Gezondheidsraad
Health Council of the Netherlands

To the Minister of Social Affairs and Employment

Subject	: advisory letter on *Health-based recommended occupational exposure limits for biological agents*
Your reference	: G&VW/GW/2011/2388
Our reference	: U 7329/AvdB/832-E3 Publication no. 2012/35E
Enclosure(s)	: 2
Date	: December 17, 2012

Dear Minister

This advisory letter is part of a series of recommendations concerning the possibility of establishing health-based exposure limits for various occupational hazards. In his request for advice dated 10 July 2007, the then Minister of Social Affairs and Employment (SZW in Dutch) had asked the Health Council of the Netherlands to alert him periodically to possible new (international) scientific insights concerning health- and safety-based limits for various occupational hazards (see Annex A). The occupational hazards in question are named in the Dutch Health and Safety Act (*Arbowet*) and the corresponding regulations. In the present advisory memorandum, the Health Council's Committee on the Identification of Workplace Risks (see Annex B) has examined the possibilities of determining health-based recommended occupational exposure limits for airborne biological agents to which humans may be exposed. On completion, the advisory letter was reviewed by the Standing Committee on Health and the Environment.

Biological agents are omnipresent in our day-to-day living environment. They may be found in our mouth, nose and gut and on our skin and mucous membranes. One person plays host to about 10^{14} micro-organisms. However, most of these micro-organisms are quite innocuous and do not cause disease. Only a small number of micro-organisms (the pathogens) give rise to diseases in man.

Reports about various infectious biological agents have appeared in the Dutch press recently. These concerned the outbreak of Q fever in the southeast of the country, livestock farmers and veterinarians who were found to be carriers of cattle-related strains of MRSA,[a] and Mexican flu (the H1N1 virus). Biological agents were also mentioned in the recent advisory report from the Health Council concerning health hazards on livestock farms.[1] That report dealt with the exposure

[a] MRSA: Methicillin-resistant Staphylococcus aureus.

P.O. Box 16052
NL-2500 BB The Hague
Telephone +31 (70) 340 70 17
E-mail: a.vander.burght@gr.nl
www.healthcouncil.nl

Visiting Address
Parnassusplein 5
NL-2511 VX The Hague
The Netherlands

of local residents, but in all the other reports occupational exposure might also play a role. Workers who are in close contact with infected patients or in direct contact with infected animals (zoonoses) are often the group with a particularly high risk of infection.[2] They also represent a potential source of infection for other workers and for the general population.

It has been estimated that throughout the world 320,000 workers, including 5,000 in the European Union, die each year as a result of occupational exposure to biological agents.[3,4] The number who fall ill due to occupational exposure to biological agents is probably much higher, but is difficult to estimate because there is no specific monitoring in this field and the reported data are insufficient.

What are biological agents?

The term "biological agents" covers a wide range of different micro-organisms, including bacteria, viruses, moulds, yeasts, parasites and live cell cultures.

Dutch health and safety legislation contains a definition of biological agents. This may be found in Chapter 4, Section 9 of the Working Conditions Decree (*Arbeidsomstandighedenbesluit*),[5] and is derived from the European Directive from 1990 and 2000 (2000/54/EC).[6] The definition given in the European Directive states that biological agents are micro-organisms, including those which have been genetically modified, cell cultures and human endoparasites, which may be able to provoke any infection, allergy or toxicity. In this context, a cell culture is defined as the in-vitro growth of cells derived from multicellular organisms; an endoparasite as a living organism that reproduces itself within the human body; and a micro-organism as a microbiological entity, cellular or non-cellular, capable of replication or of transferring genetic material.

The Committee follows the definition of biological agents given in the Working Conditions Decree, and classifies the biological agents in this advisory memorandum into the following groups on the basis of the health effects they can cause:

- biological agents (both living micro-organisms and products of micro-organisms) that give rise to toxic effects;
- biological agents (mainly non-living allergens derived from moulds) that give rise to allergic effects;
- biological agents (mainly living micro-organisms) that give rise to infectious diseases.

P.O. Box 16052
NL-2500 BB The Hague
Telephone +31 (70) 340 70 17
E-mail: a.vander.burght@gr.nl
www.healthcouncil.nl

Visiting Address
Parnassusplein 5
NL-2511 VX The Hague
The Netherlands

In this advisory memorandum, the Committee will first discuss possible ways of quantifying exposure to biological agents. It will then go on to consider the possibilities of determining health-based recommended occupational exposure limits for each of the above-mentioned categories.

Quantifying the exposure to biological agents

The quantification of the exposure to biological agents is a complex matter. Measurement of the exposure to airborne substances is also associated with considerable problems, such as the difficulty of taking representative samples. In addition, specific points have to be taken into account when measuring the exposure to biological agents.

Fluctuations in exposure

Biological agents are often living organisms that can grow, multiply (sometimes enormously) and die. As a result, exposure to biological agents can vary more strongly in time than that to chemical agents. A single exposure measurement thus only gives picture of the concentration of airborne biological agents of a given moment in time. Multiple measurements are needed to get a correct picture. In addition, the exposure concentration depends strongly on the season and the measurement location. All these factors complicate the task of obtaining a representative picture of the airborne exposure.

Different exposure routes

Many of the available measuring methods apply only to airborne biological agents. There has been little or no investigation of dermal exposure to biological agents in the working environment. Oral or dermal exposure (via hand-mouth or hand-nose contact) resulting from contamination of surfaces can, however, play a significant role in some situations, but there are as yet no standardised measuring methods in this field. Despite the absence of such measuring methods, there is a strong focus on effective hand hygiene in hospitals in order to minimise the transmission of pathogens by this route.[7]

P.O. Box 16052
NL-2500 BB The Hague
Telephone +31 (70) 340 70 17
E-mail: a.vander.burght@gr.nl
www.healthcouncil.nl

Visiting Address
Parnassusplein 5
NL-2511 VX The Hague
The Netherlands

Limitations of measuring methods

Very few standardised measuring methods for biological agents have been described. The CEN standard EN13098 lays down the general principles of the measurement of airborne micro-organisms and gives details of the procedures to be followed.[8] No methods are available for the measurement of exposure to specific airborne micro-organisms. Some methods have been described for the quantification of the exposure via the air to "viable" and "non-viable" micro-organisms.

The methods for the quantification of the exposure to viable micro-organisms are based on the culture of the organisms in question isolated from the air and the counting of the number of the resulting colony forming units (CFU).[9-11] The result is given in units of CFU/m^3. The CFU count is only a measure of the viable fraction of the micro-organisms. This is needed to quantify the risk of infection. It may however not correlate with the total allergenic or toxic load, which is determined by the (non-viable) toxic or allergenic components of the biological agents. Dead micro-organisms or fragments of micro-organisms can also contribute to health effects, but are not detected by these methods.

An alternative approach is to count the micro-organisms in a "non-viable" state.[10,11] This can be done with a microscope or electron microscope. Methods are also available for determining exposure to specific agents, such as airborne endotoxins. Dutch standard NEN-EN 14031 describes a method for determination of the endotoxin concentration in air.

Measuring methods making use of the genetic information of specific micro-organisms have undergone major advances of recent years. The polymerase chain reaction (PCR) permits measurements on small amounts of DNA. PCR technology is used for the analysis of micro-organisms in water samples and identification of colonies of micro-organisms in clinical samples by looking for parts of the genome specific to the micro-organism in question. This approach allows micro-organisms to be detected faster and characterised more accurately than ever before. In addition, an increasing range of IgE antibodies are becoming available that can be used to quantify exposure with the aid of ELISA[a] tests.

Most of the methods are labour-intensive and can only be performed in specialised laboratories. Moreover, the results of many measurements can only be compared with the particular laboratory's own internal reference data.[8,10,11] In the Committee's opinion, further development of various measuring methods is of great importance in order to gain more insight

[a] ELISA = Enzyme-linked immunosorbent assay.

P.O. Box 16052
NL-2500 BB The Hague
Telephone +31 (70) 340 70 17
E-mail: a.vander.burght@gr.nl
www.healthcouncil.nl

Visiting Address
Parnassusplein 5
NL-2511 VX The Hague
The Netherlands

into exposure to biological agents in the working environment. The Committee believes that recent developments in the field of molecular technology may permit substantial advances here in the near future.

Biological agents giving rise to toxic effects

Existing national and international limit values

In the Netherlands, the Health Council in 2010 examined one specific group of biological agents capable of producing toxic effects, namely the endotoxins, substances derived from Gram-negative bacteria.[12,13] Chronic exposure to endotoxins leads to a reduction in pulmonary function in humans. However, workers are unlikely to experience adverse health effects as long as the average concentration in the air over an 8-hour working day remains below 90 EU (endotoxin units)/m^3. The Health Council has not yet derived other health-based recommended occupational exposure limits for other micro-organisms with mainly toxic effects. However, the risk of cancer – in particular, liver cancer – due to occupational exposure to aflatoxins has been calculated[a] and formed the basis for the legally binding limit value of aflatoxin in air set by the Minister of Social Affairs and Employment. This value amounts to 0.005 µg/m^3 for an eight-hour working day.[14]

In Scandinavia, the Nordic Expert Group (NEG) has examined the effects on health of moulds capable of producing toxic effects.[15,16] The NEG has used experimental and observational studies on humans to determine the exposure level in air at which non-sensitised workers start to experience effects.[b] The level for moulds amounts to about 10^5 spores per cubic metre of air[c]. This is the level at which respiratory complaints, changes in pulmonary function and inflammation of the lungs start to be observed. However, the NEG has not made any recommendations for a health-based limit value in this case.

[a] By the Dutch Expert Committee on Occupational Safety (DECOS). This working group became part of the Health Council in 1996.

[b] This is known as the lowest observed adverse effect level (LOAEL).

[c] This value applies to moulds without traces of mycotoxins and pathogens.

P.O. Box 16052
NL-2500 BB The Hague
Telephone +31 (70) 340 70 17
E-mail: a.vander.burght@gr.nl
www.healthcouncil.nl

Visiting Address
Parnassusplein 5
NL-2511 VX The Hague
The Netherlands

Effects of exposure

The Health Council has issued a number of advisory reports on the relationship between exposure to chemical substances and toxic effects.[17,18] Based on the knowledge concerning the mechanism of action of these substances, it is theoretically possible to derive an exposure level in air at which it can reasonably be expected that adverse effects on health will be prevented. In the Committee's opinion, this approach could also apply to biological agents giving rise to toxic effects. There is one exception, i.e. carcinogenic biological agents with a genotoxic mechanism of action. In the case of these biological agents no safe exposure level can be given below which no carcinogenic effects can be expected. The Health Council calculates the extra risk of cancer for this group of compounds.[19,20]

Recommendation

In the Committee's opinion, it is theoretically possible to derive health-based recommended occupational exposure limits for biological agents giving rise to mainly toxic effects. There is no need to depart from the procedures currently used in the Netherlands to establish health-based recommended exposure limits in the case of such biological agents. There is however a lack of good quantitative data on exposure and the associated toxic effect (the relationship between exposure and effect).

Biological agents giving rise to allergic effects

Existing national and international limit values

The Health Council issued an advisory report on the prevention of occupational respiratory allergies in 2008.[21] Exposure to allergens causes workers to be sensitised, and they may develop an allergy in the long term. It is estimated that 500 to 2,000 new cases of asthma occur annually in the Netherlands due to exposure at work.[22] On the basis of this advisory report from the Council, the Social and Economic Council of the Netherlands (*Sociaal-Economische Raad*) has recommended a twin-track policy for inhalable allergens. The first track is based on prevention, and the second on the development and determination of limit and/or reference values. So far, the Health Council has only proposed reference values for occupational exposure to wheat flour, based on its allergenic properties. No limit values for allergens of microbial origin have yet been determined in

P.O. Box 16052
NL-2500 BB The Hague
Telephone +31 (70) 340 70 17
E-mail: a.vander.burght@gr.nl
www.healthcouncil.nl

Visiting Address
Parnassusplein 5
NL-2511 VX The Hague
The Netherlands

the Netherlands. The American Conference of Governmental Industrial Hygienists (ACGIH) has established a threshold limit value (TLV) for subtilisin, an enzyme of bacterial origin that used as a detergent among other things. Specific subtilisins are currently produced with the aid of genetically modified micro-organisms.

Effects of exposure

An allergy is a hypersensitivity reaction triggered by the response of the body's defence systems to a foreign substance known as an allergen. A characteristic feature of this reaction is that the initial exposure to the antigen brings the immune system into an enhanced state of readiness (a process known as sensitisation), often without leading to complaints. On renewed exposure, sensitised persons may suffer an allergic reaction with symptoms such as a runny nose (rhinitis), red eyes (conjunctivitis) and asthma. The Health Council concluded in 2008 that sensitisation is a crucial component of the pathogenesis of allergic respiratory complaints. It is in fact a necessary condition for the occurrence of such complaints: in other words, no allergic complaints are found in persons who have not been sensitised.[21] In the Committee's opinion, allergies to biological agents will be developed in a comparable way.

Recommendation

The Committee sees no reason to depart from the conclusions of a previous Health Council report on respiratory allergens which stated that it is theoretically possible to derive health-based recommended occupational exposure limits. The Committee therefore supports the existing procedures that have been developed in the Netherlands when deriving health-based OEL's for biological agents with allergenic effects. Here again, the amount of quantitative information available in practice is limited. However, exposure-response relationships described in the scientific literature may permit the derivation of health-based recommended limit values for α-amylase[a] and subtilisin.

[a] The Health Council's Dutch Expert Committee on Occupational Safety (DECOS) has already placed α-amylase on its working programme.

P.O. Box 16052
NL-2500 BB The Hague
Telephone +31 (70) 340 70 17
E-mail: a.vander.burght@gr.nl
www.healthcouncil.nl

Visiting Address
Parnassusplein 5
NL-2511 VX The Hague
The Netherlands

Biological agents giving rise to infectious diseases

Population at risk

There are two registration systems that may be consulted to gain an insight into the prevalence of infectious diseases in the Netherlands. The first is the national registration of occupational diseases at the Netherlands Centre for Occupational Diseases (*Nederlands Centrum voor Beroepsziekten*, NCvB).[23,24] Under the provisions of the Dutch Health and Safety Act (*Arbowet*), occupational health and safety departments and physicians (in particular company medical officers) are obliged to report all suspected or confirmed cases of occupational diseases. The number of cases of infectious diseases reported by company medical officers in 2009, 2010 and 2011 were 156, 89 and 141 respectively.[23,25] Nearly half (44%) of the reports of infectious diseases came from the health and welfare sector. The diseases most commonly reported to the NCVB are intestinal infections, skin infections, Lyme disease and tuberculosis[24].

The second source of information is OSIRIS, the registration system of the National Institute of Public Health and the Environment (RIVM). The Infectious Diseases Act (*Infectieziektewet*) names 43 infectious diseases that GPs are required to report to their Municipal Health Service (GGD). The GGDs pass these reports on to OSIRIS. The number of occupational infectious diseases registered in OSIRIS in 2009, 2010 and 2011 were 154, 189 and 193 respectively[25]. Education (29%), healthcare (22%), and the agricultural and veterinary sector (11%) had the highest prevalence of occupational infectious diseases. The most commonly reported occupational infectious diseases were pertussis (whooping cough), malaria, mumps and Legionnaires' disease.[26]

However, these two registration systems are constructed on different principles, and both have limitations. It is clear on the one hand that infectious diseases are significantly underreported in the NCvB database because company medical officers only have to report infectious diseases leading to actual loss of working time. On the other hand, reports made by the GGDs are not specifically focused on occupational infectious diseases. These factors make it difficult to get a good overview of the prevalence of occupational infectious diseases in the Netherlands.

Existing national and international limit values

The Committee has not been able to find any specific health-based recommended exposure limits for infectious agents in the working environment. In some cases, limit values are given for the occurrence of the agent in the environment. This applies for example to *Legionella spp.* in stagnant

P.O. Box 16052
NL-2500 BB The Hague
Telephone +31 (70) 340 70 17
E-mail: a.vander.burght@gr.nl
www.healthcouncil.nl

Visiting Address
Parnassusplein 5
NL-2511 VX The Hague
The Netherlands

water (in fire hoses, boilers (including central heating boilers), etc,). While these limit values do help to limit the occurrence of the agent in question in the environment, they are not health-based (no information is given about the relationship between exposure and effect) as is the case with the limit values for chemical agents.

Moreover, the ACGIH has not laid down any TLVs for biological infectious agents, though it has in the past suggested some rules of thumb that may be used to make a rough estimate of occupational exposures. For example the ACGIH states in connection with exposure to moulds that the concentration of spores in the air inside a building should in general be lower than that in the open air. Moreover, no species may be found in the air inside a building that are not normally found in the open air in the season in question. A similar approach could apply to other micro-organisms.[27,28]

Effects of exposure

Exposure to airborne micro-organisms can lead to an infection in humans. An infection means that a micro-organism has penetrated into the host's body and can multiply there. This does not necessarily imply that the host will become ill. Knowledge about the relationship between inhalatory exposure to biological agents and the risk of infectious disease is limited. More research is available on food infections.[29] It is generally assumed that there is no safe exposure threshold for airborne infectious micro-organisms below which infection is no longer possible.[30,31]

A further possibility is that an infected host develops immunity (either temporary or permanent) to a specific micro-organism. That means that the host's immune system is activated by exposure to the micro-organism in question. This will allow the host to react faster and more effectively to renewed exposure to the same micro-organism, so that the risk of disease is reduced. A model has been developed for *Campylobacter*, which shows that a high constant exposure to this micro-organism (and hence a high, constant level of infection) does not necessarily mean that the incidence of infectious disease rises.[32] The model shows strong dynamic patterns in which reduction of the exposure to campylobacter can actually lead to a rise in the incidence of infectious disease. There is a need for much more research on this development of temporary or permanent immunity. It is not yet certain, however, whether the development of (temporally) immunity permits the derivation of health-based recommended exposure limits for micro-organisms.

P.O. Box 16052
NL-2500 BB The Hague
Telephone +31 (70) 340 70 17
E-mail: a.vander.burght@gr.nl
www.healthcouncil.nl

Visiting Address
Parnassusplein 5
NL-2511 VX The Hague
The Netherlands

Subject : advisory letter on *Health-based recommended occupational exposure limits for biological agents*
Our reference : U 7329/AvdB/832-E3 Publication no. 2012/35E
Page : 10
Date : December 17, 2012

Recommendation

There is a wide variety of biological agents that are able to give rise to infectious diseases. The Committee does not believe that it is possible to determine one overall effective health-based recommended exposure limit applying to all such biological agents.

Quantitative information on exposure, the disease and the relationship between them is needed to make it possible to determine health-based recommended exposure limits for individual substances or agents. The Committee observes, however, that knowledge on biological agents in these fields is currently limited, though considerable advances are being made in the quantification of exposure which, the Committee believes, will make it possible to improve the determination of this exposure substantially. The increasing use and sophistication of new technologies such as PCR and ELISA should make it possible to quantify the exposure to specific micro-organisms better in the long term. An example of such new applications is the study of MRSA in abattoirs.[33] Biomonitoring is an alternative to the measurement of micro-organisms in the air. This might take the form of measurement of specific *Coxiella burnetii* antibodies (IgG) in the blood of veterinarians or of *Coxiella burnetii* IgG and IgE in the blood of veterinary students.[34,35]

Most of the data on the effects of exposure to infectious micro-organisms are obtained after outbreaks of diseases caused by the micro-organism in question. In such cases, research focuses on public health effects. The question is how such data can best be translated into a recommended limit value that offers workers adequate protection during an eight-hour working day, five days a week for forty years. According to the Committee, there are currently hardly any data available on the relationship between exposure at work, infection and the effects on workers' health.

Summarising, in the Committee's opinion it will not be possible in the near future to determine levels at which no or minimal effects on health may be expected for specific micro-organisms giving rise to infectious diseases.

One of the measures the Committee recommends in order to avoid any effects due to exposure at work in the short term is a *preventive approach*.

The Health Council issued an advisory report on the precautionary principle in 2008.[36] This principle may be regarded as a strategy for dealing with uncertainties in an alert, careful, reasonable and transparent fashion, which takes account of the particular situation. Many uncertainties also exist when it comes to the effects of exposure to biological agents. The

P.O. Box 16052
NL-2500 BB The Hague
Telephone +31 (70) 340 70 17
E-mail: a.vander.burght@gr.nl
www.healthcouncil.nl

Visiting Address
Parnassusplein 5
NL-2511 VX The Hague
The Netherlands

Committee believes that these uncertainties should also be dealt with in a careful, transparent manner.

A preventive approach should also include an occupational hygiene strategy. Employers should take the measures required to ensure safe and healthy working conditions for workers. These measures should be taken in a certain order, starting with addressing problems at the source as the first step. The Dutch Knowledge System for Infectious Diseases and Work (*Kennissysteem Infectieziekten en Arbeid*, KIZA) has refined this strategy by developing a special Bio-occupational hygiene principle (referred to as the *Bio-Arbeidshygienisch (BAH)-principe* in Dutch) to deal with biological agents.[37]

The Committee would like to point out that it may be useful to deploy unconventional preventive measures such as the vaccination of workers. In this connection, the State Secretary for Social Affairs and Employment asked the Health Council to set up a decision framework for whether or not to vaccinate workers.

On the other hand, the Committee recommends further *development and implementation of knowledge* concerning biological agents, with the aim of avoiding the effects of exposure at work as much as possible.

Knowledge of the effects of occupational exposure to infectious biological agents is limited. More research on the relationship between occupational exposure and the effects on health is required, and new measuring methods need to be studied and developed to permit the monitoring and evaluation of changes in occupational exposure.

The Committee also recommends that knowledge and measuring methods that are available in the field of infectious diseases and public health should be made more generally accessible to workers in the field of occupational health, to achieve improved working conditions. For example, knowledge about the measurement and reduction of exposure to MRSA in the open air should also be made available for the determination of occupational exposure.

In addition, the Dutch Working Party on Infection Prevention (WIP) has considerable expertise on how to prevent infection in hospitals.[38] This working party focuses in particular on preventing infection in patients. While advisory reports from the WIP do indeed contain information on workers, these individuals are primarily regarded as possible sources of infection (*risk factors*) for patients. A study commissioned by the Ministry of Social Affairs and Employment examined the WIP guidelines concerning working conditions.[39] The authors of this study concluded that "the WIP guidelines can be optimised by the inclusion of health and safety elements, or by dealing with such elements in a more specific form". The Committee agrees that

P.O. Box 16052
NL-2500 BB The Hague
Telephone +31 (70) 340 70 17
E-mail: a.vander.burght@gr.nl
www.healthcouncil.nl

Visiting Address
Parnassusplein 5
NL-2511 VX The Hague
The Netherlands

the value of advisory reports from the WIP could be enhanced if workers were regarded more often as people who were *at risk* of infection as well as being potential *sources* of infection.

Finally the Committee would like to point out that more knowledge about micro-organisms by all parties concerned (employers, occupational health and safety departments, etc.) could help to improve the working climate.

In summary

The Committee concludes that it is possible to derive health-based recommended occupational exposure limits for biological agents giving rise to toxic and/or allergic effects. It recommends that the existing procedures for toxic and allergenic chemical substances should be followed, with the necessary changes, for these agents. The Committee does not believe that it will be possible in the short term to determine health-based recommended occupational exposure limits for biological agents that mainly give rise to infectious diseases. The Committee recommends a preventive approach to these agents, and stresses the importance of knowledge development and implementation in this field.

I hope the above provides you with the information you require.

Yours sincerely,

(signed)
Professor W.A. van Gool,
President

P.O. Box 16052
NL-2500 BB The Hague
Telephone +31 (70) 340 70 17
E-mail: a.vander.burght@gr.nl
www.healthcouncil.nl

Visiting Address
Parnassusplein 5
NL-2511 VX The Hague
The Netherlands

Literature

1 Health Council of the Netherlands. Health risks associated with livestock farms. The Hague: Health Council of the Netherlands, 2012; publication no. 2012/27.

2 Haagsma JA, Tariq L, Heederik DJ, Havelaar AH. Infectious disease risks associated with occupational exposure: a systematic review of the literature. Occup Environ Med 2012; 69(2): 140-146.

3 Driscoll T, Takala J, Steenland K, Corvalan C, Fingerhut M. Review of estimates of the global burden of injury and illness due to occupational exposures. Am J Ind Med 2005; 48(6): 491-502.

4 Hamalainen P, Takala J, Saarela KL. Global estimates of fatal work-related diseases. Am J Ind Med 2007; 50(1): 28-41.

5 Arbeidsomstandighedenbesluit. 2011. Internet: www.arbo.nl/wet-regelgeving.

6 Europese Unie. Richtlijn 2000/54/EG van het Europees Parlement en de Raad van 18 september 2000 betreffende de bescherming van de werknemers tegen de risico's van blootstelling aan biologische agentia op het werk (zevende bijzondere richtlijn in de zin van artikel 16, lid 1, van Richtlijn 83/391/EEG) (PB L 262). http://eur-lex.europa.eu.

7 Werkgroep Infectiepreventie. Ziekenhuizen: Handhygiëne medewerkers. Leiden: Werkgroep Infectie Preventie; 2007. Internet: http://www.wip.nl/.

8 NEN. Werkplekatmosfeer - Richtlijnen voor meting van micro-organismen en endotoxine in de lucht. Nederlands Normalisatie Instituut; 2000: NEN-EN 13098.

9 Burge HA. Bioaerosols. Boca Raton, FL: CRC Press; 1995.

10 Eduard W, Heederik D. Methods for quantitative assessment of airborne levels of noninfectious microorganisms in highly contaminated work environments. Am Ind Hyg Assoc J 1998; 59(2): 113-127.

11 Heederik D, Douwes J, Thorne P. Biological agents - Monitoring and evaluation of bioaerosol exposure. In: Perkins JL, editor. Modern industrial hygiene, Volume 2 - Biological Aspects. Cincinatti, OH: ACGIH; 2008.

12 Health Council of the Netherlands. Endotoxins : health-based recommended occupational exposure limit. The Hague: Health Council of the Netherlands, 1998: 1998/03WGD.

13 Health Council of the Netherlands. Endotoxins: Health based recommended occupational exposure limit. The Hague: Health Council of the Netherlands, 2010: 2010/04OSH.

P.O. Box 16052
NL-2500 BB The Hague
Telephone +31 (70) 340 70 17
E-mail: a.vander.burght@gr.nl
www.healthcouncil.nl

Visiting Address
Parnassusplein 5
NL-2511 VX The Hague
The Netherlands

14 Dutch expert committee for occupational standards. Health-based recommended occupational exposure limits for aflatoxin. Directorate-General of Labour of the Ministry of Social Affairs and Employment, the Netherlands; 1987: RA 6/87.

15 Eduard W. The Nordic Expert Group for Criteria Documentation of Health Risks from Chemicals : 139. Fungal Spores. Arbetslivsinstitutet; 2006: Arbete och Hälsa 2006:21. Internet: http://www.inchem.org/documents/kemi/kemi/ah2006_21.pdf.

16 Eduard W. Fungal spores: a critical review of the toxicological and epidemiological evidence as a basis for occupational exposure limit setting. Crit Rev Toxicol 2009; 39(10): 799-864.

17 Health Council of the Netherlands. Toxicologische advieswaarden voor blootstelling aan stoffen. Rijswijk: 1996: 1996/12.

18 Health Council of the Netherlands. Toxicity testing: a more efficient approach. The Hague: Health Council of the Netherlands, 2001; publication no. 2001/24E.

19 Health Council of the Netherlands. Leidraad berekening risicogetallen voor carcinogene stoffen. Den Haag: 2012: 2012/16.

20 Health Council of the Netherlands. Guidline to the classification of carcinogenic compounds. The Hague: Health Council of the Netherlands, 2010; publication no. A10/07E.

21 Health Council of the Netherlands. Prevention of work-related airway allergies. Recommended occupational exposure limits and periodic screening. The Hague: Health Council of the Netherlands, 2008; publication no. 2008/03E.. Internet: ttp://www.gezondheidsraad.nl/sites/default/files/200803.pdf.

22 Heederik D, Meijer E, Doekes G. Beroepsgebonden allergische luchtwegaandoeningen. Literatuurstudie in opdracht van het Ministerie van Sociale Zaken en Werkgelegenheid. 1999.

23 Heimeriks CT, Loo MAJM, Jacobi AJ. Infectieziektebestrijding en werknemersgezondheid - Rapportage 2010-2011. Bilthoven: RIVM; 2011: Rapport 205014010.

24 Beroepsziekten in cijfers 2012. Amsterdam: NCVB/AMC/UVA; 2012. 25 Heimeriks CT, Loo MAJM, Jacobi AJ. Surveillance Arbeidsgerelateerde Infectieziekten – Analyse arbeidsgerelateerde infectieziekten 2010. Bilthoven: RIVM; 2011: Rapport 205014009.

26 Heimeriks CT. Surveillance Arbeidsgerelateerde Infectieziekten: Analyse 2011. Bilthoven: RIVM; 2012: Briefrapport 205555002/2012.

27 ACGIH. Guidelines for the assessment of bioaerosols in the indoor environment. Cincinnati, OH: American Conference of Governmental Industrial Hygienists; 1989.

28 ACGIH. Bioaerosols: Assessment and Control. In: Macher J, editor. Cincinnati, OH: American Conference of Governmental Industrial Hygienists; 1999.

P.O. Box 16052
NL-2500 BB The Hague
Telephone +31 (70) 340 70 17
E-mail: a.vander.burght@gr.nl
www.healthcouncil.nl

Visiting Address
Parnassusplein 5
NL-2511 VX The Hague
The Netherlands

29 Buchanan RL, Havelaar AH, Smith MA, Whiting RC, Julien E. The Key Events Dose-Response Framework: its potential for application to foodborne pathogenic microorganisms. Crit Rev Food Sci Nutr 2009; 49(8): 718-728.

30 Fryer HR, McLean AR. There is no safe dose of prions. PLoS One 2011; 6(8): e23664.

31 FAO-WHO. Microbiological Risk Assessment Series 3: Hazard Characterization for Pathogens in Food and Water - Guidelines. Geneva: World Health Organization; 2003.

32 Swart AN, Tomasi M, Kretzschmar M, Havelaar AH, Diekmann O. The protective effects of temporary immunity under imposed infection pressure. Epidemics 2012; 4(1): 43-47.

33 Gilbert MJ, Bos ME, Duim B, Urlings BA, Heres L, Wagenaar JA e.a. Livestock-associated MRSA ST398 carriage in pig slaughterhouse workers related to quantitative environmental exposure. Occup Environ Med 2012; 69(7): 472-478.

34 Whitney EA, Massung RF, Candee AJ, Ailes EC, Myers LM, Patterson NE e.a. Seroepidemiologic and occupational risk survey for Coxiella burnetii antibodies among US veterinarians. Clin Infect Dis 2009; 48(5): 550-557.

35 de Rooij MM, Schimmer B, Versteeg B, Schneeberger P, Berends BR, Heederik D e.a. Risk factors of Coxiella burnetii (Q fever) seropositivity in veterinary medicine students. PLoS One 2012; 7(2): e32108.

36 Health Council of the Netherlands. Prudent precaution. The Hague: Health Council of the Netherlands, 2008; publication no. 2008/18E. Internet: http://www.gezondheidsraad.nl/sites/default/files/200818E_0.pdf.

37 Stinis HPJ. Zwangerschap, infectieziekten en werk. Tijdschr Bedrijfs Verzekeringsgeneeskd 2006; 14(9): 401-6.

38 Werkgroep Infectiepreventie. Ziekenhuizen: MRSA, ziekenhuis. Leiden: Werkgroep Infectie Preventie; 2007. Internet: http://www.wip.nl/.

39 Brekelmans F, Tissing H, Zeeman S. Onderzoek Richtlijnen Werkgroep Infectie Preventie en Arbeidsomstandigheden, Eindrapport. Amersfoort, Bureau Bartels B.V., FB Advies. 20 juni 2012.

P.O. Box 16052
NL-2500 BB The Hague
Telephone +31 (70) 340 70 17
E-mail: a.vander.burght@gr.nl
www.healthcouncil.nl

Visiting Address
Parnassusplein 5
NL-2511 VX The Hague
The Netherlands

Annex **A**

Request for advice

In a letter dated 10 July 2007, reference number ARBO/A&V/2007/22676, the Minister of Social Affairs and Employment wrote to the President of the Health Council of the Netherlands:

On 26 September 2006, during deliberation in the Dutch House of Representatives of a bill to modify the Working Conditions Act, a motion by House members Koopmans and Stuurman was adoptedl.* This motion requests the government to promptly set up a work programme yielding health-based and safety-based occupational exposure limits (regulations comprising concrete figures), to which end advice is to be requested of the government's social partners.

In the debate in the Dutch House of Representatives the former State Secretary for Social Affairs and Employment indicated, in reference to this motion, that it was not the government's intention to include an unbridled number of scientific occupational exposure limits for every conceivable work risk in the Working Conditions Act. This would undermine the essential nature of the Act and run counter to the government's active policy of stimulating customisation in enterprises and sectors, reducing regulatory overhead, and slimming down Dutch supplements to European legislation on working conditions. During the debate the motion's proposers confirmed that it was not their intention that the motion lead to an unbridled number of new concrete regulations in the legislation and regulation, but that the motion would help to support, facilitate and curtail that which the government specified in a working programme.

* Kamerstuk 2005/06, 30 552, no. 27.

In a letter of 18 January 2007 to the Dutch House of Representatives* on the status of the Working Conditions Act, a proposal was made for the further elaboration of the motion. During its General Consultations of 7 February 2007 the Dutch House of Representatives made no remarks on this elaboration, but it did indicate that it wished to be informed on the different phases sketched therein:

- a committee shall be established within an independent scientific institute, which can survey the scientific domain of working conditions;
- this committee shall provide periodic reports of any new (international) scientific insights into concrete health-based or safety-based occupational exposure limits;
- on the basis of the results of these reports the Ministry of Social Affairs and Employment can initiate, where appropriate, further scientific research into health-based and / or safety-based occupational exposure limits;
- the Ministry of Social Affairs and Employment will then assess the need for and desirability of including an occupational exposure limit (as a concrete regulatory paragraph) in the Working Conditions Act and associated regulations. The department will hereby observe the provisions given in the Explanatory Memorandum on the Working Conditions Act, which stipulate that scientific occupational exposure limits will be included in the legislation and regulation if these are generally recognised, have broad social support, and are generally applicable;
- the Ministry of Social Affairs and Employment will then present its opinion on the inclusion or otherwise of a occupational exposure limit in the Working Conditions Act and associated regulations to the Social and Economic Council of the Netherlands (SER) for advice;
- on the basis of the advice put forward by the SER, a decision will be taken on whether to actually adopt the occupational exposure limit in the Working Conditions Act and its associated regulations.

In accordance with the stipulations of the motion, consultations have been held with the government's social partners. It is important that the evaluation of the revision of the Working Conditions Act can be sent to the Dutch House of Representatives within five years of the coming into force of the amendment of the law – that is to say, before 1 January 2012. This evaluation must comprise a report on the practical effects and efficacy of the Working Conditions Act.

On 21 February 2007 we consulted on the possibility of the Health Council establishing a committee comprising experts on working conditions, health, safety, and occupational disease, and the Health Council indicated its willingness to establish such a committee. I therefore request that you establish a committee for the purposes of surveying the scientific domain of working conditions and examining the following subjects:

* Kamerstuk 2006-2007, 25 883, no. 100.

1. periodic reports on whether at this moment new (international) scientific insights exist with regard to concrete health-based and / or safety-based occupational exposure limits;
2. periodic reports on whether in due course new (international) scientific insights may be expected with regard to concrete health-based and / or safety-based occupational exposure limits.

The focus shall be on the first part, periodic reports of current new (international) scientific insights into concrete health-based and / or safety-based occupational exposure limits. In the first instance, these reports will be based on those working condition risks included in the Working Conditions Act and its associated regulations. Other risks may be taken into consideration at a later date.

Please initiate the establishment of the committee and a Plan of Approach for the period 2007 to 2012, which should include reference to all the subjects mentioned above and comprise a budget. I should like to receive the Plan of Approach before next 1 September. The Health Council's Plan of Approach requires the approval of the Ministry of Social Affairs and Employment.

With regard to the periodicity of reporting, I would consider it important to publish an annual report. With this in mind I look forward to receiving the first of these annual reports before the end of 2007.

Yours sincerely,

The Minister of Social Affairs and Employment,
(signed)
J.P.H. Donner

Annex **B**

The Committee

- Professor T. Smid, *chairman*
  Endowed Professor of Working Conditions, VU Medical Center, Amsterdam and advisor working conditions, KLM Health Services, Schiphol-East
- Professor A.J. van der Beek
  Professor of Epidemiology of Work and Health, EMGO Institute, VU Medical Center, Amsterdam
- Professor A. Burdorf
  Professor of Occupational Epidemiology, Erasmus Medical Center, Rotterdam
- Professor M.H.W. Frings-Dresen
  Professor of Occupational Health, Coronel Institute for Work and Health, Academic Medical Center, Amsterdam
- Professor D.J.J. Heederik
  Professor of Health Risk Analysis, Institute for Risk Assessment Sciences, Utrecht
- Professor J.J.L. van der Klink
  Professor of Social Medicine, Work and Health, University Medical Center, Groningen
- Dr. T. Spee
  Occupational Hygiene policy advisor, the Arbouw Foundation, Amsterdam
- J. van der Wal
  HSE-manager, NAM, Assen
- H.J. van der Brugge, *observer*
  Ministry of Social Affairs and Employment, Den Haag

- Dr. P.C. Noordam, *observer*
  senior advisor, Labour inspectorate, Den Haag
- Dr. A.S.A.M. van der Burght, *scientific secretary*
  Health Council, Den Haag

The Committee has consulted the following additional expert:
- Professor ir. A.H. Havelaar
  Professor of Microbial Risk Assessment, Institute for Risk Assessment Sciences, Utrecht

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 chairperson 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 inaugural meeting the declarations issued are discussed, so that all members of the Committee are aware of each other's possible interests.