Safety in the Use of Chrysotile

Requirements and Achievements

CHRYSOTILE
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SAFETY IN THE USE OF CHRYSOTILE

Introduction

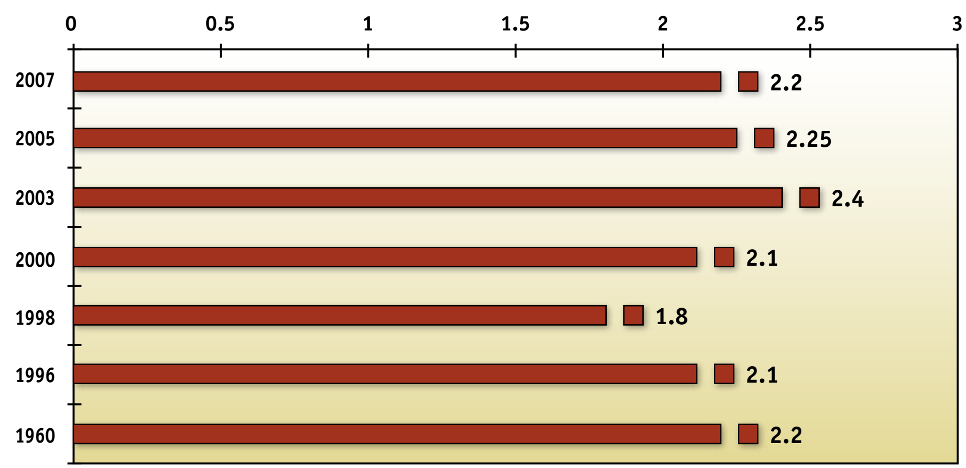
Asbestos fibres in the general environmental air have been present long before man's exploitation of the mineral. This phenomenon is due to the natural erosion from geological formations quite common throughout the world, and the total amount of asbestos emitted from natural sources is much greater than that emitted from industrial sources. In general, the ambient air concentrations rarely exceed 0.001 f/cc. At these low levels, the risk is undetectably low, indeed very much lower than other risks, such as natural background radiation. Such a low risk has been labelled: "acceptable" by the WHO, or "not significant" by the Ontario Royal Commission on Asbestos, or "...further control not justified" by the Royal Society, London. The health risk is thus associated with workplace conditions.

In the twentieth century, the commercial use of asbestos has developed into a large variety of applications such as: for insulation materials of all kinds; fibro-cement building products in the form of sheets, roofing shingles; fibro-cement piping to convey potable water and for evacuation of sewage; friction materials in the automotive industry, etc. The use of asbestos has grown in importance during the twentieth century. Up until the 1990s, three types of asbestos were mined and used to suit a variety of situations: chrysotile, crocidolite and amosite. The uncontrolled use of years past has led to a legacy of diseases among workers. Science has since established that among the three asbestos fibre types, the amphiboles (crocidolite and amosite) were particularly potent for inducing disease even at low exposure, whereas the chrysotile variety can be controlled at low exposure levels without measurable excess risk. Today, amphiboles are no longer mined and are banned in most countries.

For the last fifty years, world production from various sources has been fairly constant. Today, chrysotile is the only fibre type mined, and production is still maintained at around 2 million metric tons annually.

Trends in World Production

(Million Metric Tons)

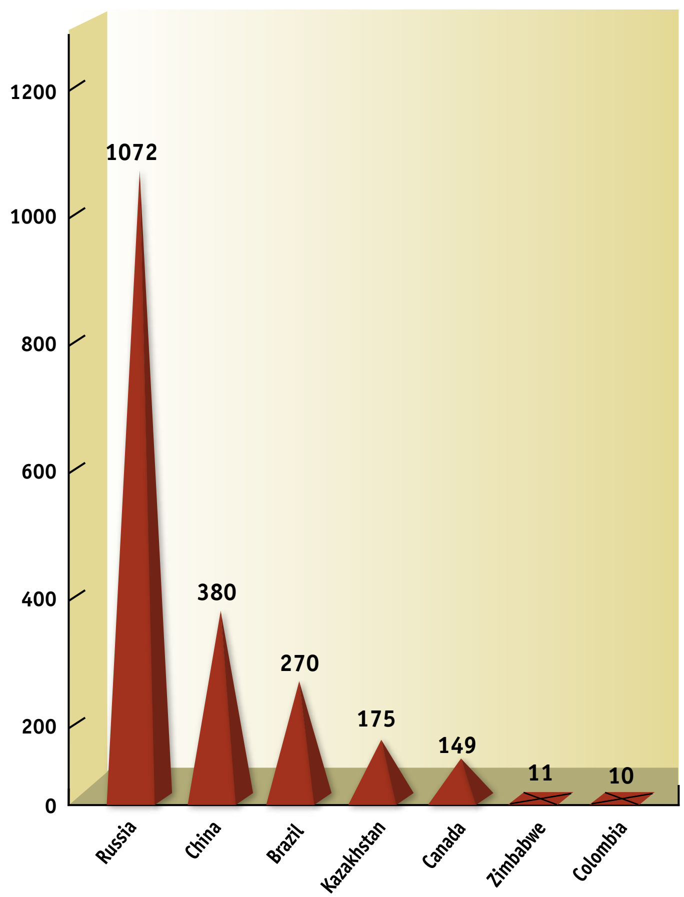


World markets have migrated over the last 30 to 40 years from countries where the need for infrastructures have gradually decreased (USA and Western Europe), to developing countries where such infrastructures were severely lacking. As a result, Russia, China, Brazil, and Kazakhstan, being closer to these markets, are accounting now for more than 80% of world production.

SAFETY IN THE USE OF CHRYSOTILE

Main Producing Countries of Chrysotile

(2008: Thousand Metric Tons)



The Emergence of Substitutes

Over the last few decades, non-asbestos fibrous materials, both man-made and extracted from natural deposits, have been proposed and are presently used as substitutes for chrysotile. In industrialized countries, they can be found in many areas of applications of asbestos. There are wide variations in competitiveness according to price, availability, technical performance, ease of handling and mixing, compatibility with other materials in composites, durability, etc.

Compared with chrysotile, evidence of biological activity of non-asbestos fibrous materials has been reported only recently. Except for a very limited number of materials (example: mineral wools), epidemiological scrutiny has yet to be undertaken in order to substantiate possible human health hazards. On the other hand, recently published results from cell, tissue and animal experimentation indicate that most fibrous materials of respirable size reviewed display some degree of biological activity. These results suggest that their widespread production and use should be governed by appropriate monitoring and control of dust exposure, especially so for materials which are long and thin, and which display long “in vivo” durability (biopersistence). Thus, the present document on safety in the use of chrysotile should apply to all fibrous substitutes as well.

The Concept of Controlled Use

In the area of occupational health, and specifically regarding the use of chrysotile, regulatory agencies in all countries have the responsibility to set workplace exposure limits that will reduce the risk to workers to the lowest possible level. That this exercise should be based on the most recent scientific assessment available would seem obvious.

Indeed, the latest scientific evidence published strongly supports the following views:

1- **Chrysotile is significantly less hazardous than the amphibole forms of asbestos (e.g. crocidolite and amosite);**

2- **When properly controlled and used, chrysotile in its modern day high-density applications does not present risks of any significance to public and/or worker health;**

With regard to the first point, a number of recently published studies have indicated some of the reasons why chrysotile is so different from the amphibole varieties of asbestos, in particular the very low resistance of inhaled chrysotile fibres when they meet the acid environment in the lungs, and thus, their very low biopersistence and rapid clearance from the lungs. In contrast, the amphiboles are highly resistant to an acid environment and display very long biopersistence.

With regard to the second point, i.e., the concept of controlled-use and safety in the use of chrysotile, this document describes first **what exactly is involved in the concept of controlled use.**

This document also illustrates with a number of scientific investigations from different situations in different parts of the world showing that the concept and the application of « Safety in the Use of Chrysotile » is indeed working, and that workers' health and that of the general population are not at unacceptable risk, while providing cost-effective and safe applications to Society.

REQUIREMENTS AND ACHIEVEMENTS

TWO SCIENTIFICALLY-BASED PREMISES

- **Chrysotile is significantly less hazardous than the amphiboles.**
- **Properly controlled, chrysotile presents no detectable health risk to the workers and the general public.**

What is involved in the concept of Controlled Use

CONTROLLED USE IS BASED ON SCIENTIFIC EVIDENCE. IT INVOLVES:

CONTROLLED USE

REGULATION & ENFORCEMENT + **IMPLEMENTATION**

- MONITORING
- ENGINEERING DUST CONTROLS
- MEDICAL SURVEILLANCE
- TRAINING AND INFORMATION

CONTROLLED USE

REGULATION AND ENFORCEMENT

A **GOVERNMENT RESPONSIBILITY**
THROUGH A
« COMPETENT AUTHORITY »

The Competent Authority:

- Sets exposure limits
- Determines measurements methods
- Receives and keeps records of all activities
- Has the power to stop operations
- Maintains constant dialogue with employers and workers.

Regulation and Enforcement

The establishment of regulations and their enforcement appears clearly as a government responsibility. A Competent Authority (CA) mandated by the government must be identified and given the power to set the necessary measures for the safety of workers. This CA will request from the employers a declaration of the various operations at each work site, namely:

- The nature of the work
- The location of the work site(s)
- The types and quantities of asbestos products manufactured
- The number of employees
- The duration of the work and the protective measures in place

This CA should also be responsible for:

- **The establishment of exposure limits**
- **The establishment of measurement methods**
- **The collection and record-keeping of the measurement results**

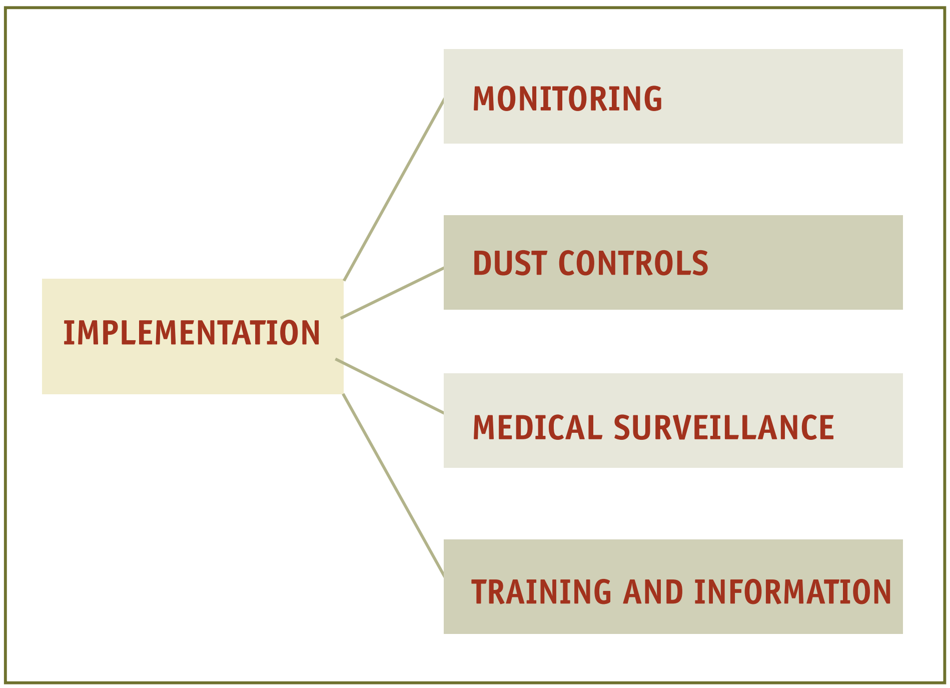
With regard to enforcement of the regulations, the CA should assist the employers when exposure limits are exceeded to rapidly correct the situation to ensure compliance with exposure limits.

The CA should have the power to stop the operations until safe conditions are re-established.

Thus, enforcement of regulations and compliance with exposure limits require a constant dialogue and interaction between the CA, the employers, the workers and the labor unions in order to ensure that controlled use guaranties safety in the use of asbestos, including chrysotile.

CONTROLLED USE

IMPLEMENTATION



Monitoring

Monitoring must be carried out by well trained industrial hygienists, using recognized methods of sampling and counting.

Ideally, monitoring of the workplace should be done by a team of hygienists comprising representatives from both the employers and the workers.

Measurements should be done on a regular basis, and the results should be reported to both the employers and the workers, as well as to the CA. This would ensure that corrective actions are taken when needed.

Dust Control

Adequate and efficient dust controls (ventilation; use of wet methods, etc.) should be installed at all sensitive working stations.

Proper functioning of dust controls should be constantly monitored.

Medical Surveillance

Medical surveillance (MS) is an obvious necessity. It should be a permanent and well-organized activity. MS activities should include:

- Periodic medical examination of the workers, before, during and after cessation of employment;
- Such medical examinations should be established according to internationally recognized protocols (X-rays, lung function test, etc.);
- Workers must be informed of the results of the medical examinations;
- Records of individual workers examinations should be kept by the occupational physician.

Training and Information

Training:

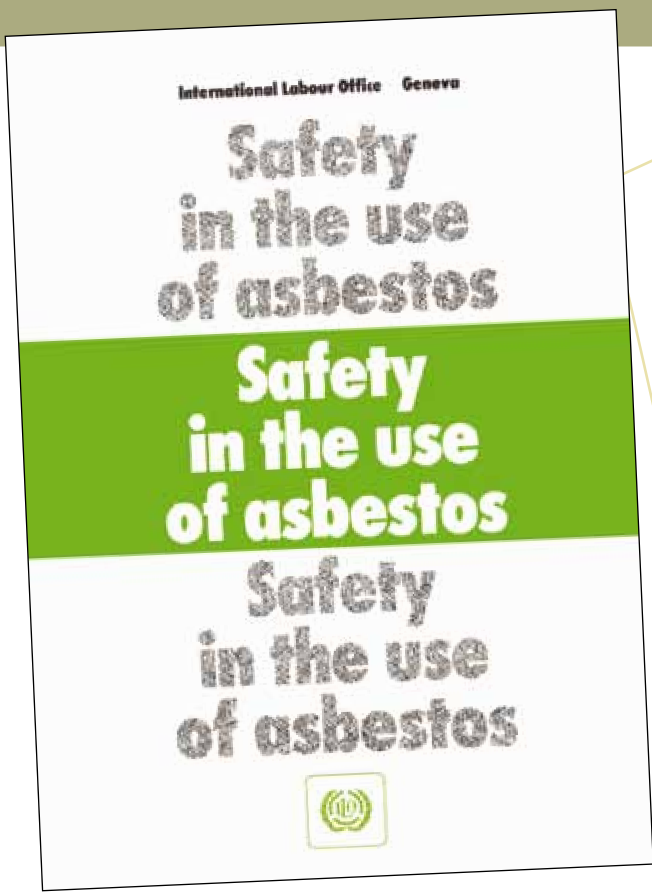
Every worker should receive adequate instructions on the safe handling and work practices in the plant and for on-site installations.

Information:

All starting materials and finished products must be clearly labelled with adequate warning signs. Instructions related to the proper handling of the starting materials and the finished products should be easily accessible (example: the warning labels on chrysotile bags).

CONTROLLED USE

PUBLICATIONS



The essential elements are detailed in the ILO publication:

« SAFETY IN THE USE OF ASBESTOS »

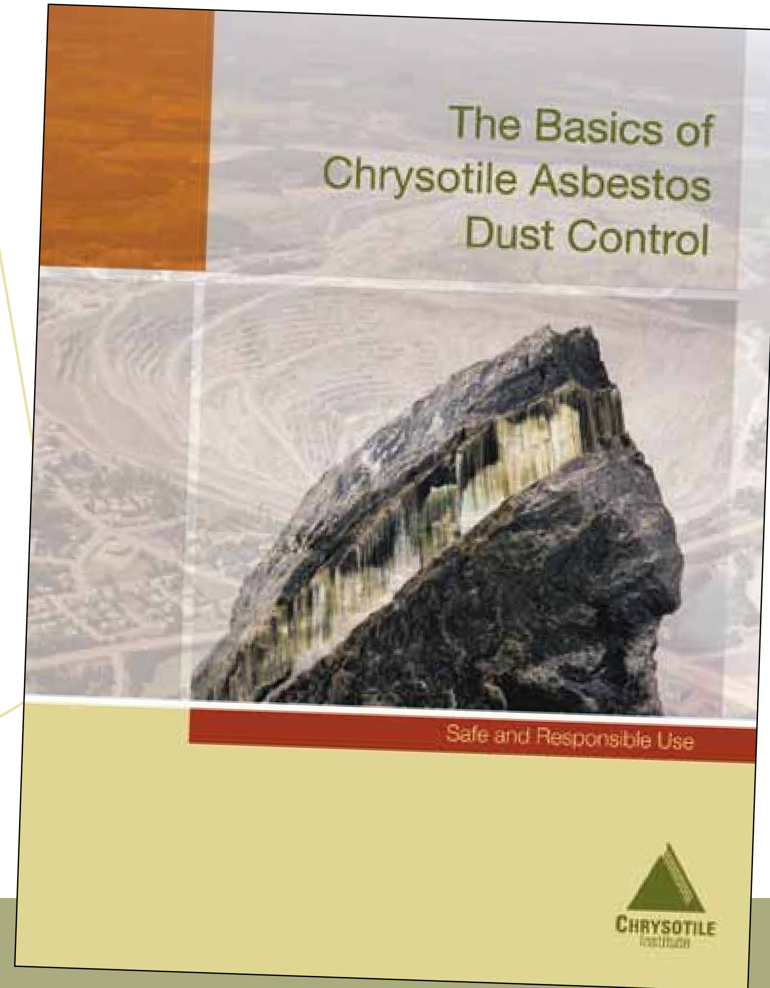
ILO CODE OF PRACTICE

http://www.ilo.org/public/english/protection/safework/cops/english/download/e841853.pdf

A practical guide for engineering Dust Control:

« THE BASICS OF CHRYSOTILE ASBESTOS DUST CONTROL »

CHRYSOTILE INSTITUTE



http://www.chrysotile.com/en/sc_publi/

CONTROLLED USE

IS IT WORKING ?

A FEW **EXAMPLES** OF PUBLISHED **STUDIES**

SHOWING **NO DETECTABLE HEALTH RISKS**

WHEN

CHRYSOTILE ONLY IS USED **IN COMPLIANCE**

WITH LOW EXPOSURE LIMITS

(≤ 1 F/CC)

ASBESTOS CEMENT

Evidence from U.S.A.

Weill, H., Hughes, J. and Waggenspack, C. (1979). *Influence of dose and fibre type on respiratory malignancy risk in asbestos cement manufacturing.* **American Review of Respiratory Disease 120(2):345-354.**

An investigation on 5,645 asbestos-cement manufacturing workers, showing no raised mortality resulting from exposure for 20 years to chrysotile asbestos at exposure levels equal to or less than 100 MPPCF.years (corresponding to approximately 15 fibres/ml.years). The authors state: "**... However, the demonstration that low cumulative and short-term exposures did not produce a detectable excess risk for respiratory malignancy may be of assistance in the development of regulatory policy, because a scientifically defensible position based on these data is that there are low degrees of exposure not associated with a demonstrable excess risk**".

Evidence from U.K.

Thomas, H.F., Benjamin, I.T., Elwood, P.C. and Sweetnam, P.M. (1982). *Further follow-up study of workers from an asbestos cement factory.* **British Journal of Industrial Medicine 39(3):273-276.**

In an asbestos-cement factory using chrysotile only, 1,970 workers were traced, and their mortality experience was examined. There was no appreciably raised Standardised Mortality Ratio (SMR) for the causes of death investigated, including all causes, all neoplasms, cancer of the lung and pleura, and cancers of the gastrointestinal tract. The authors indicate: **"Thus the general results of this mortality survey suggest that the population of the chrysotile asbestos-cement factory studied are not at any excess risk in terms of total mortality, all cancer mortality, cancers of the lung and bronchus, or gastrointestinal cancers".**

CONTROLLED USE

IS IT WORKING ?

ASBESTOS CEMENT

Evidence from U.K.

Gardner, M.J., Winter, P.D., Pannett, B. and Powell, C.A. (1986). *Follow up study of workers manufacturing chrysotile asbestos cement products.* **British Journal of Industrial Medicine 43:726-732.**

A cohort study carried out on 2,167 subjects employed between 1941 and 1983. No excess of lung cancers or other asbestos-related excess death is reported, at mean fibre concentrations below 1 f/ml, although higher levels had probably occurred in certain areas of the asbestos-cement factory.

Evidence from Sweden

Ohlson, C.-G. and Hogstedt, C. (1985). *Lung cancer among asbestos cement workers. A Swedish cohort study and a review.* **British Journal of Industrial Medicine 42(6):397-402.**

A cohort study of 1,176 asbestos-cement workers in a Swedish plant using chrysotile asbestos showing no excess related mortality at exposures of about 10-20 fibres/ml.years.

Evidence from Greece

L. Sichletidis, D. Chloros, D. Spyratos, A.-B. Haidich, I. Fourkiotou, M. Kakoura and D. Patakas (2008). *Mortality from occupational Exposure to Relatively Pure Chrysotile: A 39-Year Study.* **Respiration, Published Online: October 9, 2008. http://content.karger.com/ProdukteDB/produkte.asp?typ=pdf&doi=163443**

An investigation covering a span of almost 40 years on the mortality rate among workers exposed to relatively pure chrysotile in an asbestos cement factory that opened in 1968 in Greece. The factory used approximately 2,000 tonnes of chrysotile annually until 2005. Fiber concentration was measured regularly, and was always below permissible levels. Date and cause of death were recorded among all active and retired workers. No case of mesothelioma was reported. Overall mortality rate was significantly lower than that of the Greek general population. Conclusions of the authors: **« Occupational exposure to relatively pure chrysotile within permissible levels was not associated with a significant increase in lung cancer or with mesothelioma. »**

CONTROLLED USE

IS IT WORKING ?

FRICTION MATERIALS

Evidence from U.K.

Berry, G. and Newhouse, M.L. (1983). *Mortality of workers manufacturing friction materials using asbestos*. **British Journal of Industrial Medicine 40(1):1-7.**

A mortality (1942-1980) study carried out in a factory producing friction materials, using almost exclusively chrysotile. Compared with national death rates, there were no detectable excess of deaths due to lung cancer, gastrointestinal cancer, or other cancers. The exposure levels were low, with only 5% of men accumulating 100 fibre-ml.years. The authors state: **“The experience at this factory over a 40-year period showed that chrysotile asbestos was processed with no detectable excess mortality”.**

Evidence from U.K.

Newhouse, M.L. and Sullivan, K.R. (1989). *A mortality study of workers manufacturing friction materials: 1941-86.* **British Journal of Industrial Medicine 46(3):176-179.**

The study referred to in the preceding page has been extended by seven years. The authors confirm that there was no excess of deaths from lung cancer or other asbestos related tumours, or from chronic respiratory disease. After 1950, hygienic control was progressively improved at this factory, and from 1970, levels of asbestos have not exceeded 0.5-1.0 f/ml. The authors conclude: **"It is concluded that with good environmental control, chrysotile asbestos may be used in manufacture without causing excess mortality"**

CHRYSOTILE MINING

Evidence from Canada

Liddell, F.D.K., McDonald, J.C. and McDonald, A. (1997). *The 1891-1920 birth cohort of Quebec chrysotile miners and millers: Development from 1904 and mortality to 1992.*
Ann. Occup. Hyg. 41:13-35

This study, undoubtedly the largest cohort of asbestos workers ever studied and followed for the longest period, is that of the miners and millers of the chrysotile mines in Québec. The cohort, which was established in 1966, comprises some 11,000 workers born between 1891-1920 and has been followed ever since. The authors have updated their study several times, with a total of 9,780 men traced into 1992.
Results from exposures below 300 MPPCF.years, roughly equivalent to 900 fibres/ml x years - or, say, 45 fibres/ml for 20 years - lead the authors to conclude: "Thus it is concluded from the point of view of mortality that exposure in this industry to less than 300 MPPCF.years has been essentially innocuous".

CONTROLLED USE

A RESPONSIBLE APPROACH

THE APPLICATION OF SAFETY PRACTICES IN THE MANUFACTURE AND USE OF ANY SUBSTANCE, PRODUCT OR MIXTURE SHOULD BE SUPPORTED WORLDWIDE.

IT IS THE MOST EFFICIENT WAY TO LIMIT AS MUCH AS POSSIBLE THE POTENTIAL RISK TO HEALTH, TO SECURE THE WORKING ENVIRONMENT, TO PROTECT THE PHYSICAL INTEGRITY AND HEALTH OF THE WORKERS.

THE ELIMINATION OF INDUSTRIAL DISEASES IS THE POLICY PROMOTED BY THE WHO, AND IS SUPPORTED BY ALL ITS MEMBER STATES

CHRYSOTILE
Institute

The Chrysotile Institute

is a non profit organization established in 1984 by the industries producing chrysotile, union labour organizations and the Canadian and Quebec governments.

The Institute is dedicated to promoting the safe use of chrysotile in Canada and throughout the world.

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