Asbestos Is Still With Us: Repeat Call for a Universal Ban

Collegium Ramazzini*

All forms of asbestos are proven human carcinogens. All forms of asbestos cause malignant mesothelioma, lung, and laryngeal cancers, and may cause ovarian, gastrointestinal, and other cancers [Straif et al., 2009]. No exposure to asbestos is without risk. Asbestos cancer victims die painful lingering deaths. These deaths are almost entirely preventable. When evidence of the carcinogenicity of all forms of asbestos became incontrovertible, concerned parties, including the Collegium Ramazzini, called for a universal ban on the mining, manufacture, and use of asbestos in all countries around the world [Collegium Ramazzini, 1999]. Asbestos is now banned in 52 countries [IBAS, 2010], and safer products have replaced many materials that once were made with asbestos. Nonetheless, a large number of countries still use, import, and export asbestos and asbestos-containing products. And in many countries that have banned other forms of asbestos, the so-called "controlled use" of chrysotile asbestos is exempted from the ban, an exemption that has no basis in medical science but rather reflects the political and economic influence of the asbestos mining and manufacturing industry. All countries of the world have an obligation to their citizens to join in the international endeavor to ban all forms of asbestos. An international ban on asbestos is urgently needed. Am. J. Ind. Med.

KEY WORDS: asbestos; ban

INTRODUCTION

Asbestos is a term applied to six naturally occurring fibrous minerals. These minerals occur in two configurations: serpentine and amphibole. The only type of asbestos derived from serpentine minerals, chrysotile, also known as white asbestos, accounts for 95% of the asbestos ever used around the world, and it is the only type of asbestos in commercial use today. Amphibole minerals include five asbestos species: amosite, crocidolite, tremolite, anthophyllite, and actinolite. The two forms of amphibole asbestos that previously were most commercially important—amosite, or brown asbestos, and crocidolite, or blue asbestos—are no longer in use.

Asbestos fibers can withstand fire, heat, and acid. They have great tensile strength. They provide thermal insulation and acoustic insulation. The properties of asbestos fibers gave rise to a substantial industry before their detrimental health effects, which often take years and decades to appear, became known.

All forms of asbestos cause asbestosis, a progressive, debilitating fibrotic disease of the lungs. All forms of asbestos also cause malignant mesothelioma, lung, laryngeal, and ovarian cancers, and may cause gastrointestinal and other cancers [Straif et al., 2009]. Asbestos was declared a proven human carcinogen by the US Environmental Protection Agency (EPA), the International Agency for Research on Cancer (IARC) of the World Health Organization, and the National Toxicology Program (NTP) more than 20 years ago [IARC, 1977; NTP, 1980; EPA, 1986]. The scientific community is in overwhelming agreement that there is no safe level of exposure to asbestos [Welch, 2007].

International Headquarters, Castello dei Pio, Carpi, Modena, Italy
*Correspondence to: Dr. Morando Soffritti, MD, General Secretary of the Collegium Ramazzini, General Secretariat, Castello di Bentivoglio, 40010 Bentivoglio, Bologna, Italy. E-mail: collegium@ramazzini.it

Accepted 12 July 2010
DOI 10.1002/ajim.20892. Published online in Wiley Online Library (wileyonlinelibrary.com).

Moreover, there is no evidence of a threshold level below, which there is no risk of mesothelioma [Hillerdal, 1999].

THE ASBESTOS CANCER PANDEMIC

Occupational Exposures to Asbestos

Many millions of workers have already been exposed to asbestos. About 20–40% of adult men report past occupations that may have entailed asbestos exposures [Goldberg et al., 2000]. In the most highly affected age groups, mesothelioma may account for over 1% of all deaths [Driscoll et al., 2005; Rake et al., 2009]. In addition to mesothelioma, 5–7% of all lung cancers are potentially attributable to occupational exposures to asbestos [Tossavainen, 2004].

Worldwide, the yearly number of asbestos-related cancer deaths in workers is estimated to be 100,000–140,000. In Western Europe, North America, Japan, and Australia 20,000 new cases of lung cancer and 10,000 cases of mesothelioma result every year from exposures to asbestos [Tossavainen, 1997]. The British mesothelioma death rate is now the highest in the world, with 1,740 deaths in men (1 in 40 of all male cancer deaths below age 80) and 316 in women in 2006. About 1 in 170 of all British men born in the 1940s will die of mesothelioma [Rake et al., 2009]. Australia's high incidence of mesothelioma is expected to reach 18,000 by 2020, with 11,000 cases yet to appear [Leigh and Driscoll, 2003].

The US National Institute for Occupational Safety and Health (NIOSH) estimates that current occupational exposures to asbestos even at OSHA's permissible exposure limit will cause five deaths from lung cancer and two deaths from asbestosis in every 1,000 workers exposed for a working lifetime [Stayner et al., 1997]. This mortality reflects the fact that an exposure to 0.1 fibers of asbestos per cubic centimeter of inspired air, over the course of a day, amounts to daily inhalation of more than one million asbestos fibers.[1]

Environmental Exposures to Asbestos

Non-occupational, environmental exposure to asbestos from the use of asbestos in construction materials is also a serious and often neglected problem in countries throughout the world. In developed countries large quantities of asbestos remain as a legacy of past construction practices in many thousands of schools, homes, and commercial buildings. And in developing countries, where asbestos is used today in large quantities in construction, asbestos-contaminated dust is now accumulating in thousands of communities.

More than 90% of the asbestos used worldwide today is used in the manufacture of asbestos-cement sheets and pipes. Use of asbestos in these materials continues despite repeated warnings that the use of asbestos in these products is highly dangerous because of the large numbers of people exposed to the airborne dust and the extreme difficulty of controlling exposures once these materials have been disseminated into communities where people of all ages, including young children, are at risk of exposure [WHO, 1998].

Both community-based and industrial exposures to asbestos and asbestiform fibers increase risks for mesothelioma [Pasetto et al., 2005]. Thus, a study of women residing in Canadian asbestos mining communities found a sevenfold increase in the mortality rate from pleural cancer [Camus et al., 1998]. The risk of developing asbestos-related cancer following in home exposures in communities near Canadian mines over a 30-year period is estimated to be 1 in 10,000 [Marier et al., 2007]. Likewise, environmental exposures to asbestos waste on the surfaces of roads and yards in a contaminated community of 130,000 residents in the Netherlands result each year in several cases of malignant mesothelioma [Driece et al., 2009]. And in a third example, the currently observed increase in female cases of mesothelioma in the United Kingdom, many with no occupational exposure to asbestos, suggests widespread environmental contamination [Rake et al., 2009].

THE POSITION OF INDUSTRY

In efforts to sustain markets in the face of a steadily growing body of scientific evidence that irrefutably links asbestos to asbestosis and human cancer, the asbestos industry has attempted to obfuscate the links between asbestos and disease by provoking spurious scientific debate over the roles of, viruses, fiber types, and genetics in the development of lung cancer and malignant mesothelioma. These tactics closely resemble those used by the tobacco industry.

Early on the asbestos industry blamed malignant mesothelioma occurrence on poliovirus vaccines used during the 1950s and 1960s that were contaminated with simian virus 40 (SV40), a monkey virus tumorigenic in rodents. However, age-specific trends in pleural mesothelioma incidence rates are not consistent with an effect of exposure to SV40-contamined poliovirus vaccine [Strickler et al., 2003].

The industry continues to generate endless debate on the relative hazards of asbestos of different fiber type and dimension. In these debates industry spokespersons argue that some forms of asbestos are less harmful than others. However, epidemiological and statistical efforts to

[1] The average adult at rest inhales 7–8 L of air per minute. That totals approximately 11,000 L of air in a day. An exposure standard of 0.1 f/cc^3 would then result in 11,000,000 cc^3 $\times$ 0.1 f/cc^3 = 1.1 million fibers/day.

characterize relative cancer potencies for different asbestos fiber types and for fibers of different sizes have not been able to overcome limitations of the exposure data. Nor can these analyses account for the fact that in the real world exposure is almost always to mixtures of asbestos fibers of different types and sizes.

Epidemiologic, experimental, and molecular evidence suggests that the arguments for the role of fiber size relative to dose, dose–response effect, and genetic susceptibility are fraught with enormous uncertainties [Tomatis et al., 2007]. Indeed NIOSH scientists contend that the uncertainties have been so great that these estimates should not be used to determine occupational and environmental health policy. The EPA has rejected and discontinued work on its proposed methods for quantifying potency factors for partitioned asbestos fiber types and sizes [Silverstein et al., 2009].

A third activity of the asbestos industry is to commission the publication of articles, primarily in toxicology journals, termed ''product defense'' articles. These articles are frequently sponsored by asbestos interests such as the defendants in personal injury asbestos litigation. They are distinguished from other science papers in that they are written by scientific consultants and consulting firms, who are paid substantial sums for their work. Their goal is to defeat liability claims [Michaels, 2006, 2008; Michaels and Monforton, 2007; Boden and Ozonoff, 2008]. Editors of scientific journals must be very stringent about the details and wording of authors' statements on conflicts of interest, and carefully select unbiased peer reviewers of articles regarding asbestos in accordance with the International Committee of Medical Journal Editors guidelines [ICMJE, 2009].

Despite their lack of scientific foundation, these continuing controversies and ploys generated by the asbestos industry have helped to make the disease experiences and early deaths of asbestos-exposed workers and people in asbestos-contaminated communities invisible and uncompensated, allowing the asbestos industry to mitigate its responsibility [Braun et al., 2003].

CHRYSOTILE ASBESTOS

Chrysotile represents 95% of all the asbestos ever used worldwide. It is the only variety in international trade in the 21st century. There is general agreement among scientists and physicians, and widespread support from numerous national health agencies in countries around the world, United Nations agencies, and the World Trade Organization, that chrysotile causes various cancers, including mesothelioma and lung cancer [OSHA, 1994; UNEP, 1998; WTO, 2000; ACGIH, 2001; ATSDR, 2001; NCI, 2003; ISSA, 2004; NTP, 2004; ILO, 2006; WHO, 2006].

Early suggestions that chrysotile might be less dangerous than other forms of asbestos have not been substantiated. And although chrysotile accounts for almost all the asbestos ever used, the asbestos industry continues to claim that asbestos-related cancers are the result of the amphibole varieties [McCulloch, 2006; Renner, 2007]. Advocates of the asbestos industry contend that ''Exposure to chrysotile in a pure form seems likely to present a very low if any risk of mesothelioma'' [Gibbs and Berry, 2008].

The Chrysotile Institute, a registered lobby group for the Quebec asbestos mining industry, takes the position that chrysotile can be handled safely [Chrysotile Institute, 2008]. Numerous epidemiologic studies, case reports, controlled animal experiments, and toxicological studies refute the assertion that chrysotile is safe [Stayner et al., 1996; Tossavainen, 1997; Smith and Wright, 1998; Landrigan et al., 1999; Lemen, 2004a; Bang et al., 2006; Lin et al., 2007]. These studies demonstrate that the so-called ''controlled use'' of asbestos is a fallacy [Lemen, 2004b]. Workers exposed to chrysotile fiber alone have excessive risks of lung cancer and mesothelioma [Frank et al., 1998; Li et al., 2004; Mirabelli et al., 2008].

The Canadian Cancer Society, the Canadian Medical Association, and the Canadian Public Health Association oppose the export of asbestos to developing countries [Canadian Medical Association, 2009; Canadian Cancer Society, 2010; Canadian Public Health Association, 2010]. The National Public Health Institute of Quebec has published 15 reports, all of them showing a failure to achieve ''controlled use'' of asbestos in Quebec itself [Takaro et al., 2010]. Pat Martin, a member of Canada's Parliament and former asbestos miner asks, ''If we in the developed world haven't found a way to handle chrysotile safely, how can we expect them to do so in developing nations? [Burki, 2010].''

The reality of the current use of Canadian asbestos in India was broadcast by the Canadian Broadcasting Corporation in a 2009 documentary [CBC, 2009]. This stunning piece of investigative journalism exposed the fallacy underpinning the asbestos industry's commercial propaganda; showing there is no such thing as the safe use of asbestos. The World Trade Organization has accepted this conclusion [Castleman, 2002].

CURRENT PRODUCTION AND USE OF ASBESTOS

Despite all that is known about the health effects of asbestos, annual world production remains at over 2 million tons. This level of production has remained steady following a 50% decline in the 1990s. Russia is now the leading producer of asbestos worldwide, followed by China, Kazakhstan, Brazil, Canada, Zimbabwe, and Colombia. These six countries accounted for 96% of the world production of asbestos in 2007 [USGS, 2008]. Russia has mines rich enough in asbestos deposits to last for more than 100 years at current levels of production. The majority

of the 9,25,000 tons of asbestos extracted annually in Russia is exported.

Asbestos is now banned in 52 countries, including all EU member countries, and safer products have replaced many that were once made with asbestos. Virtually all of the polymeric and cellulose fibers used instead of asbestos in fiber-cement sheets are >10 microns in diameter and hence are non-respirable. Nonetheless, these 52 countries make up less than a third of WHO member countries.

A much larger number of WHO member countries still use, import, and export asbestos and asbestos-containing products [WHO, 2006]. Over 70% of the world production of asbestos is used in Asia and Eastern Europe, in countries desperate for industrial growth and often naïve to the health effects of occupational and environmental exposures to asbestos. Most of the world's people still live in countries where asbestos use continues with little or no provision for prevention or compensation. And in many countries that have banned other forms of asbestos, the ''controlled use'' of chrysotile asbestos is still exempted from the ban because of the size of the asbestos industry, its pervasive influence, and the importance of asbestos mining and manufacture to the economy. The toll in most countries still using large amounts of asbestos may never be fully recorded.

In developing countries, where too often there exists little or no protection of workers and communities, the asbestos cancer pandemic may be the most devastating. China is by far the largest consumer of asbestos in the world today, followed by India, Russia, Kazakhstan, Thailand, Ukraine, and Uzbekistan.

POSITION OF UNITED NATIONS AGENCIES ON ASBESTOS

International organizations have condemned the continuing use of chrysotile asbestos [LaDou, 2004]. In 2006, WHO called for the elimination of diseases associated with asbestos [WHO, 2006]. WHO supports individual countries in developing national plans to ban asbestos and eliminate asbestos disease. The ILO has expressed concern about an evolving epidemic of asbestos-related diseases, and has drafted a resolution to promote a worldwide asbestos ban [ILO, 2006].

The Rotterdam convention is an international treaty intended to regulate global trade in dangerous chemicals—chemicals that have been banned or severely restricted because of their hazards to human health or the environment. It was enacted in 2004, and 131 nations are currently parties to the Convention. The goal is to protect the world's most vulnerable countries—developing countries and countries with economies in transition—against importation without their prior knowledge or consent of hazardous pesticides and other regulated chemicals.

Prior Informed Consent (PIC) is the core principle of the Rotterdam Convention. This legally binding procedure requires that governments in all countries be provided full information prior to importation about the risks to health and the environment of each of the hazardous materials regulated by the Convention. Annex III of the Rotterdam Convention contains a list of the chemicals—37 in number—currently regulated by the Convention.

Repeated efforts to include chrysotile asbestos under the Rotterdam Convention have failed, because of the Convention's requirement for unanimity and the determined opposition of asbestos mining and manufacturing countries [Terracini, 2008]. At the 2008 conference of parties on the Convention, opposition to chrysotile asbestos was led by Canada, Russia, and India. Kazakhstan and a few asbestos importing countries thwarted the will of over 100 other countries.

CONCLUSION - THE NEED FOR A UNIVERSAL BAN ON ASBESTOS

The profound tragedy of the asbestos pandemic is that virtually all illnesses and deaths related to asbestos are preventable. Safer substitutes for asbestos exist, and they have been introduced successfully in many nations. Asbestos–cement (A–C) pipes, sheets, and water storage tanks account for 90% of asbestos used in the world today. Substitutes for A–C water pipe include ductile iron pipe, high-density polyethylene pipe, and metal-wire-reinforced concrete pipe. Many substitutes exist for roofing, interior building walls, and ceilings, including fiber-cement flat and corrugated sheet products, made with polyvinyl alcohol fibers and cellulose fibers. For roofing, lightweight concrete tiles can be made and used in the most remote locations, using locally available plant fibers including jute, hemp, sisal, palm nut, coconut coir, and wood pulp. Galvanized iron roofing and clay tiles are among the other alternative materials [WBG, 2009].

If global use of asbestos were to cease today, a decrease in the incidence of asbestos-related diseases would become evident only two or more decades from now [WHO, 2006]. The asbestos cancer pandemic may take as many as 10 million lives before asbestos is banned worldwide and all exposure is brought to an end [Leigh, 2001; LaDou, 2004]. In this conservative estimate, it is assumed that asbestos exposures are going to cease and that the epidemic will run itself out, but currently the world's production of asbestos continues at an alarming rate, and therefore these figures may be underestimates of the true reality of this pandemic.

An international ban on the mining and use of asbestos is urgently needed. The risks of exposure to asbestos cannot be controlled by technology or by regulation of work practices. Scientists and responsible authorities in countries allowing the use of asbestos should have no illusion that ''controlled

use'' of chrysotile asbestos is an effective alternative to a ban on all use of asbestos [Castleman, 2003; Egilman et al., 2003; Egilman and Roberts, 2004]. Even the best workplace controls cannot prevent occupational and environmental exposures to products in use or to waste.

All countries of the world have an obligation to their citizens to join the international endeavor to ban all forms of asbestos.

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