Superfine glassfibre | [- -] | - | 0.5 f/ml | (see Synthetic mineral fibres) | - | - | - | A |
| Synthetic mineral fibres (SMF) | [- -] | - | 0.5 f/ml | (see Chapter 14) | - | - | - | A |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA ppm | (4) STEL mg/m ³ ppm | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|--|-----------------|-------------------|---|-------------------------------|----------------|------------|
| Ceramic fibres | [-] | - | 0.5 f/ml (see Chapter 14) | | | A |
| Glasswool (including superfine glassfibre) | [-] | - | 0.5 f/ml (see Chapter 14) | | | A |
| Rockwool | [-] | - | 0.5 f/ml (see Chapter 14) | | | A |
| 2,4,5-T | [93-76-5] | - | 10 | - | - | H |
| Talc, (containing no asbestos fibres) | [14807-96-6] | - | 2.5 | - | - | A*;R |
| Tantalum, metal & oxide dusts | [7440-25-7] | - | 5 | - | - | H |
| Tellurium & compounds (as Te) | [13494-80-9] | - | 0.1 | - | - | H |
| Tellurium hexafluoride (as Te) | [7783-80-4] | 0.02 | 0.1 | - | - | H |
| Temephos | [3383-96-8] | - | 10 | - | - | H |
| TEPP | [107-49-3] | 0.004 | 0.047 | - | Sk | H |
| Terphenyls | [26140-60-3] | 0.5 | 4.7 | Peak limitation | - | H |
| 1,1,2,2-Tetrabromoethane | [79-27-6] | 1 | 14 | - | - | H |
| 1,1,1,2-Tetrachloro-2,2-difluoroethane | [76-11-9] | 500 | 4,170 | - | - | H |
| 1,1,2,2-Tetrachloro-1,2-difluoroethane | [76-12-0] | 500 | 4,170 | - | - | H |
| 1,1,2,2-Tetrachloroethane | [79-34-5] | 1 | 6.9 | - | Sk | H |
| Tetrachloronaphthalene | [1335-88-2] | - | 2 | - | - | H |
| Tetraethyl lead (as Pb) | [78-00-2] | - | 0.1 | - | Sk | H |
| Tetrahydrofuran | [109-99-9] | 100 | 295 | - | Sk | A |
| Tetramethyl lead (as Pb) | [75-74-1] | - | 0.15 | - | Sk | H |
| Tetramethyl succinonitrile | [3333-52-6] | 0.5 | 2.8 | - | Sk | H |
| Tetranitromethane (h) | [509-14-8] | 1 | 8 | - | - | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA ppm | mg/m ³ | (4) STEL ppm | mg/m ³ | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|---|-----------------|------------------------|-------------------|--------------------|-------------------|-------------------------------|----------------|------------|
| Tetrasodium pyrophosphate | [7722-88-5] | - | 5 | - | - | - | - | H |
| Tetryl | [479-45-8] | - | 1.5 | - | - | - | Sen | H |
| Thallium, soluble compounds (as Tl) | [7440-28-0] | - | 0.1 | - | - | - | Sk | H |
| 4,4'-Thiobis (6-tert-butyl-m-cresol) | [96-69-5] | - | 10 | - | - | - | - | H |
| Thioglycolic acid | [68-11-1] | 1 | 3.8 | - | - | - | Sk | H |
| Thionyl chloride | [7719-09-7] | 1 | 4.9 | Peak limitation | - | - | - | H |
| Thiram | [137-26-8] | - | 1 | - | - | - | - | H |
| Tin, metal | [7440-31-5] | - | 2 | - | - | - | - | H |
| Tin, organic compounds (as Sn) | [7440-31-5] | - | 0.1 | - | 0.2 | - | Sk | H |
| Tin, oxide & inorganic compounds, except SnH ₄ (as Sn) | [7440-31-5] | - | 2 | - | - | - | - | H |
| Titanium dioxide (a) | [13463-67-7] | - | 10 | (see Chapter 14) | - | - | - | H |
| o-Tolidine (d) | [119-93-7] | - | - | - | 2 | - | Sk | H |
| Toluene (h) | [108-88-3] | 100 | 377 | 150 | 565 | - | - | H;R |
| Toluene-2,4-diisocyanate (TDI) | [584-84-9] | (see Isocyanates, all) | - | - | - | - | - | H |
| m-Toluidine | [108-44-1] | 2 | 8.8 | - | - | - | Sk | H |
| o-Toluidine | [95-53-4] | 2 | 8.8 | - | - | 2 | Sk | H |
| p-Toluidine | [106-49-0] | 2 | 8.8 | - | - | 2 | Sk | H |
| Tributyl phosphate | [126-73-8] | 0.2 | 2.2 | - | - | - | - | H |
| Trichloroacetic acid | [76-03-9] | 1 | 6.7 | - | - | - | - | H |
| 1,2,4-Trichlorobenzene | [120-82-1] | 5 | 37 | Peak limitation | - | - | - | H |
| 1,1,1-Trichloroethane | [71-55-6] | 125 | 680 | - | - | - | - | A |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) | | (4) | | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|---|-----------------|----------------------------|--------------------------|-----------------|---------------------------|-------------------------------|----------------|------------|
| | | ppm | TWA mg/m ³ | ppm | STEL mg/m ³ | | | |
| 1,1,2-Trichloroethane | [79-00-5] | 10 | 55 | - | - | - | Sk | H |
| Trichloroethylene | [79-01-6] | 50 | 270 | 200 | 1,080 | - | - | A |
| Trichlorofluoromethane | [75-69-4] | 1,000 | 5,620 | Peak limitation | | - | - | H |
| Trichloronaphthalene | [1321-65-9] | - | 5 | - | - | - | Sk | H |
| 1,2,3-Trichloropropane | [96-18-4] | 10 | 60 | - | - | - | Sk | H |
| 1,1,2-Trichloro- 1,2,2-trifluoroethane | [76-13-1] | 1,000 | 7,670 | 1,250 | 9,590 | - | - | H |
| Tridymite | [15468-32-3] | (see Silica - Crystalline) | | | | | | |
| Triethylamine | [121-44-8] | 3 | 12 | 5 | 20 | - | - | A |
| Trifluorobromomethane | [75-63-8] | 1,000 | 6,090 | - | - | - | - | H |
| Triglycidylisocyanurate (TGIC) | [2451-62-9] | - | - | - | - | - | - | Ch |
| Trimellitic anhydride | [552-30-7] | 0.005 | 0.039 | - | - | - | Sen | H |
| Trimethylamine (h) | [75-50-3] | 10 | 24 | 15 | 36 | - | - | H |
| Trimethyl benzene | [25551-13-7] | 25 | 123 | - | - | - | - | H |
| Trimethyl phosphite | [121-45-9] | 2 | 10 | - | - | - | - | H |
| 2,4,6-Trinitrotoluene (TNT) | [118-96-7] | - | 0.5 | - | - | - | Sk | H |
| Triorthocresyl phosphate | [78-30-8] | - | 0.1 | - | - | - | Sk | H |
| Triphenyl amine | [603-34-9] | - | 5 | - | - | - | - | H |
| Triphenyl phosphate | [115-86-6] | - | 3 | - | - | - | - | H |
| Tripoli | [1317-95-9] | (see Silica - Crystalline) | | | | | | |
| Tungsten, insoluble compounds (as W) | [7440-33-7] | - | 5 | - | 10 | - | - | H |
| Tungsten, soluble compounds (as W) | [7440-33-7] | - | 1 | - | 3 | - | - | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA ppm | mg/m ³ | (4) STEL ppm | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|---|-----------------|-------------------|-------------------|--------------------|-------------------------------|----------------|------------|
| Turpentine (wood) | [8006-64-2] | 100 | 557 | - | - | Sen | A;R |
| Uranium (natural), soluble & insoluble compounds (as H) | [7440-61-1] | - | 0.2 | 0.6 | - | - | H |
| n-Valeraldehyde | [110-62-3] | 50 | 176 | - | - | - | H |
| Vanadium (as V ₂ O ₅), (respirable dust & fume) | [1314-62-1] | - | 0.05 | - | - | - | H |
| Vegetable oil mists (a) (except castor oil, cashew nut or similar irritant oils) | [- -] | - | 10 | - | - | - | H |
| Vinyl acetate (h) | [108-05-4] | 10 | 35 | 20 | 70 | - | H |
| Vinyl bromide | [593-60-2] | 5 | 22 | - | 2 | - | H |
| Vinyl chloride, monomer | [75-01-4] | 5 | 13 | - | 1 | - | H;R |
| Vinyl cyclohexene dioxide | [106-87-6] | 10 | 57 | - | 3 | Sk | H |
| Vinylidene chloride | [75-35-4] | 5 | 20 | 20 | 79 | - | H;R |
| Vinyl toluene | [25013-15-4] | 50 | 242 | 100 | 483 | - | H |
| Warfarin | [81-81-2] | - | 0.1 | - | - | - | H |
| Welding fumes (not otherwise classified) | [- -] | - | 5 | (see Chapter 17) | - | - | H |
| White spirits | [8052-41-3] | - | 790 | (see Chapter 16) | - | - | R |
| Wood dust (certain hardwoods such as beech & oak) | [- -] | - | 1 | - | - | Sen | H;R |
| Wood dust (soft wood) | [- -] | - | 5 | - | 10 | Sen | H;R |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

EXPOSURE STANDARDS FOR ATMOSPHERIC CONTAMINANTS IN THE OCCUPATIONAL ENVIRONMENT (continued)

| (1) SUBSTANCE | (2) [CAS #] | (3) TWA | | (4) STEL | | (5) CARCINOGEN CATEGORY | (6) NOTICES | (7) REF |
|--------------------------------------|---|------------|-------------------|-----------------|-------------------|-------------------------------|----------------|------------|
| | | ppm | mg/m ³ | ppm | mg/m ³ | | | |
| Xylene (o-, m-, p- isomers) | [1330-20-7; 95-47-6; 108-38-3; 106-42-3] | 80 | 350 | 150 | 655 | - | - | A;R |
| m-Xylene α, α' -diamine | [1477-55-0] | - | 0.1 | Peak limitation | - | - | Sk | H |
| Xylidine | [1300-73-8] | 0.5 | 2.5 | - | - | 2 | Sk | H |
| Yttrium, metal & compounds (as Y) | [7440-65-5] | - | 1 | - | - | - | - | H |
| Zinc chloride (fume) | [7646-85-7] | - | 1 | - | 2 | - | - | H |
| Zinc chromate (as Cr) | [13530-65-9; 11103-86-9; 37300-23-5] | - | 0.01 | - | - | 1 | - | H |
| Zinc oxide (dust) (a) (fume) | [1314-13-2] | - | 10 | - | - | - | - | H |
| Zirconium compounds (as Zr) | [7440-67-2] | - | 5 | - | 10 | - | - | H |
| | | - | 5 | - | 10 | - | - | H |

An explanation of the column headings, abbreviations used and footnotes precedes this list. The referenced chapters are in the National Commission's Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:3008(1995)].

REFERENCED DOCUMENTS

1. American Conference of Governmental Industrial Hygienists (ACGIH), *Documentation of the Threshold Limit Values and Biological Exposure Indices*, 5th Edition, ACGIH, Cincinnati, Ohio, 1986.
2. American Conference of Governmental Industrial Hygienists (ACGIH), *Documentation of the Threshold Limit Values and Biological Exposure Indices*, 6th Edition, ACGIH, Cincinnati, Ohio, 1991.
3. National Occupational Health and Safety Commission, *Documentation of the Exposure Standards* [NOHSC:10003(1995)], Australian Government Publishing Service, Canberra, 1995.
4. National Occupational Health and Safety Commission, 'Guidance Note on the Interpretation of Exposure Standards for Atmospheric Contaminants in the Occupational Environment' [NOHSC:3008(1995)], in *Exposure Standards for Atmospheric Contaminants in the Occupational Environment: Guidance Note and National Exposure Standards*, Australian Government Publishing Service, Canberra, 1995.
5. National Occupational Health and Safety Commission, *Proposed National Exposure Standards for Atmospheric Contaminants in the Occupational Environment*, Australian Government Publishing Service, Canberra, 1995.
6. National Occupational Health and Safety Commission, 'Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Dust' [NOHSC:3003(1988)], in *Asbestos: Code of Practice and Guidance Notes*, Australian Government Publishing Service, Canberra, 1988.
7. National Occupational Health and Safety Commission, 'Guidance Note on the Membrane Filter Method for the Estimation of Airborne Synthetic Mineral Fibres' [NOHSC:3006(1989)], in *Technical Report on Synthetic Mineral Fibres and Guidance Note on the Membrane Filter Method for the Estimation of Airborne Synthetic Mineral Fibres*, Australian Government Publishing Service, Canberra, 1989.