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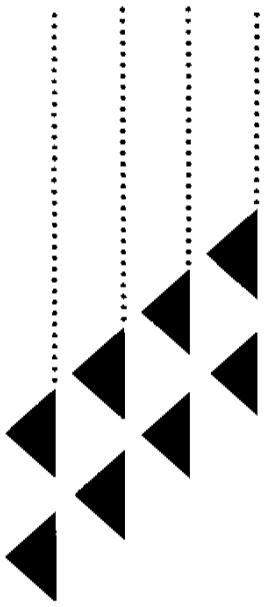
Health-Based Tolerable Daily Intakes/ Concentrations and Tumorigenic Doses/ Concentrations for Priority Substances



Canada

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Environmental Health Directorate
Health Protection Branch

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J. Argo
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I. Caldwell
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W. Dormer
M. Giddings
A. Gilman
R. Gomes
K. Hughes
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R.N. Newhook
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Preface

The values presented within this booklet are intended to form, in part, the basis for development of reference points against which the adequacy of the quality of various environmental media may be judged. They were developed on the basis of information reviewed for assessments conducted for compounds on the first Priority Substances List under the *Canadian Environmental Protection Act*. They should, for example, be helpful to provincial and municipal authorities responsible for establishment of guidelines or standards for the quality of environmental media such as air or soil. Tolerable Concentrations (TCs) provide a health-based goal to which levels of various pollutants generally in indoor or ambient air can be compared. Similarly, Tumorigenic Concentrations 05 (TC_{05}s) divided by a suitable margin also provide a benchmark against which the adequacy of ambient or indoor air (generally) can be judged, with respect to potential carcinogenicity. Tolerable Daily Intakes (TDIs) and Tumorigenic Dose 05s (TD_{05}s) (the latter divided by a suitable margin) provide a reference against which amounts ingested in, for example, drinking water and food can be compared.

The assessments conducted for compounds on the first Priority Substances List on which the values presented herein are based, were externally peer reviewed by identified experts. Following external review, they were approved by the Rulings Committee of the Bureau of Chemical Hazards which included representation from other Directorates of Health Canada, when appropriate, and subsequently by the Environment Canada/Health Canada CEPA Management Committee. This booklet and associated Supporting Documentation were externally reviewed by Toxicology Excellence for Risk Assessment (TERA). A draft of this publication was circulated for information and comment to other Directorates within the Health Protection Branch of Health Canada, the Environment Canada/Health Canada CEPA Management Committee, the CEPA Federal Provincial Advisory Committee and the Federal Provincial Committee on Environmental and Occupational Health.

These values are derived solely from assessment of toxicological and epidemiological data for the ingestion and inhalation routes of exposure and take into consideration potential effects on human health only. Though dermal contact may, in some cases, also contribute significantly to total exposure to environmental contaminants, this route has not been addressed herein, due principally to limitations of the available data that serve as a basis for development of health-based guidance in this area.

It should also be emphasized that the values presented herein do not take into account any considerations related to risk management such as feasibility of attainment and costs of measurement and control. Moreover, potential for exposure by ingestion to more than one medium (e.g., drinking water and food) needs to be considered in the development of media specific values from the Tolerable Daily Intakes and Tumorigenic Doses presented herein. A detailed discussion of the allocation of tolerable intakes or tumorigenic doses as a basis for development of media specific guidance values is included in a report of the International Programme on Chemical Safety (IPCS, 1994)[1].

It is anticipated that this booklet will be updated on a periodic basis to include additional compounds on the second Priority Substances List for which assessments are being conducted or where warranted, for parameters addressed herein to reflect more recent data.

Every attempt has been made to consider results of recent international assessments in the development of values included herein. However, variations between values presented here and those of international agencies may reflect differences in availability of data at the time of review, consistency of approach or nature of peer review.

Through peer review and consultation, every effort has been made to present information in this publication and its Supporting Documentation as accurately as possible without unduly delaying publication. However, should errors be noted or should readers wish to comment on the suitability of derived values included herein, relevant information should be submitted to the Environmental Health Directorate for consideration. If comments are not received within a one year period following release of this document, values not published previously will be considered as finalized.

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1 International Programme on Chemical Safety. Environmental Health Criteria 170. Assessing Human Health Risks of Chemicals: Derivation of Guidance Values for Health-Based Exposure Limits, World Health Organization, Geneva, 1994.

Table of Contents

1. Introduction

The *Canadian Environmental Protection Act* (CEPA) authorizes the Ministers of the Environment and Health to investigate a wide variety of substances that may contaminate the environment and cause adverse effects on the environment and/or on human health. Under the Act, assessments were completed in 1994 for the 44 environmental contaminants (or groups thereof) on the first Priority Substances List (PSL 1).

Based on the assessments conducted for PSL 1 substances, health-based Tolerable Daily Intakes/Concentrations and Tumorigenic Doses/Concentrations have been developed and are presented herein. For substances where the protocol or reporting of the critical study were limited, provisional values were established (Section 3).

Information on the classification of the weight of evidence of carcinogenicity, the nature of the critical effects, identification of the critical study and size of the uncertainty factor incorporated for non-neoplastic effects for each substance is included in Supporting Documentation to this publication available on request from the:

Environmental Health Centre
Health Canada
A.L. 0801A
Tunney's Pasture
Ottawa, Ontario, Canada
K1A 0L2

Assessment Reports for each Priority Substance and a description of the approach adopted to assessment of these compounds under CEPA ("Human Health Risk Assessment for Priority Substances") are also available from the same address. The Assessment Reports for some Priority Substances are also available on the Internet World Wide Web Site:

www.hc-sc.gc.ca/exsd-dse

Any variations from values presented in the Assessment Reports are noted in the Supporting Documentation. In some cases, relevant values have been added, often for an additional medium of exposure, based on consideration of information reviewed at the time of completion of the assessments. The manner of presentation of values for the inhalation route of exposure has been modified to be expressed as concentrations rather than doses. In a very small number of cases, uncertainty factors presented herein vary

slightly from those presented in the published assessments for Priority Substances since neoplastic and non-neoplastic effects are addressed separately and to ensure consistency across all parameters. In one case (1,2-dichloroethane), calculations for risk values were refined.

Values developed herein are based on the assumption that exposure to the substance occurs over a lifetime. Where airborne levels routinely exceed tolerable concentrations, deleterious effects on health may be induced. Similarly, where intake by ingestion routinely exceeds a TDI, there may be adverse effects on health. However, short term excursions above these values do not necessarily imply that exposure constitutes an undue risk to health. The amount by and period for which Tolerable Concentrations/Intakes can be exceeded without posing a health risk must be considered on a case by case basis, taking into account the nature of the effects of the specific substance.

For genotoxic carcinogenic effects, where it is assumed that there is some probability of harm to human health at any level of exposure, continuing efforts should be made to reduce exposure to such compounds to the greatest extent possible. However, incremental risks associated with exposure to low levels of such substances (i.e., TD_{05}/TC_{05}s divided by a suitable margin) may be sufficiently small so as to be essentially negligible compared with other risks encountered in society.

Presentation of the values herein should not be regarded as implying that the quality of various media may be degraded to specified levels. Indeed, continuous efforts should be made to ensure that the media to which humans are exposed are of the highest possible quality.

2. Explanation of Terms

Different approaches were adopted for assessments of Priority Substances for chemicals for which the critical effect is believed to have a threshold and those for which it is considered not to have a threshold. For substances for which the critical effect is considered to have a threshold (i.e., non-neoplastic effects), Tolerable Daily Intakes (TDIs) or Tolerable Concentrations (TCs) have been developed by dividing effect levels observed in studies in exposed populations or animal species, by uncertainty factors. A detailed description of the approach to human health risk assessment for Priority Substances is included in Health Canada (1994).[2]

Priority Substances are classified into one of 6 categories, based on the weight of evidence of carcinogenicity (see Section 3). For genotoxic carcinogens (i.e., primarily compounds which are considered "carcinogenic to humans" or "probably carcinogenic to humans", Groups I or II of the scheme for classification of carcinogenicity under CEPA), quantitative estimates of the carcinogenic potency within or close to the experimental range have been developed. This approach was adopted for several reasons, one of the most important of which was to avoid expressing risk in precise absolute terms (i.e., predicted excess numbers of cancers per unit of the population) based on uncertain low-dose extrapolation procedures.

Potency is expressed as the concentration or dose which induces a 5% increase in the incidence of, or deaths due to, tumours considered to be associated with exposure, observed in epidemiological studies in human populations or bioassays in experimental animals [Tumorigenic Dose 05 (TD_{05}) or Tumorigenic Concentration 05 (TC_{05})]. Wherever possible and if considered appropriate, information on pharmacokinetics and mechanisms is incorporated into the quantitative estimates of potency derived particularly from studies in animals (to provide relevant scaling for humans).

For those substances where values for both carcinogenic and non-carcinogenic effects are presented in Section 3, it is recommended that the most conservative of TD_{05}s/TC_{05}s divided by a suitable margin, or TDIs/TCs, be adopted as the basis, in part, against which the adequacy of the quality of various media is judged.

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[2] Environmental Health Directorate. Canadian Environmental Protection Act. Human Health Risk Assessment for Priority Substances. Health Canada, Ottawa, 1994.

In general, depending upon the sources and physical/chemical properties of a substance, exposure via one of the routes addressed herein (i.e., inhalation and ingestion) for specific chemical substances will predominate. Where, for specific substances, there is potential for significant intake via both ingestion and inhalation, however, it is important that this be taken into account in the development of media-specific values (i.e., exposure via inhalation and ingestion should in total, not exceed the TDI/TC or TD_{05}/TC_{05} divided by a suitable margin (see examples in IPCS, 1994)[1]

Tolerable Daily Intake (TDI): (Non-Carcinogenic Effects)

Tolerable Daily Intakes (Section 3a), expressed on a body weight basis (e.g., mg/kg b.w./day) are the total intakes by ingestion, to which it is believed that a person can be exposed daily over a lifetime without deleterious effect. They are based on non-carcinogenic effects. Absolute values per day for various age groups can be developed by multiplying the TDI by the average body weight of the age group under consideration. It should be noted, however, that exceedence of such calculated intakes by a particular age group for a small proportion of the lifespan does not necessarily imply that exposure constitutes an undue risk to health. In assessments for Priority Substances under CEPA, mean body weights of various age groups were considered to be:

Age	**Body Weight (kg)**
0 – 6 months	7
7 months – 4 years	13
5 – 11 years	27
12 – 19 years	57
20+ years	70

Tolerable Concentration (TC): (Non-Carcinogenic Effects)

Tolerable concentrations (Section 3a) (often expressed in mg/m^3) are generally airborne concentrations to which it is believed that a person can be exposed continuously over a lifetime without deleterious effect. They are based on non-carcinogenic effects.

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1 Ibid.

Tumorigenic Dose 05 (TD05): (Carcinogenic Effects)

It is assumed, for genotoxic carcinogenic effects, that there is some probability of harm to human health at any level of exposure; therefore, continuing efforts should be made to reduce exposure to compounds considered to be "carcinogenic to humans" or "probably carcinogenic to humans" (Groups I and II of the classification scheme for carcinogenicity under CEPA) to the greatest extent possible. However, it is recognized that incremental risks associated with exposure to low levels of such substances may be sufficiently small so as to be essentially negligible compared with other risks encountered in society.

The Tumorigenic Dose 05(TD_{05}) is the total intake (often expressed in mg/kg b.w./day) associated with a 5% increase in incidence or mortality due to tumours scaled, where appropriate, to reflect interspecies variations. Tumorigenic Dose 05s, divided by a suitable margin, provide a benchmark against which the adequacy of intake can be judged with respect to potential carcinogenicity. The Environmental Health Directorate of Health Canada is currently developing methodology for derivation of suitable margins for application to the TD_{05}s/TC_{05}s. In the interim, the relationship between Tumorigenic doses/concentrations and low dose risk estimates can provide the basis for practical application of TD_{05}s/TC_{05}s in determination of the adequacy of the quality of various media. For example, values based on division of the TD_{05}s presented in Section 3 (b) by a margin of (5,000 to 50,000)[3] afford similar protection to that associated with the range for low dose risk estimates generally considered by various agencies to be "essentially negligible" (i.e., 10^{-5} to 10^{-6}).

It should be noted that Health Canada does not necessarily deem as "acceptable" from a societal viewpoint health risks associated with these values. Indeed, the Health Protection Branch continues to subscribe to the position that exposure to substances for which the critical effect has no threshold be reduced to the extent possible.

As is the case for tolerable daily intakes, absolute values for daily intakes can be developed for various age groups by multiplying the TD_{05} by the average body weight of the age group under consideration; intakes in excess of these absolute values by a particular age group (constituting a small proportion of the lifespan) does not necessarily imply that exposure constitutes an undue risk to health.

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[3] Since Tumorigenic $Doses_{05}$s were computed directly from the curve within or close to the experimental region, division by an additional factor of 2 would equate approximately to the lower 95% confidence limit.

Tumorigenic Concentration 05 (TC05): (Carcinogenic Effects)

The Tumorigenic Concentration 05(TC_{05}) is the concentration generally in air (expressed, for example, in mg/m^3) associated with a 5% increase in incidence or mortality due to tumours. Similarly to the TD_{05}, values derived based on division of the TC_{05}s presented in Section 3 (b) by a suitable margin (e.g., 5,000 to 50,000)[4] can provide a benchmark against which the adequacy of indoor or ambient air can be judged, with respect to potential carcinogenicity.

Again, it should be noted that Health Canada does not necessarily deem as "acceptable" from a societal viewpoint health risks associated with these values and that the Health Protection Branch continues to subscribe to the position that exposure to substances for which the critical effect has no threshold be reduced to the extent possible.

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[4] Since Tumorigenic $Concentration_{05}$s were computed directly from the curve within or close to the experimental region, division by an additional factor of 2 would equate approximately to the lower 95% confidence limit.

3. Summary of Values

3 (a) Tolerable Concentrations/Daily Intakes for Priority Substances (Non-Carcinogenic Effects)

Substance [CAS Number]	Cut-off Date for Literature Review	Classification of Carcinogenicity in CEPA Assessment	Guidance Values Based upon Non-Carcinogenic Effects: Tolerable Daily Intake (Oral)	Guidance Values Based upon Non-Carcinogenic Effects: Tolerable Concentration (Inhalation)	Comment
Aniline [62-53-3]	June 1993	Group III	7 µg/kg b.w./day	–	
Arsenic and its inorganic compounds[5]	April 1992	Group I	–	–	Refer to Section 3 (b) for estimates of carcinogenic potency
Benzene [71-43-2]	October 1991	Group I	–	–	Refer to Section 3 (b) for estimate of carcinogenic potency
Bis (2-ethyl-hexyl) phthalate [117-81-7]	December 1992	Group IV	0.044 mg/kg b.w./day	–	
Bis(chloro-methyl) ether [542-88-1]	June 1992	Group I	–	–	Refer to Section 3 (b) for estimate of carcinogenic potency
Cadmium[5] [7440-43-9]	September 1993	Inorganic cadmium compounds have been classified as Group II			Refer to Section 3 (b) for estimate of carcinogenic potency
Chlorinated paraffins:					
Short chain ($\leq C_{13}$)	August 1992	Group II	0.01 mg/kg b.w./day	–	
Medium chain (C_{14-17})	August 1992	Group VI	0.006 mg/kg b.w./day	–	
Long chain ($\geq C_{18}$)	August 1992	Group III	0.071 mg/kg b.w./day	–	
Chlorobenzene [108-90-7]	May 1991	Group III	0.43 mg/kg b.w./day	0.01 mg/m^3 (provisional)	

5 The joint FAO/WHO Expert Committee on Food Additives has derived Provisional Weekly Tolerable Intakes for Arsenic and Cadmium.

Substance [CAS Number]	Cut-off Date for Literature Review	Classification of Carcinogenicity in CEPA Assessment	Guidance Values Based upon Non-Carcinogenic Effects: Tolerable Daily Intake (Oral)	Guidance Values Based upon Non-Carcinogenic Effects: Tolerable Concentration (Inhalation)	Comment
Chromium, total	April 1993		–	–	Refer to Section 3 (b) for estimates of carcinogenic potency
Hexavalent chromium		Group I	–	–	
Dibutyl phthalate [84-74-2]	November 1992	Group VI	0.063 mg/kg b.w./day	–	
1,2-Dichloro-benzene [95-50-1]	December 1991	Group V	0.43 mg/kg b.w./day	–	
1,4-Dichloro-benzene [106-46-7]	May 1992	Group III	0.11 mg/kg b.w./day	0.095 mg/m^3	
3,3'-Dichloro-benzidine [91-94-1]	October 1992	Group II	–	–	Refer to Section 3 (b) for estimate of carcinogenic potency
1,2-Dichloro-ethane [107-06-2]	May 1993	Group II	–	–	Refer to Section 3 (b) for estimate of carcinogenic potency
Dichloro-methane [75-09-2]	March 1993	Group II	0.05 mg/kg b.w./day	–	Refer to Section 3 (b) for estimate of carcinogenic potency
Hexachloro-benzene [118-74-1]	April 1992	Group II	500 ng/kg b.w./day	–	Refer to Section 3 (b) for estimate of carcinogenic potency
Inorganic fluoride	July 1993		200 µg/kg b.w./day (provisional)[6]	–	
Methyl methacrylate [80-62-6]	September 1992	Group VI	0.05 mg/kg b.w./day	0.052 mg/m^3	
Methyl tertiary-butyl ether [1634-04-4]	October 1991	Group VI	0.01 mg/kg b.w./day	0.037 mg/m^3	
Mineral fibres, refractory ceramic	May 1993	Group II	–	–	Refer to Section 3 (b) or estimate of carcinogenic potency

6 Based on skeletal effects; dental effects not considered.

Substance [CAS Number]	Cut-off Date for Literature Review	Classification of Carcinogenicity in CEPA Assessment	Guidance Values Based upon Non-Carcinogenic Effects: Tolerable Daily Intake (Oral)	Guidance Values Based upon Non-Carcinogenic Effects: Tolerable Concentration (Inhalation)	Comment
Nickel and its compounds:					Refer to Section 3 (b) for estimates of carcinogenic potency
Metallic nickel	August 1993	Group VI	–	0.018 µg/m^3 (provisional)	
Oxidic nickel (including nickel oxide, nickel-copper oxide, nickel silicate oxides and complex oxides)	August 1993	Group I	–	–	
Nickel oxide	August 1993			0.02 µg Ni//m^3	
Sulphidic nickel (including nickel sulphide)	August 1993	Group I			
Nickel subsulphide	August 1993			1.8 x 10^{-5} mg Ni/m^3	
Soluble nickel (primarily nickel sulphate and nickel chloride)	August 1993	Group I			
Nickel chloride	August 1993		1.3 µg Ni/kg b.w./day		
Nickel sulfate	August 1993		0.05 mg Ni/kg b.w./day	3.5 x 10^{-6} mg Ni/m^3	
Pentachloro-benzene [608-93-5]	March 1992	Group VI	1 µg/kg b.w./day	–	
Polychlorinated dibenzodioxins and polychlorinated dibenzofurans	December 1989		10 picograms toxic equivalents /kg b.w./day	–	
Polycyclic aromatic hydrocarbons	July 1993	All five PAHs in the assessment were Group II			Refer to Section 3 (b) for estimates of carcinogenic potency
Benzo(a)pyrene			–	–	
Benzo(b)fluoranthene			–	–	
Benzo(j)fluoranthene			–	–	
Benzo(k)fluoranthene			–	–	
Indeno(1,2,3-cd)pyrene			–	–	

Substance [CAS Number]	Cut-off Date for Literature Review	Classification of Carcinogenicity in CEPA Assessment	Guidance Values Based upon Non-Carcinogenic Effects		Comment
			Tolerable Daily Intake (Oral)	Tolerable Concentration (Inhalation)	
Styrene [100-42-5]	March 1993	Group III	0.12 mg/kg b.w./day	0.092 mg/m^3	
Tetrachlorobenzenes:					
1,2,4,5-Tetra-chlorobenzene [95-94-3]	June 1992	Group VI	0.21 µg/kg b.w./day	–	
1,2,3,5-Tetra-chlorobenzene [634-90-2]	June 1992	Group VI	0.41 µg/kg b.w./day	–	
1,2,3,4-Tetra-chlorobenzene [634-66-2]	June 1992	Group VI	3.4 µg/kg b.w./day	–	
Tetrachloro-ethylene [127-18-4]	April 1992	Group IV	0.014 mg/kg b.w./day	0.36 mg/m^3	
Toluene [108-88-3]	June 1991	Group IV	0.22 mg/kg b.w./day	3.8 mg/m^3	
Trichlorobenzenes:					
1,2,4-Trichloro-benzene [120-82-1]	May 1992	Group VI	1.6 µg/kg b.w./day	0.007 mg/m^3	
1,2,3-Trichloro-benzene [87-61-6]	May 1992	Group VI	1.5 µg/kg b.w./day	–	
1,3,5-Trichloro-benzene [108-70-3]	May 1992	Group VI	1.5 µg/kg b.w./day	3.6 µg/m^3	
Trichloro-ethylene [79-01-6]	October 1992	Group II			Refer to Section 3 (b) for estimates of carcinogenic potency
Xylene, mixed isomers [1330-20-7]	June 1991	Group IV	1.5 mg/kg b.w./day	0.18 mg/m^3 (provisional)	

3 (b) Tumorigenic Doses/Concentrations for Priority Substances (Carcinogenic Effects)

Substance [CAS Number]	Cut-off Date for Literature Review	Classification of Carcinogenicity in CEPA Assessment	Estimate of Carcinogenic Potency		Comment
			TD_{05} (ingestion)	TC_{05} (inhalation, unless otherwise specified)	
Aniline [62-53-3	June 1993	Group III	–	–	Refer to Section 3(a) for value based upon non-carcinogenic effects
Arsenic and its inorganic compounds	April 1992	Group I		7.8 µg/m^3 (air) 840 µg/litre (drinking water)	
Benzene [71-43-2]	October 1991	Group I	–	15 mg/m^3	
Bis (2-ethylhexyl) phthalate [117-81-7]	December 1992	Group IV	–	–	Refer to Section 3(a) for value based upon non-carcinogenic effects
Bis(chloromethyl) ether [542-88-1]	June 1992	Group I	–	5.3 µg/m^3	
Cadmium [7440-43-9]	September 1993	Inorganic cadmium compounds have been classified as Group II	–	5.1 µg/m^3	
Chlorinated paraffins:					Refer to Section 3(a) for values based upon non-carcinogenic effects
Short chain ($\leq C_{13}$)	August 1992	Group II	–	–	
Medium chain (C_{14-17})	August 1992	Group VI	–	–	
Long chain ($\geq C_{18}$)	August 1992	Group III	–	–	
Chlorobenzene [108-90-7]	May 1991	Group III	–	–	Refer to Section 3(a) for values based upon non-carcinogenic effects
Chromium, total	April 1993		–	4.6 µg/m^3	
Hexavalent chromium		Group I	–	0.66 µg/m^3	

Substance [CAS Number]	Cut-off Date for Literature Review	Classification of Carcinogenicity in CEPA Assessment	Estimate of Carcinogenic Potency		Comment
			TD_{05} (ingestion)	TC_{05} (inhalation, unless other-wise specified)	
Dibutyl-phthalate [84-74-2]	November 1992	Group VI	–	–	Refer to Section 3(a) for values based upon non-carcinogenic effects
1,2-Dichloro-benzene [95-50-1]	December 1991	Group V	–	–	Refer to Section 3(a) for value based upon non-carcinogenic effects
1,4-Dichloro-benzene [106-46-7]	May 1992	Group III	–	–	Refer to Section 3(a) for values based upon non-carcinogenic effects
3,3'-Dichloro-benzidine [91-94-1]	October 1992	Group II	0.74 mg/kg b.w./day	–	
1,2-Dichloro-ethane [107-06-2]	May 1993	Group II	6.2 mg/kg b.w./day	–	
Dichloro-methane [75-09-2	March 1993	Group II	–	2200 mg/m^3	Refer to Section 3(a) for value based upon non-carcinogenic effects
Hexachloro-benzene [118-74-1]	April 1992	Group II	0.06 mg/kg b.w./day	–	Refer to Section 3(a) for value based upon non-carcinogenic effects
Inorganic fluoride	July 1993		–	–	Refer to Section 3(a) for value based upon non-carcinogenic effects
Methyl methacrylate [80-62-6]	September 1992	Group VI	–	–	Refer to Section 3(a) for value based upon non-carcinogenic effects
Methyl tertiary-butyl ether [1634-04-4]	October 1991	Group VI	–	–	Refer to Section 3(a) for values based upon non-carcinogenic effects
Mineral fibres, refractory ceramic	May 1993	Group II	–	110 fibers/ml	

Substance [CAS Number]	Cut-off Date for Literature Review	Classification of Carcinogenicity in CEPA Assessment	Estimate of Carcinogenic Potency TD_{05} (ingestion)	Estimate of Carcinogenic Potency TC_{05} (inhalation, unless other-wise specified)	Comment
Nickel and its compounds:					Refer to Section 3(a) for values based upon non-carcinogenic effects
Metallic nickel	August 1993	Group VI	–	–	
Oxidic/sulphidic/ soluble nickel	August 1993			0.04 mg/m^3 (*combined* oxidic, sulphidic and soluble nickel)	
Oxidic nickel (including nickel oxide, nickel-copper oxide, nickel silicate oxides and complex oxides)	August 1993	Group I	–		
Nickel oxide	August 1993				
Sulphidic nickel (including nickel sulphide)	August 1993	Group I			
Nickel subsulphide	August 1993				
Soluble nickel (primarily nickel sulphate and nickel chloride)	August 1993	Group I		0.07 mg/m^3	
Nickel chloride Nickel sulfate	August 1993		–		
Pentachloro-benzene [608-93-5]	March 1992	Group VI	–	–	Refer to Section 3(a) for value based upon non-carcinogenic effects
Polychlorinated dibenzodioxins and polychlorinated dibenzofurans	December 1989				Refer to Section 3(a) for value based upon non-carcinogenic effects
Polycyclic aromatic hydrocarbons	July 1993	All five PAHs in the assessment were Group II			
Benzo(a)pyrene			–	1.6 mg/m^3	
Benzo(b)fluoranthene			–	26.7 mg/m^3	
Benzo(j)fluoranthene			–	32.0 mg/m^3	
Benzo(k)fluoranthene			–	40.0 mg/m^3	
Indeno(1,2,3-cd)pyrene			–	13.3 mg/m^3	

Substance [CAS Number]	Cut-off Date for Literature Review	Classification of Carcinogenicity in CEPA Assessment	Estimate of Carcinogenic Potency		Comment
			TD_{05} (ingestion)	TC_{05} (inhalation, unless other-wise specified)	
Styrene [100-42-5]	March 1993	Group III	–	–	Refer to Section 3(a) for values based upon non-carcinogenic effects
Tetrachlorobenzenes:					Refer to Section 3(a) for values based upon non-carcinogenic effects
1,2,4,5-Tetra-chlorobenzene [95-94-3]	June 1992	Group VI	–	–	
1,2,3,5-Tetra-chlorobenzene [634-90-2]	June 1992	Group VI	–	–	
1,2,3,4-Tetra-chlorobenzene [634-66-2]	June 1992	Group VI	–	–	
Tetrachloro-ethylene [127-18-4]	April 1992	Group IV	–	–	Refer to Section 3(a) for values based upon non-carcinogenic effects
Toluene [108-88-3]	June 1991	Group IV	–	–	Refer to Section 3(a) for values based upon non-carcinogenic effects
Trichlorobenzenes:					Refer to Section 3(a) for values based upon non-carcinogenic effects
1,2,4-Trichloro-benzene [120-82-1]	May 1992	Group VI	–	–	
1,2,3-Trichloro-benzene [87-61-6]	May 1992	Group VI	–	–	
1,3,5-Trichloro-benzene [108-70-3]	May 1992	Group VI	–	–	
Trichloro-ethylene [79-01-6]	October 1992	Group II	200 mg/kg b.w./day	82 mg/m^3	
Xylene, mixed isomers [1330-20-7]	June 1991	Group IV			Refer to Section 3(a) for values based upon non-carcinogenic effects

4. Priority Substances under Review or Scheduled for Review

It is anticipated that values for the following substances, which are either under review or scheduled for review as Priority Substances under CEPA, will appear in subsequent editions of this booklet.

Acetaldehyde
Acrolein
Acrylonitrile
Aluminum chloride, aluminum sulphate, aluminum nitrate
1,3-Butadiene
Butylbenzylphthalate (BBP)
Carbon disulphide
Chloramines
Chloroform
N-N-Dimethylformamide (DMF)
Ethylene glycol
Ethylene oxide
Formaldehyde
Hexachlorobutadiene (HCBD)
2-Methoxy ethanol, 2-Ethoxy ethanol, 2-Butoxy ethanol
N-Nitrosodimethylamine (NDMA)
Nonylphenol and its ethoxylates (NPE)
Phenol