

The Global Spread of Asbestos

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ABSTRACT

Background: Asbestos continues to be used in large quantities around the world and to be an important commodity in global trade.

Objective: To assess and quantify current global patterns of asbestos production, export and use; to examine global patterns of asbestos-related disease; and to examine barriers to an asbestos ban.

Method: Review of the biomedical literature describing patterns of asbestos exposure and disease; review of documents from national governments, UN agencies, and NGOs on asbestos production and use.

Findings: Despite widespread knowledge of the hazards of asbestos and bans on any use of asbestos in more than 50 countries, an estimated 2 million tons of asbestos continue to be used around the world each year. Although this amount is significantly less than peak annual consumption of nearly 5 million tons two decades ago, significant amounts of asbestos are still used in India, China, Russia, and some developing countries. This use of asbestos is responsible for disease today and will cause still more asbestos-related disease in the years ahead. Real and artificially manufactured controversies regarding asbestos such as arguments about the relative hazards of different asbestos fiber types and fiber sizes have impeded bans on asbestos.

Conclusions: All forms of asbestos pose grave dangers to human health. All are proven human carcinogens. There is no continued justification for the use of asbestos. Its production and use should be banned worldwide.

Key Words: asbestos, asbestos-related diseases, international scientific cooperation, Latin America

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INTRODUCTION

The term *asbestos* applies collectively to 6 naturally occurring fibrous minerals—crocidolite, amosite, tremolite, actinolite, anthophyllite, and chrysotile.¹ The fibers that characterize these minerals are longitudinal structures with a ratio of length to width of at least 3:1, and often much higher.

Asbestos minerals are divided into 2 groups—amphibole and serpentine asbestos—based on their chemistry and fiber morphology. The amphibole group includes crocidolite, amosite, tremolite, actinolite, and anthophyllite asbestos. Amphibole fibers are all straight and needle-like in their microscopic appearance. The serpentine group is comprised solely of chrysotile

asbestos. Serpentine fibers appear wavy under low magnification (Figs. 1 and 2).

Crocidolite carries the name blue asbestos, amosite (which was mined only in South Africa) is known as brown asbestos, and chrysotile is called white asbestos.

Chrysotile asbestos accounts for some 90% to 95% of all the asbestos used worldwide. Crocidolite and amosite made up the bulk of the commercially used asbestos that was not chrysotile.

In addition to the 6 minerals collectively names asbestos, there are other fibrous minerals that are similar structurally, but are not technically classified as asbestos. These are referred to as “asbestiform minerals.”

The single most important point here is that all types of asbestos can cause all of the diseases associated with exposure to asbestos. No form of asbestos is “safe.” The myth has been perpetrated that chrysotile asbestos is “safe” asbestos, but this is absolutely not true.

CURRENT USES OF ASBESTOS

Modern usage of asbestos began a bit more than 100 years after major deposits were discovered in Canada.² Asbestos began replacing the use of dried dung on the outside of furnaces as an insulation material, and soon developed into a product with many uses. Eventually,

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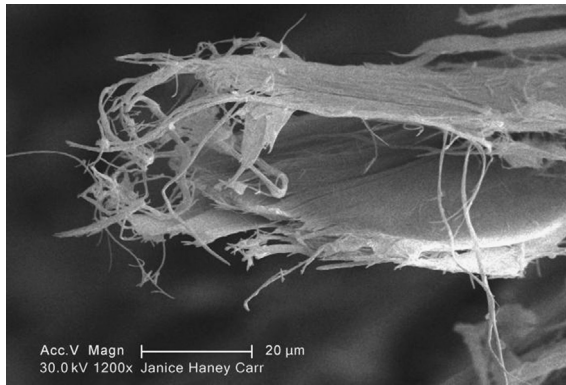


Figure 1. Chrysotile asbestos.

some 3000 to 4000 products were made with asbestos. The major growth in the use of asbestos began in the 1920s and 1930s with products such as textiles, brakes, and other materials being made. Large quantities were used in the 1940s in the building of ships both in the United States and elsewhere. At its peak, in the United States, some 775,000 tons of asbestos were used in 1972. Much asbestos was used in the construction trades and in the shipbuilding industry, and wherever there were needs for insulation. However, there were also many consumer products that used asbestos as well. These were as varied as the inside of toasters and in hair dryers, and in arts and crafts materials. Industrial uses for asbestos increased as well, with some of it being used to filter beer, wine, and pharmaceuticals.^{3,4}

As the health risks associated with asbestos became increasingly recognized, use began to decline. Starting approximately 30 years ago, some countries began to ban of all forms of asbestos. Sweden was among the first countries to do so, and the benefits to such banning have been clear as mesothelioma rates have dropped considerably since that time. At present, more than 50

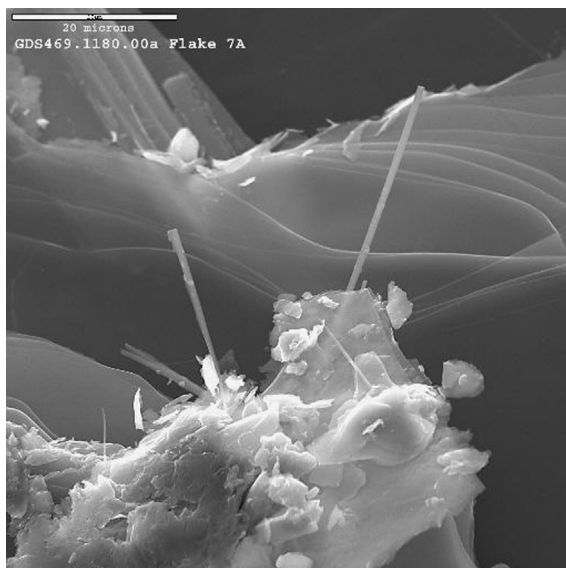


Figure 2. Amphibole asbestos.

countries have banned asbestos, although the United States is not one of those countries, nor is India.

For many years, Canada mined and exported vast quantities of asbestos even during a time when its use within Canada was virtually nil and the Canadian government was removing asbestos from public buildings such as the Houses of Parliament in Ottawa. Canada finally closed its asbestos mines in Quebec in 2012.

Unfortunately, as the developed world was banning or constricting the use of asbestos, the developing world was greatly increasing its use of this toxic material. Major producers such as Russia, Kazakhstan, China, and Brazil continue to produce⁵ and export asbestos to countries around the world, especially to low- and middle-income countries that too often have weak or nonexistent occupational and environmental regulations (Figs. 3 and 4). The producer countries consume only a fraction of the asbestos that they mine and export the rest. As a result, considerable use of asbestos has continued in much of Asia, Africa, and in some countries in Latin America. China has been a major consumer of asbestos as has been India.⁶ India produces little or no asbestos, but has become a major importer with exponential growth in manufacture of asbestos cement and pipes.⁷ Although safer substitutes are available, deliberate actions have been taken, such as is the case in India, where tariffs have been kept modest on asbestos but raised on artificial materials that are safer. Other countries have found nontoxic substitutes for asbestos, such as the Vietnamese, who use naturally occurring vines that are shredded to make fibers that are incorporated into building materials in place of asbestos and carry with it no apparent health risks.

TYPES OF EXPOSURE

Traditionally, occupational exposures to those who directly handle asbestos have been documented to be the most hazardous, and asbestos workers develop the

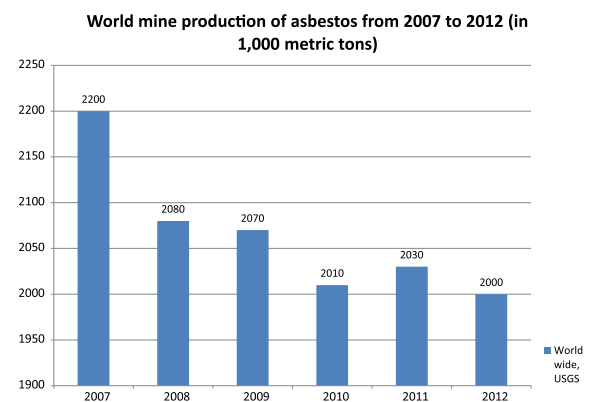


Figure 3. World mine production of asbestos from 2007 to 2012 (in 1000 metric tons). **Abbreviation:** USGS, United State Geological Survey.

Global Asbestos Fiber Consumption, 2012

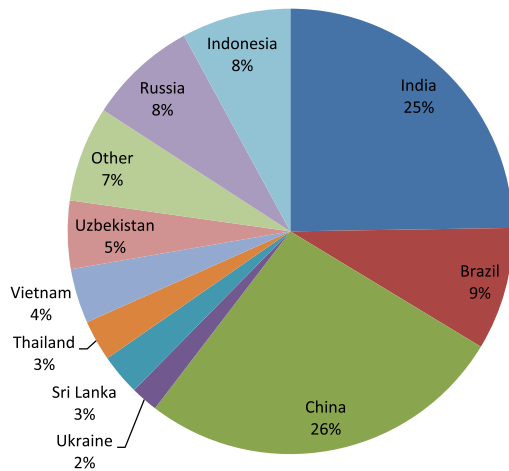


Figure 4. Global asbestos fiber consumption, 2012*. *Source: International Ban Asbestos Secretariat & Citi Research.

greatest amount of asbestos-related disease.^{8,9} This is to be expected given the usual dose-response relationship seen with exposure to asbestos.

The risks for exposure to asbestos extend far beyond the workplace. Other groups at risk include those who experience “bystander” exposure to asbestos. These include workers who are not themselves asbestos workers, but who work in proximity to poorly controlled asbestos work and are exposed to airborne fibers. Such exposures have been especially prevalent in the construction trade as well as in the shipbuilding industry.^{10,11}

Children and family members of asbestos workers are also at risk for bystander exposure. When workers contaminate their cars or carry asbestos home on their clothing or on their person they then contaminate the household and can give rise to family members, especially wives and children, coming down with asbestos-related disease, including mesothelioma, lung cancer, and asbestosis.¹² Such household or familial exposure has been well documented, going back at least to 1960 with the work of Wagner,⁸ and the appreciation of this as a potential health hazard was recognized in government regulations as far back as 1918 when it was suggested that workers be allowed to shower and change clothing before going home with asbestos on their clothing.¹³

Lastly, it has been shown that simply living near a facility that uses asbestos, such as a mine or a manufacturing plant, can put people at risk. This is called neighborhood exposure and has been documented in South Africa, England, and Finland.^{8,12,14}

DISEASES ASSOCIATED WITH ASBESTOS

Two groups of diseases are associated with exposures to asbestos: nonmalignant diseases, which can be fatal, and cancer.

The nonmalignant diseases associated with exposure to asbestos include asbestos warts, benign asbestotic pleural effusion, and the disease asbestosis. Traditionally, asbestosis involved both the parenchymal of the lung and the pleura, although a more modern view separates pleural disease from parenchymal fibrosis. This flies in the face, however, of the historical view that goes back to Zenker in 1867 classifying the pneumoconiosis as a series of dust diseases with his original description affecting both the pleura and the parenchymal.¹⁵ Also, Lanza, in his 1938 book on silicosis and asbestosis, discussed the pleural manifestations of asbestosis.¹⁶ Even the International Labor Organization recognizes pleural disease as a pneumoconiosis, and logic would dictate that if caused by asbestos, it would be called asbestosis.¹⁷ Nevertheless, the nomenclature is of little importance and both pleural and parenchymal fibrosis can lead to death. Among asbestos insulators, classically, parenchymal fibrosis causes about 10% of such individuals to die, and the recent work involving the Libby, Montana asbestos and asbestiform minerals contaminating vermiculite documents that even pleural disease can be fatal to some individuals (personal communication, A. Whitehouse, March 2013).

The malignant diseases related to asbestos include lung cancer,² mesothelioma,² ovarian cancer,¹⁸ and laryngeal cancer,¹⁹ as well as a variety of gastrointestinal tract,⁹ oro-pharyngeal,⁹ and kidney cancers.²⁰ In some groups, such as insulators, 1 in 5 deaths is due to lung cancer with a documented synergistic effect of smoking.²¹ Also among insulators, approximately 10% to 12% of deaths are due to mesothelioma, a disease thought to occur at a background rate of 1 per 1 million, or less. The other cancers noted are all found in the scientific literature to be in excess among asbestos exposed individuals.

The Evolving Epidemiology of Asbestos Disease

Rates of asbestos-related disease are already decreasing in Western developed countries as a result of bans on asbestos use that were imposed several decades ago and can be expected to decrease further in the years ahead. By contrast, however, there is every expectation that rates of these diseases will rise in countries where asbestos use continues or is increasing, and most of these are low- and middle-income countries.⁶

Tracking of trends in asbestos disease is impeded in many developing countries by inadequate disease surveillance systems and by lack of official government recording of such diseases as mesothelioma. For example in India, no official recognition of mesotheliomas has occurred, but one hospital in Mumbai alone has documented more than 30 cases of mesothelioma treated at that hospital in a single year. As is classically appreciated in public health, the lack of data does not mean the lack of disease. Similar situations occur elsewhere, such as in Brazil where there is a vast underreporting of such

diseases. It has been estimated that worldwide there is a significant underreporting of diseases by a large margin.²² In some countries, such as Russia, the government has stopped separate coding for mesotheliomas, whereas in other nations mesotheliomas have now reached the status of being coded separately, and will be able to be more easily tracked.

REAL AND CONTRIVED CONTROVERSIES REGARDING ASBESTOS

In large part because of the economic issues surrounding asbestos, and the financial implications from growing worldwide legal implications, the corporate world, and on occasion, in partnership with governments, have created false controversies regarding the hazards of asbestos.

It should be made clear that there are some legitimate issues with regard to asbestos and its ability to cause disease, and these are enumerated here. However, there are far more insidious actions that follow a pattern first established by the tobacco industry in hiring public relations firms to obfuscate the scientific issues so that tobacco could still be sold. Over time, the truth has come out, particularly in the West, but the use of tobacco is still significant and in some cases growing, in parts of the world, such as Asia and Africa. Similarly, the asbestos industry adopted the view that a public relations campaign was needed to quash the rising concerns about its health hazards.²³

As noted, there are some legitimate controversies regarding asbestos. The relative potency of various-sized fibers to cause disease is still unknown, and there is still considerable controversy regarding the potential relative ability of amphibole versus chrysotile to cause disease, especially mesothelioma. The fact that this is a legitimate controversy should not in any way give rise to the thought that chrysotile cannot cause mesotheliomas. This has been well documented,²⁴ including the ability of non-amphibole-contaminated asbestos to cause mesothelioma.²⁵ It seems scientifically unreasonable to consider that there is a threshold for exposure to asbestos that might lead to cancer because both animal²⁶ and human data²⁷ have shown that 1 day of exposure can give rise to mesothelioma, and that even very short periods of exposure lead to increases in lung cancer mortality.²⁸ Similarly, as scientists have looked at smaller and smaller amounts of asbestos, what was thought to be a potential lower limit of 0.5 fiber cc per year²⁹ has now been lowered by a factor of 5 to 0.1 fiber cc per year as still documenting an increased risk for developing mesothelioma.³⁰ There is no reason to think that there are levels of exposure that are safe, only that are extraordinary unlikely to produce disease, such as the ambient levels of asbestos that virtually everyone in the world may be exposed to. Another theory with little

support is that of “biopersistence” with lack of acknowledgment that chrysotile asbestos most often is found in the pleura of mesothelioma patients.³¹ An excellent epidemiology review is that of Lemen.³²

Driven by lawyers, much inappropriate or even potentially downright dishonest science has entered into this field. Such science is pointed to by some, to speak of an oxymoron, that chrysotile is the “safe asbestos.” It has been well recognized that extremely large sums of money, sometimes in the tens of millions of dollars, has gone from industry or their attorneys to selected scientists to create a body of literature that flies in the face of science as it is thought of outside of the courtroom. Among the claims that have little or no scientific basis are that only fibers greater than 5 microns can cause disease, that chrysotile cannot cause mesothelioma, or only does so with extraordinarily large amounts of exposure, or that specific chrysotile deposits are somehow different than chrysotile in general and do not contribute to disease. Also, the use of chrysotile in certain products, such as friction material, has been claimed to not cause disease, but such conclusions have come with a huge price tag of many tens of millions of dollars spent by auto companies and brake manufacturers to get the support of specific scientists. Some attorneys have also gone into court and flatly denied that the products they represent, such as talc, have been contaminated with asbestos, which was known to such attorneys as being untrue, and had their clients eliminated from hundreds of lawsuits. Not surprisingly, they have also told potential or real customers that their products are safe, and contained no asbestos.

With regard to the false concept of the safe use of asbestos, this has been promulgated by suppliers of asbestos, including the Canadian government. Fortunately, relatively recently the mines of Quebec have now been scheduled for complete closure and it is expected that Canada will both get out of the business of selling asbestos, and will become less obstructive as the world tries to deal with the growing epidemic of asbestos-related disease. The Canadians, in the past, have claimed that the asbestos that they sold, chrysotile, could be used safely, but there is documentation that even in a country such as Canada, with extensive regulatory activity around such use, that in as many as 9 in 10 cases, regulations were not being followed and the material was not being handled in a safe manner. To expect developing countries to adhere to standards that cannot be easily met in the developed world clearly makes no sense. In India, there are also claims of the safe use of asbestos, but documentation of anything but that is found in photographs from asbestos factories and in the clinical cases found throughout the country. To further compound the ridiculousness of the issue of asbestos disease in India, claims are made that only Westerners in the developed world have a genetic makeup that leads to the development of disease, and that Indians are genetically protected from getting asbestos-related

disease. The fact that the sharing of genes is probably greater than 99%, and that there have been documented cases of asbestos-related disease, both benign and malignant, in India, puts this argument to rest. There has been only limited legal action in India, in a system that usually proceeds quite slowly. There is yet another reason why little is done to decrease the use of asbestos in India; most asbestos is used in the construction of asbestos cement housing-related materials, and some of the asbestos cement factories have been owned by members of Parliament.

THE SHRINKING GLOBAL USE OF ASBESTOS

As a general theme, occupational and environmental activities in Europe and Scandinavia have replaced actions in America as being on the leading edge of workplace and environmental hazard control, including the use of asbestos. First banned by Iceland, the Swedes quickly thereafter also banned any use of asbestos, and over time the European Union reached this conclusion as have now more than 50 countries around the world. The benefits of stopping the use of this material is evident with the data from Sweden and the Netherlands showing that mesothelioma rates have steadily come down over the past 30 years with the ban in place,³³ whereas in countries where it is still allowed, there is evidence of increasing numbers of mesotheliomas.²² In those countries that have only recently banned, there may still be, for a period of time, increasing numbers of cases of mesothelioma, in part because of the long latency for this disease. It is telling that in the United States no ban has yet been put in place, and speaks to the diminishing influence of America in terms of leading the world in workplace safety and health matters. Although down from its peak of more than 700,000 tons of asbestos used in a year to something around 1000 tons, this figure is artificially low because it refers to raw asbestos fiber, but does not take into account the many asbestos products that may be brought into America after being manufactured in other settings. Products made in Mexico, China, and elsewhere enter the US marketplace. Substitutes for asbestos use are clearly available and gaining acceptance in some settings.

There is even some constriction in the use of asbestos in some countries still widely known for the mining and use of this product. In China, for example, when the Olympic venues were built for the 2008 Beijing Olympics it became known that the building materials were not made from asbestos cement, which generally had been the norm in China. It turns out that the rationale for this had to do with politics more than science or health; it was thought that some athletes would not come to participate if they had to live in or participate in asbestos-containing structures. Also, having

previously been a major supplier to more than 40 countries of asbestos-containing brakes, automotive products now being made in China, especially with the growing desire to have an export market for Chinese made vehicles, are being shown to have no asbestos in brakes or other automotive components. Even such traditionally heavily utilizing operations as shipbuilding can now be found with an absolute minimal amount of asbestos being put on new ships being built in China.

Increasingly, countries are trying to be proactive with regard to preventing asbestos-related disease. Even if asbestos is not banned, there is an increasing awareness of the hazards, and the full control of asbestos would be made easier if the United States adopted such a policy as well. Public health professionals in developing countries have stated that it is hard to ban the use of asbestos when this has not yet happened in the United States. Some countries will continue to mine asbestos and attempt to sell it around the world, notably Russia, but other countries are finding restrictions being put in place, either on a piecemeal basis, or more hopefully on a countrywide basis. With regard to this latter explanation, in Brazil, where there are mines that the Miners' Union members wish to keep open many more workers want to have this material eliminated from their workplaces. Individual states in Brazil have passed regulations banning the material, but a long-awaited decision by the Brazilian Supreme Court making a permanent ban of the use of this material is still pending. A future hope is also that the Rotterdam Convention will no longer be blocked by a handful of nations and that asbestos will be labeled as an extremely hazardous substance, something that would have been something 180 countries in the world were willing to do, with the blockage of that designation by a few countries that still mine, sell, or use large quantities of asbestos.

A common theme for the continued use of asbestos is that the material is cheap. While recognizing that this is the case, and that certain manmade fibrous substitutes might cost a bit more, the cost differential is not great, unless large tariffs are put in place favoring one material over another as has been done with asbestos. Construction materials are now the most common current use of asbestos-containing materials and less harmful materials are clearly available that will shelter people but not cause disease. This is also another example of short-term cost savings but long-term additional expenses due to the health consequences that may not be seen for decades into the future.

CONCLUSIONS

There have been substantial changes in the global spread of asbestos, some of these changes coming quite recently, such as the cessation of asbestos production in sales from Canada. Also, it would have been hard to believe even a few decades ago that more than 50 countries in the world would totally ban the

use of all asbestos, including chrysotile, over which much of the controversy still swirls.

One must still be on guard against the hazards of “science for sale,” since companies are still trying to create what has been dubbed “doubt science,”²³ and even organizations such as the International Agency for Research on Cancer have been challenged to become involved with potentially seriously flawed science. The infiltration of purveyors of asbestos into the world of science is not new, and in India the asbestos industry was allowed to design and assist with a government agency carrying out an asbestos study in that country, with no independent oversight, and therefore no confidence in whatever might have been found from such a pseudoscientific investigation. Just as other scientific advances in public health have taken time to be fully accepted, we see the same pattern with regard to asbestos disease.

Eventually, the truths regarding asbestos exposure and its true hazards will be recognized and acted upon, but only after economic forces are overcome.

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