Calcium oxide

Health-based recommended occupational exposure limit

Gezondheidsraad **Voorzitter**
Health Council of the Netherlands

Aan de Staatssecretaris van Sociale Zaken en Werkgelegenheid

Onderwerp : Aanbieding advies *Calcium oxide*
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Mijnheer de staatssecretaris,

Graag bied ik u hierbij het advies aan over de beroepsmatige blootstelling aan calciumoxide. Het maakt deel uit van een uitgebreide reeks, waarin gezondheidskundige advieswaarden worden afgeleid voor concentraties van stoffen op de werkplek. Dit advies over calciumoxide is opgesteld door de Commissie WGD van de Gezondheidsraad en beoordeeld door de Beraadsgroep Gezondheid en Omgeving.

Ik heb dit advies vandaag ter kennisname toegezonden aan de minister van Volksgezondheid, Welzijn en Sport, de minister van Sociale Zaken en Werkgelegenheid en de staatssecretaris van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer.

Hoogachtend,

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Calcium oxide

Health-based recommended occupational exposure

Dutch Expert Committee on Occupational Standards
In cooperation with the Committee on Updating of Occupational Exposure Limits

to:

the State Secretary of Social Affairs and Employment

No. 2006/08OSH, The Hague, July 27, 2006

The Health Council of the Netherlands, established in 1902, is an independent scientific advisory body. Its remit is "to advise the government and Parliament on the current level of knowledge with respect to public health issues..." (Section 22, Health Act).

The Health Council receives most requests for advice from the Ministers of Health, Welfare & Sport, Housing, Spatial Planning & the Environment, Social Affairs & Employment, and Agriculture, Nature & Food Quality. The Council can publish advisory reports on its own initiative. It usually does this in order to ask attention for developments or trends that are thought to be relevant to government policy.

Most Health Council reports are prepared by multidisciplinary committees of Dutch or, sometimes, foreign experts, appointed in a personal capacity. The reports are available to the public.

This report can be downloaded from www.healthcouncil.nl.

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Samenvatting

Op verzoek van de minister van Sociale Zaken en Werkgelegenheid leidt de Gezondheidsraad gezondheidskundige advieswaarden af voor stoffen in lucht waaraan mensen beroepsmatig blootgesteld kunnen worden. Deze aanbevelingen vormen de eerste stap in een drietrapsprocedure die moet leiden tot wettelijke grenswaarden. In het voorliggende advies bespreekt de Gezondheidsraad de gevolgen van blootstelling aan calciumoxide in de lucht op de werkplek. De conclusies van de Gezondheidsraad zijn gebaseerd op wetenschappelijke publicaties die vóór april 2005 zijn verschenen.

Calciumoxide (‘ongebluste kalk’) is een poedervormige stof, die onder meer in de bouw en in de landbouw wordt gebruikt. Calciumoxide is een bijtende stof, die heftig reageert met water, waarbij veel warmte vrijkomt. Mensen die door hun werk met calciumoxide in aanraking komen, kunnen last krijgen van ernstig geïrriteerde huid, ogen en slijmvliezen.

De Gezondheidsraad concludeert op basis van de beschikbare humane gegevens dat irritatie van met name de neus het kritische effect van blootstelling aan calciumoxide in de lucht op het werk is. Omdat er geen relevante dierexperimentele studies voorhanden zijn en de betreffende humane studies van onvoldoende kwaliteit zijn, kan de Gezondheidsraad geen gezondheidskundige advieswaarde voorstellen.

Executive summary

At the request of the minister of Social Affairs and Employment, the Health Council of the Netherlands sets Health-Based Recommended Occupational Exposure Limits (HBR-OEL) for chemical substances in the workplace. These recommendations constitute the first step in a three-step procedure, which leads to legally binding occupational exposure limits. In this report, the Health Council discusses the consequences of occupational exposure to calcium oxide. The Council's conclusions are made on scientific papers published prior to April 2005.

Calcium oxide is a powdery substance, which is amongst others used in construction and agriculture. Calcium oxide is a caustic compound, which reacts violently and exothermically with water. Occupational exposure to calcium oxide may therefore cause severe irritation of the skin, eyes, and mucous membranes.

From the human data available, the Health Council concludes that irritation of, especially, the nose is the critical effect. Since there are no experimental animal data and since the available human data are inadequate, the Health Council considers the toxicological database on calcium oxide too poor to justify recommendation of a health-based occupational exposure limit.

Introduction

In the Netherlands, occupational exposure limits for chemical substances are set using a three-step procedure. In the first step, a scientific evaluation of the data on the toxicity of the substance is made by the Dutch Expert Committee on Occupational Standards (DECOS), a committee of the Health Council of the Netherlands, on request of the Minister of Social Affairs and Employment. The purpose of the committee's evaluation is to set a health-based recommended occupational exposure limit for the atmospheric concentration of the substance, provided the database allows the derivation of such a value.

In the next phase of the three-step procedure, the Social and Economic Council advises the Minister on the feasibility of using the health-based value as a regulatory Occupational Exposure Limit (OEL), or recommends a different OEL. In the final step of the procedure, the Minister of Social Affairs and Employment sets the official OEL.

This three-step procedure was also followed for a project in which initially approximately 200 substances of the Dutch MAC-list were re-evaluated on request of the Minister of Social Affairs and Employment. The President of the Health Council of the Netherlands installed the Committee on Updating Occupational Exposure Limits in August 1997 for this re-evaluation project, which ended in December 2005.

The health hazards of calcium oxide were initially evaluated by the Committee on Updating of Occupational Exposure Limits.

In December 2004, the President of the Health Council released a draft of the document for public review. In April 2005, comments were received from Y de Lespinay (EuLA, Brussels, Belgium). For practical reasons, the President of the Health Council of the Netherlands and the acting Chairman of the Committee on Updating of Occupational Exposure Limits decided to pass on these comments to the Dutch Expert Committee on Occupational Standards (DECOS).

These comments were taken into account in deciding on the final version of the document which is entirely DECOS' view.

The first draft of this document was prepared by C de Heer, Ph.D. and H Stouten, M.Sc. (TNO Nutrition and Food Research, Zeist, the Netherlands). It was based on literature searched in May 1998 in the on-line databases Medline, Toxline, and Chemical Abstracts starting from 1987, 1965, and 1967, respectively, and using the following key words: calcium oxide, lime, and 1305-78-8, and an additional search in Toxline/'Medline in June 2004. The final search in Toxline/Medline was performed in April 2005.

Hoofdstuk **1**

Identity

name	:	calcium oxide
synonyms	:	calcium monoxide; lime; burnt lime; calx; quick lime
molecular formula	:	CaO
structural formula	:	-
CAS number	:	1305-78-8

Hoofdstuk 2

Physical and chemical properties

molecular weight	:	56.8
boiling point	:	2850^{o}C
melting point	:	2572^{o}C
flash point	:	-
vapour pressure	:	at 20^{o}C: not volatile
solubility in water	:	poorly soluble (at 20^{o}C: 0.17 g/100 mL)
log $P_{octanol/water}$	:	-0.57 (estimated)
conversion factors	:	not applicable

Data from ACG02, EC00*, http://www.syrres.com/esc/est_kowdemo.htm.

Commercially produced calcium oxide is a white or greyish-white powder and sometimes has a yellowish or brownish tint, due to iron (ACG02). The pH of a saturated solution at 25^{o}C is 12.8 (Pie93).

Calcium oxide reacts exothermically with water to form the hydroxide. It also reacts readily with carbon dioxide from the air to form calcium carbonate (ACG02, Pie93).

* See remark in ‘References’.

Hoofdstuk 3

Uses

Calcium oxide is used in the manufacture of glass, paper, soda, steel, aluminium, and magnesium and in flotation of nonferrous ores. It is also used in building and construction materials, e.g., plaster, mortar, bricks, and stucco. In agriculture, it finds use as a fertiliser. It also finds use in fungicides, insecticides, and some lubricants. Calcium oxide is also used in dehairing hides, deodorising vegetable oils, in water and sewage treatment, in flue gas purification, and in the beet sugar processing industry. Finally, it is used in food for pH-control, and as a texturising, firming, and anticaking agent (ACG02, EC00, NLM04).

Hoofdstuk 4

Biotransformation and kinetics

The committee did not find data on the biotransformation and kinetics of calcium oxide.

Hoofdstuk **5**

Effects and mechanism of action

Human data

Occupational and accidental exposures have shown calcium oxide to be very irritating and corrosive to mucous membranes, eyes, and moist skin because of local liberation of heat and dehydration of tissues upon slaking of the small size particles and the resulting alkalinity of the slaked product (calcium hydroxide) (e.g., ACG02, EC00, Fis98, Flo78, Gel92, Koo92, Luo95, Mas97, Moo83, Nar00). Fatal burns have been reported after massive exposure (Ric93).

Calcium oxide was stated not to be sensitising in an open epicutaneous test, but no reference to a particular study was made (EC00).

Calcium oxide tends to form clumps in the conjunctival sac that are dangerous and difficult to wash out. It can cause severe irritation and burns to the eyes, oedema, hyperaemia, lachrymation, blurred vision, corneal opacities, ulceration, and perforation and loss of vision (Ric93).

Inflammation of the respiratory passages, ulceration, perforation of the nasal septum, and pneumonia have been attributed to inhalation of calcium oxide dust (concentrations not indicated; ACG02, Pie93). Death may result from asphyxia and circulatory collapse (Ric93). According to EC00, ‘epidemiological syndromes’ related to lime exposure during production and application are not known. Workers in lime factories for up to 40 years have experienced no ill effects from exposure to lime (EC00).

In an undated personal communication by the Pennsylvania Department of Health, it is reported that strong nasal irritation occurred because of exposure to a mixture of dusts containing calcium oxide in the range of 25 mg/m^3, but that exposure at concentrations of 9-10 mg/m^3 produced no observable irritation (ACG02*).

In a survey to determine the potential health hazard from exposure to calcium oxide (lime dust), used as a lubricant in drawing wires through stretchers to smaller diameters, in a steel company in Pueblo (Colorado, USA), employees willing to participate (ca. half the total workforce; number not presented, but probably 12) were interviewed with questionnaires including items on nose and throat irritation. The only consistent complaint was irritation of the nose and throat. Breathing zone and general room air samples were taken on all participating workers. Calcium oxide samples were collected on pre-weighed 37 mm filters using vacuum pumps operated at 1.5 and 1.7 L/min and analysed by pre- and post-weighing and X-ray diffraction. Total dust CaO levels in the breathing zone (n=9) and general room (n=1) were 0.8-5.8 mg/m^3 and 0.9 mg/m^3, respectively. For respirable CaO, levels were 0.7-2.4 mg/m^3 (n=3) and 0.4 mg/m^3 (n=2). Sampling times ranged from 7.0 to 7.4 hours. The authors did not present more detailed information, such as, e.g., exposure level vs. irritation level or particle size distributions (Gun81).

A cross-sectional study in 75 workers, in which occupational exposure to quicklime (concentrations up to 620 mg/m^3 dust, containing 0.08% silica, determined by stationary air sampling) did not affect any of the lung function parameters examined, i.e., vital capacity, FEV_1, residual volume, and diffusion capacity, is in line with the EC00 statement (Lah87).

Torén et al. investigated the effects of a reconstruction of a lime kiln department of a pulp mill on upper respiratory tract symptoms of kiln workers exposed to lime dust. They compared questionnaire responses (focussed on upper respiratory tract symptoms such as bleeding, blocking, crusts, secretion), spirometric lung function (forced expiratory volume in one second: FEV_1; forced vital capacity: FVC; the ratio of FEV_1 and FVC), nasal function tests (mucociliary function: nasal transit time; nasal peak expiratory flow; nasal lavage: eosinophilic cationic protein, myeloperoxidase, and hyaluronic acid values), and a clinical examination of the upper airways before (n=15) and one year after the reconstruction (n=12) with those of matched unexposed referents. Stationary (at the same 9 places) and personal (for 6 and 4 workers, respectively) total dust

* This information was retrieved from the 3rd revised edition of 'Patty's Industrial Hygiene and Toxicology'. However, it was not included in the 4th edition.

samples were taken before and after the reconstruction by collecting the dust on 37 mm cellulose acetate filters (Millipore cassette - open version*) at a flow rate of 2 L/min. The reconstruction resulted in lower total dust levels, with geometric means of 0.1 mg/m^3 (range: 0.1-0.2 mg/m^3) for stationary samples (before: geometric mean: 1.2 mg/m^3; range: 0.1-7.7 mg/m^3) and of 0.2 mg/m^3 (0.1-0.6 mg/m^3) for personal samples (before: 1.2 mg/m^3; range: 0.4-5.8 mg/m^3), while concentrations of heavy metals such as lead, cadmium, nickel, and chromium increased (from <5, <0.5, 4.3, and 3.9 mg/kg, respectively, to 94, 3.9, 11, and 91 mg/kg, respectively).** Temperatures decreased from 42^o to 28^{o}C. Torén et al. did not observe statistically significant differences in reported symptoms, lung function tests, nasal peak expiratory flow, nasal lavage values, and clinical examination results between exposed and referent workers before and after reconstruction. However before the reconstruction, mucociliary function was significantly impaired in exposed workers as indicated by a statistically significant increase in nasal transit time (mean: 13.4 min; range: 6.0-26 min) when compared to unexposed workers (mean: 10.0 min; range: 4-20 min). After the reconstruction, there was no statistically significant difference in nasal transit times with mean values of 8.6 (range: 1.4-15 min) and 10.2 (range: 5.5-20 min) min between exposed and unexposed workers, respectively. Comparison of mean transit times determined in exposed workers before and after the reconstruction showed improvement in 7 and deterioration in 3, while transit times were similar in the remaining 2 workers; for unexposed referents, these figures were 3, 2, and 7, respectively. The authors discussed the influence of high temperature as measured before reconstruction on (impairment of) mucociliary function. Although there is some evidence in literature for such a relationship, they thought that the improved nasal clearance seen after the reconstruction was mainly an effect of the reduced lime dust levels, but some influence of reduced temperature could not be excluded (Tor96). Since calcium oxide has caustic properties, especially under moist conditions, and can deposit in the nose, the committee is of the opinion that impaired mucociliary functioning is a plausible and relevant effect. However, the committee is of the opinion that this study cannot be used as a starting point for deriving a health-based recommended occupational exposure limit (HBROEL). Exposure was characterised inadequately. Data were presented as total dust levels where it is internationally widely agreed by harmonising bodies such as the International Standards Organization (ISO), the Comité Européen

* K Torén, personal communication.

** According to Torén (personal communication), the workers were only working in the lime kiln with no other competing exposures such as SO_2.

de Normalisation (CEN), and the American Conference of Governmental Industrial Hygienists (ACGIH) that inhalable dust levels are more appropriate (see e.g., Lid00, Tsa01). The sampler used has a poor collection efficiency for inhalable particulate matter and may considerably underestimate exposure to the inhalable dust fraction; i.e., the ratio between the inhalable exposure as measured with the Institute of Occupational Medicine (IOM) inhalable aerosol sampler and 'total' aerosol exposure as measured with the open-face 37 mm cassettes was estimated to be 2 for 9 types of organic dust (see Lid00). The ratio was reported to tend to be greater when aerosols were more coarse (see Wer96, Wil96). However, the committee feels that, in this case, a reliable adjustment cannot be made due to a lack of data on particle size and particle size distribution and the limited number of measurements taken. Very few personal air samples were taken on a limited number of days: for 6 out of 15 workers before reconstruction and for 4 out of 12 after reconstruction, and it was not indicated whether these samples were representative for the workers who were not monitored. Further, there was no information on the relationship between individual exposure levels and individual nasal transit times to gain some understanding of a dose-response relationship.

Cain et al. studied sensory and associated reactions ('chemesthesis') to dusts of, amongst others, calcium oxide. Healthy male volunteers (n=12; age: 18-35 years) exercising on an ergometer simulating light industrial work were exposed in a dome to dusts of a calcium oxide/hydrated calcium sulphate mixture (ratio 1:9 by weight) at nominal calcium oxide concentrations of 0, 1, 2, and 5 mg/m^3 for 20 minutes. The dome contained several apertures amongst others for sampling dust via a light-scattering aerosol monitor and for sampling particles on 47-mm Pallflex filters (sampling rate: 2 L/min) for gravimetric measurement of total suspended particulate matter. Particle size distributions were measured for each exposure (using a multilevel sampling impactor; sampling rate: 7 L/min). The mass median aerodynamic diameter (MMAD) and geometric standard deviation were 6.53±0.76 μm and 2.6±0.00 (3 determinations). Health parameters measured included nasal resistance, nasal secretion, mucociliary clearance (nasal transit time), chemesthetic magnitude for eyes, nose, and throat, as well as minute ventilation, heart rate, and blood oxygenation. Before exposure to calcium oxide, the chemesthetic magnitude was calibrated to the pungency of carbon dioxide. As references for degrees of feel and irritation, a vapour delivery system emitted 6 levels of carbon dioxide that varied in increments of 5 percentage points from 10% to 35% at a flow rate of 10 L/min from 6 separate glass cones. According to Cain et al., very few people would use the term irritation to describe the nasal sensation evoked when sniffing 10% for 2 seconds, some would use that term at 15%, and the majority would use it at 20%. Above 20%, the sensation would rise sharply with concentration, 35% being bearable for a few seconds only. In neither exposure, any subject asked to terminate a session. The subjects registered 'feel from exposures' principally in the nose and secondarily in the throat. For the eyes, perceived magnitude did not differ from background levels at any of the concentrations. For the nose and throat, the perceived magnitude increased concentration and time dependently (levelling off somewhat towards the end of the exposure), and was significantly above control levels at all exposure concentrations. For the throat, the feel registered at the end of the exposure period was comparable to the feel that would be experienced at concentrations of carbon dioxide of 10 to 15%. For the nose, a feel comparable to that evoked by a carbon dioxide concentration of 20% was induced at exposure to 5 mg/m^3 and to that evoked by a CO_2 concentration of 15% at 1 and 2 mg/m^3. Exposure did not affect nasal resistance, nasal secretion, or mucociliary clearance (Cai04). In this study, the nose was the target organ, volunteers experiencing some irritation and 'feel' at levels of 5 mg/m^3 and 1-2 mg/m^3, respectively. However, since exposure was single and short (20 minutes), the committee is of the opinion that this study cannot be used as a starting point for deriving a health-based recommended occupational exposure limit (HBROEL).

Animal data

Calcium oxide was reported not to be irritating in rabbits when tested according to OECD guideline 404 (acute dermal irritation/corrosion), but no reference to a particular study was made (EC00).

The oral LD_{50} in the rat is 500-2000 mg/kg bw (no reference made) (EC00).

Exposure of male rats to welding fumes, either repeated inhalation exposure to 413 mg/m^3 (30 minutes/day, 6 days/week, 2 weeks) or a single 1-hour exposure to 1026 mg/m^3, did not result in deaths, behavioural changes, or reductions in food intake or body weight. No significant differences were noted in haematological or biochemical parameters in serum or urine in the same animals. The only significant changes occurred in the lung (increased lung weight and morphological changes such as hyperplasia of mucus cells in the bronchial epithelium). Besides 4.64 or 12.25% CaO, the welding fumes consisted of considerable levels of Fe_2O_3, SiO_2, and Cr_2O_3 (Uem84).

Calcium oxide was negative when tested at a concentration of 0.00125%, with and without metabolic activation, in gene mutation and mitotic recombination assays in *S. cerevisiae* (strain D4) and in a reverse mutation assay in *S. typhimurium* strains TA1535, TA1537, and TA1538 (Bru75). However, due to several methodological shortcomings, this test is considered to be inadequate. In another study, concentrations up to 1 g/L were negative in *S. typhimurium* strains TA98 and TA100, both with and without metabolic activation, whereas higher concentrations decreased the viability of the tester strains (Saw95).

No effects indicative of maternal (death, weight) or developmental toxicity (number of corpora lutea, implantation and resorption sites, and live and dead fetuses; fetal weights; skeletal and visceral abnormalities) were seen in Wistar rats (n=19-21/group) and CD-1 mice (n=17-21/group) given daily oral (gavage) doses of CaO, administered as a water suspension, of 6.8-680 and 4.4-440 mg/kg bw, respectively, during gestational days 6-15 (Bai74). [The committee notes that due to the way the substance was administered not calcium oxide per se but calcium hydroxide was tested].

Hoofdstuk 6

Existing guidelines

The current occupational exposure limit (MAC) for calcium oxide in the Netherlands is 2 mg/m^3, 8-hour TWA. The short-term exposure limit, 15-minute TWA, is 5 mg/m^3.

Existing occupational exposure limits for calcium oxide in some European countries and in the USA are summarised in Annex C.

Hoofdstuk 7

Assessment of health hazard

Calcium oxide is a very caustic compound, which exothermically reacts with water to form the hydroxide. It may, therefore, cause severe irritation of skin, eyes, and mucous membranes. It is noted that the rate of hydrolysis of lime depends on the production process and therefore the irritation potency may depend on the production process.

However, there were hardly any adequate human and experimental animal data that substantiated the irritating potential or described a concentration-response relationship.

There were no verifiable or adequate experimental animal data.

The committee is of the opinion that irritation of, especially, the nose is the critical effect of exposure to calcium oxide. Numerous case reports have shown that calcium oxide can be very irritating and corrosive to mucous membranes, eyes, and moist skin. Kiln workers exposed to lime dust at total dust levels from personal air sampling of 0.4 to 5.8 mg/m^3, some heavy metals, but not to other competing irritating compounds, showed impairment of mucociliary functioning when compared to matched unexposed controls, but not after reconstruction of the department, which resulted in decreases in total dust levels (0.1 to 0.6 mg/m^3) and temperatures (from 42 to 28^{o}C) (Tor96). Volunteers reported some irritation of the nose when exposed to inhalable dust levels of 5 mg/m^3 for 20 minutes and some ‘feel’ at lower levels of 1 and 2 mg/m^3 (Cai04). However, due to flaws in design (inadequately characterised exposure, lack of dose-response information, small group size) in the Torén study and the exposure conditions (single, 20 minutes) in the Cain study, the committee is of the opinion that these data cannot be used for deriving a health-based occupational exposure limit.

The committee considers the toxicological database on calcium oxide too poor to justify recommendation of a health-based occupational exposure limit.

Hoofdstuk 8

Additional consideration

From the Cain study (Cai04), in which volunteers were exposed to CaO for 20 minutes, the committee infers that 2 mg/m^3 may be the lower limit of irritation.

Noting that the results of this study are based on a limited set of data in healthy volunteers, the committee is of the opinion that applying an occupational exposure limit of 2 mg/m^3, as inhalable dust, as a 15-minute time-weighted average is justifiable.

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* This dossier is a compilation based on data reported by the European Chemicals Industry following 'Council Regulation (EEC) 793/93 on the Evaluation and Control of the Risks of Existing Substances' to allow a risk assessment by member states of the EC. However, the data in the dossier have not undergone any evaluation by an EC member state yet.

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A The committees

B Comments on the public draft

C Occupational exposure limits

Annexes

Annex **A**

The committees

Dutch Expert Committee on Occupational Standards

- GJ Mulder, *chairman*
  emeritus professor of toxicology, Leiden University, Leiden
- RB Beems
  toxicologic pathologist; National Institute of Public Health and the Environment, Bilthoven
- LJNGM Bloemen
  epidemiologist; Exponent Inc., Terneuzen
- PJ Boogaard
  toxicologist; SHELL International BV, The Hague
- PJ Borm
  toxicologist; Centre of Expertise in Life Sciences, Hogeschool Zuyd, Heerlen
- JJAM Brokamp, *advisor*
  Social and Economic Council, The Hague
- DJJ Heederik
  professor of risk assessment in occupational epidemiology; IRAS, University of Utrecht, Utrecht
- TM Pal
  occupational physician; Dutch Centre for Occupational Diseases, Amsterdam
- IM Rietjens
  professor of toxicology; Wageningen University, Wageningen.

- H Roelfsema, *advisor*
  ministery of Health, Welfare and Sport, The Hague
- T Smid
  occupational hygienist/epidemiologist; KLM Health Safety & Environment, Schiphol; and, professor of working conditions, Free University, Amsterdam
- GMH Swaen
  epidemiologist; Dow Chemical Company, the Netherlands
- RA Woutersen
  toxicologic pathologist; TNO Quality of Life, Zeist
- P Wulp
  occupational physician; Labour Inspectorate, Groningen
- JTJ Stouten, *scientific secretary*
  Health Council of the Netherlands, The Hague, the Netherlands

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Committee on Updating of Occupational Exposure Limits, that was disbanded in December 2005, consisted of:

- J Noordhoek, *chairman*†
  professor of toxicology; University of Nijmegen, Nijmegen, the Netherlands
- A Aitio
  senior scientist; International Programme on Chemical Safety, World Health Organization, Geneva, Switzerland
- PL Chambers †
  co-ordinator toxicology studies; University of Dublin, Ireland
- VJ Feron
  professor of toxicology; TNO Nutrition and Food Research Institute, Zeist, the Netherlands
- H Greim
  professor of toxicology; Senatskommission der Deutschen Forschungsgemeinschaft zur Prüfung gesundheitsschädlicher Arbeitsstoffe, Technische Universität München, Freising-Weihenstephan, Germany
- U Hass
  senior researcher in toxicology; Institute of Food Safety and Toxicology; Søborg, Denmark
- CJ Högberg
  professor of toxicology; National Institute for Working Life and Karolinska Institutet, Stockholm, Sweden
- G De Mik
  toxicologist; National Institute of Public Health and the Environment, Bilthoven, the Netherlands

- A Moses
  consultant toxicologist; Hartford, Northwich, United Kingdom
- W Seinen
  professor of toxicology; Utrecht University, Utrecht, the Netherlands
- GMH Swaen
  epidemiologist; Dow Chemical, Terneuzen, the Netherlands
- WMD Wagner, *corresponding member*
  American Conference of Governmental Industrial Hygienists,
  Cincinnati OH, USA
- RD Zumwalde
  senior scientist; National Institute for Occupational Safety and Health,
  Cincinnati, Ohio, USA
- LCMP Hontelez, *advisor*
  Ministry of Social Affairs and Employment, The Hague, the Netherlands
- WF Passchier, *observer*
  Health Council of the Netherlands, The Hague, the Netherlands
- CA Bouwman, *scientific secretary*
  Health Council of the Netherlands, The Hague, the Netherlands
- JTJ Stouten, *scientific secretary*
  Health Council of the Netherlands, The Hague, the Netherlands

The Health Council and interests

Members of Health Council Committees are appointed in a personal capacity because of their special expertise in the matters to be addressed. Nonetheless, it is precisely because of this expertise that they may also have interests. This in itself does not necessarily present an obstacle for membership of a Health Council Committee. Transparency regarding possible conflicts of interest is nonetheless important, both for the President and members of a Committee and for the President of the Health Council. On being invited to join a Committee, members are asked to submit a form detailing the functions they hold and any other material and immaterial interests which could be relevant for the Committee's work. It is the responsibility of the President of the Health Council to assess whether the interests indicated constitute grounds for non-appointment. An advisorship will then sometimes make it possible to exploit the expertise of the specialist involved. During the establishment meeting the declarations issued are discussed, so that all members of the Committee are aware of each other's possible interests.

Annex **B**

Comments on the public draft

A draft of the present report was released in 2005. The following person has commented on the draft document:

- Y de Lespinay, EuLA, Brussels, Belgium

Annex **C**

Occupational exposure limits

Occupational exposure limits for calcium oxide in various countries.

country - organisation	occupational exposure limit ppm	mg/m³	time-weighted average	type of exposure limit	note[a]	reference[b]
the Netherlands						
- Ministry of Social Affairs and Employment	-	2	8 h	administrative		SZW06
		5	15 min	force		
Germany						
- AGS	-	-				TRG06
- DFG MAK-Kommission	-	-[d]				DFG05
Great Britain						
- HSE	-	2	8 h	WEL		HSE05
Sweden	-	1[c]	8 h			Arb05b
	-	2.5[c]	15 min			
Denmark	-	2	8 h			Arb05a
USA						
- ACGIH	-	2	8 h	TLV		ACG06
- OSHA	-	5	8 h	PEL		ACG04
- NIOSH	-	2	10 h	REL		ACG04
European Union						
- SCOEL	-	-				EC06

[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.
[c] Inhalable dust.
[d] Listed among compounds for which studies of the effects in man or experimental animals have yielded insufficient information for the establishment of MAK values.