Gezondheidsraad **Voorzitter**
Health Council of the Netherlands

Aan de Staatssecretaris van Sociale Zaken en Werkgelegenheid

Onderwerp : Aanbieding adviezen herevaluatie bestuurlijke MAC-waarden
Uw kenmerk : ARBO/AMIL/97/00648
Ons kenmerk : U 2706/CB/MP/563-O3
Bijlagen : 18
Datum : 14 december 2000

Mijnheer de staatssecretaris,

Op verzoek van uw ambtsvoorganger bied ik u hierbij de eerste adviezen aan van een reeks over de gezondheidskundige basis van uit het buitenland overgenomen grenswaarden voor beroepsmatige blootstelling aan stoffen. Het verzoek om deze adviezen is in algemene zin vervat in brief nr ARBO/AMIL/97/00648 en in latere stadia door uw departement toegespitst op afzonderlijke stoffen. De adviezen zijn opgesteld door een daartoe door mij geformeerde internationale commissie van de Gezondheidsraad en beoordeeld door de Beraadsgroep Gezondheid en Omgeving.

De beoogde reeks van in het Engels gestelde adviezen zal losbladig worden gepubliceerd onder ons publicatienummer 2000/15OSH en, conform de aan de Gezondheidsraad voorgelegde toespitsingen van de adviesaanvraag, betrekking hebben op 168 stoffen. Het u thans aangeboden eerste pakket bestaat uit een Algemene Inleiding (publicatienummer 2000/15OSH/000) en uit de adviezen genummerd 2000/15OSH/001 tot en met 2000/15OSH/017, respectievelijk betrekking hebbend op:
cesiumhydroxide, cyclopentaan, diboraan, dimethoxymethaan, dipropylketon, fenylfosfine, germaniumtetrahydride, hexachloornaftaleen, methaanthiol, methylcyclohexanol, methylisopropylketon, mica, natriumhydroxide, octachloornaftaleen, silaan, tetrachloornaftaleen, en yttrium en yttriumverbindingen.

Bij afronding van de werkzaamheden van de hierboven bedoelde commissie ontvangt u een Nederlandstalige samenvatting van de in de gehele reeks van adviezen neergelegde bevindingen.

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Gezondheidsraad
Health Council of the Netherlands

Onderwerp : Herevaluatie uit het buitenland overgenomen grenswaarden
Ons kenmerk : U
Pagina : 2
Datum : 14 december 2000

De u thans aangeboden adviezen heb ik vandaag ter informatie doen toekomen aan de Minister van Volksgezondheid, Welzijn en Sport en aan de Minister van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer.

Hoogachtend,

prof. dr JJ Sixma

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Germanium tetrahydride

(CAS reg. no: 7785-65-2)

Health-based Reassessment of Administrative Occupational Exposure Limits

Committee on Updating of Occupational Exposure Limits,
a committee of the Health Council of the Netherlands

No. 2000/15OSH/006, The Hague, 14 December 2000

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1 Introduction

The present document contains the assessment of the health hazard of germanium tetrahydride by the Committee on Updating of Occupational Exposure Limits, a committee of the Health Council of the Netherlands. The first draft of this document was prepared by mrs S Bosman-Hoefakker, Ph.D. and H Stouten, M.Sc. (TNO Nutrition and Food Research Institute, Zeist, the Netherlands).

The evaluation of the toxicity of germanium tetrahydride has been based on the review by the American Conference of Governmental Industrial Hygienists (ACG91). Where relevant, the original publications were reviewed and evaluated as will be indicated in the text. In addition, literature was retrieved from the online data bases Medline, Toxline, and Chemical Abstracts covering the period 1966 to 7 May 1997 (19970507/UP), 1965 to 21 March 1997 (970321/ED), and 1967 to 13 May 1997 (970513/ED; vol 126, iss 20), respectively. Medline was searched with the CAS Registry Number 7782-65-2 and the names germanium tetrahydride, germanium hydride, GeH4, monogermane, tetrahydrogermane, and germane AND germanium/CT, Toxline with the CAS Registry Number 7782-65-2, and Chemical Abstracts with 7782-65-2 in the Sections “Toxicology” and “Air Pollution and Industrial Hygiene”. HSDB (no record) and RTECS, data bases available from CD-ROM, were consulted as well (NIO97, NLM97). The final literature search has been carried out in May 1997.

In February 1999, the President of the Health Council released a draft of the document for public review. Comments were received by the following individuals and organizations: A Aalto (Ministry of Social Affairs and Health, Tampere, Finland). These comments were taken into account in deciding on the final version of the document.

2 Identity

name	:	germanium tetrahydride
synonyms	:	germanium hydride germane monogermane tetrahydrogermane
molecular formula	:	GeH_4
CAS reg nr	:	7785-65-2

Data from ACG91, Ric94.

3 Physical and chemical properties

molecular weight	:	76.6
boiling point	:	-90^0C
melting point	:	-165^0C
flash point	:	-
vapour pressure	:	-
solubility	:	insoluble in water; soluble in liquid ammonia; slightly soluble in hot hydrochloric acid; decomposes in nitric acid
log $P_{oct/water}$	:	-
conversion factors (20^oC, 101.3 kPa)	:	1 ppm = 3.2 mg/m^3 1 mg/m^3 = 0.31 ppm

Data from ACG91.

Germanium tetrahydride is a colourless gas and a catalyst.

4 Uses

Germanium tetrahydride finds some use as a doping agent for solid-state electronic components, and as a catalyst (ACG91, Ric94).

5 Biotransformation and kinetics

No data on biotransformation and kinetics of germanium tetrahydride were found.

6 Effects and mechanism of action

Human data

No data on human (occupational) exposure to germanium tetrahydride were found.

Animal data

The 2 hour-LC_{50} in mice was 1380 mg/m^3 (Fil93). In this study (reported in Russian), clinical signs were dyspnea, convulsion, and coma. Autopsy revealed congested internal organs, haemorrhages, nerve cell vacuolization, and degenerative changes in the cells of parenchymal organs. In guinea pigs exposed for 4 hours to 260-1400 mg/m^3 (approximately 80-480 ppm), similar (histo)pathological changes were seen (Fil93).

Exposures to 6800 mg/m^3 (approx. 2130 ppm) for 1 hour, 610 mg/m^3 (approx. 190 ppm) for 30 minutes, 580 mg/m^3 (approx. 180 ppm) for 1 hour, or 480 mg/m^3 (approx. 150 ppm) for 1 hour were lethal to mice (time of death: within 1, 8, 13 hours and 1 day, resp). Dyspnea was observed in these animals. Guinea pigs survived a 1-hour exposure to 480 mg/m^3 (approx. 150 ppm), but not to 580 mg/m^3 (approx. 180 ppm) (time of death: within 4 days). In both experiments, haemoglobinuria was seen, while from the first experiment, dyspnea and pneumonia were reported. Some dyspnea was observed in a rabbit surviving a 1-hour exposure to 310 mg/m^3 (100 ppm) (all experiments were performed with one animal only) (Pan24).

The oral LD_{50} in mice was 1280 mg/kg (Ric94).

In a cited study, probably Russian, no visible signs of toxicity were observed in rats exposed to 13-170 mg/m^3 (approx. 4-53 ppm), 4 hours/day, for 30 days. Autopsy revealed traces of occasional haemorrhages with gliotic nodules in the brain (Fil93).

No data on long-term exposure, mutagenicity, genotoxicity, carcinogenicity and reproduction toxicity of germanium tetrahydride have been found.

7 Existing guidelines

The current administrative occupational exposure limit (MAC) for germanium tetrahydride in the Netherlands is 0.6 mg/m^3 (0.2 ppm), 8 h TWA.

Existing occupational exposure limits for germanium tetrahydride in some European countries and in the USA are summarized in the annex.

8 Assessment of health hazard

There are no human data available.

Experimental animal data concern acute and subacute studies only. However, they were described and designed too poorly to allow conclusions with respect to effects and dose-response relationships.

The committee considers the toxicological data base on germanium tetrahydride too poor to justify recommendation of a health-based occupational exposure limit.

The committee concludes that there is insufficient information to comment on the level of the present MAC-value.

References

ACG91 American Conference of Governmental Industrial Hygienists (ACGIH). Documentation of the threshold limit values and biological exposure indices. 6th ed. Cincinnati OH, USA: ACGIH 1991; 702.

ACG00 American Conference of Governmental Industrial Hygienists (ACGIH). 2000 TLVs® and BEIs®. Threshold Limit Values for chemical substances and physical agents. Biological Exposure Indices. Cincinnati OH, USA: ACGIH, 2000.

Arb96 Arbejdstilsynet. Exposure limit values for substances and materials. Copenhagen, Denmark: The Working Environment Service; Instruction no. 3.1.0.2. 1996.

Bel94 Beliles RB. Germanium, Ge. In: Clayton GD, Clayton FE, eds. In: Toxicology. 4th ed. New York, USA: J. Wiley & Sons, 1994: 2013-20 (Patty's industrial hygiene and toxicology; Vol II Pt C).

DFG99 Deutsche Forschungsgemeinschaft (DFG): Senatskommission zur Prüfung gesundheitsschädlicher Arbeitsstoffe. MAK- und BAT-Werte-Liste 1999. Maximale Arbeitsplatzkonzentrationen und biologische Arbeitsstofftoleranzwerte. Weinheim, FRG: VCH Verlagsgesellschaft mbH, 1999; Mitteilung 35.

Fil93 Filov VA, Ivan BA, Bandman AL. Germanium and its compounds. In: Harmful chemical substances. New York, USA: E. Horwood, 1993: 531-8 (Vol 1).

HSE99 Health and Safety Executive (HSE). EH40/99. Occupational Exposure Limits 1999. Sudbury (Suffolk), England: HSE Books, 1999.

NBO96 National Board of Occupational Safety and Health. Occupational exposure limit values. Solna, Sweden: NBOSH, 1996; Ordinance AFS1996/2.

NIO97 US National Institute of Occupational Safety and Health (NIOSH). Registry of Toxic Effects of Chemical Substances (RTECS) [CD-ROM], issue April 1997. SilverPlatter International, 1997 (last update germanium tetrahydride file: January 1997).

NLM97 US National Library of Medicine (NLM). Hazardous Substances Data Bank (HSDB) [CD-ROM], issue April 1997. SilverPlatter International, 1997.

Ric94 Richardson ML, Gangolli S, eds. G11 Germanium tetrahydride. In: The dictionary of substances and their effects. Cambridge, UK: Royal Society of Chemistry, 1994: 681-2 (Vol 4).

SZW00 Ministerie van Sociale Zaken en Werkgelegenheid (SZW). De nationale MAC-lijst 2000. The Hague, The Netherlands: Servicecentrum Sdu Uitgevers, 2000.

TRG00 TRGS 900. [Grenzwerte in der Luft am Arbeitsplatz; Technische Regeln für Gefahrstoffe]. German. B Arb Bl. 2000; 2.

Annex

Occupational exposure standards for germanium tetrahydride in various countries.

country -organisation	occupational exposure limit		time-weighted average	type of exposure limit	note[a]	lit ref[b]
	ppm	mg/m^3				
The Netherlands						
-Ministry	0.2	0.6	8 h	administrative		SZW00
Germany						
-AGS	-					TRG00
-DFG MAK-Kom.	-					DFG99
Great-Britain						
-HSE	0.2	0.6	8 h	OES		HSE99
	0.6	1.8	15 min			
Sweden	-	-				NBO96
Denmark	0.2	0.6	8 h			Arb96
USA						
-ACGIH	0.2	0.63	8 h	TLV		ACG00
-OSHA	0.2		8 h	PEL		
-NIOSH	0.2	0.6	10 h	REL		
European Union						
-SCOEL						

[a] S = skin notation; which mean that skin absorption may contribute considerably to body burden
sens = substance can cause sensitisation

[b] Reference to the most recent official publication of occupational exposure limits