Special Report

Chrysotile:

Among The Least Hazardous Industrial Fibres

The Asbestos Institute

CHRYSOTILE: AMONG THE LEAST HAZARDOUS INDUSTRIAL FIBRES

Health risk related to the use of industrial fibrous materials, in particular asbestos and man-made mineral fibres (MMMF), has been a continuous concern among scientists, workers and regulatory authorities. Over the last four decades, asbestos has received particular attention, and much is now known about exposure-effect relationships, especially with respect to differences in health effects among the different types of commercial asbestos fibres. It was confirmed repeatedly that **chrysotile** asbestos is much less hazardous to human health than the **amphibole** asbestos fibre types (such as crocidolite and amosite). Unfortunately, this fact is frequently ignored and contributed to a misperception about the safe level which can be achieved by using chrysotile properly.

Progress made during the last 15 years on asbestos and other fibres has confirmed that, added to the dose factor, certain dimensions (fibre length and diameter) are prerequisites for biological potency, since these two parameters are related to respirability. Still more recently, new evidence has come from the use of more modern investigative techniques, in particular mineral analyses performed on lung tissues, also known as "lung burden" studies. As a result, an additional parameter of fibrous materials is now universally recognized as of paramount importance for pathogenic potential of inhaled particles: **durability**.

DURABILITY

The longer the biopersistence, the greater the risk for adverse health effects to become manifest. Conversely, inhaled particles characterized by short biopersistence are cleared much faster, thus reducing the risk that they can eventually induce damaging and permanent effects.

"Durability" is this characteristic that varies widely among different respirable particles, and which is likely related to chemical composition and structure. Durability will determine the extent of a key biological phenomenon known as **biopersistence**, which is the length of time for inhaled particles to persist in the lung and adversely affect surrounding tissues before they are eventually dissolved and/or cleared.

Biopersistence studies have been carried out on a number of different respirable particles, and it has now become clear that there are vast differences among various respirable particles presently used by industry. In fact, there seems to be a continuum of values for biopersistence of mineral particles, from very short persistence (low durability) to practically indefinite persistence (very high durability).

In the 1990's, it was confirmed by numerous scientists in several studies that respirable fibres have different biopersistence characteristics, which may vary according to their respective manufacturing process and chemical composition[1]. Current international efforts in developing standardized methodology for durability and biopersistence assessment of all industrial fibres are certainly opportune, as this parameter now appears to be an **important element for carcinogenic risk evaluation** and eventually occupational standards setting policy. Indeed, the 2001 *IARC Monographs Programme* to re-evaluate carcinogenic risks from airborne man-made vitreous fibres reinforces the concept that "**high biopersistence** of inhaled fibrous materials is correlated with **high carcinogenicity**". The Monographs Working Group concluded that only the more biopersistent materials remain classified by IARC as possible human carcinogens. As a matter of fact, the labelling regulation in the European Union states that respirable particles with very short biopersistence can be exempted from the "carcinogen" label.

1 See for instance: Wagner, JC and Pooley, FD (1986) Thorax **41:** 161-166; Wagner JC et al (1988) Br. J. Ind. Med. **45:** 305-308; Albin et al (1994) Occup Environ Med **51:** 205-211; Cullen et al. (2002) Inhalation Toxicology **14:** 685-703.

2 Bernstein et al.(1999) 7th Int. Symp.Part.Toxicol., Maastricht; Bernstein (2000) The Toxicologist Vol. 54, p. 318.

3 Muhle & Bellman (1997) Ann. Occup. Hyg. **41:** 184-188.

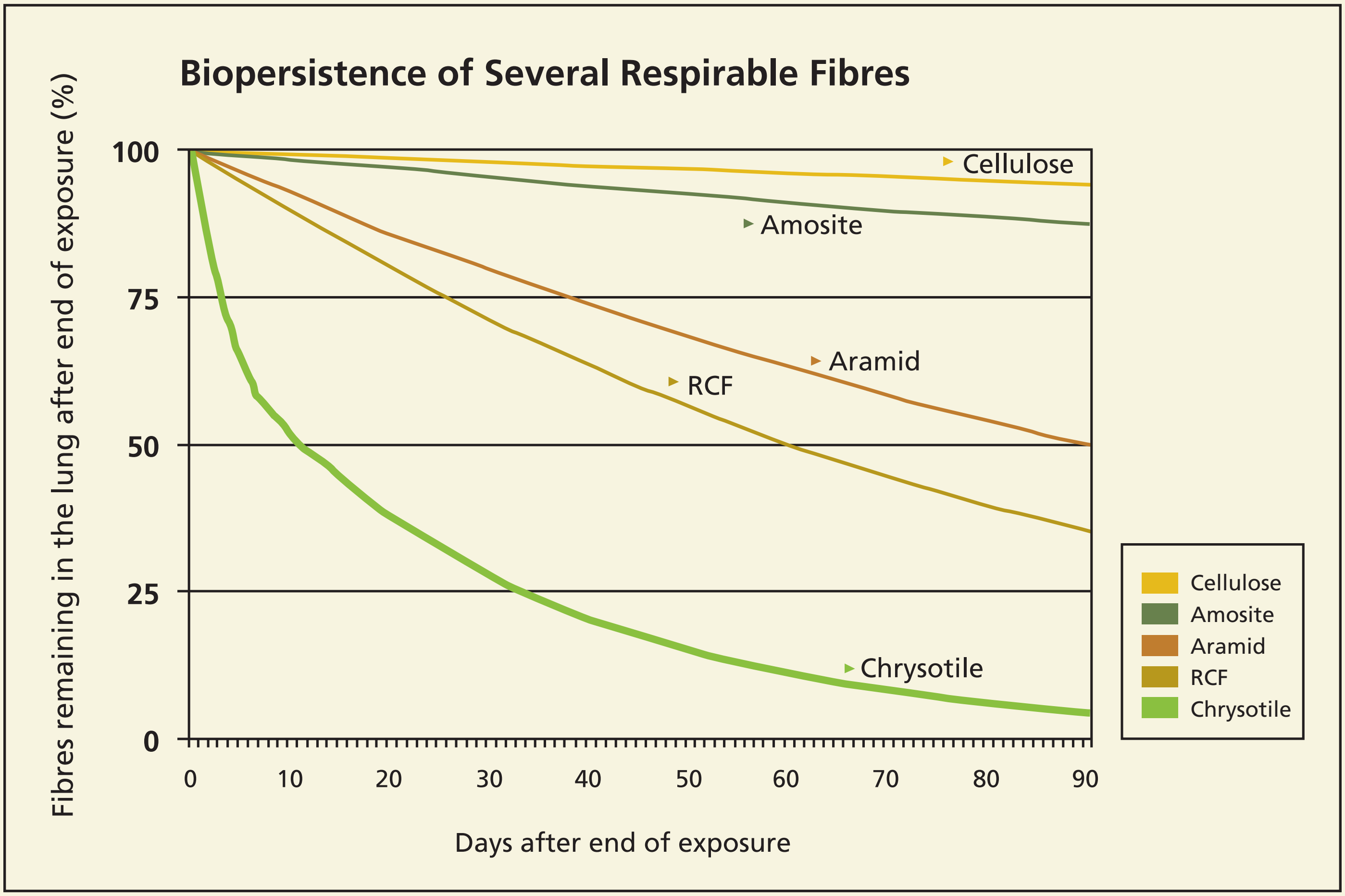
4 Bellman et al, (2000) Toxicol. Sci. S. 237-250; Franhofer Institute (1998) Report, Hannover, August 1998.

The use of substitute fibres to asbestos is relatively recent, no epidemiology studies can presently evaluate their human health effects. With the negative publicity arising with the past uses of asbestos fibres, these new fibres were developed to take over a growing market, and encouraged by political stance of certain governments supporting their use. Many scientists have raised serious concerns about possible health effects of these new fibrous materials and especially about the fact that the reliable scientific information is very meagre. However, it is clear now that "biopersistence" is a key parameter to take into account when comparing the toxicity of respirable fibres.

Results of the ongoing study by three laboratories in Switzerland, Germany and in the U.S.A. demonstrates that the **half-time clearance** for Canadian commercial chrysotile, i.e. the number of days necessary to eliminate half of the fibres remaining in the lungs after end of exposure, is about **15 days**. This number is in accordance with other data published recently about chrysotile[2], and in line with epidemiology studies confirming that amphiboles are more fibrogenic and carcinogenic than chrysotile (**amosite** asbestos has a half-time clearance of ~ **466 days** [2]).

How does chrysotile compare with the most commonly used replacement fibres? Less durable, according to recent research using the same methodology. For instance, **ceramic fibre** (RCF 1) have a half-time clearance of **60 days**[3], **aramid** fibre around **90 days**[4] and **cellulose** fibre over **1000 days**[3].

Is this new information in accordance with the much larger number of asbestos related diseases we can observe among workers than with other fibres?
In fact, it is. **First**, people who were diagnosed with asbestos-related diseases were exposed to the more biopersistent amphibole types or a mixture of chrysotile and amphiboles. **Second**, chrysotile has been used for more than a century, often at high exposure levels before the 1960's, while alternative fibres are of recent use. **Third**, with today's working conditions using exclusively chrysotile fibres in high-density materials, pulmonary diseases linked to fibre exposure will be eliminated. Careful consideration of all the facts yields one and only one conclusion: **controlled-use is the regulatory policy of choice instead of a comprehensive product ban, not only for chrysotile, but also for other natural and man-made fibres.**



The Asbestos Institute

is a private organization established in 1984 by the Canadian companies producing chrysotile asbestos, trade unions, and the Canadian and Quebec governments. The Institute is dedicated to promoting the safe use of chrysotile asbestos in Canada and throughout the world.

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