# Executive summary

Health Council of the Netherlands. Asbestos: Risks of environmental and occupational exposure. The Hague: Health Council of the Netherlands, 2010; publication no. 2010/10.

## Background

Exposure to asbestos can cause cancer in various organs. The conditions most commonly associated with asbestos exposure are cancer of the pleura and peritoneum (known as mesothelioma) and lung cancer. Because these types of cancer often do not develop until years after exposure, environmental and occupational exposure to asbestos in the past continues to cause mortality.

In the Netherlands about eight million tons of asbestos-containing products were produced and consumed, in the previous century – much in the form of asbestos-cement products for use in the building industry, but also in a wide variety of other applications. Two main forms of asbestos are distinguished: serpentine asbestos (also known as chrysotile or white asbestos) and amphibole asbestos (which includes crocidolite, or blue asbestos, and amosite, or brown asbestos). Chrysotile asbestos accounts for more than 90 per cent of asbestos applications. The two most widely used types of amphibole asbestos are amosite and crocidolite.

Although the use of asbestos was prohibited in 1993, people are still being exposed, because asbestos used in the past is still present in many settings. Occupational exposure can still occur when homes and other buildings are demolished, when soil purification activities are undertaken, and when ships, drilling

platforms and other machines with asbestos insulation are repaired. Incidental exposure may take place in the context of building renovations and if asbestos is present in the environment.

## Ministerial request for advice

In an advisory letter on asbestos submitted in 2006, the Health Council pointed out that new knowledge was available, which might justify revision of the standards governing exposure to airborne asbestos. The State Secretary for Housing, Spatial Planning and Environmental Management at that time accordingly asked the Council to calculate the asbestos concentrations consistent with the risk levels defined in the context of Dutch environmental policy: the maximum permissible risk level (*maximaal toelaatbaar risiconiveau*, *MTR*) and the negligible risk level (*verwaarloosbaar risiconiveau*, *VR*). The State Secretary for Social Affairs and Employment additionally asked the Health Council to consider whether new occupational exposure limits for asbestos were necessary and, if so, to specify the concentrations corresponding to the risk levels defined by the government.

### The risk analyses underpinning existing policy

The concentrations corresponding to a given risk level* are calculated by means of risk analysis. Such analysis is based on data concerning groups of people who experienced occupational exposure in the last century. On the basis of the observed associations between asbestos exposure and lung cancer or mesothelioma incidence, so-called $K_L$ values (for lung cancer) and $K_M$ values (for mesothelioma) are calculated. These values are expressions of the increase in risk per unit of exposure.

The existing policy is based on reports published by the WHO and the RIVM in 1987. Those reports share two characteristics that are important in this context. First, the various calculations used the average of the $K_L$ and $K_M$ values from the individual studies. In other words, no clearly defined allowance was made for the methodological quality of the studies in question. Second, both advisory bodies chose to make recommendations for various concentration intervals, partly because of the uncertainties that existed. However, it was not made clear how the intervals related to the corresponding calculations.

* A risk level is an expression of the likelihood of dying of cancer as a result of exposure to a particular carcinogen (in this case, asbestos).

## The Committee's risk analysis

In this report, the Committee presents detailed arguments for concluding that not all studies are equally suitable as sources of risk analysis data. In many cases, for example, the way the exposure is characterised introduces substantial measurement error. The quality of the available epidemiological data can vary considerably in other respects as well. The Committee therefore considered it essential that meta-analyses are performed for both lung cancer and mesothelioma, using only data from studies selected on the basis of predefined criteria. In this way the best possible point-estimate is obtained, and although the uncertainties are not eliminated, they are reduced as much as possible.

### Lung cancer

For the *lung cancer* meta-analysis, the Committee made a selection from eighteen available cohort studies. On the basis of the Committee's selection criteria, four studies were considered suitable for inclusion. The $K_L$ values calculated using the data from these studies did not differ with the type of asbestos (chrysotile or amphibole). The weighted average of the $K_L$ values (resulting in a so-called pooled $K_L$ value) from the four selected studies has been used as the basis for defining the ultimate values for lung cancer, as associated with all types of asbestos.

### Mesothelioma

Where *mesothelioma* is concerned, clear differences in carcinogenic potential were discernible between chrysotile asbestos and the amphiboles. Separate $K_M$ values were therefore calculated for these two general forms of asbestos. For its *mesothelioma* meta-analysis, the Committee made a selection from twelve available cohort studies. Application of the Committee's selection criteria led to just two of these cohort studies being deemed suitable for inclusion: one concerned exclusively with exposure to chrysotile asbestos and one concerned with exposure to a mixture of amosite and chrysotile asbestos, in which the latter was predominant. The Committee used the $K_M$ values from these studies to calculate a single value for chrysotile asbestos and a single value for exposure to a mixture of chrysotile asbestos and up to 20 per cent amphibole asbestos. However, in the Netherlands, various situations may occur that could result in exposure to amphibole asbestos on its own. The Committee has therefore calculated a $K_M$ value for amphibole asbestos from the two available studies that looked exclusively at

amphiboles, even though the studies in question did not satisfy the criteria for inclusion in the meta-analysis. The $K_M$ values used by the Committee indicate that the carcinogenic potential of amphiboles is fifty times as great as that of chrysotile asbestos.

## Risk analyses for environmental policy

The following table summarizes the conclusions of the Committee's risk analyses for exposure to asbestos in the environment. Distinction has been made according to the type of fibre to which a person is exposed, and the concentration that corresponds to the risk levels defined by the government is stated in each case. The existing values are also presented for comparison.

Proposed new *MTR* and *VR* values and the existing values for asbestos by type. The values are for lifetime exposure from the general environment, expressed in fibres/m$^3$ as measured using TEM (Transmission Electron Microscopy). The proposed values are for the two health effects (mesothelioma and lung cancer) combined. The existing MTR and VR values are for mesothelioma only.

| | Proposed new MTR and VR values | | | Existing MTR and VR values | |
|---|---|---|---|---|---|
| | Chrysotile in fibres per m$^3$ | Mixed exposure to chrysotile and up to 20% amphibole in fibres per m$^3$ | 100% amphibole in fibres per m$^3$ | Chrysotile in fibres per m$^3$ | Amphibole in fibres per m$^3$ |
| MTR | 2,800 | 1,300 | 300 | 100,000 | 10,000 |
| VR | 28 | 13 | 3 | 1,000 | 100 |

The Maximum Permissible Risk (MTR) values calculated by the Committee for chrysotile asbestos are about forty times lower than the existing MTR values; the Committee's MTR values for amphibole asbestos are roughly thirty times lower. The discrepancies are attributable not so much to higher $K_L$ and $K_M$ values – where the divergence is relatively small – but mainly to methodological differences. Two such differences are of particular significance. First, as indicated above, the current policy is based upon concentration intervals, as opposed to estimates for specific concentrations, which the Committee prefers to work with. Second, the existing MTR and VR values have been assigned to the upper confidence interval of the calculated concentration; this has a particularly pronounced effect.

On the other hand, the existing environmental quality objective is derived from the VR value, whereas, where other substances are concerned, the limit is derived from the MTR value. Consequently, although the existing MTR value for environmental exposure is considerably higher than the Committee's value, the fact that the existing environmental quality objective for asbestos is based upon

the VR value instead of the MTR value means that it is a hundred times lower than the limit proposed by the Committee.

### *Risk analyses for occupational safety policy*

The proposed occupational exposure limits for chrysotile, for a mixture of chrysotile and up to 20% amphibole asbestos, and for amphibole asbestos on its own are presented in the table below.

Exposure levels by asbestos type for mesothelioma and lung cancer combined, corresponding to risk levels of $4.10^{-3}$ and $4.10^{-5}$. The values are for occupational exposure (eight hours per day, five days per week, for a period of forty years) and are expressed in fibres per $m^3$ (with fibres/ml between brackets), as measured by TEM.

| Risk level | Occupational exposure levels (as measured by TEM) corresponding to the risk level | | |
|---|---|---|---|
| | Chrysotile in fibres per $m^3$ (fibres/ml) | Mixed exposure to up to 20% amphibole in fibres per $m^3$ (fibres/ml) | 100% amphibole in fibres per $m^3$ (fibres/ml) |
| $4.10^{-3}$ | 200,000 (0.2) | 130,000 (0.13) | 42,000 (0.042) |
| $4.10^{-5}$ | 2,000 (0.002) | 1,300 (0.0013) | 420 (0.00042) |

The existing occupational exposure limit is expressed in the form of values as measured by PCM: 10,000 fibres/$m^3$ or 0.01 fibres/ml; these figures equate to TEM values of 20,000 fibres/$m^3$ or 0.02 fibres/ml.

NB: the existing Dutch occupational exposure limit is not based on a calculated concentration corresponding to a given risk level.

The existing Dutch occupational exposure limit is 0.01 fibres/ml, as measured by phase contrast microscopy (which equates to a TEM value of 0.02 fibres/ml); this limit applies to all types of asbestos. The existing Dutch occupational exposure limit is not based on a calculated concentration corresponding to a given risk level, but is derived from (and ten times lower than) the current EU standard for chrysotile. The latter standard is based partly on the detection threshold for phase contrast microscopy. The concentrations calculated by the Committee to correspond to a risk level of $4.10^{-5}$ are substantially lower than the existing Dutch occupational exposure limits.