

The Asbestos Cancer Epidemic

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The asbestos cancer epidemic may take as many as 10 million lives before asbestos is banned worldwide and exposures are brought to an end. In many developed countries, in the most affected age groups, mesothelioma may account for 1% of all deaths. In addition to mesotheliomas, 5–7% of all lung cancers can be attributed to occupational exposures to asbestos. The asbestos cancer epidemic would have been largely preventable if the World Health Organization (WHO) and the International Labor Organization (ILO) had responded early and responsibly. The WHO was late in recognizing the epidemic and failed to act decisively after it was well under way. The WHO and the ILO continue to fail to address the problem of asbestos mining, manufacturing, and use and world trade of a known human carcinogen. Part of the problem is that the WHO and the ILO have allowed organizations such as the International Commission on Occupational Health (ICOH) and other asbestos industry advocates to manipulate them and to distort scientific evidence. The global asbestos cancer epidemic is a story of monumental failure to protect the public health. *Key words:* amosite, asbestos, asbestos cancer epidemic, chrysotile, crocidolite, ICOH, ILO, international occupational health, lung cancer, mesothelioma, WHO. *Environ Health Perspect* 112:285–290 (2004). doi:10.1289/ehp.6704 available via <http://dx.doi.org/> [Online 24 November 2003]

Asbestos is a general term applied to certain fibrous minerals long popular for their thermal resistance, tensile strength, and acoustic insulation properties. Asbestos minerals are divided into two groups: serpentine and amphibole. Only one type of asbestos is derived from serpentine minerals: chrysotile, also known as white asbestos. Amphibole minerals include five asbestos species: amosite, crocidolite, tremolite, anthophyllite, and actinolite. Two of these are the most commercially valuable forms: amosite, or brown asbestos, and crocidolite, or blue asbestos.

More than 30 million tons of asbestos in its various forms have been mined in the past century. Asbestos is one of the most pervasive environmental hazards in the world, present in more than 3,000 manufactured products. All forms of asbestos can result in asbestosis (a progressive fibrotic disease of the lungs), lung cancer, and mesothelioma, a cancer arising in the membranes lining the pleural and peritoneal cavities.

Asbestos exposure affects not only asbestos workers but also their families, users of asbestos products, and the public as it is exposed to building materials and asbestos in heating and ventilating systems. In developing countries, where protection of workers and communities is scant or nonexistent, the asbestos cancer epidemic may be even more devastating than it has been in developed countries. The battle against asbestos is in danger of being lost where the human costs may be greatest, in developing countries desperate for industry.

With rare exceptions, the developed countries defer to the United Nations (UN) the responsibility for international occupational health. The UN's international agencies have had only limited success in bringing

occupational health to the industrializing countries. The World Health Organization (WHO) is responsible for the technical aspects of occupational health and safety. The International Labor Organization (ILO) Conventions and Recommendations (Takala 1999) are intended to guide all countries in the promotion of workplace safety. The ILO has no enforcement power, and UN funding for the WHO and the ILO is so meager that neither agency has the power of moral suasion.

UN Agencies

International organizations such as the WHO and the ILO have long been important sources of information about toxic substances such as asbestos, but these agencies are expected to provide more than just information. Most people presume that the WHO, the ILO, and many other public health agencies intercede directly when an epidemic occurs. Recent revelations of the degree to which these agencies are manipulated by industry representatives explain how the asbestos industry was able to dissuade the WHO and the ILO from intervening to stem the asbestos cancer epidemic (Castleman 1999, 2001; Castleman and Lemen 1998b; Rosenstock and Lee 2002; Watterson 1993).

The asbestos cancer epidemic currently sweeping the globe would have been largely preventable if the WHO and the ILO had responded early and forcefully. Not only was the WHO late in recognizing the emergence of the asbestos cancer epidemic, but the WHO also ignored it for years and, quite without explanation, continues to fail to address the problem of asbestos mining and manufacturing and world trade of a known human carcinogen.

The WHO, through its International Agency for Research on Cancer (IARC) and in the collaborative program with the International Program for Chemical Safety (IPCS), together with the ILO and the UN Environment Program, has on several occasions assessed the effects of asbestos and different asbestos fiber types on human health, but it has not done so in a timely manner and has had no real effect on the continued global use of asbestos (IARC 1973, 1977, 1987, IPCS 1986, 1989, 1996, 1998; WHO 1989, 1997).

Early reports linking asbestos and cancers of the lung and pleura by British, South African, and Italian investigators in the 1950s (Doll 1955; Tweedale 2002; Vigliani et al. 1964; Wagner et al. 1960) laid the foundation for the definitive investigations of insulation workers in the United States by Irving Selikoff and his colleagues. Selikoff's studies showed the greatly increased mortality of insulation workers exposed to asbestos and made clear that an epidemic of occupational and environmental cancer was under way (Selikoff et al. 1964). In the following decade, IARC studied the carcinogenicity of asbestos fibers, but it was not until 1986, 22 years after publication of the article by Selikoff et al. (1964), that the WHO published its first document on asbestos. By that time, the asbestos cancer epidemic was claiming tens of thousands of lives. By 1973, the full range of the danger of asbestos was apparent (Hammons and Huff 1974; Huff et al. 1974, 1975). It was at this point, at least 30 years ago, that one might have expected the WHO to take up the cudgel against asbestos.

All one need do is review the list of asbestos industry advocates involved in the writing of the WHO documents to see how the confusion arose over which asbestos fibers were to be considered carcinogenic (Egilman et al. 2003; Infante, in press; Lemen, in press; Tweedale 2000). The last WHO publication to recommend a protective exposure standard for asbestos was published 15 years ago (WHO 1987). The WHO's only recent publication is a pamphlet on how to avoid asbestos-induced health effects (WHO 2000).

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The author declares he has no competing financial interests.

Received 26 August 2003; accepted 24 November 2003.

The WHO appears to be satisfied at this point that it has addressed the asbestos problem with a series of publications, none of which gets to the root problem of the epidemic.

Antero Aitio of the IPCS recently stated,

At present, WHO has no activity on asbestos in progress—mainly as WHO work is more geared toward risk assessment than risk management—and quite apparently, asbestos at present is more a problem for risk management—especially of course in building renovation all over the world, and in many areas, increasingly, in developing countries. (Aitio A. Personal communication)

If the WHO had spent the past three decades pressing the world community to end asbestos mining and manufacture, the world could have gone a long way to add asbestos to polio and smallpox viruses as conquered agents.

Part of the explanation for this bland acceptance of the asbestos cancer epidemic is that the WHO and the ILO have allowed organizations such as the International Commission on Occupational Health (ICOH) and other asbestos industry consultants and experts to manipulate them and to distort the scientific evidence. The WHO and the ILO were lulled into inaction by conflicting scientific reports of the epidemic. The WHO and the ILO unfortunately respond readily to political pressure and industry influence, and they fail to overcome industry public relations techniques employed for obfuscating scientific issues. To this day they continue to play little more than a minor role in efforts to control or reverse the asbestos cancer epidemic.

The ICOH is a private organization of occupational health and safety specialists. Many ICOH members are employees of major corporations or consultants to industry. When called upon as experts, they avoid the suggestion of a “conflict of interest” by stating that they are representatives of an unbiased international commission. The WHO did adopt disclosure rules, but despite exhortation from scientists, it continues to be criticized for its poor implementation of these rules. The WHO has declined requests to adopt a policy of publicly releasing the conflict of interest disclosure statements of individuals appointed to its expert panels (Axelson et al. 2002).

Robert Murray, a former president of the ICOH, was a paid consultant to the asbestos industry,

whose writings on asbestos in the *British Journal of Industrial Medicine* in 1990–91 establish him uniquely as a defender of the asbestos industry for its past and present business conduct. (Castleman 1996)

Murray held an official position with the ILO while he represented the ICOH and the asbestos industry. During Murray’s leadership of the ICOH, consultants to the asbestos industry became prominent on the relevant

ICOH scientific committees. The ICOH Scientific Committee on Fibers for many years has been dominated by members affiliated with the asbestos industry. Scientific committee members have claimed to “represent the ICOH” at meetings around the world, often misleading both international agencies and developing countries about asbestos while not disclosing their industry connections (Ashford et al. 2002; Grandjean 1997; LaDou 1998; Richter and Berman 2000; Watterson 2000).

The evidence is everywhere to be found. Castleman and Lemen (1998a) cited a few recent examples:

In July 1997, copies of WHO draft reports called “Asbestos and Health” and “Asbestos and Housing” became available for technical review. Both report drafts read as if they had been written by the asbestos industry.

Although at least 85% of asbestos today is used in asbestos-cement construction materials,

the housing draft offered only the vaguest information [about] the hazards of building with asbestos-cement sheets and pipes; it did not warn of the need for special cutting tools equipped with suction hoods and high-efficiency dust capture. It said nothing to direct or encourage people to use safer substitute materials for asbestos-cement pipe and sheet products. The health report described high exposures to asbestos as largely a thing of the past, in complete disregard for the way asbestos products ... are made and used today.... (Castleman and Lemen (1998a)

in many developing countries (Castleman 1999). Neither of the WHO reports mentioned the proliferation of national bans on asbestos by European countries.

Critical early reviewers of the reports said that they suffered from many errors of fact and imbalance. Morris Greenberg, HM Inspector of Factories, United Kingdom, pleaded for an extension of the review process, “for the reputation of the WHO” (Greenberg 1997). Alan Dalton, a health, safety, and environment coordinator for the Transport and General Workers’ Union, pressed the WHO to do better, noting that an editorial in *The Lancet* (Lancet 1997) had lamented the decline in the WHO’s reputation for technical expertise (Dalton 1997). Philippe Grandjean, of the University of Southern Denmark Odense, urged the WHO to emphasize that there were alternative building materials that could be used instead of asbestos cement (Grandjean 1998).

The WHO Regional Office for Europe published the “Asbestos and Health” report in 1999 (WHO 1999). The report received immediate criticism from the International Confederation of Free Trade Unions and from Lorenzo Tomatis, former director of the IARC. One month after the report’s publication, it was withdrawn. The report was revised

and reissued in an improved form a year later (WHO 2000).

The battle against asbestos is in danger of being lost where the human costs may be greatest, in developing countries desperate for industry. Relentless efforts are being employed in the intensive campaign to establish and maintain the asbestos industry in these countries (Castleman 2000, 2001; Kazan-Allen 2003; Reuther 1997). The Indian asbestos industry, assisted by Canadian interests, announced plans to stage a conference in Delhi in 2000 to promote the manufacture and use of asbestos products. Before the meeting, a WHO letter was widely circulated in which an official of the WHO Regional Office for Southeast Asia wrote that the asbestos-cement industry and its products are “highly eco-friendly” (Aldana et al. 2000). WHO officials are often poorly informed about asbestos and subject to manipulation by industry representatives; this is particularly so in the WHO regional offices (LaDou 2002).

The ILO is a coordinating body that plays an important role in promoting occupational health and safety. It sets minimum standards in the field of occupational health and safety (Takala 1999). ILO conventions are intended to guide all countries in the promotion of workplace safety and in managing occupational health and safety programs. The ILO Conventions and Recommendations on occupational safety and health are international agreements that have legal force only if they are ratified by the governments of the member states. The ILO has no enforcement authority, and most member states do not ratify the ILO Conventions (LaDou 2003).

The ILO shares responsibility with the WHO for the failure to address the asbestos cancer epidemic. Responding to industry pressures and unrelenting scientific distortions, member states failed to support ILO efforts to confront the epidemic. The lack of participation of its member states discourages the ILO from taking on important occupational health issues. The ILO Asbestos Convention of 1986 (ILO 1986) is a good example. Written 18 years ago and not amended since that time despite major studies that show that all forms of asbestos cause asbestosis and cancer, the ILO Asbestos Convention does not ban asbestos, only crocidolite and certain manufacturing processes. Member states of the ILO are under constant pressure from the international asbestos industry to protect jobs and national prosperity. The ILO Asbestos Convention, as weak and outdated as it is, has been ratified by only 27 of the 176 ILO member states (Table 1; LaDou 2003).

The asbestos cancer epidemic is often portrayed as a classic struggle of workers and communities against the entrenched wealth,

influence, and greed of industry. It is most certainly that, but this is only part of the story. The asbestos cancer epidemic is first and foremost a public health issue that requires the forceful and effective intervention of public health agencies. In this regard, the UN and many other responsible agencies have failed miserably because they were captured by the industry they were supposed to control.

Asbestos Bans

The only way to assure an end to the asbestos cancer epidemic is to ban asbestos mining and to ban all asbestos manufacture. This approach, which has been taken in many developed countries, is even more necessary in developing countries, where enforcement of health and safety regulations is not a viable alternative to a ban. Some further examples of industry manipulation will demonstrate how the ban movement has been successfully opposed for many years.

An international meeting was held in 1994 in São Paulo, Brazil. Its organizer was the courageous Brazilian labor inspector Fernanda Giannasi, a woman who was charged with “criminal defamation” by the Brazilian subsidiary of the multinational Saint-Gobain Corporation in a vain effort to silence her objections to the asbestos industry. The meeting called for a global asbestos ban. The conference was held in a very tense atmosphere. The Canadian government, the French Asbestos Committee, and Brazilian

asbestos manufacturers were outspoken in their opposition to the meeting. Events leading up to the meeting explain why.

The ILO had been approached in 1993 by the International Fiber Safety Group (IFSG) to hold training workshops in Brazil and Mexico to train specialists in the reading of chest X-ray films. The IFSG offered to bear most of the cost of the Latin American workshops (Giannasi and Thébaud-Mony 1997). The IFSG’s representative was Scott Houston, who actually worked in Quebec as the director of the Asbestos Institute, an industry association. The IFSG was created as a result of agreements within the international asbestos industry, although its exclusive representation of asbestos interests was obscured by its name. Inside the ILO, agreements with the IFSG were handled by longtime asbestos industry representative Michel Lesage (Giannasi and Thébaud-Mony 1997).

Lesage, introduced at the Brazil conference as a medical expert from the ILO, was also a member of the board of directors of the ICOH and a spokesman for the asbestos industry. Lesage had previously been an official of the Quebec Asbestos Mining Association and has since returned to Canada. He spoke against the proposed asbestos ban (Castleman 2000). His statements at the conference surprised the other participants, who had expected the ILO to have a position distinct from that of the asbestos industry. Lesage advanced the concept of “controlled use” of asbestos, “safe” practices that are a fiction in the developing countries where regulations is seldom enforced and voluntary standards are almost never implemented or monitored (Castleman 2003; Egilman and Roberts 2004). The strictest occupational exposure limit in the world for chrysotile asbestos (0.1 fiber/cc) is estimated to be associated with lifetime risks of 5/1,000 for lung cancer and 2/1,000 for asbestosis (Stayner et al. 1997). This exposure limit can be technically achieved in the United States and in a few other highly industrialized countries, but the residual risks still are too high to be acceptable. In newly industrializing countries engaged in mining, manufacturing, and construction, asbestos exposures are often much higher, and the potential for epidemics of asbestos-related disease is greatly increased (Giannasi and Thébaud-Mony 1997; Izmerov et al. 1998).

Marianne Saux, also an ICOH board member, was introduced in Brazil as a labor expert representing the French Ministry of Labor. She was actually an employee of asbestos manufacturer Saint-Gobain, a fact known to her ICOH colleagues but made public only after an investigative journalist wrote a book in France about the asbestos industry and its international dimensions (Malye 1996). The meeting was followed

within months by a meeting jointly sponsored by the ILO and the asbestos industry (represented by the IFSG).

A monograph on fibrous materials was prepared for the ILO by the ICOH Scientific Committee on Fibers (Castleman 1999). The monograph was distributed by the ILO to scientific reviewers in August 1997. Experts on asbestos (among them, William Nicholson, Morris Greenberg, and John Dement) noted with dismay that the asbestos chapter had been written by Jacques Dunnigan, Director for Health and Environment for the Asbestos Institute, and that the editor-in-chief was Graham Gibbs, another member of the ICOH board of directors and perennial representative of the Canadian asbestos industry. Nicholson, Greenberg, and Dement declined to review chapters of the draft ILO report, not wanting to have their names associated with it (Castleman 1999; Castleman and Lemen 1998b). Strong protests from unions in the United Kingdom, the Nordic countries, and the United States followed, along with criticism from scientists. The ILO judiciously withdrew the report from consideration as an ILO publication.

ICOH Vice President Bengt Knave expressed surprise to learn of the asbestos controversy in January 1998, then refused to discuss the matter. In an effort to understand how the ILO had come to believe that the draft fibers report was being prepared by the ILO “in cooperation with” the ICOH, the ILO was asked to provide a copy of the cover letter that accompanied the monograph when it was delivered to the ILO by the ICOH Scientific Committee on Fibers (Ashford et al. 2002). Jukka Takala, chief of the Occupational Safety and Health Branch, Working Conditions and Environment Department at the ILO, has denied all efforts to obtain the document (Ashford et al. 2002).

ICOH President Jean-Francois Caillard presided over an ICOH meeting in Nice, France. He introduced and praised J.P. Beffa, President of Saint-Gobain, in gratitude for support to the ICOH meeting given by the asbestos company. When the ICOH officers and board members later met in Paris, they convened in the Saint-Gobain boardroom, as did the officers of all the scientific committees. Later, at an address before the French Society for Occupational Medicine, Caillard said that asbestos, which was responsible for an estimated 2,000 deaths annually, had been a “health catastrophe” for France (Caillard 1997). Caillard defended French occupational physicians from criticism of their failure to recognize and to properly report the asbestos cancer epidemic. Caillard did not mention his own close ties to the asbestos industry, or those of many of his French colleagues (Thébaud-Mony 2003).

Table 1. Countries that have ratified the ILO Asbestos Convention (ILO 1986) and the year ratified.

Country	Year
Belgium	1996
Bolivia	1990
Bosnia and Herzegovina	1993
Brazil	1990
Cameroon	1989
Canada	1988
Chile	1994
Colombia	2001
Croatia	1991
Cyprus	1992
Ecuador	1990
Finland	1988
Germany	1993
Guatemala	1989
Netherlands	1999
Norway	1992
Portugal	1999
Russian Federation	2000
Serbia and Montenegro	2000
Slovenia	1992
Spain	1990
Sweden	1987
Switzerland	1992
The Former Yugoslav Republic of Macedonia	1991
Uganda	1990
Uruguay	1995
Zimbabwe	2003

Data from LaDou (2003).

Funding of International Agencies

The WHO and the ILO are poorly funded and are able to direct only very small sums to occupational health and safety programs around the world. The courtly diplomacy of the WHO and the ILO often masks the meagerness of their accomplishments in international occupational health and safety. The agencies are primarily European in their staffing, and they go to extremes to achieve consensus on every issue, greatly limiting their effectiveness in addressing important problems in public health.

The WHO Programme for Occupational Health supports a staff of only four people. Regional WHO offices have few, if any, specialists trained in occupational health and safety. SafeWork, the ILO Programme on Safety, Health at Work, and the Environment, has been leading the ILO's efforts to promote occupational health. The 2-year ILO SafeWork budget was recently cut. According to its director, "The result is a virtual disappearance of interest in occupational safety and health" (Takala 2002). For example, the enforcement (labor inspection) unit of SafeWork has been reduced to a single person.

To be successful, the international agencies will need to rise above the level of their current activities, sadly underfunded and mired in hopeless attempts to placate industry while compromising on their mission to protect the public health and the health and safety of workers. Nowhere is the problem more obvious than in the evaluation of carcinogenicity of chemicals at IARC. Lorenzo Tomatis, former director of IARC, asserts that IARC is unscientifically and prematurely downgrading carcinogen classifications of chemicals for which there were clear and undeniable positive results in experimental bioassays (Tomatis 2002). James Huff, who was instrumental in developing the IARC Monographs program in the 1970s and the U.S. National Toxicology Program since then, has elaborated on the increase in industry influence at IARC in recent years (Huff 2002). *The Lancet* published an editorial agreeing that "IARC may have come under undue influences, especially commercial ones," and urged WHO programs to adopt more transparency and greater access by nonindustry scientists and organizations (Lancet 2003).

Asbestos Exposure Globalizes

From the beginning of the 20th century, world production of asbestos grew steadily. In Western Europe, Scandinavia, North America, and Australia, the manufacture and use of asbestos products peaked in the 1970s. At that time, worldwide asbestos production exceeded 5 million tons/year. Despite everything that was known about the health effects of asbestos, annual production remained at

> 4 million tons for more than a dozen years. To this day, > 2 million tons of chrysotile are mined and shipped around the world each year. Asbestos industry advocates allege that crocidolite is the fiber with the greater risk for lung cancer and that chrysotile can be handled safely. Actually, on a per-fiber basis, the highest risks of lung cancer have been shown for chrysotile (Dement et al. 1994; Infante, in press; Stayner et al. 1996; Tossavainen 2004).

The largest asbestos producers are Russia, China, Canada, Kazakhstan, Brazil, and Zimbabwe (Table 2). Canada dominates world trade, with an annual export of about 300,000 tons of chrysotile asbestos. The trade value of crude chrysotile asbestos averages about \$500 Canadian per ton.

More than 70% of the world production is used in Eastern Europe, Latin America, and Asia (Table 3), in countries desperate for industry and naive to the health effects of occupational and environmental exposures to asbestos. Brazil, China, India, Japan, Russia, and Thailand are the only countries that consumed > 60,000 tons of asbestos in 2000. These six countries accounted for > 80% of the world's apparent consumption of asbestos, although underreporting is an obvious problem. The highest rate of consumption occurs in Russia (3.4 kg/capita/year), whereas < 0.1 kg/capita/year is still used in Western Europe or North America (Takahashi and Karjalainen 2003).

In 1974, about 350,000 tons of asbestos were used in Japan (3.1 kg/capita/year), but in 1995 the registered incidence of mesothelioma (5 cases/million/year) was much lower than in other industrialized countries. Moreover, in Russia, the extensive use of asbestos would predict a high mesothelioma incidence. There is no explanation for the low rates of mesothelioma in these and many other countries except the obvious likelihood that mesothelioma is not being properly reported. As is the case in Eastern Europe, no reliable incidence data are available for the developing countries in Asia, Africa, or South America. The areas

Table 2. Asbestos production by country, 2000.

Country	Tons
Russia	752,000
China	350,000
Canada	320,000
Brazil	209,000
Kazakhstan	179,000
Zimbabwe	152,000
Greece	32,000
South Africa	19,000
India	15,000
Swaziland	13,000
United States	5,000
Iran	2,000
Other countries	2,000
Total	2,050,000

Data from U.S. Geological Survey, 2000.

where the epidemic is now beginning to cause the greatest loss of life are the very areas where nonreporting of asbestos-related cancers is a major problem.

The asbestos-based multinational corporations of the past are all in bankruptcy proceedings and/or in other businesses. The asbestos industry today is composed of national companies whose political influence is large within their countries but is not globally coordinated. The protection and advancement of asbestos globally are mainly promoted by the government of Canada, the largest asbestos-exporting country. The success of Canadian efforts to export chrysotile as a safer asbestos are readily apparent in Asia. Most Asian countries have enforced a ban on the use of crocidolite (Table 4), but no Asian country except Saudi Arabia has yet banned chrysotile asbestos. Singapore comes close to a full ban on asbestos, but this is most likely because it can readily relocate its asbestos interests in neighboring countries. Japan and Vietnam are currently amending their laws and regulations to adopt a total ban of asbestos, including chrysotile. These three countries may provide an important influence in the region, with an asbestos ban not even under consideration, at least officially, in any of the other Asian countries, despite campaigns by nongovernmental organizations for bans on asbestos in Korea, Malaysia, and India.

The likelihood of a successful ban on asbestos in Asia is reflected in the current levels and recent trends of asbestos consumption. Consumption levels range from 0 in Singapore to 1.9 kg/capita/year in Thailand. In Japan, the

Table 3. Asbestos consumed by country, 2000.

Country	Tons	kg/capita/year
Russia	447,000	3.4
China	410,000	0.4
Brazil	182,000	1.3
India	125,000	0.2
Thailand	121,000	3.0
Japan	99,000	1.5
Indonesia	55,000	0.3
South Korea	29,000	1.9
Mexico	27,000	0.4
Belarus	25,000	
Turkey	19,000	0.5
Kyrgyzstan	17,000	
Spain	15,000	0.7
South Africa	13,000	0.5
Colombia	12,000	0.9
Zimbabwe	12,000	
Romania	10,000	0.5
Azerbaijan	8,000	
Canada	5,000	0.2
Portugal	5,000	
Taiwan	5,000	
Ecuador	4,000	
Kazakhstan	4,000	1.8
Pakistan	4,000	
Other countries	20,000	
Total	1,673,000	

Data from U.S. Geological Survey, 2000.

level of 0.6 kg/capita/year (or 79,463 tons) is decreasing from a peak of 3.1 kg/capita/year (or 352,110 tons) in 1974. A striking contrast in asbestos use can be seen across Asia. The wealthy industrialized countries show a steady decrease in asbestos use, whereas the poorer developing countries show a definite increase (Table 5) (Takahashi and Karjalainen 2003). As countries gain in industrial affluence, their hazardous, costly industries migrate to poorer neighboring countries.

The Cost of Failure to Act

Occupational exposures to asbestos constitute a major health hazard in all industrialized countries of the world. Peto et al. (1999) predicted that deaths from mesothelioma among men in Western Europe would increase from just over 5,000 per year in 1998 to about 9,000 by the year 2018. In Western Europe alone, past asbestos exposure will cause a quarter of a million deaths from mesothelioma over the next 35 years. The number of lung cancer deaths caused by asbestos is at least equal to the number of deaths from mesothelioma. The ratio may be much higher than 1 to 1, with some reports suggesting up to 7 to 1 (Howie 2001), so there may be more than a half million asbestos cancer deaths in Western Europe over the next 35 years (Peto et al. 1999). In Sweden, Jarvholm et al. (1999) have reported that the number of deaths caused each year by malignant mesothelioma is greater than the number of deaths caused in that country by all workplace injuries.

Worldwide, many millions of workers have been exposed to asbestos in the workplace. About 20–40% of adult men report some past occupations and jobs that may have entailed asbestos exposures at work (Goldberg et al. 2000; Tossavainen 1997). In the most affected age groups, mesothelioma may account for 1% of all deaths (Peto et al. 1995). In addition to mesotheliomas, 5–7% of all lung cancers can be attributable to occupational exposures to asbestos (Tossavainen 2004). A number of studies have projected the premature deaths that will result from the asbestos cancer epidemic (Goldberg et al. 2000; Howie 2001; Jarvholm et al. 1999; Peto et al. 1999; Tossavainen 1997, 2000, 2004; Tossavainen and Takahashi 2000). The ILO has taken the incidence of asbestos-related cancer in Finland and extrapolated it to the world worker population, resulting in an estimate that at least 100,000 and maybe as many as 140,000 workers die each year from asbestos exposures resulting in cancer (ILO 2003). When the various estimates from this and other studies are extrapolated to include the world population, they project that the asbestos cancer epidemic will cause 5–10 million deaths, past and present (Leigh 2001). In this conservative estimate, it is assumed that asbestos exposures are going to cease and that the epidemic will run itself out, but the world's production of asbestos, which went down by half in the 1990s, seems to have stabilized at around 2 million tons/year in 2001–2002, and further progress is far from assured. There is no indication at this time that a global ban on asbestos is likely to be accepted by all countries, and international enforcement of a ban on asbestos is unlikely to occur. In developing countries, where little or no protection of workers and communities is taking place, the asbestos cancer epidemic may be even more devastating and may continue indefinitely.

Conclusion

Most countries ban asbestos after the external costs of mining and manufacture begin to affect the profitability of the industry. Health-related costs, if borne by the asbestos industry, are far higher than the return on sales. Such costs include proper warnings, stringent hygiene measures to prevent occupational and environmental exposures, and full treatment and compensation to those who develop asbestos-related diseases. Migration of the industry to developing countries allows companies to continue to make a profit in the manufacture and sale of asbestos products. The low cost of mining and manufacture in developing countries gives the asbestos industry an unfair advantage in the marketplace when competing against safer substitute materials. Developing countries increasingly bear the externalized costs of an epidemic of disease and pollution

from asbestos, costs that should be borne by the asbestos industry and reflected in the prices of asbestos products.

One country has made a particularly shameful contribution to future generations of asbestos disease. Canada has used its full influence in international organizations to protect its export market for asbestos, and Canada has aggressively promoted the use of asbestos in developing countries. Leading scientists such as Irving Selikoff have called on Canada since the 1970s to close the asbestos mines and pension off the workers (now estimated at around 1,500 in all of Canada) rather than continue exporting virtually all the asbestos mined to poor countries. With the asbestos multinational corporations gone, the government of Canada stands out as the most powerful opponent of national and international efforts to ban asbestos around the world. The sacrifice of honor and principle is harmful to the international reputation of Canada, and the people of Canada should demand a higher standard of their government on the world stage.

The export of asbestos mining and manufacture to developing countries provides an opportunity to continue the use of asbestos products and propagates asbestos exposures in areas that do not recognize and report health effects. The asbestos cancer epidemic will have no end until this shameful practice stops. The WHO and the ILO, along with many other public health agencies, need to step forward with a clear demand for an international ban on asbestos and plans to accomplish the goal.

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Table 4. Asbestos bans in 10 Asian countries.

Country	Ban		
	Crocidolite	Amosite	Chrysotile
China	Yes	No	No
Indonesia	NR	NR	No
Japan	Yes	Yes	No
Korea	Yes	NR	No
Malaysia	Yes	No	No
Philippines	Yes	Yes	No
Singapore	Yes	Yes	No
Taiwan	Yes	Yes	No
Thailand	Yes	Yes	No
Vietnam	No	No	No

NR, not reported.

Table 5. Asbestos consumption in 10 Asian countries.

Country	Current consumption (kg/capita/year)	Recent trend
China	0.4	Increase
Indonesia	0.3	Increase
Japan	0.6	Decrease
Korea	0.5	Decrease
Malaysia	0.9	Plateau
Philippines	≤ 0.1	Increase
Singapore	0	Decrease
Taiwan	0.2	Decrease
Thailand	1.9	Increase
Vietnam	0.2	Increase

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